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L'insuffisance rénale chronique et terminale (IRC/IRCT)

Épidémiologie, coût et parcours de soins

Bibliographie thématique

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Sommaire

Problématique

L'objectif de cette bibliographie est de recenser les sources d'information (ouvrages, rapports, articles scientifiques, littérature grise, sites institutionnels…) dans le domaine de l'insuffisance rénale chronique et terminale.

Le périmètre géographique retenu concerne la France et les pays de l'OCDE.

Les aspects ciblés sont les suivants :

- Définition des différentes formes de l'insuffisance rénale ;
- Épidémiologie de la maladie et sources de données ;
- Évolution de la maladie selon les différents stades ;
- Économie de la maladie ;
- Prise en charge de la maladie et pratiques médicales.

Les recherches bibliographiques ont été réalisées sur les bases suivantes : Base bibliographique de l'Irdes, Banque de données santé publique (BDSP), Medline sur la période s'étendant des années 2000-2018.

Lorsque les requêtes de recherches rapportaient plus de 1 000 références dans la littérature scientifique notamment anglo-saxonne, nous avons orienté la sélection vers les revues de la littérature (review, systematic review, literature review, scopus review) et les documents accompagnés de résumé.

Les références sont présentées par auteurs. Elles sont précédées d'une définition des différents stades de l'insuffisance rénale, ainsi que d'une étude sur la terminologie.

Éléments de définition et de terminologie

L'insuffisance rénale correspond à l'altération du fonctionnement des deux reins, qui ne filtrent plus correctement le sang. La maladie est dite « aiguë » si le dysfonctionnement est transitoire et réversible et « chronique » si la destruction est irréversible, sans possibilité de guérison. Dans ce cas, la maladie peut être stabilisée. Si l'insuffisance rénale est majeure, la fonction rénale peut être supplantée par dialyse ou transplantation. La dialyse permet de filtrer le sang par un circuit dérivé, le plus souvent extérieur à l'organisme.
L'insuffisance rénale aiguë survient le plus souvent après une agression comme une baisse brutale et transitoire de la pression artérielle, lors d'une hémorragie, d'une infection générale (septicémie), d'une intoxication médicamenteuse ou encore d'obstruction des voies urinaires par un calcul ou un adénome prostatique. Les reins se remettent à fonctionner après quelques jours de traitement.

L'insuffisance rénale chronique ne régresse pas, par définition. Elle est induite par des pathologies (diabète, hypertension…) qui détruisent progressivement et de façon irréversible les différentes structures rénales. Il existe cinq stades de la maladie jusqu'au stade terminal auquel la capacité de filtration est inférieure à 15 % de la normale pour l'ensemble des reins. Ce stade nécessite d'envisager les techniques de remplacement de la fonction rénale : dialyse ou transplantation[1].

Au niveau terminologique, les termes les plus fréquemment utilisés pour identifier la maladie rénale et ses évolutions dans les bases de données sont : insuffisance rénale, insuffisance rénale aiguë, insuffisance rénale chronique (IRC) et insuffisance rénale chronique terminale (IRCT), ainsi que : dialyse rénale et transplantation rénale.

Dan la littérature anglo-saxone – si on s'en réfère au thesaurus MeSH de Medline - le vocalulaire est beaucoup plus large :

- Renal insufficiency, Acute kidney failure, Acute kidney insufficiency, Acute renal insufficiency, Acute renal injury pour insuffisance rénale aiguë ;
- Renal insufficiency, chronic - ou Chronic renal insufficiency pour insuffisance rénale chronique (IRCT) ;
- Kidney failure, chronic - Chronic kidney failure - End stage Kidney Disease - End stage Renal Disease, ESRD - Renal disease, End stage - Renal failure, Chronic - Renal failure, End stage pour insuffisance rénale chronique terminale (IRCT) ;
- Renal dialysis et renal transplantation pour dialyse rénale et transplantation rénale.

Épidémiologie de l'insuffisance rénale chronique : une maladie dont la fréquence augmente avec l'âge

FOCUS : QUELQUES DONNEES CHIFFREES

Selon une étude menée aux États-Unis sur la période 1999-2000 (National Health and Nutrition Examination Survey IV), 9,4 % de la population générale, dont deux tiers d'hommes, présentaient une insuffisance rénale, dont 5,6 % à un stade léger et modéré, 3,7 % à un stade sévère et 0,13 % à un stade terminal. La maladie est rare avant 45 ans mais sa prévalence augmente avec l'âge, notamment après 65 ans[2].

Dans l'ensemble des pays de l'OCDE, si l'on considère les deux types de traitement – dialyse et transplantation – la proportion de personnes traitées pour une insuffisance rénale terminale, a augmenté de plus de 5 % par an sur les vingt dernières années.[3] Cela signifie que la prévalence des traitements pour insuffisance rénale terminale a plus que doublé depuis 1990. Le Japon et les États-Unis ont les taux les plus élevés avec respectivement 190 et 180 patients d'insuffisance rénale terminale pour 100 000 habitants. Viennent ensuite la Hongrie, puis le Portugal qui ont enregistré le plus fort taux de croissance depuis 1990. On ne sait pas très bien

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[1] Inserm (2012). L'insuffisance rénale.
[2] Coresh J., Byrd-Holt D., Astor BC, et al. (2005). Chronic kidney disease awarenee, prevalence and trends among US adults, 1999 to 2000. J am Soc Nephrol : 16
[3] OCDE (2011). Panorama de la santé 2011 : les indicateurs de l'OCDE

pourquoi ces pays déclarent des taux de traitement de l'insuffisance rénale aussi élevés, mais cela ne semble pas être seulement lié à une prévalence plus grande du diabète, laquelle n'est pas particulièrement plus élevée dans ces pays que dans d'autres pays de l'OCDE.

Dans la plupart des pays de l'OCDE, la majorité des patients souffrant d'insuffisance rénale terminale sont traités par dialyse par opposition à la transplantation rénale. Cela est dû au fait que la prévalence des personnes souffrant d'IRCT a fortement augmenté mais que le nombre des transplantations demeure limité par manque de donneurs. Seuls font exception la Finlande, l'Islande, les Pays-Bas et l'Irlande, où la plupart des patients traités pour insuffisance rénale terminale ont reçu une greffe de rein.

En France, on estime à environ 5,7 millions le nombre d'adultes souffrant de maladie rénale[4]. En 2015, 82 295 patients, soit 1 232 par million d'habitants, sont traités pour insuffisance rénale chronique terminale, soit par dialyse (56 %), soit par greffe (44 %)[5]. Si le risque d'atteindre le stade d'insuffisance rénale chronique terminale est relativement faible, de l'ordre de 1,4 % des personnes souffrant de maladie rénale chronique, ce stade de la maladie est caractérisé par un taux de mortalité très élevé, 10,6 % toutes prises en charge confondues. La France, avec une incidence de 166 par million d'habitants, se situe dans les valeurs hautes européennes. L'incidence de l'insuffisance rénale chronique terminale en Europe était de 119 par million d'habitants en 2015 variant de 24 à 232. De même, la prévalence de l'insuffisance rénale chronique terminale en France à 1246 par million d'habitants se situe dans les valeurs hautes européennes qui varient de 178 à 1 824 pour une valeur moyenne de 801. Le taux de transplantations varie de 2 à 94 par million d'habitants en Europe. La France se situe dans la moyenne à 52 par million d'habitants (Kramer et al., 2018).

La prévalence de cette maladie devrait encore augmenter dans les années qui viennent en raison du vieillissement de la population et de l'augmentation du diabète (deux causes majeures d'insuffisance rénale), et grâce à l'amélioration de la survie des patients transplantés et dialysés[6].

LES DONNEES EPIDEMIOLOGIQUES

Eckardt, K. U., Coresh, J., Devuyst, O., et al. (2013). "Evolving importance of kidney disease: from subspecialty to global health burden." Lancet **382**(9887): 158-169.

Jacquelinet, C. et Stengel, B. (2016). Maladie rénale chronique. Traité de santé publique.**:** 536-548.

Mills, K. T., Xu, Y., Zhang, W., et al. (2015). "A systematic analysis of worldwide population-based data on the global burden of chronic kidney disease in 2010." Kidney Int **88**(5): 950-957.

Études françaises

Assogba, F. G., Couchoud, C., Hannedouche, T., et al. (2014). "Trends in the epidemiology and care of diabetes mellitus-related end-stage renal disease in France, 2007-2011." Diabetologia **57**(4): 718-728.

> AIMS/HYPOTHESIS: The aim was to study geographic variations and recent trends in the incidence of end-stage renal disease (ESRD) by diabetes status and type, and in patient condition and modalities of care at initiation of renal replacement therapy. METHODS: Data from the French population-based dialysis and transplantation registry of all ESRD patients were used to study geographic variations in 5,857 patients without diabetes mellitus, 227 with type 1 diabetes mellitus, and 3,410 with type 2. Trends in incidence and patient care from 2007 to 2011 were estimated. RESULTS: Age- and sex-

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[4] Mills, K. T., Xu, Y., Zhang, W., et al. (2015). "A systematic analysis of worldwide population-based data on the global burden of chronic kidney disease in 2010." Kidney Int **88**(5)
IrdesAgence de Biomédecine, Irdes (2018). Atlas de l'IRCT

[6] Agence de Biomédecine (2016). Rapport annuel REIN 2015

adjusted incidence rates were higher in the overseas territories than in continental France for ESRD unrelated to diabetes and related to type 2 diabetes, but quite similar for type 1 diabetes-related ESRD. ESRD incidence decreased significantly over time for patients with type 1 diabetes (-10% annually) and not significantly for non-diabetic patients (0.2%), but increased significantly for patients with type 2 diabetes (+7% annually until 2009 and seemingly stabilised thereafter). In type 2 diabetes, the net change in the absolute number was +21%, of which +3% can be attributed to population ageing, +2% to population growth and +16% to the residual effect of the disease. Patients with type 2 diabetes more often started dialysis as an emergency (32%) than those with type 1 (20%) or no diabetes. CONCLUSIONS/INTERPRETATION: The major impact of diabetes on ESRD incidence is due to type 2 diabetes mellitus. Our data demonstrate the need to reinforce strategies for optimal management of patients with diabetes to improve prevention, or delay the onset, of diabetic nephropathy, ESRD and cardiovascular comorbidities, and to reduce the rate of emergency dialysis.

Bayat, S., Kessler, M., Briancon, S., et al. (2010). "Survival of transplanted and dialysed patients in a French region with focus on outcomes in the elderly." Nephrol Dial Transplant **25**(1): 292-300.

BACKGROUND: Impact of kidney transplantation on survival of French end-stage renal disease (ESRD) patients is unknown. METHODS: A total of 1495 adults living in the Lorraine region and starting renal replacement therapy from 1997 to 2003 were included. A propensity score (PS) of registration on the renal transplant waiting list was estimated. Patient survival was studied using a time-dependent Cox multivariate regression and a Cox model stratified by PS tertiles. Survival of older patients (> or =60 years) was detailed. RESULTS: Survival was associated with age, medical factors and transplantation. The hazard ratio (HR) of death for patients on dialysis compared to transplant recipients was 4.6 (95% CI: 2.9-7.2). The survival analysis stratified by PS was similar to the multivariate Cox model. The survival benefit of transplantation over dialysis persisted among elderly patients [HR: 4.6 (95% CI: 2.2-9.7)]. CONCLUSIONS: In a French community-based network, after taking into account comorbidities, transplantation was associated with longer survival even among elderly patients. Age per se should not therefore be considered as a contraindication to renal transplantation. However, elderly patients should be evaluated carefully before registration on the list. Medical guidelines should put forward a standard set of criteria for access to renal transplantation.

Chantrel, F., de Cornelissen, F., Deloumeaux, J., et al. (2013). "[Survival and mortality in ESRD patients]." Nephrol Ther **9 Suppl 1**: S127-137.

This chapter provides a set of indicators on survival, life expectancy and causes of death of patients in chronic renal failure treated by dialysis or transplantation beginning a first replacement therapy between 2002 and 2011. Age strongly influences survival on dialysis. Thus, one year survival of patients under age 65 is over 90%. After 5 years, among patients over 85 years, it is more than 15%. The presence of diabetes or one or more cardiovascular comorbidities also significantly worse patient survival. In terms of trend, we do not find significant improvement in the 2-year survival between patients in the cohort 2006-2007 and the 2008-2009 cohort. Cardiovascular diseases account for 27% of causes of death to infectious diseases (12%) and cancer (10%). Life expectancy of patients is highly dependent on their treatment. Thus, a transplant patient aged 30 has a life expectancy of 41 years versus 23 years for a dialysis patient. Transplant patients have a mortality rate much lower than those of dialysis patients. Thus, between 60 and 69 years, for 1000 patients in dialysis in 2011, 127 died within the year. For 1000 patients of the same age, who have a functioning kidney transplant, 24 died within the year.

Couchoud, C. et Lassalle, M. (2015). "Incidence de l'insuffisance rénale chronique terminale traitée chez les personnes diabétiques traitées pharmacologiquement en France en 2013." Bulletin Epidemiologique Hebdomadaire(34-35): 632-637.
http://www.invs.sante.fr/Publications-et-outils/BEH-Bulletin-epidemiologique-hebdomadaire/Archives/2015/BEH-n-34-35-2015

[BDSP. Notice produite par InVS DR0xDIBp. Diffusion soumise à autorisation]. L'objectif de cet article est de décrire l'incidence de l'insuffisance rénale chronique terminale en France en 2013 chez les personnes diabétiques traitées pharmacologiquement, d'en décrire les disparités régionales et l'évolution temporelle, à partir des données disponibles dans le registre REIN (Réseau épidémiologie et information en néphrologie). En 2013, en France, 4 256 personnes diabétiques ont démarré un traitement de suppléance pour une insuffisance rénale chronique terminale (IRCT), soit un taux d'incidence de 142/100 000 personnes diabétiques. L'âge médian de ces personnes diabétiques était de 71,6 ans. À structure d'âge identique, cinq régions enregistraient des taux d'incidence élevés par rapport au taux d'incidence standardisé national et cinq autres des taux d'incidence très inférieurs. L'incidence standardisée de l'IRCT parmi les diabétiques tend à augmenter depuis 2011. Après prise en compte de l'effet du vieillissement et de l'augmentation de la taille de la population générale, la part résiduelle représente 70% de l'évolution du nombre de nouveaux cas.

Desseix, A. (2011). ""L'hémodialyse, cette maladie". Approche anthropologique d'un amalgame." Sciences Sociales Et Sante **29**(3): 41-73, rés.

[BDSP. Notice produite par ORSMIP DR0xGCHG. Diffusion soumise à autorisation]. Certains patients insuffisants rénaux chroniques, traités par hémodialyse, développent une représentation particulière de ce traitement en l'amalgamant à une maladie. En partant des définitions de l'expérience de la maladie en lien avec les notions de "rupture biographique" de symptômes et d'exposition à la mortalité, l'auteur étudie les raisons menant à un vécu de l'hémodialyse selon ces modalités. Il apparaît que le caractère asymptomatique de l'insuffisance rénale chronique et le manque de représentation liée à son diagnostic ne permettent pas la prise de conscience de la gravité de la maladie. A contrario, le traitement par ses effets secondaires et par les représentations liés au corps qu'il suscite expose le patient à sa vulnérabilité et à sa mortalité. Cet amalgame, s'il devient confusion, a des conséquences négatives pour les patients traités par hémodialyse mais aussi pour ceux traités, ensuite par transplantation rénale. (R.A.).

Frimat, L. (2010). "[Epidemiology of chronic renal disease]." Soins(745): 27-28.

In France, 8500 new patients develop chronic renal failure requiring a treatment by substitution each year. The yearly increase in the number of patients treated by dialysis or transplantation is estimated at 4% for metropolitan France.

Glaudet, F., Hottelart, C., Allard, J., et al. (2013). "The clinical status and survival in elderly dialysis: example of the oldest region of France." BMC Nephrol **14**: 131.

BACKGROUND: The number of elderly (>/=75 years) patients with end-stage renal disease (ESRD) has increased markedly, including in the Limousin region, which has the oldest population in France. We retrospectively compared outcomes in elderly and non-elderly ESRD patients who started dialysis during two time periods. METHODS: Baseline clinical characteristics, care, and survival rates were assessed in 557 ESRD patients aged >/=75 and <75 years who started dialysis in 2002-2004 and 2005-2007. Survival curves and Cox proportional hazards model were used to assess survival and factors associated with survival. RESULTS: Of the 557 patients, 343 and 214 were <75 years and >/=75 years, respectively. Dialysis was started in 2002-2004 and 2005-2007 by 197 and 146 patients <75 years, respectively, and by 96 and 118 patients >/=75 years, respectively. Median age (73.4 years [interquartile range [IQR] 61.7-79.5 years] vs 69.5 years [IQR 57.4-77.4 years] p = 0.001) and the proportion aged >/=75 years (44.7% vs 32.8%, p = 0.004) were significantly higher in 2005-2007 than in 2002-2004. Improved initial status during 2005-2007 was observed only in patients >/=75 years, with a decrease in some co-morbidities, improved walking and better preparation for dialysis. Mortality rates were significantly lower in 2005-2007 than in 2002-2004 (hazard ratio 0.81, 95% confidence interval 0.69-0.95; p = 0.008), with the difference due to factors associated with clinical status and care. CONCLUSIONS: Improved initial clinical status and better preparation for dialysis, accompanied by increased survival, were observed for patients >/=75 years who started dialysis more recently, perhaps because of early referral to a nephrologist.

Jacquelinet, C. et Stengel, B. (2016). Maladie rénale chronique. Traité de santé publique.**:** 536-548.

[BDSP. Notice produite par InVS 8r7DBR0x. Diffusion soumise à autorisation]. L'incidence de l'insuffisance rénale chronique terminale traitée (IRTT) semble se stabiliser depuis 2007. Néanmoins, chaque année dans notre pays, près de 10 000 personnes démarrent un traitement de suppléance, essentiellement par dialyse. Malgré l'augmentation du prélèvement, moins de 3 000 personnes bénéficient chaque année d'une greffe rénale, essentiellement parmi les 41 000 malades en dialyse. En l'absence de modification majeure de l'incidence de l'IRTT, de la distribution des déterminants de la qualité de vie dans la cohorte des malades en traitement de suppléance et des pratiques de soins, les résultats de l'enquête de qualité de vie Quavi-REIN 2011 peuvent être considérés comme toujours d'actualité et extrapolables à l'ensemble de la France métropolitaine. À qualité de vie inchangée pour la dialyse et la greffe rénale, l'augmentation du nombre de malades porteurs d'un greffon rénal fonctionnel contribue à augmenter la qualité de vie de l'ensemble.

Occelli, F., Deram, A., Genin, M., et al. (2014). "Mapping end-stage renal disease (ESRD): spatial variations on small area level in northern France, and association with deprivation." PLoS One **9**(11): e110132.

BACKGROUND: Strong geographic variations in the incidence of end-stage renal disease (ESRD) are observed in developed countries. The reasons for these variations are unknown. They may reflect regional inequalities in the population's sociodemographic characteristics, related diseases, or medical practice patterns. In France, at the district level, the highest incidence rates have been found in the Nord-Pas-de-Calais region. This area, with a high population density and homogeneous healthcare provision, represents a geographic situation which is quite suitable for the study, over small areas, of spatial disparities in the incidence of ESRD, together with their correlation with a deprivation index and other risk factors. METHODS: The Renal Epidemiology and Information Network is a national registry, which lists all ESRD patients in France. All cases included in the Nord-Pas-de-Calais registry between 2005 and 2011 were extracted. Adjusted and smoothed standardized incidence ratio (SIR) was calculated for each of the 170 cantons, thanks to a hierarchical Bayesian model. The correlation between ESRD incidence and deprivation was assessed using the quintiles of Townsend index. Relative risk (RR) and credible intervals (CI) were estimated for each quintile. RESULTS: Significant spatial disparities in ESRD incidence were found within the Nord-Pas-de-Calais region. The sex- and age-adjusted, smoothed SIRs varied from 0.66 to 1.64. Although no correlation is found with diabetic or vascular nephropathy, the smoothed SIRs are correlated with the Townsend index (RR: 1.18, 95% CI [1.00-1.34] for Q2; 1.28, 95% CI [1.11-1.47] for Q3; 1.30, 95% CI [1.14-1.51] for Q4; 1.44, 95% CI [1.32-1.74] for Q5). CONCLUSION: For the first time at this aggregation level in France, this study reveals significant geographic differences in ESRD incidence. Unlike the time of renal replacement care, deprivation is certainly a determinant in this phenomenon. This association is probably independent of the patients' financial ability to gain access to healthcare.

Stengel, B. (2011). "[Chronic renal failure: an epidemic?]." Presse Med **40**(11): 1020-1027.

End-stage renal disease affects more than 70,000 persons in France, i.e., 1,1 per 1000 people, of whom 53% are on dialysis and 47% are living with a functioning graft. This prevalence increases about 4% per year. Overall, end-stage renal disease incidence tends to stabilize, except in persons aged 75 years or older and in those with diabetes in whom it continues to rise. About 30% of the patients treated for end-stage renal disease start dialysis on an emergency basis, indicating the persistence and frequency of inadequate care in the advanced stage of chronic kidney disease, whatever the reasons for it. Screening of chronic kidney disease includes measures of both urinary albumin- or protein-to-creatinine ratio and serum creatinine, preferably with an enzymatic assay, and estimation of glomerular filtration rate with new equations such as MDRD. Highest priority for targeted screening include patients with diabetes, hypertension or cardiovascular disease. Screening should also be considered in the elderly, in those obese, exposed to toxic drugs, with family history of chronic kidney disease or with personal history of low birth weight, nephrectomy, kidney or urinary tract cancers or chronic infections. Chronic kidney disease stages 1 to 3 is about 100 times more common than end-stage renal disease, mortality risk at these stages being much higher than to progress to end-stage. In the elderly, chronic kidney disease is extremely common, affecting about one person older than 70 years out of three, but only a fraction, higher in men than women, may have clinically relevant markers requiring appropriate care. Glomerular filtration rate decline with age should be monitored regularly and drug doses adjusted in order to prevent adverse effects.

Études internationales

(2014). "Cardiovascular disease, chronic kidney disease, and diabetes mortality burden of cardiometabolic risk factors from 1980 to 2010: a comparative risk assessment." Lancet Diabetes Endocrinol **2**(8): 634-647.

> BACKGROUND: High blood pressure, blood glucose, serum cholesterol, and BMI are risk factors for cardiovascular diseases and some of these factors also increase the risk of chronic kidney disease and diabetes. We estimated mortality from cardiovascular diseases, chronic kidney disease, and diabetes that was attributable to these four cardiometabolic risk factors for all countries and regions from 1980 to 2010. METHODS: We used data for exposure to risk factors by country, age group, and sex from pooled analyses of population-based health surveys. We obtained relative risks for the effects of risk factors on cause-specific mortality from meta-analyses of large prospective studies. We calculated the population attributable fractions for each risk factor alone, and for the combination of all risk factors, accounting for multicausality and for mediation of the effects of BMI by the other three risks. We calculated attributable deaths by multiplying the cause-specific population attributable fractions by the number of disease-specific deaths. We obtained cause-specific mortality from the Global Burden of Diseases, Injuries, and Risk Factors 2010 Study. We propagated the uncertainties of all the inputs to the final estimates. FINDINGS: In 2010, high blood pressure was the leading risk factor for deaths due to cardiovascular diseases, chronic kidney disease, and diabetes in every region, causing more than 40% of worldwide deaths from these diseases; high BMI and glucose were each responsible for about 15% of deaths, and high cholesterol for more than 10%. After accounting for multicausality, 63% (10.8 million deaths, 95% CI 10.1-11.5) of deaths from these diseases in 2010 were attributable to the combined effect of these four metabolic risk factors, compared with 67% (7.1 million deaths, 6.6-7.6) in 1980. The mortality burden of high BMI and glucose nearly doubled from 1980 to 2010. At the country level, age-standardised death rates from these diseases attributable to the combined effects of these four risk factors surpassed 925 deaths per 100 000 for men in Belarus, Kazakhstan, and Mongolia, but were less than 130 deaths per 100 000 for women and less than 200 for men in some high-income countries including Australia, Canada, France, Japan, the Netherlands, Singapore, South Korea, and Spain. INTERPRETATION: The salient features of the cardiometabolic disease and risk factor epidemic at the beginning of the 21st century are high blood pressure and an increasing effect of obesity and diabetes. The mortality burden of cardiometabolic risk factors has shifted from high-income to low-income and middle-income countries. Lowering cardiometabolic risks through dietary, behavioural, and pharmacological interventions should be a part of the global response to non-communicable diseases. FUNDING: UK Medical Research Council, US National Institutes of Health.

Ayav, C., Beuscart, J. B., Briancon, S., et al. (2016). "Competing risk of death and end-stage renal disease in incident chronic kidney disease (stages 3 to 5): the EPIRAN community-based study." BMC Nephrol **17**(1): 174.

> BACKGROUND: Although chronic kidney disease (CKD) affects a growing number of people, epidemiologic data on incident CKD in the general population are scarce. Screening strategies to increase early CKD detection have been developed. METHODS: From a community-based sample of 4,409 individuals residing in a well-defined geographical area, we determined the number of patients having a first serum creatinine value >/=1.7 mg/dL and present for at least 3 months that allowed us to calculate an annual incidence rate of CKD (stages 3 to 5). CKD (stages 3 to 5) was defined by estimated glomerular filtration rate (eGFR) <60 mL/min/1.73 m(2). We also described the primary care, outcomes and risk factors associated with outcomes using competing risks analyses for these CKD patients. RESULTS: A total of 631 incident CKD patients (stages 3 to 5) were followed-up until the occurrence of death and dialysis initiation for more than 3 years. The annual incidence rate of CKD (stages 3 to 5) was estimated at 977.7 per million inhabitants. Analyses were performed on 514 patients with available medical data. During the study, 155 patients (30.2 %) were referred to a nephrologist, 193 (37.5 %) died and 58 (11.3 %) reached end-stage renal disease and initiated dialysis. A total of 139 patients (27.6 %) had a fast decline of their renal function, 92 (18.3 %) a moderate decline and the 272 remaining patients had a physiological decline (21.1 %) or a small improvement of their renal function (33.0 %). Predictors of death found in both Cox and Fine-Gray multivariable regression models included age at diagnosis, anemia, active neoplasia and chronic heart failure, but not a low glomerular filtration rate (GFR). Age at diagnosis, anemia and a low GFR were independently associated with dialysis initiation in Cox model, but anemia was not found to be a risk factor for

dialysis initiation in Fine-Gray model. CONCLUSIONS: This large cohort study provided useful epidemiological data on incident CKD (stages 3 to 5) and stressed the need to improve the hands-on implementation of clinical practice guidelines for the evaluation and the management of CKD in primary care.

de Francisco, A. L., Kim, J., Anker, S. D., et al. (2011). "An epidemiological study of hemodialysis patients based on the European Fresenius Medical Care hemodialysis network: results of the ARO study." Nephron Clin Pract **118**(2): c143-154.

BACKGROUND/AIMS: ARO, an observational study of hemodialysis (HD) patients in Europe, aims to enhance our understanding of patient characteristics and practice patterns to improve patient outcome. METHODS: HD patients (n = 8,963) from 134 Fresenius Medical Care facilities treated between 2005 and 2006 were randomly selected from 9 European countries (Czech Republic, France, Hungary, Italy, Poland, Portugal, Spain, Slovak Republic and Slovenia) and Turkey. Information was captured on demographics, comorbidities, medications, laboratory and dialysis parameters, and outcome. RESULTS: Patients were followed for 1.4 +/- 0.7 years. Wide variation by country was observed for age, sex and diabetes as a cause of chronic kidney disease. Cardiovascular disease was present in 73% of patients. Dialysis parameters were homogeneous across countries. Arteriovenous fistulas were frequently used (73%). More incident patients had hemoglobin <11 g/dl than prevalent patients (50 vs. 33%, respectively). Phosphatemia and intact parathyroid hormone were similar between incident and prevalent patients (4.7 +/- 1.2 mg/dl and 190 vs. 213 ng/l, respectively). Medication use varied widely by country. In total, 5% of patients underwent renal transplantation. Overall death rate was 124/1,000 patient-years. CONCLUSION: ARO revealed differences in HD practice patterns and patient characteristics in the 10 participating countries. Future ARO studies will fill gaps in the knowledge about the care of European HD patients.

Eckardt, K. U., Coresh, J., Devuyst, O., et al. (2013). "Evolving importance of kidney disease: from subspecialty to global health burden." Lancet **382**(9887): 158-169.

In the past decade, kidney disease diagnosed with objective measures of kidney damage and function has been recognised as a major public health burden. The population prevalence of chronic kidney disease exceeds 10%, and is more than 50% in high-risk subpopulations. Independent of age, sex, ethnic group, and comorbidity, strong, graded, and consistent associations exist between clinical prognosis and two hallmarks of chronic kidney disease: reduced glomerular filtration rate and increased urinary albumin excretion. Furthermore, an acute reduction in glomerular filtration rate is a risk factor for adverse clinical outcomes and the development and progression of chronic kidney disease. An increasing amount of evidence suggests that the kidneys are not only target organs of many diseases but also can strikingly aggravate or start systemic pathophysiological processes through their complex functions and effects on body homoeostasis. Risk of kidney disease has a notable genetic component, and identified genes have provided new insights into relevant abnormalities in renal structure and function and essential homoeostatic processes. Collaboration across general and specialised health-care professionals is needed to fully address the challenge of prevention of acute and chronic kidney disease and improve outcomes.

Elliott, R. W. (2012). "Demographics of the older adult and chronic kidney disease: a literature review." Nephrol Nurs J **39**(6): 491-496; quiz 497.

Older adults (65 years of age and older) comprised 4.1% of the population in 1900 (3.1 million), rose to 13.0% in 2010 (40.3 million), and are projected to reach 16.1% in 2020 (54.8 million). With each decade, there has been a steady increase, including older adults, in the population with chronic kidney disease. This article provides a review of the literature related to the demographics of the older adult population and older adults with chronic kidney disease. It also explores life expectancy, health promotion, and the economic impact of chronic kidney disease and its co-morbidities.

Greenberg, J. H., Coca, S. et Parikh, C. R. (2014). "Long-term risk of chronic kidney disease and mortality in children after acute kidney injury: a systematic review." BMC Nephrol **15**: 184.

> BACKGROUND: Acute kidney injury (AKI) is associated with significant short-term morbidity and mortality in children. However, the risk for long-term outcomes after AKI is largely unknown. METHODS: We performed a systematic review and meta-analysis to determine the cumulative incidence rate of proteinuria, hypertension, decline in glomerular filtration rate (GFR), and mortality after an episode of AKI. After screening 1934 published articles from 1985-2013, we included 10 cohort studies that reported long-term outcomes after AKI in children. RESULTS: A total of 346 patients were included in these studies with a mean follow-up of 6.5 years (range 2-16) after AKI. The studies were of variable quality and had differing definitions of AKI with five studies only including patients who required dialysis during an AKI episode. There was a substantial discrepancy in the outcomes across these studies, most likely due to study size, disparate outcome definitions, and methodological differences. In addition, there was no non-AKI comparator group in any of the published studies. The cumulative incidence rates for proteinuria, hypertension, abnormal GFR (<90 ml/min/1.73 m2), GFR < 60 ml/min/1.73 m2, end stage renal disease, and mortality per 100 patient-years were 3.1 (95% CI 2.1-4.1), 1.4 (0.9-2.1), 6.3 (5.1-7.5), 0.8 (0.4 -1.4), 0.9 (0.6-1.4), and 3.7 (2.8-4.5) respectively. CONCLUSIONS: AKI appears to be associated with a high risk of long-term renal outcomes in children. These findings may have implications for care after an episode of AKI in children. Future prospective studies with appropriate non-AKI comparator groups will be required to confirm these results.

Khan, U. A., Garg, A. X., Parikh, C. R., et al. (2013). "Prevention of chronic kidney disease and subsequent effect on mortality: a systematic review and meta-analysis." PLoS One **8**(8): e71784.

OBJECTIVES: To perform a systematic review of randomized controlled trials to determine whether prevention or slowing of progression of chronic kidney disease would translate into improved mortality, and if so, the attributable risk due to CKD itself on mortality. BACKGROUND: CKD is associated with increased mortality. This association is largely based on evidence from the observational

Hole, B. et Salem, J. (2016). "How long do patients with chronic disease expect to live? A systematic review of the literature." BMJ Open **6**(12): e012248.

> OBJECTIVE: To systematically identify and summarise the literature on perceived life expectancy among individuals with non-cancer chronic disease. SETTING: Published and grey literature up to and including September 2016 where adults with non-cancer chronic disease were asked to estimate their own life expectancy. PARTICIPANTS: From 6837 screened titles, 9 articles were identified that met prespecified criteria for inclusion. Studies came from the UK, Netherlands and USA. A total of 729 participants were included (heart failure (HF) 573; chronic obstructive pulmonary disease (COPD) 89; end-stage renal failure 62; chronic kidney disease (CKD) 5). No papers reporting on other lung diseases, neurodegenerative disease or cirrhosis were found. PRIMARY AND SECONDARY OUTCOME MEASURES: All measures of self-estimated life expectancy were accepted. Self-estimated life expectancy was compared, where available, with observed survival, physician-estimated life expectancy and model-estimated life expectancy. Meta-analysis was not conducted due to the heterogeneity of the patient groups and study methodologies. RESULTS: Among patients with HF, median self-estimated life expectancy was 40% longer than predicted by a validated model. Outpatients receiving haemodialysis were more optimistic about prognosis than their nephrologists and overestimated their chances of surviving 5 years. Patients with HF and COPD were approximately three times more likely to die in the next year than they predicted. Data available for patients with CKD were of insufficient quality to draw conclusions. CONCLUSIONS: Individuals with chronic disease may have unrealistically optimistic expectations of their prognosis. More research is needed to understand how perceived life expectancy affects behaviour. Meanwhile, clinicians should attempt to identify each patient's prognostic preferences and provide information in a way that they can understand and use to inform their decisions. TRIAL REGISTRATION NUMBER: CRD42015020732.

Huang, Y., Cai, X., Zhang, J., et al. (2014). "Prehypertension and Incidence of ESRD: a systematic review and meta-analysis." Am J Kidney Dis **63**(1): 76-83.

> BACKGROUND: Studies of the association of prehypertension with the incidence of end-stage renal disease (ESRD) after adjusting for other cardiovascular risk factors have shown controversial results. STUDY DESIGN: Systematic review and meta-analysis of prospective cohort studies. SETTING & POPULATION: Adults with prehypertension. SELECTION CRITERIA FOR STUDIES: Studies evaluating the association of prehypertension with the incidence of ESRD identified by searches in PubMed, EMBASE, and Cochrane Library databases and conference proceedings, without language restriction. PREDICTOR: Prehypertension. OUTCOMES: The relative risks (RRs) of ESRD were calculated and reported with 95% CIs. Subgroup analyses were conducted according to blood pressure (BP), age, sex, ethnicity, and study characteristics. RESULTS: Data from 1,003,793 participants were derived from 6 prospective cohort studies. Compared with optimal BP, prehypertension significantly increased the risk of ESRD (RR, 1.59; 95% CI, 1.39-1.91). In subgroup analyses, prehypertension significantly predicted higher ESRD risk across age, sex, ethnicity, and study characteristics. Even low-range (BP, 120-129/80-84 mm Hg) prehypertension increased the risk of ESRD compared with optimal BP (RR, 1.44; 95% CI, 1.19-1.74), and the risk increased further with high-range (BP, 130-139/85-89 mm Hg) prehypertension (RR, 2.02; 95% CI, 1.70-2.40). The RR was significantly higher in the high-range compared with the low-range prehypertensive population (P = 0.01). LIMITATIONS: No access to individual patient-level data. CONCLUSIONS: Prehypertension is associated with incident ESRD. The increased risk is driven largely by high-range prehypertension.

Khan, U. A., Garg, A. X., Parikh, C. R., et al. (2013). "Prevention of chronic kidney disease and subsequent effect on mortality: a systematic review and meta-analysis." PLoS One **8**(8): e71784.

> OBJECTIVES: To perform a systematic review of randomized controlled trials to determine whether prevention or slowing of progression of chronic kidney disease would translate into improved mortality, and if so, the attributable risk due to CKD itself on mortality. BACKGROUND: CKD is associated with increased mortality. This association is largely based on evidence from the observational studies and evidence from randomized controlled trials is lacking. METHODS: We searched Ovid, Medline and Embase for RCTs in which an intervention was given to prevent or slow the progression of CKD and mortality was reported as primary, secondary or adverse outcomes were eligible and selected. For the first phase, pooled relative risks for renal endpoints were assessed. For the second phase, we assessed the effect on mortality in trials of interventions that definitively reduced CKD endpoints. RESULTS: Among 52 studies selected in first phase, only renin-angiotensin-aldosterone-system blockade vs. placebo (n = 18 trials, 32,557 participants) met the efficacy criteria for further analysis in the second phase by reducing renal endpoints 15 to 27% compared to placebo. There was no difference in all-cause mortality (RR 0.99, 95% CI 0.92 to 1.08) or CV death (RR 0.97, 95% CI 0.78 to 1.21) between the treatment and control groups in these trials. There was sufficient statistical power to detect a 9% relative risk reduction in all-cause mortality and a 14% relative risk reduction in cardiovascular mortality. CONCLUSIONS: Firm evidence is lacking that prevention of CKD translates into reductions in mortality. Larger trials with longer follow-up time are needed to determine the benefit of CKD prevention on survival.

Koye, D. N., Shaw, J. E., Reid, C. M., et al. (2017). "Incidence of chronic kidney disease among people with diabetes: a systematic review of observational studies." Diabet Med **34**(7): 887-901.

> AIMS: The aim was to systematically review published articles that reported the incidence of chronic kidney disease among people with diabetes. METHODS: A systematic literature search was performed using MEDLINE, Embase and CINAHL databases. The titles and abstracts of all publications identified by the search were reviewed and 10 047 studies were retrieved. RESULTS: A total of 71 studies from 30 different countries with sample sizes ranging from 505 to 211 132 met the inclusion criteria. The annual incidence of microalbuminuria and albuminuria ranged from 1.3% to 3.8% for Type 1 diabetes. For Type 2 diabetes and studies combining both diabetes types, the range was from 3.8% to 12.7%, with four of six studies reporting annual rates between 7.4% and 8.6%. In studies reporting the incidence of eGFR < 60 ml/min/1.73 m(2) using the Modification of Diet on Renal Disease (MDRD) equation, apart from one study which reported an annual incidence of 8.9%, the annual incidence ranged from 1.9% to 4.3%. The annual incidence of end-stage renal disease ranged from 0.04% to 1.8%. CONCLUSIONS: The annual incidence of microalbuminuria and albuminuria is ~ 2-3% in Type 1 diabetes, and ~ 8% in Type 2 diabetes or mixed diabetes type. The incidence of developing eGFR < 60

ml/min/1.73 m(2) is ~ 2-4% per year. Despite the wide variation in methods and study design, within a particular category of kidney disease, there was only modest variation in incidence rates. These findings may be useful in clinical settings to help understand the risk of developing kidney disease among those with diabetes.

Kramann, R., Floege, J., Ketteler, M., et al. (2012). "Medical options to fight mortality in end-stage renal disease: a review of the literature." Nephrol Dial Transplant **27**(12): 4298-4307.

Many therapeutic strategies for end-stage renal disease (ESRD) patients have failed to exhibit survival improvement in large-scale randomized controlled trials (RCTs). The current review gives an overview on the medical strategies for treatment of ESRD patients that have previously been tested in RCTs with mortality reduction as pre-specified study endpoint. We identified 19 RCTs with the following therapeutic strategies: haematocrit increase by erythropoietin (n = 1), growth hormone application (n = 1), lipid-lowering by statins (n = 3), renin-angiotensin system blockage (n = 4), beta-receptor blockage (n = 1), homocysteine lowering (n = 5), application of anti-oxidative substances (n = 2), omega-3-fatty-acid supplementation (n = 1) and calcium-free phosphate binders (n = 1). While several of these studies were able to demonstrate reductions in hard cardiovascular endpoints such as myocardial infarction, survival improvement in ESRD patients was demonstrated in only three studies. The substances tested in these three trials were telmisartan, candesartan and carvedilol. In summary, most pharmaceutical mono-interventions failed to reduce mortality in ESRD patients, i.e. a multi-morbid population. Apart from the issues relating to future trial design, this raises the question of whether we need multi-faceted interventions to improve this dismal situation. Until then, nephrologists are left with little evidence and lots of opinions.

Mills, K. T., Xu, Y., Zhang, W., et al. (2015). "A systematic analysis of worldwide population-based data on the global burden of chronic kidney disease in 2010." Kidney Int **88**(5): 950-957.

Chronic kidney disease (CKD) is a major risk factor for end-stage renal disease, cardiovascular disease, and premature death. Here we estimated the global prevalence and absolute burden of CKD in 2010 by pooling data from population-based studies. We searched MEDLINE (January 1990 to December 2014), International Society of Nephrology Global Outreach Program-funded projects, and bibliographies of retrieved articles and selected 33 studies reporting gender- and age-specific prevalence of CKD in representative population samples. The age-standardized global prevalence of CKD stages 1-5 in adults aged 20 and older was 10.4% in men (95% confidence interval 9.3-11.9%) and 11.8% in women (11.2-12.6%). This consisted of 8.6% in men (7.3-9.8%) and 9.6% in women (7.7-11.1%) in high-income countries, and 10.6% in men (9.4-13.1%) and 12.5% in women (11.8-14.0%) in low- and middle-income countries. The total number of adults with CKD was 225.7 million (205.7-257.4 million) men and 271.8 million (258.0-293.7 million) women. This consisted of 48.3 million (42.3-53.3 million) men and 61.7 million (50.4-69.9 million) women in high-income countries, and 177.4 million (159.2-215.9 million) men and 210.1 million (200.8-231.7 million) women in low- and middle-income countries. Thus, CKD is an important global-health challenge, especially in low- and middle-income countries. National and international efforts for prevention, detection, and treatment of CKD are needed to reduce its morbidity and mortality worldwide.

Narres, M., Claessen, H., Droste, S., et al. (2016). "The Incidence of End-Stage Renal Disease in the Diabetic (Compared to the Non-Diabetic) Population: A Systematic Review." PLoS One **11**(1): e0147329.

End-stage renal disease (ESRD) in diabetes is a life threatening complication resulting in a poor prognosis for patients as well as high medical costs. The aims of this systematic review were (1) to evaluate the incidence of ESRD due to all causes and due to diabetic nephropathy in the diabetic population and differences between incidences of ESRD with respect to sex, ethnicity, age and regions, (2) to compare incidence rates in the diabetic and non-diabetic population, and (3) to investigate time trends. The systematic review was conducted according to the PRISMA group guidelines by performing systematic literature searches in the biomedical databases until January 3rd 2015; thirty-two studies were included. Among patients with incident type 1 diabetes the 30-year cumulative incidence ranged from 3.3% to 7.8%. Among patients with prevalent diabetes, incidence rates of ESRD due to all causes ranged from 132.0 to 167.0 per 100,000 person-years, whereas incidence rates of ESRD due to

> diabetic nephropathy varied from 38.4 to 804.0 per 100,000 person-years. The incidence of ESRD in the diabetic population was higher compared to the non-diabetic population, and relative risks varied from 6.2 in the white population to 62.0 among Native Americans. The results regarding time trends were inconsistent. The review conducted demonstrates the considerable variation of incidences of ESRD among the diabetic population. Consistent findings included an excess risk when comparing the diabetic to the non-diabetic population and ethnic differences. We recommend that newly designed studies should use standardized methods for the determination of ESRD and population at risk.

Rodriguez, R. A., Hotchkiss, J. R. et O'Hare, A. M. (2013). "Geographic information systems and chronic kidney disease: racial disparities, rural residence and forecasting." J Nephrol **26**(1): 3-15.

> The dynamics of health and health care provision in the United States vary substantially across regions, and there is substantial regional heterogeneity in population density, age distribution, disease prevalence, race and ethnicity, poverty and the ability to access care. Geocoding and geographic information systems (GIS) are important tools to link patient or population location to information regarding these characteristics. In this review, we provide an overview of basic GIS concepts and provide examples to illustrate how GIS techniques have been applied to the study of kidney disease, and in particular to understanding the interplay between race, poverty, rural residence and the planning of renal services for this population. The interplay of socioeconomic status and renal disease outcomes remains an important area for investigation and recent publications have explored this relationship utilizing GIS techniques to incorporate measures of socioeconomic status and racial composition of neighborhoods. In addition, there are many potential challenges in providing care to rural patients with chronic kidney disease including long travel times and sparse renal services such as transplant and dialysis centers. Geospatially fluent analytic approaches can also inform system level analyses of health care systems and these approaches can be applied to identify an optimal distribution of dialysis facilities. GIS analysis could help untangle the complex interplay between geography, socioeconomic status, and racial disparities in chronic kidney disease, and could inform policy decisions and resource allocation as the population ages and the prevalence of renal disease increases.

Roughley, M. J., Belcher, J., Mallen, C. D., et al. (2015). "Gout and risk of chronic kidney disease and nephrolithiasis: meta-analysis of observational studies." Arthritis Res Ther **17**: 90.

> INTRODUCTION: To determine the prevalence of chronic kidney disease and nephrolithiasis in people with gout, and the association between gout and prevalent or incident chronic kidney disease and nephrolithiasis. METHODS: Systematic review and meta-analysis of epidemiological studies. Data sources; MEDLINE, EMBASE and CINAHL databases, hand-searched reference lists, citation history and contact with authors. ELIGIBILITY CRITERIA: cohort, case-control or cross-sectional studies which examined the occurrence of chronic kidney disease or nephrolithiasis amongst adults with gout (with or without a non-gout comparator group) in primary care or general population samples. Prevalence and risk estimate meta-analyses were performed using a random-effects model. RESULTS: Seventeen studies were included in the meta-analysis (chronic kidney disease n = 7, nephrolithiasis n = 8, both n = 2). Pooled prevalence estimates of chronic kidney disease stage >/=3 and self-reported lifetime nephrolithiasis in people with gout were 24% (95% confidence interval 19% to 28%) and 14% (95% CI 12% to 17%) respectively. Gout was associated with both chronic kidney disease (pooled adjusted odds ratio 2.41, 95% confidence interval 1.86 to 3.11) and self-reported lifetime nephrolithiasis (1.77, 1.43 to 2.19). CONCLUSIONS: Chronic kidney disease and nephrolithiasis are commonly found amongst patients with gout. Gout is independently associated with both chronic kidney disease and nephrolithiasis. Patients with gout should be actively screened for chronic kidney disease and its consequences.

Ympa, Y. P., Sakr, Y., Reinhart, K., et al. (2005). "Has mortality from acute renal failure decreased? A systematic review of the literature." Am J Med **118**(8): 827-832.

> PURPOSE: To determine mortality rates in patients with acute renal failure during the past decades. METHODS: We performed a MEDLINE search using the keywords "acute renal failure" crossed with "outcome," "mortality," "ICU," "critically ill" or "prognosis" in the period from January 1970 to December

> 2004. Abstracts and full articles were eligible if mortality rates were reported. We also reviewed the bibliographies of available studies for further potentially eligible studies. The dates of the observation period for each study and not the publication dates were considered for the analysis, so the earliest data were from 1956. RESULTS: Of 85 articles fulfilling the criteria, 5 were excluded because of duplicate publications using the same database, so that 80 were included in our review with a total of 15897 patients. Mortality rates in most studies exceeded 30%, and there was no consistent change over time. CONCLUSION: Despite technical progress in the management of acute renal failure over the last 50 years, mortality rates seem to have remained unchanged at around 50%.

LES DONNEES DES REGISTRES

Études françaises

Agence de Biomédecine (2016). Rapport annuel 2015 de REIN (Réseau épidémiologique, information, néphrologie). Paris : Agence de Biomédecine.

Agence FrançasedeBiomédecine (2017). Registre français de traitements de suppléance de l'insuffisance rénale chronique : rapport du Réseau Epidémiologie et Information en Néphrologie (REIN) 2016, Paris : Agence Française de Biomédecine

> Cette publication rassemble les données épidémiologiques 2016 sur l'insuffisance rénale chronique et terminale en France ainsi que des informations sur la prise en charge et les modalités de traitement : dialyse, greffe.

Bechade, C., Dejardin, O., Bara, S., et al. (2018). "Incidence and characteristics of chronic renal replacement therapy in patients with cancer: data from kidney and cancer registries in Basse-Normandie." J Nephrol **31**(1): 111-118.

> Aims To estimate the incidence of chronic dialysis in patients with a history of cancer and assess how renal replacement therapy is initiated in this population. Methods We merged data from cancer registries and hospital databases in one French region to identify patients with an incident cancer between 2001 and 2008 who started chronic dialysis. Results Mean participation time was 3.4 +/- 2.7 years. Males comprised 58.5 % of participants. During the study period, 74 chronic dialysis treatments were initiated. Chronic interstitial nephritis was the leading cause of end-stage renal disease (21.6 %), and 46.6 % of dialysis initiation cases were unplanned. The incidence rate of chronic dialysis initiation in the population of incident cancer patients was 370 per million population/year (74 events/199,809 person-years). After age-adjustment, the standardized incidence ratio was 1.26, 95 % confidence interval 0.98-1.57, p = 0.55. Conclusion Cancer patients are known to be at risk of chronic kidney disease. However, the standardized incidence ratio of chronic dialysis initiation did not differ significantly between cancer patients and the general population. Further studies should be performed to identify the barriers to starting renal replacement therapy in cancer patients.

Ben Said, M., le Mignot, L., Mugnier, C., et al. (2005). "A Multi-Source Information System via the Internet for End-Stage Renal Disease: Scalability and Data Quality." Stud Health Technol Inform **116**: 994-999.

> A Multi-Source Information System (MSIS), has been designed for the Renal Epidemiology and Information Network (REIN) dedicated to End-Stage Renal Disease (ESRD). MSIS aims at providing reliable follow-up data for ESRD patients. It is based on an n-tier architecture, made out of a universal client, a dynamic Web server connected to a production database and to a data warehouse. MSIS is operational since 2002 and progressively deployed in 9 regions in France. It includes 11,500 patients. MSIS facilitates documenting medical events which occur during the course of ESRD patient' health care and provides means to control the quality of each patient's record and reconstruct the patient trajectory of care. Consolidated data are made available to a data warehouse and to a geographic information system for analysis and data representation in support of public-health decision making.

Briancon, S., Gentile, S., Isnard-Bagnis, C., et al. (2014). "Focus. Méthodologie générale de l'étude Quavi-REIN, Volet dialyse & greffe 2011, France." Bulletin Epidemiologique Hebdomadaire(37-38): 611-615.
http://www.invs.sante.fr/beh/2014/37-38/2014_37-38_4.html

Castrale, C., Evans, D., Verger, C., et al. (2010). "Peritoneal dialysis in elderly patients: report from the French Peritoneal Dialysis Registry (RDPLF)." Nephrol Dial Transplant **25**(1): 255-262.

> BACKGROUND: The number of elderly patients starting dialysis is increasing in developed countries. Older age is frequently associated with contraindication of peritoneal dialysis (PD). The aim of this study was to report the outcome of elderly patients on PD in a country where assisted PD is available. METHODS: This was a retrospective study based on the data of the French Language Peritoneal Dialysis Registry (RDPLF). We retrospectively analysed 1613 patients older than 75 years who started PD between January 2000 and December 2005. The end of the observation period was 31 December 2007. RESULTS: The mean age at dialysis initiation was 81.9 years; 545 patients had a Charlson comorbidity index (CCI) >9. Of these 1613 patients, 1435 were treated by continuous ambulatory peritoneal dialysis (CAPD) and 1232 were on assisted PD. The median patient survival was 27.1 months. In the multivariate analysis, patient survival was associated with sex, age, modified CCI, method of assistance and underlying nephropathy. The median pure technique survival was 21.4 months. In the Cox model, technique survival was associated with the modified CCI, but the association did not remain significant after adjustment for the centre size. The median survival free of peritonitis was 32.1 months. Neither the modality of assistance nor the centre size was associated with peritonitis risk. CONCLUSION: PD is a suitable method for elderly patients. In order to increase the rate of PD utilization in elderly patients, the need for the funding of assisted peritoneal dialysis has to be taken into account.

Couchoud, C., Lassalle, M. et Jacquelinet, C. (2013). "[REIN Report 2011--summary]." Nephrol Ther **9 Suppl 1**: S3-6.

> INCIDENT PATIENTS: In 2011, in France, we estimate that 9 400 patients started a treatment by dialysis (incidence of dialysis: 144 per million inhabitants) and 335 patients with a pre-emptive graft without previous dialysis (incidence of pre-emptive graft: 5 per million inhabitants). As in 2010, incidence rate seems to stabilize. Elders provide the majority of new patients (median age at RRT start: 71 years old). New patients present a high rate of disabilities especially diabetes (41% of the new patients) and cardiovascular disabilities (>50% of the new patients) that increase with age. Considering treatment and follow-up, the first treatment remains center's hemodialysis and we do not notice any progression of self-dialysis. RRT started in emergency in 33% of the patients. This finding contrasts with the fact that 56% of patients started hemodialysis on a catheter. This, together with the major inter-region variability, suggests that different strategies of management exist. Finally, the hemoglobin level at RRT start seems to be an interesting indicator of good management and follow-up since 13% of patients presenting an underprovided follow-up have a hemoglobin level under 10g/dl, whereas only 2.5% of patients with an appropriate follow-up presented such a condition. PREVALENT PATIENTS: On December 31, 2011, in France, we estimate that 70.700 patients were receiving a renal replacement therapy, 39.600 (56%) on dialysis and 31.100 (44%) living with a functional renal transplant. The overall crude prevalence was 1091 per million inhabitants. It was 1.6 higher in males. Prevalence was subject to regional variations with 5 regions (3 overseas) above the national rate. Renal transplant share varied from 33% in Nord-Pas de Calais to 53% in Pays de Loire, and from 16 to 25% in overseas regions. The study of temporal variations for 18 regions contributing to the registry since 2007 demonstrated a +4% increase in standardized prevalence of ESRD patients with a functional transplant vs. +2% increase for dialysis, resulting in a decreasing gap between dialysis and transplantation prevalence, due to an increase number of renal transplant and a longer survival of transplanted patients. The main dialysis technique was hemodialysis (93.3% of patients). Even if an important inter-region variability remains considering the choices of treatment, more than 50% of the patients are undergoing hemodialysis in a hospital-based incenter unit, and we noticed an increase in hemodialysis in a medical satellite unit with time whereas the rate of self-care hemodialysis decreases. The rate of peritoneal dialysis remains stable. When comparing guidelines to real-life treatments, 77.5% of patients receive adequate dose of treatment (12 H/week, KT/ V>1.2), the rate of patients with a hemoglobin blood-level lower than 10g/dl and without erythropoietin treatment is 1.3%, which

confirmed a good management of anemia. On the contrary, 34% of patients have a BMI lower than 23kg/m(2) and only 23% have an albumin blood-level over 40g/l, which underlines that nutritional management of ESRD patients can be improved. MORTALITY: Age strongly influences survival on dialysis. Thus, one year survival of patients under age 65 is over 90%. After 5 years, among patients over 85 years, it is more than 15%. The presence of diabetes or one or more cardiovascular comorbidities also significantly worse patient survival. In terms of trend, we do not find significant improvement in the 2-year survival between patients in the cohort 2006-2007 and the 2008-2009 cohort. Cardiovascular diseases account for 27% of causes of death to infectious diseases (12%) and cancer (10%). Life expectancy of patients is highly dependent on their treatment. Thus, a transplant patient aged 30 has a life expectancy of 41 years versus 23 years for a dialysis patient. ESRD PEDIATRIC PATIENTS: In 2011, the incidence and the prevalence of ESRD among patients under 20 years old remained stable at 8 and 53 per million inhabitants respectively. The first causes of ESDR remain uropathies and hypodysplasia followed by glomerulonephritis and genetic diseases. Considering the initial treatment, we found a high rate of hemodialysis and a low rate of peritoneal dialysis that is mainly used in younger children. In 2011, 31 preemptive transplantations were performed accounting for 27.7% of new patients. Finally, survival analysis confirm that younger children (under 4 years old) have the highest risk of death (88% survival rate at 2 years vs. 98% in patients over 4 years old) and that the treatment of choice remains the renal transplantation since it increases the expected remaining lifetime of 20 to 40 years depending on the considered age. TRANSPLANTATION: Access to the waiting list is evaluated on a cohort of 51,846 new patients who started dialysis between 2002 and 2011 in 25 regions. The probability of first wait-listing was of 3.7% at the start of dialysis (pre-emptive registrations), 15% at 12, 22% at 36 and 24% to 60 months. Patient older than 60 had a very poor access to the waiting list, whatever their diabetes status was. Among 13,653 patients less than 60 years old, the probability of being registered was 11% at the start of dialysis, 43% to 12 months, 62% to 36 months and 66% to 60 months (median dialysis duration: 16 months). Seventeen regions with up to 5 years follow-up show an increase of 8 to 15% in pre-emptive registrations between 2007 and 2001, without change at 1 year. Access to kidney transplant is evaluated on a cohort of 53,301 new patients who started a renal replacement therapy (dialysis or pre-emptive renal transplant) between 2002 and 2011 in 25 regions. The probability of first kidney transplant was of 7% at 12, 17% at 36 and 21% at 60 months. 8,633 patients (16,2%) had received a first renal transplant within 14.7 month median time; 1,455 (2.7%) had received a pre-emptive graft. Among the 14.770 new patients less than 60 years old, the probability of being transplanted was of 21% at 12, 46% at 36 and 58% at 60 months (median dialysis duration: 42 months). When pre-emptive graft were excluded, the probability of being transplanted was of 5% at 12, 15% to 36 and 19% to 60 months FLOW BETWEEN TREATMENT MODALITIES: Among the 36.849 patients on dialysis at 31/10/2010, 79% were already on RRT at 31/12/2009. Respectively 91%, 85% and 93% of the patients on HD in-center, HD self-care unit and peritoneal dialysis were in the same modality of treatment the year before. Among the 29.758 patients with a functioning graft at 31/12/2010, 98% were already on RRT at 31/12/2009, 95% of them with a functioning graft.72%, 72% and 74% of the patients with in-center HD, out-center HD and self-care unit were in the same modality of treatment at 31/12/2011. But 37% of the patients on PD at 31/12/2010 were not on PD at 31/12/2011. In 2011, new patients represented 89% of the entries in peritoneal dialysis. Renal transplantation represented 10% of the outcomes of the HD patients in self-care unit or at home.

Couchoud, C., Lassalle, M., Stengel, B., et al. (2008). "[Renal Epidemiology and Information Network: 2006 annual report]." Nephrol Ther **4 Suppl 2**: S53-167.

In 2006, 6,509 patients with end-stage renal disease living in 16 regions covering 48(M) inhabitants (79% of the French population), started renal replacement therapy (dialysis or preemptive graft): median age was 71 years; 3% had a preemptive graft. The overall crude annual incidence rate of renal replacement therapy for end-stage renal disease was 137 per million population (pmp) in 16 regions that met exhaustivity, with significant differences in sex and age-adjusted incidence across regions (107 to 179 pmh). At initiation, more than one patient out of two had at least one cardiovascular disease and 37% diabetes (88% Type 2 non-insulin-dependent diabetes). On December 31, 2006, 25,774 patients living in these 16 regions were on dialysis: median age was 69.5 years. On December 31, 19,491 patients were living with a functioning graft: median age was 53 years. The overall crude prevalence rate of dialysis was 536 pmp in 15 regions. The overall crude prevalence rate of renal graft was 409 pmp in 15 regions. The overall crude prevalence rate of renal replacement therapy for end-stage renal disease was 945 pmp in 15 regions, with significant differences in age-adjusted prevalence across regions (765 to 1061 pmh). In the 2002-06 cohort of 18,264 incident patients, the overall one-year survival rate was 82%, 72% at 2 years and 63% at 3 years. Survival decreased with age, but remained above 50% at 2 years in patients older than 75 at RRT initiation. Among the 6,321 new patients starting dialysis in 2006 in the 16 regions, 6% had a BMI lower than 18.5 kg/m(2) and 17% a BMI higher than 30. At initiation, 62% had a haemoglobin value lower than 11g/l and 9% an albumin value lower than 25g/l. The first haemodialysis was started in emergency in 30% of the patients and with a catheter in 48%. On December 31, 2006, 8% treated in the dialysis units of the 16 regions received peritoneal dialysis, of which 38% were treated with automated peritoneal dialysis. 95% of the patients on haemodialysis had 3 sessions per week, with a median duration of 4 hours. In 2006, 2,144 patients received a renal graft. On December 31, 2006, 4,838 patients were on the waiting list for a renal graft in the transplantation centres of the 16 regions.

Couchoud, C., Lassalle, M., Stengel, B., et al. (2009). "[Renal Epidemiology and Information Network: 2007 annual report]." Nephrol Ther **5 Suppl 1**: S3-144.

In 2007, 7197 patients with end-stage renal disease living in 18 regions (Auvergne, Basse-Normandie, Bourgogne, Bretagne, Centre, Champagne-Ardenne, Corse, Haute-Normandie, Ile de France, Languedoc-Roussillon, Limousin, Lorraine, Midi-Pyrenees, Nord-Pas de Calais, Picardie, Poitou-Charentes, Provence-Alpes Cote d'Azur et Rhone-Alpes) covering 52 million inhabitants (82% of the French population), started renal replacement therapy (dialysis or preemptive graft): median age was 70, 4 years; 3% had preemptive graft. The overall crude annual incidence rate of renal replacement therapy for end-stage renal disease was 139 per million population(pmp), with significant differences in sex and age-adjusted incidence across regions (99 to 168 pmh). At initiation, more than one patient out of the two had at least one cardiovascular disease and 39% diabetes (90% Type 2 non-insulin-dependent diabetes). On December 31, 2007, 31056 patients living in 20 regions(the above region plus Aquitaine and la Reunion) were on dialysis: median age was 69, 8 years. On December 31, 2007, 25699 patients were living with a functioning graft: median age was 53,5 years. In these 20 regions, the overall prevalence of dialysis was 554 pmp, that of renal graft, 459 pmp and the overall rate of renal replacement therapy for end stage renal disease, 1013 pmp with significant differences in age-adjusted prevalence across regions (746 to 2,586 pmh). In the 2003-2007 cohort of 26423 incident patients, the overall one-year survival rate was 83%, 56% at 4 years. Survival decreased with age, but remains above 50% at 2 years in patients older than 75 at RRT initiation. Among the 7195 new patients starting dialysis in 2007 in 19 regions, 7% had a BMI lower than 18,5 kg/m2 and 18% a BMI higher than 30. At initiation, 62% had an haemoglobin value lower than 11 g/l and 10% an albumin value lower than 25 g/l. The first haemodialysis was started in emergency in 32% of the patients and with a catheter in 51%. On December 31, 2007, 8% treated in the dialysis units of the 20 regions received peritoneal dialysis, of which 39% were treated with automated peritoneal dialysis. 95% of the patients on haemodialysis had 3 sessions per week, with a median duration of 4 hours. In the 2002-2007 cohort of incident patients in 11 regions under 60 years, the probability to be at least once on the waiting list for a renal graft is 50% at 18 months. In 2007, 2530 patients received renal graft. On December 31, 2007, 5661 patients were on the waiting list for a renal graft in the transplantation centres of the 20 regions..

Couchoud, C., Moranne, O., Frimat, L., et al. (2007). "Associations between comorbidities, treatment choice and outcome in the elderly with end-stage renal disease." Nephrol Dial Transplant **22**(11): 3246-3254.

BACKGROUND: New patients treated for end-stage renal disease are increasingly elderly: in France, 38% are 75 years or older. The best treatment choices for the elderly are still debated. METHODS: We studied case-mix factors associated with choice of initial dialysis modality and 2-year survival in the 3512 patients aged 75 years or older who started dialysis between 2002 and 2005 and were included in the French REIN registry. RESULTS: Overall, 18% began with peritoneal dialysis (PD), 50% with planned haemodialysis (planned HD) and 32% with unplanned HD, that is, HD that started on an emergency basis. At least one comorbid condition was reported for 85%, and three or more for 36%, but case-mix varied with age. PD was chosen significantly more often than planned HD for the oldest (> or =85) compared with the youngest (75-79) patients: odds ratio 2.1 (95% confidence interval, 1.5-

2.8), in those with congestive heart failure: 1.8 (1.5-2.3) and severe behavioural disorder: 2.2 (1.3-3.5), but less often for obese patients: 0.5 (0.3-0.8) and smokers: 0.4 (0.2-0.9). Two-year survival rates were 58, 52 and 39% in patients aged 75-79, 80-84 and > or =85, respectively. Compared with planned HD, unplanned HD was associated with a risk of mortality 50% higher, and PD with a risk 30% higher, independent of patient case-mix. CONCLUSION: PD is a common treatment option in French elderly patients, but our study suggests the need for caution in the long-term use. The high frequency of unplanned HD would require further attention.

Couchoud, C., Stengel, B. et Jacquelinet, C. (2007). "[REIN annual report 2005. Renal Epidemiology and Information Network & Agence de la biomedecine]." Nephrol Ther **3 Suppl 1**: S1-82.

In 2005, 6,021 patients with end-stage renal disease living in fourteen regions covering 45 millions inhabitants (73% of the French population), started renal replacement therapy (dialysis or preemptive graft): median age was 70 years; 3% had a preemptive graft. The overall crude annual incidence rate of renal replacement therapy for end-stage renal disease was 139 per million population (pmp) in thirteen regions that met exhaustivity, with significant differences in sex and age-adjusted incidence across regions (92 to 171 pmh). At initiation, 48% of the patients had at least one cardiovascular disease and 36% diabetes (89% Type 2 non-insulin-dependent diabetes). On December 31, 2005, 21,813 patients living in these fourteen regions were on dialysis: median age was 69 years. The overall crude prevalence rate of dialysis was 539 pmp in thirteen regions. On December 31, 2005, 19,491 patients were living with a functioning graft : median age was 53 years. The overall crude prevalence rate for these patients was 390 pmp in thirteen regions. The overall crude prevalence rate of renal replacement therapy for end-stage renal disease was 929 pmp in thirteen regions, with significant differences in age-adjusted prevalence across regions (732 to 1009 pmh). In the 2002-05 cohort of 11,632 incident patients, the overall one-year survival rate was 82%, 72% at 2 years and 62% at 3 years. Survival decreased with age, but remained above 50% at 2 years in patients older than 75 at RRT initiation. Among the 5,902 new patients starting dialysis in 2005 in the 14 regions, 7% had a BMI lower than 18,5 kg/m2 and 16% a BMI higher than 30. At initiation, 63% had an haemoglobin value lower than 11 g/ l and 9% an albumin value lower than 25 g/l. The first haemodialysis was started in emergency in 30% of the patients and with a catheter in 46%. On December 31, 2005, 8% treated in the dialysis units of the fourteen regions received peritoneal dialysis, of which 35% were treated with automated peritoneal dialysis. 94% of the patients on haemodialysis had 3 sessions per week, with a median duration of 4 hours. In 2005, 1,911 patients received a renal graft. On December 31, 2005, 4,634 patients were on the waiting List for a renal graft in the transplantation centres of the 14 regions.

Couchoud, C., Stengel, B., Landais, P., et al. (2006). "The renal epidemiology and information network (REIN): a new registry for end-stage renal disease in France." Nephrol Dial Transplant **21**(2): 411-418.

The French Renal Epidemiology and Information Network (REIN) registry began in 2002 to provide a tool for public health decision support, evaluation and research related to renal replacement therapies (RRT) for end-stage renal disease (ESRD). It relies on a network of nephrologists, epidemiologists, patients and public health representatives, coordinated regionally and nationally. Continuous registration covers all dialysis and transplanted patients. In 2003, 2070 patients started RRT, 7854 were on dialysis and 7294 lived with a functioning graft in seven regions (with a population of 16.5 million people). The overall crude annual incidence rate of RRT for ESRD was 123 per million population (p.m.p.) with significant differences in age-adjusted rates across regions, from 84 [95% confidence interval (CI): 74-94] to 155 [138-172] p.m.p. The principal causes of ESRD were hypertension (21%) and diabetic (20%) nephropathies. Initial treatment for ESRD was peritoneal dialysis for 15% of patients and a pre-emptive graft for 3%. The one-year survival rate was 81% [79-83] in the cohort of 2002-2003 incident patients. As of December 31, 2003, the overall crude prevalence was 898 [884-913] p.m.p, with 5% of patients receiving peritoneal dialysis, 47% on haemodialysis and 48% with a functioning graft. The experience in these seven regions over these two years clearly shows the feasibility of the REIN registry, which is progressively expanding to cover the entire country.

Deschenes, G. et Fila, M. (2011). "[Pediatric renal transplantation in France. Introduction]." Nephrol Ther **7**(7): 582-586.

Pediatric nephrology is a relatively recent medical speciality. The first French center opened in January 1969 at the Hospital des Enfants-Malades. In 2008, according to the Reseau Epidemiologie et Information en Nephrologie (REIN), the annual incidence of end stage renal disease (ESRD) was of 7,8 children/million children below the age of 20, which equals a prevalence of 49 pediatric ESRD patients/million inhabitants. The frequency of causative factors of ESRD varies according to the geographic and ethnic origin of the patients. Many challenges still lay ahead of ESRD management. The children's physical, psychological and social development has to be well taken care of until adulthood and the transition from pediatric to adult unit has to be handled with special care. The set up of pediatric nephrology departments helped to the access of patients to renal replacement therapy, in particular the pediatric priority for kidney donors below 30 years of age. In the 2000s period, the annual rate of pediatric renal transplantation was 70 to 75 grafts per year in France, half of which performed in the Paris area. This article presents the historical background of pediatric nephrology and pediatric renal transplantation in France.

Hourmant, M., de Cornelissen, F., Brunet, P., et al. (2013). "[Access to the waiting list and renal transplantation]." Nephrol Ther **9 Suppl 1**: S139-166.

This chapter provides a set of indicators related to Renal Transplantation access in France. It describes patient outcomes and reports on cumulative incidence rates of wait-listing and renal transplantation according to main patient of characteristics and regions. The REIN registry integrates kidney transplant and dialysis data. It provides a comprehensive view on waiting list and renal transplantation access to the patients, nephrologists, and national or regional health authorities. Access to the waiting list is evaluated on a cohort of 51,845 new patients who started dialysis between 2002 and 2011 in 25 regions. The probability of first wait-listing was of 3.7% at the start of dialysis (pre-emptive registrations), 15% at 12, 22% at 36 and 24% to 60 months. The probability of being registered was strongly related to age, diabetes and region. Patient older than 60 had a very poor access to the waiting list, whatever their diabetes status was. Probability of first wait-listing was much lower (36.5% at 60 months) in type 2 diabetic-40 to 59 years old patients. Among 13,653 patients less than 60 years old, the probability of being registered was 11% at the start of dialysis, 43% to 12 months, 62% to 36 months and 66% to 60 months (median dialysis duration: 16 months). Seventeen regions with up to 5 years follow-up show an increase of 8 to 15% in pre-emptive registrations between 2007 and 2001, without change at 1 year. Access to kidney transplant is evaluated on a cohort of 53,301 new patients who started a renal replacement therapy (dialysis or pre-emptive renal transplant) between 2002 and 2011 in 25 regions. The probability of first kidney transplant was of 7% at 12, 17% at 36 and 21% at 60 months. 8,633 patients (16,2%) had received a first renal transplant within 14.7 month median time; 1,455 (2.7%) had received a pre-emptive graft [male: 58%, median age: 48.7y]. Among the 14,770 new patients less than 60 years old, the probability of being transplanted was of 21% at 12, 46% at 36 and 58% at 60 months (median dialysis duration: 42 months). When pre-emptive graft were excluded, the probability of being transplanted was of 5% at 12, 15% to 36 and 19% to 60 months Insofar as kidney transplant is regarded as the most efficient treatment, access to the waiting list and renal transplant are sensitive issues.

Jacquelinet, C. et Briancon, S. (2005). "Le Réseau épidémiologie et information en néphrologie (Rein) : un registre national des traitements de suppléance de l'insuffisance rénale chronique." Bulletin Epidemiologique Hebdomadaire(37-38): 185-187, 182 tabl.

[BDSP. Notice produite par InVS GN58R0xP. Diffusion soumise à autorisation]. Le "Réseau épidémiologie et information en néphrologie" (Rein) a été conçu pour répondre aux questions de santé publique que soulèvent les traitements de suppléance de l'insuffisance rénale chronique terminale. Sa finalité est de contribuer à l'élaboration et à l'évaluation de stratégies sanitaires cherchant à améliorer la prise en charge de l'insuffisance rénale dans ses différentes dimensions : organisation des soins et pratiques cliniques. Cette finalité impose de mieux connaître les besoins de santé, l'offre de soins et le devenir des malades. Rein s'inscrit dans une démarche de médecine et de politique de santé publique fondée sur les données probantes en cohérence avec les décrets n° 2002-1197 et 2002-1198 qui déterminent un nouveau système de régulation de la dialyse basé sur les besoins de la population et avec la loi relative à la politique de santé publique du 9 Août 2004 qui fixe des objectifs explicites pour l'insuffisance rénale chronique. Après une phase expérimentale qui a montré la faisabilité du projet, Rein est maintenant implanté dans 13 régions représentant 70% de la population française (tableau 1). Cet article décrit ces objectifs, les méthodes, les technologies et les résultats attendus. (Introduction).

Kessler, M., Ayav, C., Erpelding, M. L., et al. (2012). "[Trends in the characteristics of ESRD patients at the initiation of dialysis]." Nephrol Ther **8**(7): 521-526.

Changing trends concerning the incidence, sociodemographic features, and comorbidities observed among patients, starting their first renal replacement therapy by dialysis were studied in nine geographic regions in France participating in the REIN registry from 2004 to 2009. The standardized incidence of patients on dialysis remained stable while patient age tended to increase. After adjustment for age, the overall number of comorbid conditions remained unchanged, with a decrease in the number of patients with cardiovascular disease. These results, together with trends in laboratory results, suggest that the general health status of the patient population remains unchanged despite increasing age and that care for chronic renal failure has improved, generating an environment of prudent optimism for the future.

Landais, P., Simonet, A., Guillon, D., et al. (2002). "[SIMS REIN: a multi-source information system for end-stage renal disease]." C R Biol **325**(4): 515-528.

In France, the prevalence of End-Stage Renal Disease (ESRD) is not precisely known. The sources of information are scattered and not coordinated. Consequently, care is ill adapted to meet the demand. The Multi-Source Information System is the basis of the Renal Epidemiology and Information Network (REIN). It is dedicated to improve and organise our medical and epidemiological knowledge of ESRD and to aid public health decision-making in this area. The proposed approach is based on the datawarehouses. This model allows a unified vision of scattered data into distinct databases, for a better management, be it particular (patient follow-up) or global (regional follow-up), with a finality of aid in decision-making. Several categories of problems were considered: the global conception of the information system, the organisation of the datawarehouse, which offers different viewpoints of the data, the integration of heterogeneous data coming from different sources, data exchange and definition of a specific ontology.

Lassalle, M., Ayav, C., Frimat, L., et al. (2015). "The essential of 2012 results from the French Renal Epidemiology and Information Network (REIN) ESRD registry." Nephrol Ther **11**(2): 78-87.

The French Renal Epidemiology and Information Network (REIN) registry began in 2002 to provide a tool for public health decision support, evaluation and research related to renal replacement therapies (RRT) for end-stage renal disease (ESRD). It is relying on a network of nephrologists, epidemiologists, patients and public health representatives. Continuous registration covers all dialysis and transplanted patients. In 2012, in France, 10,048 patients started a RRT (154 per million inhabitants). Elders provided majority of new patients (median age at RRT start: 70 years old). New patients had a high and age increasing rate of comorbidities, especially diabetes (42% of the new patients) and cardiovascular comorbidities (>50% of the new patients). Like previous years, incidence is stabilized. On December 31, 2012, 73,491 patients were receiving a RRT in France (1127 per million inhabitants, 56% on dialysis and 44% living with a functional renal transplant). More than 50% of patients were undergoing in-center hemodialysis with significant variations among regions. An increase in medical satellite unit hemodialysis but a decrease in self-care unit hemodialysis rates were noticed across the time, whereas peritoneal dialysis remained stable at 7%. Five years after starting RRT, the overall survival rate was 51% but only 16% among patients over 85 years. Mortality rate was highly dependent on treatment and age; transplanted patients aged 60-69 had a 27/1000 patients-year mortality rate versus 133 for a dialysis patient. Patients who started dialysis had a probability of first wait-listing of 4.8% at the start of dialysis (pre-emptive registrations) and 27% at 72 months. Whatever their diabetes status was, patients older than 60 had poor access to the waiting list. Seventeen percent of the patients received a first renal transplant within 15.4 month median time; 3% had received a pre-emptive graft. Ten years after the start of the French ESRD registry, this report provides a comprehensive and nation-wide overview of dialysis and transplantation cares in France, including overseas.

Moranne, O., Couchoud, C., Kolko-Labadens, A., et al. (2012). "[Description of characteristics, therapy and outcome of patients older than 75 years presenting with severe renal insufficiency (eGFR below 20 mL/min/1.73 m(2): pilot study]." Nephrol Ther **8**(7): 516-520.

In France, the incidence of dialysis patients is increasing in people over 75 years and represents 40% of incident patients. In these elderly patients with many comorbidities, the benefit of dialysis in terms of survival and quality of life remains controversial. Using data from REIN, determinants of early mortality were identified and a prognostic score was provided. This approach must now be adapted to elderly with end stage renal failure (ESRF) not on dialysis for which we have little data on their clinical characteristics, therapeutic projects and outcome. We report the results of a pilot study and the prospective study protocol that resulted. In four French nephrology department, 76 patients were studied with a mean age of 83 +/- 5 years, with a MDRD estimated GFR (abbreviated MDRD) of 16 +/- 4 mL/min/1.73 m(2). These patients were different from the population on dialysis recorded in REIN. This pilot study has shown the feasibility of a prospective study on a larger scale, which aims to build a valuable tool for decision making in elderly patients with ESRF not yet on dialysis.

Occelli, F., Deram, A., Genin, M., et al. (2014). "Mapping end-stage renal disease (ESRD): spatial variations on small area level in northern France, and association with deprivation." PLoS One **9**(11): e110132.

BACKGROUND: Strong geographic variations in the incidence of end-stage renal disease (ESRD) are observed in developed countries. The reasons for these variations are unknown. They may reflect regional inequalities in the population's sociodemographic characteristics, related diseases, or medical practice patterns. In France, at the district level, the highest incidence rates have been found in the Nord-Pas-de-Calais region. This area, with a high population density and homogeneous healthcare provision, represents a geographic situation which is quite suitable for the study, over small areas, of spatial disparities in the incidence of ESRD, together with their correlation with a deprivation index and other risk factors. METHODS: The Renal Epidemiology and Information Network is a national registry, which lists all ESRD patients in France. All cases included in the Nord-Pas-de-Calais registry between 2005 and 2011 were extracted. Adjusted and smoothed standardized incidence ratio (SIR) was calculated for each of the 170 cantons, thanks to a hierarchical Bayesian model. The correlation between ESRD incidence and deprivation was assessed using the quintiles of Townsend index. Relative risk (RR) and credible intervals (CI) were estimated for each quintile. RESULTS: Significant spatial disparities in ESRD incidence were found within the Nord-Pas-de-Calais region. The sex- and age-adjusted, smoothed SIRs varied from 0.66 to 1.64. Although no correlation is found with diabetic or vascular nephropathy, the smoothed SIRs are correlated with the Townsend index (RR: 1.18, 95% CI [1.00-1.34] for Q2; 1.28, 95% CI [1.11-1.47] for Q3; 1.30, 95% CI [1.14-1.51] for Q4; 1.44, 95% CI [1.32-1.74] for Q5). CONCLUSION: For the first time at this aggregation level in France, this study reveals significant geographic differences in ESRD incidence. Unlike the time of renal replacement care, deprivation is certainly a determinant in this phenomenon. This association is probably independent of the patients' financial ability to gain access to healthcare.

Richard, J. B., Aldigier, J. C., Le Mignot, L., et al. (2009). "Equity of accessibility to dialysis facilities." Stud Health Technol Inform **150**: 777-781.

Patients' end-stage renal disease (ESRD) characteristics are changing. Improving the quality of care requires a steady adaptation of treatment modalities together with equity of access to dialysis facilities. We explored the ability of the health system to cope with the demand of ESRD care. An analysis of a 5-year follow-up cohort of ESRD patients in the Limousin region, France, was performed. Data were entered in the Multi-Source Information System of the Renal Epidemiology and Information Network (REIN). The participation rate of centres was complete. We analysed patient characteristics, therapeutic options and driving time to reach dialysis facilities. We investigated geographic accessibility by defining areas within 45 minutes from dialysis units. We constructed scenarios to assess the impact of health care reorganization. In-centre haemodialysis units represented 73% of treatment modalities. One quarter of patients lived at more than 45 minutes of their dialysis unit.

Based on a scenario of creating an additional In-centre unit, the number of patients living far from their centre would decrease by 31%. This study emphasizes important issues related to ESRD epidemiology, comorbidity and health care planning. It stimulates the development of new scenarios allowing the assessment of equity in accessing health care facilities.

Romeu, M., Couchoud, C., Delaroziere, J. C., et al. (2014). "Survival of patients with ANCA-associated vasculitis on chronic dialysis: data from the French REIN registry from 2002 to 2011." Qjm **107**(7): 545-555.

BACKGROUND: Anti-neutrophil cytoplasmic antibody (ANCA)-associated vasculitides (AAV) can lead to end-stage renal disease in patients with renal involvement. OBJECTIVE: This study evaluated the survival of AAV patients on chronic dialysis in France. METHODS: Between 2002 and 2011, a total of 425 AAV patients started chronic dialysis and were registered in the Renal Epidemiology and Information Network. We analysed survival censored for renal transplantation, recovery of renal function and loss to follow-up. AAV patients were compared with 794 matched non-AAV patients on chronic dialysis. RESULTS: A total of 166 (39%) patients with microscopic polyangiitis and 259 (61%) patients with granulomatosis with polyangiitis were registered. Within a median follow-up of 23 months, 58 (14%) patients received a renal allograft and 19 (4%) recovered renal function. Median survival on dialysis was 5.35 years (95% CI, 4.4-6.3) and survival rates at 3 months, 1, 3 and 5 years were 96%, 85%, 68% and 53%, respectively. A total of 143 (41%) patients died after a median of 16 months. Causes of death were cardiovascular (29%), infections (20%), malnutrition (13%), malignancies (4%), AAV relapse (2%), miscellaneous (14%) and unknown (18%). Multivariate logistic regression identified three independent risk factors associated with AAV patients' mortality: age (HR = 1.05/year, P < 0.001), peripheral artery disease (HR = 2.62, P = 0.003) and frailty (HR = 2.43, P < 0.001). Survival of AAV patients did not differ from non-AAV controls, but infectious mortality was higher in AAV patients (20% vs. 8%, P < 0.001). CONCLUSION: Survival of AAV patients in chronic dialysis, although poor, was comparable to survival of non-AAV controls on dialysis. There was a similar burden of cardiovascular mortality, but higher infectious mortality.

Ronco, P. (2012). "[Kidney diseases: new issues]." Presse Med **41**(3 Pt 1): 240-246.

Chronic kidney disease (CKD) affects two to four million people in France and most of them are not aware of their disease. CKD is a major, independent risk factor of cardiovascular mortality and morbidity; the cardiovascular risk increases with the severity of renal failure. Evaluation of renal function (GFR) relies on MDRD and CKD-EPI equations. The French CKD-REIN cohort with more than 3000 patients followed for 5 years, will hopefully provide substantial advances in the knowledge of CKD epidemiology, of risk factors and mechanisms of CKD progression and medical practices. Improving CKD screening based on blood pressure, proteinuria (microalbuminuria in diabetic patients) and serum creatinine, is a national duty in high risk patients (with diabetes, hypertension and cardiovascular diseases). A major research goal is to identify new therapeutic targets and biomarkers, in order to treat kidney diseases before the occurrence of renal insufficiency, to halt their progression and to decrease cardiovascular risk. Careful therapeutic education of patients is required to successfully implement established guidelines, appropriate diets and new therapeutic strategies.

Societe Francophone de Nephrologie Dialyse (2017). "[Report on chronic dialysis in France in 2016]." Nephrol Ther **13**(2): 105-126.

The report on dialysis in France in 2016 from the French Speaking Society of Nephrology Dialysis and Transplantation (SFNDT) provides an exhaustive and documented inventory on dialysis in France. It underlines the organizations that are important in 2016 to maintain a high quality dialysis. Several measures are proposed to maintain and improve the care of dialysis in France: (1) The regulation of dialysis treatment in France must be maintained; (2) a burden of care indicator is proposed to ensure that patients requiring the most care are treated in the centers. Proposals are also made to stimulate peritoneal dialysis offers, (3) to improve the calculation of the cost of dialysis and warn against lower reimbursement rates of dialysis, (4) to reduce transport costs by minimizing transport by ambulance (5). The SFNDT recalls recent recommendations concerning access to the renal transplant waiting list, are recalled; (6) as well as recommendations that require waiting until clinical signs are present to start dialysis (7). The SFNDT makes the proposal to set up advanced renal failure units. These units are expected to develop care that is not supported today: consultation with a nurse, a dietician, a social worker or psychologist, palliative care, and coordination (8). Finally, the financial and human resources for pediatric dialysis should be maintained.

Speyer, E., Gentile, S., Isnard-Bagnis, C., et al. (2014). "Caractéristiques sociodémographiques et médicales des participants à l'étude Quavi-REIN, Volet dialyse & greffe 2011, France." Bulletin Epidemiologique Hebdomadaire(37-38): 616-622.
http://www.invs.sante.fr/beh/2014/37-38/2014_37-38_4.html

[BDSP. Notice produite par InVS 9J7R0xlE. Diffusion soumise à autorisation]. Cet article présente les caractéristiques de l'état de santé des personnes adultes en insuffisance rénale chronique terminale (IRCT), en dialyse ou porteuses d'un greffon fonctionnel depuis au moins un an en France. Les informations reposent sur l'étude Quavi-REIN, enquête nationale représentative auprès des personnes en IRCT menée en 2011. L'échantillon était constitué de 1 251 personnes en dialyse et 1 658 personnes greffées. L'âge moyen des personnes à l'initiation du premier traitement de suppléance était de 63,9 ans pour les dialysés et de 45,9 ans pour les greffés (p<0,0001). La durée du traitement de suppléance était en moyenne de 6 ans [min : 1,5 ; max : 37,5] pour les personnes en dialyse et de 10 ans [1,5 ; 39,8] pour les greffés. La durée moyenne de dialyse avant la transplantation était de 2,6 ans. Les personnes en dialyse présentaient en moyenne plus de comorbidités (2,6 comorbidités en sus de leur IRCT vs. 1,8 comorbidité ; p<0,0001). Les personnes dialysées avaient davantage de difficultés à respecter leur traitement médicamenteux que les greffés (p=0,0038). Cependant, 11% des greffés rapportaient avoir des difficultés à suivre leur traitement immunosuppresseur. Aucun lien de causalité ne peut être avancé, aussi des analyses longitudinales sont encouragées pour étudier l'impact du type de traitement de suppléance sur différents critères cliniques ou autres.

Stengel, B., Combe, C., Jacquelinet, C., et al. (2014). "The French Chronic Kidney Disease-Renal Epidemiology and Information Network (CKD-REIN) cohort study." Nephrol Dial Transplant **29**(8): 1500-1507.

BACKGROUND: While much has been learned about the epidemiology and treatment of end-stage renal disease (ESRD) in the last 30 years, chronic kidney disease (CKD) before the end-stage has been less investigated. Not enough is known about factors associated with CKD progression and complications, as well as its transition to ESRD. We designed the CKD-renal epidemiology and information network (REIN) cohort to provide a research platform to address these key questions and to assess clinical practices and costs in patients with moderate or advanced CKD. METHODS: A total of 46 clinic sites and 4 renal care networks participate in the cohort. A stratified selection of clinic sites yields a sample that represents a diversity of settings, e.g. geographic region, and public versus for-profit and non-for-profit private clinics. In each site, 60-90 patients with CKD are enrolled at a routine clinic visit during a 12-month enrolment phase: 3600 total, including 1800 with Stage 3 and 1800 with Stage 4 CKD. Follow-up will continue for 5 years, including after initiation of renal replacement therapy. Data will be collected from medical records at inclusion and at yearly intervals, as well as from self-administered patient questionnaires and provider-level questionnaires. Patients will also be interviewed at baseline, and at 1, 3 and 5 years. Healthcare costs will also be determined. Blood and urine samples will be collected and stored for future studies on all patients at enrolment and at study end, and at 1 and 3 years in a subsample of 1200. CONCLUSIONS: The CKD-REIN cohort will serve to improve our understanding of the biological, clinical and healthcare system determinants associated with CKD progression and adverse outcomes as well as of international variations in collaboration with the CKD Outcome and Practice Pattern Study (CKDopps). It will foster CKD epidemiology and outcomes research and provide evidence to improve the health and quality of life of patients with CKD and the performances of the healthcare system in this field.

Verger, C., Ryckelynck, J. P., Duman, M., et al. (2006). "French peritoneal dialysis registry (RDPLF): outline and main results." Kidney Int Suppl(103): S12-20.

The Registre de Dialyse Peritoneale de Langue Francaise (RDPLF Registry) is a non-profit association that has been set up to assist physicians and nurses in evaluating their practical experience and results regarding peritoneal dialysis (PD). Five French-speaking and two Spanish-speaking countries have participated in this initiative (which includes 21 000 patients). In France, 82% of all PD patients are included in the registry and the main results for the period from 1995 to January 2006 form the basis of this report: of 11 744 incident patients with a median age of 71 years, 21.5% were over 80 years of age and 56% were not able to perform PD treatment at home without assistance. Eighty-six percent of the latter group received external assistance from a private nurse and 14% were aided by their family. The overall average rate of peritonitis was one episode every 29 months. The probability of being peritonitis-free appeared to be better for patients on automated PD (59.4% at 2 year) than for those on continuous ambulatory PD (55.3%), but this finding requires further validation. The average waiting time before transplantation was about 2 years. In patients who had undergone transplantation, the peritonitis rate was one episode per 42 months before transplantation compared to one episode per 29 months for patients who had not received a transplant. Eighty-three percent of patients had a hemoglobin level greater than 11 g%. Catheter survival was 92% at 2 years post-insertion and 85% at 5 years, with 94% being implanted by experienced surgeons. In conclusion, the RDPLF results demonstrate that PD may be successfully prescribed for older patients who receive assistance either from their family or from a nurse. Further, a larger number of younger patients should also be prescribed this technique in France. Patients eligible for transplantation and on short-term PD have the lowest risk of developing peritonitis; PD before transplantation may help prolong residual renal function, and initial treatment by PD may also help to preserve vascular access for the future.

Vigneau, C., Kolko, A., Stengel, B., et al. (2017). "Ten-years trends in renal replacement therapy for end-stage renal disease in mainland France: Lessons from the French Renal Epidemiology and Information Network (REIN) registry." Nephrol Ther **13**(4): 228-235.

> BACKGROUND: The incidence rate of renal replacement therapy (RRT) for end-stage renal disease (ESRD) is decreasing in several countries, but not in France. We studied the RRT trends in mainland France from 2005 to 2014 to understand the reasons for this discrepancy and determine the effects of ESRD management changes. METHODS: Data were extracted from the French Renal Epidemiology and Information Network registry. Time trends of RRT incidence and prevalence rates, patients' clinical and treatment characteristics were analysed using the Joinpoint regression program and annual percentage changes. Survival within the first year of RRT was analysed using Kaplan-Meier estimates for 4 periods of time. RESULTS: The overall age- and gender-adjusted RRT incidence rate increased from 144 to 159 individuals per million inhabitants (pmi) (+0.8% per year; 95% CI: 0.5-1.2) and the prevalence from 903 to 1141 pmi (+2.4% per year; 95% CI: 2.2-2.7). This increase concerned exclusively ESRD associated with type 2 diabetes (+4.0%; 3.4-4.6) and mostly elderly men. Despite patient aging and increasing comorbidity burden and a persistent 30% rate of emergency dialysis start, the one-year survival rate slightly improved from 82.1% (81.4-82.8) to 83.8% (83.3-84.4). Pre-emptive wait listing for renal transplantation and the percentage of wait-listed patients within one year after dialysis start strongly increased (from 5.6% to 15.5% and from 29% to 39%, respectively). CONCLUSION: Kidney transplantation and survival significantly improved despite the heavier patient burden. However, the rise in type 2 diabetes-related ESRD and the stable high rate of emergency dialysis start remain major issues.

Études internationales

Une étude comparée sur les registres

Liu, F. X., et al. (2015). "A global overview of renal registries: a systematic review." BMC Nephrol **16**: 31.
http://bmcnephrol.biomedcentral.com/articles/10.1186/s12882-015-0028-2

> BACKGROUND: Patient registries have great potential for providing data that describe disease burden, treatments, and outcomes; which can be used to improve patient care. Many renal registries exist, but a central repository of their scope, quality, and accessibility is lacking. The objective of this study was to identify and assess worldwide renal registries reporting on renal replacement therapy and compile a list of those most suitable for use by a broad range of researchers. METHODS: Renal registries were identified through a systematic literature review and internet research. Inclusion criteria included information on dialysis use (yes/no), patient counts >/=300, and evidence of activity between June

> 2007 and June 2012. Public availability of information on dialysis modality, outcomes, and patient characteristics as well as accessibility of patient-level data for external research were evaluated. RESULTS: Of 144 identified renal registries, 48 met inclusion criteria, 23 of which were from Europe. Public accessibility to annual reports, publications, or basic data was good for 17 registries and moderate for 22. Patient-level data were available to external researchers either directly or through application and review (which may include usage fees) for 13 of the 48 registries, and were inaccessible or accessibility was unknown for 25. CONCLUSIONS: The lack of available data, particularly in emerging economies, leaves information gaps about health care and outcomes for patients with renal disease. Effective multistakeholder collaborations could help to develop renal registries where they are absent, or enhance data collection and dissemination for currently existing registries to improve patient care.

Aikawa, A., Saito, K. et Takahashi, K. (2015). "Trends in ABO-incompatible kidney transplantation." Exp Clin Transplant **13 Suppl 1**: 18-22.

> The ABO-incompatible living-donor kidney transplantation was developed in Japan in 1989. Currently, most transplant physicians and surgeons have noted that outcomes are unexpectedly excellent, and no hyperacute rejections have been reported since 2001. In the registry of the Japanese ABO-Incompatible Kidney Transplantation Committee, the data of 2434 ABO-incompatible living-donor kidney transplants were collected from 120 Japanese kidney transplant centers. Overall patient and graft survival rates were 97% and 94% at 1 year, 93% and 86% at 5 years, 90% and 71% at 10 years, and 73% and 52% at 20 years. The patient survival and graft rates in 2001 to 2012 were 93% and 81%, which were significantly better than 83% and 55% reported in 1989 to 2000. The addition of novel immunosuppressive treatments has improved results. Azathioprine has been replaced by mycophenolate mofetil since 2000 to 2001, and basiliximab and rituximab were introduced in 2002 and 2004. The titer of antidonor blood group antibody before transplantation was not correlated with graft survival in 2001 to 2012. De novo antibodies against vascular endothelium of peritubular and glomerular capillaries seemed to be more important than natural antibodies against red blood cells. Therefore, recipients with antidonor blood group antibody titers < 1:128 did not require antibody-removal procedures such as plasmapheresis or immunoadsorption. In particular, children (regard less of their peritoneal dialysis status) do not need to be catheterized for plasmapheresis or immunoadsorption. It is better to avoid the risks of catheterization and antibody removal procedures in children with end-stage renal failure.

Carey, W. A., Martz, K. L. et Warady, B. A. (2015). "Outcome of Patients Initiating Chronic Peritoneal Dialysis During the First Year of Life." Pediatrics **136**(3): e615-622.

> BACKGROUND AND OBJECTIVE: Among children with end-stage renal disease (ESRD), those who abstract initiated chronic dialysis during the first year of life historically were less likely to survive or receive a kidney transplant compared with those who initiated dialysis later in childhood.We hypothesized that recently treated infants have experienced improved outcomes. METHODS: We queried the North American Pediatric Renal Trials and Collaborative Studies database, obtaining information on 628 children who initiated maintenance peritoneal dialysis for treatment of ESRD at ,1 year of age. We further subcategorized these children by age(neonates, #31 days and infants, 32-365 days) and date of dialysis initiation (past,1992-1999, and recent, 2000-2012). RESULTS: Survival while on dialysis and overall survival were significantly better among neonates and infants in the recent cohort. Overall survival at 3 years after dialysis initiation was 78.6%and 84.6% among the recently treated neonates and infants, respectively. Neonates and infants in the recent cohort also were more likely to terminate dialysis for transplantation, and graft survival was improved among recently transplanted infants (3-year graft survival 92.1%). CONCLUSIONS: Among children who initiate chronic peritoneal dialysis for treatment of ESRD in the first year of life, survival has improved in recent years. Graft survival also has improved for the subset of these patients who received a kidney transplant.

Fosby, B., Melum, E., Bjoro, K., et al. (2015). "Liver transplantation in the Nordic countries - An intention to treat and post-transplant analysis from The Nordic Liver Transplant Registry 1982-2013." Scand J Gastroenterol **50**(6): 797-808.

AIM AND BACKGROUND: The Nordic Liver Transplant Registry (NLTR) accounts for all liver transplants performed in the Nordic countries since the start of the transplant program in 1982. Due to short waiting times, donor liver allocation has been made without considerations of the model of end-stage liver disease (MELD) score. We aimed to summarize key outcome measures and developments for the activity up to December 2013. MATERIALS AND METHODS: The registry is integrated with the operational waiting-list and liver allocation system of Scandiatransplant (www.scandiatransplant.org) and accounted at the end of 2013 for 6019 patients out of whom 5198 were transplanted. Data for recipient and donor characteristics and relevant end-points retransplantation and death are manually curated on an annual basis to allow for statistical analysis and the annual report. RESULTS: Primary sclerosing cholangitis, acute hepatic failure, alcoholic liver disease, primary biliary cirrhosis and hepatocellular carcinoma are the five most frequent diagnoses (accounting for 15.3%, 10.8%, 10.6%, 9.3% and 9.0% of all transplants, respectively). Median waiting time for non-urgent liver transplantation during the last 10-year period was 39 days. Outcome has improved over time, and for patients transplanted during 2004-2013, overall one-, five- and 10-year survival rates were 91%, 80% and 71%, respectively. In an intention-to-treat analysis, corresponding numbers during the same time period were 87%, 75% and 66%, respectively. CONCLUSION: The liver transplant program in the Nordic countries provides comparable outcomes to programs with a MELD-based donor liver allocation system. Unique features comprise the diagnostic spectrum, waiting times and the availability of an integrated waiting list and transplant registry (NLTR).

Guinsburg, A. M., Usvyat, L. A., Etter, M., et al. (2015). "Seasonal variations in mortality and clinical indicators in international hemodialysis populations from the MONDO registry." BMC Nephrol **16**: 139.

BACKGROUND: Seasonal mortality differences have been reported in US hemodialysis (HD) patients. Here we examine the effect of seasons on mortality, clinical and laboratory parameters on a global scale. METHODS: Databases from the international Monitoring Dialysis Outcomes (MONDO) consortium were queried to identify patients who received in-center HD for at least 1 year. Clinics were stratified by hemisphere and climate zone (tropical or temperate). We recorded mortality and computed averages of pre-dialysis systolic blood pressure (pre-SBP), interdialytic weight gain (IDWG), serum albumin, and log C-reactive protein (CRP). We explored seasonal effects using cosinor analysis and adjusted linear mixed models globally, and after stratification. RESULTS: Data from 87,399 patients were included (northern temperate: 63,671; northern tropical: 7,159; southern temperate: 13,917; southern tropical: 2,652 patients). Globally, mortality was highest in winter. Following stratification, mortality was significantly lower in spring and summer compared to winter in temperate, but not in tropical zones. Globally, pre-SBP and IDWG were lower in summer and spring as compared to winter, although less pronounced in tropical zones. Except for southern temperate zone, serum albumin levels were higher in winter. CRP levels were highest in winter. CONCLUSION: Significant global seasonal variations in mortality, pre-SBP, IDWG, albumin and CRP were observed. Seasonal variations in mortality were most pronounced in temperate climate zones.

Lentine, K. L., Schnitzler, M. A., Garg, A. X., et al. (2015). "Race, Relationship and Renal Diagnoses After Living Kidney Donation." Transplantation **99**(8): 1723-1729.

BACKGROUND: In response to recent studies, a better understanding of the risks of renal complications among African American and biologically related living kidney donors is needed. METHODS: We examined a database linking U.S. registry identifiers for living kidney donors (1987-2007) to billing claims from a private health insurer (2000-2007 claims) to identify renal condition diagnoses categorized by International Classification of Diseases 9th Revision coding. Cox regression with left and right censoring was used to estimate cumulative incidence of diagnoses after donation and associations (adjusted hazards ratios, aHR) with donor traits. RESULTS: Among 4650 living donors, 13.1% were African American and 76.3% were white; 76.1% were first-degree relatives of their recipient. By 7 years post-donation, after adjustment for age and sex, greater proportions of African American compared with white donors had renal condition diagnoses: chronic kidney disease (12.6% vs 5.6%; aHR, 2.32; 95% confidence interval [95% CI], 1.48-3.62), proteinuria (5.7% vs 2.6%; aHR, 2.27; 95% CI, 1.32-3.89), nephrotic syndrome (1.3% vs 0.1%; aHR, 15.7; 95% CI, 2.97-83.0), and any renal condition (14.9% vs 9.0%; aHR, 1.72; 95% CI, 1.23-2.41). Although first-degree biological relationship to the recipient was not associated with renal risk, associations of African American race persisted for these conditions and included unspecified renal failure and reported disorders of kidney dysfunction after adjustment for biological donor-recipient relationship. CONCLUSIONS: African Americans more commonly develop renal conditions after living kidney donation, independent of donor-recipient relationship. Continued research is needed to improve risk stratification for renal outcomes among African American living donors.

Nadeau-Fredette, A. C., Hawley, C. M., Pascoe, E. M., et al. (2015). "An Incident Cohort Study Comparing Survival on Home Hemodialysis and Peritoneal Dialysis (Australia and New Zealand Dialysis and Transplantation Registry)." Clin J Am Soc Nephrol **10**(8): 1397-1407.

BACKGROUND AND OBJECTIVES: Home dialysis is often recognized as a first-choice therapy for patients initiating dialysis. However, studies comparing clinical outcomes between peritoneal dialysis and home hemodialysis have been very limited. DESIGN, SETTING, PARTICIPANTS, & MEASUREMENTS: This Australia and New Zealand Dialysis and Transplantation Registry study assessed all Australian and New Zealand adult patients receiving home dialysis on day 90 after initiation of RRT between 2000 and 2012. The primary outcome was overall survival. The secondary outcomes were on-treatment survival, patient and technique survival, and death-censored technique survival. All results were adjusted with three prespecified models: multivariable Cox proportional hazards model (main model), propensity score quintile-stratified model, and propensity score-matched model. RESULTS: The study included 10,710 patients on incident peritoneal dialysis and 706 patients on incident home hemodialysis. Treatment with home hemodialysis was associated with better patient survival than treatment with peritoneal dialysis (5-year survival: 85% versus 44%, respectively; log-rank P<0.001). Using multivariable Cox proportional hazards analysis, home hemodialysis was associated with superior patient survival (hazard ratio for overall death, 0.47; 95% confidence interval, 0.38 to 0.59) as well as better on-treatment survival (hazard ratio for on-treatment death, 0.34; 95% confidence interval, 0.26 to 0.45), composite patient and technique survival (hazard ratio for death or technique failure, 0.34; 95% confidence interval, 0.29 to 0.40), and death-censored technique survival (hazard ratio for technique failure, 0.34; 95% confidence interval, 0.28 to 0.41). Similar results were obtained with the propensity score models as well as sensitivity analyses using competing risks models and different definitions for technique failure and lag period after modality switch, during which events were attributed to the initial modality. CONCLUSIONS: Home hemodialysis was associated with superior patient and technique survival compared with peritoneal dialysis.

Pippias, M., Stel, V. S., Abad Diez, J. M., et al. (2015). "Renal replacement therapy in Europe: a summary of the 2012 ERA-EDTA Registry Annual Report." Clin Kidney J **8**(3): 248-261.

BACKGROUND: This article summarizes the 2012 European Renal Association-European Dialysis and Transplant Association Registry Annual Report (available at www.era-edta-reg.org) with a specific focus on older patients (defined as >/=65 years). METHODS: Data provided by 45 national or regional renal registries in 30 countries in Europe and bordering the Mediterranean Sea were used. Individual patient level data were received from 31 renal registries, whereas 14 renal registries contributed data in an aggregated form. The incidence, prevalence and survival probabilities of patients with end-stage renal disease (ESRD) receiving renal replacement therapy (RRT) and renal transplantation rates for 2012 are presented. RESULTS: In 2012, the overall unadjusted incidence rate of patients with ESRD receiving RRT was 109.6 per million population (pmp) (n = 69 035), ranging from 219.9 pmp in Portugal to 24.2 pmp in Montenegro. The proportion of incident patients >/=75 years varied from 15 to 44% between countries. The overall unadjusted prevalence on 31 December 2012 was 716.7 pmp (n = 451 270), ranging from 1670.2 pmp in Portugal to 146.7 pmp in the Ukraine. The proportion of prevalent patients >/=75 years varied from 11 to 32% between countries. The overall renal transplantation rate in 2012 was 28.3 pmp (n = 15 673), with the highest rate seen in the Spanish region of Catalonia. The proportion of patients >/=65 years receiving a transplant ranged from 0 to 35%. Five-year adjusted survival for all RRT patients was 59.7% (95% confidence interval, CI: 59.3-60.0) which fell to 39.3% (95% CI: 38.7-39.9) in patients 65-74 years and 21.3% (95% CI: 20.8-21.9) in patients >/=75 years.

Prischl, F. C., Auinger, M., Saemann, M., et al. (2015). "Diabetes-related end-stage renal disease in Austria 1965-2013." Nephrol Dial Transplant **30**(11): 1920-1927.

BACKGROUND: Diabetic kidney disease (DKD) is the leading cause of end-stage renal disease (ESRD) in Austria, accounting for a high burden of morbidity and mortality. In this nationwide study, we aimed to evaluate the incidence and fate of patients with DKD-ESRD over time. METHODS: Data (collected annually) from the Austrian Dialysis- and Transplant Registry were analysed for the development of ESRD due to DKD from 1965 to 2013. RESULTS: Over 48 years, 8322 and 22 975 patients with ESRD due to diabetes and non-diabetes, respectively, entered dialysis. While DKD-ESRD-patients were not dialysed until 1974, in 1975 seven type 1- and one type 2-diabetics started dialysis (1.06 per million population-PMP). In the mid-eighties, DKD-ESRD-patients increasingly were accepted for dialysis (1986: 14.53 PMP, 1996: 31.16 PMP). After a peak incidence of 415 diabetic ESRD-patients in 2006 (50.19 PMP), numbers decreased continuously thereafter (2013: 299 patients, 35.73 PMP). Mean age at start of dialysis increased over time and was lower in type 1- and higher in type 2- compared with non-diabetic patients. Five-year-survival-probability in two diabetic ESRD-cohorts, starting in 2007/08 and 10 years earlier was calculated. Five-year-survival was 28% in 1997/98 and 37.5% in 2007/08. Adjusted relative risk reduction was 33% (HR 0.67, CI 95% 0.57-0.78; P < 0.001). CONCLUSION: Despite a growing prevalence of diabetes, the incidence of diabetic ESRD has decreased after 2006. Five-year-survival-probability has improved over 10 years. Multifactorial therapeutic interventions may have resulted in this improvement.

Rhee, J. J., Ding, V. Y., Rehkopf, D. H., et al. (2015). "Correlates of poor glycemic control among patients with diabetes initiating hemodialysis for end-stage renal disease." BMC Nephrol **16**: 204.

BACKGROUND: Maintaining tight glycemic control is important for prevention of diabetes-related outcomes in end-stage renal disease patients with diabetes, especially in light of their poor prognosis. This study aimed to determine factors associated with poor glycemic control among U.S. patients with diabetes mellitus initiating hemodialysis for end-stage renal disease. METHODS: Using data from the U.S. Renal Data System, electronic health records of a large national dialysis provider, and U.S. Census data, we performed a cross-sectional multivariable Poisson regression analysis to characterize risk factors associated with poor glycemic control, defined as glycated hemoglobin (HbA1c) > 7 vs. </= 7 %, in adult patients with diabetes who initiated hemodialysis at an outpatient facility between 2006 and 2011. RESULTS: Of 16,297 patients with diabetes, 21.2 % had HbA1c >7 %. In multivariable analysis, younger patients, patients of Native American race, and those of Hispanic ethnicity had higher prevalence of poor glycemic control. Independent correlates of poor glycemic control further included higher platelet count, white blood cell count, and ferritin; higher body mass index, systolic blood pressure, total cholesterol and triglyceride concentrations; lower HDL and albumin concentrations; lower normalized protein catabolic rate; and higher estimated glomerular filtration rate at initiation of dialysis (all P < 0.05). No independent associations were found with area-level socioeconomic indicators. Occurrence of diabetes in patients < 40 years of age, a proxy for type 1 diabetes, was associated with poor HbA1c control compared with that in patients >/= 40 years of age, which was classified as type 2 diabetes. These findings were robust to the different outcome definitions of HbA1c > 7.5 % and > 8 %. CONCLUSION: In this cohort of incident end-stage renal disease patients with diabetes, poor glycemic control was independently associated with younger age, Native American race, Hispanic ethnicity, higher body mass index, and clinical risk factors including atherogenic lipoprotein profile, hypertension, inflammation, and markers indicative of malnutrition and a more serious systemic disease.

Sederholm Lawesson, S., Alfredsson, J., Szummer, K., et al. (2015). "Prevalence and prognostic impact of chronic kidney disease in STEMI from a gender perspective: data from the SWEDEHEART register, a large Swedish prospective cohort." BMJ Open **5**(6): e008188.

OBJECTIVES: Gender differences in prevalence and prognostic impact of chronic kidney disease (CKD) in ST segment elevation myocardial infarction (STEMI) have been poorly evaluated. In STEMI, female gender has been independently associated with an increased risk of mortality. CKD has been found to be an important prognostic marker in myocardial infarction. The aim of this study was to evaluate gender differences in prevalence and prognostic impact of CKD on short-term and long-term mortality. DESIGN: Prospective observational cohort study. SETTING: The national quality register SWEDEHEART was used. In the beginning of the study period, 94% of the Swedish coronary care units contributed data to the register, which subsequently increased to 100%. The glomerular filtration rate was estimated (eGFR) according to Modification of Diet in Renal Disease Study (MDRD) and Cockcroft-Gault (CG). PARTICIPANTS: All patients with STEMI registered in SWEDEHEART from the years 2003-2009 were included (37,991 patients, 66% men). MAIN RESULTS: Women had 1.6 (MDRD) to 2.2 (CG) times higher multivariable adjusted risk of CKD. Half of the women had CKD according to CG. CKD was associated with 2-2.5 times higher risk of in-hospital mortality and approximately 1.5 times higher risk of long-term mortality in both genders. Each 10 mL/min decline of eGFR was associated with an increased risk of in-hospital and long-term mortality (22-33% and 9-16%, respectively) and this did not vary significantly by gender. Both in-hospital and long-term mortality were doubled in women. After multivariable adjustment including eGFR, there was no longer any gender difference in early outcome and the long-term outcome was better in women. CONCLUSIONS: Among patients with STEMI, female gender was independently associated with CKD. Reduced eGFR was a strong independent risk factor for short-term and long-term mortality without a significant gender difference in prognostic impact and seems to be an important reason why women have higher mortality than men with STEMI.

Thomas, B., Wulf, S., Bikbov, B., et al. (2015). "Maintenance Dialysis throughout the World in Years 1990 and 2010." J Am Soc Nephrol **26**(11): 2621-2633.

Rapidly rising global rates of chronic diseases portend a consequent rise in ESRD. Despite this, kidney disease is not included in the list of noncommunicable diseases (NCDs) targeted by the United Nations for 25% reduction by year 2025. In an effort to accurately report the trajectory and pattern of global growth of maintenance dialysis, we present the change in prevalence and incidence from 1990 to 2010. Data were extracted from the Global Burden of Disease 2010 epidemiologic database. The results are on the basis of an analysis of data from worldwide national and regional renal disease registries and detailed systematic literature review for years 1980-2010. Incidence and prevalence estimates of provision of maintenance dialysis from this database were updated using a negative binomial Bayesian meta-regression tool for 187 countries. Results indicate substantial growth in utilization of maintenance dialysis in almost all world regions. Changes in population structure, changes in aging, and the worldwide increase in diabetes mellitus and hypertension explain a significant portion, but not all, of the increase because increased dialysis provision also accounts for a portion of the rise. These findings argue for the importance of inclusion of kidney disease among NCD targets for reducing premature death throughout the world.

Tuot, D. S., Velasquez, A., McCulloch, C. E., et al. (2015). "The Kidney Awareness Registry and Education (KARE) study: protocol of a randomized controlled trial to enhance provider and patient engagement with chronic kidney disease." BMC Nephrol **16**: 166.

BACKGROUND: Chronic kidney disease (CKD) is common and is associated with excess mortality and morbidity. Better management could slow progression of disease, prevent metabolic complications, and reduce cardiovascular outcomes. Low patient awareness of CKD and ineffective patient-provider communication can impede such efforts. We developed provider and patient-directed interventions that harness health information technology to enhance provider recognition of CKD and delivery of guideline concordant care and augment patient understanding and engagement in CKD care. METHODS/DESIGN: We report the design and protocol of the Kidney Awareness Registry and Education (KARE) Study, a 2x2 factorial randomized controlled trial that examines the impact of a multi-level intervention on health outcomes among low-income English, Spanish and Cantonese-speaking patients with CKD in a safety net system. The intervention includes: (1) implementation of a primary care electronic CKD registry that notifies practice teams of patients' CKD status and employs a patient profile and quarterly feedback to encourage provision of guideline-concordant care at point-of-care and via outreach; and (2) a language-concordant, culturally-sensitive self-management support program that consists of automated telephone modules, provision of low-literacy written patient-educational materials and telephone health coaching. The primary outcomes of the trial are changes in systolic blood pressure (BP) and the proportion of patients with BP control (</= 140/90 mmHg) after one year. Secondary outcomes include patient understanding of CKD, participation in healthy behaviors, and practice team delivery of guideline-concordant CKD care. DISCUSSION: Results from the KARE study will provide data on the feasibility, effectiveness, and acceptability of technology-based

interventions that support primary care efforts at improving health outcomes among vulnerable patients with CKD. TRIAL REGISTRATION: ClinicalTrials.gov, number: NCT01530958.

Vart, P., Gansevoort, R. T., Joosten, M. M., et al. (2015). "Socioeconomic disparities in chronic kidney disease: a systematic review and meta-analysis." Am J Prev Med **48**(5): 580-592.

CONTEXT: Evidence on the strength of the association between low SES and chronic kidney disease (CKD; measured by low estimated glomerular filtration rate [eGFR], high albuminuria, low eGFR/high albuminuria, and renal failure) is scattered and sometimes conflicting. Therefore, a systematic review and meta-analysis was performed to summarize the strength of the associations between SES and CKD and identify study-level characteristics related to this association. EVIDENCE ACQUISITION: Studies published through January 2013 in MEDLINE and Embase were searched. From 35 studies that met the inclusion criteria, association estimates were pooled per CKD measure in the meta-analysis (performed between 2013 and 2014). Meta-regression analysis was used to identify study-level characteristics related to the strength of the SES-CKD association. EVIDENCE SYNTHESIS: Low SES was associated with low eGFR (OR=1.41, 95% CI=1.21, 1.62), high albuminuria (OR=1.52, 95% CI=1.22, 1.82), low eGFR/high albuminuria (OR=1.38, 95% CI=1.03, 1.74), and renal failure (OR=1.55, 95% CI=1.40, 1.71). Differences in SES measures across studies were not related to the strength of associations between low SES and any of the CKD measures (low GFR, p=0.63; high albuminuria, p=0.29; low eGFR/high albuminuria, p=0.54; renal failure, p=0.31). Variations in the strength of associations were related to the level of covariate adjustment for low eGFR (p<0.001) and high albuminuria (p<0.001). CONCLUSIONS: Socioeconomic disparities in CKD were fairly strong, irrespective of how SES was measured. Variations in the strength of the associations were related to the level of covariate adjustment, particularly for low eGFR and high albuminuria.

Viecelli, A. K., Lim, W. H., Macaskill, P., et al. (2015). "Cancer-Specific and All-Cause Mortality in Kidney Transplant Recipients With and Without Previous Cancer." Transplantation **99**(12): 2586-2592.

BACKGROUND: For dialysis patients with a cancer history, a period of surveillance is generally recommended before listing for transplantation. However, the outcomes of patients with cancer recurrence and/or a second primary cancer after transplantation are unknown. AIM: To determine the prognosis of kidney transplant recipients who developed cancer after transplantation and whether this varied with cancer types (first cancer, recurrence, second primary cancer). METHODS: Using data from the Australian and New Zealand Dialysis and Transplant Registry, we compared the cancer-specific and all-cause mortality among recipients with different cancer types using adjusted Cox proportional hazard models. RESULTS: Of the 21,415 recipients transplanted between 1965 and 2012, 3% (651 of 21,415) had a previous cancer history. A total of 2840 (13%) recipients developed cancer after the first transplant, of whom 2760 (97.2%) developed a first cancer, 23 (0.8%) experienced cancer recurrence, and 57 (2%) developed a second primary cancer. There were no significant differences in the risks of cancer-specific and all-cause mortality between recipients who developed their first cancer after transplant, those with cancer recurrence (adjusted hazard ratios [aHRs], 0.79; 95% confidence interval [95% CI], 0.38-1.67; P = 0.54 and aHRs, 0.86; 95% CI, 0.45-1.66; P = 0.66, respectively) and recipients who developed a second primary cancer after transplantation (aHRs, 1.01; 95%CI, 0.63-1.62; P = 0.95 and aHRs, 1.16; 95% CI, 0.79-1.69; P = 0.45, respectively). CONCLUSION: Among patients with a previous history of malignancy, recurrent and second primary cancers are infrequent after renal transplantation. A history of previous malignancy does not have an additive effect on the cancer-specific and overall survival of kidney transplant recipients who develop cancer.

Vitullo, F. (2003). "[Using Dialysis and Transplantation Registries for regional and small-area epidemiology]." G Ital Nefrol **20**(2): 151-159.

BACKGROUND: Aim of this review on Italian Dialysis and Transplantation Registries (RDTR), mostly of recent implementation, is to assess the use of epidemiological data for planning purposes, in order to promote local developments of regional registries. METHODS; Medline and reports on the website of the Italian Society of Nephrology. RESULTS: We selected two publications with data from the Italian Registry (RIDT) and 56 articles on RDTR. Most papers refer to RDTR for the Italian regions of Piedmont, Lombardy and Lazio. RIDT reports containing 1998-1999 data for all the regions are published on web.

> Consistent with international figures, epidemiological data show an increasing incidence and prevalence of end-stage renal disease patients on renal replacement therapy (RRT), particularly older patients with diabetes and vascular diseases. Important regional variations are observed (RIDT data): 1995-97 dialysis provision (3-25 centres pmp; private: 2%-83%) - 1999 frequency figures: RRT incidence (75-200 pmp); dialysis prevalence (437-842 pmp), transplant prevalence (21-344 pmp) - 1995 mortality (8%-15%). Data on referral modalities and access to RRT seem scarce. Some studies assess hospital use among dialysis patients, while no papers have been found on the decision-making processes in local planning and policy. CONCLUSIONS: RDTR are still under-utilised for developing local data, both for further investigating epidemiological and clinical differences, and for guiding decisions in regions with different resources and cultural background. We believe that linking RDTR data with other regional databases represents an effective strategy.

Zoccali, C., Kramer, A. et Jager, K. (2009). "The databases: renal replacement therapy since 1989--the European Renal Association and European Dialysis and Transplant Association (ERA-EDTA)." Clin J Am Soc Nephrol **4 Suppl 1**: S18-22.

> Chronic kidney disease is now considered a public health priority, and the prevalence of this disease is approximately 10% in both North American and European countries. Such a phenomenon raises concern about the future increased incidence of ESRD. A recent analysis in the European Renal Association-European Dialysis and Transplant Association Registry shows that the incidence rates in Northern European countries have stabilized at approximately 110 per million people, a phenomenon that is associated with a parallel stabilization in the incidence of ESRD caused by diabetes. Such a stabilization has occurred in the face of an increasing prevalence of diabetes and hypertension in the general population, suggesting that this improvement may be the result of better prevention. Genetic factors, competing risks with other diseases, and other medical factors explain only in part the variability in the incidence of renal replacement therapy in European countries. Health care financing priorities have an obvious influence on the outcome of ESRD. Nonmedical factors seem to be of importance at least equal to that of medical factors. In this respect, Dialysis Outcomes and Practice Patterns Study Europe has revealed relevant differences in clinical policies that are related to ESRD treatment among European countries.

LES DONNEES DE PREVALENCE

Études françaises

Assogba, G. F., Couchoud, C., Roudier, C., et al. (2012). "Prevalence, screening and treatment of chronic kidney disease in people with type 2 diabetes in France: the ENTRED surveys (2001 and 2007)." Diabetes Metab **38**(6): 558-566.

> AIMS: The study aimed to assess the prevalence, quality of screening and treatment of chronic kidney disease (CKD), and their trends between 2001 and 2007, in French adults with type 2 diabetes (T2D). METHODS: The 2007 ENTRED survey randomly selected, from French medical insurance fund databases, 8926 adults treated for diabetes who had been reimbursed at least three times over the previous 12 months for oral hypoglycaemic agents or insulin. Medical reimbursement data were extracted and two sets of questionnaires were mailed, one to all patients (48% response rate) and the other to their doctors (62%). Analyses were restricted to the 3894 responders with T2D (2232 with data from their doctors). Trends between the 2001 and 2007 ENTRED surveys were studied. RESULTS: Participants' mean age was 66 years. The prevalence of CKD was estimated to be at least 29%, based on doctors' data (missing data included). Overall, only 17% had no claims for serum creatinine measurements during the year, and 71% had no claims for albuminuria tests; nonetheless, both figures had decreased from 2001. Older people, those who lived alone and those who felt poorly informed about diabetes were more likely to have made no claims for CKD screening. Assessment of quality of care (prescribing antihypertensive treatment when indicated) was possible for 66% of responders, of whom 25% did not receive such treatment. CONCLUSION: CKD is frequently seen in patients with T2D and is likely to be underestimated because albuminuria screening remains inadequate, despite significant improvements since 2001. Further efforts are needed to improve CKD

screening, patient and doctor awareness, and adequate use of antihypertensive/nephroprotective medications.

Bongard, V., Dallongeville, J., Arveiler, D., et al. (2012). "[Assessment and characteristics of chronic renal insufficiency in France]." Ann Cardiol Angeiol (Paris) **61**(4): 239-244.

Chronic kidney disease (CKD) is a major public health issue. In France, few studies have evaluated CKD prevalence. The objective of the MONA LISA study was to estimate and to characterize CKD in three representative cross-sectional surveys in subjects aged 35-74.9 years. CKD was defined as subjects having MDRD glomerular filtration rate lower than 60 mL/min/1.73 m(2). Prevalence of CKD in MONA LISA was standardized according to the French population. A multiple logistic regression analysis was performed in order to find independent factors associated to CKD. The French estimate of CKD prevalence was 8.2% (95% confidence interval: 7.4-8.9%), that is 2,454,548 (95% confidence interval: 2,215,080-2,664,082) subjects aged 35-74.9 years. Factors significantly and independently associated to CKD were older age, hypertension and dyslipidemias. In conclusion, the MONA LISA study evaluated for the first time in France CKD prevalence in subjects aged 35-74.9 years. This prevalence probably underestimates the real CKD size due to selection bias present in every representative cross-sectional survey.

Charra, B., VoVan, C., Marcelli, D., et al. (2001). "Diabetes mellitus in Tassin, France: remarkable transformation in incidence and outcome of ESRD in diabetes." Adv Ren Replace Ther **8**(1): 42-56.

The incidence and prevalence of diabetes mellitus (DM) in the dialysis population in Europe, and more especially in France, have been lagging behind the impressive United States and Japanese rates. For a decade, things have been changing, and the incidence of DM in hemodialysis (HD) reached almost 40 in Tassin, France in 1999. The prevalence has followed the same trend but increased more slowly. The increase in incidence and prevalence is almost totally accounted for by type 2 DM explosive outbreak and development. The morbidity on dialysis (hypotensive episodes, hospitalization number, and duration) was significantly worse in diabetic patients (without difference between type 1 and 2) than in nondiabetic patients. The mortality rate was higher in diabetic patients than in nondiabetic patients (mean half-life 3 and 13 years, respectively), even after adjustment for age and comorbidity. The mortality rate was higher in type 2 than in type 1 (mean half-life 2.7 and 5.2 years, respectively), a difference which disappears when adjusting for age and comorbidity. Specific causes of death were different in diabetic and nondiabetic HD patients; in diabetics there was a six-fold higher cardiovascular (CV) and three-fold higher infectious mortality, but there was the same mortality from cancer. A strong difference was observed between type 1 and type 2 DM: in type 1 there was no increased infectious mortality and a moderately increased CV mortality compared with nondiabetic patients. Type 2 diabetic patients had a four-fold increased infectious and an eight-fold increased CV mortality. Altogether, the eruption of DM in our unit over the last decade has drastically increased the crude mortality, but the standardized mortality ratio using the USRDS mortality table remained unchanged, about 45 of expected mortality.

Charriere, S., Rognant, N., Chiche, F., et al. (2009). "[Chronic renal insufficiency and cardiovascular disease]." Ann Cardiol Angeiol (Paris) **58**(1): 40-52.

Renal insufficiency is frequently seen in patients with cardiovascular disease. In contrast, coronary artery disease is the leading cause of death in patients with renal impairment. The recognition of renal insufficiency is essential in these patients and preventive measures must be put in place to prevent the progression or onset of cardiovascular disease. In this article, we explain the methods to assess kidney function, the epidemiology of coronary heart disease in patients with renal impairment, risk factors conventional and non-conventional found in these patients and the main recommendations for their therapeutic care.

Detournay, B., Simon, D., Guillausseau, P. J., et al. (2012). "Chronic kidney disease in type 2 diabetes patients in France: prevalence, influence of glycaemic control and implications for the pharmacological management of diabetes." Diabetes Metab **38**(2): 102-112.

AIM: Type 2 diabetes mellitus (T2DM) is often associated with chronic kidney disease. For this reason, this article reviews the relationship between treatment of T2DM and renal disease. METHOD: The review presents the recent French data on the management of diabetes in patients with renal impairment, and discusses the implications of renal disease for the treatment of such patients. Prescribing data are presented for various antidiabetic treatments, and the use of the more commonly prescribed medications is discussed with reference to T2DM patients with renal disease. RESULTS: In France, it is estimated that 4-5% of the general population has T2DM and that almost 40% of patients with end-stage renal failure have diabetes. Diabetes and renal disease are both risk factors for cardiovascular morbidity and mortality. Glycaemic control is pivotal in T2DM patients for minimizing the risk of vascular complications and hypoglycaemic episodes, particularly in patients with renal disease who also have a higher risk of hypoglycaemia. Whereas poorly controlled glycaemia increases the risk of renal disease and its progression, the risk is diminished in patients treated intensively for diabetes and in those who achieve stable glycaemic control. Intensive multitargeted treatment can also help to decrease cardiovascular morbidity and mortality, especially if started early in patients who have not yet developed macrovascular complications. CONCLUSION: In recent years, considerable improvement has been observed in France regarding the follow-up of diabetic patients. Less extensive, but nonetheless significant, improvement has also been observed in glycaemic control. However, even though treatment decisions generally take renal function into account, some at-risk treatments are often still being used in patients with renal insufficiency.

Hummel, A. (2010). "[Chronic renal failure, a frequent and asymptomatic pathology]." Soins(745): 24-26.

Chronic renal failure is a frequent and multifactorial pathology. Early treatment can prevent or slow down its development into end-stage chronic renal failure requiring dialysis or transplantation.

Ingrand, I., Barbail, A., Migeot, V., et al. (2002). "[Chronic renal failure in Poitou-Charentes: prevalence, structure adequacy, and patient satisfaction]." Sante Publique **14**(1): 5-19.

The characteristics of the existing cases in the region, the adequacy of the structures with respect to the needs, and the satisfaction of patients undergoing dialysis have been analysed as part of an ongoing project for the development of a Regional Outline for Health Organisation in the Poitou-Charentes region of France. A cross-sectional survey was conducted in the haemodialysis units, dialysis facilities and patient associations in the region and bordering areas where patients were being treated. As of March 31, 2000, the prevalence of chronic renal failure was estimated to be 373 people per one million of the population. According to the nephrologist, the adequacy of the care structures was found to be satisfactory for 82% of the patients. The main reasons for non-adequacy were first, the lack of intermediate structures between centres and outpatient units; second, the patient's refusal to be referred to another structure; and finally, other medical, physical and intellectual factors. For 90% of patients, their treatment method corresponded to their choice of therapy. The lack of a nearby structure was equally recognised as a primary reason for dissatisfaction. It should be noted that 42% of the patients under 60 years old felt that they were either poorly or very poorly informed of their rights, the coverage and the treatment of this illness.

Jacquelinet, C., Lange, C. et Briancon, S. (2013). "[The prevalence of ESRD in 2011]." Nephrol Ther **9 Suppl 1**: S39-64.

This chapter describes temporal and geographical variations of ESRD prevalence in France. This indicator assesses health needs of ESRD patients on dialysis or living with functional transplant. It does not include patients on conservative treatment. On December 31, 2011, 70 300 patients were receiving a renal replacement therapy in one of the 25 regions contributing to the registry, 39 200 (56%) on dialysis and 31 100 (44%) living with a functional renal transplant. The overall crude prevalence was 1091pmh. It was 1.6 higher in males. Prevalence was subject to regional variations with 5 regions (3 overseas) above the national rate. Renal transplant share varied from 33% in Nord-Pas-de-Calais to 53% in Pays de Loire, and from 16 to 25% in overseas regions. The overall sex and age standardised prevalence was 40, 567 and 483 pmh respectively for peritoneal dialysis, haemodialysis and transplantation, with marked regional variations. The study of temporal variations for 18 regions contributing to the registry since 2007 demonstrated a +4% increase in standardised prevalence of

ESRD patients with a functional transplant vs +2% increase for dialysis, resulting in a decreasing gap between dialysis and transplantation prevalence, due to an increase number of renal transplant and a longer survival of transplanted patients. Such an evolution should prompt the nephrological community and health authorities to anticipate changes in the ESRD healthcare organisation and to adapt them to the regional context.

Jungers, P., Joly, D., Barbey, F., et al. (2004). "ESRD caused by nephrolithiasis: prevalence, mechanisms, and prevention." Am J Kidney Dis **44**(5): 799-805.

BACKGROUND: The contribution of nephrolithiasis-related end-stage renal disease (ESRD) to patients requiring renal replacement therapy has never been specifically evaluated. METHODS: Of the entire cohort of 1,391 consecutive patients who started maintenance dialysis therapy at our nephrology department between January 1989 and December 2000, a total of 45 patients (21 men) had renal stone disease as the cause of ESRD and constitute the study material. Type and cause of renal stone disease was determined in the 45 patients, as well as the change in prevalence of nephrolithiasis-related ESRD with time during this 12-year period. RESULTS: The overall proportion of nephrolithiasis-related ESRD was 3.2%. Infection (struvite) stones accounted for 42.2%; calcium stones, 26.7%; uric acid nephrolithiasis, 17.8%; and hereditary diseases (including primary hyperoxaluria type 1 and cystinuria), 13.3% of cases. Women were predominant among patients with infection and calcium stones, whereas men were predominant among patients with uric acid or hereditary stone disease. The proportion of patients with nephrolithiasis-related ESRD decreased from 4.7% in the triennial period 1989 to 1991 to 2.2% in the most recent period, 1998 to 2000 (P = 0.07). This tendency to a decreasing prevalence mainly was caused by a rarefaction of infection and calcium stones with time, whereas frequencies of uric acid and hereditary stone disease remained essentially unchanged. CONCLUSION: Severe forms of nephrolithiasis remain an underestimated cause of potentially avoidable ESRD and need for renal replacement therapy. These findings highlight the crucial importance of accurate stone analysis and metabolic evaluation to provide early diagnosis and proper therapy for conditions that may lead to ESRD through recurrent stone formation and/or parenchymal crystal infiltration.

Jungers, P., Massy, Z., Man, N. K., et al. (2000). "[Incidence of end-stage renal disease in Ile de France: a prospective epidemiological survey]." Presse Med **29**(11): 589-592.

OBJECTIVES: To evaluate incidence and prevalence of patients with end-stage renal disease (ESRD) treated with maintenance dialysis in the Ile de France district in 1998. METHODOLOGY: Prospective epidemiologic inquiry with the cooperation of the 91 nephrology departments and dialysis facilities of the Ile de France district (total population: 10,695,300 inhabitants in March 1999), from January 1st to December 31st, 1998. Evaluation of the demographic and clinical characteristics of the 1155 patients accepted on maintenance dialysis in 1998, and recording of the total number of dialyzed patients at the beginning and at the end of the same year. RESULTS: The total number of ESRD patients was 1155, including 29 (2.5%) children aged < or = 17 years and 86 (7.4%) returns to dialysis following kidney graft failure. Incidence of ESRD in first-dialyzed patients was 100/million/year and overall incidence, including returns from transplantation, was 108/million/year. Mean age of the 1040 adult first-dialysis patients was 59 +/- 16.8 years, with a proportion of those aged > or = 75 years of 21.6%. Patients with vascular renal disease were 22.5% and those with diabetic nephropathy 20.6%. As a whole, 36.5% of patients were referred to the nephrologist < 6 months of starting dialysis. Prevalence of patients on supportive dialysis increased from 417 to 433 per million inhabitants (a 3.8% increase) from the beginning to the end of 1998, with the proportion of patients treated with self-care dialysis or peritoneal dialysis rising by 10%. From January 1995 to January 1999, prevalence of dialysis-treated ESRD patients rose by nearly 4% per year as a mean. CONCLUSION: Incidence of ESRD patients requiring maintenance dialysis in the Ile de France district reached 100/million in 1998, an increment of 4% per year over the past 4 years. The increase in incidence results from the increasing number of older patients, parallel to the ageing of general population, these patients having a high comorbidity mainly due to diabetes and atherosclerosis. Prevalence of dialysis-treated patients was 433/million population at the end of 1998. It rose at a similar rate as did incidence, although with a growing proportion of out-center dialysis.

Kabore, J., Metzger, M., Helmer, C., et al. (2016). "Kidney Function Decline and Apparent Treatment-Resistant Hypertension in the Elderly." PLoS One **11**(1): e0146056.

> BACKGROUND: Cross-sectional studies show a strong association between chronic kidney disease and apparent treatment-resistant hypertension, but the longitudinal association of the rate of kidney function decline with the risk of resistant hypertension is unknown. METHODS: The population-based Three-City included 8,695 participants older than 65 years, 4265 of them treated for hypertension. We estimated the odds ratios (OR) of new-onset apparent treatment-resistant hypertension, defined as blood pressure >/= 140/90 mmHg despite use of 3 antihypertensive drug classes or >/= 4 classes regardless of blood pressure, associated with the mean estimated glomerular filtration rate (eGFR) level and its rate of decline over 4 years, compared with both controlled hypertension and uncontrolled nonresistant hypertension with </= 2 drugs. GFR was estimated with three different equations. RESULTS: Baseline prevalence of apparent treatment-resistant hypertension and of controlled and uncontrolled nonresistant hypertension, were 6.5%, 62.3% and 31.2%, respectively. During follow-up, 162 participants developed apparent treatment-resistant hypertension. Mean eGFR decline with the MDRD equation was 1.5+/-2.9 mL/min/1.73 m(2) per year: 27.7% of the participants had an eGFR >/=3 and 10.1% >/= 5 mL/min/1.73 m(2) per year. After adjusting for age, sex, obesity, diabetes, and cardiovascular history, the ORs for new-onset apparent treatment-resistant hypertension associated with a mean eGFR level, per 15 mL/min/1.73 m(2) drop, were 1.23 [95% confidence interval 0.91-1.64] compared to controlled hypertension and 1.10 [0.83-1.45] compared to uncontrolled nonresistant hypertension; ORs associated with a decline rate >/= 3 mL/min/1.73 m(2) per year were 1.89 [1.09-3.29] and 1.99 [1.19-3.35], respectively. Similar results were obtained when we estimated GFR with the CKDEPI and the BIS1 equations. ORs tended to be higher for an eGFR decline rate >/= 5 mL/min/1.73 m(2) per year. CONCLUSION: The speed of kidney function decline is associated more strongly than kidney function itself with the risk of apparent treatment-resistant hypertension in the elderly.

Labeeuw, M. et Couchoud, C. (2013). "[Flows between modalities in the treatment of ESRD]." Nephrol Ther **9 Suppl 1**: S181-191.

> This chapter provides indicators to describe the outcome of prevalent and incident patients in the various modalities of treatment. Among the 36 849 patients on dialysis at 31/10/2010, 79% were already on RRT at 31/12/2009. Respectively 91%, 85% and 93% of the patients on HD in-center, HD self-care unit and peritoneal dialysis were in the same modality of treatment the year before. Among the 29 758 patients with a functioning graft at 31/12/2010, 98% were already on RRT at 31/12/2009, 95% of them with a functioning graft. 72%, 72% and 74% of the patients with in-center HD, outcenter HD and self-care unit were in the same modality of treatment at 31/12/2011. But 37% of the patients on PD at 31/12/2010 were not on PD at 31/12/2011. In 2011, new patients represented 89% of the entries in peritoneal dialysis. Renal transplantation represented 10% of the outcomes of the HD patients in self-care unit or at home.

Le Goaziou, M. F., Zerbib, Y. et Chopin Gheorghiev, C. (2007). "[Chronic renal failure in patients aged more than 50 years in general practice: an epidemiological survey among a sample of 1034 patients]." Presse Med **36**(12 Pt 1): 1766-1768.

Macron-Nogues, F., Vernay, M., Ekong, E., et al. (2005). "The prevalence of ESRD treated with renal dialysis in France in 2003." Am J Kidney Dis **46**(2): 309-315.

> BACKGROUND: The prevalence of end-stage renal disease (ESRD) treated with renal dialysis is poorly known in France because there is no national registry of dialysis patients. The specific aims of this study are to determine the total number of patients treated with renal dialysis and their social, demographic, and clinical characteristics, as well as define the overall care they received. METHODS: We performed a cross-sectional descriptive study from June 2 to June 8, 2003, in all renal dialysis units (including pediatric units) by including all patients residing in France with ESRD who were dialyzed during that week, irrespective of age or the treatment they received. We gathered sociodemographic (age, sex, place of residence, and occupation) and clinical data (year they entered dialysis therapy, initial renal disease, comorbidities, and associated handicaps) and information concerning their overall

treatment plan (waiting list for kidney transplant, therapeutic regimen, and dialysis technique used). RESULTS: A total of 30,882 patients residing in France were treated with renal dialysis. The unadjusted prevalence of dialysis was 513.1 patients per million population (pmp); 498.2 pmp in metropolitan France and 1,035.7 pmp in the overseas territories. Clinical and sociodemographic characteristics of patients and their therapeutic regimens were different in metropolitan France and the overseas territories. CONCLUSION: This study constitutes the first comprehensive inventory of dialysis therapy in France, where the prevalence of ESRD is among the highest in the world.

Martin-Malo, A., Papadimitriou, M., Cruz, J., et al. (2013). "Geographical variability of patient characteristics and treatment patterns affect outcomes for incident hemodialysis patients." J Nephrol **26**(1): 119-128.

BACKGROUND: Geographical differences in disease prevalence and mortality have been described in the general population and in chronic kidney disease patients in Europe. In this secondary analysis of the Membrane Permeability Outcome (MPO) study, we addressed differences in patient and treatment patterns, and whether these affect patient outcomes. METHODS: Participating countries were grouped according to geographical location; thus study centers in France, Greece, Italy, Portugal and Spain were allocated to southern Europe (n=499), and those in all other countries (Belgium, Germany, Poland and Sweden) to northern Europe (n=148). Descriptive analysis of patient and treatment patterns at study start, as well as survival analysis, was performed. RESULTS: In patients from the northern European countries, a higher prevalence of diabetes mellitus and of cardiovascular disease was observed than in those from southern Europe (diabetes 35.1% vs. 21.0%, p=0.0007; cardiovascular disease 40.5% vs. 22.8%, p<0.0001). In northern Europe, 23% of patients started hemodialysis with a catheter for vascular access, while in southern European centers, only 13% did so (p=0.0042). Kaplan-Meier survival analysis revealed a lower probability for both all-cause and cardiovascular mortality in southern Europe (log-rank test p<0.001). In a Cox proportional hazards model, a higher mortality risk was estimated for the northern European patients after adjustment for age, sex, membrane permeability, comorbidity index and vascular access (hazard ratio = 1.831; 95% confidence interval, 1.282-2.615; p=0.0009). CONCLUSIONS: Our study patients from northern Europe showed a higher risk profile than those from southern Europe. However, only some of the factors can be modified in attempts to lower the mortality risk in this geographical area.

Saune, K., Kamar, N., Miedouge, M., et al. (2011). "Decreased prevalence and incidence of HCV markers in haemodialysis units: a multicentric French survey." Nephrol Dial Transplant **26**(7): 2309-2316.

BACKGROUND: A variety of epidemiological data provide evidence for the nosocomial transmission of hepatitis C virus (HCV) infections to haemodialysis patients. We conducted a multicentric study to determine the prevalence and incidence of HCV infection in French haemodialysis units. METHODS: Patients undergoing chronic haemodialysis in 56 French units (4718 patients) were systematically screened for anti-HCV antibodies using third-generation tests. The incidence was estimated by detecting HCV RNA in seronegative patients using a standardized real-time PCR assay on pooled samples. RESULTS: Testing for HCV antibodies identified 361 patients with anti-HCV antibodies, giving a prevalence of 7.7%. Multivariate analysis demonstrated that anti-HCV status was linked to the time on haemodialysis, previous kidney transplantation and the presence of anti-HBc antibodies, whereas erythropoietin therapy and carrying out dialysis in dedicated spaces seem to protect against HCV infection. Only two of the 4357 patients without anti-HCV antibodies tested positive for HCV RNA, giving an estimated incidence of 0.05% new HCV infections/year. Molecular analyses indicated that the two patients probably acquired HCV outside the haemodialysis unit. CONCLUSION: This decreased prevalence and incidence emphasizes the importance of adhering to the recommended universal infection-control precautions. Virological follow-up based on detecting anti-HCV antibodies with sensitive, specific new-generation serological tests could be adequate for dialysis units with few HCV infections. However, new infections in haemodialysis units should be identified by determining the HCV RNA status of seronegative patients. Standardized real-time PCR assays, plus pooling serum samples, make this a promising method for large-scale epidemiological studies.

Études étrangères

(2018). "Diabetes mellitus and chronic kidney disease in the Eastern Mediterranean Region: findings from the Global Burden of Disease 2015 study." Int J Public Health **63**(Suppl 1): 177-186.

> OBJECTIVES: We used findings from the Global Burden of Disease 2015 study to update our previous publication on the burden of diabetes and chronic kidney disease due to diabetes (CKD-DM) during 1990-2015. METHODS: We extracted GBD 2015 estimates for prevalence, mortality, and disability-adjusted life years (DALYs) of diabetes (including burden of low vision due to diabetes, neuropathy, and amputations and CKD-DM for 22 countries of the EMR from the GBD visualization tools. RESULTS: In 2015, 135,230 (95% UI 123,034-148,184) individuals died from diabetes and 16,470 (95% UI 13,977-18,961) from CKD-DM, 216 and 179% increases, respectively, compared to 1990. The total number of people with diabetes was 42.3 million (95% UI 38.6-46.4 million) in 2015. DALY rates of diabetes in 2015 were significantly higher than the expected rates based on Socio-demographic Index (SDI). CONCLUSIONS: Our study showed a large and increasing burden of diabetes in the region. There is an urgency in dealing with diabetes and its consequences, and these efforts should be at the forefront of health prevention and promotion.

Abboud, O. (2006). "Incidence, prevalence, and treatment of end-stage renal disease in the Middle East." Ethn Dis **16**(2 Suppl 2): S2-2-4.

> INTRODUCTION: This article reviews the status of end-stage renal disease in the Middle East, with emphasis on its incidence, prevalence, and treatment. METHODS: Data were obtained from English-language published literature through a Medline search over the past 40 years. Supplementary information was gathered from regional congresses and symposia, websites of specialized nephrology centers, and direct communications. RESULTS: Of the 14 Middle East countries, attention was focused on 10 countries with similar renal care systems: 7 Arabian Peninsula countries and 3 eastern Mediterranean countries. Collectively, they have a population of 72.5 million. Incidence of ESRD ranged between 64 and 212 patients per million population (pmp) with an average of 93 patients pmp. The lowest prevalence was 320, the highest was 462, and the average was 352 patients pmp. Hemodialysis is the preferred dialysis modality and is freely available in all countries for citizens. Non-citizen residents' access to hemodialysis is markedly restricted. Peritoneal dialysis is available on a limited scale. Renal transplantation is available in all countries with variable program activities. Most of the transplants are from living, related donors. Active deceased donor transplant programs exist in four countries. The results from countries with active programs are excellent, with 5-year patient and graft survival of > 90%. CONCLUSIONS: This review provides information on the incidence, prevalence and treatment modalities of ESRD in 10 Middle East countries.

Anothaisintawee, T., Rattanasiri, S., Ingsathit, A., et al. (2009). "Prevalence of chronic kidney disease: a systematic review and meta-analysis." Clin Nephrol **71**(3): 244-254.

> AIMS: Many studies have estimated the prevalence of chronic kidney disease (CKD) but results have varied due partly to the type of equation used to estimate GFR, type of subjects, and ethnicity. This review aimed to estimate the prevalence of CKD Stage III, accounting for these factors. METHODS: 403 studies were identified from Medline using the PubMed search engine, of which 34 studies were eligible. Data were independently extracted by two reviewers, and heterogeneity was assessed using metaregression. RESULTS: The pooled prevalence was estimated using a random effects model. In the general population, the prevalences of CKD Stage III using MDRD equation were 3.6% (95% CI: 2.5, 4.8), 10.7% (95% CI: 4.5 - 16.9%), and 16.3% (95% CI: 2.1 - 30.5%) for age groups 60 years. The prevalence was about double using the Cockcroft-Gault equations, i.e. 7.5% (95% CI: 6.9 - 8.2%) and 34.9 (95% CI: 25.9 - 44.8%) in age 50 years, respectively. The prevalence was similar in Caucasians and Asians aged. < or = 60, i.e. 9.9 versus 9.3%. The prevalence was also higher in the diabetic population than in the general population, i.e. 18.2% versus 10.6%. CONCLUSIONS: The pooled prevalence of CKD in the general population varied according to age groups. The prevalence is similar in Caucasians and Asians within age 60 years or younger but other age groups need more studies in order to pool. Individual patient meta-analysis would be appropriate to resolve the causes of heterogeneity.

Boucquemont, J., Heinze, G., Jager, K. J., et al. (2014). "Regression methods for investigating risk factors of chronic kidney disease outcomes: the state of the art." BMC Nephrol **15**: 45.

> BACKGROUND: Chronic kidney disease (CKD) is a progressive and usually irreversible disease. Different types of outcomes are of interest in the course of CKD such as time-to-dialysis, transplantation or decline of the glomerular filtration rate (GFR). Statistical analyses aiming at investigating the association between these outcomes and risk factors raise a number of methodological issues. The objective of this study was to give an overview of these issues and to highlight some statistical methods that can address these topics. METHODS: A literature review of statistical methods published between 2002 and 2012 to investigate risk factors of CKD outcomes was conducted within the Scopus database. The results of the review were used to identify important methodological issues as well as to discuss solutions for each type of CKD outcome. RESULTS: Three hundred and four papers were selected. Time-to-event outcomes were more often investigated than quantitative outcome variables measuring kidney function over time. The most frequently investigated events in survival analyses were all-cause death, initiation of kidney replacement therapy, and progression to a specific value of GFR. While competing risks were commonly accounted for, interval censoring was rarely acknowledged when appropriate despite existing methods. When the outcome of interest was the quantitative decline of kidney function over time, standard linear models focussing on the slope of GFR over time were almost as often used as linear mixed models which allow various numbers of repeated measurements of kidney function per patient. Informative dropout was accounted for in some of these longitudinal analyses. CONCLUSIONS: This study provides a broad overview of the statistical methods used in the last ten years for investigating risk factors of CKD progression, as well as a discussion of their limitations. Some existing potential alternatives that have been proposed in the context of CKD or in other contexts are also highlighted.

Brosnahan, G. et Fraer, M. (2010). "Chronic kidney disease: whom to screen and how to treat, part 1: definition, epidemiology, and laboratory testing." South Med J **103**(2): 140-146.

> Chronic kidney disease has become a major public health problem due to its high prevalence, its exorbitant cost, and large reductions in life expectancy and quality of life of affected people. Seventy percent of cases of end-stage renal disease are due to diabetes and hypertension, conditions which are usually managed by primary care providers. Other risk factors are cardiovascular disease, obesity, smoking, family history of kidney disease, and age greater than 55 years. Patients with these risk factors should be evaluated for the presence of chronic kidney disease during their primary care visits, because effective treatments for slowing progression are available, particularly if instituted early. Chronic kidney disease can be diagnosed by simple blood and urine tests, as recommended in guidelines issued by the National Kidney Foundation. This article begins with a case vignette, representing a common clinical scenario from a general internist's practice. We then review the definition and classification of chronic kidney disease, the epidemiology, etiology, and interconnections with cardiovascular disease. We discuss the guidelines for screening and laboratory testing, as well as the limitations of current assessment tools. A subsequent article will review evidence-based management of chronic kidney disease.

Bruck, K., Jager, K. J., Dounousi, E., et al. (2015). "Methodology used in studies reporting chronic kidney disease prevalence: a systematic literature review." Nephrol Dial Transplant **30 Suppl 4**: iv6-16.

> BACKGROUND: Many publications report the prevalence of chronic kidney disease (CKD) in the general population. Comparisons across studies are hampered as CKD prevalence estimations are influenced by study population characteristics and laboratory methods. METHODS: For this systematic review, two researchers independently searched PubMed, MEDLINE and EMBASE to identify all original research articles that were published between 1 January 2003 and 1 November 2014 reporting the prevalence of CKD in the European adult general population. Data on study methodology and reporting of CKD prevalence results were independently extracted by two researchers. RESULTS: We identified 82 eligible publications and included 48 publications of individual studies for the data extraction. There was considerable variation in population sample selection. The majority of studies did not report the sampling frame used, and the response ranged from 10 to 87%. With regard to the assessment of kidney function, 67% used a Jaffe assay, whereas 13% used the enzymatic assay for creatinine determination. Isotope dilution mass spectrometry calibration was used in 29%. The CKD-EPI (52%) and MDRD (75%) equations were most often used to estimate glomerular filtration rate

(GFR). CKD was defined as estimated GFR (eGFR) <60 mL/min/1.73 m(2) in 92% of studies. Urinary markers of CKD were assessed in 60% of the studies. CKD prevalence was reported by sex and age strata in 54 and 50% of the studies, respectively. In publications with a primary objective of reporting CKD prevalence, 39% reported a 95% confidence interval. CONCLUSIONS: The findings from this systematic review showed considerable variation in methods for sampling the general population and assessment of kidney function across studies reporting CKD prevalence. These results are utilized to provide recommendations to help optimize both the design and the reporting of future CKD prevalence studies, which will enhance comparability of study results.

Crews, D. C., Liu, Y. et Boulware, L. E. (2014). "Disparities in the burden, outcomes, and care of chronic kidney disease." Curr Opin Nephrol Hypertens **23**(3): 298-305.

PURPOSE OF REVIEW: Racial, ethnic and socioeconomic disparities in chronic kidney disease (CKD) have been documented for decades, yet little progress has been made in mitigating them. Several recent studies offer new insights into the root causes of these disparities, point to areas in which future research is warranted, and identify opportunities for changes in policy and clinical practice. RECENT FINDINGS: Recently published evidence suggests that geographic disparities in CKD prevalence exist and vary by race. CKD progression is more rapid for racial and ethnic minority groups compared with whites and may be largely, but not completely, explained by genetic factors. Stark socioeconomic disparities in outcomes for dialysis patients exist and vary by race, place of residence, and treatment facility. Disparities in access to living kidney donation may be driven primarily by the socioeconomic status of the donor as opposed to recipient factors. SUMMARY: Recent studies highlight opportunities to eliminate disparities in CKD, including efforts to direct resources to areas and populations where disparities are most prevalent, efforts to understand how to best use emerging information on the contribution of genetic factors to disparities, and continued work to identify modifiable environmental, social, and behavioral factors for targeted interventions among high-risk populations.

Dalrymple, L. S. et Go, A. S. (2008). "Epidemiology of acute infections among patients with chronic kidney disease." Clin J Am Soc Nephrol **3**(5): 1487-1493.

The objectives of this review were (1) to review recent literature on the rates, risk factors, and outcomes of infections in patients who had chronic kidney disease (CKD) and did or did not require renal replacement therapy; (2) to review literature on the efficacy and use of selected vaccines for patients with CKD; and (3) to outline a research framework for examining key issues regarding infections in patients with CKD. Infection-related hospitalizations contribute substantially to excess morbidity and mortality in patients with ESRD, and infection is the second leading cause of death in this population. Patients who have CKD and do not require renal replacement therapy seem to be at higher risk for infection compared with patients without CKD; however, data about patients who have CKD and do not require dialysis therapy are very limited. Numerous factors potentially predispose patients with CKD to infection: advanced age, presence of coexisting illnesses, vaccine hyporesponsiveness, immunosuppressive therapy, uremia, dialysis access, and the dialysis procedure. Targeted vaccination seems to have variable efficacy in the setting of CKD and is generally underused in this population. In conclusion, infection is a primary issue when caring for patients who receive maintenance dialysis. Very limited data exist about the rates, risk factors, and outcomes of infection in patients who have CKD and do not require dialysis. Future research is needed to delineate accurately the epidemiology of infections in these populations and to develop effective preventive strategies across the spectrum of CKD severity.

Elliott, M. J., Tam-Tham, H. et Hemmelgarn, B. R. (2013). "Age and treatment of kidney failure." Curr Opin Nephrol Hypertens **22**(3): 344-350.

PURPOSE OF REVIEW: This review discusses issues related to treatment of chronic kidney disease, and kidney failure in particular, among older adults. RECENT FINDINGS: A substantial proportion of older adults have chronic kidney disease and progress to kidney failure. There is considerable variability in treatment practices for advanced kidney disease among older adults, and evidence that treatment decisions such as dialysis initiation may be made without adequate preparation. When initiated, survival among older adults on chronic dialysis remains poor, and is associated with a significant decline in functional status. There is also evidence to suggest that dialysis initiation may not reflect overall treatment goals of elderly patients, but rather a lack of clear communication between patients and health practitioners, and underdeveloped conservative care programs in many centers. SUMMARY: Kidney failure is common among older adults. When considering treatment options for kidney failure, patient priorities, preferences, and symptoms should be taken into account, using a shared decision-making approach.

Feest, T. G., Rajamahesh, J., Byrne, C., et al. (2005). "Trends in adult renal replacement therapy in the UK: 1982-2002." Qjm **98**(1): 21-28.

BACKGROUND: Following the introduction of dialysis and transplantation for the treatment of established renal failure (ERF) 40 years ago, the UK failed to match the achievements of many other countries. AIM: To review progress with treatment for ERF in the UK in the past 20 years. DESIGN: Review of four cross-sectional national studies, and 1997-2002 annual UK Renal Registry data. METHODS: Data on UK patients on renal replacement treatment (RRT) were collated from three sources: European Registry reports for 1982-1990, surveys carried out within the UK in 1993, 1996, 1998 and 2002, and the UK Renal Registry database (1997-2002). Trends in acceptance and prevalence rates, median age, cause of ERF, and treatment modality were analysed and compared with current data from other countries. RESULTS: The UK annual acceptance rate for RRT increased from 20 per million population (pmp) in 1982 to 101 pmp in 2002. This growth was largely in those aged over 65 years, and in those with co-morbidity. Annual acceptance rates for ERF due to diabetes rose from 1.6 to 18 pmp. The prevalence of RRT increased from 157 pmp in 1982 to 626 pmp in 2002. Hospital haemodialysis has become the main modality, and is increasingly being provided in satellite units. Although rising, UK acceptance and prevalence rates are still lower than in many developed countries. DISCUSSION: Despite significant expansion in RRT services for adults in the UK over the last 20 years, there is evidence of unmet need, and need is expected to rise, due to demographic changes and trends in type 2 diabetes. Continuing growth in the already substantial investment in RRT will be needed, unless efforts to prevent the occurrence of ERF are successful.

Foley, R. N. (2010). "Temporal trends in the burden of chronic kidney disease in the United States." Curr Opin Nephrol Hypertens **19**(3): 273-277.

PURPOSE OF REVIEW: The public health importance of chronic kidney disease (CKD) has only recently come to be appreciated and careful examination of temporal trends is warranted. The purpose of the present review was to examine existing research on temporal trends for CKD and treated end-stage renal disease (ESRD) in the United States. RECENT FINDINGS: When the broadly representative National Health and Nutrition Examination Survey (NHANES) datasets were compared in 1988-1994 and 1999-2002, a pronounced increase in the prevalence of abnormally low glomerular filtration rate was observed when serum creatinine was used to estimate glomerular filtration rate. In contrast, glomerular filtration rate findings were almost identical when cystatin C levels were examined. Thus, although the community-wide burden of CKD is already high, uncertainty exists as to the growth rate of this problem. For treated ESRD a dramatic increase in incidence rate occurred in the 1980s and 1990s. Changing burdens of standard risk factors for CKD do not readily explain increased rates of treated ESRD, suggesting that selection criteria for dialysis and transplant programs may underlie these secular trends. If the hypothesis that nonbiological factors are major determinants of rates of treated ESRD is valid, the latter may be a poor surrogate for true ESRD and for understanding its causes and rates of progression. SUMMARY: Given its prevalence and prognostic implications, it makes intuitive sense to monitor the burden of CKD over time; the validity of the tools used to generate an answer, however, is at least as important as the direction of the answer.

Gaddam, S., Gunukula, S. K., Lohr, J. W., et al. (2016). "Prevalence of chronic kidney disease in patients with chronic obstructive pulmonary disease: a systematic review and meta-analysis." BMC Pulm Med **16**(1): 158.

BACKGROUND: The incidence and prevalence of chronic kidney disease (CKD) continue to rise worldwide. Increasing age, diabetes, hypertension, and cigarette smoking are well-recognized risk factors for CKD. Chronic obstructive pulmonary disease (COPD) is characterized by chronic airway inflammation leading to airway obstruction and parenchymal lung destruction. Due to some of the common pathogenic mechanisms, COPD has been associated with increased prevalence of CKD. METHODS: Systematic review of medical literature reporting the incidence and prevalence of CKD in patients with COPD using the Cochrane Collaboration Methodology, and conduct meta-analysis to study the cumulative effect of the eligible studies. We searched Medline via Ovid, PubMed, EMBASE and ISI Web of Science databases from 1950 through May, 2016. We included prospective and retrospective observational studies that reported the prevalence of CKD in patients with COPD. RESULTS: Our search resulted in 19 eligible studies of which 9 have been included in the meta-analysis. The definition of CKD was uniform across all the studies included in analysis. COPD was found to be associated with CKD in the included epidemiological studies conducted in many countries. Our meta-analysis showed that COPD was found to be associated with a significantly increased prevalence of CKD (Odds Ratio [OR] = 2.20; 95% Confidence Interval [CI] 1.83, 2.65). STUDY LIMITATIONS: Studies included are observational studies. However, given the nature of our research question there is no possibility to perform a randomized control trial. CONCLUSIONS: Patients with COPD have increased odds of developing CKD. Future research should investigate the pathophysiological mechanism behind this association, which may lead to better outcomes.

Giannaki, C. D., Hadjigeorgiou, G. M., Karatzaferi, C., et al. (2014). "Epidemiology, impact, and treatment options of restless legs syndrome in end-stage renal disease patients: an evidence-based review." Kidney Int **85**(6): 1275-1282.

Restless legs syndrome (RLS) (or Willis-Ekbom disease) is a neurological disorder with high prevalence among the end-stage renal disease population. This is one of the most predominant types of secondary RLS, and it is called uremic RLS. Despite the fact that uremic RLS has been less studied compared to idiopathic RLS, recent studies now shed light in many aspects of the syndrome including clinical characteristics, impact, epidemiology, and treatment options. The current review discusses the above topics with special emphasis given on the management of uremic RLS, including the management of symptoms that often appear during a hemodialysis session. Uremic RLS symptoms may be ameliorated by using pharmacological and nonpharmacological treatments. Evidence so far shows that both approaches may be effective in terms of reducing the RLS symptom's severity; nevertheless, more research is needed on the efficiency of treatments for uremic RLS.

Glassock, R. J. et Winearls, C. (2008). "The global burden of chronic kidney disease: how valid are the estimates?" Nephron Clin Pract **110**(1): c39-46; discussion c47.

BACKGROUND/AIMS: The values for the global prevalence of chronic kidney disease (CKD) are poorly understood. Current classification schemas may overstate the prevalance of CKD. This minireview analyzes the pitfalls in the use of current classification approaches for identifying CKD on a global basis. METHODS: Literature review and comment. RESULTS: Published estimates for the global burden of CKD are likely to be incorrect and inflated. Overestimations of prevalence have occurred due to flaws in the classification systems employed and in ascertainment methods. CONCLUSIONS: A revision of the current system of diagnosing and classifying CKD is needed in order to determine with greater precision true global burden of CKD. A new system is proposed.

Hsu, C. Y., Chertow, G. M. et Curhan, G. C. (2002). "Methodological issues in studying the epidemiology of mild to moderate chronic renal insufficiency." Kidney Int **61**(5): 1567-1576.

There is increasing interest in studying the epidemiology of subjects with mild to moderate chronic renal insufficiency (CRI), defined as reduced glomerular filtration rate (GFR) not requiring renal replacement therapy. This review discusses some of the methodological challenges presented by the epidemiological study of mild to moderate CRI that have not been adequately addressed in the literature. Issues that relate to defining the prevalence of CRI include between-laboratory differences in serum creatinine (SCr) assays, within-person measurement errors in SCr, and differences in SCr in different demographic groups that are independent of GFR. Issues that relate to examining CRI as an outcome include the choice between a "slope" or "threshold" analysis. Issues that relate to examining CRI as an exposure include the choice of renal function measure (for example, SCr vs. estimated GFR) in multivariable analysis, whether to normalize renal function to body surface area or other body size parameters, potential effect modification of the association between CRI and the outcome and the complex relation between CRI, adverse outcomes, potential confounders and intermediary variables. As we enter an era of more intensive study of mild to moderate CRI, recognition of these potential pitfalls should guide researchers toward improving the quality of epidemiological research in this field.

Ko, S., Venkatesan, S., Nand, K., et al. (2018). "International statistical classification of diseases and related health problems coding underestimates the incidence and prevalence of acute kidney injury and chronic kidney disease in general medical patients." Intern Med J **48**(3): 310-315.

BACKGROUND: The international classification of diseases (ICD) code is frequently used to identify renal impairment in epidemiological research. However, Australian studies examining accuracy of this administrative data in coding kidney injury are lacking. AIMS: To compare the ICD 10 coding with the kidney disease: improving global outcomes (KDIGO) criteria in diagnosing acute kidney injury (AKI) and/or chronic kidney disease (CKD). METHODS: A retrospective study of 325 patients admitted to general medicine during January 2012 was performed. Sensitivity and specificity of ICD 10 in identifying AKI and CKD were calculated using KDIGO as gold standard. RESULTS: The sensitivities of ICD 10 in identifying AKI and CKD were low for both (59.5% and 54.1%), but the specificities were high (86.2% and 90.2%). Using KDIGO criteria, we identified 72 AKI (22%), 56 CKD (17%), 64 AKI on CKD (19%) and 133 controls (40%). Compared to the control group, patients with AKI and AKI on CKD had longer length of stay (3.2 vs 4.9 days and 3.2 vs 4.8 days, P = 0.20). Renal impairment groups had increased in-hospital mortality rate (5% control, 6% AKI, 10% CKD, 9% AKI on CKD) and re-admission rate within 30 days (13% control, 20% AKI, 25% CKD, 26% AKI on CKD). After adjusting for age, gender and comorbidities, the difference in outcomes was not statistically significant. CONCLUSION: This study shows that ICD 10 fails to identify almost half of the patients with AKI (40.5%) and CKD (45.9%) in our cohort. A total of 60% had evidence of renal impairment as defined by KDIGO.

Liyanage, T., Ninomiya, T., Jha, V., et al. (2015). "Worldwide access to treatment for end-stage kidney disease: a systematic review." Lancet **385**(9981): 1975-1982.

BACKGROUND: End-stage kidney disease is a leading cause of morbidity and mortality worldwide. Prevalence of the disease and worldwide use of renal replacement therapy (RRT) are expected to rise sharply in the next decade. We aimed to quantify estimates of this burden. METHODS: We systematically searched Medline for observational studies and renal registries, and contacted national experts to obtain RRT prevalence data. We used Poisson regression to estimate the prevalence of RRT for countries without reported data. We estimated the gap between needed and actual RRT, and projected needs to 2030. FINDINGS: In 2010, 2.618 million people received RRT worldwide. We estimated the number of patients needing RRT to be between 4.902 million (95% CI 4.438-5.431 million) in our conservative model and 9.701 million (8.544-11.021 million) in our high-estimate model, suggesting that at least 2.284 million people might have died prematurely because RRT could not be accessed. We noted the largest treatment gaps in low-income countries, particularly Asia (1.907 million people needing but not receiving RRT; conservative model) and Africa (432,000 people; conservative model). Worldwide use of RRT is projected to more than double to 5.439 million (3.899-7.640 million) people by 2030, with the most growth in Asia (0.968 million to a projected 2.162 million [1.571-3.014 million]). INTERPRETATION: The large number of people receiving RRT and the substantial number without access to it show the need to both develop low-cost treatments and implement effective population-based prevention strategies. FUNDING: Australian National Health and Medical Research Council.

Martinez-Castelao, A., Gorriz, J. L., Portoles, J. M., et al. (2011). "Baseline characteristics of patients with chronic kidney disease stage 3 and stage 4 in Spain: the MERENA observational cohort study." BMC Nephrol **12**: 53.

BACKGROUND: To obtain information on cardiovascular morbidity, hypertension control, anemia and mineral metabolism based on the analysis of the baseline characteristics of a large cohort of Spanish patients enrolled in an ongoing prospective, observational, multicenter study of patients with stages 3 and 4 chronic kidney diseases (CKD). METHODS: Multicenter study from Spanish government hospital-based Nephrology outpatient clinics involving 1129 patients with CKD stages 3 (n = 434) and 4 (n = 695) defined by GFR calculated by the MDRD formula. Additional analysis was performed with GFR calculated using the CKD-EPI and Cockcroft-Gault formula. RESULTS: In the cohort as a whole, median age 70.9 years, morbidity from all cardiovascular disease (CVD) was very high (39.1%). In CKD stage 4, CVD prevalence was higher than in stage 3 (42.2 vs 35.6% p < 0.024). Subdividing stage 3 in 3a and 3b and after adjusting for age, CVD increased with declining GFR with the hierarchy (stage 3a < stage 3b < stage 4) when calculated by CKD-EPI (31.8, 35.4, 42.1%, p 0.039) and Cockcroft-Gault formula (30.9, 35.6, 43.4%, p 0.010) and MDRD formula (32.5, 36.2, 42.2%,) but with the latter, it did not reach statistical significance (p 0.882). Hypertension was almost universal among those with stages 3 and 4 CKD (91.2% and 94.1%, respectively) despite the use of more than 3 anti-hypertensive agents including widespread use of RAS blockers. Proteinuria (> 300 mg/day) was present in more than 60% of patients and there was no significant differences between stages 3 and 4 CKD (1.2 +/- 1.8 and 1.3 +/- 1.8 g/day, respectively). A majority of the patients had hemoglobin levels greater than 11 g/dL (91.1 and 85.5% in stages 3 and 4 CKD respectively p < 0.001) while the use of erythropoiesis-stimulating agents (ESA) was limited to 16 and 34.1% in stages 3 and 4 CKD respectively. Intact parathyroid hormone (i-PTH) was elevated in stage 3 and stage 4 CKD patients (121 +/- 99 and 166 +/- 125 pg/mL p 0.001) despite good control of calcium-phosphorus levels. CONCLUSION: This study provides an overview of key clinical parameters in patients with CKD Stages 3 and 4 where delivery or care was largely by nephrologists working in a network of hospital-based clinics of the Spanish National Healthcare System.

Murtagh, F. E., Addington-Hall, J. et Higginson, I. J. (2007). "The prevalence of symptoms in end-stage renal disease: a systematic review." Adv Chronic Kidney Dis **14**(1): 82-99.

Symptoms in end-stage renal disease (ESRD) are underrecognized. Prevalence studies have focused on single symptoms rather than on the whole range of symptoms experienced. This systematic review aimed to describe prevalence of all symptoms, to better understand total symptom burden. Extensive database, "gray literature," and hand searches were undertaken, by predefined protocol, for studies reporting symptom prevalence in ESRD populations on dialysis, discontinuing dialysis, or without dialysis. Prevalence data were extracted, study quality assessed by use of established criteria, and studies contrasted/combined to show weighted mean prevalence and range. Fifty-nine studies in dialysis patients, one in patients discontinuing dialysis, and none in patients without dialysis met the inclusion criteria. For the following symptoms, weighted mean prevalence (and range) were fatigue/tiredness 71% (12% to 97%), pruritus 55% (10% to 77%), constipation 53% (8% to 57%), anorexia 49% (25% to 61%), pain 47% (8% to 82%), sleep disturbance 44% (20% to 83%), anxiety 38% (12% to 52%), dyspnea 35% (11% to 55%), nausea 33% (15% to 48%), restless legs 30% (8%to 52%), and depression 27% (5%to 58%). Prevalence variations related to differences in symptom definition, period of prevalence, and level of severity reported. ESRD patients on dialysis experience multiple symptoms, with pain, fatigue, pruritus, and constipation in more than 1 in 2 patients. In patients discontinuing dialysis, evidence is more limited, but it suggests they too have significant symptom burden. No evidence is available on symptom prevalence in ESRD patients managed conservatively (without dialysis). The need for greater recognition of and research into symptom prevalence and causes, and interventions to alleviate them, is urgent.

Palmer, S., Vecchio, M., Craig, J. C., et al. (2013). "Prevalence of depression in chronic kidney disease: systematic review and meta-analysis of observational studies." Kidney Int **84**(1): 179-191.

Prevalence estimates of depression in chronic kidney disease (CKD) vary widely in existing studies. We conducted a systematic review and meta-analysis of observational studies to summarize the point prevalence of depressive symptoms in adults with CKD. We searched MEDLINE and Embase (through January 2012). Random-effects meta-analysis was used to estimate the prevalence of depressive symptoms. We also limited the analyses to studies using clinical interview and prespecified criteria for diagnosis. We included 249 populations (55,982 participants). Estimated prevalence of depression varied by stage of CKD and the tools used for diagnosis. Prevalence of interview-based depression in CKD stage 5D was 22.8% (confidence interval (CI), 18.6-27.6), but estimates were somewhat less precise for CKD stages 1-5 (21.4% (CI, 11.1-37.2)) and for kidney transplant recipients (25.7% (12.8-44.9)). Using self- or clinician-administered rating scales, the prevalence of depressive symptoms for CKD stage 5D was higher (39.3% (CI, 36.8-42.0)) relative to CKD stages 1-5 (26.5% (CI, 18.5-36.5)) and transplant recipients (26.6% (CI, 20.9-33.1)) and suggested that self-report scales may overestimate

> the presence of depression, particularly in the dialysis setting. Thus, interview-defined depression affects approximately one-quarter of adults with CKD. Given the potential prevalence of depression in the setting of CKD, randomized trials to evaluate effects of interventions for depression on patient-centered outcomes are needed.

Pyram, R., Kansara, A., Banerji, M. A., et al. (2012). "Chronic kidney disease and diabetes." Maturitas **71**(2): 94-103.

> Chronic kidney disease has a significant worldwide prevalence affecting 7.2% of the global adult population with the number dramatically increasing in the elderly. Although the causes are various, diabetes is the most common cause of CKD in the United States and an increasing cause of the same worldwide. Therefore, we chose to focus on diabetic chronic kidney disease in this review. The pathogenesis is multifactorial involving adaptive hyperfiltration, advanced glycosylated end-product synthesis (AGES), prorenin, cytokines, nephrin expression and impaired podocyte-specific insulin signaling. Treatments focus on lifestyle interventions including control of hyperglycemia, hypertension and hyperlipidemia as well treatment of complications and preparation for renal replacement therapy. This review examines the current literature on the epidemiology, pathogenesis, complications and treatment of CKD as well as possible areas of future disease intervention.

Ruospo, M., Palmer, S. C., Craig, J. C., et al. (2014). "Prevalence and severity of oral disease in adults with chronic kidney disease: a systematic review of observational studies." Nephrol Dial Transplant **29**(2): 364-375.

> BACKGROUND: Oral disease may be increased in people with chronic kidney disease (CKD) and, due to associations with inflammation and malnutrition, represents a potential modifiable risk factor for cardiovascular disease and mortality. We summarized the prevalence of oral disease in adults with CKD and explored any association between oral disease and mortality. METHODS: We used systematic review of observational studies evaluating oral health in adults with CKD identified in MEDLINE (through September 2012) without language restriction. We summarized prevalence and associations with all-cause and cardiovascular mortality using random-effects meta-analysis. We explored for sources of heterogeneity between studies using meta-regression. RESULTS: Eighty-eight studies in 125 populations comprising 11 340 adults were eligible. Edentulism affected one in five adults with CKD Stage 5D (dialysis) {20.6% [95% confidence interval (CI), 16.4-25.6]}. Periodontitis was more common in CKD Stage 5D [56.8% (CI, 39.3-72.8)] than less severe CKD [31.6% (CI, 19.0-47.6)], although data linking periodontitis with premature death were scant. One-quarter of patients with CKD Stage 5D reported never brushing their teeth [25.6% (CI, 10.2-51.1)] and a minority used dental floss [11.4% (CI, 6.2-19.8)]; oral pain was reported by one-sixth [18.7% (CI, 8.8-35.4)], while half of patients experienced a dry mouth [48.4% (CI, 37.5-59.5)]. Data for kidney transplant recipients and CKD Stages 1-5 were limited. CONCLUSIONS: Oral disease is common in adults with CKD, potentially reflects low use of preventative dental services, and may be an important determinant of health in this clinical setting.

Sprangers, B., Evenepoel, P. et Vanrenterghem, Y. (2006). "Late referral of patients with chronic kidney disease: no time to waste." Mayo Clin Proc **81**(11): 1487-1494.

> The prevalence of patients with chronic kidney disease (CKD) in the US population is approximately 11%, and because of the increase in life expectancy and in diabetic nephropathy incidence, an exponential increase is predicted for the next decades. During the past decade, evidence that the progression of CKD can be attenuated by a multifactorial therapeutic approach has been increasing. However, a substantial percentage of patients with CKD will have progression to CKD stage V (ie, need for renal replacement therapy). Late referral of these patients (ie, <1 to 6 months before the start of renal replacement therapy) has been shown to be associated with higher mortality, morbidity, and costs. However, up to 64% of patients with CKD are still referred late. This review presents the available data on the epidemiology, causes, and consequences of late patient referral. Furthermore, it offers information to prevent late referral, improve CKD patient care, and change clinical practice.

Walker, S. R., Wagner, M. et Tangri, N. (2014). "Chronic kidney disease, frailty, and unsuccessful aging: a review." J Ren Nutr **24**(6): 364-370.

The global prevalence of chronic kidney disease (CKD) is rising, particularly among the elderly population. Defining aging as successful or unsuccessful has become clinically relevant in the last 15 years, with an increased recognition of the frail phenotype. Frailty has been shown to be associated with CKD and poorer outcomes, such as death or dialysis. It is likely that the mechanisms of disease in CKD such as altered protein metabolism, inflammation, oxidative stress, and anemia accelerate normal aging and lead to worsening frailty in elderly patients with CKD.

Yamagata, K., Yagisawa, T., Nakai, S., et al. (2015). "Prevalence and incidence of chronic kidney disease stage G5 in Japan." Clin Exp Nephrol **19**(1): 54-64.

The prevalence and incidence of end-stage kidney disease (ESKD) have continued to increase worldwide. Japan was known as having the highest prevalence of ESKD in the world; however, Taiwan took this place in 2001, with the USA still in third position. However, the prevalence data from Japan and Taiwan consisted of dialysis patients only. The prevalence and incidence of Kidney Transplantation (KT) in Japan were quite low, and the number of KT patients among those with ESKD was regarded as negligibly small. However, the number of KT recipients has increased recently. Furthermore, there are no reports about nationwide surveys on the prevalence and incidence of predialysis chronic kidney failure patients in Japan. This review describes our recent study on the estimated number of chronic kidney disease (CKD) stage G5 patients and the number of ESKD patients living in Japan, obtained via the cooperation of five related medical societies. From the results, as of Dec 31, 2007, 275,242 patients had received dialysis therapy and 10,013 patients had a functional transplanted kidney, and as of Dec 31, 2008, 286,406 patients had received dialysis therapy and 11,157 patients had a functional transplanted kidney. Consequently, there were 285,255 patients with CKD who reached ESKD and were living in Japan in 2008 and 297,563 in 2009. We also estimated that there were 67,000 predialysis CKD stage G5 patients in 2009, 37,365 patients introduced to dialysis therapy, and 101 patients who received pre-emptive renal transplantation in this year. In total, there were 37,466 patients who newly required renal replacement therapy (RRT) in 2009. Not only the average ages, but also the primary renal diseases of the new ESKD patients in each RRT modality were different.

Zhang, Q. L. et Rothenbacher, D. (2008). "Prevalence of chronic kidney disease in population-based studies: systematic review." BMC Public Health **8**: 117.

BACKGROUND: Chronic kidney disease (CKD) is becoming a major public health problem worldwide. This article reviews the published evidence of prevalence of CKD in population-based study samples that used the standardized definition from the Kidney Disease Outcomes Quality Initiative of the National Kidney Foundation (K/DOQI) practice guideline, and particularly focus on performance of serum-creatinine based equations for GFR estimation. We provide a summary of available data about the burden of CKD in various populations. METHODS: We performed a systematic review of available published data in MEDLINE. A combination of various keywords relevant to CKD was used in this research. Related data of included studies were extracted in a systematic way. RESULTS: A total of 26 studies were included in this review. The studies were conducted in different populations, and the number of study participants ranged from 237 to 65181. The median prevalence of CKD was 7.2% in persons aged 30 years or older. In persons aged 64 years or older prevalence of CKD varied from 23.4% to 35.8%. Importantly, the prevalence of CKD strongly depended on which estimating equations were used. The Modification of Diet in Renal Disease Study (MDRD) equation was likely to be preferred in recent epidemiological studies compared to the adjusted Cockcroft-Gault (CG) equation. CONCLUSION: Worldwide, CKD is becoming a common disease in the general population. Accurately detecting CKD in special groups remains inadequate, particularly among elderly persons, females or other ethnic groups such as Asians.

Zimmerman, D., Sood, M. M., Rigatto, C., et al. (2012). "Systematic review and meta-analysis of incidence, prevalence and outcomes of atrial fibrillation in patients on dialysis." Nephrol Dial Transplant **27**(10): 3816-3822.

BACKGROUND: The reported incidence, prevalence and outcomes of atrial fibrillation (AF) in patients with end-stage renal disease (ESRD) are variable. The risks and benefits of warfarin anticoagulation need to be defined as the risk of bleeding in ESRD patients may overwhelm the benefits of embolic stroke prevention. We undertook a systematic literature review to clarify these issues. METHODS: A literature search was undertaken using Medline and EMBASE from 1990 to September 2011. Studies that reported incidence, prevalence or selected outcomes in ESRD patients with AF were included. Cross-sectional, cohort and randomized controlled trials with >25 participants were included. The lists of authors and abstracts from the search were reviewed by two investigators to determine the manuscripts for full text review. Data were abstracted to a form designed specifically for this study. The quality of the studies was assessed using the Newcastle-Ottawa scale. Event rates were calculated using a random-effects model. RESULTS: Twenty-five studies met our inclusion criteria. The prevalence of AF was 11.6% and the overall incidence was 2.7/100 patient-years. The risk of mortality and stroke was increased in ESRD patients with AF at 26.9 and 5.2/100 patient-years versus 13.4 and 1.9/100 patient-years compared with ESRD patients without AF. The majority of studies do not support a protective effect for warfarin in ESRD patients with AF. CONCLUSIONS: The incidence and prevalence of AF in ESRD patients are higher than in the general population and are associated with an increased risk of stroke and mortality. An appropriately designed randomized controlled trial is required to determine whether anticoagulation is an appropriate therapeutic strategy in patients with end-stage renal disease and atrial fibrillation.

L'évolution de la maladie

LES DIFFERENTS STADES DE LA MALADIE

Études françaises

Ingrand, I., Barbail, A., Migeot, V., et al. (2002). "Insuffisance rénale chronique en Poitou-Charentes : prévalence, adéquation des structures et satisfaction des patients." Sante Publique **14**(1): 5-19.

[BDSP. Notice produite par ENSP nz1SfR0x. Diffusion soumise à autorisation]. Les caractéristiques de la file active régionale, l'adéquation des structures aux besoins et la satisfaction des patients dialysés ont été analysées dans le cadre des travaux d'élaboration du SROS de Poitou-Charentes. Une enquête transversale a été réalisée auprès des centres d'hémodialyse et des associations prenant en charge les patients dans la région, et dans les départements limitrophes. La prévalence de la dialyse rénale chronique au 31 mars 2000 est estimée à 373 par million d'habitants. Selon l'avis du néphrologue, l'adéquation de la structure de prise en charge est satisfaisante pour 82% des patients. Les motifs d'inadéquation tiennent en premier lieu à l'absence de structure de type centre "allégé", puis le refus des patients d'être orienté vers une autre structure, enfin les facteurs médicaux, physiques et intellectuels. Pour 90% des patients, leur mode de prise en charge correspond à leur choix ; l'absence de structure à proximité constitue également pour eux le premier motif d'insatisfaction. Il est à noter que 42% des patients de moins de 60 ans s'estiment peu ou très peu informés sur leurs droits et la prise en charge de la maladie. (Résumé d'auteur).

Jacquelinet, C., Couchoud, C. et Lassalle, M. (2014). "Évolution de l'épidémiologie de l'insuffisance rénale chronique terminale traitée par dialyse ou greffe rénale en France entre 2007 et 2012." Bulletin Epidemiologique Hebdomadaire(37-38): 604-611.
http://www.invs.sante.fr/beh/2014/37-38/2014_37-38_4.html

[BDSP. Notice produite par InVS 8r7DBR0x. Diffusion soumise à autorisation]. L'incidence de l'insuffisance rénale chronique terminale traitée (IRTT) semble se stabiliser depuis 2007. Néanmoins, chaque année dans notre pays, près de 10 000 personnes démarrent un traitement de suppléance, essentiellement par dialyse. Malgré l'augmentation du prélèvement, moins de 3 000 personnes bénéficient chaque année d'une greffe rénale, essentiellement parmi les 41 000 malades en dialyse. En l'absence de modification majeure de l'incidence de l'IRTT, de la distribution des déterminants de la qualité de vie dans la cohorte des malades en traitement de suppléance et des pratiques de soins, les résultats de l'enquête de qualité de vie Quavi-REIN 2011 peuvent être considérés comme toujours d'actualité et extrapolables à l'ensemble de la France métropolitaine. À qualité de vie inchangée pour la dialyse et la greffe rénale, l'augmentation du nombre de malades porteurs d'un greffon rénal fonctionnel contribue à augmenter la qualité de vie de l'ensemble.

Macron-Nogues, F., Vernay, M., Ekong, E., et al. (2005). "La prévalence de l'insuffisance rénale chronique terminale traitée par dialyse en France en 2003 : l'enquête nationale Sros-IRCT." Bulletin Epidemiologique Hebdomadaire(37-38): 182-184, 182 fig., 183 tabl.

[BDSP. Notice produite par InVS oFkVtR0x. Diffusion soumise à autorisation]. Depuis la modification de la réglementation intervenue en 2002, l'offre de soins relative à la prise en charge de l'insuffisance rénale chronique terminale, et notamment le nombre de postes de dialyse, doit être définie, non plus en fonction d'indices démographiques mais au regard des besoins de la population. Or, contrairement à de nombreux autres pays, la France ne dispose pas encore d'un registre des patients dialysés couvrant l'ensemble de son territoire. Afin de préciser l'épidémiologie de l'insuffisance rénale chronique terminale traitée par dialyse et dans l'attente du déploiement complet du registre Rein (Réseau épidémiologie et information en néphrologie), le ministère chargé de la Santé (Dhos) et la Caisse nationale d'assurance maladie des travailleurs salariés (CnamTS), en collaboration avec les sociétés savantes, les néphrologues, les associations de malades et les fédérations hospitalières, ont réalisé en juin 2003 une étude dans l'ensemble des structures de dialyse implantées en France métropolitaine et dans les départements d'outre-mer (Dom). Cette étude avait pour objectifs de déterminer le nombre et la prévalence des patients atteints d'IRCT traités par dialyse et de décrire leurs caractéristiques démographiques et cliniques ainsi que leur mode de prise en charge. (Introduction).

Macron-Nogues, F., Vernay, M., Ekong, E., et al. (2007). "La prévalence de l'insuffisance rénale chronique terminale traitée par dialyse en France." Pratiques Et Organisation Des Soins **38**(2): 103-109.
http://www.ameli.fr/fileadmin/user_upload/documents/insuffisance_renale.pdf

[BDSP. Notice produite par CNAMTS ewatR0x3. Diffusion soumise à autorisation]. Cette étude propose le premier état des lieux exhaustif de la dialyse en France. Réalisée du 2 au 8 juin 2003 dans toutes les structures pratiquant la dialyse, elle aborde les caractéristiques socio-démographiques et cliniques des patients ainsi que leur mode de prise en charge.

Noel, D. et Landais, P. (2012). "[Epidemiology of chronic kidney disease]." Rev Prat **62**(1): 38-42.

Chronic kidney disease (CKD) is set in 5 stages of increasing severity with a decrease in glomerular filtration rate leading to end stage renal disease (ESRD) requiring a treatment of substitution, dialysis or transplantation. CKD is frequent, it increases with age, and affects one person out of 10 in the general population, and only 4 per 100,000 will reach end-stage renal disease (ESRD). As soon as it occurs, CKD is associated with increased cardiovascular comorbid conditions. Mortality in dialysis is far higher than in the general population. In France, more than 4 billion Euros per year, i.e. 2% of the overall health expenditures, are dedicated to the treatment of 0.11% of the population. It is, therefore at the early stages of CKD that the efforts of screening and prevention of ESRD should be targeted.

Tuppin, P., Bessou, A., Legeai, C., et al. (2018). "Two-year management after renal transplantation in 2013 in France: Input from the French national health system database." Nephrol Ther.

The objective of this study was to describe the management of patients undergoing renal transplantation in 2013 and over the following two years on the basis of healthcare consumption data. The National Health Insurance Information System was used to identify 1876 general scheme beneficiaries undergoing a first isolated renal transplantation (median age: 53 years; men 63%). Overall, 1.2% of patients died during the transplantation hospital stay (>65 years 3.3%) and 87% of patients had a functional graft at 2 years. Thirty-three percent of patients were readmitted to hospital for 1 day or longer during the first month, 73% the first year and 55% the second year. At least 10% of patients were hospitalised for antirejection treatment during the first quarter after renal transplantation, 16% the first year and 9% the second year. The first year, 32% of patients were hospitalised for renal disease (12% the second year), 14% were hospitalised for cardiovascular disease (9% the second year), 13% for infectious disease (5% the second year) and 2% for a malignant tumour

(2% the second year). Almost 80% of patients consulted their general practitioner each year (almost 50% consulted every quarter). During the second year, 83% of patients were taking antihypertensives, 45% lipid-lowering drugs, 26% antidiabetic drugs, 77% tacrolimus, 18% ciclosporin, 88% mycophenolic acid and 69% corticosteroids. This study highlights the important contribution of healthcare consumption data to a better understanding of the modalities of management of renal transplant recipients in France, allowing improvement of this management in line with guidelines.

Tuppin, P., Cuerq, A., Torre, S., et al. (2017). "[Management of patients with end-stage renal disease prior to initiation of renal replacement therapy in 2013 in France]." Nephrol Ther **13**(2): 76-86.

> This study evaluated the management of patients with end-stage renal disease prior to initiation of renal replacement therapy. Among the 51 million national health insurance general scheme beneficiaries (77% of the population), persons 18 years and older, starting dialysis or undergoing preemptive renal transplantation in 2013, were included in this study. Data were derived from the French national health insurance system (SNIIRAM). In this population of 6674 patients (median age: 68 years), 88% initiated renal replacement therapy by haemodialysis, 8% by peritoneal dialysis, and 4% by renal transplantation. During the year preceding initiation of dialysis, 76% of patients had been hospitalised with at least one diagnostic code for renal disease in 83% of cases, 16% had not received any reimbursements for serum creatinine assay and 32% had not seen a nephrologist; 87% were taking at least one antihypertensive drug (60% were taking at least a renin-angiotensin system inhibitor) and 30% were taking a combination of 4 or more classes of antihypertensive drugs. For patients initiating haemodialysis in a haemodialysis centre, 39% had undergone a procedure related to arteriovenous fistula and 10% had been admitted to an intensive care unit. This study, based on the available reimbursement data, shows that, despite frequent use of the health care system by this population, there is still room for improvement of screening and management of patients with end-stage renal disease and preparation for renal replacement therapy.

Études internationales

Annear, N. M., Banerjee, D., Joseph, J., et al. (2008). "Prevalence of chronic kidney disease stages 3-5 among acute medical admissions: another opportunity for screening." Qjm **101**(2): 91-97.

> BACKGROUND: Early identification of chronic kidney disease (CKD) can help delay or prevent its progression, but the opportunities for systematic screening of patients are not well defined. AIM: To define the prevalence of CKD Stages 3-5 and related anaemia among acute medical admissions. DESIGN: Retrospective analysis. METHODS: We studied all acute medical admissions to a major London teaching hospital during one year. The lowest creatinine, highest haemoglobin (Hb) and average mean corpuscular volume (MCV) were determined for 3 months before and after admission. Patients were categorized as CKD Stages 3-5 if the highest estimated GFR (eGFR) was <60 ml/min/1.73 m2. CKD-related anaemia was diagnosed if these patients had Hb <11 g/dl with normal MCV. RESULTS: A total of 6073 patients were studied: male 49.0%, age 65.4 +/- 19.6 years (mean +/- SD), creatinine 82.7 +/- 46.7 micromol/l, eGFR 89.1 +/- 32.5 ml/min/1.73 m2, Hb 13.6 +/- 1.73 g/dl, MCV 87.7 +/- 7.2 fl. There was an inverse correlation between eGFR and age (r2 = 0.5; P < 0.001). Males were younger than females (63.5 +/- 18.4 years vs. 67.3 +/- 20.5) and had higher eGFR (93.6 +/- 34.1 vs. 84.7 +/- 30.2 ml/min/1.73 m2; P < 0.001). A total of 743 patients (12.2%) had raised creatinine >110 micromol/l, however using eGFR <60 ml/min/1.73 m2, 1075 patients (17.7%) were identified. The patients were categorized as follows: Stage 3: 950 (15.6%), Stage 4: 100 (1.7%), Stage 5: 25 (0.4%). Ninety-nine (9.2%) of the 1075 patients had normocytic anaemia. CONCLUSION: We have found a high prevalence of CKD Stages 3-5 (17.7%) among acute medical admissions, of whom 9.2% had a related anaemia. Our findings highlight an important opportunity (amongst the 1.9 million acute medical admissions annually in England) for detecting patients with CKD.

Arroyo, D., Betriu, A., Martinez-Alonso, M., et al. (2014). "Observational multicenter study to evaluate the prevalence and prognosis of subclinical atheromatosis in a Spanish chronic kidney disease cohort: baseline data from the NEFRONA study." BMC Nephrol **15**: 168.

BACKGROUND: Cardiovascular events (CVE) are more prevalent in chronic kidney disease (CKD) than in general population, being the main cause of morbimortality. Specific risk factors related to CKD have been suggested, because traditional factors do not fully explain this increase in cardiovascular disease rates. However, the role of atheromatosis, its pathogenesis and evolution are still unclear. The potential use of diagnostic tests to detect subclinical atheromatosis has to be determined. METHODS: NEFRONA is a prospective multicenter cohort study. 2445 CKD subjects were enrolled from 81 Spanish hospitals and dialysis clinics, from 2010 to 2012. Eligibility criteria included: 18 to 74 years old, CKD stage 3 or higher, and no previous CVE. 559 non-CKD controls were also recruited. Demographical, clinical and analytical data were collected. Carotid and femoral ultrasounds were performed by a single trained team to measure carotid intima-media thickness (cIMT) and detect atheromatous plaques. Ankle-brachial index (ABI) was measured. RESULTS: Differences in age, sex and prevalence and control of cardiovascular risk factors were found between controls and CKD patients. These differences are similar to those described in epidemiological studies.No difference was found regarding cIMT between controls and CKD (when subjects with plaques in common carotid arteries were omitted); earlier CKD stages had higher values. CKD patients had a higher rate of atheromatous plaques, with no difference between stages in the unadjusted analysis. A group of patients had plaques in femoral arteries but were plaque-free in carotid arteries, and would have gone underdiagnosed without the femoral study. The percentage of pathologic ABI was higher in CKD, with higher prevalence in more advanced stages, and a higher rate of ABI >1.4 than <0.9, suggesting more vascular calcification. CONCLUSIONS: NEFRONA is the first large study describing the actual prevalence of subclinical atheromatosis across different CKD stages. There is a very high rate of atheromatous plaques and pathologic ABI in CKD. Prospective data will add important information to the pathogenesis and evolution of atheromatosis in CKD, compared to non-CKD subjects.

Banerjee, D., Contreras, G., Jaraba, I., et al. (2009). "Chronic kidney disease stages 3-5 and cardiovascular disease in the veterans affairs population." Int Urol Nephrol **41**(2): 443-451.

AIM: Cardiovascular complications are common in patients with chronic kidney disease in the general population. The study aims to investigate the prevalence and prognosis of CKD stages 3-5 in the veterans affairs (VA) population, which is sicker with more co-morbid conditions. METHODS: In this case-controlled study of 6,432 men the associations of risk factors with CKD and its risk of mortality were estimated using, primarily, logistic regression analysis. RESULTS: The 1,045 (16.2%) patients with CKD stages 3-5 were older (72 +/- 10 vs. 59 +/- 13 years, P < 0.0001) with more hypertension (53.6 vs. 39.6%, P < 0.0001), diabetes (24.9 vs. 19.8%, P < 0.0002), and CVD (35.3 vs. 17.8%, P < 0.0001) at baseline. Age > or =65 years (odds ratio [95% CI]) (4.95 [4.22-5.82]), hypertension (1.56 [1.34-1.79]), diabetes mellitus (1.21 [1.03-1.43]), CVD (1.71 [1.47-2.00]), and White not Hispanic (1.57 [1.32-1.85]) were independently associated with CKD. The prevalence of CVD at baseline increased with decreasing renal function. Old age (1.98 [1.66-2.35]), CKD (1.94 [1.61-2.33], CVD (1.46 [1.23-1.74]) and tobacco use (1.91 [1.05-3.47]) were independently associated with the 750 (11.7%) deaths. CONCLUSION: Among veterans, traditional cardiovascular risk factors, CVD, and CKD are highly prevalent. CKD is associated with increased risk of baseline CVD and follow-up mortality.

Bastos, R. M., Bastos, M. G., Ribeiro, L. C., et al. (2009). "[Prevalence of chronic kidney disease, stages 3, 4 and 5 in adults]." Rev Assoc Med Bras **55**(1): 40-44.

INTRODUCTION: Strategies that optimize early diagnosis of chronic kidney disease (CKD) are paramount to decrease progression of the disease and the burden of patients needing renal replacement therapy. OBJECTIVE: The aim of this study was to determine the prevalence of CKD stage 3, 4 and 5 in people submitted to dosage of serum creatinine due to different causes, employing a dataset from a private laboratory of the city of Juiz de Fora comprising the years 2004 and 2005. METHODS: Diagnosis and staging of CKD were based upon glomerular filtration rate (GFR) estimated from serum creatinine as recommended by the KDOQI of the National Kidney Foundation and the Brazilian Society of Nephrology. RESULTS: Prevalence of CKD stage 3, 4 and 5 was of 9.6%, with 12.2%, 5.8%, 25.2% and 3.7% among women, men, people >60 and < 60 years of age, respectively. CONCLUSION: Prevalence of CKD found in our study may not only be interpreted as an epidemiologic indicator, but also discloses an alternative operational strategy to identify the disease. Furthermore it supports a proposal to include the estimation of GFR from serum creatinine in the laboratory report as an important and simple tool for early diagnosis of CKD.

Bauer, C., Melamed, M. L. et Hostetter, T. H. (2008). "Staging of chronic kidney disease: time for a course correction." J Am Soc Nephrol **19**(5): 844-846.

Awareness of chronic kidney disease (CKD) has increased in part because of the definitions and treatment guidelines set out by Kidney Disease Outcomes Quality Initiative (KDOQI); however, the staging system set forth by these guidelines has led to several problems and unforeseen consequences. Stages 1 and 2 CKD are difficult to determine using the standard Modification of Diet in Renal Disease (MDRD) estimation of GFR, and their clinical significance in the absence of other risk factors is unclear. Just because microalbuminuria in people without diabetes is a cardiovascular risk factor does not make it kidney disease. Most patients who receive a diagnosis of stage 3 CKD (GFR between 30 and 59 ml/min) are elderly people, and the vast majority of these patients will die before they reach ESRD. The staging system needs to be modified to reflect the severity and complications of CKD. It is suggested that stages 1 and 2 be eliminated and stages 3, 4, and 5, be simply termed moderate impairment, severe impairment, and kidney failure, respectively. In addition, age should be a modifying factor, especially in moderate kidney impairment. These changes would allow identification and treatment of clinically relevant disease and avoidance of what can seem exaggerated prevalence estimates.

Bellizzi, V. (2008). "[Prevalence of chronic kidney disease]." G Ital Nefrol **25 Suppl 42**: S3-7.

The prevalence of chronic kidney disease (CKD), especially the early stages, is still not exactly known. This is also true for CKD stage 3, when cardiovascular and other major complications generally appear. The NANHES data have shown a steady increase in the prevalence of CKD 3 up to 7.7% in 2004. Chronic kidney disease and renal failure are underdiagnosed all over the world. In Italy, prevalence estimates for stage 3 to 5 CKD are around 4 million yet, less than 30% of these subjects are believed to be followed at nephrology clinics. This means that in Italy for every dialyzed patient there are about 85 individuals with possibly progressive kidney disease, while fewer than five (mainly stage 4 and 5 patients) are actually followed by a nephrologist.

Capuano, V., Lamaida, N., Borrelli, M. I., et al. (2012). "[Chronic kidney disease prevalence and trends (1998-2008) in an area of southern Italy. The data of the VIP project]." G Ital Nefrol **29**(4): 445-451.

Chronic kidney disease (CKD) is a common disorder whose prevalence is increasing worldwide. In Italy the prevalence of CKD, especially the early stages, is still not exactly known. Our study examines the prevalence and trends in ten years (1200 subjects in 1998-1999 and 1200 subjects in 2008-2009) of the estimated glomerular filtration rate (eGFR) in a population of southern Italy. We analyzed, within the VIP project, the prevalence of CKD (eGFR <60) in our area and its relationship to diabetes and hypertension as well as the trend between the years 1998-1999 and 2008-2009. The estimate of the GFR was obtained with the Cockcroft-Gault formula corrected for body surface area. The prevalence of CKD, stratified by the population of Campania, was about 5.9% in males and 3.9% in females in the years 1998-1999; ten years later (2008-2009) it had increased to 6.2% in males and 4.5% in females. The differences between males and females and between the two decades are not statistically significant although the trend shows a clear increase in subjects affected by CKD among both sexes. Among the male population the prevalence of CKD in persons with hypertension or diabetes, in those with both diseases, and in those free from these diseases was 11.2%, 12%, 13.8% and 6.3% (p=0.018), respectively. The same groups among females showed a CKD prevalence of 8%, 9.2%, 9.7% and 4.4%, respectively (p=0.042). Our work provides a picture of the prevalence of CKD in an area of southern Italy. It highlights the increase in CKD and calls upon a greater use of renal function tests in clinical practice, so that individuals at increased risk of developing cardiovascular complications may be detected as early as possible.

Cepoi, V., Onofriescu, M., Segall, L., et al. (2012). "The prevalence of chronic kidney disease in the general population in Romania: a study on 60,000 persons." Int Urol Nephrol **44**(1): 213-220.

> INTRODUCTION: Chronic kidney disease (CKD) is a major public health problem worldwide, due to its epidemic proportions and to its association with high cardiovascular risk. Therefore, screening for CKD is an increasingly important concept, aiming for early detection and prevention of progression and complications of this disease. MATERIALS AND METHODS: We studied the prevalence of CKD in the adult population of Iasi, the largest county in Romania, based on the results of a national general health screening program from 2007 to 2008. The patients were tested for CKD with serum creatinine and urinary dipstick. We used two different methods to estimate the glomerular filtration rate (eGFR): the simplified Modification of Diet in Renal Disease (MDRD) and the CKD Epidemiology Collaboration (CKD-EPI) equations. Based on the Kidney Disease Improving Global Outcomes (KDIGO) criteria, we defined CKD as the presence of either eGFR < 60 ml/min/1.73 m(2) and/or dipstick proteinuria. The classification of CKD by stage was also done according to the KDIGO criteria. RESULTS: The study population included 60,969 people. The global prevalence of CKD was found to be 6.69% by the MDRD formula and 7.32% when using the CKD-EPI equation. The prevalence of CKD was much higher in women than in men: 9.09% versus 3.7%, by MDRD, and 9.32% versus 4.85%, by CKD-EPI. By age groups, the prevalence of CKD was 0.95% and 0.64% in persons aged 18-44 years old, 4.27% and 3.57% (45-64 years old), 13.36% and 15.34% (65-79 years old), and 23.59% and 34.56% (>80 years old), according to MDRD and CKD-EPI, respectively. By stages, the prevalence of CKD stage 3a (eGFR 59 to 45 ml/min/1.73 m(2)) was 5.72% by MDRD and 5.96% according to CKD-EPI, whereas the prevalence of stages 3b, 4, and 5 taken together (eGFR < 45 ml/min/1.73 m(2)) was 0.96% (MDRD) and 1.35% (CKD-EPI). Patients with CKD were significantly older (71.0 years versus 53.7 years) and had lower levels of serum Hb, total cholesterol, and glutamic pyruvic transaminase, and significantly higher serum creatinine and blood glucose, in comparison with the individuals without CKD. Impaired fasting glucose (106 mg/dl) was found in the CKD population, but not in non-CKD individuals. CONCLUSIONS: Our study is one of the largest ever reported on the prevalence of CKD worldwide, the first one in Romania, and one of the very few of its kind in Europe (particularly in Eastern Europe). The study showed that the prevalence of CKD in our country is around 7%, which is lower than in other countries; however, this could be underestimated due to population selection bias. The prevalence is similar with the MDRD and the CKD-EPI equations; it increases with age and is much higher in women than in men. Impaired fasting glucose was detected in CKD patients, a finding that should probably raise the awareness of the high cardiovascular risk associated with CKD.

Chan, T. C., Yap, D. Y., Shea, Y. F., et al. (2012). "Prevalence and associated comorbidities of moderate to severe chronic renal impairment in Chinese nursing home older adults." J Am Med Dir Assoc **13**(7): 630-633.

> OBJECTIVE: To investigate the prevalence and associated comorbidities of Stage 3 (GFR 30-59 mL/min/1.73m(2)) and Stages 4 and 5 (GFR <30 mL/min/1.73m(2)) chronic kidney disease (CKD) among Chinese nursing home older adults. DESIGN: Retrospective cross-sectional study. Glomerular filtration rate (GFR) was estimated by Modification of Diet in Renal Disease Study (Chinese-adjusted) equation and The Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equations. SETTING: Nine nursing homes in Hong Kong PARTICIPANTS: Participants included 812 nursing home older adults (271 men and 571 women), mean age 86.0 +/- 7.6. MEASUREMENTS: Prevalence of Stage 3 (GFR 30-59 mL/min/1.73m(2)) and Stages 4 and 5 (GFR <30 mL/min/1.73m(2)) CKD. The comorbidities associated with renal impairment were also assessed. RESULTS: There were 18.4% of nursing home older adults who had elevated serum creatinine levels above the normal limits. Using Modification of Diet in Renal Disease Study and CKD-EPI equations, 26.4% and 21.2% of them had Stage 3 CKD, whereas 6.8% and 4.4% had Stage 4-5 CKD, respectively. Diabetes mellitus, hypertension, congestive heart failure, and ischemic heart disease correlated significantly with moderate to severe renal impairment in Chinese nursing home older adults. CONCLUSION: Stages 3 to 5 CKD are prevalent in Chinese nursing home older adults. Early identification of these patients facilitates drug prescription, renal management, and advance care planning.

Chen, P. M., Chen, P. Y. et Chiang, W. C. (2014). "Comments on "Progression of stages 3b-5 chronic kidney disease--preliminary results of Taiwan national pre-ESRD disease management program in Southern Taiwan"." J Formos Med Assoc **113**(10): 770-771.

Chou, C. C., Lien, L. M., Chen, W. H., et al. (2011). "Adults with late stage 3 chronic kidney disease are at high risk for prevalent silent brain infarction: a population-based study." Stroke **42**(8): 2120-2125.

BACKGROUND AND PURPOSE: The close relationship between stroke and chronic kidney disease (CKD) has been well-documented. However, few studies have focused on silent brain infarction (SBI) in CKD. We investigated the prevalence of SBI in different stages of CKD. METHODS: We included 1312 participants aged 30 to 93 years who came from either a random sample of residents or from a group of physically examined subjects in the same community. Basic information, clinical evaluations, laboratory tests, and MRI images were assessed. Subjects were divided into groups 1, 2, 3a, and 3b, corresponding to the estimated glomerular filtration rate (eGFR) levels of >/= 90.0, 60.0 to 89.9, 45.0 to 59.9, and 30.0 to 44.9 mL/min/1.73 m(2). RESULTS: The crude prevalence was 4.7%: 2.6% (20 of 759 subjects) in group 1; 6.3% (32 of 506) in group 2; 12.9% (4 of 31) in group 3a; and 37.5% (6 of 16) in group 3b (P<0.001). Additionally, SBI also correlated with age, male sex, hypertension, diabetes, moderate carotid plaque, higher blood pressures, obesity, and levels of triglyceride, high-density lipoprotein cholesterol, high-sensitivity C-reactive protein, and uric acid (all P<0.05). The effects for SBI risk in each eGFR group versus group 1 did not increase except for group 3b (OR, 9.34; P<0.001). CONCLUSIONS: A close association exists between SBI and eGFR. We have found a significant increase in prevalence of SBI when eGFR is between 30.0 and 44.9 mL/min/1.73 m(2). Adults with late stage 3 CKD are at high risk for prevalent SBI.

Coresh, J., Selvin, E., Stevens, L. A., et al. (2007). "Prevalence of chronic kidney disease in the United States." Jama **298**(17): 2038-2047.

CONTEXT: The prevalence and incidence of kidney failure treated by dialysis and transplantation in the United States have increased from 1988 to 2004. Whether there have been changes in the prevalence of earlier stages of chronic kidney disease (CKD) during this period is uncertain. OBJECTIVE: To update the estimated prevalence of CKD in the United States. DESIGN, SETTING, AND PARTICIPANTS: Cross-sectional analysis of the most recent National Health and Nutrition Examination Surveys (NHANES 1988-1994 and NHANES 1999-2004), a nationally representative sample of noninstitutionalized adults aged 20 years or older in 1988-1994 (n = 15,488) and 1999-2004 (n = 13,233). MAIN OUTCOME MEASURES: Chronic kidney disease prevalence was determined based on persistent albuminuria and decreased estimated glomerular filtration rate (GFR). Persistence of microalbuminuria (>30 mg/g) was estimated from repeat visit data in NHANES 1988-1994. The GFR was estimated using the abbreviated Modification of Diet in Renal Disease Study equation reexpressed to standard serum creatinine. RESULTS: The prevalence of both albuminuria and decreased GFR increased from 1988-1994 to 1999-2004. The prevalence of CKD stages 1 to 4 increased from 10.0% (95% confidence interval [CI], 9.2%-10.9%) in 1988-1994 to 13.1% (95% CI, 12.0%-14.1%) in 1999-2004 with a prevalence ratio of 1.3 (95% CI, 1.2-1.4). The prevalence estimates of CKD stages in 1988-1994 and 1999-2004, respectively, were 1.7% (95% CI, 1.3%-2.2%) and 1.8% (95% CI, 1.4%-2.3%) for stage 1; 2.7% (95% CI, 2.2%-3.2%) and 3.2% (95% CI, 2.6%-3.9%) for stage 2; 5.4% (95% CI, 4.9%-6.0%) and 7.7% (95% CI, 7.0%-8.4%) for stage 3; and 0.21% (95% CI, 0.15%-0.27%) and 0.35% (0.25%-0.45%) for stage 4. A higher prevalence of diagnosed diabetes and hypertension and higher body mass index explained the entire increase in prevalence of albuminuria but only part of the increase in the prevalence of decreased GFR. Estimation of GFR from serum creatinine has limited precision and a change in mean serum creatinine accounted for some of the increased prevalence of CKD. CONCLUSIONS: The prevalence of CKD in the United States in 1999-2004 is higher than it was in 1988-1994. This increase is partly explained by the increasing prevalence of diabetes and hypertension and raises concerns about future increased incidence of kidney failure and other complications of CKD.

de Francisco, A. L., De la Cruz, J. J., Cases, A., et al. (2007). "[Prevalence of kidney insufficiency in primary care population in Spain: EROCAP study]." Nefrologia **27**(3): 300-312.

This cross-sectional, multicenter study investigated the prevalence of chronic kidney disease and associated disorders, in an adult population sample (> 18 years old) attending Primary Care services in Spain. Estimated glomerular filtration rate (Modification Diet in Renal Disease equation) was used for analysis of kidney disease prevalence according to NFK-KDOQI (The National Kidney Foundation-Kidney Disease Outcomes Quality Initiative) stages. Data were collected on serum creatinine, other laboratory parameters blood pressure, and medical history of cardiovascular risk factors or disease (hypertension, dislypidemia, diabetes, congestive heart failure, coronary artery disease, stroke or peripheral arteriopathy) in 7,202 patients attending Primary Care Centers. 47.3% were males, mean age 60,6 +/- 14,3 years, BMI 28.2 +/- 5.3, with 27,6% overweight (27-30 kg/m2) and 32,1% obese (BMI>or=30 kg/m2), The prevalence of cardiovascular risks factors were: absence in 17.3%, one factor 26.9% two 31.2%, and 23.6% presented three or more The frequency of CV risk factors was: hypertension (66.7%), dyslipidemia (48%) and diabetes (31.5%). Congestive heart failure, coronary artery disease, stroke or peripheral vascular disease frequency was lower than 10% The prevalence of eGFR < 60 ml/min x 1.73 m2 was: stage 3 (30-59 ml/min/1.73 m2) 19.7%; stage 4 (15-29 ml/min/1.73 m2) 1.2%; stage 5 no dialysis (GFR < 15 ml/min) 0.4%. This prevalence increased with age in both sexes and 33,7% of patients attending Primary Care services over 70 years presented a eGFR < 60 ml/min. Of the total patients with eGFR < 60 ml/min 37.3% had normal serum creatinine levels. This study documents the substantial prevalence of significantly abnormal renal function among patients at Primary Care level. Early identification and appropriate nephrological management of these patients with renal disease is an important opportunity for an adequate prescription of drugs that interfere with renal function, to delay the progression of renal disease and modify CV risk factors.

De Nicola, L., Donfrancesco, C., Minutolo, R., et al. (2015). "Prevalence and cardiovascular risk profile of chronic kidney disease in Italy: results of the 2008-12 National Health Examination Survey." Nephrol Dial Transplant **30**(5): 806-814.

BACKGROUND: National surveys in countries outside Europe have reported a high prevalence (11-13%) of chronic kidney disease (CKD). Studies in Europe have provided a variable prevalence likely due to differences in study design, including age and extent of geographic areas, equation used to evaluate estimated glomerular filtration rate (eGFR) and CKD stages examined. METHODS: The 2008-12 National Health Examination Survey in Italy randomly extracted samples from the general population aged 35-79 years, stratified by age and gender, from the resident list of each Italian region (440 persons/1.5 million of residents). We estimated the prevalence of CKD by means of urinary albumin : creatinine ratio and eGFR (CKD-EPI equation-enzymatic assay of serum creatinine). Cardiovascular (CV) risk profile was also evaluated. RESULTS: Three thousand eight hundred and forty-eight men and 3704 women were examined. In the whole population, mean age was 57 +/- 12 and 56 +/- 12 years in men and women, respectively; hypertension was prevalent in men and women, respectively (56 and 43%) and the same held true for overweight (48 and 33%), obesity (26 and 27%), diabetes (14 and 9%) and smoking (21 and 18%), whereas CV disease was less frequent (9 and 6%). Overall, the prevalence of CKD (95% confidence interval) was 7.05% (6.48-7.65). Early stages constituted 59% of the CKD population [Stage G1-2 A2-3: 4.16% (3.71-4.61) and Stage G3-5: 2.89% (2.51-3.26)]. At multivariate regression analysis, age, obesity, hypertension, diabetes, CV disease and smoking were all independent correlates of CKD. CONCLUSIONS: CKD has a relatively lower prevalence in Italy, in particular for advanced stages, when compared with similar national surveys outside Europe. This occurs despite older age and unfavourable CV risk profile of the whole population.

Dowling, T. C. (2007). "Prevalence, etiology, and consequences of anemia and clinical and economic benefits of anemia correction in patients with chronic kidney disease: an overview." Am J Health Syst Pharm **64**(13 Suppl 8): S3-7; quiz S23-25.

PURPOSE: The prevalence of chronic kidney disease (CKD) and anemia in the United States, classification scheme for CKD, definition of anemia, etiology and consequences of anemia in patients with CKD, and the clinical and economic benefits of correcting anemia are described. SUMMARY: Approximately 20 million people in the United States population have CKD, and 2-4 million of these may also have anemia, which often goes undetected and untreated. Patients with CKD are now classified into five stages based on the degree of kidney function impairment. Here, anemia is caused by insufficient erythropoietin production, and may occur as early as stage 3 CKD. Potential consequences of anemia include cognitive impairment, angina, and the cardiorenal anemia syndrome, a triad of worsening anemia, worsening CKD, and worsening congestive heart failure. Treatment of anemia in predialysis patients with stage 2-4 CKD may slow renal disease progression and improve energy, work capacity, health-related quality of life, and cardiac function. Optimizing the hemoglobin or hematocrit value before initiating dialysis may reduce mortality. Anemia contributes to significant healthcare costs associated with CKD. Substitution of the subcutaneous route of administration for the intravenous route of administration for epoetin alfa can reduce drug acquisition and healthcare costs, the two largest components of healthcare costs in CKD patients. Efforts to slow the progression of CKD could also have a substantial impact on hospitalizations and costs. CONCLUSION: Correcting anemia has the potential to improve clinical and economic outcomes in patients with CKD.

Ferraro, P. M., Lupo, A., Yabarek, T., et al. (2011). "Metabolic syndrome, cardiovascular disease, and risk for chronic kidney disease in an Italian cohort: analysis of the INCIPE study." Metab Syndr Relat Disord **9**(5): 381-388.

BACKGROUND: Metabolic syndrome is a frequent condition that has been linked to cardiovascular disease (CVD) and mortality. Metabolic syndrome has been extensively shown to increase the risk of chronic nephropathies in Americans and Asians, but not in European populations. Renal disease increases the risk of CVD and mortality. However, the chronic nephropathy-CVD liaison has not been analyzed in the framework of the possible role of metabolic syndrome in both. METHODS: We analyzed data from 3,757 subjects participating in the INCIPE survey (Initiative on Nephropathy, of relevance to public health, which is Chronic, possibly in its Initial stages, and carries a Potential risk of major clinical End-points), a cross-sectional study enrolling subjects from the general population in the Veneto region in Italy, and calculated the odds ratio (OR) and 95% confidence interval (CI) of the association between metabolic syndrome, and/or chronic kidney disease (CKD) and albuminuria, and/or previous CVD after adjustment for confounding factors. RESULTS: Metabolic syndrome is associated with CKD (OR 2.17; P<0.001) and albuminuria (OR 2.28; P<0.001) and CVD (OR 1.58; P=0.002). There is a direct correlation between number of metabolic syndrome traits and nephropathy and CVD. CVD and nephropathies are associated even after adjustment for metabolic syndrome (OR 2.30; P<0.001). CONCLUSIONS: In a homogeneous Caucasian European population, metabolic syndrome is associated with CKD and albuminuria, and CVD. Although metabolic syndrome is a risk factor for both CVD and nephropathy, it does not entirely explain the dangerous CVD-nephropathy liaison.

Garlo, K., Williams, D., Lucas, L., et al. (2015). "Severity of Anemia Predicts Hospital Length of Stay but Not Readmission in Patients with Chronic Kidney Disease: A Retrospective Cohort Study." Medicine (Baltimore) **94**(25): e964.

The aim of this study was to examine the relationship of severe anemia to hospital readmission and length of stay (LOS) in patients with chronic kidney disease (CKD) stage 3-5. Compared with the general population, patients with moderate CKD have a higher hospital readmission rate and LOS. Anemia in patients with moderate CKD is associated with higher morbidity and mortality. The influence of anemia on hospital outcomes in patients with moderate CKD has not been characterized.We conducted a retrospective cohort study at Maine Medical Center, a 606-bed academic tertiary care hospital. Patients with CKD stages 3-5 and not on dialysis admitted during February 2013 to January 2014 were eligible. Patients with end stage renal disease on hemodialysis or peritoneal dialysis, kidney transplant, acute kidney injury, gastrointestinal bleeding, active malignancy, pregnancy, and surgery were excluded. The cohort was split into severe anemia (hemoglobin </=9 g/dL) versus a comparison group (hemoglobin >9 g /dL), and examined for differences in 30-day hospital readmission and LOS.In this study, the data of 1141 patients were included, out of which 156 (13.7%) had severe anemia (mean hemoglobin 8.1 g/dL, SD 0.8). Severe anemia was associated with increased hospital LOS (mean 6.4 (SD 6.0) days vs mean 4.5 (SD 4.0) days, P < 0.001). The difference was 1.7 day longer (95% CI 0.94, 2.45). There was no difference in readmission rate (mean 11.5% vs 10.2%, P = 0.7).Patients with moderate CKD and severe anemia are at risk for increased hospital LOS. Interventions targeting this high-risk population, including outpatient management of anemia, may benefit patient care and save costs through improved hospital outcomes.

Garofalo, C., Liberti, M. E., Sagliocca, A., et al. (2012). "[Epidemiology and prognosis of chronic kidney disease in Italy]." G Ital Nefrol **29 Suppl 58**: S3-11.

Because chronic kidney disease (CKD) is a major public health issue, it is important to make the available epidemiological data widely known for a proper understanding of its social impact, and to identify risk factors that can influence the prognosis of the disease. The data from the CARHES study show in the general population of Italy a prevalence of CKD (stage 1-5) of 8%, less than in other countries, a higher prevalence of proteinuria at early stages (1-2), and a cardiovascular risk profile in CKD patients characterized by metabolic syndrome. The prognosis of CKD is an essential element in clinical practice as it allows to better define the severity of the disease and to determine the most appropriate therapeutic approach. The data from the TABLE study, performed in nephrology care, show that ESRD was more frequent than death before dialysis but not in stage 3; we note that advanced age reduces the progression of renal failure and that the most important among the modifiable risk factors is proteinuria, which has a negative predictive role in stage 3-4 but not stage 5 and which interacts specifically with advanced age. No predictive role was found for hypertension, but this is only apparently surprising; in fact, there is growing evidence of the superior effectiveness of ambulatory blood pressure measurement (ABPM) over office blood pressure measurement. These data, together with the results of some trials, show the need for the more extensive use of ABPM to identify subjects with white-coat hypertension and to better control the circadian blood pressure profile by administering antihypertensive drugs also in the evening.

Gifford, F. J., Methven, S., Boag, D. E., et al. (2011). "Chronic kidney disease prevalence and secular trends in a UK population: the impact of MDRD and CKD-EPI formulae." Qjm **104**(12): 1045-1053.

INTRODUCTION: Most UK laboratories use the MDRD4 formula to estimate glomerular filtration rate (eGFR), but this may exaggerate chronic kidney disease (CKD) prevalence. In a large adult population, we examined the impact of the more accurate CKD-EPI formulae on prevalence estimates, and on secular trends in prevalence. METHODS: We extracted all serum creatinine (SCr) results for adults, processed in our laboratory during two 1-year periods (2004, 2009-10). To minimize the effect of acute illness, a patient's lowest SCr was used for each period. eGFR (traceable to isotope dilution mass spectrometry value) was calculated using the MDRD4 and CKD-EPI formulae. Prevalence estimates were compared, with sub-group analysis by age and sex. RESULTS: In 2004, 102 322 patients had SCr tested (35.4% of the adult population), rising to 123 121 (42.3%) in 2009-10. The proportion tested rose with age to 86% of 85- to 89-year olds. The prevalence of CKD stages 3-5 was lower with the CKD-EPI formulae than the MDRD4 formula. The CKD-EPI formulae reclassified 17 014 patients (5.8%) to milder stages of CKD, most commonly from eGFR 60-89 ml/min/1.73m(2) and CKD stage 3A, in women, and in those <70 years old. 5172 patients (1.8%), mostly elderly women, were reclassified to more severe stages of CKD. Between the two time periods, the prevalence of CKD stages 3-5 rose from 5.44% to 5.63% of the population using MDRD4, but was static at 4.94% with CKD-EPI. CONCLUSION: The CKD-EPI formulae, which are more accurate than the MDRD4 formula at higher GFR, reduced the estimated prevalence of CKD stages 3-5 by 0.5% in 2004 and 0.7% in 2009-10. The greatest reclassification was seen in CKD 3A, particularly amongst middle-aged females. The minor rise in CKD prevalence between 2004 and 2009-10 seen with the MDRD4 formula was not confirmed with the CKD-EPI formulae. The CKD-EPI formulae may reduce overdiagnosis of CKD, but further assessment in the elderly is required before widespread implementation.

Guerrero, A., Montes, R., Munoz-Terol, J., et al. (2006). "Peripheral arterial disease in patients with stages IV and V chronic renal failure." Nephrol Dial Transplant **21**(12): 3525-3531.

BACKGROUND: Cardiovascular disorders are frequently found among chronic renal failure (CRF) patients due to their higher susceptibility to develop atherosclerosis. However, peripheral arterial disease (PAD), that is associated with a high mortality rate, is not usually assessed in these patients. The aims of this study are to find out the prevalence of PAD affecting lower limbs in a population of CRF patients in stages IV/V, and to assess how much PAD determines the 5-year patient survival. METHODS: The study population (44 males and 29 females) was aged 58 +/- 15 years. They suffered from advanced CRF (18.6 +/- 6.1 ml/min creatinine clearance), but they were not on dialysis. These patients were sequentially referred initially to the predialysis unit over a period of 14 months. The vascular lesions were assessed by carotid and transcranial ultrasound, as well as by ankle-brachial index test (ABI). Routine 24 h blood and urine laboratory tests were performed for each patient. Cardiovascular morbidity and cardiovascular disease risk factors were evaluated through personal interview. RESULTS: Fourteen patients had an ABI index of less than 0.91 (PAD indicative), 11 of them also suffered from intermittent claudication. PAD affected significantly more males (P = 0.001) and diabetics (P = 0.001). Also, PAD prevalence was significantly higher in patients with a previous clinical record of coronary heart disease (P = 0.001), increased clinical record of cerebrovascular disease (P =

0.005), a thickness of the left ventricular posterior wall (P = 0.03) and lower cardiac ejection fraction (P = 0.02). PAD patients had a significantly different protein intake (P = 0.003), calcium-phosphorus product (P = 0.001), risk of coronary heart disease based on the Framingham score (P = 0.001) and 5-year survival rate (P = 0.004). There were no significant differences for PAD patients in terms of body mass index, creatinine clearance, lipid profile, Ca and P. Multivariate risk factor analysis revealed that a previous clinical record of coronary heart disease and diabetes increased the risk of developing PAD, as defined by ABI < 0.91. After 5 years, 21 patients (29%) had died: 64% of patients that suffered PAD (9/14) and 20% of the non-PAD population (12/59). The Cox proportional hazards model demonstrated that older age and a lower ABI increased the risk of death. CONCLUSIONS: The present study, conducted on CRF patients in stages IV and V not undergoing dialysis, showed; (a) that a high percentage of these patients developed PAD (19%) or other vascular pathologies; (b) that there was an associated high mortality rate (29%) after 5 years; (c) that the 5-year mortality rate was significantly higher (P = 0.004) in PAD patients (64 vs 20%).

Hallan, S. I., Coresh, J., Astor, B. C., et al. (2006). "International comparison of the relationship of chronic kidney disease prevalence and ESRD risk." J Am Soc Nephrol **17**(8): 2275-2284.

ESRD incidence is much lower in Europe compared with the United States. This study investigated whether this reflects a difference in the prevalence of earlier stages of chronic kidney disease (CKD) or other mechanisms. CKD prevalence in Norway was estimated from the population-based Health Survey of Nord-Trondelag County (HUNT II), which included 65,181 adults in 1995 through 1997 (participation rate 70.4%). Data were analyzed using the same methods as two US National Health and Nutrition Examination Surveys in 1988 through 1994 (n = 15,488) and 1999 through 2000 (n = 4101). The primary analysis used gender-specific cutoffs in estimating persistent albuminuria for CKD stages 1 and 2. ESRD rates and other relevant data were extracted from national registries. Total CKD prevalence in Norway was 10.2% (SE 0.5): CKD stage 1 (GFR >90 ml/min per 1.73 m2 and albuminuria), 2.7% (SE 0.3); stage 2 (GFR 60 to 89 ml/min per 1.73 m2 and albuminuria), 3.2% (SE 0.4); stage 3 (GFR 30 to 59 ml/min per 1.73 m2), 4.2% (SE 0.1); and stage 4 (GFR 15 to 29 ml/min per 1.73 m2), 0.2% (SE 0.01). This closely approximates reported US CKD prevalence (11.0% in 1988 through 1994 and 11.7% in 1999 through 2000). The relative risk for progression from CKD stages 3 or 4 to ESRD in US white patients compared with Norwegian patients was 2.5. This was only modestly modified by adjustment for age, gender, and diabetes. Age and GFR at start of dialysis were similar, hypertension and cardiovascular mortality in the populations were comparable, but US white patients were referred later to a nephrologist and had higher prevalence of obesity and diabetes. In conclusion, CKD prevalence in Norway was similar to that in the United States, suggesting that lower progression to ESRD rather than a smaller pool of individuals at risk accounts for the lower incidence of ESRD in Norway.

Hallan, S. I. et Vikse, B. E. (2008). "Relationship between chronic kidney disease prevalence and end-stage renal disease risk." Curr Opin Nephrol Hypertens **17**(3): 286-291.

PURPOSE OF REVIEW: Incidence of end-stage renal disease has increased dramatically during the last 30 years and screening for early stages of chronic kidney disease is often suggested as a preventive measure. The relationship between chronic kidney disease and end-stage renal disease is complex, however, and recent studies have given some insights into this relationship. The review will summarize these studies and briefly discuss the clinical implications. RECENT FINDINGS: While the prevalence of chronic kidney disease is high in most Western countries, the incidence of end-stage renal disease differs substantially. The general increase in the incidence of end-stage renal disease seen in recent years may be partially explained by a lower cardiovascular mortality, allowing more patients with chronic kidney disease to develop end-stage renal disease, and widening of entrance criteria for renal replacement therapy. Data do not, however, support these factors as explanatory for the existing international differences. These differences are better explained by different prevalences of diabetes and obesity as well as by differences in rate of progression from early chronic kidney disease stages to end-stage renal disease. Rate of progression seems to be affected by race, socioeconomic status and predialytic care. SUMMARY: Several mechanisms influence the relationship between chronic kidney disease and risk of end-stage renal disease. Decreased cardiovascular mortality and improved treatment availability may explain parts of the increase in the incidence of

> end-stage renal disease, and there are also large international differences in rates of progression from chronic kidney disease to end-stage renal disease that may be amendable by public health and predialytic care interventions.

Hebert, K., Dias, A., Delgado, M. C., et al. (2010). "Epidemiology and survival of the five stages of chronic kidney disease in a systolic heart failure population." Eur J Heart Fail **12**(8): 861-865.

> AIMS: The epidemiology of the five stages of chronic kidney disease (CKD) in systolic heart failure (HF) patients has predominantly been described in hospitalized White patients, with little known about the prevalence in outpatient Blacks and Hispanics. The purpose of this study was to compare the prevalence of the five stages of CKD by race, ethnicity (Whites, Blacks, and Hispanics), and gender in an outpatient systolic HF population and also to evaluate the impact of CKD on mortality. METHODS AND RESULTS: We conducted a prospective study of 1301 patients recruited from two hospital facilities in Louisiana and Florida, USA. All patients were enrolled in a systolic HF disease management programme (HFDMP), which enrolled patients with an ejection fraction of < or =40% by echocardiography. The estimated glomerular filtration rate was calculated using the abbreviated Modification of Diet in Renal Disease Study equation. Patients were classified into five stages of CKD according to the National Kidney Foundation classification system. A total of 338 patients (26%) were found to have CKD. Patients with CKD were older, more likely to be Hispanics, to have less education, New York Heart Association class III, elevated systolic blood pressure, and diabetes. There was no statistical difference in prevalence by gender. Survival was reduced in patients with CKD. CONCLUSION: The prevalence of CKD in an outpatient systolic HFDMP is high, with over one in four patients affected. CKD patients had significantly lower survival rates compared with patients without CKD.

Imai, E., Horio, M., Watanabe, T., et al. (2009). "Prevalence of chronic kidney disease in the Japanese general population." Clin Exp Nephrol **13**(6): 621-630.

> BACKGROUND: We previously estimated the prevalence of chronic kidney disease (CKD) stages 3-5 at 19.1 million based on data from the Japanese annual health check program for 2000-2004 using the Modification of Diet in Renal Disease (MDRD) equation multiplied by the coefficient 0.881 for the Japanese population. However, this equation underestimates the GFR, particularly for glomerular filtration rates (GFRs) of over 60 ml/min/1.73 m(2). We did not classify the participants as CKD stages 1 and 2 because we did not obtain proteinuria data for all of the participants. We re-estimated the prevalence of CKD by measuring proteinuria using a dipstick test and by calculating the GFR using a new equation that estimates GFR based on data from the Japanese annual health check program in 2005. METHODS: Data were obtained for 574,024 (male 240,594, female 333,430) participants over 20 years old taken from the general adult population, who were from 11 different prefectures in Japan (Hokkaido, Yamagata, Fukushima, Tochigi, Ibaraki, Tokyo, Kanazawa, Osaka, Fukuoka, Miyazaki and Okinawa) and took part in the annual health check program in 2005. The glomerular filtration rate (GFR) of each participant was computed from the serum creatinine value using a new equation: GFR (ml/min/1.73 m(2)) = 194 x Age(-0.287) x S-Cr(-1.094) (if female x 0.739). The CKD population nationwide was calculated using census data from 2005. We also recalculated the prevalence of CKD in Japan assuming that the age composition of the population was same as that in the USA. RESULTS: The prevalence of CKD stages 1, 2, 3, and 4 + 5 were 0.6, 1.7, 10.4 and 0.2% in the study population, which resulted in predictions of 0.6, 1.7, 10.7 and 0.2 million patients, respectively, nationwide. The prevalence of low GFR was significantly higher in the hypertensive and proteinuric populations than it was in the populations without proteinuria or hypertension. The prevalence rate of CKD in Japan was similar to that in the USA when the Japanese general population was age adjusted to the US 2005 population estimate. CONCLUSION: About 13% of the Japanese adult population-approximately 13.3 million people-were predicted to have CKD in 2005.

Ito, H., Oshikiri, K., Mifune, M., et al. (2012). "The usefulness of the revised classification for chronic kidney disease by the KDIGO for determining the frequency of diabetic micro- and macroangiopathies in Japanese patients with type 2 diabetes mellitus." J Diabetes Complications **26**(4): 286-290.

AIMS: A new classification of chronic kidney disease (CKD) was proposed by the Kidney Disease: Improving Global Outcomes (KDIGO) in 2011. The major point of revision of this classification was the introduction of a two-dimensional staging of the CKD according to the level of albuminuria in addition to the GFR level. Furthermore, the previous CKD stage 3 was subdivided into two stages (G3a and G3b). We examined the prevalence of diabetic micro- and macroangiopathies in patients with type 2 diabetes mellitus based on the new classification. METHODS: A cross-sectional study was performed in 2018 patients with type 2 diabetes mellitus. RESULTS: All of the diabetic micro- and macroangiopathies significantly more common in the later stages of both the GFR and albuminuria. The proportion of subjects with diabetic retinopathy, neuropathy, cerebrovascular disease and coronary heart disease was significantly higher in the G3b group than in the G3a group. The brachial-ankle pulse wave velocity, which is one of the surrogate markers for atherosclerosis, was also significantly greater in the G3b group compared to the G3a group. CONCLUSION: The subdivision of the G3 stage in the revised classification proposed by the KDIGO is useful to evaluate the risk for diabetic vascular complications.

Jain, P., Calvert, M., Cockwell, P., et al. (2014). "The need for improved identification and accurate classification of stages 3-5 Chronic Kidney Disease in primary care: retrospective cohort study." PLoS One **9**(8): e100831.

BACKGROUND: Around ten percent of the population have been reported as having Chronic Kidney Disease (CKD), which is associated with increased cardiovascular mortality. Few previous studies have ascertained the chronicity of CKD. In the UK, a payment for performance (P4P) initiative incentivizes CKD (stages 3-5) recognition and management in primary care, but the impact of this has not been assessed. METHODS AND FINDINGS: Using data from 426 primary care practices (population 2,707,130), the age standardised prevalence of stages 3-5 CKD was identified using two consecutive estimated Glomerular Filtration Rates (eGFRs) seven days apart. Additionally the accuracy of practice CKD registers and the relationship between accurate identification of CKD and the achievement of P4P indicators was determined. Between 2005 and 2009, the prevalence of stages 3-5 CKD increased from 0.3% to 3.9%. In 2009, 30,440 patients (1.1% unadjusted) fulfilled biochemical criteria for CKD but were not on a practice CKD register (uncoded CKD) and 60,705 patients (2.2% unadjusted) were included on a practice CKD register but did not fulfil biochemical criteria (miscoded CKD). For patients with confirmed CKD, inclusion in a practice register was associated with increasing age, male sex, diabetes, hypertension, cardiovascular disease and increasing CKD stage (p<0.0001). Uncoded CKD patients compared to miscoded patients were less likely to achieve performance indicators for blood pressure (OR 0.84, 95% CI 0.82-0.86 p<0.001) or recorded albumin-creatinine ratio (OR 0.73, 0.70-0.76, p<0.001). CONCLUSIONS: The prevalence of stages 3-5 CKD, using two laboratory reported eGFRs, was lower than estimates from previous studies. Clinically significant discrepancies were identified between biochemically defined CKD and appearance on practice registers, with misclassification associated with sub-optimal care for some people with CKD.

Kainz, A., Hronsky, M., Stel, V. S., et al. (2015). "Prediction of prevalence of chronic kidney disease in diabetic patients in countries of the European Union up to 2025." Nephrol Dial Transplant **30 Suppl 4**: iv113-118.

BACKGROUND: Diabetes and chronic kidney disease (CKD) are a growing burden for health-care systems. The prevalence of diabetes has increased constantly during the last decade, although a slight flattening of end-stage renal disease as a result of diabetes has been observed recently in some European countries. In this study, we project the prevalence of CKD in patients with diabetes in European countries up to the year 2025. METHODS: We analysed the population with diabetes and development of nephropathy in 12 European countries, which we computed from models published previously and on data from the annual reports of the European Renal Association (1998-2011). The prevalence of CKD stage 5 in patients with diabetes up to the year 2025 was projected by the Lee-Carter algorithm. Those for stage 3 and 4 were then estimated by applying the same ratios of CKD prevalences as estimated in the Austrian population with diabetic nephropathy. RESULTS: The estimated prevalence of CKD in patients with diabetes is expected to increase in all 12 countries up to the year 2025. For CKD stage 3, we estimate for Austria in 2025 a prevalence of 215 000 per million diabetic population (p.m.p.) (95% confidence interval 169 000, 275 000), for CKD4 18 600 p.m.p. (14 500, 23 700) and for CKD5 6900 p.m.p. (5400, 8900). The median prevalence in the considered countries is 132 900 p.m.p. (IQR: 118 500, 195 800), 11 500 (10 200, 16 900) and 4300 (3800, 6300) for

CKD stages 3, 4 and 5, respectively. Altogether, these data predict in the years 2012-25 an annual increase of 3.2% in the prevalence of diabetic CKD stage 5. CONCLUSIONS: Due to the increase in prevalence of diabetes and CKD5, the costs of renal therapy are expected to rise. We believe that these data may help health-care policy makers to make informed decisions.

Kim, J. J., Booth, C. J., Waller, S., et al. (2013). "The demographic characteristics of children with chronic kidney disease stages 3-5 in South East England over a 5-year period." Arch Dis Child **98**(3): 189-194.

OBJECTIVE: To analyse the demographics of children with moderate to severe chronic kidney disease (CKD) stages 3-5 over a 5-year period for the population of South East England. METHODS: Retrospective study of all children <18 years of age with estimated glomerular filtration rate (eGFR) <60 ml/min/1.73 m(2) managed at Evelina Children's Hospital, London from 2005 to 2009. eGFR was estimated using the Schwartz formula, and stages of CKD were defined using Kidney Disease Outcome Quality Initiative criteria. We excluded all patients with a functioning kidney transplant. RESULTS: There were 293 children (58% male) with a median (IQR) age of 6.7 (2.3, 12.1) years; 288 were aged <16 years and five 16-18 years at first presentation. The mean incidence and prevalence of children <16 years with CKD stage 3-5 during the 5-year study period was 17.5 and 90.0 per million age-related population (pmarp), respectively. There was a marked increase in incidence and prevalence over the 5 years (incidence 8.4 to 25.2 pmarp; prevalence 79.5 to 104.7 pmarp). There was an initial peak in children presenting under 2 years of age (48/141, 34%) due to congenital renal disease, and a second peak in the 12-15.9-year age group (32/141, 23%) due to glomerulonephritides. Forty-five children (15%) were transplanted, and 22 (8%) transitioned to adult care. There were seven deaths giving a death rate of 0.84 per 100 patient-years. CONCLUSIONS: We observed a steady increase in the incidence and prevalence of children with CKD stage 3-5. As a result of improved management, the majority of children with CKD will proceed to kidney transplantation, transition to adult nephrology services, and continue to require lifelong medical care.

Li Vecchi, M., Fuiano, G., Francesco, M., et al. (2007). "Prevalence and severity of anaemia in patients with type 2 diabetic nephropathy and different degrees of chronic renal insufficiency." Nephron Clin Pract **105**(2): c62-67.

BACKGROUND/AIM: Type 2 diabetes mellitus is the single most common cause of chronic kidney disease (CKD); however its real impact on renal anaemia has not been established. The aim of this study was to evaluate whether onset, severity, and prevalence of anaemia during the course of CKD is different between type 2 diabetic and non-diabetic patients. METHODS: We enrolled 281 patients with: (1) type 2 diabetes and no CKD (n = 75); (2) type 2 diabetes plus CKD (n = 106), and (3) CKD without type 2 diabetes (n = 100). According to K/DOQI guidelines, the patients with renal insufficiency (i.e., those with a glomerular filtration rate <60 ml/min) were subgrouped into three tertiles of CKD: (1) stage 3 (creatinine clearance 60-30 ml/min); (2) stage 4 (creatinine clearance 29-15 ml/min), and (3) stage 5 (creatinine clearance <15 ml/min). RESULTS: Anaemia was observed in 16% of the diabetic patients without CKD; it was more frequent in the diabetic patients with CKD than in the non-diabetic patients with CKD (61.7 vs. 52%, $p < 0.05$). The comparison among the tertiles showed that the prevalence of anaemia was significantly higher only in diabetic CKD patients of stages 4 and 5. The prevalence was higher in females independently of type 2 diabetes mellitus. In diabetics with a normal renal function, the haemoglobin levels were higher than in diabetics and non-diabetics with CKD, but the diabetics showed lower levels of haemoglobin than non-diabetics at stage 3 and stage 4 of CKD. CONCLUSIONS: Diabetic patients with CKD of stages 4 and 5 have a higher prevalence of anaemia than non-diabetic patients with comparable glomerular filtration rate. A higher awareness of this risk will allow earlier diagnosis and treatment.

Lin, C. M., Yang, M. C., Hwang, S. J., et al. (2013). "Progression of stages 3b-5 chronic kidney disease--preliminary results of Taiwan national pre-ESRD disease management program in Southern Taiwan." J Formos Med Assoc **112**(12): 773-782.

BACKGROUND/PURPOSE: The outcomes and their predictors, and rates of estimated glomerular filtration rate (eGFR) changes among Taiwanese, an ethnic Chinese population, with chronic kidney disease (CKD) stages 3b-5, enrolled in a nationwide pre-end-stage renal disease (pre-ESRD) management program that have not been previously reported. METHODS: This study focused on a cohort of patients enrolled in the Taiwan's pre-ESRD disease management program from Southern Taiwan, including 4061 CKD 3b-5 patients who received more than 12 weeks of follow-up from 2007 to 2010. The decline rates of eGFR, outcomes, and the predictors of initiating dialysis were analyzed. RESULTS: The study participants consisted of patients who were 70.1 +/- 12.3 years old, of whom 56.4% were male, 46.3% were diabetic, and 72.1% were hypertensive. The mean annual eGFR changes were 0.47 +/- 0.42 mL/min/1.73 m(2)/year, -1.27 +/- 0.32 mL/min/1.73 m(2)/year, and -2.69 +/- 0.39 mL/min/1.73 m(2)/year for stages 3b, 4, and 5, respectively; however, more rapid declines were noted in diabetic patients. The Kaplan-Meier analyses revealed that the probabilities of patients remaining alive and free of dialysis treatment for CKD stage 3b, 4, and 5 without or with diabetes were 89.46% versus 84.65%, 79.88% versus 55.68%, and 34.42% versus 9.64%, respectively, during 42 months of follow-up. Male gender, diabetes, lower baseline eGFR, higher systolic blood pressure, lower hematocrit, and albumin levels were the significant risk factors for initiating dialysis. CONCLUSION: Even though we cannot conclude with certainty that the Taiwan pre-ESRD disease management program is beneficial in slowing the progression of CKD stages 3b-5, our preliminary results seem to suggest this trend. Furthermore, the program may be improved by integrating it with other programs, such as those on diabetes and hypertension, thus making it a more patient-centered, multidisciplinary program.

McFarlane, S. I., McCullough, P. A., Sowers, J. R., et al. (2011). "Comparison of the CKD Epidemiology Collaboration (CKD-EPI) and Modification of Diet in Renal Disease (MDRD) study equations: prevalence of and risk factors for diabetes mellitus in CKD in the Kidney Early Evaluation Program (KEEP)." Am J Kidney Dis **57**(3 Suppl 2): S24-31.

BACKGROUND: Diabetes is a leading cause of chronic kidney disease (CKD). Whether reclassification of CKD stages based on glomerular filtration rate estimated using the CKD Epidemiology Collaboration (CKD-EPI) equation versus the Modification of Diet in Renal Disease (MDRD) Study equation modifies estimates of prevalent risk factors across stages is unknown. METHODS: This is a cross-sectional analysis of data from the Kidney Early Evaluation Program (KEEP), a community-based health screening program targeting individuals 18 years and older with diabetes, hypertension, or a family history of diabetes, hypertension, or kidney disease. Of 109,055 participants, 68.2% were women and 31.8% were African American. Mean age was 55.3 +/- 0.05 years. Clinical, demographic, and laboratory data were collected from August 2000 through December 2009. Glomerular filtration rate was estimated using the CKD-EPI and MDRD Study equations. RESULTS: CKD was present in 25.6% and 23.5% of the study population using the MDRD Study and CKD-EPI equations, respectively. Diabetes was present in 42.4% and 43.8% of participants with CKD, respectively. Prevalent risk factors for diabetes included obesity (body mass index >30 kg/m(2)), 44.0%; hypertension, 80.5%; cardiovascular disease, 23.2%; family history of diabetes, 55.9%; and dyslipidemia, 43.0%. In a logistic regression model after adjusting for age and other risk factors, odds for diabetes increased significantly compared with no CKD with each CKD stage based on the CKD-EPI equation and similarly with stages based on the MDRD Study equation. Using a CKD-EPI-adjusted model, ORs were: stage 1, 2.08 (95% CI, 1.90-2.27); stage 2, 1.86 (95% CI, 1.72-2.02); stage 3, 1.23 (95% CI, 1.17-1.30); stage 4, 1.69 (95% CI, 1.42-2.03); and stage 5, 2.46 (95% CI, 1.46-4.14). CONCLUSIONS: Using the CKD-EPI equation led to a lower prevalence of CKD but to similar diabetes prevalence rates associated with CKD across all stages compared with the MDRD Study equation. Diabetes and other CKD risk factor prevalence was increased compared with the non-CKD population.

Najafi, I., Shakeri, R., Islami, F., et al. (2012). "Prevalence of chronic kidney disease and its associated risk factors: the first report from Iran using both microalbuminuria and urine sediment." Arch Iran Med **15**(2): 70-75.

BACKGROUND: The incidence of major risk factors of chronic kidney disease (CKD) in the world is on the rise, and it is expected that this incidence and prevalence, particularly in developing countries, will continue to increase. Using data on urinary sediment and microalbuminuria, we aimed to estimate the prevalence of CKD in northeast Iran. METHODS: In a cross-sectional study, the prevalence of CKD in a sample of 1557 regionally representative people, aged >/= 18 years, was analyzed. CKD was determined based on glomerular filtration rate (GFR) and microalbuminuria. Life style data, urine and blood samples were collected. Urine samples without any proteinuria in the initial dipstick test were checked for qualitative microalbuminuria. If the latter was positive, quantitative microalbuminuria was evaluated. RESULTS: 1557 subjects with a mean age of 56.76 +/- 12.04 years were enrolled in this study. Based on the modification of diet in renal disease (MDRD) equation, 137 subjects (8.89%) were categorized as CKD stages III-V. Based on urine abnormalities, the prevalence of combined CKD stages I and II was 10.63%, and based on macro- and microalbuminuria it was 14.53%. The prevalence of CKD was significantly associated with sex, age, marital status, education, diabetes mellitus (DM), hypertension (HTN), ischemic heart disease (IHD), waist to hip ratio, myocardial infarction (MI), and cerebrovascular accident (CVA). CONCLUSION: CKD and its main risk factors are common and represent a definite health threat in this region of Iran. Using and standardizing less expensive screening tests in low resource countries could be a good alternative that may improve the outcome through early detection of CKD.

Nolan, M. S., Podoll, A. S., Hause, A. M., et al. (2012). "Prevalence of chronic kidney disease and progression of disease over time among patients enrolled in the Houston West Nile virus cohort." PLoS One **7**(7): e40374.

INTRODUCTION: In experimental models of West Nile virus (WNV) infection, animals develop chronic kidney infection with histopathological changes in the kidney up to 8-months post-infection. However, the long term pathologic effects of acute infection in humans are largely unknown. The purpose of this study was to assess renal outcomes following WNV infection, specifically the development of chronic kidney disease (CKD). METHODS: In a cohort of 139 study participants with a previous diagnosis of WNV infection, we investigated the prevalence of CKD using the Kidney Disease Outcomes Quality Initiative (KDOQI) criteria based on the Modification of Diet in Renal Disease (MDRD) formula and urinary abnormalities, and assessed various risk factors and biomarkers. RESULTS: Study participants were primarily male (60%) and non-Hispanic white (86%) with a mean age of 57 years. Most (83%) were four to nine years post-infection at the time of this study. Based on the KDOQI definition, 40% of participants had evidence of CKD, with 10% having Stage III or greater and 30% having Stage I-II. By urinary dipstick testing, 26% of patients had proteinuria and 23% had hematuria. Plasma NGAL levels were elevated in 14% of participants while MCP-1 levels were increased in 12%. Over 1.5 years, the average change in eGFR was -3.71 mL/min/1.73 m(2). Only a history of Neuroinvasive WNV disease was independently associated with CKD following multivariate analysis. DISCUSSION: We found a high prevalence of CKD after long term follow-up in a cohort of participants previously infected with WNV. The majority of those with CKD are in Stage I-II indicating early stages of renal disease. Traditional risk factors were not associated with the presence of CKD in this population. Therefore, clinicians should regularly evaluate all patients with a history of WNV for evidence of CKD.

Otero, A., de Francisco, A., Gayoso, P., et al. (2010). "Prevalence of chronic renal disease in Spain: results of the EPIRCE study." Nefrologia **30**(1): 78-86.

INTRODUCTION: Chronic kidney disease (CKD) is an independent cardiovascular risk factor. The knowledge of prevalence in general population may help to early detection of CKD and prevent or delay its progression. METHODS: Sociodemographic, baseline characteristics, and CKD prevalence (measured by centralized serum creatinine and MDRD equation) were evaluated in a randomly selected sample of general population aged 20 years or older, collected in all Spanish regions and stratified by habitat, age and sex according to 2001 census (n=2746). Univariate and multivariate logistic regression analyses were used to evaluate associations with CKD risk factors. RESULTS: Mean age was 49.5 years. The overall prevalence of Kidney Disease Outcomes Quality Initiative grades 3-5 CKD was 6.8%, with a 95% confidence interval (CI) of 5.4 to 8.2 (3.3% for age 40-64 years and 21.4% for age > 64 years). The prevalence estimates of CKD stages were: 0.99% for stage 1 (glomerular filtration rate [GFR] >or=90 ml/min per 1.73 m2 with proteinuria); 1.3% for stage 2 (GFR 60-89); 5.4% for stage 3a (GFR 45-59); 1.1% for stage 3b (GFR 30-44); 0.27% for stage 4 (GFR 15-29); and 0.03% for stage 5 (GFR < 15). An important prevalence of classical cardiovascular risk factors was observed: dyslipemia (29.3%), obesity (26.1%), hypertension (24.1%), diabetes (9.2%) and current smoking (25.5%). The independent predictor factors for CKD were age, obesity and previously diagnosed hypertension. CONCLUSION: The prevalence of CKD at any stage in general population from Spain is relatively high, especially in the elderly, and similar to countries of the same geographical area. Independently of age, two modifiable risks factors, hypertension and obesity, are associated with an increased prevalence of CKD.

Ponte, B., Pruijm, M., Marques-Vidal, P., et al. (2013). "Determinants and burden of chronic kidney disease in the population-based CoLaus study: a cross-sectional analysis." Nephrol Dial Transplant **28**(9): 2329-2339.

> BACKGROUND: Chronic kidney disease (CKD) represents an increasing health burden. We present the population-based prevalence of CKD and compare the CKD Epidemiology collaboration (CKD-EPI) and modification of diet in renal disease (MDRD) equations to estimate the glomerular filtration rate, using the revised CKD classification with three albuminuria classes. We also explore factors associated with CKD. METHODS: The Swiss population-based, cross-sectional CoLaus study conducted in Lausanne (2003-2006) included 2810 men and 3111 women aged 35-75. CKD prevalence was assessed using CKD-EPI and MDRD equations and albuminuria estimated by the albumin-to-creatinine ratio in spot morning urine. Multivariate logistic regression was used to analyse determinants of CKD. RESULTS: Prevalence [95% confidence interval (CI)] of all stages CKD was 10.0% (9.2-10.8%) with CKD-EPI and 13.8% (12.9-14.6%) with MDRD. Using the revised CKD classification, the prevalence of low-, medium-, high- and very high-risk groups was 90.0, 8.46, 1.18 and 0.35% with CKD-EPI, respectively. With MDRD, the corresponding values were 86.24, 11.86, 1.55 and 0.35%. Using the revised classification, CKD-EPI systematically reclassified people in a lower risk category than MDRD. Age and obesity were more strongly associated with CKD in men [odds ratio (95% CI): 2.23(1.95; 2.56) per 10 years and 3.05(2.08;4.47), respectively] than in women [1.46 (1.29; 1.65) and 1.78 (1.30;2.44), respectively]. Hypertension, type 2 diabetes, serum homocysteine and uric acid were positively independently associated with CKD in men and women. CONCLUSIONS: One in 10 adults suffers from CKD in the population of Lausanne. CKD-EPI systematically reclassifies people in a lower CKD risk category than MDRD. Serum homocysteine and uric acid levels are associated with CKD independently of classical risk factors such as age, hypertension and diabetes.

Rayner, H. C., Baharani, J., Dasgupta, I., et al. (2014). "Does community-wide chronic kidney disease management improve patient outcomes?" Nephrol Dial Transplant **29**(3): 644-649.

> BACKGROUND: The number of patients starting renal replacement therapy (RRT) is increasing in England, as it is worldwide. Improvements in the management of chronic kidney disease (CKD) across communities to alter this trend are a public health priority. We have prospectively studied changes in the incidence and modality of treatment for end-stage renal disease following the introduction of a CKD management programme in the West Midlands region of England. METHODS: Nephrology service to approximately 700 000 adult population of mixed ethnicity in urban and suburban areas, many with social deprivation. The programme was introduced in stages between 2003 and 2006 and comprised primary care education and financial incentives, personal clinical reports written directly to patients following every consultation, routine laboratory estimated glomerular filtration rate (eGFR) reporting, eGFR graph surveillance to identify and monitor patients at risk, multidisciplinary pre-RRT care and conservative care. Prevalent patients: 10 552 with CKD and 8509 without CKD with diabetes. OUTCOMES: access to nephrology care, trends in RRT incidence and starting modality, place of death without RRT. Incident count was adjusted for changes in the local adult population recorded in national censuses. RESULTS: Ninety-one per cent of patients aged >/=75 years with incident CKD stage 5 were known to a nephrologist. The population-adjusted incident RRT rate peaked in 2005 and then declined; the proportion starting with transplant, peritoneal dialysis or haemodialysis by arterio-venous fistula increased to 63% by 2012 (P = 0.001 versus 2005). Fifty-two per cent of patients receiving planned conservative care without dialysis died out of hospital. CONCLUSIONS: Following the introduction of a community-wide systematic CKD management programme, the population-adjusted incidence of RRT reduced, modality of initiation of RRT improved and a majority of patients receiving planned conservative care without dialysis died out of hospital.

Rodriguez-Poncelas, A., Garre-Olmo, J., Franch-Nadal, J., et al. (2013). "Prevalence of chronic kidney disease in patients with type 2 diabetes in Spain: PERCEDIME2 study." BMC Nephrol **14**: 46.

> BACKGROUND: The objective of this study was to determinate the prevalence of chronic kidney disease (CKD) and the different stages of CKD in patients with type 2 diabetes mellitus (DM2) treated in primary care consults in Spain. METHODS: A national cross-sectional study was performed in primary care consults. The following data were collected: demographic and anthropometric

information; list of present cardiovascular risk factors (CVRF); previous macrovascular and microvascular disease history; physical examination and analytical data from the previous 12 months, including the urine albumin-creatinine ratio (UACR) and estimated glomerular filtration rate (eGFR) to evaluate renal function. RESULTS: With regard to the patients, 27.9% presented some degree of CKD as follows: 3.5% with stage 1; 6.4% with stage 2; 16.8% with stage 3 (11.6% with stage 3A and 5.2% with stage 3B); and 1.2% with stages 4 and 5. The prevalence of patients with UACR >/= 30 mg/g was 15.4% (13% microalbuminuria and 2.4% macroalbuminuria). Renal impairment (RI) was found in 206 patients (18%) of whom 133 patients (64.6%) was stage 3A, 60 patients (29.1%) was stage 3B and 13 patients (6.3%) stages 4 and 5. Among patients with RI, 143 patients (69.4%) had normoalbuminuria. The following variables were significantly associated with CKD: age; sex (women); systolic arterial blood pressure (SABP) >/= 150 mmHg; and a previous history of cardiovascular disease. CONCLUSIONS: The results showed that the prevalence for any type of CKD was 27.9%. A systematic determination of UACR and eGFR may contribute to an early diagnosis, thus allowing intervention during the initial stages of the disease when treatment is more efficient.

Rothenbacher, D., Klenk, J., Denkinger, M., et al. (2012). "Prevalence and determinants of chronic kidney disease in community-dwelling elderly by various estimating equations." BMC Public Health **12**: 343.

BACKGROUND: Chronic kidney disease (CKD) represents a global public health problem. Few data exist in the elderly. The objective of the current study is to estimate the prevalence of CKD by means of various established and new equations and to identify the main determinants of CKD in elderly. METHODS: The ActiFE Ulm (Activity and Function in the Elderly in Ulm) study is a population-based cohort study in people of 65 years and older. Kidney function was assessed by means of estimated glomerular filtration rate (eGFR) based on two creatinine- (Cr-; MDRD, CKD-EPI) and one cystatin C - (CysC-) based method. The relationship between various potential risk factors and CKD was quantified using unconditional logistic regression. RESULTS: A total of 1471 subjects were in the final analysis (mean age 75.6 years, SD 6.56). Overall, prevalence of CKD (eGFR < 60 mL/min/1.73 m(2)) was 34.3% by MDRD, 33.0% by CKD-EPI, and 14.6% by the CysC-based eGFR. All eGFRs showed statistically significant correlations with C-reactive protein, uric acid, as well as with lipid values. In multivariable analysis age was clearly related to prevalence of CKD and the risks were highest with the CysC-based equation. Females had a higher risk for CKD stages 3-5 with MDRD (OR 1.63; 95% CI: 1.23-2.16) whereas the OR was 1.23 (95% CI 0.92-1.65) with the CKD-Epi and OR = 0.89 (95% CI 0.58-1.34) with the CysC-based equation after multivariable adjustment. Although the cystatin C based definition of CKD resulted in a lower prevalence compared to the creatinine based ones, other measures of renal damage such as albuminuria were more prevalent in those defined by CysC-eGFR. CONCLUSIONS: Prevalence of CKD is very variable based on the used estimating equation. More work is needed to evaluate the various estimating equations especially in elderly before we are able to assess the practical consequences of the observed differences.

Shahinian, V. B., Hedgeman, E., Gillespie, B. W., et al. (2013). "Estimating prevalence of CKD stages 3-5 using health system data." Am J Kidney Dis **61**(6): 930-938.

BACKGROUND: The feasibility of using health system data to estimate prevalence of chronic kidney disease (CKD) stages 3-5 was explored. STUDY DESIGN: Cohort study. SETTING & PARTICIPANTS: A 5% national random sample of patients from the Veterans Affairs (VA) health care system, enrollees in a managed care plan in Michigan (M-CARE), and participants from the 2005-2006 National Health and Nutrition Examination Survey (NHANES). PREDICTOR: Observed CKD prevalence estimates in the health system population were calculated as patients with an available outpatient serum creatinine measurement with estimated glomerular filtration rate <60 mL/min/1.73 m(2), among those with at least one outpatient visit during the year. OUTCOMES & MEASUREMENTS: A logistic regression model was fitted using data from the 2005-2006 NHANES to predict CKD prevalence in those untested for serum creatinine in the health system population, adjusted for demographics and comorbid conditions. Model results then were combined with the observed prevalence in tested patients to derive an overall predicted prevalence of CKD within the health systems. RESULTS: Patients in the VA system were older, had more comorbid conditions, and were more likely to be tested for serum creatinine than those in the M-CARE system. Observed prevalences of CKD stages 3-5 were 15.6% and 0.9% in the VA and M-CARE systems, respectively. Using data from NHANES, the overall predicted prevalences of CKD were 20.4% and 1.6% in the VA and M-CARE systems, respectively. LIMITATIONS: Health system data quality was limited by missing data for laboratory results and race. A single estimated glomerular filtration rate value was used to define CKD, rather than persistence over 3 months. CONCLUSIONS: Estimation of CKD prevalence within health care systems is feasible, but discrepancies between observed and predicted prevalences suggest that this approach is dependent on data availability and quality of information for comorbid conditions, as well as the frequency of testing for CKD in the health care system.

Soliman, E. Z., Prineas, R. J., Go, A. S., et al. (2010). "Chronic kidney disease and prevalent atrial fibrillation: the Chronic Renal Insufficiency Cohort (CRIC)." Am Heart J **159**(6): 1102-1107.

BACKGROUND: The epidemiology of atrial fibrillation (AF) has been mainly investigated in patients with end-stage renal disease, with limited data on less advanced chronic kidney disease (CKD) stages. METHODS: A total of 3,267 adult participants (50% non-Hispanic blacks, 46% women) with CKD from the Chronic Renal Insufficiency Cohort were included in this study. None of the study participants had been on dialysis. Those with self-identified race/ethnicity other than non-Hispanic black or white (n = 323) or those without electrocardiographic data (n = 22) were excluded. Atrial fibrillation was ascertained by a 12-lead electrocardiogram and self-report. Age-, sex-, and race/ethnicity-specific prevalence rates of AF were estimated and compared between subgroups. Cross-sectional associations and correlates with prevalent AF were examined using unadjusted and multivariable-adjusted logistic regression analysis. RESULTS: The mean estimated glomerular filtration rate was 43.6 (+/-13.0) mL/(min 1.73 m(2)). Atrial fibrillation was present in 18% of the study population and in >25% of those > or =70 years old. In multivariable-adjusted models, 1-SD increase in age (11 years) (odds ratio 1.27, CI 95% 1.13-1.43, P < .0001), male [corrected] sex (0.80, 0.65-0.98, P = .0303), smoking (former vs never) (1.34, 1.08-1.66, P = .0081), history of heart failure (3.28, 2.47-4.36, P < .001), and history of cardiovascular disease (1.94, 1.56-2.43, P < .0001) were significantly associated with AF. Race/ethnicity, hypertension, diabetes, body mass index, physical activity, education, high-sensitivity C-reactive protein, total cholesterol, and alcohol intake were not significantly associated with AF. An estimated glomerular filtration rate <45 mL/(min 1.73 m(2)) was associated with AF in an unadjusted model (1.35, 1.13-1.62, P = .0010), but not after multivariable adjustment (1.12, 0.92-1.35, P = .2710). CONCLUSIONS: Nearly 1 in 5 participants in Chronic Renal Insufficiency Cohort, a national study of CKD, had evidence of AF at study entry, a prevalence similar to that reported among patients with end-stage renal disease and 2 to 3 times of that reported in the general population. Risk factors for AF in this CKD population do not mirror those reported in the general population.

St Peter, W. L. (2007). "Introduction: chronic kidney disease: a burgeoning health epidemic." J Manag Care Pharm **13**(9 Suppl D): S2-5.

BACKGROUND: The kidneys function as excretory, biosynthetic, and metabolic organs, vital for maintaining normal physiology. Although dialysis can replace some kidney functions, it cannot replicate the biosynthetic and metabolic activities of the normal kidney. Chronic kidney disease (CKD) and its terminal complication, end-stage renal disease (ESRD), may progress undetected until immediately before symptomatic kidney failure develops. At this point in the disease process, few opportunities exist to prevent adverse outcomes. OBJECTIVES: To (1) review the incidence, prevalence, and staging of CKD and ESRD and (2) elucidate that the management of CKD is suboptimal and costly. SUMMARY: CKD is defined according to the presence or absence of kidney damage and level of kidney function. The Kidney Disease Outcomes Quality Initiative designates 5 stages of CKD, with stage 5 being ESRD -- the point at which patients' loss of kidney function precipitates a need for dialysis or kidney transplant. The United States Renal Data System has documented monumental growth of the ESRD population and its significant impact on Medicare and its budget. In 2005, approximately 1.2% of Medicare's 31 million beneficiaries who had ESRD generated 6.4% of Medicare's total costs. One of the most important aspects of CKD diagnosis and treatment is early detection and aggressive management of underlying causes. However, care for CKD patients is fragmented. Primary care physicians, cardiovascular specialists, endocrinologists, dietitians, and pharmacists may be engaged in the patient's care early but the nephrologist may not be approached until late, if at all. CONCLUSION: CKD is costly. Preventing progression to ESRD may improve quality of life and help save health care dollars. A concerted approach to manage CKD patients effectively starts with early detection and integrated management by multiple specialties. Delaying disease progression is crucial and must include patient education and aggressive treatment and management of CKD and its comorbidities. Interdisciplinary care models in which pharmacists are integrally involved should be replicated.

Stevens, L. A., Li, S., Wang, C., et al. (2010). "Prevalence of CKD and comorbid illness in elderly patients in the United States: results from the Kidney Early Evaluation Program (KEEP)." Am J Kidney Dis **55**(3 Suppl 2): S23-33.

BACKGROUND: Elderly individuals with chronic kidney disease (CKD) have high rates of comorbid conditions, including cardiovascular disease and its risk factors, and CKD-related complications. In individuals aged > or = 65 years, we sought to describe the prevalence of CKD determined from laboratory test results in the Kidney Early Evaluation Program (KEEP; n = 27,017) and National Health and Nutrition Examination Survey (NHANES) 1999-2006 (n = 5,538) and the prevalence of diagnosed CKD determined from billing codes in the Medicare 5% sample (n = 1,236,946). In all 3 data sources, we also explored comorbid conditions and CKD-related complications. METHODS: CKD was identified as decreased estimated glomerular filtration rate (<60 mL/min/1.73 m(2)) or increased albumin-creatinine ratio in KEEP and NHANES; CKD was identified using International Classification of Diseases, Ninth Revision, Clinical Modification codes in Medicare. Investigated comorbid conditions included diabetes, hypertension, high cholesterol level, coronary artery disease, congestive heart failure, cerebrovascular disease, peripheral vascular disease, and cancer, and CKD-related complications included anemia, hypocalcemia, hyperphosphatemia, and hyperparathyroidism. RESULTS: The prevalence of CKD was approximately 44% in both KEEP and NHANES participants, and the prevalence of diagnosed CKD was 7% in Medicare beneficiaries. In all 3 data sets, the prevalence of CKD or diagnosed CKD was higher in participants aged > or = 80 years and those with comorbid conditions. For KEEP and NHANES participants, the prevalence of most comorbid conditions and CKD complications increased with decreasing estimated glomerular filtration rate. For participants with CKD stages 3-5, a total of 29.2% (95% CI, 27.8-30.6) in KEEP and 19.9% (95% CI, 17.0-23.1) in NHANES had anemia, 0.7% (95% CI, 0.4-0.9) and 0.6% (95% CI, 0.3-1.3) had hypocalcemia, 5.4% (95% CI, 4.7-6.1) and 6.4% (95% CI, 5.1-8.0) had hyperphosphatemia, and 52.0% (95% CI, 50.4-53.6) and 30.0% (95% CI, 25.9-34.3) had hyperparathyroidism, respectively. CONCLUSIONS: CKD is common in the elderly population and is associated with high frequencies of concomitant comorbid conditions and biochemical abnormalities. Because CKD is not commonly diagnosed, greater emphasis on physician education may be beneficial.

Stevens, L. A., Viswanathan, G. et Weiner, D. E. (2010). "Chronic kidney disease and end-stage renal disease in the elderly population: current prevalence, future projections, and clinical significance." Adv Chronic Kidney Dis **17**(4): 293-301.

The world's population is aging, with the number of older adults projected to increase dramatically over the next 2 decades. This trend poses major challenges to health care systems, reflecting the greater health care use and more comorbid conditions among elderly adults. Chronic kidney disease (CKD) is a substantial concern in the elderly population, with both an increasing incidence of treated kidney failure with dialysis as well as a high prevalence of earlier stages of CKD. Given the high burden of risk factors for CKD, the high prevalence of CKD in the elderly population is not surprising, with the rise in obesity, diabetes, and hypertension in middle-aged adults likely foreshadowing further increases in CKD prevalence among the elderly population. It is now commonly agreed that the presence of CKD identifies a higher risk state in the elderly population, with increased risk for multiple adverse outcomes, including kidney failure, cardiovascular disease, cognitive impairment, and death. Accordingly, CKD in older adults is worthy of attention by both health care providers and patients, with the presence of a reduced glomerular filtration rate or albuminuria in the elderly potentially informing therapeutic and diagnostic decisions for these individuals.

Takahashi, S., Okada, K. et Yanai, M. (2010). "The Kidney Early Evaluation Program (KEEP) of Japan: results from the initial screening period." Kidney Int Suppl(116): S17-23.

The International Kidney Evaluation Association Japan evaluated chronic kidney disease (CKD) in Japan, using a Japanese version of the US National Kidney Foundation's Kidney Early Evaluation

Program (KEEP). The screening criteria for the first 1065 participants were presence of diabetes or hypertension, or family history of diabetes, hypertension, or kidney disease. Mean age was 59.7+/-16.1 years; 501 participants were men, 564 women. Of participants, 26.9% had diabetes, 59.2% had hypertension (with an additional 21.5% diagnosed after the program), 16.9% had history of diabetes and hypertension together, and 30.6% had neither, but had family history of diabetes, hypertension, or kidney disease. CKD (stages 1-4) prevalence was 26.7%, defined by albumin-creatinine ratio and estimated glomerular filtration rate. CKD prevalence was 35.0% among diabetic participants, 34.8% among hypertensive participants, and 37.1% among participants with cardiovascular disease (CVD). The following baseline conditions were significantly associated with discovered CKD: diabetes, odds ratio 1.71 (95% confidence interval 1.28-2.30); hypertension, 3.42 (2.15-5.44); CVD, 1.88 (1.37-2.57). CKD prevalence was high compared with the general Japanese population. KEEP Japan seems to define a high-risk population with evidence of CKD based on the targeted nature of the program.

van Blijderveen, J. C., Straus, S. M., Zietse, R., et al. (2014). "A population-based study on the prevalence and incidence of chronic kidney disease in the Netherlands." Int Urol Nephrol **46**(3): 583-592.

PURPOSE: Because most population-based studies on the epidemiology of chronic kidney disease (CKD) are cross-sectional, there is, except for end-stage renal disease, hardly any information on incidence rates. METHODS: We conducted a retrospective cohort study in a dynamic population, using data of 784,563 adult participants retrieved from the Integrated Primary Care Information database, a primary care database containing the complete electronic longitudinal medical records. CKD (both incidence and prevalence) was based on (1) an increased urine albumin-to-creatinine ratio, (2) a decreased estimated glomerular filtration rate, or (3) explicit statement in the medical record. Results were stratified by age according to the WHO standard population, sex, and diabetes mellitus. RESULTS: Based on a single measurement only, the incidence rate of CKD in adults was 1,213 per 100,000 person-years, and 6.7 percent of the adult population had a prevalent diagnosis of CKD. The incidence rate increased by age and was the highest in participants with diabetes with an incidence of 25,000 per 100,000 person-years, affecting over 75 percent of participants with diabetes. CONCLUSIONS: This is the first study to report the incidence rates of all stages of CKD for the entire adult population, stratified by sex, 5-year age groups, and diabetes. Our data demonstrate that the incidence of CKD increases with age and is the highest in participants with diabetes mellitus.

Venuthurupalli, S. K., Hoy, W. E., Healy, H. G., et al. (2012). "CKD.QLD: chronic kidney disease surveillance and research in Queensland, Australia." Nephrol Dial Transplant **27 Suppl 3**: iii139-145.

BACKGROUND: Chronic kidney disease (CKD) is recognized as a major public health problem in Australia with significant mortality, morbidity and economic burden. However, there is no comprehensive surveillance programme to collect, collate and analyse data on CKD in a systematic way. METHODS: We describe an initiative called CKD Queensland (CKD.QLD), which was established in 2009 to address this deficiency, and outline the processes and progress made to date. The foundation is a CKD Registry of all CKD patients attending public health renal services in Queensland, and patient recruitment and data capture have started. RESULTS: We have established through early work of CKD.QLD that there are over 11,500 CKD patients attending public renal services in Queensland, and these are the target population for our registry. Progress so far includes conducting two CKD clinic site surveys, consenting over 3000 patients into the registry and initiation of baseline data analysis of the first 600 patients enrolled at the Royal Brisbane and Women's Hospital (RBWH) site. In addition, research studies in dietary intake and CKD outcomes and in models of care in CKD patient management are underway. CONCLUSIONS: Through the CKD Registry, we will define the distribution of CKD patients referred to renal practices in the public system in Queensland by region, remoteness, age, gender, ethnicity and socioeconomic status. We will define the clinical characteristics of those patients, and the CKD associations, stages, co-morbidities and current management. We will follow the course and outcomes in individuals over time, as well as group trends over time. Through our activities and outcomes, we are aiming to provide a nidus for other states in Australia to join in a national CKD registry and network.

Vinhas, J., Gardete-Correia, L., Boavida, J. M., et al. (2011). "Prevalence of chronic kidney disease and associated risk factors, and risk of end-stage renal disease: data from the PREVADIAB study." Nephron Clin Pract **119**(1): c35-40.

> BACKGROUND/AIMS: Chronic kidney disease (CKD) is a growing public health problem. However, data on risk factors and prevalence of CKD exist only in a small number of countries. Portugal has the highest incidence of end-stage renal disease (ESRD) among European countries, but there are huge disparities among countries. Whether these disparities reflect differences in risk factors, prevalence of CKD or other factors is currently unknown. METHODS: We analyzed data from a nationally representative sample of 5,167 subjects, and estimated the prevalence of CKD and associated risk factors, and combined these prevalence estimates with available data on ESRD. RESULTS: The prevalence of risk factors such as diabetes (11.7%), obesity (33.7%), and metabolic syndrome (41.5%) was similar to that in the US, but greater than in most European countries. The prevalence of CKD stages 3-5 was 6.1%, which is similar to that in other Western countries. The risk of ESRD was greater than in other European countries, but lower than in the US. CONCLUSION: The high incidence of ESRD among the Portuguese population is not due to a greater prevalence of CKD. A higher rate of progression associated with the high prevalence of risk factors may account for the high incidence of ESRD. The role of unmeasured factors needs to be evaluated in further studies.

Young, J. M., Terrin, N., Wang, X., et al. (2009). "Asymmetric dimethylarginine and mortality in stages 3 to 4 chronic kidney disease." Clin J Am Soc Nephrol **4**(6): 1115-1120.

> BACKGROUND AND OBJECTIVES: Asymmetric dimethylarginine (ADMA), an endogenous inhibitor of nitric oxide synthase, reduces bioavailability of nitric oxide and induces endothelial dysfunction. This dimethylated amino acid accumulates in chronic kidney disease and may be involved in the pathophysiology of cardiovascular disease (CVD) in this population. DESIGN, SETTINGS, PARTICIPANTS, & METHODS: The Modification of Diet in Renal Disease Study was a randomized, controlled trial conducted between 1989 and 1993. We measured ADMA in frozen samples collected at baseline (n = 820) and obtained survival status, up to December 31, 2000, from the National Death Index. We examined the relationship of ADMA with prevalent CVD and performed multivariable Cox models to examine the relationship of ADMA with all-cause and CVD mortality. RESULTS: Mean (SD) age was 52 (12) yr, GFR was 32 +/- 12 ml/min per 1.73 m(2), and ADMA was 0.70 +/- 0.25 micromol/L. A 1-SD increase in ADMA was associated with a 31% increased odds of prevalent CVD in an adjusted logistic regression model. During the 10-yr follow-up period, 202 (25%) participants died of any cause, 122 (15%) from CVD, and 545 (66%) reached kidney failure. In multivariable Cox models, a 1-SD increase in ADMA was associated with a 9% increased risk for all-cause and 19% increased risk for CVD mortality. CONCLUSIONS: In this cohort of patients with predominantly nondiabetic, stages 3 to 4 chronic kidney disease, there was a strong association of ADMA with prevalent CVD and a modest association with all-cause and CVD mortality.

DE L'INSUFFISANCE RENALE CHRONIQUE A L'INSUFFISANCE RENALE CHRONIQUE TERMINALE

Études françaises

(2017). "Maladie rénale chronique. Repousser l'échéance des traitements de suppléance tout en les prévoyant." Concours Medical **139**(9): 28-32, phot., tabl.

> [BDSP. Notice produite par ORSRA 89Do7R0x. Diffusion soumise à autorisation]. Le vieillissement de la population, l'évolution des comportements et de meilleurs dépistages sont à l'origine du nombre croissant de patients atteints de maladies chroniques. Parmi celles-ci, la maladie rénale chronique se caractérise par une difficulté spécifique : son aspect asymptomatique, qui engendre des retards dans le dépistage. Il est ainsi indispensable d'avoir recours à la biologie et à la radiologie pour définir le degré de gravité et le type de maladie rénale. À cet égard, l'estimation systématique du débit de filtration glomérulaire avec tout dosage de créatinine est un progrès considérable. À la suite de l'annonce de la maladie chronique, il faut expliquer au patient le bénéfice d'un traitement conservateur au long cours, dans le but de ralentir l'évolution et d'anticiper et gérer des complications

éventuelles. L'élaboration du parcours de soins est un enjeu majeur dans l'offre de santé vis-à-vis de la maladie chronique, dans le souci premier de conserver au mieux la qualité de vie des patients bénéficiant de soins dans la durée et la complexité de plusieurs disciplines médicales.

Hannedouche, T., Krummel, T. et Parvès-Braun, L. (2004). "Néphroprotection. Comment ralentir l'évolution de l'insuffisance rénale chronique ?" EMC - Néphrologie **1**(4): 127-136.
http://www.sciencedirect.com/science/article/pii/S1638624804000155

Résumé La plupart des néphropathies se caractérisent par une évolution progressive qui peut aboutir à l'insuffisance rénale terminale. En dehors du traitement spécifique lorsqu'il est possible, il est possible de retarder l'échéance de l'insuffisance rénale terminale grâce à un traitement néphroprotecteur. Après une définition des facteurs de risque de progression des maladies rénales, les différentes approches thérapeutiques qui se rattachent au concept de néphroprotection sont passées en revue. Les résultats que l'on peut en attendre sont exposés à la lumière des données de la littérature, et notamment des essais thérapeutiques randomisés, selon les principes de la médecine factuelle (evidence-based medicine). Le blocage du système rénine-angiotensine occupe une grande place dans les stratégies de néphroprotection. Il ne doit faire négliger ni les mesures diététiques, ni le traitement pharmacologique des troubles métaboliques associés à la néphropathie. Most nephropathies are characterized by a progression that may result in end-stage renal failure (ESRF). Apart from the specific treatment implemented when possible, ESRF may be delayed by nephroprotective therapy. Following the definition of the risk factors likely to induce progressive renal disease, the various therapeutic strategies that may play a nephroprotective role are reviewed. The potential results are described with regard to published data, in particular randomised trials, as recommended by the evidence-based medicine principles. Blockade of the renin-angiotensin system plays a major role in terms of nephroprotection. However, this strategy should not replace lifestyle measures and pharmacological treatment of the metabolic disorders associated to nephropathies.

Verhelst, D. (2018). "[Characteristics and epidemiology of chronic kidney disease]." Soins **63**(826): 14-16.

Today in France, more than 5% of the population suffers from chronic kidney disease and its prevalence is increasing. It is important to detect these pathologies early and to provide patients with a multidisciplinary care programme in which nephrologists, endocrinologists and cardiologists coordinate their approach.

Études internationales

Alebiosu, C. O. et Ayodele, O. E. (2005). "The global burden of chronic kidney disease and the way forward." Ethn Dis **15**(3): 418-423.

BACKGROUND: Chronic kidney disease (CKD) is increasing worldwide at an annual growth rate of 8%. Regional differences exist in the epidemiology of the condition, and non-Whites are more affected. METHODS: An English-language literature search using Medline (January 1984-October 2003) was done to assess research/review articles on burden and prevention of CKD. Particular attention was paid to epidemiology and prevention of chronic kidney diseases. RESULTS: The prevalence of CKD is higher in developing countries than in the developed world. The most common causes of CKD in the developing countries are chronic glomerulonephritis and systemic hypertension, diabetic nephropathy being the most common cause in Europe, the United States, and Japan. Factors contributing to the regional differences in the etiology and prevalence of CKD are race and ethnicity, genetic predisposition, increasing prevalence of type 2 diabetes, mortality caused by other disease, obesity, and possibly cigarette smoking. The control of hypertension, dyslipidemia, proteinuria, obesity, avoidance of low birth weight, smoking, and preventing ingesting of heavy metals such as lead are intervention strategies that retard or prevent progression of renal diseases. The magnitude of the existing burden of illness caused by renal failure, the projections for increasing incidence of CKD, and the limitations of our existing treatments for renal insufficiency all point to the need for clinical and population-based interventions aimed at prevention of CKD. CONCLUSIONS: A comprehensive health education campaign and screening of the general populace are needed in order to detect chronic kidney disease early. These measures will ensure appropriate and timely institution of proven measures to halt or reduce progression of CKD.

Becker, B. N., Breiterman-White, R., Nylander, W., et al. (1997). "Care pathway reduces hospitalizations and cost for hemodialysis vascular access surgery." Am J Kidney Dis **30**(4): 525-531.

Hemodialysis vascular access-related hospitalizations account for more than 20% of United States end-stage renal disease (ESRD) hospitalizations, with an annual cost approximating $675 million. Limiting access-related costs while delivering similar degrees of quality care thus would enhance alternative utilization of ESRD funding. We implemented a vascular access care pathway emphasizing coordinated patient evaluation and outpatient surgery to determine whether such an intervention affected outcomes associated with vascular access surgery. Data examining hospitalization and vascular access surgery charges, complications, and patient satisfaction (determined by questionnaire) were analyzed, comparing patients who underwent vascular access surgery in 1994 and 1995 as inpatients (non-care pathway patients) and patients who underwent vascular access surgery via the care pathway in 1995. Inpatient days declined in 1995 (1994: 582 days; 1995: 85 days; P < 0.03) and the average charges per patient for the care pathway cohort were significantly less than charges per patient in 1994 and charges for non-care pathway patients in 1995 (1994 patients: $10,524 +/- $5,209; 1995 non-care pathway patients: $11,196 +/- $5,806; 1995 care pathway patients: $4,686 +/- $2,912/patient; P < 0.02). Incidence rates for major (life-threatening) complications were not significantly different between 1994 patients and care pathway patients in 1995. However, the 1995 non-care pathway patients had a higher incidence of major complications (15.4%). Forty-seven repeat access procedures were performed in 29 patients in 1994 versus 35 repeat access procedures in 22 care pathway patients in 1995, and 12 repeat access procedures were performed in eight non-care pathway patients in 1995. Finally, a majority of the patients entered into the care pathway who responded to a survey stated that they were satisfied with access surgery via the care pathway. These data suggest that a vascular access care pathway can reduce hospital days and costs while achieving acceptable outcomes for access surgery.

Bodson, A., Meunier, P., Krzesinski, J. M., et al. (2016). "[Autosomal dominant polycystic kidney diseae: how and whu should we identify the patients “rapidly progressing” to end-stage renal disease." Rev Med Liege **71**(4): 184-192.

Autosomal dominant polycystic kidney disease (ADPKD) is a common inherited disease characterised by the progressive development of multiple and bilateral cysts in kidneys and other organs. Most patients with ADPKD will develop, sooner or later, end-stage renal disease (ESRD). The morbidity and mortality associated with ESRD prompt physicians to identify early ADPKD patients considered as "rapid progressors", who have the greatest risk to rapidly develop ESRD. The rate of progression can be assessed by clinical--especially with the "predicting renal outcome in polycystic kidney disease score" (PROPKD-Score)-, biological (a decline of the glomerular filtration rate (GFR) of 4.4-5.9 ml/min/year and/or the doubling of serum creatinine within a 36-month period), or radiological criteria (total kidney volume (TKV) adjusted for the size > 600 cc/m and/or TKV annual growth rate > 5 %). Nowadays, there is no curative treatment for ADPKD. However, vasopressin-2 receptor antagonists, such as tolvaptan, appear to slow down the growth of renal cysts and the slope of GFR decline. The current management of ADPKD patients is mostly based on correcting the risk factors for progression, i.e. encouraging (over)-hydration, normalizing blood pressure, stimulating smoking cessation.

Cerqueira, D. C., Soares, C. M., Silva, V. R., et al. (2014). "A predictive model of progression of CKD to ESRD in a predialysis pediatric interdisciplinary program." Clin J Am Soc Nephrol **9**(4): 728-735.

BACKGROUND AND OBJECTIVES: The incidence of ESRD in children has increased over the last two decades. Nevertheless, there are still limited data on risk factors related to the emergence of ESRD among patients with CKD. The aim of this study was to develop a model of prediction of ESRD in children and adolescents with CKD (stages 2-4) enrolled in a predialysis interdisciplinary management program. DESIGN, SETTING, PARTICIPANTS, & MEASUREMENTS: In this retrospective cohort study, 147 patients with CKD admitted from 1990 to 2008 were systematically followed up at a tertiary pediatric nephrology unit for a median of about 4.5 years. The primary outcome was the progression to CKD stage 5. A predictive model was developed using Cox proportional hazards model and evaluated by c statistics. RESULTS: The median renal survival was estimated at 98.7 months (95% confidence interval [95% CI], 68.7 to 129.6 months). The probability of reaching CKD stage 5 was estimated as 52% in 10 years. The most accurate model included eGFR, proteinuria at admission, and primary renal disease. Risk score ranged from 0 to 13 points (median, 4 points). The accuracy of the score applied to the sample was high, with c statistics of 0.865 (95% CI, 0.80 to 0.93) and 0.837 (95% CI, 0.76 to 0.91) at follow-up of 2 and 5 years, respectively. By survival analysis, it was estimated that at 10 years after admission, the probability of renal survival was about 63% for patients in the low-risk group and 43% for the medium-risk group; all patients assigned to the high-risk group had CKD stage 5 (P<0.001). CONCLUSION: The predictive model of progression of CKD might contribute to early identification of a subgroup of patients at high risk for accelerated renal failure.

Chambers, S., Healy, H., Hoy, W. E., et al. (2018). "Health service utilisation during the last year of life: a prospective, longitudinal study of the pathways of patients with chronic kidney disease stages 3-5." BMC Palliat Care **17**(1): 57.

BACKGROUND: Chronic kidney disease (CKD) is a growing global problem affecting around 10% of many countries' populations. Providing appropriate palliative care services (PCS) to those with advanced kidney disease is becoming paramount. Palliative/supportive care alongside usual CKD clinical treatment is gaining acceptance in nephrology services although the collaboration with and use of PCS is not consistent. METHODS: The goal of this study was to track and quantify the health service utilisation of people with CKD stages 3-5 over the last 12 months of life. Patients were recruited from a kidney health service (Queensland, Australia) for this prospective, longitudinal study. Data were collected for 12 months (or until death, whichever was sooner) during 2015-17 from administrative health sources. Emergency department presentations (EDP) and inpatient admissions (IPA) (collectively referred to as critical events) were reviewed by two Nephrologists to gauge if the events were avoidable. RESULTS: Participants (n = 19) with a median age of 78 years (range 42-90), were mostly male (63%), 79% had CKD stage 5, and were heavy users of health services during the study period. Fifteen patients (79%) collectively recorded 44 EDP; 61% occurred after-hours, 91% were triaged as imminently and potentially life-threatening and 73% were admitted. Seventy-four IPA were collectively recorded across 16 patients (84%); 14% occurred on weekends or public holidays. Median length of stay was 3 days (range 1-29). The median number of EDP and IPA per patient was 1 and 2 (range 0-12 and 0-20) respectively. The most common trigger to both EDP (30%) and IPA (15%) was respiratory distress. By study end 37% of patients died, 63% were known to PCS and 11% rejected a referral to a PCS. All critical events were deemed unavoidable. CONCLUSIONS: Few patients avoided using acute health care services in a 12 month period, highlighting the high service needs of this cohort throughout the long, slow decline of CKD. Proactive end-of-life care earlier in the disease trajectory through integrating renal and palliative care teams may avoid acute presentations to hospital through better symptom management and planned care pathways.

Chan, T. C., Fan, I., Liu, M. S., et al. (2014). "Addressing health disparities in chronic kidney disease." Int J Environ Res Public Health **11**(12): 12848-12865.

According to the official health statistics, Taiwan has the highest prevalence of end stage renal disease (ESRD) in the world. Each year, around 60,000 ESRD patients in Taiwan consume 6% of the national insurance budget for dialysis treatment. The prevalence of chronic kidney disease (CKD) has been climbing during 2008-2012.However, the spatial disparities and clustering of CKD at the public health level have rarely been discussed. The aims of this study are to explore the possible population level risk factors and identify any clusters of CKD, using the national health insurance database.The results show that the ESRD prevalence in females is higher than that in males. ESRD medical expenditure constitutes 87% of total CKD medical expenditure. Pre-CKD and pre-ESRD disease management might slow the progression from CKD to ESRD. After applying ordinary least-squares regression, the percentages of high education status and the elderly in the townships are positively correlated with CKD prevalence. Geographically weighted regression and Local Moran's I are used for identifying the clusters in southern Taiwan. The findings can be important evidence for earlier and targeted community interventions and reducing the health disparities of CKD.

Chang, Y. K., Liu, J. S., Hsu, Y. H., et al. (2015). "Increased Risk of End-Stage Renal Disease (ESRD) Requiring Chronic Dialysis is Associated With Use of Nonsteroidal Anti-Inflammatory Drugs (NSAIDs): Nationwide Case-Crossover Study." Medicine (Baltimore) **94**(38): e1362.

> It is known that many medical adverse events can be caused by nonsteroidal anti-inflammatory drugs (NSAIDs); however, epidemiologic evidence has not granted an affirmative relationship between NSAID use and the risk of end-stage renal disease (ESRD). We aimed to investigate the relationship in a Chinese population between short-term NSAID use and development of ESRD requiring chronic dialysis. A retrospective case-crossover design was used in this study. Using the Taiwanese National Health Insurance database, we identified 109,400 incident chronic ESRD patients with dialysis initiation from 1998 to 2009. For each patient, we defined the case period as 1 to 14 days and the control period as 105 to 118 days, respectively, before the first dialysis date. The washout period was 90 days between the case and control period. Detailed information about NSAID use was compared between the case and control periods. We calculated odds ratios (ORs) and their 95% confidence intervals (CIs) using a conditional logistic regression model. NSAID use was found to be a significant risk factor associated with dialysis commencement. The adjusted OR was 2.73 (95% CI: 2.62-2.84) for nonselective NSAIDs and 2.17 (95% CI: 1.83-2.57) for celecoxib. The OR reached 3.05 for the use of acetic acid derivatives. Compared with the oral forms, significantly higher risks were seen in parenteral NSAID use (OR: 8.66, 95% CI: 6.12-20.19). NSAIDs should be prescribed with caution, especially for those in ESRD high-risk groups.

Charytoniuk, T., Malyszko, M., Baczek, J., et al. (2018). "Progression to chronic kidney disease in patients undergoing nephrectomy for small renal masses: a price to pay for a therapeutic success?" Postgrad Med **130**(7): 613-620.

> Nephrectomy, which constitutes a gold-standard procedure for the treatment of renal-cell carcinoma (RCC), has been widely discussed in the past decade as a significant risk factor of the development of chronic kidney disease (CKD). RCC is the third most common genitourinary cancer in the United States, with an estimated more than 65,000 new cases and 14,970 deaths. The aim of this review was to precisely and comprehensively summarize the status of current knowledge in CKD risk factors after nephrectomy, the advantages of minimally invasive vs. radical nephrectomy, post-nephrectomy biomarkers of CKD, ways of post-operative CKD prevention and, therefore, better understand why various aspects of CKD after nephrectomy. The majority of current studies indicated a better long-term kidney function preservation in patients undergoing partial nephrectomy in comparison to those after radical nephrectomy. Furthermore, a nephron-sparing surgery should be a preferred first-line procedure among young patients with small renal masses. As partial nephrectomy is followed by a greater risk of adverse outcomes relative to radical nephrectomy, a potential survival benefit should always be considered especially in the elderly or patients with comorbidities.

Chawla, L. S., Amdur, R. L., Amodeo, S., et al. (2011). "The severity of acute kidney injury predicts progression to chronic kidney disease." Kidney Int **79**(12): 1361-1369.

> Acute kidney injury (AKI) is associated with progression to advanced chronic kidney disease (CKD). We tested whether patients who survive AKI and are at higher risk for CKD progression can be identified during their hospital admission, thus providing opportunities to intervene. This was assessed in patients in the Department of Veterans Affairs Healthcare System hospitalized with a primary diagnosis indicating AKI (ICD9 codes 584.xx). In the exploratory phase, three multivariate prediction models for progression to stage 4 CKD were developed. In the confirmatory phase, the models were validated in 11,589 patients admitted for myocardial infarction or pneumonia during the same time frame that had RIFLE codes R, I, or F and complete data for all predictor variables. Of the 5351 patients in the AKI group, 728 entered stage 4 CKD after hospitalization. Models 1, 2, and 3 were all significant with 'c' statistics of 0.82, 0.81, and 0.77, respectively. In model validation, all three were highly significant when tested in the confirmatory patients, with moderate to large effect sizes and good predictive accuracy ('c' 0.81-0.82). Patients with AKI who required dialysis and then recovered were at especially high risk for progression to CKD. Hence, the severity of AKI is a robust predictor of progression to CKD.

Chen, N., Pan, X. X., Gu, Y., et al. (2012). "Analysis of early kidney damage in hospitalized patients with chronic kidney disease: a multicenter study." Ren Fail **34**(3): 329-333.

> BACKGROUND: To identify the risk factors for early kidney damage in hospitalized Chinese patients with chronic kidney disease (CKD). METHODS: A total of 12 multicenter cross-sectional studies were conducted between January 2005 and January 2006 in Chinese CKD patients with estimated glomerular filtration rate (eGFR) equal to or more than 30 mL/min/1.73 m2 in Shanghai. CKD was defined according to the K/DOQI guideline. GFR was estimated by the simplified modification of diet in renal disease equation. The demographic, clinical, and laboratory data were collected through a questionnaire and analyzed among eligible patients stratified by three different CKD groups (CKD stages 1, 2, and 3). The relevant clinical and laboratory risk factors for early kidney damage with a GFR < 90 mL/min/1.73 m2 were determined by logistic regression. RESULTS: A total of 822 CKD patients were enrolled in this study. There were significant differences in age and gender among patients with CKD stages 1, 2, and 3. The prevalence of hypertension, cardiovascular disease, cerebral vascular disease, anemia, and hyperuricemia increases when the eGFR declines. Logistic analysis showed that age, hypertension, anemia, and hyperuricemia were independently associated with early kidney damage. CONCLUSIONS: In CKD patients, we have identified only age, hypertension, anemia, and hyperuricemia as the risk factors for early kidney damage. Risk factors should be managed to prevent accelerated kidney damage in CKD patients.

Chen, S. H., Tsai, Y. F., Sun, C. Y., et al. (2011). "The impact of self-management support on the progression of chronic kidney disease--a prospective randomized controlled trial." Nephrol Dial Transplant **26**(11): 3560-3566.

> BACKGROUND: Chronic kidney disease (CKD) is a public health problem worldwide. Multidisciplinary intervention helps improve outcomes for CKD patients. We conducted an open-label, randomized controlled trial to examine the impact of self-management support (SMS) in the outcome of late-stage CKD patients. METHODS: Incidental CKD (Stages III-V) patients were randomized into self-management support (SMS) and non-SMS groups and followed up for 12 months. SMS comprised health information, patient education, telephone-based support and the aid of a support group. The primary end points were absolute estimated glomerular filtration rate (eGFR) alteration and number of hospitalization events. The secondary end points were an eGFR decrease of up to 50%, end-stage renal disease (ESRD) demanding renal replacement therapy (RRT), all-cause mortality or a composite secondary end point. RESULTS: The study included 54 patients; 27 patients were randomized into an SMS group and the same number into a non-SMS group. The absolute eGFR at the end of the study was significantly higher in SMS patients than in the non-SMS group (29.11 +/- 20.61 versus 15.72 +/- 10.67 mL/min; P < 0.05). There were fewer hospitalization events for SMS patients than for non-SMS patients [5 (18.50%) versus 12 (44.47%); P < 0.05]. One patient (3.7%) in the SMS group and nine (33.3%) in the non-SMS group had an eGFR reduction of >50% (P < 0.05). However, survival analysis of the composite secondary end points of ESRD that required RRT and all-cause mortality revealed no differences between the two groups. CONCLUSIONS: Our randomized study suggests that a standardized SMS program may play a significant role in reducing CKD progression and morbidity of late-stage CKD patients.

Chertow, G. M., Burdick, E., Honour, M., et al. (2005). "Acute kidney injury, mortality, length of stay, and costs in hospitalized patients." J Am Soc Nephrol **16**(11): 3365-3370.

> The marginal effects of acute kidney injury on in-hospital mortality, length of stay (LOS), and costs have not been well described. A consecutive sample of 19,982 adults who were admitted to an urban academic medical center, including 9210 who had two or more serum creatinine (SCr) determinations, was evaluated. The presence and degree of acute kidney injury were assessed using absolute and relative increases from baseline to peak SCr concentration during hospitalization. Large increases in SCr concentration were relatively rare (e.g., >or=2.0 mg/dl in 105 [1%] patients), whereas more modest increases in SCr were common (e.g., >or=0.5 mg/dl in 1237 [13%] patients). Modest changes in SCr were significantly associated with mortality, LOS, and costs, even after adjustment for age, gender, admission International Classification of Diseases, Ninth Revision, Clinical Modification diagnosis, severity of illness (diagnosis-related group weight), and chronic kidney disease. For

example, an increase in SCr >or=0.5 mg/dl was associated with a 6.5-fold (95% confidence interval 5.0 to 8.5) increase in the odds of death, a 3.5-d increase in LOS, and nearly 7500 dollars in excess hospital costs. Acute kidney injury is associated with significantly increased mortality, LOS, and costs across a broad spectrum of conditions. Moreover, outcomes are related directly to the severity of acute kidney injury, whether characterized by nominal or percentage changes in serum creatinine.

Cho, E. J., Park, H. C., Yoon, H. B., et al. (2012). "Effect of multidisciplinary pre-dialysis education in advanced chronic kidney disease: Propensity score matched cohort analysis." Nephrology (Carlton) **17**(5): 472-479.

AIM: The mortality and morbidity of end-stage renal failure patients remains high despite recent advances in pre-dialysis care. Previous studies suggesting a positive effect of pre-dialysis education were limited by unmatched comparisons between the recipients and non-recipients of education. The present study aimed to clarify the roles of the multidisciplinary pre-dialysis education (MPE) in chronic kidney disease patients. METHODS: We performed a retrospective single centre study, enrolling 1218 consecutive pre-dialysis chronic kidney disease patients, between July 2007 and Feb 2008 and followed them up to 30 months. By using propensity score matching, we matched 149 recipient- and non-recipient pairs from 1218 patients. The incidences of renal replacement therapy, mortality, cardiovascular event and infection were compared between recipients and non-recipients of MPE. RESULTS: Renal replacement therapy was initiated in 62 and 64 patients in the recipients and non-recipients, respectively (P > 0.05). The MPE reduced unplanned urgent dialysis (8.7% vs 24.2%, P < 0.001) and shortened hospital days (2.16 vs 5.05 days/patient per year). MPE recipients had a better metabolic status at the time of initiating renal replacement therapy. Although no significant survival advantage from MPE was exhibited, MPE recipients had lower incidence of cardiovascular events (adjusted hazard ratio, 0.24; 95% confidence interval (CI), 0.08 to 0.78; P = 0.017), and a tendency toward a lower infection rate (adjusted hazard ratio, 0.44; 95% CI, 0.17 to 1.11; P = 0.083). CONCLUSION: MPE was associated with better clinical outcomes in terms of urgent dialysis, cardiovascular events and infection.

Collins, G. S., Omar, O., Shanyinde, M., et al. (2013). "A systematic review finds prediction models for chronic kidney disease were poorly reported and often developed using inappropriate methods." J Clin Epidemiol **66**(3): 268-277.

BACKGROUND: Chronic kidney disease (CKD) is a global health concern that is increasing mainly as the result of increasing incidences of diabetes and hypertension. Furthermore, if left untreated, individuals with CKD may progress to end-stage kidney failure. Identifying individuals with undiagnosed CKD or those who are at an increased risk of developing CKD or progressing to end-stage kidney disease (ESKD) is therefore an important challenge. We sought to systematically review and critically assess the conduct and reporting of methods used to develop risk prediction models for predicting the risk of having undiagnosed (prevalent) or future risk of developing (incident) CKD or end-stage kidney failure in adults. METHODS: We conducted a systematic search of PubMed database to identify studies published up until September 2011 that describe the development of models combining two or more variables to predict the risk of prevalent or incident CKD or ESKD. We extracted key information that describes aspects of developing a prediction model, including the study design, data quality, sample size and number of events, outcome definition, risk predictor selection and coding, missing data, model-building strategies, and aspects of performance. RESULTS: Eleven studies describing the development of 14 prediction models were included. Eight studies reported the development of 11 models to predict incident CKD or ESKD, whereas 3 studies developed models for prevalent CKD. A total of 97 candidate risk predictors were considered, and 43 different risk predictors featured in the 14 prediction models. A method, not recommended to select risk predictors for inclusion in the multivariate model, using statistical significance from univariate screening was carried out in six studies. Missing data were frequently poorly handled and reported with no mention of missing data in four studies; 4 studies explicitly excluded individuals with missing data, and only 2 studies used multiple imputation to replace missing values. CONCLUSION: We found that prediction models for chronic kidney were often developed using inappropriate methods and were generally poorly reported. Using poor methods can affect the predictive ability of the models, whereas inadequate reporting hinders an objective evaluation of the potential usefulness of the model.

Collins, G. (2013). "Reply to "A systematic review finds prediction models for chronic kidney disease were poorly reported and often developed using inappropriate methods"." J Clin Epidemiol **66**(6): 697-698.

Daugas, E., Dussol, B., Henri, P., et al. (2012). "[Prepare: cross-sectional study on management of chronic kidney disease by nephrologists before dialysis in France]." Nephrol Ther **8**(6): 439-450.

> There are few epidemiologic data on Chronic Kidney Disease management before replacement therapy. The two objectives of the PREPARE study were (1) to describe the characteristics of these patients and accordance to clinical practice guidelines (2) to study nephrologists preference for renal replacement therapy in case of progression to end stage renal disease. PREPARE is a non-interventional cross-sectional study. All the French nephrologists had been solicited to collect information about CKD outpatients not on dialysis, not transplanted, with glomerular filtration rate lower than 60mL/min/1,73m(2), followed on any day between 23 and 27 November 2009. Three hundred and eight investigators included 2089 patients, 59% of them were male, they were on average 69 years old, 15, 37 and 48% had respectively a CKD stage V, stage IV and stage III, the nephropathy was the most often (43%) vascular. The most frequently reported cardiovascular risk factors were hypertension (88%), hypercholesterolemia (53%), diabetes (37%). The average time between diagnosis of nephropathy and the first nephrology consultation was too long 1,5 years. The implementation measures of nephroprotection and treatment of complications of CKD were generally satisfactory. However, preparation for replacement therapy was often too late, haemodialysis was more likely scheduled instead of peritoneal dialysis and without preparation for renal transplantation. PREPARE can therefore highlight the qualities of the current management of CKD by nephrologists in France. Nevertheless, PREPARE also shows weaknesses in preparation for replacement therapy. One can suggest that they could be reduced by systematic access of patients with risk of progression to stage V, as soon as the stage IV, to structured multidisciplinary care.

De Nicola, L., Chiodini, P., Zoccali, C., et al. (2011). "Prognosis of CKD patients receiving outpatient nephrology care in Italy." Clin J Am Soc Nephrol **6**(10): 2421-2428.

> BACKGROUND AND OBJECTIVES: Prognosis in nondialysis chronic kidney disease (CKD) patients under regular nephrology care is rarely investigated. Design, setting, participants, & measurements We prospectively followed from 2003 to death or June 2010 a cohort of 1248 patients with CKD stages 3 to 5 and previous nephrology care >/=1 year in 25 Italian outpatient nephrology clinics. Cumulative incidence of ESRD or death before ESRD were estimated using the competing-risk approach. RESULTS: Estimated rates (per 100 patient-years) of ESRD and death 8.3 (95% confidence interval [CI], 7.4 to 9.2) and 5.9 (95% CI 5.2 to 6.6), respectively. Risk of ESRD and death increased progressively from stages 3 to 5. ESRD was more frequent than death in stage 4 and 5 CKD, whereas the opposite was true in stage 3 CKD. Younger age, lower body mass index, proteinuria, and high phosphate predicted ESRD, whereas older age, diabetes, previous cardiovascular disease, ESRD, proteinuria, high uric acid, and anemia predicted death ($P < 0.05$ for all). Among modifiable risk factors, proteinuria accounted for the greatest contribution to the model fit for either outcome. CONCLUSIONS: In patients receiving continuity of care in Italian nephrology clinics, ESRD was a more frequent outcome than death in stage 4 and 5 CKD, but the opposite was true in stage 3. Outcomes were predicted by modifiable risk factors specific to CKD. Proteinuria used in conjunction with estimated GFR refined risk stratification. These findings provide information, specific to CKD patients under regular outpatient nephrology care, for risk stratification that complement recent observations in the general population.

Diggle, P. J., Sousa, I. et Asar, O. (2015). "Real-time monitoring of progression towards renal failure in primary care patients." Biostatistics **16**(3): 522-536.

> Chronic renal failure is a progressive condition that, typically, is asymptomatic for many years. Early detection of incipient kidney failure enables ameliorative treatment that can slow the rate of progression to end-stage renal failure, at which point expensive and invasive renal replacement therapy (dialysis or transplantation) is required. We use routinely collected clinical data from a large sample of primary care patients to develop a system for real-time monitoring of the progression of undiagnosed incipient renal failure. Progression is characterized as the rate of change in a person's kidney function as measured by the estimated glomerular filtration rate, an adjusted version of serum

creatinine level in a blood sample. Clinical guidelines in the UK suggest that a person who is losing kidney function at a relative rate of at least 5% per year should be referred to specialist secondary care. We model the time-course of a person's underlying kidney function through a combination of explanatory variables, a random intercept and a continuous-time, non-stationary stochastic process. We then use the model to calculate for each person the predictive probability that they meet the clinical guideline for referral to secondary care. We suggest that probabilistic predictive inference linked to clinical criteria can be a useful component of a real-time surveillance system to guide, but not dictate, clinical decision-making.

Echouffo-Tcheugui, J. B. et Kengne, A. P. (2012). "Risk models to predict chronic kidney disease and its progression: a systematic review." PLoS Med **9**(11): e1001344.

BACKGROUND: Chronic kidney disease (CKD) is common, and associated with increased risk of cardiovascular disease and end-stage renal disease, which are potentially preventable through early identification and treatment of individuals at risk. Although risk factors for occurrence and progression of CKD have been identified, their utility for CKD risk stratification through prediction models remains unclear. We critically assessed risk models to predict CKD and its progression, and evaluated their suitability for clinical use. METHODS AND FINDINGS: We systematically searched MEDLINE and Embase (1 January 1980 to 20 June 2012). Dual review was conducted to identify studies that reported on the development, validation, or impact assessment of a model constructed to predict the occurrence/presence of CKD or progression to advanced stages. Data were extracted on study characteristics, risk predictors, discrimination, calibration, and reclassification performance of models, as well as validation and impact analyses. We included 26 publications reporting on 30 CKD occurrence prediction risk scores and 17 CKD progression prediction risk scores. The vast majority of CKD risk models had acceptable-to-good discriminatory performance (area under the receiver operating characteristic curve>0.70) in the derivation sample. Calibration was less commonly assessed, but overall was found to be acceptable. Only eight CKD occurrence and five CKD progression risk models have been externally validated, displaying modest-to-acceptable discrimination. Whether novel biomarkers of CKD (circulatory or genetic) can improve prediction largely remains unclear, and impact studies of CKD prediction models have not yet been conducted. Limitations of risk models include the lack of ethnic diversity in derivation samples, and the scarcity of validation studies. The review is limited by the lack of an agreed-on system for rating prediction models, and the difficulty of assessing publication bias. CONCLUSIONS: The development and clinical application of renal risk scores is in its infancy; however, the discriminatory performance of existing tools is acceptable. The effect of using these models in practice is still to be explored.

Ekart, R., Ferjuc, A., Furman, B., et al. (2013). "Chronic kidney disease progression to end stage renal disease: a single center experience of the role of the underlying kidney disease." Ther Apher Dial **17**(4): 363-367.

Chronic kidney disease (CKD) is common and several factors affect its progression to end-stage renal disease (ESRD). The main goal of our study was to assess the influence of underlying kidney disease and some other important factors during the time of CKD progression to ESRD. A retrospective study of 91 patients (57 men, 34 women; average age 57.7 +/- 13.2 years) was carried out. Patients were monitored at least one month before the first renal replacement treatment (RRT). Estimated glomerular filtration rate (eGFR) at first referral to nephrologist was determined by Modification of Diet in Renal Disease equation. Proteinuria was assessed semiquantitatively with dipsticks. Thirty-five patients (38.5%) had diabetic nephropathy (DN), 21 (23.1%) hypertensive nephrosclerosis (HN), 21 (23.1%) adult polycystic kidney disease (APKD) and 14 (15.4%) immunoglobulin A nephropathy (IgAN). Average eGFR at first referral for DN patients was 20.1, and then 23.4 for HN, 35.5 for APKD, and 36.4 mL/min per 1,73 m(2) for IgAN patients. Average time between first nephrological visit and first RRT was 28.4 months for DN patients, 41 for HN, 80.8 for APKD, and 70.1 for IgAN patients. Comparison of all four groups of CKD patients showed that in patients with APKD and IgAN impairment of kidney function to ESRD had progressed statistically significantly slower (P < 0.001). When eGFR at referral, proteinuria, smoking, and renin-angiontensin-aldosterone blockade treatment had been added into the model, patients with APKD and IgAN had a statistically significant longer period between first nephrological visit and first RRT (P < 0.026). In comparison with patients with other underlying causes of CKD, patients with APKD and IgAN had a statistically significant slower progression rate of CKD to ESRD.

Elliott, M. J., Tam-Tham, H. et Hemmelgarn, B. R. (2013). "Age and treatment of kidney failure." Curr Opin Nephrol Hypertens **22**(3): 344-350.

PURPOSE OF REVIEW: This review discusses issues related to treatment of chronic kidney disease, and kidney failure in particular, among older adults. RECENT FINDINGS: A substantial proportion of older adults have chronic kidney disease and progress to kidney failure. There is considerable variability in treatment practices for advanced kidney disease among older adults, and evidence that treatment decisions such as dialysis initiation may be made without adequate preparation. When initiated, survival among older adults on chronic dialysis remains poor, and is associated with a significant decline in functional status. There is also evidence to suggest that dialysis initiation may not reflect overall treatment goals of elderly patients, but rather a lack of clear communication between patients and health practitioners, and underdeveloped conservative care programs in many centers. SUMMARY: Kidney failure is common among older adults. When considering treatment options for kidney failure, patient priorities, preferences, and symptoms should be taken into account, using a shared decision-making approach.

Erickson, K. F., Winkelmayer, W. C., Chertow, G. M., et al. (2014). "Physician visits and 30-day hospital readmissions in patients receiving hemodialysis." J Am Soc Nephrol **25**(9): 2079-2087.

A focus of health care reform has been on reducing 30-day hospital readmissions. Patients with ESRD are at high risk for hospital readmission. It is unknown whether more monitoring by outpatient providers can reduce hospital readmissions in patients receiving hemodialysis. In nationally representative cohorts of patients in the United States receiving in-center hemodialysis between 2004 and 2009, we used a quasi-experimental (instrumental variable) approach to assess the relationship between frequency of visits to patients receiving hemodialysis following hospital discharge and the probability of rehospitalization. We then used a multivariable regression model and published hospitalization data to estimate the cost savings and number of hospitalizations that could be prevented annually with additional provider visits to patients in the month following hospitalization. In the main cohort (n=26,613), one additional provider visit in the month following hospital discharge was estimated to reduce the absolute probability of 30-day hospital readmission by 3.5% (95% confidence interval, 1.6% to 5.3%). The reduction in 30-day hospital readmission ranged from 0.5% to 4.9% in an additional four cohorts tested, depending on population density around facilities, facility profit status, and patient Medicaid eligibility. At current Medicare reimbursement rates, the effort to visit patients one additional time in the month following hospital discharge could lead to 31,370 fewer hospitalizations per year, and $240 million per year saved. In conclusion, more frequent physician visits following hospital discharge are estimated to reduce rehospitalizations in patients undergoing hemodialysis. Incentives for closer outpatient monitoring following hospital discharge could lead to substantial cost savings.

Fenton, A., Jesky, M. D., Webster, R., et al. (2018). "Association between urinary free light chains and progression to end stage renal disease in chronic kidney disease." PLoS One **13**(5): e0197043.

BACKGROUND: Patients with chronic kidney disease (CKD) are at an increased risk of developing end-stage renal disease (ESRD). We assessed for the first time whether urinary free light chains (FLC) are independently associated with risk of ESRD in patients with CKD, and whether they offer incremental value in risk stratification. MATERIALS AND METHODS: We measured urinary FLCs in 556 patients with CKD from a prospective cohort study. The association between urinary kappa/creatinine (KCR) and lambda/creatinine (LCR) ratios and development of ESRD was assessed by competing-risks regression (to account for the competing risk of death). The change in C-statistic and integrated discrimination improvement were used to assess the incremental value of adding KCR or LCR to the Kidney Failure Risk Equation (KFRE). RESULTS: 136 participants developed ESRD during a median follow-up time of 51 months. Significant associations between KCR and LCR and risk of ESRD became non-significant after adjustment for estimated glomerular filtration rate (eGFR) and albumin/creatinine ratio (ACR), although having a KCR or LCR >75th centile remained independently associated with risk of ESRD.

Neither KCR nor LCR as continuous or categorical variables provided incremental value when added to the KFRE for estimating risk of ESRD at two years. CONCLUSIONS: Urinary FLCs have an association with progression to ESRD in patients with CKD which appears to be explained to a degree by their correlation with eGFR and ACR. Levels above the 75th centile do have an independent association with ESRD, but do not improve upon a current model for risk stratification.

Forni, L. G., Dawes, T., Sinclair, H., et al. (2013). "Identifying the patient at risk of acute kidney injury: a predictive scoring system for the development of acute kidney injury in acute medical patients." Nephron Clin Pract **123**(3-4): 143-150.

BACKGROUND: Acute kidney injury (AKI) in hospitalized patients has significant implications in terms of morbidity and mortality, length of hospital stay and associated costs. To date, no interventions are proven to prevent the development of AKI but this is hampered in part by the lack of early recognition of patients at risk. We aimed to determine whether a simple system could be devised from both physiological and demographic data in order to identify individuals at increased risk from the development of inpatient AKI. METHOD: Our observational, population-based single-centred study took place in an 870-bed associated university hospital. All patients admitted to the acute medical admissions unit on the Worthing site of the Western Sussex Hospitals Trust during the study period were included. RESULTS: Multivariate logistic regression analysis demonstrated that age, respiratory rate and disturbed consciousness together with a history of chronic kidney disease, diabetes mellitus, congestive cardiac failure and liver disease were associated with an increased risk of developing AKI within 7 days of admission. We derived a simple scoring system to identify acute medical patients at greater risk of developing AKI. CONCLUSIONS: The incidence of AKI complicating inpatient admissions remains high, however with the application of the derived AKI prediction score it is hoped that early recognition will translate to improved outcomes.

Griffin, K. A. (2017). "Hypertensive Kidney Injury and the Progression of Chronic Kidney Disease." Hypertension **70**(4): 687-694.

Gutierrez, O. M., Muntner, P., Rizk, D. V., et al. (2014). "Dietary patterns and risk of death and progression to ESRD in individuals with CKD: a cohort study." Am J Kidney Dis **64**(2): 204-213.

BACKGROUND: Nutrition is linked strongly with health outcomes in chronic kidney disease (CKD). However, few studies have examined relationships between dietary patterns and health outcomes in persons with CKD. STUDY DESIGN: Observational cohort study. SETTING & PARTICIPANTS: 3,972 participants with CKD (defined as estimated glomerular filtration rate < 60 mL/min/1.73 m2 or albumin-creatinine ratio >/= 30 mg/g at baseline) from the Reasons for Geographic and Racial Differences in Stroke (REGARDS) Study, a prospective cohort study of 30,239 black and white adults at least 45 years of age. PREDICTORS: 5 empirically derived dietary patterns identified by factor analysis: "convenience" (Chinese and Mexican foods, pizza, and other mixed dishes), "plant-based" (fruits and vegetables), "sweets/fats" (sugary foods), "Southern" (fried foods, organ meats, and sweetened beverages), and "alcohol/salads" (alcohol, green-leafy vegetables, and salad dressing). OUTCOMES: All-cause mortality and end-stage renal disease (ESRD). RESULTS: 816 deaths and 141 ESRD events were observed over approximately 6 years of follow-up. There were no statistically significant associations of convenience, sweets/fats, or alcohol/salads pattern scores with all-cause mortality after multivariable adjustment. In Cox regression models adjusted for sociodemographic factors, energy intake, comorbid conditions, and baseline kidney function, higher plant-based pattern scores (indicating greater consistency with the pattern) were associated with lower risk of mortality (HR comparing fourth to first quartile, 0.77; 95% CI, 0.61-0.97), whereas higher Southern pattern scores were associated with greater risk of mortality (HR comparing fourth to first quartile, 1.51; 95% CI, 1.19-1.92). There were no associations of dietary patterns with incident ESRD in multivariable-adjusted models. LIMITATIONS: Missing dietary pattern data, potential residual confounding from lifestyle factors. CONCLUSIONS: A Southern dietary pattern rich in processed and fried foods was associated independently with mortality in persons with CKD. In contrast, a diet rich in fruits and vegetables appeared to be protective.

Hagg-Holmberg, S., Thorn, L. M., Forsblom, C. M., et al. (2017). "Prognosis and Its Predictors After Incident Stroke in Patients With Type 1 Diabetes." Diabetes Care **40**(10): 1394-1400.

> OBJECTIVE: Although patients with type 1 diabetes have a poor prognosis after a stroke, predictors of survival after an incident stroke in these patients are poorly studied. RESEARCH DESIGN AND METHODS: In this observational study, a total of 144 patients of 4,083 with type 1 diabetes from the Finnish Diabetic Nephropathy (FinnDiane) Study suffered an incident stroke in 1997-2010, and were followed for a mean 3.4 +/- 3.1 years after the stroke. Information was recorded on hard cardiovascular events and death as a result of cardiovascular or diabetes-related cause, collectively referred to as vascular composite end point. Information was collected from medical records, death certificates, and the National Care Register of Health Care. Predictors at the time of the incident stroke were studied for the end points. RESULTS: During follow-up, 104 (72%) patients suffered a vascular composite end point. Of these, 33 (32%) had a recurrent stroke, 33 (32%) a hard cardiovascular event, and 76 (53%) died of cardiovascular or diabetes-related causes, with an overall 1-year survival of 76% and 5-year survival of 58%. The predictors of a vascular composite end point were hemorrhagic stroke subtype (hazard ratio 2.03 [95% CI 1.29-3.19]), as well as chronic kidney disease stage 2 (2.48 [1.17-5.24]), stage 3 (3.04 [1.54-6.04]), stage 4 (3.95 [1.72-9.04]), and stage 5 (6.71 [3.14-14.34]). All-cause mortality increased with deteriorating kidney function. CONCLUSIONS: Patients with type 1 diabetes with an incident stroke have a poor cardiovascular prognosis and a high risk of all-cause mortality. In particular, hemorrhagic stroke subtype and progression of diabetic kidney disease conveys worse outcome.

Hazzan, M., Frimat, M., Glowacki, F., et al. (2017). "[New scores in renal transplantation: How can we use them?]." Nephrol Ther **13 Suppl 1**: S131-s136.

> In renal transplant medicine, several scores have been recently developed in order to help decision-making in clinical practice. The aim of this update is to focus on these new scores that allow to better estimate the quality of the renal transplant, to refine the allocation policy, to help registration of old recipients on the waiting list, or to evaluate the risk to develop end-stage renal failure after living donation.

Hoerger, T. J., Simpson, S. A., Yarnoff, B. O., et al. (2015). "The future burden of CKD in the United States: a simulation model for the CDC CKD Initiative." Am J Kidney Dis **65**(3): 403-411.

> BACKGROUND: Awareness of chronic kidney disease (CKD), defined by kidney damage or reduced glomerular filtration rate, remains low in the United States, and few estimates of its future burden exist. STUDY DESIGN: We used the CKD Health Policy Model to simulate the residual lifetime incidence of CKD and project the prevalence of CKD in 2020 and 2030. The simulation sample was based on nationally representative data from the 1999 to 2010 National Health and Nutrition Examination Surveys. SETTING & POPULATION: Current US population. MODEL, PERSPECTIVE, & TIMELINE: Simulation model following up individuals from current age through death or age 90 years. OUTCOMES: Residual lifetime incidence represents the projected percentage of persons who will develop new CKD during their lifetimes. Future prevalence is projected for 2020 and 2030. MEASUREMENTS: Development and progression of CKD are based on annual decrements in estimated glomerular filtration rates that depend on age and risk factors. RESULTS: For US adults aged 30 to 49, 50 to 64, and 65 years or older with no CKD at baseline, the residual lifetime incidences of CKD are 54%, 52%, and 42%, respectively. The prevalence of CKD in adults 30 years or older is projected to increase from 13.2% currently to 14.4% in 2020 and 16.7% in 2030. LIMITATIONS: Due to limited data, our simulation model estimates are based on assumptions about annual decrements in estimated glomerular filtration rates. CONCLUSIONS: For an individual, lifetime risk of CKD is high, with more than half the US adults aged 30 to 64 years likely to develop CKD. Knowing the lifetime incidence of CKD may raise individuals' awareness and encourage them to take steps to prevent CKD. From a national burden perspective, we estimate that the population prevalence of CKD will increase in coming decades, suggesting that development of interventions to slow CKD onset and progression should be considered.

Hoshino, J., Nagai, K., Kai, H., et al. (2018). "A nationwide prospective cohort study of patients with advanced chronic kidney disease in Japan: The Reach-J CKD cohort study." Clin Exp Nephrol **22**(2): 309-317.

> BACKGROUND: Epidemiology and outcomes of Japanese patients with advanced chronic kidney disease (CKD)-an estimated glomerular filtration rate (eGFR) < 45 ml/min/1.73 m(2)-has remained largely unexamined. METHODS: We conducted a nationwide survey to determine the distribution of Japanese CKD patients, and are conducting a cohort study of these patients. A questionnaire eliciting details about facilities and their CKD practices was sent to all clinics/hospitals with nephrologists. Based on the survey results, we recruited 2400 advanced CKD patients receiving nephrologist care from at least 30 representative facilities throughout Japan, selected randomly with stratification by region and facility size. Through patient questionnaires and nephrologist-practice surveys aligned with the international CKD Outcomes and Practice Patterns Study (CKDopps), we shall annually or semi-annually collect patient, physician and clinic data prospectively, detailing CKD practices for 5 years, with a primary outcome of death or renal replacement therapy initiation, and secondary outcomes being decline of eGFR by 30% or 50%, CKD progression to CKD G5, or a cardiovascular event. RESULTS: Of 790 eligible, responding facilities, 330 (41.8%) treat >/=80 advanced CKD patients in the average 3-month period. Regional distribution of these facilities is similar to that of persons in the general population. Hence, the 30 facilities selected for data collection appear to be geographically representative in Japan. CONCLUSIONS: Our study will enhance understanding of various CKD practices and biological data associated with CKD progression, and allow international comparisons using the CKDopps platform. This will provide evidences to improve the health and quality of life for patients with advanced CKD.

Huang, Y., Cai, X., Zhang, J., et al. (2014). "Prehypertension and Incidence of ESRD: a systematic review and meta-analysis." Am J Kidney Dis **63**(1): 76-83.

> BACKGROUND: Studies of the association of prehypertension with the incidence of end-stage renal disease (ESRD) after adjusting for other cardiovascular risk factors have shown controversial results. STUDY DESIGN: Systematic review and meta-analysis of prospective cohort studies. SETTING & POPULATION: Adults with prehypertension. SELECTION CRITERIA FOR STUDIES: Studies evaluating the association of prehypertension with the incidence of ESRD identified by searches in PubMed, EMBASE, and Cochrane Library databases and conference proceedings, without language restriction. PREDICTOR: Prehypertension. OUTCOMES: The relative risks (RRs) of ESRD were calculated and reported with 95% CIs. Subgroup analyses were conducted according to blood pressure (BP), age, sex, ethnicity, and study characteristics. RESULTS: Data from 1,003,793 participants were derived from 6 prospective cohort studies. Compared with optimal BP, prehypertension significantly increased the risk of ESRD (RR, 1.59; 95% CI, 1.39-1.91). In subgroup analyses, prehypertension significantly predicted higher ESRD risk across age, sex, ethnicity, and study characteristics. Even low-range (BP, 120-129/80-84 mm Hg) prehypertension increased the risk of ESRD compared with optimal BP (RR, 1.44; 95% CI, 1.19-1.74), and the risk increased further with high-range (BP, 130-139/85-89 mm Hg) prehypertension (RR, 2.02; 95% CI, 1.70-2.40). The RR was significantly higher in the high-range compared with the low-range prehypertensive population (P = 0.01). LIMITATIONS: No access to individual patient-level data. CONCLUSIONS: Prehypertension is associated with incident ESRD. The increased risk is driven largely by high-range prehypertension.

Indridason, O. S., Thorsteinsdottir, I. et Palsson, R. (2007). "[Advances in detection, evaluation and management of chronic kidney disease]." Laeknabladid **93**(3): 201-207.

> The incidence of end-stage kidney failure has increased dramatically world-wide in recent decades. It is a disorder that carries high mortality and morbidity and its treatment is expensive. Increased emphasis has been placed on early detection in recent years in the hope that it may lead to preventive strategies. However, these efforts have been hampered by ambiguous disease definitions. Recent guidelines have defined chronic kidney disease (CKD) as glomerular filtration rate (GFR) less than 60 ml/min/1.73 m(2) and/or evidence of kidney damage by laboratory or imaging studies, of more than 3 months duration. Chronic kidney disease is divided into 5 stages based on renal function, where stage 1 is defined as normal GFR or above 90 ml/min/1.73 m(2), and stage 5 as GFR below 15 ml/min/1.73 m(2) which is consistent with end-stage kidney failure. The GFR can be measured directly but more

conveniently it is calculated based on serum creatinine using formulas that have been shown to be fairly accurate. Epidemiological studies employing the new definition have shown that the prevalence of CKD is 5-10% in Western countries, leading to its recognition as a major public health problem. It has also been demonstrated that CKD is associated with increased cardiovascular risk. This year the Clinical Biochemistry Laboratory at Landspitali University Hospital will begin reporting the estimated GFR along with the serum creatinine values. It is important that Icelandic physicians learn to use the estimated GFR in their daily practice to make the diagnosis and staging of CKD more effective. Hopefully this will lead to earlier detection and institution of therapy that may retard the development of end-stage kidney failure and decrease the associated cardiovascular risk.

Ishani, A., Xue, J. L., Himmelfarb, J., et al. (2009). "Acute kidney injury increases risk of ESRD among elderly." J Am Soc Nephrol **20**(1): 223-228.

Risk for ESRD among elderly patients with acute kidney injury (AKI) has not been studied in a large, representative sample. This study aimed to determine incidence rates and hazard ratios for developing ESRD in elderly individuals, with and without chronic kidney disease (CKD), who had AKI. In the 2000 5% random sample of Medicare beneficiaries, clinical conditions were identified using Medicare claims; ESRD treatment information was obtained from ESRD registration during 2 yr of follow-up. Our cohort of 233,803 patients were hospitalized in 2000, were aged > or = 67 yr on discharge, did not have previous ESRD or AKI, and were Medicare-entitled for > or = 2 yr before discharge. In this cohort, 3.1% survived to discharge with a diagnosis of AKI, and 5.3 per 1000 developed ESRD. Among patients who received treatment for ESRD, 25.2% had a previous history of AKI. After adjustment for age, gender, race, diabetes, and hypertension, the hazard ratio for developing ESRD was 41.2 (95% confidence interval [CI] 34.6 to 49.1) for patients with AKI and CKD relative to those without kidney disease, 13.0 (95% CI 10.6 to 16.0) for patients with AKI and without previous CKD, and 8.4 (95% CI 7.4 to 9.6) for patients with CKD and without AKI. In summary, elderly individuals with AKI, particularly those with previously diagnosed CKD, are at significantly increased risk for ESRD, suggesting that episodes of AKI may accelerate progression of renal disease.

Kainz, A., Hronsky, M., Stel, V. S., et al. (2015). "Prediction of prevalence of chronic kidney disease in diabetic patients in countries of the European Union up to 2025." Nephrol Dial Transplant **30 Suppl 4**: iv113-118.

BACKGROUND: Diabetes and chronic kidney disease (CKD) are a growing burden for health-care systems. The prevalence of diabetes has increased constantly during the last decade, although a slight flattening of end-stage renal disease as a result of diabetes has been observed recently in some European countries. In this study, we project the prevalence of CKD in patients with diabetes in European countries up to the year 2025. METHODS: We analysed the population with diabetes and development of nephropathy in 12 European countries, which we computed from models published previously and on data from the annual reports of the European Renal Association (1998-2011). The prevalence of CKD stage 5 in patients with diabetes up to the year 2025 was projected by the Lee-Carter algorithm. Those for stage 3 and 4 were then estimated by applying the same ratios of CKD prevalences as estimated in the Austrian population with diabetic nephropathy. RESULTS: The estimated prevalence of CKD in patients with diabetes is expected to increase in all 12 countries up to the year 2025. For CKD stage 3, we estimate for Austria in 2025 a prevalence of 215 000 per million diabetic population (p.m.p.) (95% confidence interval 169 000, 275 000), for CKD4 18 600 p.m.p. (14 500, 23 700) and for CKD5 6900 p.m.p. (5400, 8900). The median prevalence in the considered countries is 132 900 p.m.p. (IQR: 118 500, 195 800), 11 500 (10 200, 16 900) and 4300 (3800, 6300) for CKD stages 3, 4 and 5, respectively. Altogether, these data predict in the years 2012-25 an annual increase of 3.2% in the prevalence of diabetic CKD stage 5. CONCLUSIONS: Due to the increase in prevalence of diabetes and CKD5, the costs of renal therapy are expected to rise. We believe that these data may help health-care policy makers to make informed decisions.

Kaushal, A., Naimark, D. et Tangri, N. (2015). "Use of the Kidney Failure Risk Equation to reduce uncertainty in predicting time to ESRD." Am J Kidney Dis **65**(3): 369-371.

Khan, U. A., Garg, A. X., Parikh, C. R., et al. (2013). "Prevention of chronic kidney disease and subsequent effect on mortality: a systematic review and meta-analysis." PLoS One **8**(8): e71784.

> OBJECTIVES: To perform a systematic review of randomized controlled trials to determine whether prevention or slowing of progression of chronic kidney disease would translate into improved mortality, and if so, the attributable risk due to CKD itself on mortality. BACKGROUND: CKD is associated with increased mortality. This association is largely based on evidence from the observational studies and evidence from randomized controlled trials is lacking. METHODS: We searched Ovid, Medline and Embase for RCTs in which an intervention was given to prevent or slow the progression of CKD and mortality was reported as primary, secondary or adverse outcomes were eligible and selected. For the first phase, pooled relative risks for renal endpoints were assessed. For the second phase, we assessed the effect on mortality in trials of interventions that definitively reduced CKD endpoints. RESULTS: Among 52 studies selected in first phase, only renin-angiotensin-aldosterone-system blockade vs. placebo (n = 18 trials, 32,557 participants) met the efficacy criteria for further analysis in the second phase by reducing renal endpoints 15 to 27% compared to placebo. There was no difference in all-cause mortality (RR 0.99, 95% CI 0.92 to 1.08) or CV death (RR 0.97, 95% CI 0.78 to 1.21) between the treatment and control groups in these trials. There was sufficient statistical power to detect a 9% relative risk reduction in all-cause mortality and a 14% relative risk reduction in cardiovascular mortality. CONCLUSIONS: Firm evidence is lacking that prevention of CKD translates into reductions in mortality. Larger trials with longer follow-up time are needed to determine the benefit of CKD prevention on survival.

Lafrance, J. P. et Miller, D. R. (2010). "Defining acute kidney injury in database studies: the effects of varying the baseline kidney function assessment period and considering CKD status." Am J Kidney Dis **56**(4): 651-660.

> BACKGROUND: Existing acute kidney injury (AKI) definitions are not well adapted for database studies, leading to a great variety of methods used in research. Variations in time before hospitalization used to assess baseline kidney function when identifying episodes of AKI may lead to different case samples and mortality risks in database studies, but the magnitude of these effects is not known. STUDY DESIGN: A retrospective cohort study. SETTINGS & PARTICIPANTS: 1,126,636 veterans hospitalized at least once within the US Department of Veterans Affairs health care system between 2000 and 2005. PREDICTOR: AKI was defined by comparing (using ratio [>/=1.5] or difference [increase of 0.3-0.5 mg/dL]) the highest serum creatinine level during hospitalization with the lowest level during 4 different baseline assessment periods (in-hospital only and 3, 6, or 12 months preadmission). OUTCOMES & MEASUREMENTS: In-hospital mortality risk was estimated using multivariable logistic regression models. RESULTS: Using the ratio definition, the cumulative incidence of AKI ranged from 12.5% (in-hospital only) to 18.3% (12 months preadmission). Newly added cases had milder AKI and lower mortality risk. The discriminative power increased slightly (C statistic increased from 0.846 to 0.855; P = 0.001) by extending the baseline period to at least 3 months. Both the ratio and difference definitions did not perform well in patients with chronic kidney disease stages 4 and 5. LIMITATIONS: Possibility of residual confounding and under-representation of women (4.5%). CONCLUSIONS: Many additional AKI cases may be identified by extending the baseline assessment period; however, added cases may be less severe with lower mortality risk. The relative strengths of these biases and combined effects of reducing misclassification (identification of more AKI cases) and increasing risk dilution (identifying milder cases) may vary across populations. Consensus regarding how baseline kidney function should be determined in database studies should be reached.

Lee, C. F., Lin, C. L., Lin, M. C., et al. (2014). "Surgical treatment for patients with periodontal disease reduces risk of end-stage renal disease: a nationwide population-based retrospective cohort study." J Periodontol **85**(1): 50-56.

> BACKGROUND: The association between periodontal disease treatment and end-stage renal disease (ESRD) remains unclear. This study aims to determine whether surgical periodontal treatment reduces ESRD risk. METHODS: From the insurance claims data of patients with periodontal disease who were free of ESRD from 1997 to 2009, 35,496 patients were identified who underwent surgery for subgingival curettage and/or periodontal flap and are considered the treatment cohort. For comparison, 141,824 patients who did not undergo these treatments were considered the no-treatment cohort. Follow-ups were performed until the end of 2009 to estimate the incidence and risk of ESRD in these two cohorts. Cox proportional hazard regression was used to estimate the related

hazard ratio (HR) and 95% confidence interval (CI) of ESRD. RESULTS: The incidence of ESRD was lower in the treatment cohort than in the no-treatment cohort (4.66 versus 7.38 per 10,000 person-years), with an adjusted HR of 0.59 (95% CI = 0.46 to 0.75). Sex- and age-specific analysis showed that the incidence rate ratio of the treatment cohort to the no-treatment cohort was higher for women than for men and declined with age. The risks of ESRD were consistently lower in the treatment cohort even when compared by comorbidity. CONCLUSIONS: Patients with periodontal disease who undergo procedures for subgingival curettage and/or periodontal flap have a remarkably decreased risk of ESRD.

Levin, A., Tonelli, M., Bonventre, J., et al. (2017). "Global kidney health 2017 and beyond: a roadmap for closing gaps in care, research, and policy." Lancet **390**(10105): 1888-1917.

The global nephrology community recognises the need for a cohesive plan to address the problem of chronic kidney disease (CKD). In July, 2016, the International Society of Nephrology hosted a CKD summit of more than 85 people with diverse expertise and professional backgrounds from around the globe. The purpose was to identify and prioritise key activities for the next 5-10 years in the domains of clinical care, research, and advocacy and to create an action plan and performance framework based on ten themes: strengthen CKD surveillance; tackle major risk factors for CKD; reduce acute kidney injury-a special risk factor for CKD; enhance understanding of the genetic causes of CKD; establish better diagnostic methods in CKD; improve understanding of the natural course of CKD; assess and implement established treatment options in patients with CKD; improve management of symptoms and complications of CKD; develop novel therapeutic interventions to slow CKD progression and reduce CKD complications; and increase the quantity and quality of clinical trials in CKD. Each group produced a prioritised list of goals, activities, and a set of key deliverable objectives for each of the themes. The intended users of this action plan are clinicians, patients, scientists, industry partners, governments, and advocacy organisations. Implementation of this integrated comprehensive plan will benefit people who are at risk for or affected by CKD worldwide.

Liu, X., Zhai, T., Ma, R., et al. (2018). "Effects of uric acid-lowering therapy on the progression of chronic kidney disease: a systematic review and meta-analysis." Ren Fail **40**(1): 289-297.

OBJECTIVES: Whether uric acid levels were associated with the progression of chronic kidney disease (CKD) remained controversial. This meta-analysis was aimed to assess the effect of lowering serum uric acid therapy on the progression of CKD to clarify the role of uric acid in the progression of CKD indirectly. METHODS: Pubmed, Embase, the Cochrane library, CBM were searched for randomized controlled trials (RCTs) that assessed the efficiency of lowering serum uric acid therapy on the progression of CKD without language restriction. Summary estimates of weighted mean differences (WMDs) and relative risk (RR) were obtained by using random-effect or fixed-effect models. Sensitivity analyses were performed to identify the source of heterogeneity. RESULTS: A total of 12 randomized controlled trials with 832 CKD participants were included in the analysis. Pooled estimate for eGFR was in favor of lowering serum uric acid therapy with a mean difference (MD) of 3.88 ml/min/1.73 m(2), 95% CI 1.26-6.49 ml/min/1.73 m(2), p = .004 and this was consistent with results for serum creatinine. The risk of worsening of kidney function or ESRD or death was significantly decreased in the treatment group compared to the control group (RR 0.39, 95% CI 0.28-0.52, p< .01). CONCLUSIONS: Uric acid-lowering therapy may be effective in retarding the progression of CKD. Further randomized controlled trials should be performed to confirm the effect of lowering serum uric acid therapy on the progression of CKD.

Longenecker, J. C., Estrella, M. M., Segev, D. L., et al. (2015). "Patterns of Kidney Function Before and After Orthotopic Liver Transplant: Associations With Length of Hospital Stay, Progression to End-Stage Renal Disease, and Mortality." Transplantation **99**(12): 2556-2564.

BACKGROUND: In the context of orthotopic liver transplantation (OLT), renal dysfunction is used as a criterion for simultaneous liver-kidney transplantation. Changes in glomerular filtration rate (GFR) the year before and after OLT have not been well defined. METHODS: In a cohort of 416 OLT patients from 1996 to 2009, estimated GFR (eGFR) was assessed during the 12 months before OLT (period A), at time of OLT (period B), and the 12 months after OLT (period C). Outcomes included progression to end stage renal disease (ESRD), length of stay, and mortality. RESULTS: The overall rate of progression to ESRD over 15 years of follow-up was 0.155/person-year and was strongly associated with eGFR <60 (hazard ratio [HR] = 2.7; P < 0.001), diabetes (HR = 2.6; P < 0.001), and with a combination of the 2 (HR = 5.5; P < 0.0001). Mean eGFR decreased from period A (86 mL/min per 1.73 m) to period B (77; P < 0.001) to period C (71; P < 0.001), with similar decreases in eGFR across subgroups of clinical variables. Patients with eGFR less than 60 mL/min per 1.73 m at OLT had acute and large decreases in eGFR from periods A to B, then increases to period C. Length of stay was associated with eGFR at OLT, hepatorenal syndrome, dialysis requirement, model for end-stage liver disease score, and alcoholic liver disease. Twelve-month mortality was strongly associated with time-dependent change in eGFR, hepatorenal syndrome, dialysis requirement, hepatitis C, and model for end-stage liver disease era transplantation but was not associated with eGFR at OLT. CONCLUSIONS: Among OLT patients, renal function worsened in all subgroups from before to after OLT, but the association of progression to ESRD was particularly high among patients with both diabetes and eGFR less than 60 at the time of OLT. This suggests that diabetes could be considered as a criterion when making decisions regarding simultaneous liver-kidney transplantation.

Lopez-Vargas, P. A., Tong, A., Sureshkumar, P., et al. (2013). "Prevention, detection and management of early chronic kidney disease: a systematic review of clinical practice guidelines." Nephrology (Carlton) **18**(9): 592-604.

AIM: In response to the increase in Chronic Kidney Disease (CKD) worldwide, several professional organizations have developed clinical practice guidelines to manage and prevent its progression. This study aims to compare the scope, content and consistency of published guidelines on CKD stages I-III. METHODS: Electronic databases of the medical literature, guideline organizations, and the websites of nephrology societies were searched to November 2011. The Appraisal of Guidelines for Research and Evaluation (AGREE) II instrument and textual synthesis was used to appraise and compare recommendations. RESULTS: One consensus statement and 15 guidelines were identified and included. Methodological rigour across guidelines was variable, with average domain scores ranging from 24% to 95%. For detection of CKD, all guidelines recommended estimated glomerular filtration rate measurement, some also recommended serum creatinine and dipstick urinalysis. The recommended protein and albumin creatinine ratios and proteinuria definition thresholds varied (>150-300 mg/day to >500 mg/day). Blood pressure targets ranged (<125/75 to <140/90 mmHg). Angiotensin converting enzyme inhibitor and angiotensin receptor blockers were recommended for hypertension, as combined or as monotherapy. Protein intake recommendations varied (no restriction or 0.75 g/kg per day-1.0 g/kg per day). Salt intake of 6 g/day was recommended by most. Psychosocial support and education were recommended by few but specific strategies were absent. CONCLUSION: CKD guidelines were consistent in scope but were variable with respect to their recommendations, coverage and methodological quality. To promote effective primary and secondary prevention of CKD, regularly updated guidelines that are based on the best available evidence and augmented with healthcare context-specific strategies for implementation are warranted.

Mahdavi-Mazdeh, M., Hatmi, Z. N. et Shahpari-Niri, S. (2012). "Does a medical management program for CKD patients postpone renal replacement therapy and mortality? A 5-year-cohort study." BMC Nephrol **13**: 138.

BACKGROUND: Many countries have started screening and prevention programs for chronic kidney disease (CKD). However, one of the main concerns of health authorities is whether management strategies for diagnosed CKD patients can decrease mortality or morbidity. This study aimed to investigate the effect of two competing clinical strategies of treatments under nephrologists' supervision compared with no treatment on the frequency of the need to start renal replacement therapy (RRT) and mortality in CKD patients. METHODS: Our cohort comprised consecutive newly diagnosed patients with CKD in an outpatient clinic in Tehran between October 2002 and October 2011. CKD Patient enrollment occurred if two criteria of high plasma creatinine level and chronicity of renal disease by at least 3 months of clinical history or small sized kidneys in ultrasound findings were met. Demographic data and time of RRT or mortality in patients who had been followed up regularly were compared with those in the control group. The control group included those patients who did not attend a nephrology clinic to receive CKD management package for at least 1 year during the study period. RESULTS: The cohort included 76 patients in the control group and 389 patients in the supervised group. The mean age of the patients was 61.33+/-14.9 years (16-95 years). The ratio of males/females was 1.47 (277/188). The mean follow-up in the control and supervised groups was 33.29+/-20.50 (7-111) and 36.03+/-25.24 (6-124) months , respectively, and the total patient years of follow-up was 1382.3. A substantial number of patients survived without RRT until the first year of follow up (96%) in both groups, but afterward, those in the control group had more deaths or need to start RRT in comparison with those who received medical advice (20 vs. 67 months; p= 0.029). This cohort also showed a higher survival and a longer time to show a GFR of less than 15 cc/min (84 vs 34 months, p<0.0001) in patients who had been under physician supervision compared with the control group. CONCLUSIONS: Active follow-up of CKD patients appears to significantly decrease the risk of death or progression to end-stage renal disease and the requirement to start renal replacement therapy.

Martinez-Ramirez, H. R., Cortes-Sanabria, L., Rojas-Campos, E., et al. (2013). "Multidisciplinary strategies in the management of early chronic kidney disease." Arch Med Res **44**(8): 611-615.

Chronic kidney disease (CKD) is a worldwide epidemic especially in developing countries, with clear deficiencies in identification and treatment. Better care of CKD requires more than only economic resources, utilization of health research in policy-making and health systems changes that produce better outcomes. A multidisciplinary approach may facilitate and improve management of patients from early CKD in the primary health-care setting. This approach is a strategy for improving comprehensive care, initiating and maintaining healthy behaviors, promoting teamwork, eliminating barriers to achieve goals and improving the processes of care. A multidisciplinary intervention may include educational processes guided by health professional, use of self-help groups and the development of a CKD management plan. The complex and fragmented care management of patients with CKD, associated with poor outcome, enhances the importance of implementing a multidisciplinary approach in the management of this disease from the early stages. Multidisciplinary strategies should focus on the needs of patients (to increase their empowerment) and should be adapted to the resources and health systems prevailing in each country; its systematic implementation can help to improve patient care and slow the progression of CKD.

Merkin, S. S., Diez Roux, A. V., Coresh, J., et al. (2007). "Individual and neighborhood socioeconomic status and progressive chronic kidney disease in an elderly population: The Cardiovascular Health Study." Soc Sci Med **65**(4): 809-821.

Few studies have focused on the association between socioeconomic status (SES) and progressive chronic kidney disease (pCKD) in an elderly population. We conducted a cohort study of 4735 Cardiovascular Health Study participants, ages 65 and older and living in 4 US communities, to examine the independent risk of pCKD associated with income, education and living in a low SES area. pCKD was defined as creatinine elevation 0.4 mg/dL (35 micromol/L) over a 4-7 year follow-up or CKD hospitalization. Area SES was characterized using measures of income, wealth, education and occupation for 1990 (corresponding to time of enrollment) US Census block groups of residence. Age and study site-adjusted incidence rates (per 1000 person years) of pCKD by quartiles of area-level SES score, income and education showed decreasing rates with increasing SES. Cox proportional hazards models showed that living in the lowest SES area quartile, as opposed to the highest, was associated with 50% greater risk of pCKD, after adjusting for age, gender, study site, baseline creatinine, and individual-level SES. This increased risk and trend persisted after adjusting for lifestyle risk factors, diabetes and hypertension. We found no significant independent associations between pCKD and individual-level income or education (after adjusting for all other SES factors). As such, living in a low SES area is associated with greater risk of pCKD in an elderly US population.

Mise, K., Imamura, M., Yamaguchi, S., et al. (2018). "Identification of Novel Urinary Biomarkers for Predicting Renal Prognosis in Patients With Type 2 Diabetes by Glycan Profiling in a Multicenter Prospective Cohort Study: U-CARE Study 1." Diabetes Care **41**(8): 1765-1775.

OBJECTIVE: Because quantifying glycans with complex structures is technically challenging, little is known about the association of glycosylation profiles with the renal prognosis in diabetic kidney disease (DKD). RESEARCH DESIGN AND METHODS: In 675 patients with type 2 diabetes, we assessed the baseline urinary glycan signals binding to 45 lectins with different specificities. The end point was a decrease of estimated glomerular filtration rate (eGFR) by >/=30% from baseline or dialysis for end-stage renal disease. RESULTS: During a median follow-up of 4.0 years, 63 patients reached the end point. Cox proportional hazards analysis revealed that urinary levels of glycans binding to six lectins were significantly associated with the outcome after adjustment for known indicators of DKD, although these urinary glycans, except that for DBA, were highly correlated with baseline albuminuria and eGFR. Hazard ratios for these lectins were (+1 SD for the glycan index) as follows: SNA (recognizing glycan Siaalpha2-6Gal/GalNAc), 1.42 (95% CI 1.14-1.76); RCA120 (Galbeta4GlcNAc), 1.28 (1.01-1.64); DBA (GalNAcalpha3GalNAc), 0.80 (0.64-0.997); ABA (Galbeta3GalNAc), 1.29 (1.02-1.64); Jacalin (Galbeta3GalNAc), 1.30 (1.02-1.67); and ACA (Galbeta3GalNAc), 1.32 (1.04-1.67). Adding these glycan indexes to a model containing known indicators of progression improved prediction of the outcome (net reclassification improvement increased by 0.51 [0.22-0.80], relative integrated discrimination improvement increased by 0.18 [0.01-0.35], and the Akaike information criterion decreased from 296 to 287). CONCLUSIONS: The urinary glycan profile identified in this study may be useful for predicting renal prognosis in patients with type 2 diabetes. Additional investigation of glycosylation changes and urinary glycan excretion in DKD is needed.

Morton, R. L., Schlackow, I., Mihaylova, B., et al. (2016). "The impact of social disadvantage in moderate-to-severe chronic kidney disease: an equity-focused systematic review." Nephrol Dial Transplant **31**(1): 46-56.

It is unclear whether a social gradient in health outcomes exists for people with moderate-to-severe chronic kidney disease (CKD). We critically review the literature for evidence of social gradients in health and investigate the 'suitability' of statistical analyses in the primary studies. In this equity-focused systematic review among adults with moderate-to-severe CKD, factors of disadvantage included gender, race/ethnicity, religion, education, socio-economic status or social capital, occupation and place of residence. Outcomes included access to healthcare, kidney disease progression, cardiovascular events, all-cause mortality and suitability of analyses. Twenty-four studies in the pre-dialysis population and 34 in the dialysis population representing 8.9 million people from 10 countries were included. In methodologically suitable studies among pre-dialysis patients, a significant social gradient was observed in access to healthcare for those with no health insurance and no home ownership. Low income and no home ownership were associated with higher cardiovascular event rates and higher mortality [HR 1.94, 95% confidence interval (CI) 1.27-2.98; HR 1.28, 95% CI 1.04-1.58], respectively. In methodologically suitable studies among dialysis patients, females, ethnic minorities, those with low education, no health insurance, low occupational level or no home ownership were significantly less likely to access cardiovascular healthcare than their more advantaged dialysis counterparts. Low education level and geographic remoteness were associated with higher cardiovascular event rates and higher mortality (HR 1.54, 95% CI 1.01-2.35; HR 1.21, 95% CI 1.08-1.37), respectively. Socially disadvantaged pre-dialysis and dialysis patients experience poorer access to specialist cardiovascular health services, and higher rates of cardiovascular events and mortality than their more advantaged counterparts.

Morton, R. L., Schlackow, I., Staplin, N., et al. (2016). "Impact of Educational Attainment on Health Outcomes in Moderate to Severe CKD." Am J Kidney Dis **67**(1): 31-39.

BACKGROUND: The inverse association between educational attainment and mortality is well established, but its relevance to vascular events and renal progression in a population with chronic kidney disease (CKD) is less clear. This study aims to determine the association between highest educational attainment and risk of vascular events, cause-specific mortality, and CKD progression. STUDY DESIGN: Prospective epidemiologic analysis among participants in the Study of Heart and Renal Protection (SHARP), a randomized controlled trial. SETTING & PARTICIPANTS: 9,270 adults with moderate to severe CKD (6,245 not receiving dialysis at baseline) and no history of myocardial infarction or coronary revascularization recruited in Europe, North America, Asia, Australia, and New Zealand. PREDICTOR: Highest educational attainment measured at study entry using 6 levels that ranged from "no formal education" to "tertiary education." OUTCOMES: Any vascular event (any fatal or nonfatal cardiac, cerebrovascular, or peripheral vascular event), cause-specific mortality, and CKD progression during 4.9 years' median follow-up. RESULTS: There was a significant trend (P<0.001) toward increased vascular risk with decreasing levels of education. Participants with no formal education were at a 46% higher risk of vascular events (relative risk [RR], 1.46; 95% CI, 1.14-1.86) compared with participants with tertiary education. The trend for mortality across education levels was also significant (P<0.001): all-cause mortality was twice as high among those with no formal education compared with tertiary-educated individuals (RR, 2.05; 95% CI, 1.62-2.58), and significant increases were seen for both vascular (RR, 1.84; 95% CI, 1.21-2.81) and nonvascular (RR, 2.15; 95% CI, 1.60-2.89) deaths. Lifestyle factors and prior disease explain most of the excess mortality risk. Among 6,245 participants not receiving dialysis at baseline, education level was not significantly associated with progression to end-stage renal disease or doubling of creatinine level (P for trend = 0.4). LIMITATIONS: No data for employment or health insurance coverage. CONCLUSIONS: Lower educational attainment is associated with increased risk of adverse health outcomes in individuals with CKD.

Nicholas, S. B., Kalantar-Zadeh, K. et Norris, K. C. (2015). "Socioeconomic disparities in chronic kidney disease." Adv Chronic Kidney Dis **22**(1): 6-15.

CKD is a national public health problem that afflicts persons of all segments of society. Although racial/ethnic disparities in advanced CKD including dialysis-dependent populations have been well established, the finding of differences in CKD incidence, prevalence, and progression across different socioeconomic groups and racial and ethnic strata has only recently started to receive significant attention. Socioeconomics may exert both interdependent and independent effects on CKD and its complications and may confound racial and ethnic disparities. Socioeconomic constellations influence not only access to quality care for CKD risk factors and CKD treatment but may mediate many of the cultural and environmental determinants of health that are becoming more widely recognized as affecting complex medical disorders. In this article, we have reviewed the available literature pertaining to the role of socioeconomic status and economic factors in both non-dialysis-dependent CKD and ESRD. Advancing our understanding of the role of socioeconomic factors in patients with or at risk for CKD can lead to improved strategies for disease prevention and management.

Norouzi, J., Yadollahpour, A., Mirbagheri, S. A., et al. (2016). "Predicting Renal Failure Progression in Chronic Kidney Disease Using Integrated Intelligent Fuzzy Expert System." Comput Math Methods Med **2016**: 6080814.

BACKGROUND: Chronic kidney disease (CKD) is a covert disease. Accurate prediction of CKD progression over time is necessary for reducing its costs and mortality rates. The present study proposes an adaptive neurofuzzy inference system (ANFIS) for predicting the renal failure timeframe of CKD based on real clinical data. METHODS: This study used 10-year clinical records of newly diagnosed CKD patients. The threshold value of 15 cc/kg/min/1.73 m(2) of glomerular filtration rate (GFR) was used as the marker of renal failure. A Takagi-Sugeno type ANFIS model was used to predict GFR values. Variables of age, sex, weight, underlying diseases, diastolic blood pressure, creatinine, calcium, phosphorus, uric acid, and GFR were initially selected for the predicting model. RESULTS: Weight, diastolic blood pressure, diabetes mellitus as underlying disease, and current GFR(t) showed significant correlation with GFRs and were selected as the inputs of model. The comparisons of the predicted values with the real data showed that the ANFIS model could accurately estimate GFR variations in all sequential periods (Normalized Mean Absolute Error lower than 5%). CONCLUSIONS: Despite the high uncertainties of human body and dynamic nature of CKD progression, our model can accurately predict the GFR variations at long future periods.

Orskov, B., Romming Sorensen, V., Feldt-Rasmussen, B., et al. (2010). "Improved prognosis in patients with autosomal dominant polycystic kidney disease in Denmark." Clin J Am Soc Nephrol **5**(11): 2034-2039.

BACKGROUND AND OBJECTIVES: The introduction of new therapies, including agents that block the renin-angiotensin system, may have affected progression of autosomal dominant polycystic kidney disease (ADPKD). We investigated whether the age when reaching ESRD and survival during renal replacement therapy in Danish patients with ADPKD changed from January 1, 1990, through December 31, 2007. DESIGN, SETTING, PARTICIPANTS, & MEASUREMENTS: According to the Danish National Registry on Regular Dialysis and Transplantation, 693 patients with ADPKD reached ESRD in the study period. The 18 years were divided into three consecutive 6-year intervals. RESULTS: The incidence of reaching ESRD for patients with ADPKD increased from 6.45 per million people in 1990 through 1995 to 7.59 per million people in 2002 through 2007, and the mean age at onset of ESRD increased by 4.7 years. The age-adjusted male-to-female ratio for onset of ESRD changed from 1.6 to 1.1, indicating a trend toward similar progression in both genders. From onset of ESRD, a Cox regression analysis to compare the first and second 6-year intervals, adjusted for age, gender, and treatment modality, showed that patient survival improved by 38%. Although NS, a similar trend was found during the second and third time intervals. CONCLUSIONS: This study demonstrates that in Danish patients with ADPKD, the prognosis had significantly improved during the study period. Furthermore, the results indicate that male gender may be losing its importance as a risk factor for progression in ADPKD.

Porter, A. C., Lash, J. P., Xie, D., et al. (2016). "Predictors and Outcomes of Health-Related Quality of Life in Adults with CKD." Clin J Am Soc Nephrol **11**(7): 1154-1162.

BACKGROUND AND OBJECTIVES: Low health-related quality of life is associated with increased mortality in patients with ESRD. However, little is known about demographic and clinical factors associated with health-related quality of life or its effect on outcomes in adults with CKD. DESIGN, SETTINGS, PARTICIPANTS, & MEASUREMENTS: Data from 3837 adult participants with mild to severe CKD enrolled in the prospective observational Chronic Renal Insufficiency Cohort and Hispanic Chronic Renal Insufficiency Cohort Studies were analyzed. Health-related quality of life was assessed at baseline with the Kidney Disease Quality of Life-36 and its five subscales: mental component summary, physical component summary, burden of kidney disease (burden), effects of kidney disease (effects), and symptoms and problems of kidney disease (symptoms). Low health-related quality of life was defined as baseline score >1 SD below the mean. Using Cox proportional hazards analysis, the relationships between low health-related quality of life and the following outcomes were examined: (1) CKD progression (50% eGFR loss or incident ESRD), (2) incident cardiovascular events, and (3) all-cause death. RESULTS: Younger age, women, low education, diabetes, vascular disease, congestive heart failure, obesity, and lower eGFR were associated with low baseline health-related quality of life ($P<0.05$). During a median follow-up of 6.2 years, there were 1055 CKD progression events, 841 cardiovascular events, and 694 deaths. Significantly higher crude rates of CKD progression, incident cardiovascular events, and all-cause death were observed among participants with low health-related quality of life in all subscales ($P<0.05$). In fully adjusted models, low physical component summary, effects, and symptoms subscales were independently associated with a higher risk of incident cardiovascular events and death, whereas low mental component summary was independently associated with a higher risk of death ($P<0.05$). Low health-related quality of life was not associated with CKD progression. CONCLUSIONS: Low health-related quality of life across several subscales was independently associated with a higher risk of incident cardiovascular events and death but not associated with CKD progression.

Rahman, M., Xie, D., Feldman, H. I., et al. (2014). "Association between chronic kidney disease progression and cardiovascular disease: results from the CRIC Study." Am J Nephrol **40**(5): 399-407.

BACKGROUND AND AIMS: There is limited information on the risk of progression of chronic kidney disease (CKD) among individuals with CVD (cardiovascular disease). We studied the association between prevalent CVD and the risk of progression of CKD among persons enrolled in a long-term observational study. METHODS: A prospective cohort study of 3,939 women and men with CKD enrolled in the chronic renal insufficiency cohort (CRIC) study between June 2003 and June 2008. Prevalent cardiovascular disease (myocardial infarction/revascularization, heart failure, stroke, and peripheral vascular disease) was determined by self-report at baseline. The primary outcome was a composite of either end-stage renal disease or a 50% decline in estimated glomerular filtration rate (eGFR) from baseline. RESULTS: One-third (1,316 of 3,939, 33.4%) of the study participants reported a history of any cardiovascular disease, and 9.6% (n = 382) a history of heart failure at baseline. After a median follow up of 6.63 years, 1,028 patients experienced the primary outcome. The composite of any CVD at baseline was not independently associated with the primary outcome (Hazard Ratio 1.04 95% CI (0.91, 1.19)). However, a history of heart failure was independently associated with a 29% higher risk of the primary outcome (Hazard Ratio 1.29 95% CI (1.06, 1.57)). The relationship between heart failure and risk of CKD progression was consistent in subgroups defined by age, race, gender, baseline eGFR, and diabetes. Neither the composite measure of any CVD or heart failure was associated with the rate of decline in eGFR. CONCLUSIONS: Self-reported heart failure was an independent risk factor for the development of the endpoint of ESRD or 50% decline in GFR in a cohort of patients with chronic kidney disease.

Remuzzi, G., Perico, N., Macia, M., et al. (2005). "The role of renin-angiotensin-aldosterone system in the progression of chronic kidney disease." Kidney Int Suppl(99): S57-65.

The renin-angiotensin-aldosterone system (RAAS) is a well known regulator of blood pressure (BP) and determinant of target-organ damage. It controls fluid and electrolyte balance through coordinated effects on the heart, blood vessels, and Kidneys. Angiotensin II (AII) is the main effector of the RAAS and exerts its vasoconstrictor effect predominantly on the postglomerular arterioles, thereby increasing the glomerular hydraulic pressure and the ultrafiltration of plasma proteins, effects that may contribute to the onset and progression of chronic renal damage. AII may also directly contribute to accelerate renal damage by sustaining cell growth, inflammation, and fibrosis. Interventions that inhibit the activity of the RAAS are renoprotective and may slow or even halt the progression of chronic nephropathies. ACE inhibitors and angiotensin II receptor antagonists can be used in combination to maximize RAAS inhibition and more effectively reduce proteinuria and GFR decline in diabetic and nondiabetic renal disease. Recent evidence suggests that add-on therapy with an aldosterone antagonist may further increase renoprotection, but may also enhance the risk hyperkalemia. Maximized RAAS inhibition, combined with intensified blood pressure control (and metabolic control in diabetics) and amelioration of dyslipidemia in a multimodal approach including lifestyle modifications (Remission Clinic), may achieve remission of proteinuria and renal function stabilization in a substantial proportion of patients with proteinuric renal disease. Ongoing studies will tell whether novel drugs inhibiting the RAAS, such as the renin inhibitors or the vasopeptidase inhibitors, may offer additional benefits to those who do not respond, or only partially respond, to this multimodal regimen.

Rucci, P., Mandreoli, M., Gibertoni, D., et al. (2014). "A clinical stratification tool for chronic kidney disease progression rate based on classification tree analysis." Nephrol Dial Transplant **29**(3): 603-610.

BACKGROUND: Registry-based studies have identified risk factors for chronic kidney disease (CKD) and for progression to end-stage renal disease. However, usually, these studies do not incorporate sequential measurements of kidney function and provide little information on the prognosis of individual patients. The aim of this study is to identify which combinations of demographic and clinical characteristics are useful to discriminate patients with a differential annual decline in glomerular filtration rate (GFR). METHODS: This observational retrospective study includes patients enlisted in the registry of the Prevention of Progressive Renal Insufficiency Project of Emilia-Romagna region (Italy) from July 2004 to June 2010, with at least four serum creatinine measurements. Classification tree analysis (CTA) was used to identify subgroups of patients with a different annual GFR decline using demographic and laboratory data collected at study entry. RESULTS: The CTA procedure generated seven mutually exclusive groups. Among patients with proteinuria, those with a baseline estimated GFR (eGFR) of >33 mL/min/1.73 m(2) exhibited the fastest illness progression in the study population (-3.655 mL/min/1.73 m(2)), followed by patients with a baseline eGFR of <33 mL/min/1.73 m(2) and a baseline serum phosphorus of >4.3 mg/dL (-2.833 mL/min/1.73 m(2)). Among patients without proteinuria, those aged <67 years exhibited a significantly faster progression, which was even faster for the subgroup with diabetes. Among patients aged >67 years, females had on average a stable eGFR over time, with a large variability. CONCLUSIONS: It is possible to rely on a few variables typically accessible in routine clinical practice to stratify patients with a different CKD progression rate. Stratification can be used to guide decisions about the follow-up schedule, treatments to slow progression of kidney disease, prevent its complications and to begin planning for dialysis and transplantation.

Schulman, G., Berl, T., Beck, G. J., et al. (2018). "Risk factors for progression of chronic kidney disease in the EPPIC trials and the effect of AST-120." Clin Exp Nephrol **22**(2): 299-308.

BACKGROUND: Two randomized, double-blind, placebo-controlled trials (EPPIC-1 and EPPIC-2) investigated the efficacy and safety of AST-120, an oral spherical carbon adsorbent, in adults with chronic kidney disease (CKD). While the benefit of adding AST-120 to standard therapy was not supported by these trials, we performed a post hoc analysis to focus on CKD progression and to determine the risk factors for the primary endpoint in the EPPIC trial population. METHODS: In the EPPIC trials, patients were randomly assigned 1:1 to treatment with AST-120 or placebo. The primary endpoint was a composite of dialysis initiation, kidney transplantation, or doubling of serum creatinine. The EPPIC trial pooled population was evaluated with the same statistical methods used for analysis of the primary and secondary efficacy endpoints. The trials were registered on ClinicalTrials.gov (NCT00500682 [EPPIC-1] and NCT00501046 [EPPIC-2]). RESULTS: An analysis of the placebo population suggested baseline urinary protein to urinary creatinine ratio (UP/UCr) >/=1.0 and hematuria were independent risk factors for event occurrence and eGFR lowering. Analysis of the high risk patients revealed a difference in the primary endpoint occurrence between treatment groups, if angiotensin-converting enzyme inhibitors and/or angiotensin receptor blockers were administered (hazard ratio 0.74, 95% confidence interval 0.56-0.96). Also, the eGFR changes from baseline in the AST-120 group were smaller than that in the placebo group (P = 0.035). CONCLUSIONS: CKD progression may have an association with baseline UP/UCr and hematuria. Treatment with AST-120 may delay the time to the primary endpoint in patients with progressive CKD receiving standard therapy, thus warranting further investigation.

Sumida, K., Diskin, C. D., Molnar, M. Z., et al. (2017). "Pre-End-Stage Renal Disease Hemoglobin Variability Predicts Post-End-Stage Renal Disease Mortality in Patients Transitioning to Dialysis." Am J Nephrol **46**(5): 397-407.

BACKGROUND: Hemoglobin variability (Hb-var) has been associated with increased mortality both in non-dialysis dependent chronic kidney disease (NDD-CKD) and end-stage renal disease (ESRD) patients. However, the impact of Hb-var in advanced NDD-CKD on outcomes after dialysis initiation remains unknown. METHODS: Among 11,872 US veterans with advanced NDD-CKD transitioning to dialysis between October 2007 through September 2011, we assessed Hb-var calculated from the residual SD of at least 3 Hb values during the last 6 months before dialysis initiation (prelude period) using within-subject linear regression models, and stratified into quartiles. Outcomes included post-transition all-cause, cardiovascular, and infection-related mortality, assessed in Cox proportional hazards models and adjusted for demographics, comorbidities, length of hospitalization, medications, estimated glomerular filtration rate (eGFR), type of vascular access, Hb parameters (baseline Hb [i.e., intercept] and change in Hb [i.e., slope]), and number of Hb measurements. RESULTS: Higher prelude Hb-var was associated with use of iron and antiplatelet agents, tunneled dialysis catheter use, higher levels of baseline Hb, change in Hb, eGFR, and serum ferritin. After multivariable adjustment, higher prelude Hb-var was associated with higher post-ESRD all-cause and infection-related mortality, but not cardiovascular mortality (adjusted hazard ratios [95% CI] for the highest [vs. lowest] quartile of Hb-var, 1.10 [1.02-1.19], 1.28 [0.93-1.75], and 0.93 [0.79-1.10], respectively). CONCLUSIONS: High pre-ESRD Hb-var is associated with higher mortality, particularly from infectious causes rather than cardiovascular causes. Further research is required to clarify the underlying mechanisms and true causal nature of the observed association.

Tadaki, F., Inagaki, M., Miyamoto, Y., et al. (2005). "Early hospital readmission was less likely for hemodialysis patients from facilities with longer median length of stay in the DOPPS study." Hemodial Int **9**(1): 23-29.

The length of hospital stay is considered to influence hospital readmission in general. The Dialysis Outcomes and Practice Patterns Study (DOPPS), an international prospective observational study undertaken to establish a relationship between facility practices and dialysis outcomes, started in 1996. Results suggest that the duration of hospital stay is significantly correlated with the probability of early readmission in dialysis patients. Thus, early hospital readmission was observed to be less likely for hemodialysis patients from facilities with longer median length of stay. The lengths of hospital stay for hemodialysis patients differed in the three continents studied. Although socioeconomic pressures may drive the lengths of hospital stay, the duration of hospitalization should be determined keeping in mind the safety of clinical course for each disease. In this forum, a 47-year-old female hemodialysis patient with severe secondary hyperparathyroidism, who had been treated with hemodialysis for 21 years, was hospitalized with severe clinical symptoms. Although the clinical symptoms disappeared 10 days after total parathyroidectomy with autotransplantation, severe hypocalcemia persisted despite large amounts of intravenous calcium gluconate. This patient was hospitalized for a long duration owing to the large calcium deficit in her body. Had the length of her hospital stay been shortened, either she could have needed rehospitalization or her condition could have worsened.

Tangri, N., Inker, L. et Levey, A. S. (2013). "A systematic review finds prediction models for chronic kidney disease were poorly reported and often developed using inappropriate methods." J Clin Epidemiol **66**(6): 697.

Tangri, N., Kitsios, G. D., Inker, L. A., et al. (2013). "Risk prediction models for patients with chronic kidney disease: a systematic review." Ann Intern Med **158**(8): 596-603.

BACKGROUND: Patients with chronic kidney disease (CKD) are at increased risk for kidney failure, cardiovascular events, and all-cause mortality. Accurate models are needed to predict the individual risk for these outcomes. PURPOSE: To systematically review risk prediction models for kidney failure, cardiovascular events, and death in patients with CKD. DATA SOURCES: MEDLINE search of English-language articles published from 1966 to November 2012. STUDY SELECTION: Cohort studies that examined adults with any stage of CKD who were not receiving dialysis and had not had a transplant; had at least 1 year of follow-up; and reported on a model that predicted the risk for kidney failure, cardiovascular events, or all-cause mortality. DATA EXTRACTION: Reviewers extracted data on study design, population characteristics, modeling methods, metrics of model performance, risk of bias, and clinical usefulness. DATA SYNTHESIS: Thirteen studies describing 23 models were found. Eight studies (11 models) involved kidney failure, 5 studies (6 models) involved all-cause mortality, and 3 studies (6 models) involved cardiovascular events. Measures of estimated glomerular filtration rate or serum creatinine level were included in 10 studies (17 models), and measures of proteinuria were included in 9 studies (15 models). Only 2 studies (4 models) met the criteria for clinical usefulness, of which 1 study (3 models) presented reclassification indices with clinically useful risk categories. LIMITATION: A validated risk-of-bias tool and comparisons of the performance of different models in the same validation population were lacking. CONCLUSION: Accurate, externally validated models for predicting risk for kidney failure in patients with CKD are available and ready for clinical testing. Further development of models for cardiovascular events and all-cause mortality is needed. PRIMARY FUNDING SOURCE: None.

Tangri, N., Stevens, L. A., Griffith, J., et al. (2011). "A predictive model for progression of chronic kidney disease to kidney failure." Jama **305**(15): 1553-1559.

CONTEXT: Chronic kidney disease (CKD) is common. Kidney disease severity can be classified by estimated glomerular filtration rate (GFR) and albuminuria, but more accurate information regarding risk for progression to kidney failure is required for clinical decisions about testing, treatment, and referral. OBJECTIVE: To develop and validate predictive models for progression of CKD. DESIGN, SETTING, AND PARTICIPANTS: Development and validation of prediction models using demographic, clinical, and laboratory data from 2 independent Canadian cohorts of patients with CKD stages 3 to 5 (estimated GFR, 10-59 mL/min/1.73 m(2)) who were referred to nephrologists between April 1, 2001, and December 31, 2008. Models were developed using Cox proportional hazards regression methods and evaluated using C statistics and integrated discrimination improvement for discrimination, calibration plots and Akaike Information Criterion for goodness of fit, and net reclassification improvement (NRI) at 1, 3, and 5 years. MAIN OUTCOME MEASURE: Kidney failure, defined as need for dialysis or preemptive kidney transplantation. RESULTS: The development and validation cohorts included 3449 patients (386 with kidney failure [11%]) and 4942 patients (1177 with kidney failure [24%]), respectively. The most accurate model included age, sex, estimated GFR, albuminuria, serum calcium, serum phosphate, serum bicarbonate, and serum albumin (C statistic, 0.917; 95% confidence interval [CI], 0.901-0.933 in the development cohort and 0.841; 95% CI, 0.825-0.857 in the validation cohort). In the validation cohort, this model was more accurate than a simpler model that included age, sex, estimated GFR, and albuminuria (integrated discrimination improvement, 3.2%; 95% CI, 2.4%-4.2%; calibration [Nam and D'Agostino chi(2) statistic, 19 vs 32]; and reclassification for CKD stage 3 [NRI, 8.0%; 95% CI, 2.1%-13.9%] and for CKD stage 4 [NRI, 4.1%; 95% CI, -0.5% to 8.8%]). CONCLUSION: A model using routinely obtained laboratory tests can accurately predict progression to kidney failure in patients with CKD stages 3 to 5.

Vart, P., Gansevoort, R. T., Joosten, M. M., et al. (2015). "Socioeconomic disparities in chronic kidney disease: a systematic review and meta-analysis." Am J Prev Med **48**(5): 580-592.

> CONTEXT: Evidence on the strength of the association between low SES and chronic kidney disease (CKD; measured by low estimated glomerular filtration rate [eGFR], high albuminuria, low eGFR/high albuminuria, and renal failure) is scattered and sometimes conflicting. Therefore, a systematic review and meta-analysis was performed to summarize the strength of the associations between SES and CKD and identify study-level characteristics related to this association. EVIDENCE ACQUISITION: Studies published through January 2013 in MEDLINE and Embase were searched. From 35 studies that met the inclusion criteria, association estimates were pooled per CKD measure in the meta-analysis (performed between 2013 and 2014). Meta-regression analysis was used to identify study-level characteristics related to the strength of the SES-CKD association. EVIDENCE SYNTHESIS: Low SES was associated with low eGFR (OR=1.41, 95% CI=1.21, 1.62), high albuminuria (OR=1.52, 95% CI=1.22, 1.82), low eGFR/high albuminuria (OR=1.38, 95% CI=1.03, 1.74), and renal failure (OR=1.55, 95% CI=1.40, 1.71). Differences in SES measures across studies were not related to the strength of associations between low SES and any of the CKD measures (low GFR, p=0.63; high albuminuria, p=0.29; low eGFR/high albuminuria, p=0.54; renal failure, p=0.31). Variations in the strength of associations were related to the level of covariate adjustment for low eGFR (p<0.001) and high albuminuria (p<0.001). CONCLUSIONS: Socioeconomic disparities in CKD were fairly strong, irrespective of how SES was measured. Variations in the strength of the associations were related to the level of covariate adjustment, particularly for low eGFR and high albuminuria.

Vejakama, P., Ingsathit, A., Attia, J., et al. (2015). "Epidemiological study of chronic kidney disease progression: a large-scale population-based cohort study." Medicine (Baltimore) **94**(4): e475.

> The prognostic information about CKD progression, particularly for GFR categories 1 and 2, is still limited. This cohort was therefore conducted to determine the CKD progression using a competing risk approach. We conducted a retrospective cohort study linking community health screening with hospitals and death registry data in a province of Thailand, from 1997 to 2011. A competing risk model was applied by treating death as a competing risk factor to estimate 2-, 5-, and 10-year probability of kidney failure and median time for CKD progression from lower to higher GFR category. There were 17,074 non-diabetic and 15,032 diabetic CKD subjects. Diabetic subjects progressed more rapidly through GFR categories with the median times for CKD progression from GFR categories G1 to G2, G2 to G3a, G3a to G3b, G3b to G4, and G4 to G5 of 4.4, 6.1, 4.9, 6.3, and 9.0 years, respectively. Non-diabetic subjects took longer to progress with the corresponding median time of 9.4, 14.0, 11.0, 13.8, and >14.3 years. After adjusting for confounders, diabetic subjects were 49% (cause-specific hazard ratio ((c)HR) = 1.49, 95% CI: 1.37, 1.62) more likely to develop kidney failure than non-diabetic subjects. Albuminuria categories A3 and A2 were, respectively, 3.40 (95% CI: 3.07, 3.76) and 1.71 (95% CI: 1.53, 1.92) higher risk of kidney failure when compared to A1. For each albumin category, death rate increased as albuminuria increased particularly in diabetic subjects, which was approximately 2 times higher in A3 compared to A1. Considering GFR category, it gradually increased from G1 to G4 and sharply increased from G4 to G5 in both non-diabetic and diabetic subjects. This study has quantified CKD progression in an Asian population within ordinary practice. Diabetic subjects progress through GFR and albuminuria categories and reach kidney failure about twice as rapidly as non-diabetic subjects.

Warady, B. A., Abraham, A. G., Schwartz, G. J., et al. (2015). "Predictors of Rapid Progression of Glomerular and Nonglomerular Kidney Disease in Children and Adolescents: The Chronic Kidney Disease in Children (CKiD) Cohort." Am J Kidney Dis **65**(6): 878-888.

> BACKGROUND: Few studies have prospectively evaluated the progression of chronic kidney disease (CKD) in children and adolescents, as well as factors associated with progression. STUDY DESIGN: Prospective multicenter observational cohort study. SETTING & PARTICIPANTS: 496 children and adolescents with CKD enrolled in the Chronic Kidney Disease in Children (CKiD) Study. PREDICTORS: Proteinuria, hypoalbuminemia, blood pressure, dyslipidemia, and anemia. OUTCOMES: Parametric failure-time models were used to characterize adjusted associations between baseline levels and changes in predictors and time to a composite event of renal replacement therapy or 50% decline in

glomerular filtration rate (GFR). RESULTS: 398 patients had nonglomerular disease and 98 had glomerular disease; of these, 29% and 41%, respectively, progressed to the composite event after median follow-ups of 5.2 and 3.7 years, respectively. Demographic and clinical characteristics and outcomes differed substantially according to the underlying diagnosis; hence, risk factors for progression were assessed in stratified analyses, and formal interactions by diagnosis were performed. Among patients with nonglomerular disease and after adjusting for baseline GFR, times to the composite event were significantly shorter with urinary protein-creatinine ratio > 2mg/mg, hypoalbuminemia, elevated blood pressure, dyslipidemia, male sex, and anemia, by 79%, 69%, 38%, 40%, 38%, and 45%, respectively. Among patients with glomerular disease, urinary protein-creatinine ratio >2mg/mg, hypoalbuminemia, and elevated blood pressure were associated with significantly reduced times to the composite event by 94%, 71%, and 67%, respectively. Variables expressing change in patient clinical status over the initial year of the study contributed significantly to the model, which was cross-validated internally. LIMITATIONS: Small number of events in glomerular patients and use of internal cross-validation. CONCLUSIONS: Characterization and modeling of risk factors for CKD progression can be used to predict the extent to which these factors, either alone or in combination, would shorten the time to renal replacement therapy or 50% decline in GFR in children with CKD.

Wijnen, E., Planken, N., Keuter, X., et al. (2006). "Impact of a quality improvement programme based on vascular access flow monitoring on costs, access occlusion and access failure." Nephrol Dial Transplant **21**(12): 3514-3519.

BACKGROUND: Vascular access thrombosis is a substantial source of morbidity in chronic haemodialysis patients. Periodical access flow measurements can predict the presence of vascular access stenosis and provide an opportunity for early intervention to prevent subsequent vascular access thrombosis. By this system of quality improvement, vascular access-related costs might be reduced. The aim of this study was to analyse the cost impact of a quality improvement programme based on periodic access flow measurements. METHODS: The number and costs of vascular access interventions (summary of angiography, percutaneous transluminal angioplasty, catheter placement, hospitalization days and costs for surgery) in the period 2001-2003 (quality improvement period; QIP, 218.6 patient-years observed) were retrospectively compared with a reference period (RP, 1996-1998, 214.4 patient-years observed) during which no access flow was measured. All access flow measurements were done on a regular base and interventions were performed according to the Kidney Disease Outcome Quality Initiative. RESULTS: Surgical thrombectomy procedures were significantly less during the QIP (0.25 +/- 0.57 events/patient-year) compared with RP (0.63 +/- 1.06 events/patient-year; P = 0.000), whereas access loss was not significantly different. During the QIP, 205 radiological interventions were performed (0.88 +/- 1.16 events/patient-year), and in the RP around 48 (0.33 +/- 0.65 events/patient-year; P = 0.000). Access-related costs tended to be lower during the QIP compared with the RP. The cost reduction appeared to be limited to patients with arteriovenous graft (AVG), in which access-related costs were significantly lower during the QIP (2360.95 euro +/- 2838.17 euro patient-year) compared with the RP (4003.96 euro +/- 3810.92 euro patient-year; P = 0.012), but not in patients with arteriovenous fistula (AVF). CONCLUSION: A quality improvement programme based on periodical access flow measurement reduced the number of acute vascular access failures due to thrombotic events and also significantly reduced health care costs in patients with AVG, but not in patients with AVF. The quality improvement programme had no effect on access survival.

Woon, C., Bielinski-Bradbury, A., O'Reilly, K., et al. (2015). "A systematic review of the predictors of disease progression in patients with autosomal dominant polycystic kidney disease." BMC Nephrol **16**: 140.

BACKGROUND: Autosomal dominant polycystic kidney disease (ADPKD) is a genetic disorder characterised by progressive renal cyst formation leading to renal failure in the majority of patients. The likelihood and rate of ADPKD progression is difficult to predict and there is a clear need to identify prognostic indicators that could be used to anticipate ADPKD progression, to aid the management of patients in clinical practice. METHODS: A systematic literature review was conducted to identify publications detailing the natural history of ADPKD, including diagnosis, prognosis and progression. Publications were identified and filtered, and data were extracted, based on a predefined research protocol. RESULTS: The review identified 2799 journal articles and 444 conference abstracts; 254

articles, including observational studies, clinical trials and reviews, proceeded to data extraction. Disease progression was associated with a variety of prognostic indicators, most commonly age and total kidney volume (TKV). In the identified clinical trials, the absence of a consistent measure of disease progression led to variation in the primary endpoints used. Consequently, there was difficulty in consistently and effectively demonstrating and comparing the efficacy of investigational treatments across studies. More consistency was found in the observational studies, where disease progression was most frequently measured by TKV and glomerular filtration rate. CONCLUSIONS: This systematic review identified age and TKV as the most commonly cited prognostic indicators in the published ADPKD literature. It is envisaged that this review may inform future research, trial design and predictive models of ADPKD natural history, helping to optimise patient care.

Xie, D., Yang, W., Jepson, C., et al. (2017). "Statistical Methods for Modeling Time-Updated Exposures in Cohort Studies of Chronic Kidney Disease." Clin J Am Soc Nephrol **12**(11): 1892-1899.

When estimating the effect of an exposure on a time-to-event type of outcome, one can focus on the baseline exposure or the time-updated exposures. Cox regression models can be used in both situations. When time-dependent confounding exists, the Cox model with time-updated covariates may produce biased effect estimates. Marginal structural models, estimated through inverse-probability weighting, were developed to appropriately adjust for time-dependent confounding. We review the concept of time-dependent confounding and illustrate the process of inverse-probability weighting. We fit a marginal structural model to estimate the effect of time-updated systolic BP on the time to renal events such as ESRD in the Chronic Renal Insufficiency Cohort. We compare the Cox regression model and the marginal structural model on several attributes (effects estimated, result interpretation, and assumptions) and give recommendations for when to use each method.

Xie, Y., Bowe, B., Xian, H., et al. (2016). "Estimated GFR Trajectories of People Entering CKD Stage 4 and Subsequent Kidney Disease Outcomes and Mortality." Am J Kidney Dis.

BACKGROUND: Estimated glomerular filtration rate (eGFR) trajectories of people entering chronic kidney disease (CKD) stage 4 and their associations with subsequent kidney disease outcomes or death are not known. STUDY DESIGN: Longitudinal observational cohort study. SETTING & PARTICIPANTS: 26,246 patients in the Veterans Affairs Healthcare System who entered CKD stage 4 in fiscal year 2008 followed up until October 2013. FACTORS: 5-year eGFR trajectories, demographic and health characteristics. OUTCOMES: Composite kidney disease outcome of kidney failure, dialysis therapy or transplantation, and death. RESULTS: Latent class group modeling and functional characterization suggest the presence of 3 distinct trajectory classes: class 1 (72%), consistent slow decline with absolute eGFR change of -2.45 (IQR, -3.89 to -1.16) mL/min/1.73m2 per year; class 2 (18%), consistent fast decline and eGFR change of -8.60 (IQR, -11.29 to -6.66) mL/min/1.73m2 per year; and class 3 (10%), early nondecline and late fast decline with eGFR change of -0.4mL/min/1.73m2 per year in years 1 to 3 and -7.98 and -21.36mL/min/1.73m2 per year in years 4 and 5, respectively. During 4.34 years of follow-up, 9,809 (37%) patients had the composite kidney disease outcome and 14,550 (55%) patients died. Compared to the referent group (trajectory class 1), HRs for 1-year risk for composite kidney disease outcome for trajectory classes 2 and 3 were 1.13 (95% CI, 1.05-1.22) and 0.67 (95% CI, 0.59-0.75), whereas HRs for 1-year risk for death for classes 2 and 3 were 1.17 (95% CI, 1.10-1.28) and 1.29 (95% CI, 1.18-1.42), respectively. The 1-year risk for composite kidney disease outcome was 32% and was 42% more likely than the risk for death in trajectory classes 1 and 2, respectively, whereas the risk for death was 67% more likely than the risk for composite kidney disease outcome in trajectory class 3. LIMITATIONS: Inclusion criteria and mostly male participants limit generalizability of study results. CONCLUSIONS: We characterized 3 different eGFR trajectory classes of people entering CKD stage 4. Our results suggest that the pattern of eGFR trajectory informs the risk for kidney disease outcomes and death.

L'économie de l'insuffisance rénale chronique

LE COUT DE LA MALADIE

Selon l'Assurance maladie, les dépenses de prise en charge de l'insuffisance rénale chronique terminale s'élèvent en France à 3,4 milliards d'euros pour le Régime général dont 2,7 milliards pour la dialyse et 700 millions pour la greffe rénale et le suivi des patients greffés (Assurance maladie, 2017). L'évaluation médico-économique des stratégies de prise en charge de l'insuffisance rénale chronique terminale réalisée par la Haute Autorité de santé (HAS), conjointement avec l'Agence de la biomédecine en 2014, identifie les stratégies efficientes comme étant prioritairement la greffe rénale, puis la dialyse en privilégiant la proximité du domicile et les modalités de dialyse autonomes lorsque cela est possible et souhaité par le patient.

Études françaises

Allenbach, D. et Pereira, O. (2015). "[Analysis of reimbursement of dialysis patients' transport expenses in Lorraine]." Sante Publique **27**(1 Suppl): S155-165.

> INTRODUCTION: Renal failure is defined as impairment of the excretory function of the kidney. Chronic Kidney Disease (CKD) gets progressively worse and end-stage renal disease (ESRD) constitutes thefinal stage. In France, overall spending generated by CKD in 2011 amounted to euro3.3 billion. More than 80% of this cost was related to dialysis. Transport of patients in 2012 also cost euro3.8 billion and 17% of this expenditure concerned patients with ESRD. METHODS: The aim of this study was to analyze reimbursement of transport expenses of dialysis patients in order to develop a regional action plan to optimize this reimbursement in Lorraine. PMSI-DCIR data from SNIIRAM portal were used to study the characteristics of the Lorraine population of general scheme patients (including Local Mutualist Sections) dialyzed at least once with or without reimbursement of transport expenses in 2012. RESULTS: In 2012, 1,692 patients in Lorraine received at least one dialysis session. Nearly euro22 millions were reimbursed for transportation of these patients. An analysis of the population of patients treated exclusively by hemodialysis throughout 2012 showed significant differences in the cost of transport according to their age, their department and the distance of the dialysis center from their home, the type of transport and long-term disease status. DISCUSSION: Among all ofthe possible actions, patient intervention in health centers could be considered during training at the beginning of dialysis depending on the distance of the center from their home, in order to explain the modalities ofreimbursement of theirfuture transport by health insurance (the more "attractive" Personal Vehicle package, combined transportation, seated transportation card), to partially relieve health centers of this burden and to ensure that the transport is adapted to the patient's state of health.

Benain, J. P., Faller, B., Briat, C., et al. (2007). "[Cost of dialysis in France]." Nephrol Ther **3**(3): 96-106.

> The provision of care for patients with end-stage chronic renal failure is an important medical and economic challenge for the Health Insurance. Previous studies have shown a lower cost for home dialysis. More recently, studies have confirmed identical short-term survival rates between haemodialysis and peritoneal dialysis. Notwithstanding, home dialysis techniques utilization remains weak in France. This work aims at: determining the average annual cost of dialysis, per patient and per technique of dialysis, and assessing the global annual cost of dialysis in France, from the Health Insurance perspective. Methodologically, this article provides a static estimation of the cost of dialysis. Costs related to co-morbidities of end-stage chronic renal failure have not been considered. Standard patient care schemes have been outlined by a multidisciplinary expert committee, for each dialysis technique, and have been valorised using publicly available data and tariffs recorded in 2005. Our result show that home dialysis techniques are the less costly, with an average annual cost per patient of 49.9, 49.7 and 50.0 k euro respectively for home haemodialysis, automated peritoneal dialysis, and continuous ambulatory peritoneal dialysis. Autodialysis, autonomous in-center haemodialysis and in-center haemodialysis respectively cost 59.5, 62.3 and 81.5 k euro per patient and per annum. The total 2005 cost of dialysis for the Health Insurance is estimated at 2.1 billion euro. Therefore, the

development of alternative techniques to in-center haemodialysis, such as home dialysis or autonomous in-center haemodialysis, autodialysis being already well developed, could generate savings for the Health Insurance. From the patient's perspective, it could also allow the enlightened choice of the best customized technique, less guided by local offer than by medical or social criteria, as well as by the patient's own opinion.

Blotiere, P. O., Tuppin, P., Weill, A., et al. (2010). "[The cost of dialysis and kidney transplantation in France in 2007, impact of an increase of peritoneal dialysis and transplantation]." Nephrol Ther **6**(4): 240-247.

INTRODUCTION: This study estimates the costs for the national health insurance in 2007 of the patients with end-stage renal disease (ESRD) according to therapies modalities. METHOD: Data for all patients covered by the general health insurance scheme (77% of the French population) from hospital discharge and outpatients reimbursement databases were linked. ESRD therapies were identified using an algorithm mainly based on discharge diagnosis and immunosuppressive drugs refunds. RESULTS: Extrapolated to all French population at the end of 2007, 60,900 patients had an ESRD therapy: 30,900 were treated on haemodialysis (HD) (51%), 2600 on peritonea dialysis (DP) (4%) and 27,300 had a kidney transplant (45%). Patients with dialysis therapies had more often complementary universal coverage for low earners. According to the French regions, patient treated with DP were between 0 to 26% and 19 to 57% for those with a transplant. The total refund cost for National Health Insurance was four billion euro of which 77% for HD. Annual mean costs per patient were 64 keuro for DP, 89 keuro for HD, 86 keuro for the year of transplantation and 20 keuro for the following years. A 25% increase of DP would allow a decrease of the annual cost of 155 millions euro and 900 transplantations more each year during 10 years a decrease of 2.5 billions euro. CONCLUSION: The increase of ESRD prevalence and its total cost require patients and professionals information and formation about the less expensive and more autonomous therapies and others alternatives facing the lack of kidney transplants from deceased donors.

Caisse Nationale de l'Assurance Maladie des Travailleurs Salariés (2018). Rapport sur les charges et produits de l'assurance maladie pour 2019 : Améliorer la qualité du système de santé et maîtriser les dépenses : propositions de l'Assurance Maladie pour 2019. Paris Cnam**:** 262, tabl.
https://www.ameli.fr/l-assurance-maladie/statistiques-et-publications/rapports-et-periodiques/rapports-charges-produits-de-l-assurance-maladie/rapports-charges-et-produits-pour-2018-et-2019/rapport-charges-et-produits-pour-l-annee-2018.php

Chaque année, l'Assurance Maladie présente au Gouvernement et au Parlement ses propositions relatives à l'évolution des charges et produits au titre de l'année suivante et aux mesures nécessaires pour atteindre l'équilibre prévu par le cadrage financier pluriannuel des dépenses d'assurance maladie. À partir d'analyses réalisées sur l'évolution des dépenses et des pratiques, et en s'appuyant sur les recommandations françaises et internationales, le rapport Charges et produits pour l'année 2019 présente des propositions et des pistes de réflexion visant à améliorer la qualité et l'efficience des soins, et à optimiser les dépenses de santé.

Caisse Nationale de l'Assurance Maladie des Travailleurs Salariés (2017). Rapport sur les charges et produits de l'assurance maladie pour 2018 : Améliorer la qualité du système de santé et maîtriser les dépenses : propositions de l'Assurance Maladie pour 2018. Paris Cnamts**:** 206, tabl.
www.ameli.fr/l-assurance-maladie/statistiques-et-publications/rapports-et-periodiques/rapports-charges-produits-de-l-assurance-maladie/rapports-charges-et-produits-pour-2018-et-2019/rapport-charges-et-produits-pour-l-annee-2018.php

Caisse Nationale de l'Assurance Maladie des Travailleurs Salariés (2016). Rapport sur les charges et produits de l'assurance maladie pour 2017 : Améliorer la qualité du système de santé et maîtriser les dépenses : propositions de l'Assurance Maladie pour 2017. Paris Cnamts**:** 178, tabl.
http://www.ameli.fr/fileadmin/user_upload/documents/cnamts_rapport_charges_produits_2017.pdf

Caisse Nationale de l'Assurance Maladie des Travailleurs Salariés (2015). Rapport sur les charges et produits de l'assurance maladie pour 2016 : Améliorer la qualité du système de santé et maîtriser les dépenses : propositions de l'Assurance Maladie pour 2016. Rapport au ministre chargé de la sécurité sociale et au

Parlement sur l'évolution des charges et des produits de l'Assurance Maladie au titre de 2016. Paris, Cnamts**:** 190p.

Cash, R. et Kervasdoue, J. d. (2018). La coûteuse inégalités des soins : soigner mieux, soigner moins cher. Paris Economica**:** 172, tab., graph., fig.

> Si les soins médicaux en France font encore partie des meilleurs du monde, ils ne sont plus les premiers. En revanche, ils sont trop souvent onéreux, inégalitaires et inefficaces. En effet, les traitements pour une même maladie varient d'un praticien à l'autre, d'un hôpital à l'autre, voire d'un service à l'autre au sein du même établissement ce qui a de lourdes conséquences médicales et économiques. Comment se fait-il qu'avec le même corpus de connaissances, le même système de paiement des professionnels de santé et des hôpitaux, l'on constate une telle hétérogénéité ? Non seulement il existe une inégalité de l'accès aux soins mais il y a aussi, et surtout, une inégalité des soins : excellents ici, plus discutables là. Peut-on alors, en même temps, réduire cette tragique inégalité et soigner mieux pour moins cher ? Oui, comme le révèlent les 20 exemples de cet ouvrage. Qu'il s'agisse de médicaments, d'actes chirurgicaux ou d'examens diagnostiques on constate, selon les lieux de prise en charge, des surprescriptions, des sousprescriptions et des prescriptions inadaptées au cas des patients. À partir de ces études de cas, les auteurs montrent comment interagissent à des degrés divers des forces économiques mais aussi sociologiques, éthiques, ethnologiques et politiques. Leurs influences délétères sont les signes d'un système qui n'est pas géré et qui, trop souvent, se perd dans la recherche de remèdes généraux à des questions spécifiques. Oui, on peut faire mieux pour moins cher et les économies potentielles se chiffrent en milliards d'euros.

Chanliau, J. (2009). "[Financial barriers and peritoneal dialysis]." Nephrol Ther **5 Suppl 4**: S290-292.

> Peritoneal Dialysis (PD) has shown good result for the patients'survival and quality of life, but there is no development of PD in France. Many reasons can explain this situation, but we will focus here on financial restraint. PD has a low reimbursement rate, lower than the real cost of the technique. Furthermore, it is very difficult to find a place for PD patients when they need an hospitalization or lose their autonomy. The Pilot Committee for Kidney Disease is about to propose some solutions, but the effects may be limited as long as the difference in the reimbursement rate between PD and in center dialysis will persist.

Couchoud, C., Couillerot, A. L., Dantony, E., et al. (2015). "Economic impact of a modification of the treatment trajectories of patients with end-stage renal disease." Nephrol Dial Transplant **30**(12): 2054-2068.

> BACKGROUND: This study assumed that some patients currently treated at hospital-based haemodialysis centres can be treated with another renal replacement therapy (RRT) modality without any increase in mortality risk and sought to evaluate the monthly cost impact of replacing hospital-based haemodialysis, for which fees are highest, by different proportions of other modalities. METHODS: We used a deterministic model tool to predict the outcomes and trajectories of hypothetical cohorts of incident adult end-stage renal disease (ESRD) patients for 15 years of RRT (10 different modalities). Our estimates were based on data from 67 258 patients in the REIN registry and 65 662 patients in the French national health insurance information system. Patients were categorized into six subcohorts, stratified for age and diabetes at ESRD onset, and analyses run for each subcohort. We simulated new strategies of care by changing any or all of the following: initial distributions in treatment modalities, transition rates and some costs. Strategies were classified according to their monthly per-patient cost compared to current practices (cost-minimization analysis). RESULTS: Simulations of the status quo for the next 15 years predicted a per-patient monthly cost of euro2684 for a patient aged 18-45 years without diabetes and euro7361 for one older than 70 years with diabetes. All of the strategies we analysed had monthly per-patient costs lower than the status quo, except for daily home HD. None impaired expected survival. Savings varied by strategy. CONCLUSIONS: Alternative strategies may well be less expensive than current practices. The decision to implement new strategies must nonetheless consider the number of patients concerned, feasibility of renal care reorganization, and investment costs. It must also take into account the role of patients' choice and the availability of professionals.

Cogny-Van-Weydevelt, F., Ngohou, C., Pontefract, R., et al. (1995). "Insuffisance rénale terminale. Analyse et comparatif des coûts et qualité de vie des traitements par hémodialyse et transplantation." Gestions Hospitalieres(350): 701-706.

> [BDSP. Notice produite par ENSP ZOeR0xb0. Diffusion soumise à autorisation]. La prise en charge de l'insuffisance rénale terminale impose à la société de faire face à un consommation de soins importante pour suppléer les reins défaillants. Il s'agit toujours de thérapeutiques lourdes et définitives, le patient devenant tributaire de son traitement jusqu'à la fin de sa vie.

Cour des Comptes (2015). L'insufisance rénale chronique terminale : favoriser des prises en charge plus efficientes. In : Sécurité sociale : Rapport 2015 sur l'application des lois de financement de la Sécurité sociale. Paris : Cour des Comptes**:** 673, tabl.
https://www.ccomptes.fr/Actualites/A-la-une/La-securite-sociale2

> Ce rapport de la Cour des comptes sur l'application des lois de financement de la sécurité sociale s'inscrit dans le cadre de sa mission constitutionnelle d'assistance au Parlement et au Gouvernement. L'édition 2015 démontre que malgré la persistance et l'ampleur des déficits sociaux, qui demeurent une anomalie, leur réduction a été limitée en 2014, comme en 2013. 2015 devrait connaître un ralentissement marqué du rythme de réduction des déficits et l'objectif affiché d'un équilibre des comptes sociaux en 2017 est désormais reporté à un horizon indéfini. La Cour identifie de nouveaux champs possibles de réformes de nature à contribuer au rétablissement de cet équilibre.

Cour des Comptes (2018). Sécurité sociale : Rapport 2018 sur l'application des lois de financement de la sécurité sociale. Paris Cour des Comptes**:** 473, tabl.
https://www.ccomptes.fr/fr/publications/securite-sociale-2018

Durand-Zaleski, I., Combe, C. et Lang, P. (2007). "International Study of Health Care Organization and Financing for end-stage renal disease in France." Int J Health Care Finance Econ **7**(2-3): 171-183.

> The major features of ESRD management in France include the predominance of hemodialysis and the resulting competition for dialysis stations. In 2003, the prevalence of ESRD in France was 0.087%. Of the 52,000 ESRD patients, 30,882 were receiving dialysis and 21,233 had functioning renal transplants. The annual expenditure per ESRD patient in 2003 was estimated at euro40,975. Autodialysis, at euro49,133 per patient per year, was much less expensive than dialyzing in-center at either a public or private facility (euro111,006 and euro75,125, respectively). Transplant activity in France has rapidly increased in recent years, reaching 22 donors per million population in 2005.

HAS et Agencedelabiomédecine (2014). Évaluation médico-économique des stratégies de prise en charge de l'insuffisance rénale chronique terminale en France, Saint-Denis : HAS**:** 324p.

> La HAS et l'Agence de la biomédecine ont conduit une évaluation médico-économique des stratégies de prise en charge des patients traités pour insuffisance rénale chronique terminale (IRCT). L'objectif était d'évaluer l'impact clinique et économique de possibilités de changements dans la trajectoire de soins des patients entre différentes modalités de traitement de suppléance : hémodialyse en centre, en unité de dialyse médicalisée, en unité d'autodialyse, à domicile ; dialyse péritonéale automatisée (DPA) et dialyse péritonéale continue ambulatoire (DPCA) assistée ou non assistée par une infirmière ; transplantation rénale à partir de donneur décédé ou vivant. L'évaluation s'est fondée d'une part, sur une étude de coût à partir des données de l'Assurance maladie et, d'autre part, sur un modèle alimenté par les trajectoires observées dans le registre français des traitements de suppléance de l'IRCT (REIN). Ce modèle a permis d'évaluer l'efficience de différentes stratégies de prise en charge, en tenant compte des possibilités d'évolutions par rapport à la situation actuelle, en particulier le développement de la transplantation rénale, le développement de la prise en charge hors centre de dialyse et à domicile.

Landais, P. (2002). "[Epidemiology of care demands]." Presse Med **31**(4): 167-175.

SOME FIGURES: Terminal renal failure (TRF) is a major public health problem in France in view of its increasing incidence (110 pmi/year), prevalence (700 pmi) and the costs of treatments supplied. In France, more than 6,500 new patients started treatment for TRF in 2001; around 42,000 patients with renal failure have been treated. The mean cost of treatment per patient is estimated to be of 350 KF per annum for dialysis, 450 KF for transplantation the first year and 50 KF per annum thereafter. Hence, more than 10 billion francs are spent every year on treating TRF, i.e., 1.5% of the Health Scheme. However, these costs do not include expensive treatments (erythropoietin), transport or hospitalisation. RECENT TENDENCIES: Our information system concerning TRF is fragmented and not coordinated. Identification of the cases is incomplete, their declaration is not always systematic and the quality control of the data has not been formalized. Nonetheless, major tendencies can be identified. The notable facts of the last 10 years are an aging TRF population and an increase in associated comorbidity. The diseases leading to TRF are changing. Vascular nephropathies predominate; ischemic renal diseases have become the first cause of TRF in elderly patients. The incidence of type 2 diabetes is increasing and strangely in the French overseas territories. Glomerular nephropathies are the third cause of TRF, particularly in the young. However, compared with other causes, their prevalence is decreasing. INSUFFICIENCIES: The morbidity and mortality with dialysis is dominated by cardiac and vascular causes. Renal transplantation has stagnated; the waiting lists increase and donations are insufficient. Conversely, transplantation survival is progressing. In a second part, we will examine the elements of health strategy necessary to adapt the supply of care and the organization of preventive measures.

Marrisal, J. P. et Sally, J. C. (2002). "Eléments de problématique économique dans le domaine de l'épuration extra-rénale." Sante Publique **14**(2): 107-119, tabl.

[BDSP. Notice produite par ENSP wR0xFhdc. Diffusion soumise à autorisation]. L'objectif du présent article est d'apporter un éclairage économique concernant le débat qui s'est développé autour de la question de la place respective de la dialyse péritonéale et de l'hémodialyse dans la prise en charge de l'insuffisance rénale chronique terminale par épuration extra-rénale. Pour ce faire, nous adoptons une approche de type coût-efficacité visant à rapprocher deux types de données : des données d'efficacité des méthodes d'épuration extra-rénale, d'une part, et des données de coût de ces différentes modalités techniques, d'autre part. La littérature internationale tend à montrer que deux techniques de dialyse sont comparables en termes d'efficacité, hormis pour des patients diabétiques, pour des coûts de traitement inférieurs dans le cas de la dialyse péritonéale comparée à l'hémodialyse, quelle que soit la zone géographique considérée et malgré certains biais méthodologiques liés à la taille des échantillons mis en oeuvre. Somme toute, il apparaît donc que la dialyse péritionéale présente les estimations de ratio coût-efficacité les plus avantageux, en comparaison avec les méthodes d'hémodialyse hors centre et en centre. Ce constat plaide pour le développement des modalités de dialyse péritonéale dans les pays où cette modalité est faiblement utilisée, ce qui est le cas en France, dans les conditions médicales d'application de cette technique.

Ranchon, F., Hedoux, S., Laville, M., et al. (2010). "[Direct medical cost of erythropoiesis-stimulating agents in anaemia treatment of chronic renal failure patient: a literature review]." Nephrol Ther **6**(2): 97-104.

INTRODUCTION: Management of anaemia in chronic renal insufficiency (CRI) represents an important medico-economic challenge because of the great number of patients and the cost of the erythropoiesis-stimulating agent (ESA). The aim of this study was to identify determinants of the costs associated with these treatments in order to choose, with equal efficacy, the most efficient ASE. METHOD: A bibliographic research was realised by Medline database interrogation. RESULTS: Among the direct medical costs, five studies showed that acquisition of epoetine alfa (EA) compared to darbepoetin alfa (DA) was less expensive. Concerning the costs associated with the route of administration, the subcutaneous injection (SC) of epoetine allowed a gain in costs because of the decrease of doses compared to the intravenous (IV) route. The switch from EA in SC to DA in IV, for hemodialysis patients, was associated with a reduction of the number of injections and with a treatment's cost lower by DA than by EA. Costs related to the regimen of administration, notably those related to nursing, medical and pharmaceutical time, were negligible towards those associated to the acquisition of the ASE. Finally, the costs of the therapeutic follow-up and treatment of the adverse effects of the ASE were similar between the EA and the DA. CONCLUSION: The costs associated with the prices of acquisition of the ASE, negotiated by the structure of care, represent the most important part of the direct medical costs.

Rottembourg, J., Tilleul, P., Deray, G., et al. (2015). "Cost of managing anemia in end-stage renal disease: the experience of five French dialysis centers." Eur J Health Econ **16**(4): 357-364.

OBJECTIVE: The aim of this retrospective study was to evaluate the direct cost of anemia treatment in hemodialysis patients and to evidence factors predictive of 1-year cost. METHODS: Retrospective study which included hemodialyzed patients during year 2009 in five centers. Patients were evaluable if they had at least one hemoglobin (Hb) assay per month and were monitored for at least 4 months. Patients were classified in different "annual Hb category" according to their monthly mean Hb [Hb categories: Ideal (10 </= Hb </= 12 g/dL); High (Hb > 12 g/dL) and Low (Hb < 10 g/dL) if >75% of time in respective category, otherwise classified in the Fluctuating category]. RESULTS: We analyzed 636 patients (male, 59.4%) with a mean age of 67 years who underwent 144 hemodialysis sessions (median number per patient) in 2009. The cost of anemia treatment was largely driven by erythropoiesis-stimulating agents (ESA) (68% of total cost for Low Hb category and approximately 90% for the other Hb categories). Adjusted predictive factors for 1-year direct cost of anemia treatment (p < 0.0001) were dialysis center (<euro>2,518-<euro>5,617), death (<euro>6,091 vs. <euro>4,911), age (<euro>4,911 for </=55 years and <euro>5,378 for 65-75 years), female gender (<euro>4,911 vs. <euro>4,398 for male), Low Hb category (<euro>13,005 vs. <euro>5,034 for Ideal, <euro>4,911 for Fluctuating and <euro>2,418 for High), serum ferritin level (<euro>5,102 for 200-500 mug/mL and <euro>4,646 for >/=500 mug/mL) and duration of dialysis (<euro>4,911 if </=2 years and <euro>2,952 if 4-6 years). LIMITATIONS: Retrospective study, and low number of patients in the Low Hb category. CONCLUSIONS: The main factors that were predictive of 1-year cost of anemia treatment in hemodialysis patients were centers, patients in the Low Hb category, and dialysis duration of less than 2 years.

Études internationales

Agar, J. W., Knight, R. J., Simmonds, R. E., et al. (2005). "Nocturnal haemodialysis: an Australian cost comparison with conventional satellite haemodialysis." Nephrology (Carlton) **10**(6): 557-570.

> Dialysis is an expensive therapy, particularly considering its recurrent, protracted nature while patient numbers are also increasing. To afford dialysis for those in need, smarter, more efficient use of limited funds is mandatory. Newer techniques and improved equipment now permit safe, highly effective haemodialysis (HD) at home, alone and while asleep. Indeed, the increase in treatment hours and frequency achieved through nocturnal HD both increase HD efficiency and reduce cardiovascular stress when comparing nocturnal HD (6 nights/week for 8 h/treatment) to conventional daytime HD (4 h/treatment, three times/week). This study compares the expenditure of two distinct HD programmes in the same renal service during the Australian financial year 2003/2004. A conventional satellite HD unit (SHDU) and a nocturnal home HD programme (NHHD(6)) are compared, with both programmes 'notionalised' to 30 patients. The state-derived funding models under which these programmes operate are explained. All wage costs, recurrent expenditure, fixed costs and the estimated costs of building and infrastructure are included. The total NHHD(6) programme expenditure was 33,392 Australian dollars/patient per year (103.82 Australian dollars/treatment) and was 3,892 Australian dollars/patient per year less (a 10.75% saving) when compared with the SHDU expenditure of 36,284 Australian dollars/patient per year (232.58 Australian dollars/treatment). This represented an annual 116,750 Australian dollars programme saving for a 30 patient cohort. Potential additional NHHD(6) savings in erythropoietin, hospitalization and social security dependence were also identified. Home-based therapies are clinically sound, effective and fiscally prudent and efficient. Funding models should reward home-based HD. Health services should encourage home training and support systems, sustaining patients at home wherever possible.

Altinors, N. et Haberal, M. (2018). "The Economics of Organ Transplantation." Exp Clin Transplant **16 Suppl 1**(Suppl 1): 108-111.

> To determine the cost effectiveness of transplantation, we analyzed the financial economics of the organ and tissue transplant process. We compared the cost of this process with traditional modalities for treating endstage liver and kidney disease. Medical, surgical, legal, social, ethical, and religious issues are important in organ transplant procedures. Government, health insurance companies, and uninsured individuals are affected by the financial economics of organ transplantation. The distribution of financial burden differs among countries and is dependent on the unique circumstances of each country.

Ashton, T. et Marshall, M. R. (2007). "The organization and financing of dialysis and kidney transplantation services in New Zealand." Int J Health Care Finance Econ **7**(4): 233-252.

> In New Zealand, patients receive treatment for end-stage renal disease (ESRD) within the tax-funded health system. All hospital and specialist outpatient services are free, while general practitioner consultations and pharmaceuticals prescribed outside of hospitals incur copayments. Total ESRD prevalence is 0.07%, half the U.S. rate, and the prevalence of home-based and self-care dialysis is the highest in the world. Medical staff are not subject to direct financial incentives that could affect treatment choice. Estimated total expenditure per ESRD patient is relatively low. Funding constraints encourage physicians and patients to consider the probable benefit of dialysis for a patient before treatment is prescribed.

Axelrod, D. A., Schnitzler, M. A., Xiao, H., et al. (2018). "An economic assessment of contemporary kidney transplant practice." Am J Transplant **18**(5): 1168-1176.

> Kidney transplantation is the optimal therapy for end-stage renal disease, prolonging survival and reducing spending. Prior economic analyses of kidney transplantation, using Markov models, have generally assumed compatible, low-risk donors. The economic implications of transplantation with high Kidney Donor Profile Index (KDPI) deceased donors, ABO incompatible living donors, and HLA

incompatible living donors have not been assessed. The costs of transplantation and dialysis were compared with the use of discrete event simulation over a 10-year period, with data from the United States Renal Data System, University HealthSystem Consortium, and literature review. Graft failure rates and expenditures were adjusted for donor characteristics. All transplantation options were associated with improved survival compared with dialysis (transplantation: 5.20-6.34 quality-adjusted life-years [QALYs] vs dialysis: 4.03 QALYs). Living donor and low-KDPI deceased donor transplantations were cost-saving compared with dialysis, while transplantations using high-KDPI deceased donor, ABO-incompatible or HLA-incompatible living donors were cost-effective (<$100 000 per QALY). Predicted costs per QALY range from $39 939 for HLA-compatible living donor transplantation to $80 486 for HLA-incompatible donors compared with $72 476 for dialysis. In conclusion, kidney transplantation is cost-effective across all donor types despite higher costs for marginal organs and innovative living donor practices.

Baboolal, K., McEwan, P., Sondhi, S., et al. (2008). "The cost of renal dialysis in a UK setting--a multicentre study." Nephrol Dial Transplant **23**(6): 1982-1989.

BACKGROUND: The UK National Health Service (NHS) will fund renal services using Payment by Results (PbR), from 2009. Central to the success of PbR will be the creation of tariffs that reflect the true cost of medical services. We have therefore estimated the cost of different dialysis modalities in the Cardiff and Vale NHS Trust and six other hospitals in the UK. METHODS: We used semi-structured interviews with nephrologists, head nurses and business managers to identify the steps involved in delivering the different dialysis modalities. We assigned costs to these using published figures or suppliers' published price lists. The study used mixed costing methods. Dialysis costs were estimated by a combination of microcosting and a top-down approach. Where we did not have access to detailed accounts, we applied values for Cardiff. RESULTS: The most efficient modalities were automated peritoneal dialysis (APD) and continuous ambulatory peritoneal dialysis (CAPD), the mean annual costs of which were pound21 655 and pound15 570, respectively. Hospital-based haemodialysis (HD) cost pound35 023 per annum and satellite-unit-based HD cost pound32 669. The cost of home-based HD was pound20 764 per year (based on data from only one unit). The main cost drivers for PD were the costs of solutions and management of anaemia. For HD they were costs of disposables, nursing, the overheads associated with running the unit and management of anaemia. CONCLUSIONS: Renal tariffs for PbR need to reflect the true cost of dialysis provision if choices about modalities are not to be influenced by erroneous estimates of cost. Knowledge of the true costs of modalities will also maximize the number of established renal failure patients treated by dialysis within the limited funds available from the NHS.

Baumeister, S. E., Boger, C. A., Kramer, B. K., et al. (2010). "Effect of chronic kidney disease and comorbid conditions on health care costs: A 10-year observational study in a general population." Am J Nephrol **31**(3): 222-229.

BACKGROUND: Chronic kidney disease (CKD) is common, but the longitudinal effects of CKD and associated comorbidities on health care costs in the general population are unknown. METHODS: Population-based cohort study of 2,988 subjects in Germany, aged 25-74 years at baseline, who participated both in the baseline and 10-year follow-up examination (1994/95-2004/05). Presence of CKD was based on serum creatinine and defined as an estimated glomerular filtration rate of <60 ml/min/1.73 m(2). Self-reported health services utilization was used to estimate costs. RESULTS: Health care costs at baseline and follow-up were higher for subjects with CKD. Controlling for socio-economics, lifestyle factors and comorbid conditions, subjects with baseline CKD, in comparison to those without, exhibited 65% higher total costs 10 years after baseline examination, corresponding to a difference in adjusted costs of EUR 743. Incident CKD was related to 38% higher total costs. Costs for inpatient treatment and drug costs were the major costs components, while CKD revealed no effect on outpatient costs. The effect of CKD was strongly modified by angina, myocardial infarction, diabetes, and anemia. CONCLUSIONS: The direct effect of CKD on costs is modified by comorbid conditions. Therefore, early treatment of CKD and its precipitous factors may save future health care costs.

Beddhu, S., Bruns, F. J., Saul, M., et al. (2000). "A simple comorbidity scale predicts clinical outcomes and costs in dialysis patients." Am J Med **108**(8): 609-613.

PURPOSE: In a university-based dialysis program, we found that 25% of the patients accounted for 50% of the costs and 42% of the deaths. We determined whether the Charlson Comorbidity Index, a simple measure of comorbid conditions, could predict clinical outcomes and costs in these patients. METHODS: Patients on hemodialysis or peritoneal dialysis from July 1996 to June 1998 at the University of Pittsburgh outpatient dialysis unit were studied. Comorbidity scores and outcomes were determined by reviewing the Medical Archival Retrieval System database and outpatient records. RESULTS: Two hundred sixty-eight patients were observed for 293 patient-years. The Comorbidity Index strongly predicted admission rate (relative risk per each unit increase = 1.20; 95% confidence interval [CI]: 1.16 to 1.23, P = 0.0001), hospital days and inpatient costs (both P <0.0001), and mortality (relative risk per unit increase = 1.24, 95% CI: 1.11 to 1.39, P = 0.0002.). Age and diabetes, used in the Health Care Financing Administration dialysis capitation model, correlated poorly with outcomes. CONCLUSIONS: The modified Charlson Comorbidity Index predicts outcomes and costs in dialysis patients. This index may be useful in determining appropriate payment for care of dialysis patients under capitated payment schemes and as a research tool to stratify dialysis patients in order to compare the outcomes of various interventions.

Bello, A. K., Levin, A., Manns, B. J., et al. (2015). "Effective CKD care in European countries: challenges and opportunities for health policy." Am J Kidney Dis **65**(1): 15-25.

Chronic kidney disease (CKD) is an important global public health problem that is associated with adverse health outcomes and high health care costs. Effective and cost-effective treatments are available for slowing the progression of CKD and preventing its complications, including cardiovascular disease. Although wealthy nations have highly structured schemes in place to support the care of people with kidney failure, less consideration has been given to health systems and policy for the much larger population of people with non-dialysis-dependent CKD. Further, how to integrate such strategies with national and international initiatives for control of other chronic noncommunicable diseases (NCDs) merits attention. We synthesized the various approaches to CKD control across 17 European countries and present our findings according to the key domains suggested by the World Health Organization framework for NCD control. This report identifies opportunities to strengthen CKD-relevant health systems and explores potential mechanisms to capitalize on these opportunities. Across the 17 countries studied, we found a number of common barriers to the care of people with non-dialysis-dependent CKD: limited work force capacity, the nearly complete absence of mechanisms for disease surveillance, lack of a coordinated CKD care strategy, poor integration of CKD care with other NCD control initiatives, and low awareness of the significance of CKD. These common challenges faced by diverse health systems reflect the need for international cooperation to strengthen health systems and policies for CKD care.

Bhowmik, D., Song, X., Intorcia, M., et al. (2018). "Healthcare resource use and costs associated with chronic kidney disease in US private insurance patients with multiple myeloma." J Oncol Pharm Pract: 1078155218766408.

Objectives Within a median 1.2 years after patients have an initial diagnosis with multiple myeloma, up to 61% were diagnosed with renal impairment and 50% were diagnosed with chronic kidney disease. This study estimated economic burden associated with chronic kidney disease in multiple myeloma patients in the US. Methods In this retrospective cohort study, patients >/=18 years old with >/=1 inpatient or >/= 2 outpatient multiple myeloma diagnoses between 1 January 2008 and 31 March 2015 were identified from MarketScan(R) Commercial and Medicare Supplemental Databases. Chronic kidney disease patients had >/=1 diagnosis of chronic kidney disease Stages 1-5 (first chronic kidney disease diagnosis date = index date) on or after the first multiple myeloma diagnosis, and were propensity score matched 1:1 to multiple myeloma patients without chronic kidney disease, end-stage renal disease, dialysis, or other type of chronically impaired renal function. All patients had >/=six-month continuous enrollment prior to index date and were followed for >/=one month from index date until the earliest of inpatient death, end of continuous enrollment, or end of the study period (30 September 2015). The per-patient per-year healthcare resource utilization and costs were measured during follow-up. Costs were total reimbursed amount in 2016 US dollars. Results A total of 2541 multiple myeloma patients with chronic kidney disease stages 1-5 and 2541 matched controls met the study criteria and were respectively 69.3 and 69.6 years, 54.5% and 55.3% men, and had 572.2 and 533.4 mean days of follow up. Compared to controls, chronic kidney disease patients had significantly (all P < 0.001) higher proportions (57.1% vs. 32.1%) and frequency (1.2 vs. 0.5) of inpatient admissions, frequency of emergency room visits (5.1 vs. 3.3), and total costs ($106,634 vs. $71,880). Sensitivity analyses found that patients with chronic kidney disease, end-stage renal disease, or dialysis had $78,455 (P < 0.001) higher costs (per-patient per-year) than matched controls. Conclusions The economic burden associated with chronic kidney disease in patients with multiple myeloma was estimated to be between $34,754 and $78,455 per-patient per-year. Given its substantial clinical and economic impact, preservation of renal function is important in multiple myeloma patient care.

Bohlouli, B., Jackson, T., Tonelli, M., et al. (2017). "Health care costs associated with hospital acquired complications in patients with chronic kidney disease." BMC Nephrol **18**(1): 375.

BACKGROUND: Patients with CKD are at increased risk of potentially preventable hospital acquired complications (HACs). Understanding the economic consequences of preventable HACs, may define the scope and investment of initiatives aimed at prevention. METHODS: Adult patients hospitalized from April, 2003 to March, 2008 in Alberta, Canada comprised the study cohort. Healthcare costs were determined and categorized into 'index hospitalization' including hospital cost and in-hospital physician claims, and 'post discharge' including ambulatory care cost, physician claims, and readmission costs from discharge to 90 days. Multivariable regression was used to estimate the incremental healthcare costs associated with potentially preventable HACs. RESULTS: In fully adjusted models, the median incremental index hospitalization cost was CAN-$6169 (95% CI; 6003-6336) in CKD patients with >/=1 potentially preventable HACs, compared with those without. Post-discharge incremental costs were 1471(95% CI; 844-2099) in those patients with CKD who developed potentially preventable HACs within 90 days after discharge compared with patients without potentially preventable HACs. Additionally, the incremental costs associated with >/=1 potentially preventable HACs within 90 days from admission in patients with CKD were $7522 (95% CI; 7219-7824). A graded relation of the incremental costs was noted with the increasing number of complications. In patients without CKD but with >/=1 preventable HACs incremental costs within 90 days from hospital admission was $6688 (95% CI: 6612-6723). CONCLUSIONS: Potentially preventable HACs are associated with substantial increases in healthcare costs in people with CKD. Investment in implementing targeted strategies to reduce HACs may have a significant benefit for patient and health system outcomes.

Cantaluppi, A. et East, P. (2000). "Technical and economic strategies of maintenance dialysis in the UK and Nordic Countries." J Nephrol **13 Suppl 3**: S10-15.

The technical and economic strategies of maintenance dialysis in the UK and Nordic Countries are described. In particular the concept of 'Therapy Cost', or therapy pricing, as it is also known, in the UK and the concept of 'Patient Flow', which basically plots the flow of patients through the dialysis process, in the Nordic Region are discussed.

Chang, Y. K., Hsu, C. C., Chen, P. C., et al. (2015). "Trends of cost and mortality of patients on haemodialysis with end stage renal disease." Nephrology (Carlton) **20**(4): 243-249.

AIM: The prevalence of end-stage renal disease in Taiwan is among the highest in the world. Treatment reimbursement for haemodialysis was capped in 1996 in order to contain costs. This study evaluated temporal changes in the costs and utilization of medical care and mortality in patients receiving haemodialysis following capped reimbursement. METHODS: Using insurance claims data in Taiwan between 1998 to 2009, we established eight annual subcohorts of patients with incident haemodialysis, increasing from 6099 in 1998 to 7745 in 2005. With a 4-year follow-up paradigm for each subcohort, we evaluated resources use and costs of medical services, as well as mortality trends. RESULTS: The annual mean cost for each haemodialysis patient increased from US $431 to $737 for emergency visits, US $9007 to $13,280 for hospitalizations and US $79,141 to $92,416 (16.8% increase) for total costs, from the initial to final subcohorts, respectively. Compared to the 1998 subcohort, the adjusted hazard ratio of deaths declined from 0.97 (95% CI 0.91 to 1.02) for the 1999 subcohort to 0.86 (95% CI 0.82 to 0.91) for the 2005 subcohort (P for trend <0.001). The corresponding cumulative probability of deaths decreased from 45.5% to 35.4%. CONCLUSIONS: The mortality for patients with haemodialysis decreased annually, whereas the overall annual cost increased despite capped reimbursement for haemodialysis. These results encourage further study on reasons of increased uses of emergency service and hospitalization.

Chen, B., Kuo, C. C., Huang, N., et al. (2018). "Reducing costs at the end of life through provider incentives for hospice care: A retrospective cohort study." Palliat Med **32**(8): 1389-1400.

BACKGROUND: Costs of medical care have been found to be highest at the end of life. AIM: To evaluate the effect of provider reimbursement for hospice care on end-of-life costs. DESIGN: The policy expanded access to hospice care for end-stage renal disease patients, a policy previously limited to cancer patients only. This study employed a difference-in-differences analysis using a generalized linear model. The main outcome is inpatient expenditures in the last 30 days of life. SETTING/PARTICIPANTS: A cohort of 151,509 patients with chronic kidney disease or cancer, aged 65 years or older, who died between 2005 and 2012 in the National Health Insurance Research Database, which contains all enrollment and inpatient claims data for Taiwan. RESULTS: Even as end-of-life costs for cancer are declining over time, expanding hospice care benefits to end-stage renal disease patients is associated with an additional reduction of 7.3% in end-of-life costs per decedent, holding constant patient and provider characteristics. On average, end-of-life costs are also high for end-stage renal disease (1.88 times higher than those for cancer). The cost savings were larger among older patients-among those who died at 80 years of age or higher, the cost reduction was 9.8%. CONCLUSION: By expanding hospice care benefits through a provider reimbursement policy, significant costs at the end of life were saved.

Chui, B. K., Manns, B., Pannu, N., et al. (2013). "Health care costs of peritoneal dialysis technique failure and dialysis modality switching." Am J Kidney Dis **61**(1): 104-111.

BACKGROUND: Although there is a strong economic rationale in favor of peritoneal dialysis (PD) over hemodialysis (HD), the potentially costly effect of PD technique failure is an important consideration in PD program promotion that is unknown. STUDY DESIGN: Incident dialysis patients were categorized by initial and subsequent modality changes during the first year of dialysis and tracked for inpatient and outpatient costs, physician claims, and medication costs for 3 years using merged administrative data sets. We determined unadjusted and adjusted total cumulative costs for each modality group using multivariable linear regression models. SETTING & PARTICIPANTS: All incident dialysis patients from Alberta in 1999-2003. OUTCOMES: 3-year mean adjusted total cumulative costs. MEASUREMENTS: Mean direct health care costs by modality group determined using patient-level resource utilization data. RESULTS: 3-year adjusted total cumulative costs for patients in the PD-only and HD-to-PD groups were $58,724 (95% CI, $44,123-$73,325) and $114,503 (95% CI, $96,318-$132,688), respectively, compared with $175,996 (95% CI, $134,787-$217,205) for HD only. PD technique failure was associated with lower costs by $11,466 (95% CI, $248-$22,964) at 1 year compared with HD only; however, costs were similar at 3 years. Costs drivers in PD technique failure arose primarily from costs of dialysis provision, hospitalization, medications, and physician fees. LIMITATIONS: This analysis is taken from the perspective of the health payer, and costs that are outside the health care system are not measured. CONCLUSIONS: Compared with patients who receive only HD, those who received PD only and those who transitioned from HD to PD therapy had significantly lower total health care costs at 1 and 3 years. Patients experiencing PD technique failure had costs similar and not in excess of HD-only patients at 3 years, further supporting the economic rationale for a PD-first policy in all eligible patients.

Chung, R., Howard, K., Craig, J. C., et al. (2014). "Economic evaluations in kidney transplantation: frequency, characteristics, and quality-a systematic review." Transplantation **97**(10): 1027-1033.

BACKGROUND: Economic evaluation provides a unique tool for informing healthcare decisions by explicitly quantifying limited resources required to achieve health gains and are widely used by policy makers to inform regulatory and subsidy decisions, but the validity of these studies in the field of transplantation is unknown. AIM: The objective of this study is to describe and evaluate the quality and reporting of recently published economic evaluations in kidney transplantation. METHODS: A comprehensive literature search was undertaken for economic evaluations of interventions used in kidney transplantation published between January 2000 and December 2011. RESULTS: A total of 66 studies were identified, with the majority (>60%) being supported by academia. About 80% of the included studies reported highly favorable cost-effectiveness ratios, with the majority showing dominance against the comparator. The overall qualities of the studies were adequate, but there was no improvement in the overall quality and frequency of economic evaluations over time. On a continuous scale between 0 and 1, studies that used a broader (societal) perspective, assessed health gains in quality adjusted life years, were supported by academia, and evaluated non-pharmaceutical interventions were associated with a 5% to 10% increase in the overall quality of the studies compared to studies that employed a narrower perspective, assessed health gains in natural units, were supported by industry, and evaluated pharmaceutical interventions. CONCLUSIONS: Economic evaluations are infrequently published in transplantation, but the overall methodological quality is high. Publication bias appears highly prevalent, with under-representation of studies that find small health gains and less favorable cost-effectiveness ratios published.

Covic, A. et Schiller, A. (2010). "Burden of disease - prevalence and incidence of ESRD in selected European regions and populations." Clin Nephrol **74 Suppl 1**: S23-27.

Rates of renal replacement therapy (RRT) vary markedly between Eastern and Western European countries. This review aims to establish the characteristics of healthcare systems and renal services that are independently associated with rates of initiation of RRT in these countries. The incidence of RRT varied from 12 to 455 per million populations (pmp); the only general population indicator independently associated with RRT incidence was aged 65+. Economic and financial conditions could also play an important role. Gross Domestic Product (GDP) per capita and the proportion of GDP spent on healthcare independently predicted RRT incidence. Each increase in hemodialysis (HD) facilities and competition between providers is associated with higher RRT incidence. In this context, macroeconomic and potentially modifiable renal service organizational factors appear more important determinants of provision of RRT than measurable medical factors. The economic, financial or medical conditions could also play an important role in treatment strategy. The proportion of patients receiving HD, peritoneal dialysis (PD) or transplantation shows marked variation in Europe. The East Europeans use more HD and less RTx as compared to West Europeans; the use of PD is similar. Treatment of anemia and mineral metabolism disorders also varies from one region to another. The mean baseline hemoglobin level and the prevalence of patients reaching this value are higher in West Europeans. Regarding mineral metabolism, the percent of patients achieving all four parameters (Ca, P, CaxP and PTH) was also higher in Western Europe. The adherence to EBPG (European Best Practice Guidelines) was also higher in these countries.

Davis, A. C., Shen, E., Shah, N. R., et al. (2018). "Segmentation of High-Cost Adults in an Integrated Healthcare System Based on Empirical Clustering of Acute and Chronic Conditions." J Gen Intern Med.

BACKGROUND: High-cost patients are a frequent focus of improvement projects based on primary care and other settings. Efforts to characterize high-cost, high-need patients are needed to inform care planning, but such efforts often rely on a priori assumptions, masking underlying complexities of a heterogenous population. OBJECTIVE: To define recognizable subgroups of patients among high-cost adults based on clinical conditions, and describe their survival and future spending. DESIGN: Retrospective observational cohort study. PARTICIPANTS: Within a large integrated delivery system with 2.7 million adult members, we selected the top 1% of continuously enrolled adults with respect to total healthcare expenditures during 2010. MAIN MEASURES: We used latent class analysis to identify clusters of alike patients based on 53 hierarchical condition categories. Prognosis as measured by healthcare spending and survival was assessed through 2014 for the resulting classes of patients. RESULTS: Among 21,183 high-cost adults, seven clinically distinctive subgroups of patients emerged. Classes included end-stage renal disease (12% of high-cost population), cardiopulmonary conditions (17%), diabetes with multiple comorbidities (8%), acute illness superimposed on chronic conditions (11%), conditions requiring highly specialized care (14%), neurologic and catastrophic conditions (5%), and patients with few comorbidities (the largest class, 33%). Over 4 years of follow-up, 6566 (31%) patients died, and survival in the classes ranged from 43 to 88%. Spending regressed to the mean in all classes except the ESRD and diabetes with multiple comorbidities groups. CONCLUSIONS: Data-driven characterization of high-cost adults yielded clinically intuitive classes that were associated with survival and reflected markedly different healthcare needs. Relatively few high-cost patients remain persistently high cost over 4 years. Our results suggest that high-cost patients, while not a monolithic group, can be segmented into few subgroups. These subgroups may be the focus of future work to understand appropriateness of care and design interventions accordingly.

De Vecchi, A. F., Dratwa, M. et Wiedemann, M. E. (1999). "Healthcare systems and end-stage renal disease (ESRD) therapies--an international review: costs and reimbursement/funding of ESRD therapies." Nephrol Dial Transplant **14 Suppl 6**: 31-41.

BACKGROUND: In healthcare economics, the cost factor plays a leading role, particularly for chronic diseases such as end-stage renal disease because of the growing number of patients. OBJECTIVES: An international comparison was made of the costs and reimbursement/funding of a selection of key dialysis modalities--centre haemodialysis (CHD), limited care haemodialysis (LCHD), home haemodialysis (home HD), continuous ambulatory peritoneal dialysis (CAPD) and automated peritoneal dialysis (APD)--in various industrial countries. The focus was on treatment costs plus erythropoietin medication and reimbursement of transportation costs. RESULTS: Reimbursement/funding of dialysis is different from country to country, with some healthcare system-specific commonalities: in 'public' systems, the funding is based more on global budgets, whereas in mixed public and private countries it is based mainly on reimbursement rates per treatment. Only in the 'private system' of the US is there one DRG (diagnostic-related group)-type rate for dialysis. By comparing the costs (in public countries) or reimbursements (in mixed countries) of treatment modalities within each country, we could see similar curves: the costs were the highest for public CHD, followed by private CHD. They were lower on LCHD and the lowest for home HD and CAPD, which were at nearly the same level. The cost level for APD was almost the same as that of LCHD. The reimbursements followed the cost pattern. Some countries introduced increases for CAPD and APD with the intention of increasing the share of home care. The costs and reimbursement patterns in the majority of countries (except the US and Japan) were very similar and therefore did not explain the different distribution of modalities in these countries. One explanation could be, however, the difference in microeconomics, CHD being a treatment with high fixed costs (personnel and structure) and CAPD being a treatment with low fixed costs, but high variable costs (supplies) and a low need for investments. DISCUSSION: The choice of treatment modality seems to be influenced strongly by the provider's perspective, being either public with limited HD capacity or private having invested in HD capacity. For public providers (and healthcare payers), CAPD is less expensive than CHD and offers a number of potential savings. In many countries, two CAPD patients could be treated for the same costs as one CHD patient. The microeconomics of private centres, however, are meant to use the investments maximally for CHD. Only if capacity limits are reached, is PD, with mainly supply costs, interesting. The future with constantly increasing numbers of patients and growing cost constraints will force all providers to make the best use of their resources by also offering home therapies such as PD to patients. The latter are cost efficient and offer comparable survival and quality of life.

de Wit, G. A., Ramsteijn, P. G. et de Charro, F. T. (1998). "Economic evaluation of end stage renal disease treatment." Health Policy **44**(3): 215-232.

This paper examines the cost-effectiveness of end stage renal disease (ESRD) treatments. Empirical data on costs of treatment modalities and quality of life of patients were gathered alongside a clinical trial and combined with data on patient and technique survival from the Dutch Renal Replacement Registry. A Markov-chain model, based on the actual Dutch ESRD program as of January 1st 1997, predicted the cost-effectiveness and cost-utility of dialysis and transplantation over the 5-year period 1997-2001. Total annual costs amounted to DFL 650 million (1.1% of the health care budget). Centre Haemodialysis was found to be the least cost-effective treatment, while transplantation and Continuous Ambulatory Peritoneal Dialysis (CAPD) were the most cost-effective treatments. The Markov-chain model was used to study the influence of substitutive policies on the overall cost-effectiveness of the ESRD treatment program. The influence of such policies was found to be modest in the Dutch context, where a high percentage of patients is already being treated with more cost-effective treatment modalities. In countries where Centre Haemodialysis is still the only or the major treatment option for ESRD patients, substitutive policies might have a more substantial impact on cost-effectiveness of ESRD treatment.

Dratwa, M. (2008). "Costs of home assistance for peritoneal dialysis: results of a European survey." Kidney Int Suppl(108): S72-75.

Assisted peritoneal dialysis (aPD) was 'invented' in France in 1977 and was immediately very well reimbursed. This has since helped to maintain a high French peritoneal dialysis (PD) penetration rate among elderly dependent patients who might enjoy a better quality of life by remaining in their own environment. The aim of this study was to investigate the present status of aPD funding in European countries through a questionnaire sent in 2006 to health authorities and commercial PD providers asking about reimbursement modalities (in euro ([euro]) per patient per year) for nurse aPD. Specific funding for aPD only exists in Belgium, Denmark, France, Switzerland, and one region of Spain (Canary Islands). Germany and the United Kingdom are testing pilot schemes. Compared to France, all other countries exhibit significant differences in reimbursement for similar services (performing bag exchanges or disconnections from/to a cycler, exit site care, monitoring weight as well as blood pressure and ultrafiltration, and also including transportation costs) both for continuous ambulatory peritoneal dialysis (CAPD) (23 400 vs 7280 \[euro] per patient per year in Spain) and automated peritoneal dialysis (APD) (18 200 vs 5356 euro per patient per year in Belgium); these differences are difficult to understand and might reflect disparities in cost of living, national health-care budget, and/or mean nurses' salaries. Also, there is no correlation between these rates and the reimbursement for PD therapy itself. Only France and Belgium differentiate assisted CAPD and APD, but these differences do not reflect the time really spent at the patient's home. It is concluded that high reimbursement rates for assistance add significant extra cost to PD, but allow granting many dependent patients all the advantages of home therapy, instead of treating them with in-center hemodialysis which in any case still remains more expensive for our societies.

Ellimoottil, C., Ye, Z., Chakrabarti, A. K., et al. (2016). "Understanding Inpatient Cost Variation in Kidney Transplantation: Implications for Payment Reforms." Urology **87**: 88-94.

OBJECTIVE: To examine the magnitude and sources of inpatient cost variation for kidney transplantation. METHODS: We used the 2005-2009 Nationwide Inpatient Sample to identify patients who underwent kidney transplantation. We first calculated the patient-level cost of each transplantation admission and then aggregated costs to the hospital level. We fit hierarchical linear regression models to identify sources of cost variation and to estimate how much unexplained variation remained after adjusting for case-mix variables commonly found in administrative datasets. RESULTS: We identified 8866 living donor (LDRT) and 5589 deceased donor (DDRT) renal transplantations. We found that higher costs were associated with the presence of complications (LDRT, 14%; P <.001; DDRT, 24%; P <.001), plasmapheresis (LDRT, 27%; P <.001; DDRT, 27%; P <.001), dialysis (LDRT, 4%; P <.001), and prolonged length of stay (LDRT, 84%; P <.001; DDRT, 82%; P <.001). Even after case-mix adjustment, a considerable amount of unexplained cost variation remained between transplant centers (DDRT, 52%; LDRT, 66%). CONCLUSION: Although significant inpatient cost variation is present across transplant centers, much of the cost variation for kidney transplantation is not explained by commonly used risk-adjustment variables in administrative datasets. These findings suggest that although there is an opportunity to achieve savings through payment reforms for kidney transplantation, policymakers should seek alternative sources of information (eg, clinical registry data) to delineate sources of warranted and unwarranted cost variation.

Endre, Z. H., Beaven, D. et Buttimore, A. (2006). "Preventable kidney failure: the cost of diabetes neglect?" N Z Med J **119**(1246): U2338.

AIMS: Diabetic kidney disease is currently responsible for 45% of new patients reaching end-stage chronic kidney disease in New Zealand. Since much of this may be prevented or deferred, we have made a preliminary analysis of the cost of diabetic nephropathy to New Zealand for those patients requiring renal replacement therapy (dialysis or transplantation). METHODS: Patient numbers were obtained from the Australian and New Zealand Dialysis and Transplant Registry and the Christchurch Hospital Nephrology database. Agreed costs were utilised for dialysis patients' average length of stay,

> and surgical costs of kidney transplantation were based on local estimates. National data were used for pharmaceutical costs. RESULTS: The cost of renal replacement therapy in New Zealand is conservatively estimated at NZ90 million dollars annually (based on 2003 figures). Diabetic nephropathy is responsible for at least 36 million dollars in direct annual healthcare costs. CONCLUSIONS: Primary or early secondary intervention strategies should be coordinated and implemented nationally. Renal indicator data from Get Checked and similar strategies must be made widely available to facilitate identification of early diabetic renal disease and allow coordinated intervention. These initiatives are now urgently required.

Essue, B. M., Wong, G., Chapman, J., et al. (2013). "How are patients managing with the costs of care for chronic kidney disease in Australia? A cross-sectional study." BMC Nephrol **14**: 5.

> BACKGROUND: Chronic kidney disease (CKD) poses a financial burden on patients and their households. This descriptive study measures the prevalence of economic hardship and out-of-pocket costs in an Australian CKD population. METHODS: A cross-sectional study of patients receiving care for CKD (stage III-V) in Western Sydney, Australia using a structured questionnaire. Data collection occurred between November 2010 and April 2011. Multivariate analyses assessed the relationships between economic hardship and individual, household and health system characteristics. RESULTS: The study included 247 prevalent CKD patients. A mean of AUD$907 per three months was paid out-of-pocket resulting in 71% (n=153) of participants experiencing financial catastrophe (out-of-pocket costs exceeding 10% of household income). Fifty-seven percent (n=140) of households reported economic hardship. The adjusted risk factors that decreased the likelihood of hardship included: home ownership (OR: 0.32, 95% CI: 0.14-0.71), access to financial resources (OR: 0.24, 95% CI: 0.11-0.50) and quality of life (OR: 0.12, 95% CI: 0.02-0.56). The factors that increased the likelihood of hardship included if income was negatively impacted by CKD (OR: 4.80, 95% CI: 2.17-10.62) and concessional status (i.e. receiving government support) (OR: 3.09, 95% CI: 1.38-6.91). Out-of-pocket costs and financial catastrophe were not found to be significantly associated with hardship in this analysis. CONCLUSIONS: This study describes the poorer economic circumstances of households affected by CKD and reinforces the inter-relationships between chronic illness, economic well-being and quality of life for this patient population.

Everett, B., Castel, L. D., McGinnis, M., et al. (2017). "Economic and Clinical Outcomes Resulting From the Stage 4 Chronic Kidney Disease Case Management Quality Improvement Initiative." Prof Case Manag **22**(6): 291-298.

> PURPOSE OF STUDY: Chronic kidney disease (CKD) is a costly and burdensome public health concern. The goal of this study was to evaluate the impact on outcomes and utilization of a pilot program to identify and engage beneficiaries with CKD at risk for progression from Stage 4 to Stage 5. PRIMARY PRACTICE SETTINGS: A quality improvement initiative was conducted to assess the impact of case management on costs and outcomes among 7,720 Cigna commercial medical beneficiaries with Stage 4 CKD enrolled in the United States between January 2012 and October 2012. METHODOLOGY AND SAMPLE: Claims data were analyzed to compare 3,861 beneficiaries randomized to receive condition-focused case management with 3,859 controls, with follow-up through July 2013. After using an algorithm to identify beneficiaries at highest risk of progression, a case management team implemented, among those assigned to the intervention, an evidence-based assessment tool, provided education and follow-up, engaged nephrologists and other providers, and conducted weekly rounds. Primary outcome measures were hospital admissions, emergency department visits, nephrologist visits, dialysis, arteriovenous (AV) fistula creation, and total medical costs. Analysis of variance techniques were used to test group differences. RESULTS: As compared with controls, intervention beneficiaries were 12% more likely to have fistula creation (p = .004). Intervention beneficiaries were observed to have savings of $199 per member per month (PMPM), F = 23.05, p = .04. This difference equated to 6% lower total medical costs in the intervention group. Savings observed were derived half from improved in-network utilization and half from reduced hospital costs. IMPLICATIONS FOR CASE MANAGEMENT PRACTICE: .

Ferguson, T. W., Zacharias, J., Walker, S. R., et al. (2015). "An Economic Assessment Model of Rural and Remote Satellite Hemodialysis Units." PLoS One **10**(8): e0135587.

BACKGROUND: Kidney Failure is epidemic in many remote communities in Canada. In-centre hemodialysis is provided within these settings in satellite hemodialysis units. The key cost drivers of this program have not been fully described. Such information is important in informing the design of programs aimed at optimizing efficiency in providing dialysis and preventative chronic kidney disease care in remote communities. DESIGN, SETTING, PARTICIPANTS, AND MEASUREMENTS: We constructed a cost model based on data derived from 16 of Manitoba, Canada's remote satellite units. We included all costs for operation of the unit, transportation, treatment, and capital costs. All costs were presented in 2013 Canadian dollars. RESULTS: The annual per-patient cost of providing hemodialysis in the satellite units ranged from $80,372 to $215,918 per patient, per year. The median per patient, per year cost was $99,888 (IQR $89,057-$122,640). Primary cost drivers were capital costs related to construction, human resource expenses, and expenses for return to tertiary care centres for health care. Costs related to transport considerably increased estimates in units that required plane or helicopter transfers. CONCLUSIONS: Satellite hemodialysis units in remote areas are more expensive on a per-patient basis than hospital hemodialysis and satellite hemodialysis available in urban areas. In some rural, remote locations, better value for money may reside in local surveillance and prevention programs in addition support for home dialysis therapies over construction of new satellite hemodialysis units.

Grun, R. P., Constantinovici, N., Normand, C., et al. (2003). "Costs of dialysis for elderly people in the UK." Nephrol Dial Transplant **18**(10): 2122-2127.

BACKGROUND: Growing acceptance rates of elderly patients for dialysis requires a careful planning of renal services expansion. As little is known about the actual resource use in patients 70 years and over, we evaluated the entire range of costs related to treatment, hospitalization, medication and other health and social service use, and assessed the impact of socio-demographic and clinical factors on costs. METHODS: Service use and costs were assessed in a 12-month prospective cohort study of 171 dialysis patients, 70 years of age and over, from four hospital-based renal units in London, UK. RESULTS: Total costs ranged between 14,940 pounds and 58,250 pounds per annum. The average annual cost was 22,740 pounds [95% confidence interval (CI), 21,470-24,020 pounds]. The majority of costs were allocated to dialysis treatment and transport (70%), hospitalizations (12%) and medication (12%). Other health and social services accounted for only 6% of total costs. Dialysis and hospitalization costs were pound 68.4 per day on average. Univariate subgroup analyses showed no significant difference between patients on peritoneal dialysis (64.5 pounds) and haemodialysis (71.5 pounds, P = 0.13). Age 80 years and over and presence of peripheral vascular disease (PVD) were associated with higher daily costs of 73.3 pounds compared with 63.2 pounds in the 70-74 age group (P = 0.033) and 76.9 pounds vs 63.8 pounds in patients without PVD (P = 0.022), respectively. Proximity to death was associated with a nearly pound 40 increase in daily costs (96.8 vs 59.7 pounds; P < 0.001). Multiple linear regression analyses confirmed these findings and showed that age 80 years and over and presence of peripheral and cerebrovascular disease were significant predictors of costs. There was a large but marginally significant difference in costs in patients with cancer. We found no evidence that diabetes was associated with higher dialysis and hospitalization costs. CONCLUSIONS: The costs of providing dialysis for patients 70 years and over are largely shaped by the treatment costs rather than by use of community health and social services. Though age above 80 and co-morbidity are associated with increased resource use, average treatment costs are not higher than estimates for dialysis patients in general. This suggests that there is no case for providing treatment to younger patients and denying it to elderly patients on grounds of cost.

Hallinen, T., Soini, E. J., Martikainen, J. A., et al. (2009). "Costs and quality of life effects of the first year of renal replacement therapy in one Finnish treatment centre." J Med Econ **12**(2): 136-140.

OBJECTIVE: The main objective of the study was to assess the cost and quality of life (QoL) effects of elective dialysis patients during the first year of end-stage renal disease (ESRD) treatment in one Finnish treatment centre. METHODS: A prospective case-series study was performed involving all elective dialysis patients (n=29) in a Finnish dialysis unit during 2003-2004. Direct costs of ESRD treatment were obtained from the hospital database and the Social Insurance Institution. The QoL effects were measured at the initiation of treatment, at 6 and at 12 months using 15D, a generic QoL instrument. RESULTS: The average cost of ESRD treatment was 69,085 euro. The improvement in the patients' QoL score was statistically and clinically significant during the first treatment year. The most significant changes were seen in the dimensions of breathing and vitality. The condition of patients commencing haemodialysis (HD) was more severe than that of patients commencing peritoneal dialysis (PD) as indicated by worse residual kidney function and poorer quality of life at the initiation. CONCLUSIONS: In this small patient population, treatment of ESRD during the first year seemed to improve or maintain the QoL of the patients.

Harris, A. (2007). "The organization and funding of the treatment of end-stage renal disease in Australia." Int J Health Care Finance Econ **7**(2-3): 113-132.

Treatment rates for end-stage renal disease have risen over the last 25 years in Australia, from 3,181 patients in 1981 to 14,221 patients (707 per million) in 2004. Access to dialysis services is largely through the national public insurance system, with more than 85% of services provided by public hospitals for outpatient (68%) or home-based (32%) care. Annual payment rates per patient are around AU$53,500 for hemodialysis (78% of patients). Total recurrent health expenditure on all chronic kidney disease was AU$647 million, or 1.3% of the total recurrent health expenditure that could be allocated by disease.

Hernandez-Jaras, J., Garcia, H., Bernat, A., et al. (2000). "[Approximation to cost analysis of various types of hemodialysis using relative value units]." Nefrologia **20**(3): 284-290.

Hemodialysis sessions performed in Hospital Units have a different degree of complexity depending on the kind of patients who is receiving this treatment. This paper's aim is to apply certain weighting factors, which measure the complexity of each type of session performed, and so allow a more realistic comparison with hemodialysis sessions performed in dialysis Units. The various costs of the Castellon General Hospital Dialysis Unit were calculated. Five types of Hospital-performed sessions were defined, to which were applied concrete weighting factors called Relative Value Units (RVU). These took account of health professionals' time, disposable material and drug expenses. The cost of single hemodialysis session, before the RVU calculation was added, was 28,549 pesetas (171.58 Eu.). Thirty-two per cent of the cost was from disposable material, 29.38% for cost of health professionals time, 18.54% for structural costs, 13.4% for drug expenses, and 5.73% for the nephrologists' time. When RVU were applied, the Type I session cost (chronic renal failure patients on regular hemodialysis), was 28,882 pesetas (149.54 Eu.). As the complexity of the procedure increased, up to the Type V session (acute renal failure patients in intensive Care Units), the costs also rose to 68,448 pesetas (411.38 Eu.). We conclude that weighing the different types of hemodialysis sessions by means of RVU, allows a better measurement of the costs and achieves a more accurate comparison with others hemodialysis units.

Higashiyama, A., Okamura, T., Watanabe, M., et al. (2009). "Effect of chronic kidney disease on individual and population medical expenditures in the Japanese population." Hypertens Res **32**(6): 450-454.

Chronic kidney disease (CKD) is associated with increased risk of cardiovascular disease (CVD), and may also lead to an increase in medical expenditures. The effect of CKD on individual and population medical expenditures was examined in a Japanese cohort study. The participants included 4026 Japanese National Health Insurance beneficiaries aged 40-74 years living in one city, who had no history of major CVD. They were classified into three categories according to their glomerular filtration rate (GFR) at the baseline survey, and their total medical expenditures were followed-up for 3 years. The arithmetic and geometric means of the cumulative medical expenditures were calculated for each category. The geometric mean was also expressed after adjusting for several confounding factors using analysis of covariance. The CKD-related medical expenditures attributable to the participants with mild (60 < or = GFR < 90) or moderate (30 < or = GFR < 60) kidney dysfunction were compared with those of participants with normal (GFR > or = 90) kidney function. There was a negative correlation between the GFR category and the arithmetic and geometric means of personal medical expenditures (adjusted geometric mean: GFR > or = 90, 167,879 yen; 60 < or = GFR < 90, 210,660 yen; and 30 < or = GFR < 60, 330,050 yen). The CKD-related medical expenditures accounted for 11.5 and 6.5% of the total medical expenditures for the participants with mild and moderate kidney dysfunction, respectively. The prevention of mild CKD is very important for containing medical expenditures. Appropriate strategies, such as regular creatinine measurement, are needed for early detection of CKD.

Hirth, R. A. (2007). "The organization and financing of kidney dialysis and transplant care in the United States of America." Int J Health Care Finance Econ **7**(4): 301-318.

In the United States, end-stage renal disease (ESRD) patients are primarily insured by the publicly funded Medicare program. Compared to other countries in the International Study of Health Care Organization and Financing (ISHCOF), the United States has the highest health care expenditures for the general population and among ESRD patients. However, because the Medicare program is more influential in the market for ESRD-related services than for other medical services, ESRD price controls have been relatively stringent. Nonetheless, ESRD costs have grown substantially through increases in prevalence and use of ancillary services. Treatment costs are also controlled by the relatively high rate of transplantation. Proposed reforms include bundling more services into a prospective payment system, developing case-mix adjustments, and financially rewarding providers for quality.

Hirth, R. A., Tedeschi, P. J. et Wheeler, J. R. (2001). "Extent and sources of geographic variation in Medicare end-stage renal disease expenditures." Am J Kidney Dis **38**(4): 824-831.

Geographic variations in practices and expenditures have been widely documented, leading to concerns that care in some regions is clinically suboptimal and/or economically inefficient. Our objectives are to determine the extent and sources of geographic variation in Medicare expenditures per patient with end-stage renal disease (ESRD) per year. The study population included all patients with ESRD with Medicare as primary payer during 1997 (n = 284,670). Medicare expenditures were summarized at the hospital referral region (HRR) level. Using regression analysis, we estimated the relationship between expenditures and demographics, case mix, dialysis provider characteristics, distribution of patients across renal replacement therapy modalities, standardized hospitalization ratios, and healthcare wages. Spending per patient-year varied threefold across HRRs, ranging from $17,791 to $59,025 (mean, $38,966 +/- $6,774 [SD]). The regression equation explained 80% of this variation. Although several demographic and case-mix indicators that have been related to spending at the individual level were statistically significant predictors of spending at the HRR level, they did not show enough geographic variation to explain a large fraction of spending variation. Rather, patient distributions across renal replacement modalities, hospitalization patterns, and healthcare wages were the most powerful predictors of spending. Compared with Medicare generally, both the mean and SD of ESRD expenditures were approximately seven times larger. The substantial geographic variability in expenditures for patients with ESRD indicates the potential for improving efficiency and quality of care. Interventions designed to increase transplantation rates, ensure access to peritoneal dialysis, and reduce hospitalization appear most promising.

Honeycutt, A. A., Segel, J. E., Zhuo, X., et al. (2013). "Medical costs of CKD in the Medicare population." J Am Soc Nephrol **24**(9): 1478-1483.

Estimates of the medical costs associated with different stages of CKD are needed to assess the economic benefits of interventions that slow the progression of kidney disease. We combined laboratory data from the National Health and Nutrition Examination Survey with expenditure data from Medicare claims to estimate the Medicare program's annual costs that were attributable to CKD stage 1-4. The Medicare costs for persons who have stage 1 kidney disease were not significantly different from zero. Per person annual Medicare expenses attributable to CKD were $1700 for stage 2, $3500 for stage 3, and $12,700 for stage 4, adjusted to 2010 dollars. Our findings suggest that the medical costs attributable to CKD are substantial among Medicare beneficiaries, even during the early stages; moreover, costs increase as disease severity worsens. These cost estimates may facilitate the assessment of the net economic benefits of interventions that prevent or slow the progression of CKD.

Hynes, D. M., Stroupe, K. T., Fischer, M. J., et al. (2012). "Comparing VA and private sector healthcare costs for end-stage renal disease." Med Care **50**(2): 161-170.

BACKGROUND: Healthcare for end-stage renal disease (ESRD) is intensive, expensive, and provided in both the public and private sector. Using a societal perspective, we examined healthcare costs and health outcomes for Department of Veterans Affairs (VA) ESRD patients comparing those who received hemodialysis care at VA versus private sector facilities. METHODS: Dialysis patients were recruited from 8 VA medical centers from 2001 through 2003 and followed for 12 months in a prospective cohort study. Patient demographics, clinical characteristics, quality of life, healthcare use, and cost data were collected. Healthcare data included utilization (VA), claims (Medicare), and patient self-report. Costs included VA calculated costs, Medicare dialysis facility reports and reimbursement rates, and patient self-report. Multivariable regression was used to compare costs between patients receiving dialysis at VA versus private sector facilities. RESULTS: The cohort comprised 334 patients: 170 patients in the VA dialysis group and 164 patients in the private sector group. The VA dialysis group had more comorbidities at baseline, outpatient and emergency visits, prescriptions, and longer hospital stays; they also had more conservative anemia management and lower baseline urea reduction ratio (67% vs. 72%; P<0.001), although levels were consistent with guidelines (Kt/V>/=1.2). In adjusted analysis, the VA dialysis group had $36,431 higher costs than those in the private sector dialysis group (P<0.001). CONCLUSIONS: Continued research addressing costs and effectiveness of care across public and private sector settings is critical in informing health policy options for patients with complex chronic illnesses such as ESRD.

Jaber, B. L., Finkelstein, F. O., Glickman, J. D., et al. (2009). "Scope and design of the Following Rehabilitation, Economics and Everyday-Dialysis Outcome Measurements (FREEDOM) Study." Am J Kidney Dis **53**(2): 310-320.

BACKGROUND: Conventional thrice-weekly hemodialysis (HD) has limited the ability to generate further improvements in patient quality of life, morbidity, and mortality. Daily HD (DHD) offers the promise of providing clinical and economic benefits. The objectives of the Following Rehabilitation, Economics and Everyday-Dialysis Outcome Measurements Study are to evaluate outcomes of DHD (6 times/wk) with the NxStage System One (NxStage Medical Inc, Lawrence, MA) device. DESIGN: Cohort study with matched control group. SETTING & PARTICIPANTS: The DHD group will include up to 500 participants at 70 clinical sites, enrolling for 3 years with a minimum of 1-year follow-up. Study candidates include adult patients (age >or= 18 years) with end-stage renal disease who are considered suitable candidates for DHD with the NxStage System One device by the treating physician and who have Medicare as their primary insurance payer. The control group will consist of a matched thrice-weekly in-center HD cohort derived from the US Renal Data System database using a 10:1 ratio, totaling 5,000 patients. PREDICTOR: Treatment with DHD and "standard of care" thrice-weekly HD. OUTCOMES & MEASUREMENTS: The primary intent-to-treat analysis compares hospitalization days/patient-year between the DHD and thrice-weekly HD groups. Other outcomes recorded in both groups include non-treatment-related medical expenditures. In addition, in the DHD cohort, changes in quality-of-life measures (baseline, 4 and 12 months, and every 6 months thereafter); urea kinetics; parameters related to anemia, bone and mineral metabolism, and nutrition; vascular access interventions; and use of medications will be examined. CONCLUSIONS: This study has the potential to elucidate the health and economic benefits of DHD and complement results of current clinical trials.

Janssen, D. J., Spruit, M. A., Wouters, E. F., et al. (2008). "Daily symptom burden in end-stage chronic organ failure: a systematic review." Palliat Med **22**(8): 938-948.

Chronic diseases are nowadays the major cause of morbidity and mortality worldwide. Patients with end-stage chronic organ failure may suffer daily from distressful physical and psychological symptoms. The objective of the present study is to systematically review studies that examined daily symptom prevalence in patients with end-stage chronic organ failure, with attention to those that included patients with either congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD) or chronic renal failure (CRF). Thirty-nine articles (8 CHF, 7 COPD, 2 CHF and COPD, 22 CRF) have been included. The included studies used various study designs. There was a wide range of daily symptom prevalence that may be due to the heterogeneity in methodology used. Nevertheless, findings suggest significant symptom burden in these patients. This review highlights the need for further prospective and longitudinal research on symptom prevalence in patients with end-stage CHF, COPD and CRF to facilitate the development of patient-centred palliative care programs.

Joy, M. S., Karagiannis, P. C. et Peyerl, F. W. (2007). "Outcomes of secondary hyperparathyroidism in chronic kidney disease and the direct costs of treatment." J Manag Care Pharm **13**(5): 397-411.

> BACKGROUND: There has been an emphasis over the last several years to identify and treat chronic kidney disease (CKD) and its complications as they evolve rather than waiting until the patient reaches end-stage renal disease (ESRD), also known as CKD stage 5. The number of patients who will be identified and prescribed therapies for complications such as secondary hyperparathyroidism (SHPT) is greater than initially proposed. OBJECTIVE: To review the pathways, complications, management, and estimated treatment costs of CKD-related SHPT. METHODS: An electronic literature search of MEDLINE (January 1980 through January 2007) was conducted for English-language publications using the base search term secondary hyperparathyroidism. To refine subsequent searches, the authors added Boolean operators to the following secondary and tertiary search terms: parathyroid hormone, chronic kidney disease, renal osteodystrophy, adynamic bone disease, vascular calcification, cardiovascular disease, vitamin D, vitamin D analogs, hypercalcemia, hyperphosphatemia, calcimimetics, costs, prevalence, and economics. RESULTS: The initial MEDLINE search produced 278 relevant articles. After refining the search terms, the authors triaged the results for English-language publications relevant to the discussion of SHPT and its complications in CKD, eliminating 149 publications. The remaining 129 publications were accepted for review. These articles represent a growing body of primarily observational evidence that demonstrates that elevated intact parathyroid hormone (PTH) levels cause deleterious physiological results across a variety of organ systems, including the cardiovascular and skeletal systems. Specific complications associated with SHPT are left ventricular hypertrophy (LVH), renal osteodystrophy (ROD), and extraskeletal calcification. Medical management of the PTH/vitamin D/calcium and phosphorus imbalances in SHPT focus on regulating PTH levels via vitamin D therapy. The class of calcimimetics is a newer treatment modality that has favorable effects on biochemical laboratory values, such as serum calcium and phosphorus levels, but current data do not show differences on hard endpoint patient-oriented outcomes compared with standard generic agents. The direct drug costs in April 2007 U.S. dollars of treating CKD-associated elevations in PTH in predialysis patients range from $8.40 per patient per week ($437 per year) for oral generic calcitriol to $88.90 per patient per week ($4,623 per year) for oral paricalcitol (expressed as 85% of average wholesale price [AWP] for brand drugs or 70% of AWP for generic drugs). The direct drug costs of treating SHPT in hemodialysis patients range from $80.20 per patient per week ($4,170 per year) for generic calcitriol (IV) to $278.46 per patient per week ($14,480 per year) for oral cinacalcet. CONCLUSIONS: SHPT causes skeletal and cardiovascular complications in CKD patients. Calcitriol therapy is effective in managing PTH levels, but efforts to reduce the associated hypercalcemia and hyperphosphatemia have led to the development of newer, yet more expensive, vitamin D analogs. With the lack of evidence to support comparative superior outcomes in end-organ disease among SHPT therapy alternatives, future research is still needed to clearly identify which newer agents are most competitive with the historical gold standard of calcitriol therapy.

Kahn, L. S., Vest, B. M., Madurai, N., et al. (2015). "Chronic kidney disease (CKD) treatment burden among low-income primary care patients." Chronic Illn **11**(3): 171-183.

> OBJECTIVE: This study explored the self-management strategies and treatment burden experienced by low-income US primary care patients with chronic kidney disease. METHODS: Semi-structured interviews were conducted with 34 patients from two primary care practices on Buffalo's East Side, a low-income community. Qualitative analysis was undertaken using an inductive thematic content analysis approach. We applied normalization process theory (NPT) to the concept of treatment burden to interpret and categorize our findings. RESULTS: The sample was predominantly African-American (79%) and female (59%). Most patients (79%) had a diagnosis of stage 3 CKD. Four major themes were identified corresponding to NPT and treatment burden: (1) coherence--making sense of CKD; (2) cognitive participation--enlisting support and organizing personal resources; (3) collective action--self-management work; and (4) reflexive monitoring--further refining chronic illness self-care in the context of CKD. For each component, we identified barriers hindering patients' ability to accomplish the necessary tasks. CONCLUSIONS: Our findings highlight the substantial treatment burden faced by inner-city primary care patients self-managing CKD in combination with other chronic illnesses. Health care providers' awareness of treatment burden can inform the development of person-centered care plans that can help patients to better manage their chronic illnesses.

Kaitelidou, D., Ziroyanis, P. N., Maniadakis, N., et al. (2005). "Economic evaluation of hemodialysis: implications for technology assessment in Greece." Int J Technol Assess Health Care **21**(1): 40-46.

> OBJECTIVES: Hemodialysis is a well-established treatment for 74 percent of end-stage renal disease (ESRD) patients in Greece. The purpose of this study is to provide an estimate of the direct cost of dialysis in a public hospital setting and an estimate of the loss of production for ESRD patients. The results will be useful for public health facility planning purposes. METHODS: A socioeconomic prevalence-based analysis was performed using micro-economic evaluation of health-care resources consumed to provide hemodialysis for ESRD patients in 2000. Lost productivity costs due to illness were estimated for the patient and family using the human capital approach and the friction method. Indirect morbidity costs due to absence from work and long-term were estimated, as well as mortality costs. Mean gross income was used for both patient and family. RESULTS: Total health-sector cost for hemodialysis in Greece exceeds 171 million Euros, or 182 Euros per session and 229 Euros per inpatient day. There were 2,046 years lost due to mortality, and the potential productivity cost was estimated at 9.9 million Euros, according to the human capital approach, and 303.000 Euros, according to the friction method. Total morbidity cost due to absence from work and early retirement was estimated at more than 273 million Euros, according to the human capital approach, and 12.5 Euros, according to the friction method. CONCLUSIONS: Providing hemodialysis care for 0.05 percent of the population suffering from ESRD absorbs approximately 2 percent of total health expenditure in Greece. In addition to the cost for the National Health System, production loss due to mortality and morbidity from the disease are also considerable. Promoting alternative technologies such as organ transplantation and home dialysis as well as improving hemodialysis efficiency through satellite units are strategies that may prove more cost-effective and psychologically advantageous for the patients.

Karopadi, A. N., Mason, G., Rettore, E., et al. (2013). "Cost of peritoneal dialysis and haemodialysis across the world." Nephrol Dial Transplant **28**(10): 2553-2569.

> Peritoneal dialysis (PD) as a modality is underutilized in most parts of the world today despite several advantages including the possibility of it being offered in the remotest of locations and being significantly more affordable than haemodialysis (HD) in most cases. In this article, we will compare the cost of HD and PD in several countries to demonstrate that PD is less than, or at least as expensive as, HD. A thorough literature survey of EMBASE and PUBMED was conducted; 78 articles which compared the annual PD and annual HD costs were finally selected. Careful attention was paid to the methodology followed by each study and the year it was published in. Our final calculations included 46 countries (20 developed and 26 developing). We found that the cost of HD was between 1.25 and 2.35 times the cost of PD in 22 countries (17 developed and 5 developing), between 0.90 and 1.25 times the cost of PD in 15 countries (2 developed and 13 developing), and between 0.22 and 0.90 times the cost of PD in 9 countries (1 developed and 8 developing). From our analysis, it is evident that most developed countries can provide PD at a lesser expense to the healthcare system than HD. The evidence on developing countries is more mixed, but in most cases PD can be provided at a similar cost where economies of scale have been achieved, either by local production or by low import duties on PD equipment.

Karopadi, A. N., Mason, G., Rettore, E., et al. (2014). "The role of economies of scale in the cost of dialysis across the world: a macroeconomic perspective." Nephrol Dial Transplant **29**(4): 885-892.

> BACKGROUND: The treatment of chronic kidney disease through dialysis is a considerable expense in most health systems. The two chief methods of providing dialysis, haemodialysis (HD) and peritoneal dialysis (PD) have significant differences in cost composition and factors of production. The aim of this article is to identify and quantify the macroeconomic variables that influence the relative cost of such modalities across different countries. METHODS: From previously published literature, we extracted the estimates of HD/PD cost ratios in a total of 46 countries. We conducted a multivariate regression analysis using the estimated HD/PD cost ratio in each country, with several country level indicators as explanatory variables. We found a strong statistical effect of the following variables on the HD/PD cost ratio: country's level of development, economies of scale and percentage of private health-care expenditure. RESULTS: The statistical effects on HD/PD ratio by local manufacturing and relaxed

> import regulation of PD equipment were calculated and were found to be very significant. CONCLUSIONS: it is possible for a country to still reap the benefits of economies of scale in provision of PD, even in the absence of a large enough market to make local production of PD equipment feasible in that country.

Kent, S., Schlackow, I., Lozano-Kuhne, J., et al. (2015). "What is the impact of chronic kidney disease stage and cardiovascular disease on the annual cost of hospital care in moderate-to-severe kidney disease?" BMC Nephrol **16**: 65.

> BACKGROUND: Reliable estimates of the impacts of chronic kidney disease (CKD) stage, with and without cardiovascular disease, on hospital costs are needed to inform health policy. METHODS: The Study of Heart and Renal Protection (SHARP) randomized trial prospectively collected information on kidney disease progression, serious adverse events and hospital care use in a cohort of patients with moderate-to-severe CKD. In a secondary analysis of SHARP data, the impact of participants' CKD stage, non-fatal cardiovascular events and deaths on annual hospital costs (i.e. all hospital admissions, routine dialysis treatments and recorded outpatient/day-case attendances in United Kingdom 2011 prices) were estimated using linear regression. RESULTS: 7,246 SHARP patients (2,498 on dialysis at baseline) from Europe, North America, and Australasia contributed 28,261 years of data. CKD patients without diabetes or vascular disease incurred annual hospital care costs ranging from pound403 (95% confidence interval: 345-462) in CKD stages 1-3B to pound525 (449-602) in CKD stage 5 (not on dialysis). Patients in receipt of maintenance dialysis incurred annual hospital costs of pound18,986 (18,620-19,352) in the year of initiation and pound23,326 (23,231-23,421) annually thereafter. Patients with a functioning kidney transplant incurred pound24,602 (24,027-25,178) in hospital care costs in the year of transplantation and pound1,148 (978-1,318) annually thereafter. Non-fatal major vascular events increased annual costs in the year of the event by pound6,133 (5,608-6,658) for patients on dialysis and by pound4,350 (3,819-4,880) for patients not on dialysis, and were associated with increased costs, though to a lesser extent, in subsequent years. CONCLUSIONS: Renal replacement therapy and major vascular events are the main contributors to the high hospital care costs in moderate-to-severe CKD. These estimates of hospital costs can be used to inform health policy in moderate-to-severe CKD.

Kerr, M., Bray, B., Medcalf, J., et al. (2012). "Estimating the financial cost of chronic kidney disease to the NHS in England." Nephrol Dial Transplant **27 Suppl 3**: iii73-80.

> BACKGROUND: Chronic kidney disease (CKD) is a major challenge for health care systems around the world, and the prevalence rates appear to be increasing. We estimate the costs of CKD in a universal health care system. METHODS: Economic modelling was used to estimate the annual cost of Stages 3-5 CKD to the National Health Service (NHS) in England, including CKD-related prescribing and care, renal replacement therapy (RRT), and excess strokes, myocardial infarctions (MIs) and Methicillin-Resistant Staphylococcus Aureus (MRSA) infections in people with CKD. RESULTS: The cost of CKD to the English NHS in 2009-10 is estimated at pound 1.44 to pound 1.45 billion, which is approximately 1.3% of all NHS spending in that year. More than half this sum was spent on RRT, which was provided for 2% of the CKD population. The economic model estimates that approximately 7000 excess strokes and 12 000 excess MIs occurred in the CKD population in 2009-10, relative to an age- and gender-matched population without CKD. The cost of excess strokes and MIs is estimated at pound 174-pound 178 million. CONCLUSIONS: The financial impact of CKD is large, with particularly high costs relating to RRT and cardiovascular complications. It is hoped that these detailed cost estimates will be useful in analysing the cost-effectiveness of treatments for CKD.

Khan, S. et Amedia, C. A., Jr. (2008). "Economic burden of chronic kidney disease." J Eval Clin Pract **14**(3): 422-434.

> OBJECTIVES: To define the cost of care and evaluate interventions associated with improving outcomes and delaying the progression of chronic kidney disease (CKD). METHODS: Using the PubMed database, a systematic review of the literature was conducted describing (i) the cost of care associated with treating earlier stages of CKD, and (ii) the role of early referral, erythropoiesis-stimulating proteins and anti-hypertensive agents in improving clinical outcomes and reducing the cost of CKD.

RESULTS: The higher costs associated with treatment of the CKD population are largely due to higher rates and duration of comorbidity-driven hospitalizations. Studies suggest that early referral to a nephrologist, use of erythropoiesis-stimulating proteins and anti-hypertensive agents may be associated with better outcomes and lower costs. In some instances, however, higher target haemoglobin levels could have harmful effects in CKD patients. CONCLUSION: The substantial costs incurred during earlier stages of CKD increase markedly during the transition to renal replacement and remain elevated thereafter. An increase in awareness among health care providers may result in more timely interventions. More proactive management, in turn, can lead to improved clinical and economic outcomes through the slowing of disease progression and prevention of comorbidities.

Kirby, L. et Vale, L. (2001). "Dialysis for end-stage renal disease. Determining a cost-effective approach." Int J Technol Assess Health Care **17**(2): 181-189.

OBJECTIVE: Renal replacement therapy (RRT) is essential for maintenance of life for those with end-stage renal disease. However, there remain many areas of uncertainty about which method of RRT should be chosen. This paper reports an economic model based on a systematic review that attempts to determine which method of dialysis, continuous ambulatory peritoneal dialysis (CAPD) or hemodialysis, a patient should have as the initial method of RRT. METHODS: A systematic review and a costing exercise carried out in a Scottish hospital were used to populate a Markov model. Scenario analysis was used to model plausible variations in variables included in the model. RESULTS: In 8 of the 16 scenarios developed hemodialysis dominated CAPD. In a further eight scenarios, the cost per life-year displayed considerable variability, ranging from between 5,000 Pounds to 51,000 Pounds. The higher costs per life-year were associated with minimum estimates of additional survival for a patient starting RRT on hospital hemodialysis. CONCLUSION: It may be more cost-effective to manage patients starting on RRT with hospital hemodialysis than CAPD. This has particular implications for the United Kingdom, given that up to 50% of new patients receive CAPD.

Klarenbach, S. W., Tonelli, M., Chui, B., et al. (2014). "Economic evaluation of dialysis therapies." Nat Rev Nephrol **10**(11): 644-652.

The prevalence of chronic kidney disease and end-stage renal disease requiring dialysis therapy continues to increase worldwide, and despite technological advances, treatment remains resource intensive. Thus, the increasing burden of dialysis therapy on finite health-care budgets is an important consideration. The principles of allocative efficiency and the concept of 'opportunity cost' can be used to assess whether dialysis is economically justified; if dialysis is to be provided, cost-minimization and cost-utility analyses can be used to identify the most efficient dialysis modality. Existing studies have examined the cost, and where relevant the effectiveness, of the various currently available peritoneal dialysis and haemodialysis modalities. In this Review, we discuss variations in the intrinsic costs of the available dialysis modalities as well as other factors, such as variation by country, available health-care infrastructures, the timing of dialysis initiation and renal transplantation. We draw on data from robust micro-costing studies of the various dialysis modalities in Canada to highlight key issues.

Kleophas, W. et Reichel, H. (2007). "International study of health care organization and financing: development of renal replacement therapy in Germany." Int J Health Care Finance Econ **7**(2-3): 185-200.

The German health system represents the case of a global budget with negotiated fees and competing medical insurance companies. Physicians in private practice and non-profit dialysis provider associations provide most dialysis therapy. End-stage renal disease (ESRD) modalities are well integrated into the overall health care system. Dialysis therapy, independent of the mode of treatment, is reimbursed at a weekly flat rate. Mandatory health insurance covers health expenses, including those related to ESRD, for more than 90% of the population. Both employees and employers contribute to the premium for this insurance. Private medical insurance covers the remainder of the population. Access to treatment, including dialysis therapy, is uniformly available.

Komenda, P. et Sood, M. M. (2009). "The economics of home dialysis: acting for the individual while planning responsibly for the population." Adv Chronic Kidney Dis **16**(3): 198-204.

> Traditional medical education paradigms tend not to focus on health economics and economic evaluation. This has led to a culture in which bedside clinicians simply allocate health care resources made available to them, with often minimal input as to what these resources are at the population or health care system level. Life sustaining chronic dialysis therapies for end-stage renal disease are heterogeneous in terms of health care costs and the quality of life provided to patients receiving them. From the traditional clinician's perspective, they may be considered equivalent because there are no well-designed randomized control trials establishing the superiority of one particular dialysis modality in terms of all-cause mortality or cardiovascular events. The intent of this review is to provide clinicians practicing in the area of chronic kidney disease some insights into the concepts of economic evaluation and how it may be integrated into clinical decision making at a programmatic level while not compromising individual patient care at the bedside. An epidemiologic perspective will be used to help frame how the implementation of home dialysis modalities vary depending on local health policies in place. Lessons learned by regional nephrology care systems may be readily transferable to other jurisdictions in augmenting the uptake of home dialysis modalities where they are dwindling or struggling to grow. A high-level understanding of economic data in this area may help influence health policy in the direction of the most efficient provision of dialysis to patients while not adversely affecting their quality of life or health outcomes.

Lameire, N., Peeters, P., Vanholder, R., et al. (2006). "Peritoneal dialysis in Europe: an analysis of its rise and fall." Blood Purif **24**(1): 107-114.

> There is a wide variability in the utilization of peritoneal dialysis throughout Europe that cannot be explained by differences in medical factors alone. Over the last years, the utilization of peritoneal dialysis has even changed in individual countries. The main factors of this variation are not medical, but rather changes in reimbursement and other financial considerations. The overall structure of the health care in an individual country is to a large extent determining the use of a renal replacement therapy modality.

Lee, H., Manns, B., Taub, K., et al. (2002). "Cost analysis of ongoing care of patients with end-stage renal disease: the impact of dialysis modality and dialysis access." Am J Kidney Dis **40**(3): 611-622.

> BACKGROUND: Care of patients with end-stage renal disease (ESRD) is important and resource intense. To enable ESRD programs to develop strategies for more cost-efficient care, an accurate estimate of the cost of caring for patients with ESRD is needed. METHODS: The objective of our study is to develop an updated and accurate itemized description of costs and resources required to treat patients with ESRD on dialysis therapy and contrast differences in resources required for various dialysis modalities. One hundred sixty-six patients who had been on dialysis therapy for longer than 6 months and agreed to enrollment were followed up prospectively for 1 year. Detailed information on baseline patient characteristics, including comorbidity, was collected. Costs considered included those related to outpatient dialysis care, inpatient care, outpatient nondialysis care, and physician claims. We also estimated separately the cost of maintaining the dialysis access. RESULTS: Overall annual cost of care for in-center, satellite, and home/self-care hemodialysis and peritoneal dialysis were US $51,252 (95% confidence interval [CI], 47,680 to 54,824), $42,057 (95% CI, 39,523 to 44,592), $29,961 (95% CI, 21,252 to 38,670), and $26,959 (95% CI, 23,500 to 30,416), respectively ($P < 0.001$). After adjustment for the effect of other important predictors of cost, such as comorbidity, these differences persisted. Among patients treated with hemodialysis, the cost of vascular access-related care was lower by more than fivefold for patients who began the study period with a functioning native arteriovenous fistula compared with those treated with a permanent catheter or synthetic graft ($P < 0.001$). CONCLUSION: To maximize the efficiency with which care is provided to patients with ESRD, dialysis programs should encourage the use of home/self-care hemodialysis and peritoneal dialysis.

Li, B., Cairns, J., Fotheringham, J., et al. (2016). "Predicting hospital costs for patients receiving renal replacement therapy to inform an economic evaluation." The European Journal of Health Economics **17**(6): 659-668.
http://dx.doi.org/10.1007/s10198-015-0705-x

> To develop a model to predict annual hospital costs for patients with established renal failure, taking into account the effect of patient and treatment characteristics of potential relevance for conducting

an economic evaluation, such as age, comorbidities and time on treatment. The analysis focuses on factors leading to variations in inpatient and outpatient costs and excludes fixed costs associated with dialysis, transplant surgery and high cost drugs.

Lin, E., Chertow, G. M., Yan, B., et al. (2018). "Cost-effectiveness of multidisciplinary care in mild to moderate chronic kidney disease in the United States: A modeling study." PLoS Med **15**(3): e1002532.

BACKGROUND: Multidisciplinary care (MDC) programs have been proposed as a way to alleviate the cost and morbidity associated with chronic kidney disease (CKD) in the US. METHODS AND FINDINGS: We assessed the cost-effectiveness of a theoretical Medicare-based MDC program for CKD compared to usual CKD care in Medicare beneficiaries with stage 3 and 4 CKD between 45 and 84 years old in the US. The program used nephrologists, advanced practitioners, educators, dieticians, and social workers. From Medicare claims and published literature, we developed a novel deterministic Markov model for CKD progression and calibrated it to long-term risks of mortality and progression to end-stage renal disease. We then used the model to project accrued discounted costs and quality-adjusted life years (QALYs) over patients' remaining lifetime. We estimated the incremental cost-effectiveness ratio (ICER) of MDC, or the cost of the intervention per QALY gained. MDC added 0.23 (95% CI: 0.08, 0.42) QALYs over usual care, costing $51,285 per QALY gained (net monetary benefit of $23,100 at a threshold of $150,000 per QALY gained; 95% CI: $6,252, $44,323). In all subpopulations analyzed, ICERs ranged from $42,663 to $72,432 per QALY gained. MDC was generally more cost-effective in patients with higher urine albumin excretion. Although ICERs were higher in younger patients, MDC could yield greater improvements in health in younger than older patients. MDC remained cost-effective when we decreased its effectiveness to 25% of the base case or increased the cost 5-fold. The program costed less than $70,000 per QALY in 95% of probabilistic sensitivity analyses and less than $87,500 per QALY in 99% of analyses. Limitations of our study include its theoretical nature and being less generalizable to populations at low risk for progression to ESRD. We did not study the potential impact of MDC on hospitalization (cardiovascular or other). CONCLUSIONS: Our model estimates that a Medicare-funded MDC program could reduce the need for dialysis, prolong life expectancy, and meet conventional cost-effectiveness thresholds in middle-aged to elderly patients with mild to moderate CKD.

Lin, Y. T., Wu, P. H., Kuo, M. C., et al. (2013). "High cost and low survival rate in high comorbidity incident elderly hemodialysis patients." PLoS One **8**(9): e75318.

BACKGROUND: The comorbidity index is a predictor of mortality in dialysis patients but there are few reports for predicting elderly dialysis mortality and national population-based cost studies on elderly dialysis. The aim of this study was to evaluate the long-term mortality of incident elderly dialysis patients using the Deyo-Charlson comorbidity index (CCI) and to assess the inpatient and outpatient visits along with non-dialysis costs. METHODS: Data were obtained from catastrophic illness registration of the Taiwan National Health Insurance Research Database. Incident elderly dialysis patients (age >/=75 years) receiving hemodialysis for more than 90 days between Jan 1, 1998, and Dec 31, 2007, were included. Baseline comorbidities were determined one year prior to the first dialysis day according to ICD-9 CM codes. Survival time, mortality rate, hospitalization time, outpatient visit frequency, and costs were calculated for different age and CCI groups. RESULTS: In 10,759 incident elderly hemodialysis patients, hazard ratios for all-cause mortality were significantly increased in the different age groups ($p < 0.001$) and CCI patients ($p < 0.001$). Death rates increased with both increasing age and CCI score. High comorbidity incident hemodialysis and elderly patients were found to have increased length of hospital stay and total hospitalization costs. CONCLUSIONS: This population-based cohort study indicated that both age and higher CCI values were predictors of survival in incident elderly hemodialysis. Increased costs and mortality rates were evident in the oldest patients and in those with high CCI scores. Conservative treatment might be considered in high comorbidity and low-survival rate end stage renal disease (ESRD) patients.

Liu, F. X., Ghaffari, A., Dhatt, H., et al. (2014). "Economic evaluation of urgent-start peritoneal dialysis versus urgent-start hemodialysis in the United States." Medicine (Baltimore) **93**(28): e293.

> Patients presenting late in the course of kidney disease who require urgent initiation of dialysis have traditionally received temporary vascular catheters followed by hemodialysis. Recent changes in Medicare payment policy for dialysis in the USA incentivized the use of peritoneal dialysis (PD). Consequently, the use of more expeditious PD for late-presenting patients (urgent-start PD) has received new attention. Urgent-start PD has been shown to be safe and effective, and offers a mechanism for increasing PD utilization. However, there has been no assessment of the dialysis-related costs over the first 90 days of care. The objective of this study was to characterize the costs associated with urgent-start PD, urgent-start hemodialysis (HD), or a dual approach (urgent-start HD followed by urgent-start PD) over the first 90 days of treatment from a provider perspective. A survey of practitioners from 5 clinics known to use urgent-start PD was conducted to provide inputs for a cost model representing typical patients. Model inputs were obtained from the survey, literature review, and available cost data. Sensitivity analyses were also conducted. The estimated per patient cost over the first 90 days for urgent-start PD was $16,398. Dialysis access represented 15% of total costs, dialysis services 48%, and initial hospitalization 37%. For urgent-start HD, total per patient costs were $19,352, and dialysis access accounted for 27%, dialysis services 42%, and initial hospitalization 31%. The estimated cost for dual patients was $19,400. Urgent-start PD may offer a cost saving approach for the initiation of dialysis in eligible patients requiring an urgent-start to dialysis.

Liu, F. X., Treharne, C., Arici, M., et al. (2015). "High-dose hemodialysis versus conventional in-center hemodialysis: a cost-utility analysis from a UK payer perspective." Value Health **18**(1): 17-24.

> OBJECTIVE: To investigate the cost-effectiveness of high-dose hemodialysis (HD) versus conventional in-center HD (ICHD), over a lifetime time horizon from the UK payer's perspective. METHODS: We used a Markov modeling approach to compare high-dose HD (in-center or at home) with conventional ICHD using current and hypothetical home HD reimbursement tariffs in England. Sensitivity analyses tested the robustness of the results. The main outcome measure was the incremental cost-effectiveness ratio (ICER) expressed as a cost per quality-adjusted life-year (QALY). RESULTS: Over a lifetime, high-dose HD in-center (5 sessions/wk) is associated with higher per-patient costs and QALYs (increases of pound108,713 and 0.862, respectively) versus conventional ICHD. The corresponding ICER (pound126,106/QALY) indicates that high-dose HD in-center is not cost-effective versus conventional ICHD at a UK willingness-to-pay threshold of pound20,000 to pound30,000. High-dose HD at home is associated with lower total costs (pound522 less per patient) and a per-patient QALY increase of 1.273 compared with ICHD under the current Payment-by Results reimbursement tariff (pound456/wk). At an increased home HD tariff (pound575/wk), the ICER for high-dose HD at home versus conventional ICHD is pound17,404/QALY. High-dose HD at home had a 62% to 84% probability of being cost-effective at a willingness-to-pay threshold of pound20,000 to pound30,000/QALY. CONCLUSIONS: Although high-dose HD has the potential to offer improved clinical and quality-of-life outcomes over conventional ICHD, under the current UK Payment-by Results reimbursement scheme, it would be considered cost-effective from a UK payer perspective only if conducted at home.

London, R., Solis, A., Goldberg, G. A., et al. (2003). "Examination of resource use and clinical interventions associated with chronic kidney disease in a managed care population." J Manag Care Pharm **9**(3): 248-255.

> BACKGROUND: The management of chronic kidney disease (CKD) is multifaceted, including monitoring, early diagnosis, and treatment of comorbidities such as diabetes, hypoalbuminemia, and anemia, and initiating timely procedures in preparation for dialysis such as vascular access placement. Presumably, optimal care provided to patients during the predialysis phase will produce a significant impact on morbidity and mortality outcomes. OBJECTIVE: A retrospective analysis was conducted to assess specific factors that may be associated with optimal quality of care for CKD patients during the predialysis phase. METHODS: Health care resource utilization and the occurrence of interventions associated with optimal predialysis care were evaluated with claims data. Predialysis erythropoietin (EPO) therapy, nephrology referrals, and nutritional supplement administration were all examined during the 12 months prior to dialysis. RESULTS: Medical and pharmacy claims from a managed care database were analyzed for 1,936 incident dialysis patients. Of these, 48.7% did not have any interventions associated with optimal care. Only a minority of patients received prescription iron preparations (6.8%), vitamin D (4.0%), and phosphate binders (7.7%). A total of 20.8% patients had a vascular access placement, and 29.8% were in the care of a nephrologist during this same time period.

Only 10.5% received predialysis EPO, yet more than 40% were diagnosed with anemia. Of the EPO users, however, 72.4% were also receiving other interventions to appropriately manage CKD. CONCLUSION: These claims-documented results suggest that the lack of EPO use in predialysis patients in a managed care plan may predict overall suboptimal treatment of these patients. There is an apparent need for the proactive management of CKD in a managed care plan to potentially redistribute or reduce health care resource utilization while improving patient outcomes.

Luño, J. (2007). "The organization and financing of end-stage renal disease in Spain." Int J Health Care Finance Econ **7**(4): 253-267.
http://dx.doi.org/10.1007/s10754-007-9021-z

While the prevalence of end-stage renal disease (ESRD) in Spain is high, the incidence in comparison to the United States and Japan is low. Spain's rate of deceased organ donation is the highest in the world, and its renal transplant incidence rate is also relatively high. In addition, ESRD care represents a large portion of the overall health care budget. Quality of care in the National Health Service is not determined by competition or performance rewards; instead, several health agencies and scientific societies monitor it. Nevertheless, nephrologists with low salaries have relatively few professional and economic incentives to improve quality.

Manns, B., Meltzer, D., Taub, K., et al. (2003). "Illustrating the impact of including future costs in economic evaluations: an application to end-stage renal disease care." Health Econ **12**(11): 949-958.

There are strong theoretical arguments for including future costs for related and unrelated medical care and non-medical expenditures within economic evaluations. Nevertheless, there is limited data on how inclusion of such costs affects the cost effectiveness of medical interventions in practice. For a low-cost intervention that improves survival in end-stage renal disease (ESRD) patients, we sought to determine how the inclusion of future costs for related medical care (i.e. dialysis and transplantation) and for unrelated medical care and non-medical expenditure would affect the magnitude of the cost per QALY ratio. We performed a cost-utility analysis comparing hemodialysis using a synthetic dialyser (the current treatment of choice in Canada) with the historical gold-standard treatment (use of a cellulose dialyser). We contrasted the results of the analysis including and excluding various measures of future costs. While the inclusion of future costs for unrelated medical care and non-medical expenditures had a significant impact on the cost per QALY ratio, the size of the cost per QALY ratio was most sensitive to inclusion of future costs for related medical care. Our analysis shows that even relatively inexpensive interventions that extend survival of dialysis patients may not be cost-effective since, by extending survival, the extra outpatient dialysis costs that are incurred are large. Inclusion of such costs (which, in and of itself, is methodologically correct) in economic evaluations in this area may mitigate against the acceptance of interventions that are relatively inexpensive themselves but which improve patient survival.

Mohr, P. E., Neumann, P. J., Franco, S. J., et al. (2001). "The case for daily dialysis: its impact on costs and quality of life." Am J Kidney Dis **37**(4): 777-789.

Research suggests daily hemodialysis may improve clinical outcomes. To date, a comprehensive review of its implications on quality of life has not been performed, and little is known about its economic impact. We conducted an economic evaluation comparing short daily or nocturnal hemodialysis with thrice-weekly conventional in-center dialysis. Data on the quality of life and clinical effects of daily dialysis were obtained from more than 60 reports from 13 daily dialysis programs around the world (n = 197). Cost data were derived principally from the US Renal Data System, Centers for Disease Control, and Medicare Payment Advisory Commission. Resource use during daily hemodialysis was modeled after two ongoing programs in the United States. Results suggest that patients feel better and direct treatment costs could be reduced with daily dialysis. Costs are sensitive to assumptions about the effect of daily dialysis on hospital days. Reductions of at least 8% in hospital days are required for these modalities to be cost saving compared with documented reductions of 30% to 100%. Larger well-controlled studies of daily versus conventional dialysis would be helpful to determine whether daily dialysis fulfills these promises. Medicare policy, which limits payment for most patients to three dialysis treatments weekly, poses a disincentive to more widespread adoption

among dialysis centers. Given this constraint to broader acceptance, we address several policy options to gain a better understanding of the potential risks and benefits of daily dialysis.

Mowatt, G., Vale, L., Perez, J., et al. (2003). "Systematic review of the effectiveness and cost-effectiveness, and economic evaluation, of home versus hospital or satellite unit haemodialysis for people with end-stage renal failure." Health Technol Assess **7**(2): 1-174.

Nicholson, T. et Roderick, P. (2007). "International Study of Health Care Organization and Financing of renal services in England and Wales." Int J Health Care Finance Econ **7**(4): 283-299.

In England and Wales, the quantity and quality of renal services have improved significantly in the last decade. While acceptance rates for renal replacement therapy appear low by international standards, they are now commensurate with many other northern European countries. The major growth in renal services has been in hemodialysis, especially at satellite units. Health care is predominantly publicly funded through a tax-based National Health Service, and such funding has increased in the last 10 years. Improvements in health outcomes in England and Wales are expected to continue due to the recent implementation of standards, initiatives, and monitoring mechanisms for renal transplantation, vascular access, and patient transport.

Nissenson, A. R., Maddux, F. W., Velez, R. L., et al. (2012). "Accountable care organizations and ESRD: the time has come." Am J Kidney Dis **59**(5): 724-733.

Accountable care organizations (ACOs) are a newly proposed vehicle for improving or maintaining high-quality patient care while controlling costs. They are meant to achieve the goals of the Medicare Shared Savings Program mandated by the Patient Protection and Affordable Care Act (PPACA) of 2010. ACOs are voluntary groups of hospitals, physicians, and health care teams that provide care for a defined group of Medicare beneficiaries and assume responsibility for providing high-quality care through defined quality measures at a cost below what would have been expected. If an ACO succeeds in achieving both the quality measures and reduced costs, the ACO will share in Medicare's cost savings. Health care for patients with end-stage renal disease is complex due to multiple patient comorbid conditions, expensive, and often poorly coordinated. Due to the unique needs of patients with end-stage renal disease receiving dialysis, ACOs may be unable to provide the highly specialized quality care these patients require. We discuss the benefits and risks of a renal-focused ACO for dialysis patients, as well as the kidney community's prior experience with an ACO-like demonstration project.

Nugent, R. A., Fathima, S. F., Feigl, A. B., et al. (2011). "The burden of chronic kidney disease on developing nations: a 21st century challenge in global health." Nephron Clin Pract **118**(3): c269-277.

Chronic diseases present a significant challenge to 21st century global health policy. In developing nations, the growing prevalence of chronic diseases such as chronic kidney disease has severe implications on health and economic output. The rapid rise of common risk factors such as diabetes, hypertension, and obesity, especially among the poor, will result in even greater and more profound burdens that developing nations are not equipped to handle. Attention to chronic diseases, chronic kidney disease in particular, has been lacking, largely due to the global health community's focus on infectious diseases and lack of awareness. There is a critical need for funding in and to developing countries to implement more comprehensive, cost-effective, and preventative interventions against chronic diseases. This paper examines the epidemiology of chronic diseases, the growing prevalence of chronic kidney disease and its implications for global public health, and the associated health and economic burdens. Finally, a summary review of cost-effective interventions and funding needs is provided.

Ozieh, M. N., Dismuke, C. E., Lynch, C. P., et al. (2015). "Medical care expenditures associated with chronic kidney disease in adults with diabetes: United States 2011." Diabetes Res Clin Pract **109**(1): 185-190.

OBJECTIVE: Approximately 1 in 3 adults with diabetes have CKD. However, there are no recent national estimates of the association of CKD with medical care expenditures in individuals with

diabetes. Our aim is to assess the association of CKD with total medical expenditures in US adults with diabetes using a national sample and novel cost estimation methodology. RESEARCH DESIGN AND METHODS: Data on 2,053 adults with diabetes in the 2011 Medical Expenditure Panel Survey (MEPS) was analyzed. Individuals with CKD were identified based on self-report. Adjusted mean health services expenditures per person in 2011 were estimated using a two-part model after adjusting for demographic and clinical covariates. RESULTS: Of the 2,053 individuals with diabetes, approximately 9.7% had self-reported CKD. Unadjusted mean expenditures for individuals with CKD were $20,726 relative to $9,689.49 for no CKD. Adjusted mean expenditures from the 2-part model for individuals with CKD were $8473 higher relative to individuals without CKD. Additional significant covariates were Hispanic/other race, uninsured, urban dwellers, CVD, stroke, high cholesterol, arthritis, and asthma. The estimated unadjusted total expenditures for individuals with CKD were estimated to be in excess of $43 billion in 2011. CONCLUSIONS: We showed that CKD is a significant contributor to the financial burden among individuals with diabetes, and that minorities and the uninsured with CKD may experience barriers in access to care. Our study also provides a baseline national estimate of CKD cost in Diabetes by which future studies can be used for comparison.

Parra Moncasi, E., Arenas Jimenez, M. D., Alonso, M., et al. (2011). "Multicentre study of haemodialysis costs." Nefrologia **31**(3): 299-307.

BACKGROUND: Previous studies to determine the cost of haemodialysis (HD) in Spain have significant limitations: they are outdated or used indirect methods. There is also a lack of analysis performed simultaneously on Public centres (PC), with direct HD services, and partially state-subsidised centres (SC). This is an important issue since the two systems coexist in Spain. OBJECTIVES: To estimate the cost of HD replacement therapy for chronic renal failure in several centres. METHODS: This is a prospective and publicly-funded study, which estimates the costs for 2008 using a cost accounting system with specific allocation criteria. We collected demographic and comorbidity data for each centre. RESULTS: Six centres participated, two PC and four SC. There were no significant differences between centres in terms of patient demographics, time on haemodialysis and the Charlson comorbidity index. The total cost per patient per year ranged between euro 46, 254 and euro 33,130. The cost per patient per year (excluding vascular access and hospital admission) for PC was euro 42, 547 and euro 39, 289 and for SC euro 32 872, euro 29, 786, euro 35, 461 and euro 35, 294 (23% more in PC than SC). Costs related to staff/patient/year and consumables/patient/year were 67% and 83% respectively, higher for PC than SC. The highest percentage cost was for staff (average 30.9%), which showed significant variability between centres, both in absolute numbers (staff cost per patient per year between euro 18,151 and euro 8504) and as a percentage (between 42.6 % and 25.4%). CONCLUSIONS: Cost variability exists among different HD centres, and this can be attributed primarily to staff and consumables costs, which is higher for PC than SC.

Patel, U. D. et Davis, M. M. (2006). "Falling into the doughnut hole: drug spending among beneficiaries with end-stage renal disease under Medicare Part D plans." J Am Soc Nephrol **17**(9): 2546-2553.

The Medicare Part D prescription drug benefit may facilitate provision of medications by subsidizing drug costs. However, beneficiaries with higher drug utilization may face higher out-of-pocket (OOP) costs under the benefit's "doughnut hole" provisions that substantially increase beneficiary cost-sharing. The Medicare Current Beneficiary Survey Cost and Use data for 1997 through 2001 were used to estimate the impact of the standard Part D benefit on drug expenditures. The sample consisted of adults who were not dually enrolled in Medicaid (41,617 without ESRD, 256 with ESRD). Outcomes were annual total and OOP drug spending projected to 2006, as well as estimates of individual spending changes under Part D. In 2006, ESRD beneficiaries will have mean annual total and OOP expenditures that are approximately twice that of their Medicare peers. The overall impact of Part D on OOP expenditures is similar among all beneficiaries; however, many individuals with employer-sponsored coverage and those with higher costs (especially those with ESRD) may face cost increases with significant monthly variability as a result of reaching the "doughnut hole," a no-coverage gap in the standard benefit. Therefore, ESRD beneficiaries face substantial total and OOP annual expenditures for medications, causing most to reach the Part D benefit gap. Higher OOP costs may lead to reductions in spending and medication use with subsequent treatment gaps that may lead to increased use of medical services. As the new legislation takes effect, policy makers who are considering modifications in the program may benefit from further research to monitor patterns and gaps in coverage, medication use and spending, and hospitalization and survival trends.

Peeters, P., Rublee, D., Just, P. M., et al. (2000). "Analysis and interpretation of cost data in dialysis: review of Western European literature." Health Policy **54**(3): 209-227.

BACKGROUND: Constant improvements in dialysis technology, combined with a growing chronic renal failure population and limited funds, have put clinicians under pressure to prescribe the most cost-effective therapies. Improvements in dialysis, which eliminates metabolic waste products and preserves a normal electrolyte and fluid balance, have enhanced the quality of care among renal patients but at high monetary cost to health systems. Several recent studies report that yearly costs of peritoneal dialysis (PD) (because of technical differences in treatment strategies) are less than hemodialysis (HD) with hospital and other costs included. However, cost analyses of dialysis modalities are not always complete. As a result they are often difficult to directly compare. Furthermore, input costs, health care organizations, and patient use of dialysis vary from country to country in important ways. OBJECTIVE: To review critically the European literature in dialysis where cost data in caring for patients is available, and maximize information about the nature of the cost data in dialysis. METHODS: Survey of published literature including an economic evaluation with cost values in Western Europe; 25 such studies were identified, described in 20 publications. The search focused primarily on articles and reports published since 1990. The appraisal of studies took place according to standard costing procedures, covering, but not limited to, specification of analytic perspective and cost components considered. RESULTS: Costs between dialysis modalities vary from country to country in important ways, although power to detect such differences was limited. The disclosure of details regarding costing methods ranged widely. Only four studies presented adequate descriptive information for dialysis costs. CONCLUSIONS: Errors should be expected in all exercises to estimate dialysis costs. But, potentially misleading conclusions about the relative costs of dialysis therapies have been published in the absence of supporting evidence. Costing information in this field is often handled inconsistently and unsatisfactorily. The analysis and reporting of costs within publications concerning dialysis needs improvement. The review suggests a positive cost advantage to peritoneal dialysis over hemodialysis, but the magnitude of the difference is difficult to evaluate at this time.

Pontoriero, G., Pozzoni, P., Vecchio, L. D., et al. (2007). "International Study of Health Care Organization and Financing for renal replacement therapy in Italy: an evolving reality." Int J Health Care Finance Econ **7**(2-3): 201-215.

The Italian national health system funds universal health care through general taxation, but health services are provided by local institutions. This study examines the epidemiology, provision, and funding of renal replacement therapy (RRT) in Italy. In 2001, prevalence and incidence of RRT in Italy were 0.083% and 0.014%, respectively. A 1999 donation law markedly increased renal transplantation rates. Italy spends 8.3% of its GDP on health care; 1.8% is for end-stage renal disease (ESRD) patients, who represent 0.083% of the general population. The reorganization of the NHS requires attention from the health community so that economic and geographic health disparities are not exacerbated.

Queeley, G. L. et Campbell, E. S. (2018). "Comparing Treatment Modalities for End-Stage Renal Disease: A Meta-Analysis." Am Health Drug Benefits **11**(3): 118-127.

Background: End-stage renal disease (ESRD) imposes significant economic and social burdens on patients and healthcare systems. In the United States alone, more than 600,000 Americans have ESRD, with an estimated annual cost of treatment of more than $30 billion. Peritoneal dialysis and hemodialysis are competing renal replacement therapies in ESRD; however, data comparing quality-of-life outcomes between these 2 modalities are limited. Objectives: To compare the effectiveness of peritoneal dialysis with the more common treatment modality of hemodialysis on the health-related quality of life (HRQoL) of patients with ESRD in the general, physical, and psychological domains; and to determine whether the time of publication and the origin of each study influenced its findings regarding the effectiveness of the 2 modalities. Methods: This meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines to collect the data. PubMed, MEDLINE, and PsycINFO were the primary databases searched. Only articles published in English were included in this meta-analysis. The measure of effect size was Cohen's standardized mean difference. A random-effects model was used to test the hypothesis of equality in the mean HRQoL. Results: A total of 15 studies with a combined sample size of 4318 patients met the study criteria and were included in the analysis. The pooled effect sizes based on the random-effects model were 0.24 (95% confidence interval [CI], -0.17-0.66) in the general domain; 0.10 (95% CI, -0.09-0.29) in the physical-functioning domain; and 0.29 (95% CI, -0.13-0.71) in the psychological-functioning domain. None of the summary effect sizes was statistically significant. Subgroup analyses favored peritoneal dialysis regarding the time and country of publication. Conclusion: The majority of the studies included in this analysis favored peritoneal dialysis over hemodialysis in all 3 domains. However, the pooled effect sizes were not significant, resulting in the inability to conclude that peritoneal dialysis is the more effective of these 2 treatment modalities.

Robbins, J. D., Kim, J. J., Zdon, G., et al. (2003). "Resource use and patient care associated with chronic kidney disease in a managed care setting." J Manag Care Pharm **9**(3): 238-247.

OBJECTIVE: To describe the resource utilization and care of chronic kidney disease (CKD) patients in a managed care plan. METHODS: This was a retrospective claims analysis of a nationwide managed care medical and pharmacy database from September 1, 1998, to July 31, 2001. Twenty-seven health plans in 19 states distributed across the Northeast, Southeast, Midwest, and Southwest United States were represented in this analysis. CKD patients were identified using ICD-9 CM, CPT-4, and HCPCS codes indicative of dialysis. Patients continuously enrolled for at least 6 months before and 3 months after an initial dialysis event were included in the study. Health care charges and associated clinical information were assessed during 3 time periods: predialysis was from the sixth through the second month before initial dialysis, peridialysis was 30 days before and 30 days after initial dialysis, and postdialysis was the second and third month after initial dialysis. The main outcome measures were total health care charges, primary diagnoses, and diagnosis- related groups (DRGs). RESULTS: The per-patient-per-month charges were 4,265 dollars in the predialysis period (average for 5 months), 35,292 dollars in the peridialysis period (average for 2 months), and 15,399 dollars in the postdialysis period (average for 2 months). The most common primary diagnosis categories during all time periods were chronic renal failure and congestive heart failure. Similarly, the most common DRGs were related to renal and heart failure. A total of 38.2% of patients did not have an initial nephrologist visit until the first dialysis event. Treatments with nutritional supplements and medications such as angiotensin-converting enzyme inhibitors and erythropoietin were found to be suboptimal. CONCLUSION: CKD patients generate significant medical charges during the predialysis period and after initiation of dialysis. Further investigations are warranted to assess the impact of active management of CKD patients on CKD-related health care expenditures in kidney disease.

Sabariego, C., Grill, E., Brach, M., et al. (2010). "Incremental cost-effectiveness analysis of a multidisciplinary renal education program for patients with chronic renal disease." Disabil Rehabil **32**(5): 392-401.

AIM: The aim of this economic evaluation is to address the economic impact of a multidisciplinary renal patient education on the work maintenance of patients with chronic renal disease. METHOD: A total of 281 patients were recruited. An incremental cost-effectiveness analysis considering direct medical costs and days in the work force was performed. In addition, a Cox proportional hazards survival analysis was performed to investigate the effect of receiving the intervention on early retirement due to work disability. RESULTS: The incremental cost-effectiveness ratio [95% CI] per day in the work force saved was 737.02 degrees euro [-3345.64; 3093.03] in the whole group, 73.74 degrees euro [-995.28; 1429.92] in patients with a mild limitation and -113.25 degrees euro [-3252.06; 1525.58] in patients with a moderate to severe limitation in kidney function. After adjusting for observed time period, serum creatinine and age, having received the intervention had an almost significant medium-term protective effect on early retirement (hazard ratio 0.314, 95% CI 0.10-1.03, p = 0.0557). CONCLUSIONS: The cost-effectiveness of the multidisciplinary patient education highly depends on the level of limitation in kidney function and the intervention may be cost-effective in maintaining patients with mild limitation in kidney function in the work force.

Sanchez-Escuredo, A., Alsina, A., Diekmann, F., et al. (2015). "Economic analysis of the treatment of end-stage renal disease treatment: living-donor kidney transplantation versus hemodialysis." Transplant Proc **47**(1): 30-33.

> INTRODUCTION: End-stage renal disease (ESRD) is a major public health problem in the Spanish health system. Kidney transplantation is the treatment of choice, offering better survival and cost-effectiveness than other alternatives. This study aimed to compare the cost of living-donor kidney transplantation (LDKT) during the first year after transplantation with that of hemodialysis (HD). METHOD: A prospective, descriptive study of cost and efficacy was performed in the Hospital Clinic in Barcelona from January to December 2011. We included 106 patients (57 undergoing HD and 49 receiving a LDKT). The costs of LDKT (donor and recipient) and HD were calculated based on our economic database program. RESULTS: The mean age of recipients and donors was 46 +/- 15 and 52 +/- 10 years, respectively, and 67% of the recipients were men. In HD patients, the mean age was 67 +/- 11 years and 62% were men. The total cost of LDKT was euro29,897.91 (euro8,128.44 for donors and euro21,769.47 for recipients). The total cost of HD was euro43,000.88 (euro37,917 for HD and related procedures plus euro5,082 for transport). LDKT represented a savings of euro13,102.97 per patient/year and the payback period was less than 1 year. Quality-adjusted life years were higher in LDKT than in HD patients. CONCLUSION: LDKT is cost effective during the first year after transplantation and is associated with enhanced quality of life. From both the medical and economic points of view, pre-emptive LDKD should be encouraged in Spain to reduce the health budget for ESRD.

Sandoz, M. S., Ess, S. M., Keusch, G. W., et al. (2004). "Prevalence and direct medical costs of end-stage renal disease in patients with type 2 diabetes mellitus in Switzerland for 2001." Swiss Med Wkly **134**(31-32): 448-458.

> BACKGROUND: The prevalence of end-stage renal disease (ESRD) in patients with type 2 diabetes mellitus (type 2 DM) has increased in recent decades throughout the world. In most industrialised countries, diabetic nephropathy in type 2 diabetics is the most frequent cause of ESRD. AIMS: The prevalence and direct medical costs for the insurance funds in Switzerland were determined for ESRD in patients with type 2 DM. METHODS: Prevalence was determined on the basis of a written retrospective cross-sectional analysis covering all centres for dialysis and transplantation in Switzerland. Costs were calculated separately for the three different therapeutic options for ESRD - haemodialysis, peritoneal dialysis and renal transplantation. Costs were calculated on the basis of the percentage of the patients in this cross-sectional study who received each of these treatments. Cost data from the Swiss Union for the Social Duties of the Insurance Funds (SVK) were used for all three treatments. SVK data were not available for some phases of transplantation, and for these phases the consumption of health resources was determined by interviewing experts on the telephone, using a questionnaire. RESULTS: The cross-sectional study in the dialysis and transplantation centres was based on full collection of data. In Switzerland in the year 2001, the prevalence of ESRD in patients with type 2 DM came to 73.0 per million inhabitants. The direct medical costs of this complication came to a total of CHF 46,065,788 (0.1% of the total health expenditure). This corresponds to CHF 1570 per 100,000 inhabitants per day. 81.6% of these costs are for haemodialysis, 7.1% for peritoneal dialysis and 11.4% for renal transplantation. ESRD costs are CHF 215 per patient per day. CONCLUSIONS: The prevalence of ESRD in patients with type 2 DM in Switzerland was 73.0 per million inhabitants in 2001. The costs of this avoidable late complication are considerable.

Sands, J. J. (2006). "Disease management improves ESRD outcomes." Int J Artif Organs **29**(2): 154-159.

> Renal disease management organizations have reported achieving significant decreases in mortality and hospitalization in conjunction with cost savings, improved patient satisfaction and quality of life. Disease management organizations strive to fill existing gaps in care delivery through the standardized use of risk assessment, predictive modeling, evidence based guidelines and process and outcomes measurement. Patient self-management education and the provision of individual nurse care managers are also key program components. As we more fully measure clinical outcomes and total health-care costs including payments from all insurance and government entities, pharmacy costs and out-of-pocket expenditures, the full implications of disease management can be better defined. The results of this analysis will have a profound influence on United States healthcare policy. At present,

current data suggests that the promise of disease management, improved care at reduced cost, can and is being realized in ESRD.

Satayathum, S., Pisoni, R. L., McCullough, K. P., et al. (2005). "Kidney transplantation and wait-listing rates from the international Dialysis Outcomes and Practice Patterns Study (DOPPS)." Kidney Int **68**(1): 330-337.

BACKGROUND: The international Dialysis Outcomes and Practice Patterns Study (DOPPS I and II) allows description of variations in kidney transplantation and wait-listing from nationally representative samples of 18- to 65-year-old hemodialysis patients. The present study examines the health status and socioeconomic characteristics of United States patients, the role of for-profit versus not-for-profit status of dialysis facilities, and the likelihood of transplant wait-listing and transplantation rates. METHODS: Analyses of transplantation rates were based on 5267 randomly selected DOPPS I patients in dialysis units in the United States, Europe, and Japan who received chronic hemodialysis therapy for at least 90 days in 2000. Left-truncated Cox regression was used to assess time to kidney transplantation. Logistic regression determined the odds of being transplant wait-listed for a cross-section of 1323 hemodialysis patients in the United States in 2000. Furthermore, kidney transplant wait-listing was determined in 12 countries from cross-sectional samples of DOPPS II hemodialysis patients in 2002 to 2003 (N= 4274). RESULTS: Transplantation rates varied widely, from very low in Japan to 25-fold higher in the United States and 75-fold higher in Spain (both P values <0.0001). Factors associated with higher rates of transplantation included younger age, nonblack race, less comorbidity, fewer years on dialysis, higher income, and higher education levels. The likelihood of being wait-listed showed wide variation internationally and by United States region but not by for-profit dialysis unit status within the United States. CONCLUSION: DOPPS I and II confirmed large variations in kidney transplantation rates by country, even after adjusting for differences in case mix. Facility size and, in the United States, profit status, were not associated with varying transplantation rates. International results consistently showed higher transplantation rates for younger, healthier, better-educated, and higher income patients.

Shih, Y. C., Guo, A., Just, P. M., et al. (2005). "Impact of initial dialysis modality and modality switches on Medicare expenditures of end-stage renal disease patients." Kidney Int **68**(1): 319-329.

BACKGROUND: The number of end-stage renal disease (ESRD) enrollees and Medicare expenditures have increased dramatically. Pathways and associated Medicare expenditures in ESRD treatment need to be examined to potentially improve the efficiency of care. METHODS: This study examines the impact of initial dialysis modality choice and subsequent modality switches on Medicare expenditure in a 3-year period. The Dialysis Morbidity and Mortality Study Wave 2 data by the United States Renal Data System (USRDS) is used along with the USRDS Core CD and USRDS claims data. RESULTS: A total of 3423 incident dialysis patients (approximately equal number of peritoneal dialysis and hemodialysis) were included in the analysis. Unadjusted average annual Medicare expenditure (in 2004 dollars) for peritoneal dialysis as first modality was 53,277 dollars(95% CI 50,626 dollars-55,927 dollars), and 72,189 dollars (95% CI 67,513 dollars-76,865 dollars) for hemodialysis. Compared to "hemodialysis, no switch" subgroup, "peritoneal dialysis, no switch" had a significantly lower annual expenditure (44,111 dollars vs. 72,185 dollars) (P < 0.001). "Peritoneal dialysis, with at least one switch" and "hemodialysis, with at least one switch" had a lower or similar annual expenditure of 66,639 dollars and 72,335 dollars, respectively. After adjusting for patient characteristics, annual Medicare expenditure was still significantly lower for patients with peritoneal dialysis as the initial modality (56,807 dollars vs. 68,253 dollars) (P < 0.001). Similarly, compared to "hemdialysis, no switch" subgroup, "peritoneal dialysis, no switch" and "peritoneal dialysis, with at least one switch" had a significantly lower total expenditure. Further analysis showed that time-to-first switch also independently impacted total expenditure. CONCLUSION: Initial modality choice (peritoneal dialysis or hemodialysis) and subsequent modality switches had significant implications for Medicare expenditure on ESRD treatments.

Soroka, S. D., Kiberd, B. A. et Jacobs, P. (2005). "The marginal cost of satellite versus in-center hemodialysis." Hemodial Int **9**(2): 196-201.

BACKGROUND: Despite increasing numbers of patients receiving hemodialysis in satellite units (SHD), the economic aspects have not been widely explored. A cost analysis of SHD and in-center hemodialysis (ICHD) from a societal perspective was performed to establish the efficiencies associated with shifting resources and patients from ICHD to SHD. METHODS: Costs were classified as fixed or variable and placed into categories. The resources for operating a SHD unit are the sum of two components: total fixed costs (TFC) and average variable cost (AVC) times SHD patient volume (Q). Using the TFC of a specific-sized SHD unit and the difference in AVC between ICHD and SHD the number of patients needed (Q) in the SHD unit for financial viability was determined. The formula TFC = (AVC(ICHD) - AVC(SHD)) X Q was used to determine the number of patients (Q) needed in a specific-sized SHD unit such that the yearly cost of SHD treatment would be the same as ICHD treatment. RESULTS: Our results show that SHD fixed costs can be fully offset if the volume of SHD patients is seven per year in a six-station unit. SHD costs were lower for nursing and physician fees. Therefore, ICHD care variable costs were $11,374 more per patient year. SHD patients would also have lower travel costs, a mean cost saving of $12,364 per year. CONCLUSION: SHD can result in significant savings both to the health-care system and to patients. Using the cost categories and formula presented, the number of patients needed in a specific-sized satellite unit to realize cost savings was determined for our program. We found that these savings can offset the fixed investment needed to operate a SHD unit at modest patient volumes.

Stroupe, K. T., Fischer, M. J., Kaufman, J. S., et al. (2011). "Predialysis nephrology care and costs in elderly patients initiating dialysis." Med Care **49**(3): 248-256.

BACKGROUND: Access to nephrology care before initiation of chronic dialysis is associated with improved outcomes after initiation. Less is known about the effect of predialysis nephrology care on healthcare costs and utilization. METHODS: We conducted retrospective analyses of elderly patients who initiated dialysis between January 1, 2000 and December 31, 2001 and were eligible for services covered by the Department of Veterans Affairs. We used multivariable generalized linear models to compare healthcare costs for patients who received no predialysis nephrology care during the year before dialysis initiation with those who received low- (1-3 nephrology visits), moderate- (4-6 visits), and high-intensity (>6 visits) nephrology care during this time period. RESULTS: There were 8022 patients meeting inclusion criteria: 37% received no predialysis nephrology care, while 24% received low, 16% moderate, and 23% high-intensity predialysis nephrology care. During the year after dialysis initiation, patients in these groups spent an average of 52, 40, 31, and 27 days in the hospital (P < 0.001), respectively, and accounted for an average of $103,772, $96,390, $93,336, and $89,961 in total healthcare costs (P < 0.001), respectively. Greater intensity of predialysis nephrology care was associated with lower costs even among patients whose first predialysis nephrology visit was </= 3 months before dialysis initiation. Patients with greater predialysis nephrology care also had lower mortality rates during the year after dialysis initiation (43%, 38%, 28%, and 25%, respectively, P < 0.001). CONCLUSIONS: Greater intensity of predialysis nephrology care was associated with fewer hospital days and lower total healthcare costs during the year after dialysis initiation, even though patients survived longer.

Sutton, A. J., Breheny, K., Deeks, J., et al. (2015). "Methods Used in Economic Evaluations of Chronic Kidney Disease Testing - A Systematic Review." PLoS One **10**(10): e0140063.

BACKGROUND: The prevalence of chronic kidney disease (CKD) is high in general populations around the world. Targeted testing and screening for CKD are often conducted to help identify individuals that may benefit from treatment to ameliorate or prevent their disease progression. AIMS: This systematic review examines the methods used in economic evaluations of testing and screening in CKD, with a particular focus on whether test accuracy has been considered, and how analysis has incorporated issues that may be important to the patient, such as the impact of testing on quality of life and the costs they incur. METHODS: Articles that described model-based economic evaluations of patient testing interventions focused on CKD were identified through the searching of electronic databases and the hand searching of the bibliographies of the included studies. RESULTS: The initial electronic searches identified 2,671 papers of which 21 were included in the final review. Eighteen studies focused on proteinuria, three evaluated glomerular filtration rate testing and one included both tests. The full impact of inaccurate test results was frequently not considered in economic evaluations in this setting as a societal perspective was rarely adopted. The impact of false positive tests on patients in terms of the costs incurred in re-attending for repeat testing, and the anxiety associated with a positive test was almost always overlooked. In one study where the impact of a false positive test on patient quality of life was examined in sensitivity analysis, it had a significant impact on the conclusions drawn from the model. CONCLUSION: Future economic evaluations of kidney function testing should examine testing and monitoring pathways from the perspective of patients, to ensure that issues that are important to patients, such as the possibility of inaccurate test results, are properly considered in the analysis.

van Nooten, F. E., Green, J., Brown, R., et al. (2010). "Burden of illness for patients with non-dialysis chronic kidney disease and anemia in the United States: review of the literature." J Med Econ **13**(2): 241-256.

OBJECTIVE: To assess the health-related quality of life (HRQL) and economic burden of chronic kidney disease (CKD) related anemia in non-dialysis patients in the United States (US) via literature review. METHODS: MEDLINE, EMBASE, PROQOLID, and Cochrane Library/Renal Group Resources were searched. Studies were appraised for patient populations, disease-specific versus generic HRQL assessments, and type and magnitude of health-related costs. RESULTS: The treatment costs for CKD patients with anemia compared to those without anemia were significantly higher and were blunted but persistent after controlling for comorbidities and confounders. Intervention with erythropoiesis stimulating agents (ESA) decreased anemia and avoided hospital admissions. Costs were higher when anemia was poorly controlled or untreated. HRQL burden was mainly due to physical limitations and difficulty in ability to perform activities of daily living. Significant positive correlations between increases in hemoglobin levels and HRQL measures were reported. CONCLUSIONS: Although evidence is limited, the economic and HRQL burden of non-dialysis CKD-related anemia is substantial. Under-treatment of anemia may contribute to higher resource consumption and higher costs; however, patient co-morbidities, use of erythropoietin-stimulating agents, and overall management introduce potential confounds. The contribution of anemia to humanistic disease burden is due to a constellation of factors, including physical activity and functional status.

Vekeman, F., Yameogo, N. D., Lefebvre, P., et al. (2010). "Healthcare costs associated with nephrology care in pre-dialysis chronic kidney disease patients." J Med Econ **13**(4): 673-680.

OBJECTIVE: To compare the healthcare costs of pre-dialysis chronic kidney disease (CKD) patients cared for in a nephrology clinic setting versus other care settings. METHODS: An analysis of health claims between 01/2002 and 09/2007 from the Ingenix Impact Database was conducted. Inclusion criteria were >/= 18 years of age, >/= 1 ICD-9 claim for CKD, and >/= 1 estimated glomerular filtration rate (eGFR) value of < 60 mL/min/1.73 m(2). Patients were classified in the nephrology care cohort if they were treated in a nephrology clinic setting at least once during the study period. Univariate and multivariate analyses were conducted to compare average annualized healthcare costs of patients in nephrology care versus other care settings. RESULTS: Among the 20,135 patients identified for analysis, 1,547 patients were cared for in a nephrology clinic setting. Nephrology care was associated with lower healthcare costs with an unadjusted cost savings of $3,049 ($11,303 vs. $14,352, p = 0.0014) and a cost ratio of 0.8:1 relative to other care settings. After adjusting for covariates, nephrology care remained associated with lower costs (adjusted cost savings: $2,742, p = 0.006). LIMITATIONS: Key limitations included potential inaccuracies of claims data, the lack of control for patients' ethnicity in the calculation of eGFR values, and the presence of potential biases due to the observational design of the study. CONCLUSIONS: The current study demonstrated that pre-dialysis CKD patients treated in nephrology clinics were associated with significantly lower healthcare costs compared with patients treated in other healthcare settings.

Villa, G., Rodriguez-Carmona, A., Fernandez-Ortiz, L., et al. (2011). "Cost analysis of the Spanish renal replacement therapy programme." Nephrol Dial Transplant **26**(11): 3709-3714.

BACKGROUND: A cost analysis of the Spanish Renal Replacement Therapy (RRT) programme in the year 2010, for end-stage renal disease (ESRD) patients, was performed from the perspective of the Public Administration. METHODS: The costs associated with each RRT modality [hemodialysis (HD), peritoneal dialysis (PD) and kidney transplantation (Tx)] were analysed. The Spanish ESRD incidence and prevalence figures in the year 2010 were forecasted in order to enable the calculation of an aggregate cost for each modality. Costs were mainly computed based on a review of the existing literature and of the Official Bulletins of the Spanish Autonomous Communities. Data from Oblikue Consulting eSalud health care costs database and from several Spanish public sources were also employed. RESULTS: In the year 2010, the forecasted incidence figures for HD, PD and Tx were 5409, 822 and 2317 patients, respectively. The forecasted prevalence figures were 22,582, 2420 and 24,761 patients, respectively. The average annual per-patient costs (incidence and prevalence) were euro2651 and euro37,968 (HD), euro1808 and euro25,826 (PD) and euro38,313 and euro6283 (Tx). Indirect costs amounted to euro8929 (HD), euro7429 (PD) and euro5483 (Tx). The economic impact of the Spanish RRT programme on the Public Administration budget was estimated at ~euro1829 million (indirect costs included): euro1327 (HD), euro109 (PD) and euro393 (Tx) million. CONCLUSIONS: HD accounted for >70% of the aggregate costs of the Spanish RRT programme in 2010. From a costs minimization perspective, it would be preferable if the number of incident and prevalent patients in PD were increased.

Wachterman, M. W., Hailpern, S. M., Keating, N. L., et al. (2018). "Association Between Hospice Length of Stay, Health Care Utilization, and Medicare Costs at the End of Life Among Patients Who Received Maintenance Hemodialysis." JAMA Intern Med **178**(6): 792-799.

Importance: Patients with end-stage renal disease are less likely to use hospice services than other patients with advanced chronic illness. Little is known about the timing of hospice referral in this population and its association with health care utilization and costs. Objective: To examine the association between hospice length of stay and health care utilization and costs at the end of life among Medicare beneficiaries who had received maintenance hemodialysis. Design, Setting, and Participants: This cross-sectional observational study was conducted via the United States Renal Data System registry. Participants were all 770191 hemodialysis patients in the registry who were enrolled in fee-for-service Medicare and died between January 1, 2000, and December 31, 2014. The dates of analysis were April 2016 to December 2017. Main Outcomes and Measures: Hospital admission, intensive care unit (ICU) admission, and receipt of an intensive procedure during the last month of life; death in the hospital; and costs to the Medicare program in the last week of life. Results: Among 770191 patients, the mean (SD) age was 74.8 (11.0) years, and 53.7% were male. Twenty percent of cohort members were receiving hospice services when they died. Of these, 41.5% received hospice for 3 days or fewer. In adjusted analyses, compared with patients who did not receive hospice, those enrolled in hospice for 3 days or fewer were less likely to die in the hospital (13.5% vs 55.1%; P < .001) or to undergo an intensive procedure in the last month of life (17.7% vs 31.6%; P < .001) but had higher rates of hospitalization (83.6% vs 74.4%; P < .001) and ICU admission (54.0% vs 51.0%; P < .001) and similar Medicare costs in the last week of life ($10756 vs $10871; P = .08). Longer lengths of stay in hospice beyond 3 days were associated with progressively lower rates of utilization and costs, especially for those referred more than 15 days before death (35.1% hospitalized and 16.7% admitted to an ICU in the last month of life; the mean Medicare costs in the last week of life were $3221). Conclusions and Relevance: Overall, 41.5% of hospice enrollees who had been treated with hemodialysis for their end-stage renal disease entered hospice within 3 days of death. Although less likely to die in the hospital and to receive an intensive procedure, these patients were more likely than those not enrolled in hospice to be hospitalized and admitted to the ICU, and they had similar Medicare costs. Without addressing barriers to more timely referral, greater use of hospice may not translate into meaningful changes in patterns of health care utilization, costs, and quality of care at the end of life in this population.

Wikstrom, B., Fored, M., Eichleay, M. A., et al. (2007). "The financing and organization of medical care for patients with end-stage renal disease in Sweden." Int J Health Care Finance Econ **7**(4): 269-281.

The total health care expenditure as a percentage of the gross domestic product in Sweden is 9.2%, and health care is funded by global budgets almost entirely through general taxation. The prevalence rate of end-stage renal disease (ESRD) in Sweden is 756 per million. Fifty-two percent of ESRD patients have a functioning transplant. Almost all ESRD treatment facilities are public. Compared with other Dialysis Outcomes and Practice Patterns Study (DOPPS) countries, the salaries for both nephrologists and professional dialysis unit staff are low. Sweden's high cost per ESRD patient, relative to other

DOPPS countries, may be a result of expensive and frequent hospitalizations and aggressive anemia treatment strategies.

Wish, J., Schulman, K., Law, A., et al. (2009). "Healthcare expenditure and resource utilization in patients with anaemia and chronic kidney disease: a retrospective claims database analysis." Kidney Blood Press Res **32**(2): 110-118.

BACKGROUND/AIMS: We conducted a retrospective claims database analysis to examine the association of anaemia and anaemia management with healthcare expenditure and utilization in patients with chronic kidney disease (CKD) before the onset of dialysis. METHODS: Claims data on patients (aged > or =15 years) with CKD were collected from the Medstat Marketscan Commercial and Medicare Databases between 2000 and 2005. Using these data, patients were evaluated for anaemia of CKD, anaemia treatment status and healthcare costs and use. RESULTS: Of the 37,105 CKD patients, 9,807 (26%) had incident anaemia; 59% of these received at least one type of anaemia treatment, with 48% receiving an erythropoiesis-stimulating agent. The total adjusted per patient per month healthcare expenditure for all CKD patients was USD 2,749. Patients with anaemia had significantly greater overall expenditure, which was 38% higher than those without anaemia. Total expenditure was 17% higher for untreated versus treated anaemic patients, largely due to higher inpatient expenditure in the untreated cohort. CONCLUSION: This analysis suggests that the presence of anaemia is associated with greater medical expenditure in patients with CKD. However, we found that anaemia management may help to lower inpatient costs associated with anaemia in the CKD population.

Wyld, M. L., Lee, C. M., Zhuo, X., et al. (2015). "Cost to government and society of chronic kidney disease stage 1-5: a national cohort study." Intern Med J **45**(7): 741-747.

BACKGROUND: Costs associated with chronic kidney disease (CKD) are not well documented. Understanding such costs is important to inform economic evaluations of prevention strategies and treatment options. AIM: To estimate the costs associated with CKD in Australia. METHODS: We used data from the 2004/2005 AusDiab study, a national longitudinal population-based study of non-institutionalised Australian adults aged >/=25 years. We included 6138 participants with CKD, diabetes and healthcare cost data. The annual age and sex-adjusted costs per person were estimated using a generalised linear model. Costs were inflated from 2005 to 2012 Australian dollars using best practice methods. RESULTS: Among 6138 study participants, there was a significant difference in the per-person annual direct healthcare costs by CKD status, increasing from $1829 (95% confidence interval (CI): $1740-1943) for those without CKD to $14 545 (95% CI: $5680-44 842) for those with stage 4 or 5 CKD (P < 0.01). Similarly, there was a significant difference in the per-person annual direct non-healthcare costs by CKD status from $524 (95% CI: $413-641) for those without CKD to $2349 (95% CI: $386-5156) for those with stage 4 or 5 CKD (P < 0.01). Diabetes is a common cause of CKD and is associated with increased health costs. Costs per person were higher for those with diabetes than those without diabetes in all CKD groups; however, this was significant only for those without CKD and those with early stage (stage 1 or 2) CKD. CONCLUSION: Individuals with CKD incur 85% higher healthcare costs and 50% higher government subsidies than individuals without CKD, and costs increase by CKD stage. Primary and secondary prevention strategies may reduce costs and warrant further consideration.

Yu, Y. J., Wu, I. W., Huang, C. Y., et al. (2014). "Multidisciplinary predialysis education reduced the inpatient and total medical costs of the first 6 months of dialysis in incident hemodialysis patients." PLoS One **9**(11): e112820.

BACKGROUND: The multidisciplinary pre-dialysis education (MPE) retards renal progression, reduce incidence of dialysis and mortality of CKD patients. However, the financial benefit of this intervention on patients starting hemodialysis has not yet been evaluated in prospective and randomized trial. METHODS: We studied the medical expenditure and utilization incurred in the first 6 months of dialysis initiation in 425 incident hemodialysis patients who were randomized into MPE and non-MPE groups before reaching end-stage renal disease. The content of the MPE was standardized in accordance with the National Kidney Foundation Dialysis Outcomes Quality Initiative guidelines. RESULTS: The mean age of study patients was 63.8+/-13.2 years, and 221 (49.7%) of them were men.

The mean serum creatinine level and estimated glomerular filtration rate was 6.1+/-4.0 mg/dL and 7.6+/-2.9 mLmin(-1)1.73 m(-2), respectively, at dialysis initiation. MPE patients tended to have lower total medical cost in the first 6 months after hemodialysis initiation (9147.6+/-0.1 USD/patient vs. 11190.6+/-0.1 USD/patient, p = 0.003), fewer in numbers [0 (1) vs. 1 (2), p<0.001] and length of hospitalization [0 (15) vs. 8 (27) days, p<0.001], and also lower inpatient cost [0 (2617.4) vs. 1559,4 (5019.6) USD/patient, p<0.001] than non-MPE patients, principally owing to reduced cardiovascular hospitalization and vascular access-related surgeries. The decreased inpatient and total medical cost associated with MPE were independent of patients' demographic characteristics, concomitant disease, baseline biochemistry and use of double-lumen catheter at initiation of hemodialysis. CONCLUSIONS: Participation of multidisciplinary education in pre-dialysis period was independently associated with reduction in the inpatient and total medical expenditures of the first 6 months post-dialysis owing to decreased inpatient service utilization secondary to cardiovascular causes and vascular access-related surgeries. TRIAL REGISTRATION: ClinicalTrials.gov NCT00644046.

Zelmer, J. L. (2007). "The economic burden of end-stage renal disease in Canada." Kidney Int **72**(9): 1122-1129.

End-stage renal disease (ESRD) is a serious illness with significant health consequences and high-cost treatment options. This study estimates direct and indirect cost associated with ESRD from a societal perspective. A prevalence-based approach was used to estimate direct health-care costs and productivity losses from short- and long-term disability. An incident-based human capital approach was used to estimate mortality costs as the sum of the discounted present value of current and future productivity losses from premature deaths. Less than 0.1% of Canadians have ESRD; however, the disease generated direct health-care costs of $1.3 billion in the year 2000. The amount of direct spending per person with ESRD is much more than the average spending per person for all health-care conditions. Adding indirect morbidity and mortality cost brings the total burden associated with ESRD to $1.9 billion. This economic impact is higher than that for skin or infectious diseases, about the same as for genitourinary or endocrine diseases, but lower than that for conditions such as cancer or stroke. This economic weight is borne by a relatively small number of individuals. With the rapid increase in the incidence of ESRD, these findings may be useful in setting priorities for research, prevention programs, and in the planning of treatments. A better understanding of the scope and magnitude of the total economic burden of ESRD would help to inform those making policy decisions.

LA PRISE EN CHARGE PAR L'ASSURANCE MALADIE : TARIFICATION ET FORFAIT

Études françaises

Bensadon, A. C., Broudic, P. et Burstin, A. (2010). Pertinence d'une intégration du montant des agents stimulant l'érythropoïèse dans les tarifs de dialyse. Rapport ; RM2010-122P. Paris IGAS**:** 66.
http://lesrapports.ladocumentationfrancaise.fr/BRP/104000477/0000.pdf

Le présent rapport traite dans une première partie de l'apport des agents stimulant l'érythropoïèse (ASE) dans la prise en charge des patients souffrant d'insuffisance rénale chronique (IRC) et des évolutions qu'ont connues les recommandations relatives à leur usage et les pratiques. Puis il examine des éléments techniques devant être pris en compte pour juger de la pertinence d'une décision d'intégration des ASE dans les tarifs de dialyse et s'attache à évaluer l'impact économique d'une telle mesure, tant macroéconomique pour l'assurance-maladie, que micro-économique dans les équilibres de certaines structures. Enfin, le rapport évalue les risques d'une telle intégration sur la prise en charge des patients et l'impact qu'elle pourrait avoir sur des travaux futurs visant à adapter l'organisation et le financement de la dialyse (résumé d'auteur).

Cash, R., Cash, E. et Dupilet, C. (2011). "Étude sur la réactivité des établissements de santé aux incitations tarifaires : rapport final." Serie Etudes Et Recherche - Document De Travail - Drees(106): 249 , tabl., graph.
http://www.drees.sante.gouv.fr/IMG/pdf/serieetud106.pdf

[BDSP. Notice produite par MIN-SANTE mB9CR0xp. Diffusion soumise à autorisation]. La tarification à l'activité (T2A) permet en théorie d'orienter l'activité des établissements de santé en agissant sur les tarifs. Par ce biais, le ministère en charge de la santé a ainsi cherché à favoriser des modes de prise en charge des patients jugés efficients. Pour évaluer l'efficacité de ces politiques, la DREES a lancé en 2010 une étude sur la réactivité des établissements de santé aux incitations tarifaires dans les domaines de la chirurgie ambulatoire et de la dialyse à domicile. En marge des tarifs, l'étude montre que la contrainte réglementaire et la démarche organisationnelle au sein de l'établissement jouent également un rôle important. Les incitations tarifaires doivent donc s'intégrer dans une politique plus globale pour réellement orienter l'activité.

Cash, R., Cash, E. et Dupilet, C. (2011). "La réactivité des établissements de santé aux incitations tarifaires." Dossiers Solidarite Et Sante (Drees)(21): 31.
http://www.drees.sante.gouv.fr/IMG/pdf/article201121.pdf

[BDSP. Notice produite par MIN-SANTE 9kr8FR0x. Diffusion soumise à autorisation]. La tarification à l'activité (T2A) permet en théorie d'orienter l'activité des établissements de santé en agissant sur les tarifs. Par ce biais, le ministère en charge de la santé a ainsi cherché à favoriser des modes de prise en charge des patients jugés efficients. Pour évaluer l'efficacité de ces politiques, la DREES a lancé en 2010 une étude sur la réactivité des établissements de santé aux incitations tarifaires dans les domaines de la chirurgie ambulatoire et de la dialyse à domicile.

Couchoud, C., Savoye, E., Frimat, L., et al. (2008). "Variability in case mix and peritoneal dialysis selection in fifty-nine French districts." Perit Dial Int **28**(5): 509-517.

In France, the use of peritoneal dialysis (PD) as the first-choice treatment varies greatly between districts, as it is already known to do between countries. Baseline clinical factors associated with choice of first modality were analyzed in 10 815 new end-stage renal disease patients in 59 districts. To describe practices at the district level, we used an agglomerative hierarchical classification, with proximity defined by a likelihood-ratio test that compared multivariate logistic regressions of the following factors: age, gender, diabetes, congestive heart failure, severe behavioral disorders, mobility, and employment. To propose a typology, each cluster of districts was described by a multivariate logistic regression. While populations starting PD in France, as elsewhere, are more likely to be young or employed, they are also more likely to be elderly or have congestive heart failure or severe behavioral disorders. Overall, 14% of patients start with PD, but this rate varies significantly across districts, from 0% to 45%. A specific combination of factors was associated with the first-choice modality in each group of districts. This study highlights the lack of consensual medical criteria for this choice and the likelihood that nonmedical factors may explain the observed differences. The high variability suggests that PD can be used in almost all clinical conditions. Accordingly, patient preference should play a more important role in the decision-making process.

HCAAM (2016). Innovations et système de santé. Tome I et II. Paris HCAAM**:** 2 vol. (154; 136), tabl., fig., annexes.
http://www.securite-sociale.fr/Rapports-et-avis

Le tome I du rapport du HCAAM « Innovation et système de santé » s'articule autour de quatre parties : les perspectives en matière d'innovation en santé, le passage d'un système d'innovation lié au « moment Debré » à un nouveau système d'innovation, la régulation du système et enfin sa gouvernance. La première partie, consacrée à la prospective en matière d'innovations en santé, s'attache à explorer les évolutions des sciences et techniques en santé avant d'aborder les innovations organisationnelles sous l'angle prospectif (quelles sont les formes d'organisation nouvelles à l'horizon de 15 ans ?), mais également en abordant les conditions de transformation des organisations. Cette partie du rapport est enfin complétée par un chapitre consacré au numérique et à ses potentialités de transformation du système de santé. La seconde partie du rapport part du modèle de la réforme menée en son temps sur la base du rapport de la Commission présidée par le professeur Robert Debré, pour proposer la refondation d'un système contemporain d'innovation soins-recherche, en insistant d'une part sur la question des ressources humaines et celle de l'articulation avec les enjeux d'innovation de l'industrie et de la recherche. La troisième partie du rapport s'attache à la régulation du système d'innovation en santé et fait des propositions sur les points clef de ce système : la veille sur les produits de santé et leur évaluation ; le développement d'approches favorables à l'innovation dans la conception de la gradation des soins, des infrastructures, de l'efficience ; le financement des soins et de l'innovation (prix des médicaments, évolutions des tarifications et des prises en charge, financement de l'investissement et de l'accompagnement au changement, évolutions de l'architecture financière globale). Enfin, la dernière partie du rapport aborde la question de la gouvernance du système d'innovation en santé, sur le plan national et sur le plan territorial en insistant sur les problématiques posées par les techniques de planification, la coordination entre les acteurs et l'articulation entre le national, le régional et le local au regard des évolutions et innovations souhaitables. Deux chapitres de cette partie du rapport sont par ailleurs consacrés à deux types d'acteurs essentiels à la réflexion sur l'innovation en santé : ceux qui in fine doivent bénéficier des innovations technologiques et organisationnelles, les patients et les citoyens, et ceux qui sont à l'origine des innovations : les innovateurs. Le tome II du rapport du HCAAM comprend lui des éléments thématiques : - Une monographie relative à l'innovation et à la prise en charge des patients atteints d'insuffisance rénale chronique terminale, une monographie relative à l'innovation dans la prise en charge en cancérologie ; - un document de présentation et de synthèse des rapports de prospective sur l'innovation en santé.

Études internationales

(2011). "Medicare program; end-stage renal disease quality incentive program. Final rule." Fed Regist **76**(3): 627-646.

This final rule will implement a quality incentive program (QIP) for Medicare outpatient end-stage renal disease (ESRD) dialysis providers and facilities with payment consequences beginning January 1, 2012, in accordance with section 1881(h) of the Act (added on July 15, 2008 by section 153(c) of the Medicare Improvements for Patients and Providers Act (MIPPA)). Under the ESRD QIP, ESRD payments made to dialysis providers and facilities under section 1881(b)(14) of the Social Security Act will be reduced by up to two percent if the providers/facilities fail to meet or exceed a total performance score with respect to performance standards established with respect to certain specified measures.

(2011). "Medicare programs: changes to the end-stage renal disease prospective payment system transition budget-neutrality adjustment. Interim final rule with comment period." Fed Regist **76**(66): 18930-18934.

This interim final rule with comment will revise the end-stage renal disease (ESRD) transition budget-neutrality adjustment finalized in the CY 2011 ESRD Prospective Payment System (PPS) final rule for renal dialysis services provided on April 1, 2011 through December 31, 2011. We are revising the transition budget-neutrality adjustment to reflect the actual election decision to receive payment under the ESRD PPS for renal dialysis services furnished on or after January 1, 2011 made by ESRD facilities, rather than projected elections using the same methodology as described in the ESRD PPS proposed and final rules. This results in a zero percent adjustment for renal dialysis services furnished April 1, 2011 through December 31, 2011.

(2012). "Medicare program; end-stage renal disease prospective payment system, quality incentive program, and bad debt reductions for all Medicare providers. Final rule." Fed Regist **77**(218): 67450-67531.

This final rule updates and makes revisions to the end-stage renal disease (ESRD) prospective payment system (PPS) for calendar year (CY) 2013. This rule also sets forth requirements for the ESRD quality incentive program (QIP), including for payment year (PY) 2015 and beyond. In addition, this rule implements changes to bad debt reimbursement for all Medicare providers, suppliers, and other entities eligible to receive Medicare payment for bad debt and removes the cap on bad debt reimbursement to ESRD facilities. (See the Table of Contents for a listing of the specific issues addressed in this final rule.)

(2013). "Medicare program; end-stage renal disease prospective payment system, quality incentive program, and durable medical equipment, prosthetics, orthotics, and supplies." Fed Regist **78**(231): 72155-72253.

This rule updates and makes revisions to the End-Stage Renal Disease (ESRD) prospective payment system (PPS) for calendar year (CY) 2014. This rule also sets forth requirements for the ESRD quality incentive program (QIP), including for payment year (PY) 2016 and beyond. In addition, this rule clarifies the grandfathering provision related to the 3-year minimum lifetime requirement (MLR) for Durable Medical Equipment (DME), and provides clarification of the definition of routinely purchased DME. This rule also implements budget-neutral fee schedules for splints and casts, and intraocular lenses (IOLs) inserted in a physician's office. Finally, this rule makes a few technical amendments and corrections to existing regulations related to payment for durable medical equipment, prosthetics, orthotics, and supplies (DMEPOS) items and services.

(2014). "Medicare program; End-Stage Renal Disease prospective payment system, quality incentive program, and Durable Medical Equipment, Prosthetics, Orthotics, and Supplies. Final rule." Fed Regist **79**(215): 66119-66265.

This final rule will update and make revisions to the End-Stage Renal Disease (ESRD) prospective payment system (PPS) for calendar year (CY) 2015. This rule also finalizes requirements for the ESRD quality incentive program (QIP), including for payment years (PYs) 2017 and 2018. This rule will also make a technical correction to remove outdated terms and definitions. In addition, this final rule sets forth the methodology for adjusting Durable Medical Equipment, Prosthetics, Orthotics, and Supplies (DMEPOS) fee schedule payment amounts using information from the Medicare DMEPOS Competitive Bidding Program (CBP); makes alternative payment rules for certain DME under the Medicare DMEPOS CBP; clarifies the statutory Medicare hearing aid coverage exclusion and specifies devices not subject to the hearing aid exclusion; will not update the definition of minimal self-adjustment; clarifies the Change of Ownership (CHOW) and provides for an exception to the current requirements; revises the appeal provisions for termination of a CBP contract, including the beneficiary notification requirement under the Medicare DMEPOS CBP, and makes a technical change to the regulation related to the conditions for awarding contracts for furnishing infusion drugs under the Medicare DMEPOS CBP.

(2015). End-stage renal disease. Medicare Payment Refinements Could Promote Increased Use of Home Dialysis. Washington GAO**:** 41 , fig.
http://www.gao.gov/products/GAO-16-125

In 2013, Medicare spent about $11.7 billion on dialysis care for about 376,000 Medicare patients with end-stage renal disease, a condition of permanent kidney failure. Some of these patients performed dialysis at home, and such patients may have increased autonomy and health-related quality of life.GAO was asked to study Medicare patients' use of home dialysis and key factors affecting its use. This report examines (1) trends in home dialysis use and estimates of the potential for wider use, (2) incentives for home dialysis associated with Medicare payments to dialysis facilities, and (3) incentives for home dialysis associated with Medicare payments to physicians. GAO reviewed CMS policies and relevant laws and regulations, and GAO analyzed data from CMS (2010-2015), the United States Renal Data System (1988-2012), and Medicare cost reports (2012), the most recent years with complete data available. GAO also interviewed CMS officials, selected dialysis facility chains, physician and patient associations, and experts on home dialysis.

(2015). "Medicare Program; End-Stage Renal Disease Prospective Payment System, and Quality Incentive Program. Final Rule." Fed Regist **80**(215): 68967-69077.

This rule updates and makes revisions to the End-Stage Renal Disease (ESRD) Prospective Payment System (PPS) for calendar year (CY) 2016. This rule is necessary to ensure that ESRD facilities receive accurate Medicare payment amounts for furnishing outpatient maintenance dialysis treatments during calendar year 2016. This rule will also set forth requirements for the ESRD Quality Incentive Program (QIP), including for PYs 2017 through 2019.

(2017). "Medicare Program; End-Stage Renal Disease Prospective Payment System, Payment for Renal Dialysis Services Furnished to Individuals With Acute Kidney Injury, and End-Stage Renal Disease Quality Incentive Program. Final rule." Fed Regist **82**(210): 50738-50797.

This rule updates and makes revisions to the end-stage renal disease (ESRD) prospective payment system (PPS) for calendar year (CY) 2018. It also updates the payment rate for renal dialysis services furnished by an ESRD facility to individuals with acute kidney injury (AKI). This rule also sets forth requirements for the ESRD Quality Incentive Program (QIP), including for payment years (PYs) 2019 through 2021.

Abma, I., Jayanti, A., Bayer, S., et al. (2014). "Perceptions and experiences of financial incentives: a qualitative study of dialysis care in England." BMJ Open **4**(2): e004249.

OBJECTIVE: The objective of the study was to understand the extent to which financial incentives such as Payment by Results and other payment mechanisms motivate kidney centres in England to change their practices. DESIGN: The study followed a qualitative design. Data collection involved 32 in-depth semistructured interviews with healthcare professionals and managers, focusing on their subjective experience of payment structures. PARTICIPANTS: Participants were kidney healthcare professionals, clinical directors, kidney centre managers and finance managers. Healthcare commissioners from different parts of England were also interviewed. SETTING: Participants worked at five kidney centres from across England. The selection was based on the prevalence of home haemodialysis, ranging from low (<3%), medium (5-8%) and high (>8%) prevalence, with at least one centre in each one of these categories at the time of selection. RESULTS: While the tariff for home haemodialysis is not a clear incentive for its adoption due to uncertainty about operational costs, Commissioning for Quality and Innovation (CQUIN) targets and the Best Practice Tariff for vascular access were seen by our case study centres as a motivator to change practices. CONCLUSIONS: The impact of financial incentives designed at a policy level is influenced by the understanding of cost and benefits at the local operational level. In a situation where costs are unclear, incentives which are based on the improvement of profit margins have a smaller impact than incentives which provide an additional direct payment, even if this extra financial support is relatively small.

Aguilar, M. D., Orte, L., Lazaro, P., et al. (2006). "[Efficiency of implementing a program aimed at achieving early referral to the nephrologist of patients with chronic renal failure in primary care]." Nefrologia **26 Suppl 3**: 114-120.

Allon, M., Dinwiddie, L., Lacson, E., Jr., et al. (2011). "Medicare reimbursement policies and hemodialysis vascular access outcomes: a need for change." J Am Soc Nephrol **22**(3): 426-430.

In March 2010, the Center for Medicare and Medicaid Services (CMS) convened several clinical technical expert panels (C-TEP) to provide recommendations for improving various aspects of hemodialysis management. One of the C-TEPs was tasked with recommending measures to decrease vascular access-related infections. The members of this C-TEP, who are the authors of this manuscript, concluded unanimously that the single most important measure would be to remove financial and regulatory barriers to timely placement and revision of hemodialysis fistulas and the concurrent avoidance of catheter use. The following position paper outlines the financial barriers to improved vascular access outcomes and our proposals for a future CMS demonstration project.

Amerling, R. (2000). "An alternative to global capitation for ESRD: global fee-for-service." Nephrol News Issues **14**(8): 15-16.

Amerling, R. (2001). "Remove price controls to relieve the shortage." Nephrol News Issues **Suppl**: S7-8.

Amerling, R. (2002). "A patient-directed fee-for-service system can work for ESRD." Nephrol News Issues **16**(10): 25-26.

Anantharaman, P. et Moss, A. H. (2007). "Should the medicare ESRD program pay for daily dialysis? An ethical analysis." Adv Chronic Kidney Dis **14**(3): 290-296.

End-stage renal disease (ESRD) is a growing problem in the United States and has now reached epidemic proportions. The mortality rate and other complications related to conventional dialysis

> remain unacceptably high necessitating improvements in dialytic therapies. One strategy has been to increase dialysis frequency through daily dialysis since the Hemodialysis study showed that clinical outcomes are not improved by simply increasing delivered dialysis dose per session. Most studies of daily dialysis are observational and limited by small sample size, variable dialysis techniques, high patient dropout, and lack of adequate control group. These studies have shown consistent improvements in blood pressure and solute clearance, but improvements in patient survival, anemia, and health-related quality of life are less clear. The costs of providing daily dialysis on a large scale are likely to be substantial. However, if there are significant improvements in the outcome measures outlined earlier as well as decreased hospitalization rates, daily dialysis may prove cost-effective or budget neutral from a global standpoint. A scientific basis is needed to justify a change in the Medicare ESRD Program to fund daily dialysis. Decisions regarding the allocation of limited medical resources such as the Medicare budget should consider ethically appropriate criteria including likelihood of benefit, urgency of need, change in quality of life, duration of benefit, patient selection, equitable distribution, and the amount of resources required. In examining the evidence base on daily dialysis according to these ethical criteria, we find that there are not yet sufficient grounds to recommend funding of daily dialysis by the Medicare ESRD Program. Randomized controlled trials comparing conventional hemodialysis to short daily and long nocturnal hemodialysis are much needed.

Arnold, W. et Alexander, S. (1997). "Cost, work, reimbursement, and the pediatric nephrologist in the United States Medicare/End-Stage Renal Disease Program." Pediatr Nephrol **11**(2): 250-257.

> The American Academy of Pediatrics, the American Society of Pediatric Nephrology, and the Renal Physicians Association combined their efforts to perform a survey of the work involved in providing care to children with end-stage renal disease (ESRD). These data document that the work of delivering care to infants and children on dialysis takes longer and is more intense than the care provided to adult patients. These data were presented to the American Medical Association Specialty Society Relative Value Scale Update Committee (RUC) to justify higher payment for pediatric ESRD care using previously developed monthly capitation payment Current Procedural Terminology codes based on patient age. Relative Work Units of 13.25 for infants (0-2 years), 9.13 for children (2-12 years), 6.47 for adolescents (12-19 years), and 5.24 for adults (> 19 years) were recommended by the RUC to Medicare. A suggested description of services for pediatric dialysis patients covered by the monthly capitated payment was developed.

Beier, U. H., Hidalgo, G. et John, E. (2008). "Financial incentives to promote prolonged renal graft survival: potential for patients and public health." Med Hypotheses **70**(2): 218-220.

> Non-adherence to immune modulating agents is the single most common cause of renal graft rejection and failure with not only devastating consequences for patients, but also increased dialysis and transplant organ demands causing substantial medical expenses. Financial incentives used to reward and promote patient compliance with immune modulating therapy and post transplantation management could constitute a motivation that might increase renal graft survival, and thereby improve individual patient outcome as well as alleviate public health spending for renal replacement therapy.

Bhat, P. et Bhat, J. G. (2012). "Tackling pay-for-performance: current and future challenges." Nephrol News Issues **26**(1): 27-29.

Bhat, P., Sokolowski, W. et Bhat, J. G. (2009). "Projected impact of the proposed "bundled" ESRD payment system on a small dialysis organization." Nephrol News Issues **23**(7): 46, 48-52.

> Payment for outpatient hemodialysis services is currently made by the Centers for Medicare & Medicaid Services on a per-treatment basis using a partially "bundled" composite rate adjusted for geographic and patient characteristics, plus a separately billable portion for medications and services not included in the bundle. In response to concerns over rising costs of the End-Stage Renal Disease Program, and specifically the increasing use of erythropoiesis-stimulating agents, Congress has mandated a new, more inclusive prospective payment system, in which current composite rate

services, separately billable medications, and dialysis-related laboratory services will be included in a single payment. It is expected that the so-called bundle will apply a geographic wage adjuster and patient-specific case-mix factors to a base rate to calculate a per-patient, per treatment payment unit. We have modeled the proposed bundle and entered clinical and financial data for 118 Medicare patients dialyzed at a suburban dialysis center in New York State during 2006. Under the proposed bundled system, we stand to lose as much as $118,000 per year in revenue, and we find the case-mix adjusters appear to be poor predictors of our actual costs. We conclude that the proposed bundle places the small dialysis provider at significant financial risk.

Blagg, C. R. (2011). "Dialysis composite rate bundling: potential effects on the utilization of home hemodialysis, daily and nocturnal hemodialysis, and peritoneal dialysis." Semin Dial **24**(6): 674-677.

Home hemodialysis was introduced because it was less expensive than center dialysis, so allowing more patients to be treated with the limited funds available in the 1960s. The start of the Medicare ESRD Program in July 1973, with almost universal entitlement, removed the financial barriers, and had many other effects including reducing the use of home dialysis. Bundled payment for dialysis, including necessary dialysis supplies and laboratory tests, was introduced as the "composite" rate in 1983. Over the ensuing years, the costs of providing dialysis treatment increased, and expensive new drugs were introduced, particularly erythropoietin. As a result, the government introduced a more extensive bundle at the beginning of this year, aimed at better control of costs. This article considers the potential effect of this reimbursement change on home dialysis.

Brady, B. M., Zhao, B., Niu, J., et al. (2018). "Patient-Reported Experiences of Dialysis Care Within a National Pay-for-Performance System." JAMA Intern Med **178**(10): 1358-1367.

Importance: Medicare's End-Stage Renal Disease Quality Incentive Program incorporates measures of perceived value into reimbursement calculations. In 2016, patient experience became a clinical measure in the Quality Incentive Program scoring system. Dialysis facility performance in patient experience measures has not been studied at the national level to date. Objective: To examine associations among dialysis facility performance with patient experience measures and patient, facility, and geographic characteristics. Design: In this cross-sectional analysis, patients from a national end-stage renal disease registry receiving in-center hemodialysis in the United States on December 31, 2014, were linked with dialysis facility scores on the In-Center Hemodialysis Consumer Assessment of Healthcare Providers and Systems (ICH-CAHPS) survey. Of 4977 US dialysis facilities, 2939 (59.1%) reported ICH-CAHPS scores from April 8, 2015, through January 11, 2016. Multivariable linear regression models with geographic random effects were used to examine associations of facility ICH-CAHPS scores with patient, dialysis facility, and geographic characteristics and to identify the amount of total between-facility variation in patient experience scores explained by these categories. Data were analyzed from September 15, 2017, through June 1, 2018. Exposures: Dialysis facility, geographic characteristic, and 10% change in patient characteristics. Main Outcomes and Measures: Dialysis facility ICH-CAHPS scores and the total between-facility variation explained by different categories of characteristics. Results: Of the 2939 facilities included in the analysis, adjusted mean ICH-CAHPS scores were 2.6 percentage points (95% CI, 1.5-3.7) lower in for-profit facilities, 1.6 percentage points (95% CI, 0.9-2.2) lower in facilities owned by large dialysis organizations, and 2.3 percentage points (95% CI, 0.5-4.2) lower in free-standing facilities compared with their counterparts. More nurses per patient was associated with 0.2 percentage points (95% CI, 0.03-0.3) higher scores; a privately insured patient population was associated with 1.2 percentage points (95% CI, 0.2-2.2) higher scores. Facilities with higher proportions of black patients had 0.95 percentage points (95% CI, 0.78-1.12) lower scores; more Native American patients, 1.00 percentage point (95% CI, 0.39-1.60) lower facility scores. Geographic location and dialysis facility characteristics explained larger proportions of the overall between-facility variation in ICH-CAHPS scores than did patient characteristics. Conclusions and Relevance: This study suggests that for-profit operation, free-standing status, and large dialysis organization designation were associated with less favorable patient-reported experiences of care. Patient experience scores varied geographically, and black and Native American populations reported less favorable experiences. The study findings suggest that perceived quality of care delivered in these settings are of concern, and that there may be opportunities for improved implementation of patient experience surveys as is highlighted.

Brunelli, S. M., Monda, K. L., Burkart, J. M., et al. (2013). "Early trends from the Study to Evaluate the Prospective Payment System Impact on Small Dialysis Organizations (STEPPS)." Am J Kidney Dis **61**(6): 947-956.

> BACKGROUND: Launched in January 2011, the prospective payment system (PPS) for the US Medicare End-Stage Renal Disease Program bundled payment for services previously reimbursed independently. Small dialysis organizations may be particularly susceptible to the financial implications of the PPS. The ongoing Study to Evaluate the Prospective Payment System Impact on Small Dialysis Organizations (STEPPS) was designed to describe trends in care and outcomes over the period of PPS implementation. This report details early results between October 2010 and June 2011. STUDY DESIGN: Prospective observational cohort study of patients from a sample of 51 small dialysis organizations. SETTING & PARTICIPANTS: 1,873 adult hemodialysis and peritoneal dialysis patients. OUTCOMES: Secular trends in processes of care, anemia, metabolic bone disease management, and red blood cell transfusions. MEASUREMENTS: Facility-level data are collected quarterly. Patient characteristics were collected at enrollment and scheduled intervals thereafter. Clinical outcomes are collected on an ongoing basis. RESULTS: Over time, no significant changes were observed in patient to staff ratios. There was a temporal trend toward greater use of peritoneal dialysis (from 2.4% to 3.6%; P = 0.09). Use of cinacalcet, phosphate binders, and oral vitamin D increased; intravenous (IV) vitamin D use decreased (P for trend for all <0.001). Parathyroid hormone levels increased (from 273 to 324 pg/dL; P < 0.001). Erythropoiesis-stimulating agent doses decreased (P < 0.001 for IV epoetin alfa and IV darbepoetin alfa), particularly high doses. Mean hemoglobin levels decreased (P < 0.001), the percentage of patients with hemoglobin levels <10 g/dL increased (from 12.7% to 16.8%), and transfusion rates increased (from 14.3 to 19.6/100 person-years; P = 0.1). Changes in anemia management were more pronounced for African American patients. LIMITATIONS: Limited data were available for the prebundle period. Secular trends may be subject to the ecologic fallacy and are not causal in nature. CONCLUSIONS: In the period after PPS implementation, IV vitamin D use decreased, use of oral therapies for metabolic bone disease increased, erythropoiesis-stimulating agent use and hemoglobin levels decreased, and transfusion rates increased numerically.

Brunelli, S. M., Sibbel, S., Colson, C., et al. (2015). "Medicare Advantage associated with lower mortality for incident dialysis patients." Nephrol News Issues **29**(13): 16-17, 21, 26-19.

> Physicians across the care continuum are increasingly aligned around the belief that coordinated care can improve patient outcomes. As the principal caregivers for one of the most medically fragile patient groups in healthcare, nephrologists are especially attuned to the potential value of integrated care. Medicare Advantage (MA) offers one way to test this hypothesis. By law, end-stage renal disease patients currently cannot enroll into an MA plan, but if they develop ESRD while in such a plan, they may continue to be enrolled. The contrast between these patients and their counterparts who carry Medicare fee for service (MFFS) thereby represents a natural experiment that affords an opportunity to examine whether enrollment in a coordinated care system may improve outcomes. In order to promote (unbiased) comparison of patients in a non-randomized context, we propensity score-matched incident dialysis patients enrolled in MA versus those in MFFS. The data demonstrate that patients who were enrolled in an MA plan upon initiation of dialysis had a 9% lower mortality rate than their MFFS counterparts. This beneficial association of MA enrollment was found to be sustained over the first two years of dialysis treatment.

Burkart, J. M., Beaubrun, A. C., Olson, K. A., et al. (2015). "Anemia management practice patterns in small dialysis organizations following implementation of the prospective payment system." Clin Nephrol **84**(4): 206-213.

> BACKGROUND: The impact of the United States Prospective Payment System (PPS) "bundle payment system" on anemia management within small dialysis organizations (SDOs) was studied to evaluate the financia burden on SDOs. METHODS: Facilities enrolled in the original study on SDOs were grouped into three hemoglobin (Hb) categories by subject-months: > 25% of subjectmonths with Hb < 10 g/dL (sub-10); > 25% of subject-months with Hb > 12 g/dL (super-12); remaining facilities (10 - 12 group). Subjectlevel data aggregated to facility level for Hb concentration, intravenous (IV) epoetin +/- (EA) dose per administration, dose titration, and EA administration frequency during the baseline and

follow-up periods were described. RESULTS: Baseline demographic characteristics were imbalanced between the sub-10 (n = 7) and super-12 facilities (n = 5). Mean (SD) Hb concentrations were similar for sub-10 (11.1 (3.0) g/dL) and super-12 (11.6 (2.2) g/dL) facilities during the baseline period, but differed during the follow-up period (10.4 (2.7) vs. 11.4 (2.3) g/dL). The median (Q1, Q3) EA IV dose per administration during follow-up was 3,726 (3,467, 3,961) and 5,712 (4,816, 7,324) units in the sub-10 and super-12 facilities, respectively. A small trend toward upward titration was seen. CONCLUSIONS: Results suggest a difference in anemia management between sub-10 and super-12 facilities during the first year of PPS implementation. Future analyses evaluating patterns of reimbursement and shifts in clinical practice guidelines are warranted globally.

Burney, M. (2011). "The impact of the bundle on lab services." Nephrol News Issues **25**(8): 14-15.

The rule states that CMS will implement a quality incentive program (QIP) for Medicare outpatient end-stage renal disease (ESRD) dialysis providers and facilities with payment consequences beginning January 1, 2012. This is in accordance with section 1881(h) of the Act (added on July 15, 2008 by section 153(c) of the Medicare Improvements for Patients and Providers Act (MIPPA)). Under the ESRD QIP, ESRD payments made to dialysis providers and facilities under section 1881(b)(14) of the Social Security Act will be reduced by up to 2% if the providers/facilities fail to meet or exceed a total performance score for standards related to certain specified performance measures.

Cappell, K. A., Shreay, S., Cao, Z., et al. (2014). "Red blood cell (RBC) transfusion rates among US chronic dialysis patients during changes to Medicare end-stage renal disease (ESRD) reimbursement systems and erythropoiesis stimulating agent (ESA) labels." BMC Nephrol **15**: 116.

BACKGROUND: Several major ESRD-related regulatory and reimbursement changes were introduced in the United States in 2011. In several large, national datasets, these changes have been associated with decreases in erythropoiesis stimulating agent (ESA) utilization and hemoglobin concentrations in the ESRD population, as well as an increase in the use of red blood cell (RBC) transfusions in this population. Our objective was to examine the use of RBC transfusion before and after the regulatory and reimbursement changes implemented in 2011 in a prevalent population of chronic dialysis patients in a large national claims database. METHODS: Patients in the Truven Health MarketScan Commercial and Medicare Databases with evidence of chronic dialysis were selected for the study. The proportion of chronic dialysis patients who received any RBC transfusion and RBC transfusion event rates per 100 patient-months were calculated in each month from January 1, 2007 to March 31, 2012. The results were analyzed overall and stratified by primary health insurance payer (commercial payer or Medicare). RESULTS: Overall, the percent of chronic dialysis patients with RBC transfusion and RBC transfusion event rates per 100 patient-months increased between January 2007 and March 2012. When stratified by primary health insurance payer, it appears that the increase was driven by the primary Medicare insurance population. While the percent of patients with RBC transfusion and RBC transfusion event rates did not increase in the commercially insured population between 2007 and 2012 they did increase in the primary Medicare insurance population; the majority of the increase occurred in 2011 during the same time frame as the ESRD-related regulatory and reimbursement changes. CONCLUSIONS: The regulatory and reimbursement changes implemented in 2011 may have contributed to an increase in the use of RBC transfusions in chronic dialysis patients in the MarketScan dataset who were covered by Medicare plus Medicare supplemental insurance.

Chambers, J. D., Weiner, D. E., Bliss, S. K., et al. (2013). "What can we learn from the U.S. expanded end-stage renal disease bundle?" Health Policy **110**(2-3): 164-171.

Episode-based payment, commonly referred to as bundled payment, has emerged as a key component of U.S. health care payment reform. Bundled payments are appealing as they share the financial risk of treating patients between payers and providers, encouraging the delivery of cost-effective care. A closely watched example is the U.S. End Stage Renal Disease (ESRD) Prospective Payment System, known as the 'expanded ESRD bundle.' In this paper we consider the expanded ESRD bundle 2 years after its implementation. First, we discuss emerging lessons, including how implementation has changed dialysis care with respect to the use of erythropoietin stimulating agents, how implementation has led to an increase in the use of home-based peritoneal dialysis, and how it may have contributed to the market consolidation of dialysis providers. Second, we use the expanded ESRD bundle to illustrate the importance of accounting for stakeholder input and staging policy implementation. Third, we highlight the need to consider system-wide consequences of implementing bundled payment policies. Fourth, we suggest how bundled payments may create research opportunities. Bundled payment policies offer opportunities and challenges. Their success will be determined not only by impacts on cost containment, but also to the extent they encourage high quality care.

Charytan, C. (2010). "Bundled-rate legislation for Medicare reimbursement for dialysis services: implications for anemia management with ESAs." Clin J Am Soc Nephrol **5**(12): 2355-2362.

With the incidence of ESRD on the rise, there is a continuing need to control anemia-related treatment costs in dialysis patients receiving reimbursement through Medicare. Currently, erythropoiesis-stimulating agents (ESAs) are billed separately from dialysis services, potentially creating little financial incentive for more efficient use. The Medicare Improvement for Patients and Providers Act, passed by the U.S. Congress in July 2008, includes provisions intended to address this concern. Under this act, dialysis services will be reimbursed using a fully bundled, comprehensive payment system that includes all services currently covered in the basic composite rate, as well as certain separately billable items, including ESAs. A base rate of $229.63 per treatment has been assigned, to be individualized using case-mix adjusters. The implications of this new system for anemia management with ESAs continue to be elucidated. With fixed compensation for ESAs, management strategies that maximize efficiencies and, thereby, optimize cost savings will be favored. Select strategies may include switching from intravenous (IV) to subcutaneous routes, lowering Hb targets and ESA doses in hyporesponsive patients, increasing administration of IV iron, increasing use of home dialysis, and optimizing ESA dosing intervals. Once-monthly ESA therapy has potential advantages under this new system as an alternative to more frequently administered ESAs and may help achieve quality metrics in a cost-efficient manner.

Chow, K. M. et Li, P. K. (2012). "Dialysis: Choice of dialysis--what to do with economic incentives." Nat Rev Nephrol **8**(9): 495-496.

A survey of seven countries has found a striking difference in dialysis reimbursement policies, even when data were adjusted for gross domestic product per capita. Although increased reimbursement is perceived to be a valuable incentive for certain treatments, this perception is not supported by current data and alternative strategies to promote home-based dialysis should be pursued.

Cleemput, I. et De Laet, C. (2013). "Analysis of the costs of dialysis and the effects of an incentive mechanism for low-cost dialysis modalities." Health Policy **110**(2-3): 172-179.

BACKGROUND: Treatment costs of end-stage renal disease with dialysis are high and vary between dialysis modalities. Public healthcare payers aim at stimulating the use of less expensive dialysis modalities, with maintenance of healthcare quality. OBJECTIVES: This study examines the effects of Belgian financial incentive mechanisms for the use of low-cost dialysis treatments. METHODS: First, the costs of different dialysis modalities were calculated from the hospital's perspective. Data were obtained through a hospital survey. The balance between costs and revenues was simulated for an average Belgian dialysis programme. Incremental profits were calculated in function of the proportion of patients on alternative dialysis modalities. RESULTS: Hospital haemodialysis is the most expensive modality per patient year, followed by peritoneal dialysis and finally satellite haemodialysis. Under current reimbursement rules mean profits of a dialysis programme are maximal if about 28% of patients are treated with a low-cost dialysis modality. This is only slightly lower than the observed percentage in Belgian dialysis centres in the same period. CONCLUSIONS: In Belgium, the financial incentives for the use of low-cost dialysis modalities only had a modest impact due to the continuing profits that could be generated by high-cost dialysis. Profit neutrality is crucial for the success of any financial incentive mechanism for low-cost dialysis modalities.

Coelho, A. P., Sa, H. O., Diniz, J. A., et al. (2014). "The integrated management for renal replacement therapy in Portugal." Hemodial Int **18**(1): 175-184.

> Portugal was the first European country to introduce an integrated management of end-stage renal disease (IM ESRD). This new program integrates various dialysis services and products, which are reimbursed at a fixed rate/patient/week called "comprehensive price payment." This initiative restructured the delivery of dialysis services, the monitoring of outcomes, and the funding of renal replacement therapy. This article described the implementation of a new model of comprehensive provision of hemodialysis (HD) services and aimed to assess its impact on dialysis care. Quality assessments and reports of patient satisfaction, produced by the Ministry of Health since 2008, as well as national registries and reports, provided the data for this review. Indicators of HD services in all continental facilities show positive results that have successively improved along the period of 2009-2011, in spite of an average annual growth of 3% of the population under HD treatment. Mortality rates for HD patients were 12.7%, 12%, and 11%, respectively in 2009, 2010, and 2011; annual hospitalization rates were 4.9%, 3.8%, and 4.4% for the same years; key performance indicators showed averages above the reference values such as hemoglobin, serum phosphorus, eKt/V, water quality, number of days of hospitalization per patient per year, and number of weekly dialysis sessions. The financing analysis of IM ESRD demonstrates a sustained control of global costs, without compromising quality. The IM ERSD program is an innovative and quality-driven approach that benefits both dialysis patients and providers, contributing toward the rationalization of service provision and the efficient use of resources.

Coutts, L. R. (2007). "Economic incentives and barriers to quality care." Nephrol News Issues **21**(6): 5.

Coutts, L. R. (2008). "Is part D working for Medicare, the taxpayer, and renal patients?" Nephrol News Issues **22**(3): 10.

Curtis, J. et Schatell, D. (2010). "The new Medicare PPS and home dialysis." Nephrol News Issues **24**(10): 30, 32-33.

> Overall, we believe that bundling of payments to dialysis facilities is positive for home dialysis. The incentive for higher utilization of home therapies comes down to the fact that, with treatments for all modalities being paid at the same rate, providers will see that home modalities cost less than facility-based treatments. The adjustment for home training treatments is certainly helpful, but it is not incentive enough on its own. From our perspective, one of the biggest financial incentives for home dialysis and more frequent dialysis therapies is that these patients are statistically known to spend less time in the hospital, over time costing taxpayers and the ESRD Program less money. We will continue to encourage CMS to consider the overall cost implications of more frequent dialysis. We are hopeful that when hospitalization costs are accounted for, CMS will do even more to encourage the use of these modalities.

Day, L. M. (1997). "From fee-for-service to capitation: factors driving ESRD reimbursement system change." Nephrol News Issues **11**(4): 22-23, 31.

de Wet, C., McKay, J. et Bowie, P. (2012). "Combining QOF data with the care bundle approach may provide a more meaningful measure of quality in general practice." BMC Health Serv Res **12**: 351.

> BACKGROUND: A significant minority of patients do not receive all the evidence-based care recommended for their conditions. Health care quality may be improved by reducing this observed variation. Composite measures offer a different patient-centred perspective on quality and are utilized in acute hospitals via the 'care bundle' concept as indicators of the reliability of specific (evidence-based) care delivery tasks and improved outcomes. A care bundle consists of a number of time-specific interventions that should be delivered to every patient every time. We aimed to apply the care bundle concept to selected QOF data to measure the quality of evidence-based care provision. METHODS: Care bundles and components were selected from QOF indicators according to defined criteria. Five clinical conditions were suitable for care bundles: Secondary Prevention of Coronary Heart Disease (CHD), Stroke & Transient Ischaemic Attack (TIA), Chronic Kidney Disease (CKD), Chronic Obstructive Pulmonary Disease (COPD) and Diabetes Mellitus (DM). Each bundle has 3-8 components. A retrospective audit was undertaken in a convenience sample of nine general medical practices in the

West of Scotland. Collected data included delivery (or not) of individual bundle components to all patients included on specific disease registers. Practice level and overall compliance with bundles and components were calculated in SPSS and expressed as a percentage. RESULTS: Nine practices (64.3%) with a combined patient population of 56,948 were able to provide data in the format requested. Overall compliance with developed QOF-based care bundles (composite measures) was as follows: CHD 64.0%, range 35.0-71.9%; Stroke/TIA 74.1%, range 51.6-82.8%; CKD 69.0%, range 64.0-81.4%; and COPD 82.0%, range 47.9-95.8%; and DM 58.4%, range 50.3-65.2%. CONCLUSIONS: In this small study compliance with individual QOF-based care bundle components was high, but overall ('all or nothing') compliance was substantially lower. Care bundles may provide a more informed measure of care quality than existing methods. However, the acceptability, feasibility and potential impact on clinical outcomes are unknown.

DeOreo, P. B. (2007). "Finances of the independent dialysis facility." Blood Purif **25**(1): 7-11.

Medicare pays 80% of the cost of dialysis treatment and associated medications. Congress directed the Centers for Medicare and Medicaid Services (CMS) to develop both a process of regular and more or less "automatic" updates of composite rate setting and "bundling" as much of the laboratory and ancillary medications as possible into the composite rate. In response to this mandate, CMS revised the wage indexing process, added an annual update, and removed the limits on the wage index range. CMS has moved the "margin" from medication acquisition and administration to an annually revised "drug add-on" to the composite rate and fixed reimbursement of separately billed medication (ancillary) to the average sales price +6%. CMS is funding a demonstration project on near 100% bundling to be completed by 2008 that will include metrics for automatically increasing the base composite rate.

Deoreo, P. B. (2008). "How dialysis is paid for: what the dialysis medical director should know, and why." Semin Dial **21**(1): 58-62.

While Medicare funds neither 100% of the patients, nor 100% of the costs incurred by dialysis patients, Medicare's policies dominate reimbursement. The medical director is well advised to understand these mechanisms and the processes leading to change. Medicare pays for dialysis according to laws and rules enacted by Congress. Congress is re-evaluating the funding of the end-stage renal disease program. The rules are changing. They are changing in a way designed to encourage better outcomes, and increased provider accountability. The new terms of art are "budget neutrality,""quality incentive payments," and "bundled composite rate." Providers will need to make choices that may impact the quality of care and the experience of the patient. It is up to the medical director to ensure that these choices result in benefit to their patients.

Desai, A. A., Bolus, R., Nissenson, A., et al. (2009). "Is there "cherry picking" in the ESRD Program? Perceptions from a Dialysis Provider Survey." Clin J Am Soc Nephrol **4**(4): 772-777.

BACKGROUND AND OBJECTIVES: Changes in ESRD reimbursement policy, including proposed bundled payment, have raised concern that dialysis facilities may use "cherry picking" practices to attract a healthier, better insured, or more adherent patient population. DESIGN, SETTING, PARTICIPANTS, & MEASUREMENTS: As part of a national survey to measure beliefs about drivers of quality in dialysis, respondents were asked about their perceptions of cherry picking, including the frequency and effect of various cherry picking strategies on dialysis outcomes. We surveyed a random sample of 250 nurse members of the American Nephrology Nurses Association, 250 nephrologist members of the American Medical Association, 50 key opinion leaders, and 2000 physician members of the Renal Physicians Association. We tested hypothesized predictors of perception, including provider group, region, age, experience, and the main practice facility features. RESULTS: Three-quarters of respondents reported that cherry picking occurred "sometimes" or "frequently." There were no differences in perceptions by provider or facility characteristics, insurance status, or health status. In multivariable regression, perceived cherry picking was 2.8- and 3.5-fold higher in the northeast and Midwest, respectively, versus the west. Among various cherry picking strategies, having a "low threshold to 'fire' chronic no-shows/late arrivers," and having a "low threshold to 'fire' for noncompliance with diet and meds" had the largest perceived association with outcomes. CONCLUSIONS: Under current reimbursement practices, dialysis caregivers perceive that cherry picking is common and important. An improved understanding of cherry picking practices, if evident, may help to protect vulnerable patients if reimbursement practices were to change.

Desai, A. A., Garber, A. M. et Chertow, G. M. (2007). "Rise of pay for performance: implications for care of people with chronic kidney disease." Clin J Am Soc Nephrol **2**(5): 1087-1095.

Many health care providers and policy makers believe that health care financing systems fail to reward high-quality care. In recent years, federal and private payers have begun to promote pay for performance, or value-based purchasing, initiatives to raise the quality of care. This report describes conceptual issues in the design and implementation of pay for performance for chronic kidney disease and ESRD care. It also considers the implications of recent ESRD payment policy changes on the broader goals of pay for performance. Congressionally mandated bundle payment demonstration for dialysis, newly implemented case-mix adjustment of the composite rate, and G codes for the monthly capitation payment are important opportunities to understand facility and provider behavior with particular attention to patient selection and treatment practices. Well-designed payment systems will reward quality care for patients while maintaining appropriate accountability and fairness for health care providers.

Dhoul, N., de Lusignan, S., Dmitrieva, O., et al. (2012). "Quality achievement and disease prevalence in primary care predicts regional variation in renal replacement therapy (RRT) incidence: an ecological study." Nephrol Dial Transplant **27**(2): 739-746.

BACKGROUND: Diabetes Meillitus (DM) and hypertension (HT) are important causes of end-stage renal disease (ESRD) and renal replacement therapy (RRT) is the standard active treatment. Financially, incentivized quality initiatives for primary care include pay-for-performance (P4P) in DM and HT. Our aim was to examine any effect of disease prevalence and P4P on RRT incidence and regional variation. METHODS: The incidence of RRT, sex and ethnicity data and P4P disease register and achievement data were obtained for each NHS locality. We calculated correlation coefficients for P4P indicators since 2004/05 and socio-demographic data for these 152 localities. We then developed a regression model and regression coefficient (R(2)) to assess to what extent these variables might predict RRT incidence. RESULTS: Many of the P4P indicators were weakly but highly significantly correlated with RRT incidence. The strongest correlation was 2004/05 for DM prevalence and 2006/07 for HT quality. DM prevalence and the percentage with blood pressure control in HT target (HT quality) were the most predictive in our regression model R(2) = 0.096 and R(2) = 0.085, respectively (P < 0.001). Combined they predicted a fifth of RRT incidence (R(2) = 0.2, P < 0.001) while ethnicity and deprivation a quarter (R(2) = 0.25, P < 0.001). Our final model contained proportion of population >75 years, DM prevalence, HT quality, ethnicity and deprivation index and predicted 40% of variation (R(2) = 0.4, P < 0.001). CONCLUSION: Our findings add prevalence of DM and quality of HT management to the known predictors of variation in RRT, ethnicity and deprivation. They raise the possibility that interventions in primary care might influence later events in specialist care.

Dor, A., Pauly, M. V., Eichleay, M. A., et al. (2007). End-stage renal disease and economic incentives : the international study of health care organization and financing. NBER Working Paper Series ; n° 13125. Cambridge NBER**:** 26 , fig.
http://www.nber.org/papers/w13125.pdf

End-stage renal disease (ESRD), or kidney failure, is a debilitating, costly, and increasingly common medical condition. Little is known about how different financing approaches affect ESRD outcomes and delivery of care. This paper presents results from a comparative review of 12 countries with alternative models of incentives and benefits, collected under the International Study of Health Care Organization and Financing, a substudy within the Dialysis Outcomes and Practice Patterns Study. Variation in spending per ESRD patient is relatively small and is correlated with overall per capita health care spending. Between-country variations in spending are reduced using an input price parity index constructed for this study. Remaining differences in costs and outcomes do not seem strongly linked to differences in incentives embedded in national programs.

Dor, A., Pauly, M. V., Eichleay, M. A., et al. (2007). "End-stage renal disease and economic incentives: the International Study of Health Care Organization and Financing (ISHCOF)." Int J Health Care Finance Econ **7**(2-3): 73-111.

> End-stage renal disease (ESRD) is a debilitating, costly, and increasingly common condition. Little is known about how different financing approaches affect ESRD outcomes and delivery of care. This paper presents results from a comparative review of 12 countries with alternative models of incentives and benefits, collected under the International Study of Health Care Organization and Financing, a substudy within the Dialysis Outcomes and Practice Patterns Study. Variation in spending per ESRD patient is relatively small, but correlated with overall per capita health care spending. Remaining differences in costs and outcomes do not seem strongly linked to differences in incentives.

Dore, D. D., Swaminathan, S., Gutman, R., et al. (2013). "Different analyses estimate different parameters of the effect of erythropoietin stimulating agents on survival in end stage renal disease: a comparison of payment policy analysis, instrumental variables, and multiple imputation of potential outcomes." J Clin Epidemiol **66**(8 Suppl): S42-50.

> OBJECTIVE: To compare the assumptions and estimands across three approaches to estimate the effect of erythropoietin-stimulating agents (ESAs) on mortality. STUDY DESIGN AND SETTING: Using data from the Renal Management Information System, we conducted two analyses using a change to bundled payment that, we hypothesized, mimicked random assignment to ESA (pre-post, difference-in-difference, and instrumental variable analyses). A third analysis was based on multiply imputing potential outcomes using propensity scores. RESULTS: There were 311,087 recipients of ESAs and 13,095 non-recipients. In the pre-post comparison, we identified no clear relationship between bundled payment (measured by calendar time) and the incidence of death within 6 months (risk difference -1.5%; 95% confidence interval [CI] -7.0%, 4.0%). In the instrumental variable analysis, the risk of mortality was similar among ESA recipients (risk difference -0.9%; 95% CI -2.1, 0.3). In the multiple imputation analysis, we observed a 4.2% (95% CI 3.4%, 4.9%) absolute reduction in mortality risk with the use of ESAs, but closer to the null for patients with baseline hematocrit level >36%. CONCLUSION: Methods emanating from different disciplines often rely on different assumptions but can be informative about a similar causal contrast. The implications of these distinct approaches are discussed.

Dykstra, D. M., Beronja, N., Menges, J., et al. (2003). "ESRD managed care demonstration: financial implications." Health Care Financ Rev **24**(4): 59-75.

> In 1996, CMS launched the end stage renal disease (ESRD) managed care demonstration to study the experience of offering managed care to ESRD patients. This article analyzes the financial impact of the demonstration, which sought to assess its economic impact on the Federal Government, the sites, and the ESRD Medicare beneficiaries. Medicare's costs for demonstration enrollees were greater than they would have been if these enrollees had remained in the fee-for-service (FFS) system. This loss was driven by the lower than average predicted Medicare spending given the demonstration patients' conditions. The sites experienced losses or only modest gains, primarily because they provided a larger benefit package than traditional Medicare coverage, including no patient obligations and other benefits, especially prescription drugs. Patient financial benefits were approximately $9,000 annually.

Eggers, P. W., Frankenfield, D. L., Greer, J. W., et al. (2002). "Comparison of mortality and intermediate outcomes between medicare dialysis patients in HMO and fee for service." Am J Kidney Dis **39**(4): 796-804.

> End-stage renal disease (ESRD) is the only disease entitlement for Medicare; therefore, most patients with ESRD have Medicare coverage. Patients with ESRD are prohibited by law from enrolling in health maintenance organizations (HMOs), the only group prohibited within Medicare. However, they may remain in an HMO if they enrolled in such a plan before their kidneys failed. Thus, it is possible to compare patients with ESRD in HMOs with those in fee-for-service (FFS) plans. To determine whether mortality, transplantation rates, and intermediate outcomes differed between Medicare ESRD beneficiaries enrolled in HMO versus FFS providers, a retrospective cohort analysis was performed of patients with ESRD from three Health Care Financing Administration data sets containing

administrative and outcome information for Medicare ESRD beneficiaries from 1990 to 1998. On December 31, 1998, a total of 278,510 prevalent patients with ESRD were in FFS plans, and 18,332 patients were in HMOs. HMO patients were older and more likely to be white and male and have diabetes mellitus and comorbid cardiovascular conditions than FFS patients. Unadjusted 2-year survival rates were 48.4% and 49.3% for FFS and HMO patients, respectively. In a multivariate model, HMO status had no significant effect on mortality, which was greater with older age, male sex, and white race. In 1998, unadjusted renal transplantation rates were 23.5% and 15.5% for FFS and HMO patients, respectively; age adjustment abrogated the apparent difference. For FFS and HMO patients, adequate hemodialysis was delivered to 72% and 82%, and 56% and 62% had hematocrits greater than the benchmark, respectively. There was no statistical difference in these outcomes in multivariate comparison. In conclusion, care by HMO for patients with an expensive chronic illness can achieve outcomes similar to those for FFS patients. Claims of poorer care and worse outcomes for patients with ESRD enrolled onto an HMO, an argument used to justify continued prohibition against widespread participation by patients with ESRD, are not supported.

Erdem, E., Prada, S. I. et Haffer, S. C. (2013). "Medicare payments: how much do chronic conditions matter?" Medicare Medicaid Res Rev **3**(2).

OBJECTIVE: Analyze differences in Medicare Fee-for-Service utilization (i.e., program payments) by beneficiary characteristics, such as gender, age, and prevalence of chronic conditions. METHODS: Using the 2008 and 2010 Chronic Conditions Public Use Files, we conduct a descriptive analysis of enrollment and program payments by gender, age categories, and eleven chronic conditions. RESULTS: We find that the effect of chronic conditions on Medicare payments is dramatic. Average Medicare payments increase significantly with the number of chronic conditions. Finally, we quantify the effect of individual conditions and find that "Stroke / Transient Ischemic Attack" and "Chronic Kidney Disease" are the costliest chronic conditions for Part A, and "Cancer" and "Chronic Kidney Disease" are the costliest for Part B.

Farley, D. O. (1994). "Financing of end-stage renal disease care: past, present, and future." Adv Ren Replace Ther **1**(1): 24-31.

The Medicare end-stage renal disease (ESRD) program has offered financial access to needed health care for ESRD patients, and it has given ESRD providers a reliable source of payment for their services. Total Medicare ESRD expenditures have increased since the inception of the program, due mainly to increased enrollment and changing patient mix. As a result, cost control is a dominant theme of payment policy. This article describes the history of Medicare ESRD financing policy and identifies related service delivery issues including treatment technology, service resources, treatment processes, and patient selection. It also discusses several options available to Medicare for managing the growth of ESRD program costs, including capitation payment methods, control of ESRD enrollment, and payment for erythropoietin treatment. Possible future changes in financing ESRD are identified. With a goal to control costs. Medicare probably will use payment methods to change service mix and reduce use by influencing provider incentives and marketplace competition. Health system reform also may affect ESRD benefits and payments, if the ESRD program is folded into a new financing system. ESRD patients and providers face a challenge of uncertainty during this period of change.

Farley, D. O., Carter, G. M., Kallich, J. D., et al. (1996). "Modified capitation and treatment incentives for end stage renal disease." Health Care Financ Rev **17**(3): 129-142.

This study developed a modified capitation payment method for the Medicare end stage renal disease (ESRD) program designed to support appropriate treatment choices and protect health plans from undue financial risk. The payment method consists of risk-adjusted monthly capitated payments for individuals on dialysis or with functioning kidney grafts, lump sum event payments for expected incremental costs of kidney transplantations or graft failures, and outlier payments for expensive patients. The methodology explained 25 percent of variation in annual payments per patient. Risk adjustment captured substantial variations across patient groups. Outlier payments reduced health plan risk by up to 15 percent.

Filangeri, J. A. (2007). "Home dialysis: a fresh look at reimbursement methods." Nephrol News Issues **21**(3): 43, 47, 52.

> Method selection, though applying only to the Medicare patient, still encompasses the majority of the dialysis patient population. Taking the time to run the numbers and to use both Methods to the advantage of your program might well have a significant impact on the profitability of a home dialysis program.

Fishbane, S., Miller, I., Danko, H., et al. (2012). "The QIP: will it improve dialysis care? An overview." Nephrol News Issues **26**(1): 20, 22-24, 26.

> The Centers for Medicare & Medicaid Services End-Stage Renal Disease Quality Incentive Program is a pay-for-performance initiative that imposes dialysis payment reductions of up to 2% for suboptimal quality. In payment years 2012 and 2013 the methodology is simple, a point system based on performance in dialysis adequacy and anemia. In payment year 2014 (performance period begins Jan. 1, 2012) the QIP changes substantially, with a methodology that more closely resembles the Medicare Hospital Inpatient Value-Based Purchasing Program. Succeeding with the QIP will require both providing high quality care for a wider variety of measures, and a clear and complete understanding of the program structure and the new scoring methodology. In this review we discuss the QIP, with a comprehensive explanation of measures and scoring procedure.

Fishbane, S., Miller, I., Wagner, J. D., et al. (2012). "Changes to the end-stage renal disease quality incentive program." Kidney Int **81**(12): 1167-1171.

> Monitoring the quality of dialysis care has long been a component of the Medicare ESRD program. As part of the 2008 Medicare Improvements for Patients and Providers Act (MIPPA), Congress mandated the Quality Incentive Program (QIP), which linked measures of care quality to payments. The legislation embraced the idea that this linkage of federal money to performance would encourage the purchase of greater 'value.' The first 2 program years for the QIP use a simple scoring methodology and a limited scope of quality metrics. For payment year 2014 (performance period calendar year 2012), the program changes substantially, with an expanded number of quality measures and a more complex scoring methodology. In this article, we describe the program structure, quality measures, scoring system, and financial impact.

Friedman, A. L. et Friedman, E. A. (2012). "A step toward solving the long-term care dilemma for living kidney donors." Transplantation **94**(10): 988-989.

> Living kidney donor transplantation, universally recognized as the best current option in care for patients with end-stage renal disease, has shown a static growth in application in the United States despite continued expansion of the prevalent number of patients sustained by dialysis. Whether insurance providers' deficient payment to transplantation facilities for long-term costs generated by living kidney donors contributes to the problem was examined by the facility. Precise focus on all coding and billing for services rendered during care beyond 6 months effectively increased reimbursement from insurance providers for a living kidney donor from 47% to 85% of the amount billed. Although the sample of 82 donors was small and predominantly white (81.7%), it seems reasonable to suggest that centers with a low rate of payment consider an examination of their own billing and coding practices. The extent of donor resistance to participate in a continuing posttransplantation relationship with the transplantation center previously linked to financial issues borne by the donor remains unaddressed and could be explored in a subsequent study.

Fukuhara, S., Yamazaki, C., Hayashino, Y., et al. (2007). "The organization and financing of end-stage renal disease treatment in Japan." Int J Health Care Finance Econ **7**(2-3): 217-231.

> End-stage renal disease (ESRD) affects 230,000 Japanese, with about 36,000 cases diagnosed each year. Recent increases in ESRD incidence are attributed mainly to increases in diabetes and a rapidly aging population. Renal transplantation is rare in Japan. In private dialysis clinics, the majority of treatment costs are paid as fixed fees per session and the rest are fee for service. Payments for

hospital-based dialysis are either fee-for-service or diagnosis-related. Dialysis is widely available, but reimbursement rates have recently been reduced. Clinical outcomes of dialysis are better in Japan than in other countries, but this may change given recent ESRD cost containment policies.

Gass Kandilov, A. M., Pope, G. C., Kautter, J., et al. (2012). "The national market for Medicare clinical laboratory testing: implications for payment reform." Medicare Medicaid Res Rev **2**(2).

Current Medicare payment policy for outpatient laboratory services is outdated. Future reforms, such as competitive bidding, should consider the characteristics of the laboratory market. To inform payment policy, we analyzed the structure of the national market for Medicare Part B clinical laboratory testing, using a 5-percent sample of 2006 Medicare claims data. The independent laboratory market is dominated by two firms--Quest Diagnostics and Laboratory Corporation of America. The hospital outreach market is not as concentrated as the independent laboratory market. Two subgroups of Medicare beneficiaries, those with end-stage renal disease and those residing in nursing homes, are each served in separate laboratory markets. Despite the concentrated independent laboratory market structure, national competitive bidding for non-patient laboratory tests could result in cost savings for Medicare.

Gilbert, R. W., Caruso, D. M., Foster, K. N., et al. (2002). "Development of a continuous renal replacement program in critically ill patients." Am J Surg **184**(6): 526-532; discussion 532-523.

BACKGROUND: Critically ill patients encounter many obstacles, such as acute renal failure, that increases length of stay as well as hospital cost. Dialysis in these patients is often ineffective thereby prolonging the inevitable and significantly increasing the cost of care. A dialysis program that could improve patient care, potentially improve outcome and be "revenue neutral" would be ideal. METHODS: A continuous renal replacement therapy (CRRT) program was developed to significantly impact the care of critically ill patients Using the latest CRRT equipment along with an innovative hands-on CRRT training program, a specialized CRRT team was created. Working in conjunction with the hospital business office, new revenue charge codes were created and existing codes were updated. Patients who underwent CRRT had their financial records reviewed for: hospital cost to perform CRRT, total hospital billing to the payer, CRRT revenue 881 (billing units) charged to the payer, total charges and reimbursement for the account, percentage of reimbursement, collected revenue, and payer. RESULTS: From April 2000 to February 2002, 39 critically ill patients underwent CRRT. Initial set-up cost was US$79,622.80 and the cost of CRRT was US$222,323.98. The hospital billed for US$656,090.63 and assuming 100% reimbursement, the potential profit was US$427,678.50. However, loss of revenue, mainly from noncompliance with charge capture resulted in the hospital billing only US$386,794.32 with a total reimbursement of US$165,779.86. The 21 burn patients who underwent CRRT yielded a net profit of US$10,294.12, with the highest reimbursement from workman's compensation and private payers. The overall mortality rate was 59% and 65% for the burn patients; significantly lower than published national averages. CONCLUSIONS: An in-house CRRT program improved patient care by providing dialysis in patients who normally would not tolerate the procedure. Although there was a loss of revenue, CRRT in the burn patients appeared "revenue neutral." Although not specifically studied in this review, based on published data, mortality rates in this population were lower than expected especially in critically ill burn patients.

Gitlin, M., Lee, J. A., Spiegel, D. M., et al. (2012). "Outpatient red blood cell transfusion payments among patients on chronic dialysis." BMC Nephrol **13**: 145.

BACKGROUND: Payments for red blood cell (RBC) transfusions are separate from US Medicare bundled payments for dialysis-related services and medications. Our objective was to examine the economic burden for payers when chronic dialysis patients receive outpatient RBC transfusions. METHODS: Using Truven Health MarketScan(R) data (1/1/02-10/31/10) in this retrospective micro-costing economic analysis, we analyzed data from chronic dialysis patients who underwent at least 1 outpatient RBC transfusion who had at least 6 months of continuous enrollment prior to initial dialysis claim and at least 30 days post-transfusion follow-up. A conceptual model of transfusion-associated resource use based on current literature was employed to estimate outpatient RBC transfusion payments. Total payments per RBC transfusion episode included screening/monitoring (within 3 days), blood acquisition/administration (within 2 days), and associated complications (within 3 days for acute events; up to 45 days for chronic events). RESULTS: A total of 3283 patient transfusion episodes were included; 56.4% were men and 40.9% had Medicare supplemental insurance. Mean (standard deviation [SD]) age was 60.9 (15.0) years, and mean Charlson comorbidity index was 4.3 (2.5). During a mean (SD) follow-up of 495 (474) days, patients had a mean of 2.2 (3.8) outpatient RBC transfusion episodes. Mean/median (SD) total payment per RBC transfusion episode was $854/$427 ($2,060) with 72.1% attributable to blood acquisition and administration payments. Complication payments ranged from mean (SD) $213 ($168) for delayed hemolytic transfusion reaction to $19,466 ($15,424) for congestive heart failure. CONCLUSIONS: Payments for outpatient RBC transfusion episodes were driven by blood acquisition and administration payments. While infrequent, transfusion complications increased payments substantially when they occurred.

Glover, J. J. et Moss, A. H. (1998). "Rationing dialysis in the United States: possible implications of capitated systems." Adv Ren Replace Ther **5**(4): 341-349.

The application of managed care to dialysis raises concerns that dialysis will be rationed in the United States. Rationing means the implicit or explicit denial of beneficial or marginally beneficial medical treatment as a result of insufficient resources to provide treatment to all. In this era of cost containment and budget cutting, rationing appears inevitable in the end-stage renal disease program because of its continued growth in numbers and cost and because many are questioning the benefit of dialysis to certain groups of patients. Rationing according to social worth, ability to pay, or age is not ethically justifiable, but it is justified to ration according to medical benefit. There is an important role for guidelines developed with broad input from patients, families, health care professionals, ethicists, health policy experts, and payers. Consensus statements exist in the literature, and the nephrology community is in the process of developing practice guidelines that will be available for future use. In the meantime, managed care companies should look to broader community input in the form of consensus statements and community dialogue. Managed care companies will need ethics committees to ensure that their policies and procedures for rationing are fair, principled, and subject to review and appeal.

Golper, T. A. (2013). "The possible impact of the US prospective payment system ("bundle") on the growth of peritoneal dialysis." Perit Dial Int **33**(6): 596-599.

Golper, T. A., Guest, S., Glickman, J. D., et al. (2011). "Home dialysis in the new USA bundled payment plan: implications and impact." Perit Dial Int **31**(1): 12-16.

On 1 January 2011, a new payment system for Medicare patients will be implemented in the United States. This new system bundles services previously charged separately and under a "fee for service" environment. The authors discuss the implications of this approach. Over the next several pages is a response by American physicians and dialysis innovators to a federal initiative to change the way dialysis is paid for in the United States. Peter Blake, the Editor-in-Chief of Peritoneal Dialysis International, invited Thomas Golper to articulate physicians' concerns with this new payment scheme. After the government of the USA closed its comment period over the new payment methodology, called "bundling," Golper sought out colleagues from diverse backgrounds and compiled this collective view of the situation.

Gupta, C., Chertow, G. M., Linthicum, M. T., et al. (2014). "Reforming medicare's dialysis payment policies: implications for patients with secondary hyperparathyroidism." Health Serv Res **49**(6): 1925-1943.

OBJECTIVE: To demonstrate how expanding services covered by a "bundled payment" can also expand variation in the costs of treating patients under the bundle, using the Medicare dialysis program as an example. DATA SOURCES/STUDY SETTING: Observational claims-based study of 197,332 Medicare hemodialysis beneficiaries enrolled for at least one quarter during 2006-2008. STUDY DESIGN: We estimated how resource utilization (all health services, dialysis-related services, and medications) changes with intensity of secondary hyperparathyroidism (sHPT) treatment. DATA EXTRACTION METHODS: Using Medicare claims, a patient-quarter level dataset was constructed, including a measure of sHPT treatment intensity. PRINCIPAL FINDINGS: Under the existing, narrow dialysis bundle, utilization of covered services is relatively constant across treatment intensity groups; under a broader bundle, it rises more rapidly with treatment intensity. CONCLUSIONS: The broader Medicare dialysis bundle reimburses providers uniformly, even though patients treated more intensively for sHPT cost more to treat. Absent any payment adjustments or efforts to ensure quality, this flat payment schedule may encourage providers to avoid high-intensity patients or reduce their treatment intensity. The first incentive harms efficiency. The second may improve or worsen efficiency, depending on whether it reduces appropriate or inappropriate treatment.

Haarsager, J., Krishnasamy, R. et Gray, N. A. (2018). "Impact of pay for performance on access at first dialysis in Queensland." Nephrology (Carlton) **23**(5): 469-475.

AIM: Commencement of haemodialysis with an arteriovenous fistula (AVF) or arteriovenous graft (AVG) is associated with improved survival compared with commencement with a central venous catheter. In 2011-2012, Queensland Health made incentive payments to renal units for early referred patients who commenced peritoneal dialysis (PD), or haemodialysis with an AVF/AVG. The aim of this study was to determine if pay for performance improved clinical care. METHODS: All patients who commenced dialysis in Australia between 2009 and 2014 and were registered with the Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) were included. A multivariable regression model was used to compare rates of commencing dialysis with a PD catheter or permanent AVF/AVG during the pay-for-performance period (2011-2012) with periods prior (2009-2010) and after (2013-2014). RESULTS: A total of 10 858 early referred patients commenced dialysis during the study period, including 2058 in Queensland. In Queensland, PD as first modality increased with time ($P < 0.001$) but there was no change in AVF/AVG rate at first haemodialysis ($P = 0.5$). In a multivariate model using the pay-for-performance period as reference, the odds ratio for commencement with PD or haemodialysis with an AVF/AVG in Queensland was 1.02 (95% CI 0.81-1.29) in 2009-2010 and 1.28 (95% CI 1.01-1.61) in 2013-2014. There was no change for the rest of Australia (0.97 95% CI 0.87-1.09 in 2009-2010 and 1.00 95% CI 0.90-1.11 in 2013-14). CONCLUSION: Pay for performance did not improve rates of commencement of dialysis with PD or an AVF/AVG during the payment period. A lag effect on clinical care may explain the improvement in later years.

Hidai, H. (2000). "Need for an incentive-based reimbursement policy toward quality care for dialysis patient management." Kidney Int **58**(1): 363-373.

BACKGROUND: In view of the growing dialysis population and the increasing reimbursement cost in the industrialized countries, a critical evaluation of the dialysis economy is warranted. METHODS: Data for the reimbursement and dialysis patients' statistics were collected from the National Medical Care Expenditure (NMCE), 1979-1996, which was published by the Japanese government, and the article "An overview of regular dialysis treatment in Japan," 1979-1998, by the Japanese Society for Dialysis Therapy, as well as unpublished data from the Yokohama Dai-ichi Hospital and 10 affiliated urban dialysis centers. RESULTS: From 1979 to 1996, the dialysis population increased 5.2 times and the NMCE increased 2.5 times, whereas the end-stage renal disease (ESRD) payment increased only 1.8 times. Because of a drastic reduction in the dialyzer cost and the dialysis-related technical fee, both the percentage of ESRD-related payment within NMCE and ESRD payment per capita per year decreased from 5.4 to 4.1% and from 16.3 million yen to 5.6 million yen, respectively. Despite this drastic cost reduction, the patient survival and quality of life determined by the social rehabilitation rate did not decline. CONCLUSION: The Japanese health insurance policy for dialysis management achieved a successful cost cut during the 1979-1996 period by using an incentive-based payment system toward quality care. However, the forthcoming further exponential increase in the dialysis population may put the dialysis economy and hence dialysis care quality in jeopardy. Effort must be made to reduce the ESRD-related cost through prevention of the progression of kidney diseases, propagation of renal transplantation, and internationalization of continuous ambulatory peritoneal dialysis and erythropoietin cost. A reduction in dialysis reimbursement, if necessary, must be achieved through an incentive-based system toward quality patient care.

Hirth, R. A., Chernew, M. E. et Orzol, S. M. (2000). "Ownership, competition, and the adoption of new technologies and cost-saving practices in a fixed-price environment." Inquiry **37**(3): 282-294.

Advances in medical technology have been implicated as the primary cause of rising health care expenditures. It is not yet known whether the increasing prevalence of managed care mechanisms, particularly capitation, will change substantially incentives for acquiring and using cost-increasing innovations. We examined the decisions of dialysis units (a set of providers that has faced capitation and real decreases in payment for several decades) with respect to use of cost-increasing technologies that enhance quality of care, cost-cutting practices that reduce quality of care, and amenities desired by patients that are unrelated to quality of care. We found that the dialysis payment system does not appear to have blocked access to a number of new, quality-enhancing technologies that were developed in the 1980s. However, facilities made adjustments along other valuable margins to facilitate adoption of these technologies; use of new technologies varied with numerous facility, regulatory, and case-mix characteristics including ownership, chain membership, size, market competition, and certificate of need programs. Interestingly, the trade-offs made by for-profit and nonprofit facilities when faced with fixed prices appeared quite different. For-profits tended to deliver lower technical quality of care but more amenities, while nonprofits favored technical quality of care over amenities. Our findings may have implications for the response of other types of health care providers to capitation and increasing economic constraints.

Hirth, R. A. et Held, P. J. (1997). "Some of the small print on managed care proposals for end-stage renal disease." Adv Ren Replace Ther **4**(4): 314-324.

In this article we discuss selected issues related to Medicare's end-stage renal disease (ESRD) managed care demonstration project and Congressional proposals to remove the barrier to ESRD patients enrolling in Medicare managed care plans. We discuss financial incentives to keep patients healthy; beneficiary obligations under fee-for-service and managed care; risk selection by beneficiaries among plans; and the baseline determination of a capitation rate. The ESRD demonstration offers the opportunity to evaluate the consequences of making Medicare managed care options available to a high cost and clinically vulnerable population. Careful evaluation is necessary to ensure that ESRD managed care options are structured to be beneficial to taxpayers, caregivers, and, most importantly, the beneficiaries choosing these options. Certainly, the potential exists for managed care to benefit patients by changing the fractured system in which each provider only has an incentive to worry about its own costs. However, the possible unintended consequences highlighted in this article strongly suggest that the evaluation of the demonstration project be undertaken before managed care options are made widely available outside the demonstration sites. Problems of a more technical nature, such as how to best use available Health Care Financing Administration data in the rate-setting process, are likely to be overcome, but the time and effort necessary to resolve them should not be underestimated.

Hirth, R. A., Roys, E. C., Wheeler, J. R., et al. (2005). "Economic impact of case-mix adjusting the dialysis composite rate." J Am Soc Nephrol **16**(5): 1172-1176.

The Medicare program reimburses dialysis providers a flat rate for a bundle of services that comprise the basic dialysis treatment. This payment system is being modified to incorporate case-mix adjustment for age and body size, which have been shown to influence dialysis costs. This study simulated the economic impact of the recently issued Medicare rule on case-mix adjustment by estimating the variation in payments across patients, facilities, and broad classes of facilities. Case-mix adjustment results in considerable patient-level variation in payments (dollar 12.99 SD in case-mix adjusted payments). The variation across dialysis facilities is smaller but still economically significant (dollar 3.77 SD). However, there was little evidence that particular classes of facilities (e.g., ownership, chain membership, size) will be substantially advantaged or disadvantaged by case-mix adjustment. There do seem to be modest changes in the regional distribution of payments.

Hirth, R. A., Turenne, M. N., Wheeler, J. R., et al. (2013). "The initial impact of Medicare's new prospective payment system for kidney dialysis." Am J Kidney Dis **62**(4): 662-669.

BACKGROUND: Medicare implemented a new prospective payment system (PPS) on January 1, 2011. This PPS covers an expanded bundle of services, including services previously paid on a fee-for-service basis. The objectives of the new PPS include more efficient decisions about treatment service combinations and modality choice. METHODS: Primary data for this study are Medicare claims files for all dialysis patients for whom Medicare is the primary payer. We compare use of key injectable medications under the bundled PPS to use when those drugs were separately billable and examine variability across providers. We also compare each patient's dialysis modality before and after the PPS. RESULTS: Use of relatively expensive drugs, including erythropoiesis-stimulating agents, declined substantially after institution of the new PPS, whereas use of iron products, often therapeutic substitutes for erythropoiesis-stimulating agents, increased. Less expensive vitamin D products were substituted for more expensive types. Drug spending overall decreased by approximately $25 per session, or about 5 times the mandated reduction in the base payment rate of approximately $5. Use of peritoneal dialysis increased in 2011 after being nearly flat in the years prior to the PPS, with the increase concentrated in patients in their first or second year of dialysis. Home hemodialysis continued to increase as a percentage of total dialysis services, but at a rate similar to the pre-PPS trend. CONCLUSION: The expanded bundle dialysis PPS provided incentives for the use of lower cost therapies. These incentives seem to have motivated dialysis providers to move toward lower cost methods of care in both their use of drugs and choice of modalities.

Hirth, R. A., Turenne, M. N., Wheeler, J. R., et al. (2007). "Case-mix adjustment for an expanded renal prospective payment system." J Am Soc Nephrol **18**(9): 2565-2574.

Medicare is considering an expansion of the bundle of dialysis-related services to be paid on a prospective basis. Exploratory models were developed to assess the potential limitations of case-mix adjustment for such an expansion. A broad set of patient characteristics explained 11.8% of the variation in Medicare allowable charges per dialysis session. Although adding recent hematocrit values or prior health care utilization to the model did increase explanatory power, it could also create adverse incentives. Projected gains or losses relative to prevailing fee-for-service payments, assuming no change in practice patterns, were significant for some individual providers. However, systematic gains or losses for different classes of providers were modest.

Hirth, R. A., Wolfe, R. A., Wheeler, J. R., et al. (2003). "Is case-mix adjustment necessary for an expanded dialysis bundle?" Health Care Financ Rev **24**(4): 77-88.

Congress has required CMS to expand the Medicare outpatient prospective payment system (PPS) for dialysis services to include as many drugs and diagnostic procedures provided to end stage renal disease (ESRD) patients as possible. One important implementation question is whether dialysis facility case mix should be reflected in payment. We use fiscal year (FY) 2000 cost report and patient billing and clinical data to determine the relationship between costs and case mix, as represented by several patient demographic, diagnostic, and clinical characteristics. Results indicate considerable variability in costs and case mix across facilities and a significant and substantial relationship between case mix and facility cost, suggesting case mix payment adjustment may be important.

Hollenbeak, C. S., Rubin, R. J., Tzivelekis, S., et al. (2015). "Trends in prevalence of patient case-mix adjusters used in the Medicare dialysis payment system." Nephrol News Issues **29**(6): 24-27, 31-24.

OBJECTIVES: The Medicare End-Stage Renal Disease Prospective Payment System (PPS) used data from 2006-08 to set weights for each case-mix adjuster that is part of the bundled payment formula. The details of the population case-mix were not made public, and little is known about consistency of case-mix over time. This study estimated the prevalence of case-mix adjusters during 2006-2008 and analyzed changes in case-mix prevalence from 2000-2008. METHODS: Cross-sectional cohort study using United States Renal Data System data for Medicare dialysis patients. Three 3-year cohorts (2000-02, 2003-05, 2006-08) were analyzed for changes over time in case-mix prevalence. RESULTS: Double-digit trends were observed in many case-mix categories between 2000-02 and 2006-08. Large declines were observed in prevalence of patients with low BMI, pericarditis, new to dialysis, and ages 18-44. Large increases were observed in chronic co-morbidities, pneumonia and age cohort 80+. CONCLUSIONS: Substantial changes in case-mix adjuster prevalence suggest the PPS payment formula should be regularly updated.

Hollingsworth, J. M., Krein, S. L., Miller, D. C., et al. (2007). "Payer leverage and hospital compliance with a benchmark: a population-based observational study." BMC Health Serv Res **7**: 112.

> BACKGROUND: Since 1976, Medicare has linked reimbursement for hospitals performing organ transplants to the attainment of certain benchmarks, including transplant volume. While Medicare is a stakeholder in all transplant services, its role in renal transplantation is likely greater, given its coverage of end-stage renal disease. Thus, Medicare's transplant experience allows us to examine the role of payer leverage in motivating hospital benchmark compliance. METHODS: Nationally representative discharge data for kidney (n = 29,272), liver (n = 7,988), heart (n = 3,530), and lung (n = 1,880) transplants from the Nationwide Inpatient Sample (1993-2003) were employed. Logistic regression techniques with robust variance estimators were used to examine the relationship between hospital volume compliance and Medicare market share; generalized estimating equations were used to explore the association between patient-level operative mortality and hospital volume compliance. RESULTS: Medicare's transplant market share varied by organ [57%, 28%, 27%, and 18% for kidney, lung, heart, and liver transplants, respectively (P < 0.001)]. Volume-based benchmark compliance varied by transplant type [85%, 75%, 44%, and 39% for kidney, liver, heart, and lung transplants, respectively (P < 0.001)], despite a lower odds of operative mortality at compliant hospitals. Adjusting for organ supply, high market leverage was independently associated with compliance at hospitals transplanting kidneys (OR, 143.00; 95% CI, 18.53-1103.49), hearts (OR, 2.84; 95% CI, 1.51-5.34), and lungs (OR, 3.24; 95% CI, 1.57-6.67). CONCLUSION: These data highlight the influence of payer leverage-an important contextual factor in value-based purchasing initiatives. For uncommon diagnoses, these data suggest that at least 30% of a provider's patients might need to be "at risk" for an incentive to motivate compliance.

Hornberger, J. et Hirth, R. A. (2012). "Financial implications of choice of dialysis type of the revised Medicare payment system: an economic analysis." Am J Kidney Dis **60**(2): 280-287.

> BACKGROUND: In 2011, the Medicare Improvements for Patients and Providers Act replaced the case-mix-adjusted composite payment system for Medicare outpatient dialysis facilities with a bundled end-stage renal disease prospective payment system (PPS). We assessed the economic implications for modality choice of the revised Medicare payment system. STUDY DESIGN: Microeconomic analyses. SETTING & POPULATION: Patients eligible for dialysis in the United States. MODEL, PERSPECTIVE, & TIMEFRAME: The perspective of this analysis is that of a financial administrator of a representative dialysis center in the United States. Data were obtained from the Medicare Payment Advisory Commission, the US Renal Data System, the DOPPS (Dialysis Outcomes and Practice Patterns Study) Practice Monitor, the US Bureau of Labor Statistics, and Medicare fee schedules. INTERVENTIONS: Recently implemented end-stage renal disease PPS versus the prior case-mix composite payment system. OUTCOMES: Medicare payment per month, center fixed and variable costs per month, net difference in revenue and variable costs (direct contribution), and net difference in revenue and total costs (operating margin). RESULTS: The direct contribution and operating margin for in-center hemodialysis and peritoneal dialysis are expected to be positive under the new bundled PPS. For Medicare fiscal intermediaries/administrators, paid treatments for home hemodialysis vary from 3.2 to more than 4.8 per week. The direct contribution and operating margin are expected to be negative for home hemodialysis if the number of paid treatments is similar between in-center and home hemodialysis; they are almost identical when the number of paid treatments increases for home hemodialysis by approximately 1 per week. LIMITATIONS: Experience across centers and intermediaries/administrators may vary. Sensitivity analyses were conducted to assess the robustness of findings and determine which variables most influenced results. CONCLUSIONS: The new bundled PPS created a financial incentive for increased use of peritoneal dialysis. Use of home hemodialysis may be influenced by number of paid treatments per week.

Humphreys, J., Harvey, G., Coleiro, M., et al. (2012). "A collaborative project to improve identification and management of patients with chronic kidney disease in a primary care setting in Greater Manchester." BMJ Qual Saf **21**(8): 700-708.

> PROBLEM: Research has demonstrated a knowledge and practice gap in the identification and management of chronic kidney disease (CKD). In 2009, published data showed that general practices

in Greater Manchester had a low detection rate for CKD. DESIGN: A 12-month improvement collaborative, supported by an evidence-informed implementation framework and financial incentives. SETTING: 19 general practices from four primary care trusts within Greater Manchester. KEY MEASURES FOR IMPROVEMENT: Number of recorded patients with CKD on practice registers; percentage of patients on registers achieving nationally agreed blood pressure targets. STRATEGIES FOR CHANGE: The collaborative commenced in September 2009 and involved three joint learning sessions, interspersed with practice level rapid improvement cycles, and supported by an implementation team from the National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care for Greater Manchester. EFFECTS OF CHANGE: At baseline, the 19 collaborative practices had 4185 patients on their CKD registers. At final data collection in September 2010, this figure had increased by 1324 to 5509. Blood pressure improved from 34% to 74% of patients on practice registers having a recorded blood pressure within recommended guidelines. LESSONS LEARNT: Evidence-based improvement can be implemented in practice for chronic disease management. A collaborative approach has been successful in enabling teams to test and apply changes to identify patients and improve care. The model has proved to be more successful for some practices, suggesting a need to develop more context-sensitive approaches to implementation and actively manage the factors that influence the success of the collaborative.

Iglehart, J. K. (2011). "Bundled payment for ESRD--including ESAs in Medicare's dialysis package." N Engl J Med **364**(7): 593-595.

Johnson, P. E. (2006). "Changes in reimbursement rates and rules associated with the Medicare Prescription Drug Improvement and Modernization Act. Introduction." Am J Health Syst Pharm **63**(21 Suppl 7): S2-6.

PURPOSE: Future trends in the Medicare population and drug expenditures, the organizational structure of the Medicare program, and recent changes in Medicare rules and rates for pharmaceutical reimbursement are described. SUMMARY: Large increases in the number of Medicare beneficiaries and drug spending are anticipated in the future. Medicare Part A provides insurance benefits for hospital inpatients, nursing home patients, home health care patients, and hospice care patients. Part B provides benefits for physician services, durable medical equipment, oral chemotherapy, and end-stage renal disease services. For hospitals, Part B rules are followed for ambulatory services, but these services are administered through the Part A Outpatient Prospective Payment System. The average sales price plus 6% is now used for pharmaceutical reimbursement, although physician-owned clinics may participate in a competitive acquisition program under Part B. Payments are the same for generic drugs and brand name products, although they differed in the past. Pharmaceutical reimbursement is available for uses listed in compendia approved by the Centers for Medicare & Medicaid Services and possibly some other authoritative sources. CONCLUSION: Medicare rules and rates for pharmaceutical reimbursement have undergone substantial changes in recent years and will continue to change in the future, with a potentially large impact on health systems and patients.

Just, P. M., de Charro, F. T., Tschosik, E. A., et al. (2008). "Reimbursement and economic factors influencing dialysis modality choice around the world." Nephrol Dial Transplant **23**(7): 2365-2373.

The worldwide incidence of kidney failure is on the rise and treatment is costly; thus, the global burden of illness is growing. Kidney failure patients require either a kidney transplant or dialysis to maintain life. This review focuses on the economics of dialysis. Alternative dialysis modalities are haemodialysis (HD) and peritoneal dialysis (PD). Important economic factors influencing dialysis modality selection include financing, reimbursement and resource availability. In general, where there is little or no facility or physician reimbursement or payment for PD, the share of PD is very low. Regarding resource availability, when centre HD capacity is high, there is an incentive to use that capacity rather than place patients on home dialysis. In certain countries, there is interest in revising the reimbursement structure to favour home-based therapies, including PD and home HD. Modality selection is influenced by employment status, with an association between being employed and PD as the modality choice. Cost drivers differ for PD and HD. PD is driven mainly by variable costs such as solutions and tubing, while HD is driven mainly by fixed costs of facility space and staff. Many cost comparisons of dialysis modalities have been conducted. A key factor to consider in reviewing cost comparisons is the perspective of the analysis because different costs are relevant for different perspectives. In developed countries, HD is generally more expensive than PD to the payer. Additional research is needed in the developing world before conclusive statements may be made regarding the relative costs of HD and PD.

Karunaratne, K., Stevens, P., Irving, J., et al. (2013). "The impact of pay for performance on the control of blood pressure in people with chronic kidney disease stage 3-5." Nephrol Dial Transplant **28**(8): 2107-2116.

BACKGROUND: The implementation of national estimated glomerular filatration rate reporting and the inclusion of renal-specific indicators in a primary care pay for performance (P4P) system since April 2006 has promoted identification and better management of risk factors related to chronic kidney disease (CKD). In the UK, the P4P framework is known as the Quality and Outcomes Framework (QOF). One of the key targets for intervention in primary care was hypertension. It is clear that hypertension is a major predictor of development and progression of CKD; thus, targeting better blood pressure control is likely to have a positive impact on outcomes in CKD. The aim of this study was to evaluate the effectiveness of renal indicators outlined in P4P on the management of hypertension in primary care. To estimate the cost implications of the resulting changes in prescribing patterns of antihypertensive medication following introduction of such indicators. METHODS: We performed a prospective cohort study using a large primary care database. This cohort was taken from a database collated as part of a clinical decision support system used to assist the management of CKD in primary care. We investigated a total population of 90 250 individuals on general practitioner (GP) registers with a valid serum creatinine estimation in the 6-year study period. A total of 10 040 patients had confirmed stage 3-5 CKD in the 2 years pre-QOF and formed the study cohort. Patients were studied over three time periods, pre-QOF (1 April 2004 to 31 March 2006), 2 years post-QOF (1 April 2006 to 31 March 2008) and finally the two subsequent years (1 April 2008 to 31 March 2010). The mean systolic and diastolic blood pressures (BP) together with antihypertensive medication were analysed over the three time periods. Cost calculation was based on 2009 British National Formulary list prices for antihypertensives. RESULTS: The mean age of the cohort at the start of the study period was 64.8 years, 55% were female. In those patients with stage 3-5 CKD 83.9% were hypertensive, defined by a pre-P4P BP of >140/85 or currently taking antihypertensive medication. The proportion of patients with CKD 3-5 attaining the BP target of 145/80 increased from 41.5% in the pre-QOF period to 50.0% in the post-QOF period. This increase was even more marked for those with hypertension in the pre-QOF period (28.8-45.1%). In the hypertensive patients, mean BP fell from 146/79 mmHg to 140/76 in the first 2 years post-P4P [P < 0.01, analysis of variance (ANOVA)]. This BP reduction was sustained in the last 2 years of the study, 139/75 (P < 0.01, ANOVA). The proportion of hypertensive patients taking angiotensin-converting enzyme inhibitors or angiotensin blockers increased, this was also sustained in the third time period. An increase in the prescribing of diuretics, calcium channel blockers and beta-blockers was also observed. The additional cost of increased prescribing was calculated to be euro25.00 per hypertensive patient based on GP prescription data. CONCLUSIONS: Population BP control has improved since the introduction of P4P renal indicators, and this improvement has been sustained. This was associated with a significant increase in the use of antihypertensive medication, resulting in increased prescription cost. Longer-term follow-up will establish whether or not this translates to improved outcomes in terms of progression of CKD, cardiovascular disease and patient mortality.

Keller, F., Dress, H., Mertz, A., et al. (2007). "[Financial incentives and dialysis]." Med Klin (Munich) **102**(8): 659-664.

Chronic renal replacement therapy by hemodialysis costs 55,000 Euros per year and constitutes the upper limit of a cost-effective treatment. Since reimbursement for dialysis is high, every patient who is in need of it will receive dialysis. Nephrology outside the hospital, however, is moving into a progress trap. Financial incentives tempt physicians to avoid complex or delicate treatments such as immunosuppression of IgA nephritis. The decision to forgo or withdraw dialysis and the referral to kidney transplantation conflict with the nephrologists' economic interests. High-tech medicine needs a shift in thinking since not all medically possible diagnostic and therapeutic procedures can be financed anymore. The costs urge to do more for prevention and treatment of kidney disease. Alternative possibilities to extend the cost-effective kidney transplantation should be discussed without moral rigorism. Since it is in competition with other cost-intensive disciplines, it is hard for nephrologists to start with the required mind-changing process.

Kleophas, W., Karaboyas, A., Li, Y., et al. (2013). "Changes in dialysis treatment modalities during institution of flat rate reimbursement and quality assurance programs." Kidney Int **84**(3): 578-584.

Dialysis procedure rates in Germany were changed in 2002 from per-session to weekly flat rate payments, and quality assurance was introduced in 2009 with defined treatment targets for spKt/V, dialysis frequency, treatment time, and hemoglobin. In order to understand trends in treatment parameters before and after the introduction of these changes, we analyzed data from 407 to 618 prevalent patients each year (hemodialysis over 90 days) in 14-21 centers in cross-sections of the Dialysis Outcomes and Practice Patterns Study (phases 1-4, 1998-2011). Descriptive statistics were used to report differences over time in the four quality assurance parameters along with erythropoietin-stimulating agent (ESA) and intravenous iron doses. Time trends were analyzed using linear mixed models adjusted for patient demographics and comorbidities. The proportion of patients with short treatment times (less than 4 h) and low spKt/V (below 1.2) improved throughout the study and was lowest after implementation of quality assurance. Hemoglobin levels have increased since 1998 and remained consistent since 2005, with only 8-10% of patients below 10 g/dl. About 90% of patients were prescribed ESAs, with the dose declining since peaking in 2006. Intravenous iron use was highest in 2011. Hence, trends to improve quality metrics for hemodialysis have been established in Germany even after introduction of flat rate reimbursement. Thus, analysis of facility practice patterns is needed to maintain quality of care in a cost-containment environment.

Kleophas, W., Karaboyas, A., Li, Y., et al. (2013). "The authors reply." Kidney Int **84**(5): 1051-1052.

Kovacs, P. J., Perkins, N., Nuschke, E., et al. (2012). "How end-stage renal disease patients manage the Medicare Part D coverage gap." Health Soc Work **37**(4): 225-233.

Medicare Part D was enacted to help elderly and disabled individuals pay for prescription drugs, but it was structured with a gap providing no coverage in 2010 between $2,830 and $6,440. Patients with end-stage renal disease (ESRD) are especially likely to be affected due to high costs of dialysis-related drugs and the importance of adherence for overall health. Researchers from social work, pharmacy, and dietetics interviewed 12 patients with ESRD to learn about strategies and challenges during the coverage gap. Constant comparison generated the following themes: the experience of hitting the gap, management strategies, physical and emotional consequences, and advice for others. Results suggest that patients could benefit from greater involvement with professionals and peers to prepare for and manage their medications during the coverage gap and for support in dealing with emotional consequences and stress related to financial pressures and living with a serious health condition.

Levy, R., Jr. (2012). "Medicare pilot program on bundled payments to health care providers could be the next PPS for dialysis." Nephrol News Issues **26**(2): 37-38.

Li, B., Cairns, J. A., Fotheringham, J., et al. (2015). "Understanding cost of care for patients on renal replacement therapy: looking beyond fixed tariffs." Nephrol Dial Transplant **30**(10): 1726-1734.

BACKGROUND: In a number of countries, reimbursement to hospitals providing renal dialysis services is set according to a fixed tariff. While the cost of maintenance dialysis and transplant surgery are amenable to a system of fixed tariffs, patients with established renal failure commonly present with comorbid conditions that can lead to variations in the need for hospitalization beyond the provision of renal replacement therapy. METHODS: Patient-level cost data for incident renal replacement therapy patients in England were obtained as a result of linkage of the Hospital Episodes Statistics dataset to UK Renal Registry data. Regression models were developed to explore variations in hospital costs in relation to treatment modality, number of years on treatment and factors such as age and comorbidities. The final models were then used to predict annual costs for patients with different sets of characteristics. RESULTS: Excluding the cost of renal replacement therapy itself, inpatient costs generally decreased with number of years on treatment for haemodialysis and transplant patients, whereas costs for patients receiving peritoneal dialysis remained constant. Diabetes was associated

> with higher mean annual costs for all patients irrespective of treatment modality and hospital setting. Age did not have a consistent effect on costs. CONCLUSIONS: Combining predicted hospital costs with the fixed costs of renal replacement therapy showed that the total cost differential for a patient continuing on dialysis rather than receiving a transplant is considerable following the first year of renal replacement therapy, thus reinforcing the longer-term economic advantage of transplantation over dialysis for the health service.

Liao, P. J., Lin, T. Y., Wang, T. C., et al. (2016). "Long-Term and Interactive Effects of Pay-For-Performance Interventions among Diabetic Nephropathy Patients at the Early Chronic Kidney Disease Stage." Medicine (Baltimore) **95**(14): e3282.

> Chronic kidney disease (CKD) is a major health problem worldwide because of the aging population and lifestyle changes. One of the important etiologies of CKD is diabetes mellitus (DM). The long-term effects of pay-for-performance (P4P) on disease progression have not been thoroughly examined.This study is a retrospective population-based patient cohort design to examine the continuous effects of diabetes and CKD P4P interventions. This study used the health insurance claims database to conduct a longitudinal analysis. A total of 32,084 early CKD patients with diabetes were extracted from the outpatient claims database from January 2011 to December 2012, and the follow-up period was extended to August 2014. A 4-group matching design, including both diabetes and early CKD P4P interventions, with only diabetes P4P intervention, with only early CKD P4P intervention, and without any P4P interventions, was performed according to their descending intensity. The primary outcome of this study was all-cause mortality and the causes of death. The statistical methods included a Chi-squared test, ANOVA, and multi-variable Cox regression models.A dose-response relationship between the intervention groups and all-cause mortality was observed as follows: comparing to both diabetes and early CKD P4P interventions (reference), hazard ratio (HR) was 1.22 (95% confidence interval [CI], 1.00-1.50) for patients with only a diabetes P4P intervention; HR was 2.00 (95% CI, 1.66-2.42) for patients with only an early CKD P4P intervention; and HR was 2.42 (95% CI, 2.02-2.91) for patients without any P4P interventions. The leading cause of death of the total diabetic nephropathy patient cohort was infectious diseases (34.32%) followed by cardiovascular diseases (17.12%), acute renal failure (1.50%), and malignant neoplasm of liver (1.40%).Because the earlier interventions have lasting long-term effects on the patient's prognosis regardless of disease course, an integrated early intervention plan is suggested in future care plan designs. The mechanisms regarding the effects of P4P intervention, such as health education on diet control, continuity of care, and practice guidelines and adherence, are the primary components of disease management programs.

Limb, M. (2014). "Payments for renal care need urgent change to tackle prevention, say doctors." Bmj **348**: g152.

Lin, M. Y., Cheng, L. J., Chiu, Y. W., et al. (2018). "Effect of national pre-ESRD care program on expenditures and mortality in incident dialysis patients: A population-based study." PLoS One **13**(6): e0198387.

> Inadequate care of chronic kidney disease (CKD) is common and may be associated with adverse outcomes after dialysis. The nationwide pre-end-stage renal disease pay for performance program (P4P) has been implemented in Taiwan to improve quality of CKD care. However, the effectiveness of the P4P program in improving the outcomes of pre-dialysis care and dialysis is uncertain. We conducted a longitudinal cohort study. Patients who newly underwent long-term dialysis (>/=3 mo) between 2007 and 2009 were identified from the Taiwan National Health Insurance Research Database. Based on the patient enrolment of the P4P program, they were categorized into P4P or non-P4P groups. We analysed pre-dialysis care, healthcare expenditures, and mortality between two groups. Among the 26 588 patients, 25.5% participated in the P4P program. The P4P group received significantly better quality of care, including a higher frequency of glomerular filtration rate measurement and CKD complications survey, a higher rate of vascular access preparation, and more frequent use of arteriovenous fistulas than the non-P4P group did. The P4P group had a 68.4% reduction of the 4-year total healthcare expenditure (excluding dialysis fee), which is equivalent to US$345.7 million, and a significant 22% reduction in three-year mortality after dialysis (hazard ratio 0.78, 95% confidence interval: 0.75-0.82, P < 0.001) compared with the non-P4P group. P4P program

improves quality of pre-dialysis CKD care, and provide survival benefit and a long-term cost saving for dialysis patients.

Liu, F. X., Treharne, C., Culleton, B., et al. (2014). "The financial impact of increasing home-based high dose haemodialysis and peritoneal dialysis." BMC Nephrol **15**: 161.

BACKGROUND: Evidence suggests that high dose haemodialysis (HD) may be associated with better health outcomes and even cost savings (if conducted at home) versus conventional in-centre HD (ICHD). Home-based regimens such as peritoneal dialysis (PD) are also associated with significant cost reductions and are more convenient for patients. However, the financial impact of increasing the use of high dose HD at home with an increased tariff is uncertain. A budget impact analysis was performed to investigate the financial impact of increasing the proportion of patients receiving home-based dialysis modalities from the perspective of the England National Health Service (NHS) payer. METHODS: A Markov model was constructed to investigate the 5 year budget impact of increasing the proportion of dialysis patients receiving home-based dialysis, including both high dose HD at home and PD, under the current reimbursement tariff and a hypothetically increased tariff for home HD (pound575/week). Five scenarios were compared with the current England dialysis modality distribution (prevalent patients, 14.1% PD, 82.0% ICHD, 3.9% conventional home HD; incident patients, 22.9% PD, 77.1% ICHD) with all increases coming from the ICHD population. RESULTS: Under the current tariff of pound456/week, increasing the proportion of dialysis patients receiving high dose HD at home resulted in a saving of pound19.6 million. Conducting high dose HD at home under a hypothetical tariff of pound575/week was associated with a budget increase (pound19.9 million). The costs of high dose HD at home were totally offset by increasing the usage of PD to 20-25%, generating savings of pound40.0 million - pound94.5 million over 5 years under the increased tariff. Conversely, having all patients treated in-centre resulted in a pound172.6 million increase in dialysis costs over 5 years. CONCLUSION: This analysis shows that performing high dose HD at home could allow the UK healthcare system to capture the clinical and humanistic benefits associated with this therapy while limiting the impact on the dialysis budget. Increasing the usage of PD to 20-25%, the levels observed in 2005-2008, will totally offset the additional costs and generate further savings.

Liu, F. X., Walton, S. M., Leipold, R., et al. (2014). "Financial implications to Medicare from changing the dialysis modality mix under the bundled prospective payment system." Perit Dial Int **34**(7): 749-757.

BACKGROUND: The economic burden of treating end-stage renal disease (ESRD) continues to grow. As one response, effective January 1, 2011, Medicare implemented a bundled prospective payment system (PPS, including injectable drugs) for dialysis patients. This study investigated the 5-year budget impact on Medicare under the new PPS of changes in the distribution of patients undergoing peritoneal dialysis (PD), in-center hemodialysis (ICHD), and home hemodialysis (HHD). METHODS: An Excel-based budget impact model was created to assess dialysis-associated Medicare costs. The model accounted for dialysis access establishment, the current monthly capitation physician payment for ESRD, Medicare dialysis payments (including start-up costs), training, oral drug costs, and the costs and probabilities of adverse events including access failure, hospitalization for access infection, pneumonia, septicemia, and cardiovascular events. United States Renal Data System (USRDS) data were used to project the US Medicare dialysis patient population across time. The baseline scenario assumed a stable distribution of PD (7.7%), HHD (1.3%) and ICHD (91.0%) over 5 years. Three comparison scenarios raised the proportions of PD and HHD by (1) 1% and 0.5%, (2) 2% and 0.75%, and (3) 3% and 1% each year; a fourth scenario held HHD constant and lowered PD by 1% per year. RESULTS: Under the bundled PPS, scenarios that increased PD and HHD from 7.7% and 1.3% over 5 years resulted in cumulative savings to Medicare of $114.8M (Scenario 1, 11.7% PD and 3.3% HHD at year 5), $232.9M (Scenario 2, 15.7% PD and 4.3% HHD at year 5), and $350.9M (Scenario 3, 19.7% PD and 5.3% HHD at year 5). When the PD population was decreased from 7.7% in 2013 to 3.7% by 2017 with a constant HHD population, the total Medicare payment for dialysis patients increased by over $121.2M. CONCLUSIONS: Under Medicare bundled PPS, increasing the proportion of patients on PD and HHD vs ICHD could generate substantial savings in dialysis-associated costs to Medicare.

Lockridge, R. S., Jr. (2004). "The direction of end-stage renal disease reimbursement in the United States." Semin Dial **17**(2): 125-130.

In the 1960s, care of the end-stage renal disease (ESRD) patient changed. Either through transplantation or intermittent hemodialysis ESRD patients were able to live longer. The Gottschalk Committee issued the "Report of the Committee on Chronic Kidney Disease" to the Bureau of Budget. This report established that hemodialysis and kidney transplantation were the standard of care for the treatment of ESRD patients. Section 2991 of the Social Security Amendment of 1972 provided that patients with ESRD who qualified for Medicare were entitled to receive dialysis and/or transplantation nationwide. The first Medicare hearing held in 1975 regarding the Medicare ESRD program found that the cost of the program was much greater than had been predicted in 1972. Ever since 1975, accelerating cost has been a concern of the government. Quality of care for ESRD patients has been a major focus of the renal community and the Centers for Medicare and Medicaid Services (CMS) over the past 10 years. Consensus for entitlement has remained, but the staggering cost of the program as a whole has become a major problem that must be addressed. Since 1978, Congress and the CMS have passed laws and developed demonstration projects to improve quality of care and reduce costs in the Medicare ESRD program. Kt/V, urea reduction ratio (URR), and hemoglobin levels have all improved, but hospital admissions have remained unchanged and mortality rates have increased. Do the renal community and CMS need to rethink how they will improve the quality of care for ESRD patients and reduce costs in the Medicare ESRD program?

Maddux, F. W. (2012). "Impact of the bundled end-stage renal disease payment system on patient care." Blood Purif **33**(1-3): 107-111.

This article provides a perspective on the impact of the bundled end-stage renal disease prospective payment system on patient care. As the first year of the bundle comes to a close, we are beginning to see information about practice pattern changes that have resulted and the impact of those changes on the care of patients with renal disease. This review recognizes the background of the prospective payment system for renal replacement therapy and its evolution to include multiple components, as well as a description of the features of this payment system that are expected to have an impact on the clinical care by nephrologists and dialysis providers. Some of the expected impact on the dosing of erythropoiesis-stimulating agents, consolidation of dialysis providers, and a move toward more measurement are beginning to be seen. This brief summary not only reviews the components of the bundled payment system, but also the anticipated impact and some early information on the response to these predicted findings in the industry.

Maddux, F. W., McMurray, S. et Nissenson, A. R. (2013). "Toward population management in an integrated care model." Clin J Am Soc Nephrol **8**(4): 694-700.

Under the Patient Protection and Affordable Care Act of 2010, accountable care organizations (ACOs) will be the primary mechanism for achieving the dual goals of high-quality patient care at managed per capita costs. To achieve these goals in the newly emerging health care environment, the nephrology community must plan for and direct integrated delivery and coordination of renal care, focusing on population management. Even though the ESRD patient population is a complex group with comorbid conditions that may confound integration of care, the nephrology community has unique experience providing integrated care through ACO-like programs. Specifically, the recent ESRD Management Demonstration Project sponsored by the Centers for Medicare & Medicaid Services and the current ESRD Prospective Payment System with it Quality Incentive Program have demonstrated that integrated delivery of renal care can be accomplished in a manner that provides improved clinical outcomes with some financial margin of savings. Moving forward, integrated renal care will probably be linked to provider performance and quality outcomes measures, and clinical integration initiatives will share several common elements, namely performance-based payment models, coordination of communication via health care information technology, and development of best practices for care coordination and resource utilization. Integration initiatives must be designed to be measured and evaluated, and, consistent with principles of continuous quality improvement, each initiative will provide for iterative improvements of the initiative.

Manns, B. J., Mendelssohn, D. C. et Taub, K. J. (2007). "The economics of end-stage renal disease care in Canada: incentives and impact on delivery of care." Int J Health Care Finance Econ **7**(2-3): 149-169.

> Examining international differences in health outcomes for end-stage renal disease (ESRD) patients requires an understanding of ESRD funding structures. In Canada, funding for all aspects of dialysis and transplant care, with the exception of drugs (for which supplementary insurance can be purchased), is provided for all citizens. Although ESRD programs across Canada's 10 provinces differ in funding structure, they share important economic characteristics, including being publicly funded and universal, and providing most facets of ESRD care for free. This paper explains how ESRD care fits into the Canadian health care system, describes the epidemiology of ESRD in Canada, and offers economic explanations for international discrepancies.

Marcelli, D., Grassmann, A. et Ponce, P. (2013). "Changes in dialysis treatment modalities during institution of flat-rate reimbursement and quality assurance programs." Kidney Int **84**(5): 1051.

McCloskey, M., VanMeter, T., McGinnis, C., et al. (2014). "Community-based hospital systems. Managing the costs of a dialysis program in the affordable health care system." Nephrol News Issues **28**(7): 14-16.

McCloskey, M., VanMeter, T., McGinnis, C., et al. (2014). "Part 2: community-based hospital systems: managing the costs of a dialysis program under the paradigm of affordable health care." Nephrol News Issues **26**(8): 24-26, 28-29.

McGinnis, C., Day, L. M. et Pristave, R. (1996). "What are the options for nephrologists under capitation?" Nephrol News Issues **10**(9): 21-25.

> Nephrologists will play a pivotal role in changing tomorrow's renal delivery system. Nephrologists still control patients and drive the health care delivered to patients suffering from ESRD. As a result, practice management companies, independent consulting firms, renal societies, hospitals, dialysis providers, insurance companies, managed care plans, government agencies, and, yes, even independent practice groups are exploring business strategies that will unite nephrologists under a common goal--that of an integrated renal delivery network. Nephrologists face what is probably their professional career's most important business decision: Partner with such organizations as hospitals, dialysis providers, or practice management companies, or form an independent nephrologist owned IPA and contract with an MSO. As nephrologists evaluate the options, they should seek partners that will at a minimum provide the following: a business plan that spells out the relationships of all the players; practice evaluations that can improved efficiencies; skilled day-to-day practice management; model legal documents; human resource management; expert, pro-physician reimbursement negotiation, coupled with a system to track contract profitability; case management, critical paths, practice guidelines; and renal industry expertise. Above all, nephrologists should seek partners in the formation of an integrated delivery system that offer an attitude dedicated to physician empowerment in the interest of good patient care.

McMurray, S. D. et Miller, J. (1997). "Impact of capitation on free-standing dialysis facilities: can you survive?" Am J Kidney Dis **30**(4): 542-548.

> Proposed changes in the Medicare reimbursement method for end-stage renal disease (ESRD) patients prompted us to study the total cost of caring for the ESRD patients in northeast Indiana over a 1-year period. We hoped to ascertain the actual cost of caring for patients treated with different modalities, determine if we could compete in a capitated environment, and identify areas in which we might reduce these expenses. Six patients new to dialysis and 29 patients already receiving treatment underwent follow-up evaluation for 1 year. We tracked their cost of care for 1 year in the outpatient setting as well as in the hospital. We found the cost of caring for all patients was $43,044 per year. Patients new to dialysis cost $3,164 more to care for than patients already receiving dialysis treatment. Hospitalization expense was the primary component of that difference. Continuous ambulatory peritoneal dialysis (CAPD) patients were $14,570 less costly per year to care for than hemodialysis patients. This differential primarily related to decreased hospitalization. Vascular access expenses were a major component of both the outpatient and inpatient cost for hemodialysis patients. Our yearly expenditures for all patients compared with suggested capitated Medicare

reimbursement rates suggested that our program could be successful in a new reimbursement model. Several areas of possible cost reduction were identified.

Mendelssohn, D. C., Langlois, N. et Blake, P. G. (2004). "Peritoneal dialysis in Ontario: a natural experiment in physician reimbursement methodology." Perit Dial Int **24**(6): 531-537.

BACKGROUND: The factors that determine dialysis modality selection and distribution are not well understood. Physician reimbursement incentives have been suggested to play an important role. Under the fee-for-service system in Ontario that existed prior to July 1998, nephrologists were paid about sevenfold more for a hemodialysis (HD) patient than for a patient on peritoneal dialysis (PD). However, since then, nephrologists have been reimbursed via a modality-independent capitation fee, whereby payment for any form of dialysis is the same. This was expected to markedly increase the use of PD. METHODS: When the capitation fee was introduced in 1998, a survey questionnaire of all Ontario nephrologists was done and repeated 3 years later (response rate 62.5%). Changes in dialysis modality incidence and prevalence rates in Ontario and in the rest of Canada were examined. RESULTS: On a scale of 1 to 7, nephrologists were convinced that the capitation fee was a good thing (mean rating 6.07); 75% said they had been seeing patients at every dialysis under the old system, compared to 41% now. Of significance, the proportion of prevalent patients on PD in Ontario declined from 27.3% in 1997 to 19.7% in 2000, increasing to 22.6% in 2002. Similarly, the incident PD rate seems to have stabilized, while the use of nonhospital-based HD has increased. CONCLUSIONS: Following the introduction of the capitation fee, PD use in Ontario continued to decline for 2 years, and then began to increase. In the rest of Canada, there are continuing declines in PD use. This is consistent with the hypothesis that the new incentives caused by the altered physician reimbursement are acting in a subtle way to increase PD and non-hospital-based HD. A longer period of observation may be required to assess the complete effect.

Mettang, T. (2004). "Changes in dialysis reimbursement regulations in Germany." Perit Dial Int **24**(6): 526-527.

Michael, M. (2005). "Futuristic plans for ESRD--a new bundled payment system." Nephrol News Issues **19**(10): 52, 54.

Monda, K. L., Joseph, P. N., Neumann, P. J., et al. (2015). "Comparative changes in treatment practices and clinical outcomes following implementation of a prospective payment system: the STEPPS study." BMC Nephrol **16**: 67.

BACKGROUND: The aim of the US dialysis Prospective Payment System bundle, launched in January 2011, was reduction and more accurate prediction of costs of services, whilst maintaining or improving patient care. Dialysis facilities could either adopt the bundle completely (100%) in the first year of launch, or phase-in (25%) over four years. Differences in practice patterns and patient outcomes were hypothesized to occur in facilities that phased-in 25% compared to those that did not. METHODS: Data are from STEPPS, a study of 51 small dialysis organization facilities designed to describe trends in dialytic treatment before and after bundle implementation. Baseline was defined as October-December 2010; follow-up as January-December 2011. Facility- and patient-level data were collected at enrollment and regularly thereafter. Cox proportional hazards and linear multi-level models were used to estimate the effect of opting-in 25% (vs. 100%) on practice patterns and clinical outcomes. RESULTS: 12 facilities (patient n = 346) opted-in 25% and 37 facilities (patient n = 1296) opted-in 100% to the dialysis bundle. At baseline, patients at 25% facilities were primarily covered by Medicare, were more likely to be black, and were receiving higher monthly epoetin alfa (EPO) doses. Throughout 2011, patients in 100% facilities received lower monthly EPO doses, and had lower mean hemoglobin concentrations; hospitalization and mortality rates were numerically lower in 25% facilities but not statistically different. CONCLUSIONS: The economic pressure for dialysis providers to work within an expanded composite rate bundle whilst maintaining patient care may be a driver of practice indicator outcomes. Additional investigations are warranted to more precisely estimate clinical outcomes in patients attending facilities enrolling into the bundle 100% relative to the previous fee-for-service framework.

Moran, J. (2010). "The 2009 proposed rule for prospective ESRD payment: perspectives from a medium-sized dialysis organization." Am J Kidney Dis **55**(2): 227-228.

Naito, H. (2006). "The Japanese health-care system and reimbursement for dialysis." Perit Dial Int **26**(2): 155-161.

> Like most countries, Japan is facing constraints on expansion of health system financial resources. There are almost 250000 Japanese patients with end-stage renal disease and almost all are managed by chronic dialysis. Hospital hemodialysis is the modality used by 96% of these patients. The Japanese health-care system has tended to support resource-intensive treatments because the fee-for-service remuneration system has rewarded their utilization. This has benefited hemodialysis at the expense of peritoneal dialysis. However, this may now be changing. Case management and global budget-related approaches are being more widely introduced, as are incentives to reward more efficient treatment options. The relative costs of dialysis modalities are difficult to appreciate, as center-based services, such as hospital hemodialysis, are dependent upon fixed resources, while home-based options, such as peritoneal dialysis, are dependent upon variable resources. The aim of this review is to reconcile various sources of information relevant to end-stage renal disease funding in Japan. The review will suggest that modifying the approach to modality selection could lead to more efficient allocation of future dialysis-related resources and so reduce the strain on Japan's health-care budget.

Nayeem, A. I. et Chertow, G. M. (2006). "Lessons for Medicare Part D in the hemodialysis community." BMC Nephrol **7**: 11.

> BACKGROUND: Medicare beneficiaries without prescription drug coverage consistently fill fewer prescriptions than beneficiaries with some form of drug coverage due to cost. ESRD patients, who are disproportionately poor and typically use multiple oral medications, would likely benefit substantially from any form of prescription drug coverage. Because most hemodialysis patients are Medicare-eligible, they as well as their providers would be expected to be well informed of changes in Medicare prescription drug coverage. By examining the level of understanding and use of the temporary Medicare Prescription Drug Discount Card Program in the hemodialysis population, we can gain a better understanding of the potential long-term utilization for Medicare Part D. METHODS: We surveyed English-speaking adult hemodialysis patients with Medicare coverage from two urban hemodialysis centers affiliated with the University of California San Francisco (UCSF) during July and August 2005 (n = 70). We also surveyed University- and community-based nephrologists and non-physician dialysis health care professionals over the same time frame (n = 70). RESULTS: Fifty-nine percent of patients received prescription drug coverage through Medi-Cal, 20% through another insurance program, and 21% had no prescription drug coverage. Forty percent of patients with no prescription drug coverage reported "sometimes" or "rarely" being able to obtain medications vs. 22% of patients with some form of drug coverage. None of the patients surveyed actually had a Medicare-approved prescription drug card, and of those who intended to apply, only 10% reported knowing how to do so. Only 11% health care professionals knew the eligibility requirements of the drug discount cards. CONCLUSION: Despite a significant need, hemodialysis patients and providers were poorly educated about the Medicare Prescription Drug Discount Cards. This has broad implications for the dissemination of information about Medicare Part D.

Neumann, M. E. (2010). "Will the bundle improve the way care is delivered?" Nephrol News Issues **24**(1): 8.

Neumann, M. E. (2011). "GAO looks at bundling outside ESRD." Nephrol News Issues **25**(4): 8.

Neumann, M. E. (2011). "New Medicare payment rules encourage home dialysis, but how to get patients started?" Nephrol News Issues **25**(12): 17.

Neumann, M. E. (2012). "Will payment and quality-driven reform improve outcomes?" Nephrol News Issues **26**(11): 12.

Nissenson, A. R. (2001). "Models of capitated payment for endstage renal disease." Am J Med **110**(6): 504-505.

Oppenheimer, C. C., Shapiro, J. R., Beronja, N., et al. (2003). "Evaluation of the ESRD managed care demonstration operations." Health Care Financ Rev **24**(4): 7-29.

> Individuals with end stage renal disease (ESRD), most of whom are insured by Medicare, are generally prohibited from enrolling in Medicare managed care plans (MCPs). CMS offered ESRD patients the opportunity to participate in an ESRD managed care demonstration mandated by Congress. The demonstration tested whether managed care systems would be of interest to ESRD patients and whether these approaches would be operationally feasible and efficient for treating ESRD patients. This article examines the structure, implementation, and operational outcomes of the three demonstration sites, focusing on: the structure of these managed care programs for ESRD patients, requirements needed to attract and enroll patients, and the challenges of introducing managed care programs in the ESRD arena.

Otts, J. A. A., Pearce, P. F. et Langford, C. A. (2017). "Effectiveness of pay-for-performance for chronic kidney disease patients on hemodialysis: a systematic review protocol." JBI Database System Rev Implement Rep **15**(7): 1850-1855.

> REVIEW QUESTION/OBJECTIVE:: The objective of this review is to assess the evidence on the effectiveness of implementation of a pay-for-performance program on clinical outcomes in the adult chronic kidney disease (CKD) patient receiving hemodialysis.The review question is: What is the effectiveness of implementation of a pay-for-performance program on clinical outcomes in the adult CKD patient receiving hemodialysis, as compared to the period immediately before implementation of the program?More specifically, the objectives are to identify.

Paganini, E. P. (2001). "The end-stage renal disease program. Experience with a chronic disease capitated health plan." Infect Dis Clin North Am **15**(3): 721-729.

> The ESRD program has demonstrated the potential for a capitated, disease-oriented, total care method of patient support. Given both the increasing age and complexity of the patient population, not only has the cost per patient decreased over the life of the program, but the standardized mortality rates have also declined. Technology has bridged the gap and made the relative cost per treatment more affordable and science has developed medications and techniques that have enhanced both patient comfort and longevity. As more complex patients enter the fold of the ESRD program, an increased awareness of enhanced coordination of care needs to be recognized.

Park, H., Rascati, K. L. et Keith, M. S. (2015). "Managing oral phosphate binder medication expenditures within the Medicare bundled end-stage renal disease prospective payment system: economic implications for large U.S. dialysis organizations." J Manag Care Spec Pharm **21**(6): 507-514.

> BACKGROUND: From January 2016, payment for oral-only renal medications (including phosphate binders and cinacalcet) was expected to be included in the new Medicare bundled end-stage renal disease (ESRD) prospective payment system (PPS). The implementation of the ESRD PPS has generated concern within the nephrology community because of the potential for inadequate funding and the impact on patient quality of care. OBJECTIVE: To estimate the potential economic impact of the new Medicare bundled ESRD PPS reimbursement from the perspective of a large dialysis organization in the United States. METHODS: We developed an interactive budget impact model to evaluate the potential economic implications of Medicare payment changes to large dialysis organizations treating patients with ESRD who are receiving phosphate binders. In this analysis, we focused on the budget impact of the intended 2016 integration of oral renal drugs, specifically oral phosphate binders, into the PPS. We also utilized the model to explore the budgetary impact of a variety of potential shifts in phosphate binder market shares under the bundled PPS from 2013 to 2016. RESULTS: The base model predicts that phosphate binder costs will increase to $34.48 per dialysis session in 2016, with estimated U.S. total costs for phosphate binders of over $682 million. Based on these estimates, a projected Medicare PPS $33.44 reimbursement rate for coverage of all oral-only renal medications (i.e., phosphate binders and cinacalcet) would be insufficient to cover these costs. A potential renal drugs and services budget shortfall for large dialysis organizations of almost $346 million was projected. CONCLUSIONS: Our findings suggest that large dialysis organizations will be challenged to

manage phosphate binder expenditures within the planned Medicare bundled rate structure. As a result, large dialysis organizations may have to make treatment choices in light of potential inadequate funding, which could have important implications for the quality of care for patients with ESRD.

Parker, J. C. (2011). "Cherry picking in ESRD: an ethical challenge in the era of pay for performance." Semin Dial **24**(1): 5-8.

In poorly designed pay-for-performance schemes in which case mix adjustments are not adequate, self-interest could lead nephrologists toward cherry picking dialysis patients. Cherry picking, however, is morally problematic. First, it may manifest itself as a subtle form of covert rationing which threatens to undermine patient trust. Second, it involves shifting the burden of caring for sicker (and less financially attractive) patients to other nephrologists and dialysis units that do not practice cherry picking, creating injustices in the health care system. Finally, it treats patients as mere means through which nephrologists achieve reimbursement instead of as persons possessing dignity and deserving of respect.

Pauly, M. V. (2012). "Accountable care organizations and kidney disease care: health reform innovation or more same-old, same-old?" Am J Kidney Dis **60**(4): 524-529.

The conceptual model for an accountable care organization imagines that care will be rendered to a defined population by an entity that receives bundled payment for that care, coordinates the individual services involved in that care, provides measures of outcomes and quality, and divides the bundled payment among those who supply services. How does this concept differ from earlier efforts, and what, if anything, does it mean for the care of patients with end-stage renal disease? The concept is similar to the largely abandoned integrated delivery networks of the 1990s. The support from Medicare may make a difference, but Medicare's need to constrain spending growth will pose a challenge. Kidney disease care is already much more coordinated than health care for the rest of the population. There are some potential gains from greater coordination, especially with care for comorbid conditions associated with hospitalization. However, economic analysis suggests that the absence of large populations of patients in given geographic sites and the relatively smaller gain from incremental improvements in coordination might mean that the accountable care organization model are not ideal for the dialysis market.

Pifer, T. B., Bragg-Gresham, J. L., Dykstra, D. M., et al. (2003). "Quality of life and patient satisfaction: ESRD managed care demonstration." Health Care Financ Rev **24**(4): 45-58.

To study the effects of managed care on dialysis patients, we compared the quality of life and patient satisfaction of patients in a managed care demonstration with three comparison samples: fee-for-service (FFS) patients, managed care patients outside the demonstration, and patients in a separate national study. Managed care patients were less satisfied than FFS patients about access to health care providers, but more satisfied with the financial benefits (copayment coverage, prescription drugs, and nutritional supplements) provided under the demonstration managed care plan (MCP). After 1 year in the demonstration, patients exhibited statistically and clinically significant increases in quality of life scores.

Ploth, D. W., Shepp, P. H., Counts, C., et al. (2003). "Prospective analysis of global costs for maintenance of patients with ESRD." Am J Kidney Dis **42**(1): 12-21.

BACKGROUND: The prevalence of end-stage renal disease (ESRD) has doubled in the past decade, with total costs projected to exceed 16.5 billion dollars by the end of 2002. METHODS: The purpose of this prospective study is to determine all costs related to inpatient and outpatient health care utilization incurred by 76 patients with ESRD in an outpatient hemodialysis setting for 1 year. Costs were derived from a computer-based cost-allocation process that distributed cost components and overhead to designated revenue-producing departments. RESULTS: During the 1-year study period, these patients had 1,459 total inpatient and outpatient hospital visits (mean, 19.2 visits/patient; range, 0 to 84 visits/patient). There were 149 general inpatient hospital admissions. Of 238 total emergency room visits, 89 visits resulted in admission to the hospital (37%). CONCLUSION: Total hospital costs for all patients for the year were 1,831,880 dollars (actual charges, 2,929,147 dollars). As expected, the greatest hospital cost expenditures were attributed to inpatient hospital admissions (1,419,022 dollars; 77.5% of total). Of total hospital costs, inpatient bed costs were the single highest expenditure. The cost for outpatient hemodialysis therapy was 33,784 dollars/patient-year, consisting of facility costs of 17,200 dollars, outpatient pharmacy costs of 14,100 dollars, and outpatient professional costs of 2,500 dollars/patient-year. Average costs for hospital facility and/or professional fees were 42,730 dollars/patient-year, whereas average costs for outpatient dialysis facility and/or professional fees were 33,784 dollars, for an estimated global cost of 76,515 dollars/patient-year. Our cost estimate for care of this unique inner-city population substantially exceeds those reported earlier by others.

Ponce, P., Marcelli, D., Guerreiro, A., et al. (2012). "Converting to a capitation system for dialysis payment--the Portuguese experience." Blood Purif **34**(3-4): 313-324.

Due to the challenge of operating within an economically strained healthcare budget, Portuguese health authorities convened with dialysis providers and agreed on a framework to change from a fee-for-service reimbursement modality to a capitation payment system for hemodialysis. This article reviews the components of the agreed capitation package implemented in 2008 as well as the necessary preparatory work undertaken by a for-profit 34-unit dialysis network (approx. 4,200 patients) to cope with the introduction of this system. Furthermore, trends in clinical quality indicators and in resource management are reviewed for 3 years immediately following capitation introduction. Here, improvements were observed over time for the specified clinical targets. Simultaneously, costs controllable by the physician could be reduced. As more countries convert to a capitation or bundled payment system for hemodialysis services, this article offers insight into the scope of the necessary preparatory work and the possible consequences in terms of costs and treatment quality.

Provenzano, R. (2005). "Paying fairly for good outcomes: which formula works?" Nephrol News Issues **19**(11): 62-63, 84.

I see the single-based payment systems moving more toward the middle, toward an American-style system using competitive bidding with outcomes-based focus. The American system is moving in the opposite direction despite knowledge of the flaws of a single-payment system. Modernizing our payment system by desegregating Medicare Part A and Part B, applying information technology, and value-based reimbursement along with a bold move toward an HSA methodology could empower patients and physicians, reinvigorate our system with cost savings, and move us in the direction that all industries in a free market system should have the freedom to move.

Ramos, R. et Molina, M. (2013). "New models of integrated health care management in nephrology." Nefrologia **33**(3): 301-307.

Chronic kidney disease (CKD) is becoming a worldwide major public health problem that is rapidly approaching epidemic proportions due to its high prevalence, as well as the associated increase of cardiovascular morbidity and mortality in these patients. Early detection and prevention may have an impact on both slowing the progression of CKD and reducing cardiovascular morbidity and mortality. CKD prevention programmes can be more cost-efficient over time without negative impacts on quality of care. Until now, reimbursement in CKD has been segmented and usually focused on the end of the process (dialysis) when cost is higher, whereas new models focused on provider integration, while balancing quality and costs, are needed to respond to today’s challenges. Traditionally, “pay for services” has been used in state-assisted dialysis centres, but this model has the risk of inducing an increase in demand. Integrated management would respond to this challenge with comprehensive solutions that manage kidney disease at all levels of health care risk. It is based on a comprehensive model that typically includes several products and services, often including pharmacological treatments. The rate of reimbursement directly depends on the achievement of previously defined quality control parameters. The third model is based on a “capitation” model that consists of the provider receiving a set amount of resources per population for a particular time regardless of the volume of services provided. The complexity and the progressive nature of CKD along with the associated morbidity rates in these patients force us to consider a global approach rather than a sum of different services. In our opinion, the first method of reimbursement in CKD that should be considered is a bundle rate, and when this model has been consolidated, tending toward a global capitation model.

Ray, N. F. et Ross, M. (2000). "Challenges and directions for Medicare ESRD payment policy." Semin Nephrol **20**(6): 565-576.

Since the inception of the ESRD program in 1973, Medicare has been challenged to provide access to high-quality care to beneficiaries with ESRD while trying to contain program payments. Despite implementing policies to control the growth in spending for outpatient dialysis and shifting the risk of certain ESRD beneficiaries to private payers, annual ESRD program payments have grown faster than overall Medicare spending. Some stakeholders contend that these policies have adversely affected beneficiaries' access to high-quality care. Refining the payment systems for caring for beneficiaries with ESRD in traditional Medicare and managed care plans may provide some respite to the growth in ESRD program spending in the short-term. In the long run, ESRD program spending may not be effectively controlled until changes are made in the delivery of health care services to this population.

Roach, J. L., Turenne, M. N., Hirth, R. A., et al. (2010). "Using race as a case-mix adjustment factor in a renal dialysis payment system: potential and pitfalls." Am J Kidney Dis **56**(5): 928-936.

BACKGROUND: Racial disparities in health care are widespread in the United States. Identifying contributing factors may improve care for underserved minorities. To the extent that differential utilization of services, based on need or biological effect, contributes to outcome disparities, prospective payment systems may require inclusion of race to minimize these adverse effects. This research determines whether costs associated with end-stage renal disease (ESRD) care varied by race and whether this variance affected payments to dialysis facilities. STUDY DESIGN: We compared the classification of race across Medicare databases and investigated differences in cost of care for long-term dialysis patients by race. SETTING & PARTICIPANTS: Medicare ESRD database including 890,776 patient-years in 2004-2006. PREDICTORS: Patient race and ethnicity. OUTCOMES: Costs associated with ESRD care and estimated payments to dialysis facilities under a prospective payment system. RESULTS: There were inconsistencies in race and ethnicity classification; however, there was significant agreement for classification of black and nonblack race across databases. In predictive models evaluating the cost of outpatient dialysis care for Medicare patients, race is a significant predictor of cost, particularly for cost of separately billed injectable medications used in dialysis. Overall, black patients had 9% higher costs than nonblack patients. In a model that did not adjust for race, other patient characteristics accounted for only 31% of this difference. LIMITATIONS: Lack of information about biological causes of the link between race and cost. CONCLUSIONS: There is a significant racial difference in the cost of providing dialysis care that is not accounted for by other factors that may be used to adjust payments. This difference has the potential to affect the delivery of care to certain populations. Of note, inclusion of race into a prospective payment system will require better understanding of biological differences in bone and anemia outcomes, as well as effects of inclusion on self-reported race.

Robinson, B., Fuller, D., Zinsser, D., et al. (2011). "The Dialysis Outcomes and Practice Patterns Study (DOPPS) Practice Monitor: rationale and methods for an initiative to monitor the new US bundled dialysis payment system." Am J Kidney Dis **57**(6): 822-831.

A new initiative of the US Dialysis Outcomes and Practice Patterns Study (DOPPS), the DOPPS Practice Monitor (DPM), provides up-to-date data and analyses to monitor trends in dialysis practice during implementation of the new Centers for Medicare & Medicaid Services (CMS) end-stage renal disease Prospective Payment System (PPS; 2011-2014). We review DPM rationale, design, sampling approach, analytic methods, and facility sample characteristics. Using stratified random sampling, the sample of ~145 US facilities provides results representative nationally and by facility type (dialysis organization size, rural/urban, free standing/hospital based), achieving coverage similar to the CMS sample frame at average values and tails of the distributions for key measures and patient characteristics. A publicly available web report (www.dopps.org/DPM) provides detailed trends, including demographic, comorbidity, and dialysis data; medications; vascular access; and quality of life. Findings are updated every 4 months with a lag of only 3-4 months. Baseline data are from mid-2010, before the new PPS. In sum, the DPM provides timely representative data to monitor effects of the expanded PPS on dialysis practice. Findings can serve as an early warning system for possible adverse effects on clinical care and as a basis for community outreach, editorial comment, and informed advocacy.

Rocha, M. J., Ferreira, S., Martins, L. S., et al. (2012). "Cost analysis of renal replacement therapy by transplant in a system of bundled payment of dialysis." Clin Transplant **26**(4): 529-531.

Renal replacement therapies (RRT) for patients with end-stage renal failure represent a high burden on European countries' healthcare budget. Our purpose was to report and compare the costs of RRT by hemodialysis (HD) or peritoneal dialysis (PD) and renal transplantation (RT) after introduction of a bundled payment system of dialysis. We analyzed average annual cost of RT in a public national health system hospital - surgical/anesthesiologist team and material, induction and maintenance immunosuppression therapy, hospital stay, diagnostic examinations (DE), and post-transplant office visits (including DE). Incentives paid to hospitals performing RT were included. Annual cost of HD or PD was estimated by bundled payment established in a recently revised law - 537.25 euro/wk. Total first year cost or RT is 61 658.14 euro and from the second year forth 543.86 euro/month. Dialysis costs 28 033.71 euro/yr. Break-even point for cost is at 32 months, and from there on, RT is less expensive. Strategies aimed at increasing RT are needed as it confers better survival than RRT by dialysis with lower costs to Portuguese health system.

Rubin, R. J. (2013). "Understanding Washington: a nephrologist's perspective from inside the Beltway." Am J Kidney Dis **62**(6): 1042-1045.

The major principles that drive U.S. federal health policy-making are: (1) fixed or reduced costs, (2) ensured outcomes (or no evidence of undertreatment), (3) streamlined administration, and (4) political viability. A corollary is that providers are uniquely sensitive to financial incentives. Understanding these principles is vital to understanding federal health policy. Critically, these principles are nonpartisan and have been supported and used by all administrations since President Reagan. This article examines the end-stage renal disease (ESRD) prospective payment system, colloquially called "The Bundle," in the context of these major principles. Successful health policy, successful legislation, and successful regulation building all require executive leadership, mutual trust, and compromise. This is demonstrated by the events surrounding the passage of the Medicare inpatient prospective payment system, which governs hospital reimbursement for Medicare beneficiaries, including those not covered in the ESRD program. Given that the ESRD benefit consumes 6.3% of the Medicare budget for approximately 2% of Medicare beneficiaries, if nephrology is to experience future success, we must change how both policymakers and the wider field of medicine perceive our specialty. Understanding the major principles behind health care policy may facilitate this goal.

Rubin, R. J., Shapiro, J. R., Hines, S. J., et al. (2001). "Disease management: what have we learned so far?" Blood Purif **19**(4): 353-360.

Disease management (DM) is becoming an increasingly important tool for use in end-stage renal disease (ESRD). The goal of a DM program is to offer a continuum of care that uses guidelines and case management protocols to prevent acute care episodes, achieve improved outcomes and reduce health care costs. This article reviews the theory behind DM, describes key components of DM programs and explains the financial incentives for DM in ESRD. Of key importance in the increasing role of DM for ESRD has been the development of nationally recognized guidelines, the effects of which are now beginning to emerge. At the same time, recent studies have identified targeted opportunities for DM programs to improve outcomes and costs, including anemia management, dialysis dose, and vascular access. DM, through the use of guidelines and targeted toward these and other areas, has the potential to significantly impact the quality of care provided to ESRD patients.

Saad, T. F. (2002). "Training, certification, and reimbursement for nephrology procedures." Semin Nephrol **22**(3): 276-285.

> The field of interventional nephrology is rapidly developing as an important new area of nephrology practice that holds great promise for improved patient care, outcomes, and cost control. This development is contingent on nephrologists acquiring the necessary knowledge and skills through suitable training and experience, and obtaining hospital privileges to perform these interventions. As more training programs are created, and credentialing criteria are established and accepted, it will become more practical for nephrologists to become interventionists. Reimbursement for interventional procedures can be complicated and confusing, with special problems applicable to a nephrology practice involved in the overall care of end-stage renal disease (ESRD) patients. It is essential to become familiar with applicable procedure codes, global periods, and code modifiers to correctly describe these procedures and receive correct reimbursement. Nephrologists work together with vascular access surgeons and interventional radiologists to provide care for dialysis patients. The role of each specialist in the management of vascular access depends on his or her level of interest, knowledge, and technical skill. These roles may vary considerably from one practice to another. There is potential for this area to become highly contentious, especially if one specialist feels threatened by the activities of another. Optimal patient care will be achieved only if all involved physicians take a serious intellectual interest in vascular access, develop superior clinical skills, and maintain cooperative, collegial, relationships.

Sadler, J. H. (2010). "The 2009 proposed rule for prospective ESRD payment: perspectives from a not-for-profit small dialysis organization." Am J Kidney Dis **55**(2): 229-230.

Sargent, J. A. et Kingston, W. W. (2005). "Analyzing the true cost of delivering medications." Am J Kidney Dis **45**(5): 917-925.

> Reimbursement to providers for delivering medications in the dialysis field is a subject of current concern, with some payors limiting payment to an amount equaling the provider's acquisition cost. At the same time, some providers arbitrarily mark up medications by a large factor. For dialysis, as well as for the general medical field, an objective approach is required for both providers and payors to fairly set prices and reimbursement levels. This analysis evaluated all cost elements involved in the delivery of medications and determined that an increase over the acquisition cost is appropriate for pricing and reimbursement. The increase has 2 parts: a fixed cost associated with resources required for a medication irrespective of its cost and a markup on the acquisition price. The conclusion of this analysis is that an increase over acquisition cost in reimbursement of providers for delivering medications is required to fairly compensate them for their actual costs and avoid compelling them to either incur a loss or cost shift by overcharging some payors to compensate for underpayment by others. Planned adjustments in Medicare reimbursement for dialysis may not recognize this reality.

Saunders, M. R., Lee, H. et Chin, M. H. (2017). "Early winners and losers in dialysis center pay-for-performance." BMC Health Serv Res **17**(1): 816.

> BACKGROUND: We examined the association of dialysis facility characteristics with payment reductions and change in clinical performance measures during the first year of the United States Centers for Medicare & Medicaid Services (CMS) End Stage Renal Disease Quality Incentive Plan (ESRD QIP) to determine its potential impact on quality and disparities in dialysis care. METHODS: We linked the 2012 ESRD QIP Facility Performance File to the 2007-2011 American Community Survey by zip code and dichotomized the QIP total performance scores-derived from percent of patients with urea reduction rate > 65, hemoglobin < 10 g/dL, and hemoglobin > 12 g/dL-as 'any' versus 'no' payment reduction. We characterized associations between payment reduction and dialysis facility characteristics and neighborhood demographics, and examined changes in facility outcomes between 2007 and 2010. RESULTS: In multivariable analysis, facilities with any payment reduction were more likely to have longer operation (OR 1.03 per year), a medium or large number of stations (OR 1.31 and OR 1.42, respectively), and a larger proportion of African Americans (OR 1.25, highest versus lowest quartile), all p < 0.05. Most improvement in clinical performance was due to reduced overtreatment of anemia, a decline in the percentage of patients with hemoglobin >/= 12 g/dL; for-profits and facilities in African American neighborhoods had the greatest reduction. CONCLUSIONS: In the first year of CMS pay-for-performance, most clinical improvement was due to reduced overtreatment of anemia.

> Facilities in African American neighborhoods were more likely to receive a payment reduction, despite their large decline in anemia overtreatment.

Shapiro, J. R., Dykstra, D. M., Pisoni, R., et al. (2003). "Patient selection in the ESRD managed care demonstration." Health Care Financ Rev **24**(4): 31-43.

> The Centers for Medicare & Medicaid Service's (CMS') end stage renal disease (ESRD) managed care demonstration offered an opportunity to assess patient selection among a chronically ill and inherently costly population. Patient selection refers to the phenomenon whereby those Medicare beneficiaries who choose to enroll or stay in health maintenance organizations (HMOs) are, on average, younger, healthier, and less costly to treat than beneficiaries who remain in the traditional Medicare fee-for-service (FFS) sector. The results presented in this article show that enrollees into the demonstration were generally younger and healthier than a representative group of comparison patients from the same geographic areas.

Shimizu, U., Mitadera, Y., Aoki, H., et al. (2015). "Dialysis patients' utilization of health care services covered by long-term care insurance in Japan." Tohoku J Exp Med **236**(1): 9-19.

> Hemodialysis patients in Japan are aging and thus more patients need support for attending hemodialysis facilities. This study aimed to clarify how dialysis patients utilize the services covered by Japan's public long-term care insurance (LTCI) system. This cross-sectional study was based on LTCI data of March 31, 2009, the latest available data provided by Niigata City, located on the northwest coast of Honshu. Among 30,349 LTCI users in Niigata City, there were 234 dialysis patients. To clarify the characteristics of the dialysis patients, we compared the utilization of LTCI services between the dialysis patients (234 users) and randomly selected 765 non-dialysis users. We also calculated the annual transportation service costs per patient for dialysis patients who continued home care (home care group) and those who switched to long-term hospital care at LTCI care levels 4 and 5 (hospital admission group). These care levels indicate difficulty in walking or maintaining a sitting posture without assistance. The dialysis group more frequently utilized home care and equipment services, such as renting or purchasing care-support products and support for home equipment repair, and utilized facility services and short-stay services (respite care) less frequently (both $p < 0.001$). Cost per patient was higher in the home care group than in the hospital admission group, because the transportation services for dialysis patients at care levels 4 and 5 involve higher costs. These findings indicate that LTCI services usable for dialysis patients were limited. Therefore, instead of merely subsidizing transportation expenses, transportation services must be improved.

Smith, S., Witten, B., Paykin, C., et al. (2011). "Medicare Part D: challenges for dialysis patients. Part 1." Nephrol News Issues **25**(12): 38-40, 42, 44-35.

> Dialysis patients require numerous medications and have high prescription drug costs compared with general Medicare patients, possibly making them more vulnerable to Medicare Part D policy-related issues. The purpose of this study was to identify problems that dialysis patients experience with Medicare Part D through a survey of dialysis social workers. The online survey was posted on www.kidneyhealthcarecoverage.org and results were collected from January 2010 through October 2010. It was completed by 184 social workers in 38 states, representing 14,200 patients. The greatest Part D plan restrictions were seen with the highest cost prescription medications--Lanthanum carbonate, sevelamer carbonate, and cinacalcet. Seventeen percent of social workers reported that dialysis patients were "very frequently" or "frequently" unaware of available Medicare Part D coverage and 54% reported that up to 20% of their patients continued to have no insurance coverage for prescription drugs. Social workers reported that patients affected by the coverage gap exhibited various changes in medication-taking behavior, such as skipping doses and decreasing dosing frequency. Higher out-of-pocket costs for some dialysis patients during the coverage gap led to reduced use of medications; such gaps in treatment could lead to increased use of medical services, but further data are needed. Currently, the government is slowly phasing out the coverage gap; this process should be completed by 2020. The anticipated shift of self-administered bone and mineral disorder medications from Part D into the dialysis bundle in 2014 has the potential to affect dialysis patients' access to these medications.

Solid, C. A. et Collins, A. J. (2013). "Changes and alternatives for dialysis facilities under the bundled payment plan." Nephrol News Issues **27**(6): 30-32.

> The new prospective payment system, or bundled payment plan, for dialysis treatments presents dialysis providers with the potential for clinical and economic risk and opportunity, depending on the modality of dialysis therapy used and the frequency and doses of injectable drugs administered. Under the bundle, some financial incentives may encourage starting incident patients on home dialysis, either home hemodialysis or peritoneal dialysis. Administration of injectable medications such as vitamin D and iron, which are no longer separately billable, may require providers to consider oral equivalents or slightly different dosing patterns. Treatment of anemia with erythropoiesis-stimulating agents will also require careful consideration, as will use of oral medications when they are added to the bundle in 2016. These factors are already playing out in the marketplace, and going forward providers will need to balance changes in utilization with patient care.

St Peter, W. L. (2007). "Chronic kidney disease and medicare." J Manag Care Pharm **13**(9 Suppl D): S13-18.

> BACKGROUND: Since 1972, Medicare has covered the cost of end-stage renal disease (ESRD). Consequently, Medicare pays a large proportion of ESRD's costs. However, before implementation of Medicare Part D, employer health plans paid most ESRD-associated prescription costs. The ESRD population faces significant hurdles when using the new Part D benefit. To understand those challenges, a basic understanding of Part D is needed. SUMMARY: Medicare Part D has unique implications for chronic kidney disease (CKD) populations (dialysis, kidney transplant, and CKD patients not on dialysis). Approximately 405,000 ESRD patients were eligible for Part D coverage in 2006. Drug coverage is available for many drugs via Medicare Part B or Part D; however, the Medicare Part B and Part D medication coverage divide is confusing to most clinicians, including pharmacists. Many ESRD patients fall into the dual-eligible category -- they are covered by both Medicare and Medicaid. These patients now receive their medications through Part D and must enroll in a prescription drug plan (PDP). However, many PDP plans may not have the drugs that were covered in state-sponsored Medicaid programs. Dialysis-specific issues also abound because of the high-cost, high-use medications needed to treat the numerous comorbid conditions (diabetes, hypertension, anemia, bone and mineral metabolism disorders, and cardiovascular disorders) that flourish in the ESRD population. CONCLUSION: Managed care demonstration projects are underway to better understand if enrolling these patients into managed care plans with disease management models (i.e., special needs plans) can provide quality care in an effective and efficient manner. Screening patients at high risk for kidney disease, identifying patients with early kidney disease, preventing progression to ESRD, and effectively managing comorbid conditions may reduce long-term medical costs and maintain work productivity. Health care providers need to make an active effort to help CKD patients select kidney-friendly formularies. Medicare requires medication therapy management (MTM) services for certain beneficiaries (called "targeted beneficiaries") enrolled in PDP plans to improve medication optimization. Approximately 80% of the typical ESRD population has more than 2 targeted comorbidities. Thus, many ESRD patients should be targeted for MTM services, a task that represents an opportunity for pharmacists.

St Peter, W. L. (2008). "Potential impact of Medicare Part D in the end-stage renal disease population." Adv Chronic Kidney Dis **15**(2): 140-146.

> Since 2006, end-stage renal disease (ESRD) patients enrolled in Medicare are also eligible to enroll in the voluntary prescription drug program, Medicare Part D, which is administered by private sector entities called prescription drug plans (PDPs) or Medicare Advantage Part D plans. Approximately 84% of ESRD patients should be eligible to receive Part D benefits based on Medicare coverage, but the percentage who lack adequate prescription coverage and are enrolled is unclear. Dually eligible (Medicare and Medicaid) ESRD patients were automatically enrolled in PDPs if they did not self-enroll. Many experienced problems after Part D implementation, including interruptions in prescription drug coverage, formulary issues, and difficulties when seeking appeals. Several key ESRD medications are not covered by Part D plans. Trade-name ESRD medications are often placed in higher formulary tiers requiring higher copayment. Enhanced plans covering more medications require higher premiums.

ESRD patients have higher out-of-pocket expenses under Part D than general Medicare patients and are more likely to reach and go through the coverage gap and to reach catastrophic coverage. The complexities of Medicare Part D make problems inevitable; ESRD patients may be more vulnerable to these problems than the general Medicare population, but further data are needed.

Stopper, A., Amato, C., Gioberge, S., et al. (2007). "Managing complexity at dialysis service centers across Europe." Blood Purif **25**(1): 77-89.

INTRODUCTION: Dialysis is probably one of the areas of medicine with more guidelines than any other. Issues such as dialysis dose are dealt with in those guidelines, and minimum values to be reached are defined. A target has to be set and reached by using a data-driven continuous quality improvement (CQI) approach. Data collection must be programmed and structured from the beginning. METHODS: Fresenius started its activities as a dialysis provider in 1996, following the merger of its dialysis business with the leading service provider in the US, National Medical Care. Currently Fresenius Medical Care's European activities involve more than 320 dialysis centers located in 15 countries and treating more than 24,000 patients. Management is based on a bi-dimensional organization where line managers can rely on international functional departments. Under this framework, the CQI techniques are applied in conjunction with benchmarking in a system driven by quality targets. In order to combine clinical governance with management targets, the Balanced ScoreCard system was selected. The Balanced ScoreCard monitors the efficiency of each dialysis center compared to an ideal model, targeting maximum possible efficiency whilst having a unique target for patient outcomes. CONCLUSION: A clear definition of targets is fundamental and activities need to be monitored and continuously improved; scientific collection of clinical data is the key.

Swaminathan, S., Mor, V., Mehrotra, R., et al. (2012). "Medicare's payment strategy for end-stage renal disease now embraces bundled payment and pay-for-performance to cut costs." Health Aff (Millwood) **31**(9): 2051-2058.

Since 1973 Medicare has provided health insurance coverage to all people who have been diagnosed with end-stage renal disease, or kidney failure. In this article we trace the history of payment policies in Medicare's dialysis program from 1973 to 2011, while also providing some insight into the rationale for changes made over time. Initially, Medicare adopted a fee-for-service payment policy for dialysis care, using the same reimbursement standards employed in the broader Medicare program. However, driven by rapid spending growth in this population, the dialysis program has implemented innovative payment reforms, such as prospective bundled payments and pay-for-performance incentives. It is uncertain whether these strategies can stem the increase in the total cost of dialysis to Medicare, or whether they can do so without adversely affecting the quality of care. Future research on the intended and unintended consequences of payment reform will be critical.

Swaminathan, S., Mor, V., Mehrotra, R., et al. (2015). "Effect of Medicare dialysis payment reform on use of erythropoiesis stimulating agents." Health Serv Res **50**(3): 790-808.

OBJECTIVE: In 2011, the Centers for Medicare and Medicaid Services (CMS) replaced fee-for-service reimbursement for erythropoiesis stimulating agents (ESAs) with a fixed-sum bundled payment for all dialysis-related care and pay-for-performance incentives to discourage maintaining patients' hematocrits above 36 percent. We examined the impact of the new payment policy on the use of ESAs. DATA SOURCES: CMS's Renal Information Management System. STUDY DESIGN: Regression discontinuity design assessing the use of ESAs by hematocrit level before and after the implementation of the payment policy change. DATA EXTRACTION: Secondary data from 424,163 patients receiving hemodialysis treatment between January 2009 and June 2011. PRINCIPAL FINDINGS: The introduction of bundled payments with pay-for-performance initiatives was associated with an immediate and substantial decline in the use of ESAs among patients with hematocrit >36 percent and little change in the use of ESAs among patients with hematocrit </=36 percent. In the first two quarters of 2011, the use of ESAs during dialysis fell by about 7-9 percentage points among patients with hematocrit levels >36 percent. No statistically significant differences in ESA use were observed at the thresholds of 30 or 33 percent. CONCLUSIONS: CMS's payment reform for dialysis care reduced the use of ESAs in patients who may not benefit from these agents.

Takemoto, Y. et Naganuma, T. (2013). "The economic issue of on-line hemodiafiltration within the Japanese medical reimbursement system." Blood Purif **35 Suppl 1**: 74-76.

> One major issue of Japan's health care system is that the Ministry of Health, Labor and Welfare (MHLW) centrally decides on the prices of medical services. Because of this, even if a treatment is deemed superior by the actual medical service provider, it may not be economically feasible to carry out. On-line hemodiafiltration has been reported to be an effective and favorable treatment modality, but the number of treated patients has declined since its approval in 2010 due to its low reimbursement price determined by MHLW. In this way, the problem with the Japanese medical reimbursement system is that MHLW's policy measures can thus affect the details of actual medical practices.

Tangri, N., Tighiouart, H., Meyer, K. B., et al. (2011). "Both patient and facility contribute to achieving the Centers for Medicare and Medicaid Services' pay-for-performance target for dialysis adequacy." J Am Soc Nephrol **22**(12): 2296-2302.

> The Centers for Medicare and Medicaid Services (CMS) designated the achieved urea reduction ratio (URR) as a pay-for-performance measure, but to what extent this measure reflects patient characteristics and adherence instead of its intent to reflect facility performance is unknown. Here, we quantified the contributions of patient case-mix and adherence to the variability in achieving URR targets across dialysis facilities. We found that 92% of 10,069 hemodialysis patients treated at 173 facilities during the last quarter of 2004 achieved the target URR >/=65%. Mixed-effect models with random intercept for dialysis facility revealed a significant facility effect: 11.5% of the variation in achievement of target URR was attributable to the facility level. Adjusting for patient case-mix reduced the proportion of variation attributable to the facility level to 6.7%. Patient gender, body surface area, dialysis access, and adherence with treatment strongly associated with achievement of the URR target. We could not identify specific facility characteristics that explained the remaining variation between facilities. These data suggest that if adherence is not a modifiable patient characteristic, providers could be unfairly penalized for caring for these patients under current CMS policy. These penalties may have unintended consequences.

Thamer, M., Zhang, Y., Kaufman, J., et al. (2014). "Major declines in epoetin dosing after prospective payment system based on dialysis facility organizational status." Am J Nephrol **40**(6): 554-560.

> BACKGROUND: Epoetin therapy used to treat anemia among ESRD patients has cost Medicare approximately $40 billion. Since January 2011, epoetin has been reimbursed via a new bundled prospective payment system (PPS). Our aim was to determine changes in epoetin dosing and hematocrit levels in response to PPS by different types of dialysis providers. METHODS: Data from the USRDS were used to identify 187,591 and 206,163 Medicare-eligible ESRD patients receiving hemodialysis during January 2010 (pre-PPS) and December 2011 (post-PPS). Standardized weekly mean epoetin dose administered pre- and post-PPS and adjustment in dose (titration) based on previous hematocrit level in each facility was disaggregated by profit status, chain membership and size. RESULTS: Major declines in epoetin use, dosing and achieved hematocrit levels were observed after PPS. Among the three largest dialysis chains, the decline in standardized epoetin dose was 29% at Fresenius, 47% at DaVita, and 52% at DCI. The standardized weekly epoetin dose among profit and nonprofit facilities declined by 38 and 42%, respectively. Changes in titration patterns suggest that a new hematocrit target of 30-33% was in place after PPS, replacing the erstwhile 33-36% hematocrit target used before PPS. CONCLUSION: Historically, important differences in anemia management were evident by dialysis organizational status. However, the confluence of financial incentives bundling epoetin payments and mounting scientific evidence linking higher hematocrit targets and higher epoetin doses to adverse outcomes have culminated in lower access to epoetin and lower doses across all dialysis providers in the first year after PPS.

Tong, A., Chapman, J. R., Wong, G., et al. (2014). "Perspectives of transplant physicians and surgeons on reimbursement, compensation, and incentives for living kidney donors." Am J Kidney Dis **64**(4): 622-632.

BACKGROUND: The shortage of donors for organ transplantation has stimulated debate on financial incentives for living kidney donors. This study aims to describe the range of attitudes and opinions of transplant physicians on financial reimbursement, compensation, and incentives in living kidney donation. STUDY DESIGN: Qualitative study. SETTING & PARTICIPANTS: 110 transplant nephrologists and surgeons from 12 countries across 43 transplantation units in Europe, Australasia, and North America. METHODOLOGY: Face-to-face semistructured interviews were conducted. ANALYTICAL APPROACH: Transcripts were thematically analyzed. RESULTS: We identified 7 major themes. Prioritizing the removal of disincentives for living kidney donors was largely deemed acceptable. By contrast, provision of financial incentives raised concerns about undermining benevolence, compromising human dignity and value, and traversing market forces. Some contended that financial incentives potentially were legitimate if regulated, arguing that this would maximize utility in transplantation, but most also acknowledged the difficulty and that operational feasibility of a regulated system of financial incentivization may be limited. LIMITATIONS: Participants were English speaking and from Western high-income countries; therefore, the transferability of our findings may be limited. CONCLUSIONS: Transplantation specialists believed that minimizing disincentives would support equity and justice in living kidney donation. Direct financial incentivization for living kidney donors, even in the context of a regulated market, was regarded by most as unjustified because of the potential moral consequences and uncertain feasibility. Removing financial disincentives and safeguarding the intrinsic volunteerism, value, and meaning of donation were viewed to uphold integrity in living kidney donation.

Turenne, M. N., Hirth, R. A., Messana, J. M., et al. (2010). "When payment systems collide: the effect of hospitalization on anemia in renal dialysis patients." Med Care **48**(4): 296-305.

BACKGROUND: Different types of providers often face differing financial incentives for providing similar types of care. This may have implications for payment systems that target improvements in care requiring multiple types of providers. OBJECTIVES: The objective of this study was to determine how hospitalization influences the anemia of Medicare patients with chronic renal failure, where anemia is treated under a prospective payment system during hospitalizations and under a fee-for-service system during outpatient renal dialysis. METHODS: We examined the effects of time in hospital and reason for hospitalization on levels of anemia among 87,263 Medicare renal dialysis patients with a hospital stay of 3 days or more during 2004. Medicare claims were used to measure changes in hematocrit between the month before and the month after hospital discharge, and to classify admissions with a high risk of anemia. Multilevel models were used to study variation in outcomes across providers. RESULTS: Longer time in the hospital was associated with worsening anemia. As expected, larger declines in hematocrit occurred following admissions for conditions or procedures with a high risk of anemia. However, we observed a similar effect of time in the hospital for admissions both with and without a high risk of anemia. There were relatively large differences in anemia outcomes across both individual hospitals and physicians. CONCLUSIONS: Hospitalization-related anemia increases the need for care by outpatient renal dialysis providers. Efforts to improve care through payment system design are more likely to be successful if financial incentives are aligned across care settings.

Turenne, M. N., Hirth, R. A., Pan, Q., et al. (2008). "Using knowledge of multiple levels of variation in care to target performance incentives to providers." Med Care **46**(2): 120-126.

BACKGROUND: In developing "pay-for-performance" and capitation systems that provide incentives for improving the quality and efficiency of care, policymakers need to determine which healthcare providers to evaluate and reward. OBJECTIVES: This study demonstrates methods for determining and understanding the relative contributions of facilities and physicians to the quality and cost of care. Specifically, this study distinguishes levels of variation in resource utilization (RU), based on research to support the development of an expanded Medicare dialysis prospective payment system. RESEARCH DESIGN: Mixed models were used to estimate the variation in RU across institutional providers, physicians, patients, and months (within patients), after adjusting for case-mix. SUBJECTS: The study includes 10,367 Medicare hemodialysis patients treated in a 4.2% stratified random sample of dialysis facilities in 2003. MEASURES: Monthly RU was measured by the average Medicare allowable charge per dialysis session for separately billable dialysis-related services (mainly injectable medications and laboratory tests) from Medicare claims. RESULTS: There was financially significant variation in RU across institutional providers and to a lesser degree across physicians, after adjusting for differences in case-mix. The remaining variation in RU reflects unexplained differences across patients that persist over time and transitory fluctuations for individual patients. CONCLUSIONS: The greater variation in RU occurring across dialysis facilities than across physicians is consistent with targeting payments to facilities, but alignment of incentives between facilities and physicians remains an important goal. Similar analytic methods may be useful in designing payment policies that reward providers for improving the quality of care.

Van Biesen, W., Lameire, N., Peeters, P., et al. (2007). "Belgium's mixed private/public health care system and its impact on the cost of end-stage renal disease." Int J Health Care Finance Econ **7**(2-3): 133-148.

Belgium has a mixed, public-private health care system, with state-organized reimbursements but private providers. The system is fee for service. For end-stage renal disease (ESRD), the fee-for-service system discourages preventive strategies, early referral to the nephrology unit, and the use of home-based therapies. The aging of the general population is reflected in the rapidly increasing number of very old dialysis patients, requiring more complicated and, therefore, more costly care. As dialysis costs increase, the ability to provide unrestricted access to dialysis treatment may be unsustainable. To aid in decision-making processes, nephrologists must be aware of financial and organizational issues.

van de Luijtgaarden, M. W., Jager, K. J., Stel, V. S., et al. (2013). "Global differences in dialysis modality mix: the role of patient characteristics, macroeconomics and renal service indicators." Nephrol Dial Transplant **28**(5): 1264-1275.

BACKGROUND: An increase in the dialysis programme expenditure is expected in most countries given the continued rise in the number of people with end-stage renal disease (ESRD) globally. Since chronic peritoneal dialysis (PD) therapy is relatively less expensive compared with haemodialysis (HD) and because there is no survival difference between PD and HD, identifying factors associated with PD use is important. METHODS: Incidence counts for the years 2003-05 were available from 36 countries worldwide. We studied associations of population characteristics, macroeconomic factors and renal service indicators with the percentage of patients on PD at Day 91 after starting dialysis. With linear regression models, we obtained relative risks (RRs) with 95% confidence intervals (CIs). RESULTS: The median percentage of incident patients on PD was 12% (interquartile range: 7-26%). Determinants independently associated with lower percentages of patients on PD were as follows: patients with diabetic kidney disease (per 5% increase) (RR 0.93; 95% CI 0.89-0.97), health expenditure as % gross domestic product (per 1% increase) (RR 0.93; 95% CI 0.87-0.98), private-for-profit share of HD facilities (per 1% increase) (RR 0.996; 95% CI 0.99-1.00; P = 0.04), costs of PD consumables relative to staffing (per 0.1 increase) (RR 0.97; 95% CI 0.95-0.99). CONCLUSIONS: The factors associated with a lower percentage of patients on PD include higher diabetes prevalence, higher healthcare expenditures, larger share of private-for-profit centres and higher costs of PD consumables relative to staffing. Whether dialysis modality mix can be influenced by changing healthcare organization and funding requires additional studies.

van der Veer, S. N., Ravani, P., Coentrao, L., et al. (2015). "Barriers to adopting a fistula-first policy in Europe: an international survey among national experts." J Vasc Access **16**(2): 113-119.

PURPOSE: The purpose of this study is to explore how vascular access care was reimbursed, promoted, and organised at the national level in European and neighbouring countries. METHODS: An electronic survey among national experts to collect country-level data. RESULTS: Forty-seven experts (response rate, 76%) from 37 countries participated. Experts from 23 countries reported that 50% or less of patients received routine preoperative imaging of vessels. Nephrologists placed catheters and created fistulas in 26 and 8 countries, respectively. Twenty-one countries had a fee per created access; the reported fee for catheter placement was never higher than for fistula creation. As the number of haemodialysis patients in a centre increased, more countries had a dedicated coordinator or multidisciplinary team responsible for vascular access maintenance at the centre-level; in 11 countries, responsibility was always with individual nephrologists, independent of a centre's size. In 23 countries, dialysis centres shared vascular access care resources, with facilitation from a service provider in 4. In most countries, national campaigns (n = 35) or educational programmes (n = 29) had addressed vascular access-related topics; 19 countries had some form of training for creating fistulas. Forty experts considered the current evidence base robust enough to justify a fistula-first policy, but only 13 believed that more than 80% of nephrologists in their country would attempt a fistula in a 75-year-old woman with comorbidities. CONCLUSIONS: Suboptimal access to surgical resources, lack of dedicated training of clinicians, limited routine use of preoperative diagnostic imaging and patient characteristics primarily emerged as potential barriers to adopting a fistula-first policy in Europe.

Vanholder, R., Davenport, A., Hannedouche, T., et al. (2012). "Reimbursement of dialysis: a comparison of seven countries." J Am Soc Nephrol **23**(8): 1291-1298.

Reimbursement for chronic dialysis consumes a substantial portion of healthcare costs for a relatively small proportion of the total population. Each country has a unique reimbursement system that attempts to control rising costs. Thus, comparing the reimbursement systems between countries might be helpful to find solutions to minimize costs to society without jeopardizing quality of treatment and outcomes. We conducted a survey of seven countries to compare crude reimbursement for various dialysis modalities and evaluated additional factors, such as inclusion of drugs or physician payments in the reimbursement package, adjustment in rates for specific patient subgroups, and pay for performance therapeutic thresholds. The comparison examines the United States, the province of Ontario in Canada, and five European countries (Belgium, France, Germany, The Netherlands, and the United Kingdom). Important differences between countries exist, resulting in as much as a 3.3-fold difference between highest and lowest reimbursement rates for chronic hemodialysis. Differences persist even when our data were adjusted for per capita gross domestic product. Reimbursement for peritoneal dialysis is lower in most countries except Germany and the United States. The United Kingdom is the only country that has implemented an incentive if patients use an arteriovenous fistula. Although home hemodialysis (prolonged or daily dialysis) allows greater flexibility and better patient outcomes, reimbursement is only incentivized in The Netherlands. Unfortunately, it is not yet clear that such differences save money or improve quality of care. Future research should focus on directly testing both outcomes.

Velez, R., Singer, D. et Blaser, R. (2012). "SGR reform and nephrology: difficult problems, potential solutions." Nephrol News Issues **26**(10): 12, 14-15.

In light of the massive uncertainty with both the federal government in general and health policy priorities specifically, it is probably constructive to focus on the things we know for sure. In Medicare Part B reimbursement, the SGR system is fundamentally flawed, and must be replaced. All of Congress has recognized this fact, and there is legislation in the House that would move the ball forward on SGR repeal and replacement. Likewise, coordinated care models like ACOs offer a logical process for achieving a triple aim: improving individual health care, improving population health, and promoting cost efficiency in health care. Hopefully, policy makers in Washington will recognize and act on these truths as well.

Villarreal-Rios, E., Cardenas-Maldonado, C., Vargas-Daza, E. R., et al. (2014). "Institutional and familial cost of patients in continuous ambulatory peritoneal dialysis." Rev Assoc Med Bras (1992) **60**(4): 335-341.

OBJECTIVE: to determine the cost of institutional and familial care for patients with chronic kidney disease replacement therapy with continuous ambulatory peritoneal dialysis. METHODS: a study of the cost of care for patients with chronic kidney disease treated with continuous ambulatory peritoneal dialysis was undertaken. The sample size (151) was calculated with the formula of the averages for an infinite population. The institutional cost included the cost of outpatient consultation, emergencies, hospitalization, ambulance, pharmacy, medication, laboratory, x-rays and application of erythropoietin. The family cost included transportation cost for services, cost of food during care, as well as the cost of medication and treatment materials acquired by the family for home care. The analysis included averages, percentages and confidence intervals. RESULTS: the average annual institutional cost is US$ 11,004.3. The average annual family cost is US$ 2,831.04. The average annual cost of patient care in continuous ambulatory peritoneal dialysis including institutional and family cost

is US$ 13,835.35. CONCLUSION: the cost of chronic kidney disease requires a large amount of economic resources, and is becoming a serious problem for health services and families. It's also true that the form of patient management in continuous ambulatory peritoneal dialysis is the most efficient in the use of institutional resources and family.

Watnick, S., Weiner, D. E., Shaffer, R., et al. (2012). "Comparing mandated health care reforms: the Affordable Care Act, accountable care organizations, and the Medicare ESRD program." Clin J Am Soc Nephrol **7**(9): 1535-1543.

In addition to extending health insurance coverage, the Affordable Care Act of 2010 aims to improve quality of care and contain costs. To this end, the act allowed introduction of bundled payments for a range of services, proposed the creation of accountable care organizations (ACOs), and established the Centers for Medicare and Medicaid Innovation to test new care delivery and payment models. The ACO program began April 1, 2012, along with demonstration projects for bundled payments for episodes of care in Medicaid. Yet even before many components of the Affordable Care Act are fully in place, the Medicare ESRD Program has instituted legislatively mandated changes for dialysis services that resemble many of these care delivery reform proposals. The ESRD program now operates under a fully bundled, case-mix adjusted prospective payment system and has implemented Medicare's first-ever mandatory pay-for-performance program: the ESRD Quality Incentive Program. As ACOs are developed, they may benefit from the nephrology community's experience with these relatively novel models of health care payment and delivery reform. Nephrologists are in a position to assure that the ACO development will benefit from the ESRD experience. This article reviews the new ESRD payment system and the Quality Incentive Program, comparing and contrasting them with ACOs. Better understanding of similarities and differences between the ESRD program and the ACO program will allow the nephrology community to have a more influential voice in shaping the future of health care delivery in the United States.

Weiner, D. E. (2011). "The 2011 ESRD prospective payment system: welcome to the bundle." Am J Kidney Dis **57**(4): 539-541.

Weiner, D. E. et Watnick, S. G. (2010). "The 2009 proposed rule for prospective ESRD payment: historical perspectives and public policies--bundle up!" Am J Kidney Dis **55**(2): 217-222.

Westman, J., George, S., Scheel, P. J., Jr., et al. (1996). "Options for dialysis providers in a global capitated environment." Nephrol News Issues **10**(9): 26-31.

Williams, A. W. (2015). "Health policy, disparities, and the kidney." Adv Chronic Kidney Dis **22**(1): 54-59.

Kidney care and public policy have been linked for 40 years, with various consequences to outcomes. The 1972 Social Security Amendment, Section 2991, expanded Medicare coverage for all modalities of dialysis and transplant services and non-kidney-related care to those with end-stage renal disease (ESRD) regardless of age. This first and only disease-specific entitlement program was a step toward decreasing disparities in access to care. Despite this, disparities in kidney disease outcomes continue as they are based on many factors. Over the last 4 decades, policies have been enacted to understand and improve the delivery of ESRD care. More recent policies include novel shared-risk payment models to ensure quality and decrease costs. This article discusses the impact or potential impact of selected policies on health disparities in advanced chronic kidney disease and ESRD. Although it is too early to know the consequences of newer policies (Affordable Care Act, ESRD Prospective Payment System, Quality Incentive Program, Accountable Care Organizations), their goal of improving access to timely patient-centered appropriate affordable and quality care should lessen the disparity gap. The Nephrology community must leverage this dynamic state of care-delivery model redesign to decrease kidney-related health disparities.

Wilmink, T., Powers, S. et Baharani, J. (2015). "UK organisation of access care." J Vasc Access **16 Suppl 9**: S5-10.

National UK audits show that 73% of patients start renal replacement therapy (RRT) with haemodialysis (HD). However, 59% of those start HD on non-permanent access in the form of a

tunnelled line (TL) or a non-tunnelled line (NTL), 40% on an arteriovenous fistula (AVF) and 1% on an arteriovenous graft (AVG). After 3 months, the number of patients dialysing on AVF was only 41%. Late referrals, within 90 days of starting dialysis to the renal service, occur in one-fifth of all incident HD patients. Referral to a surgeon was an important determinant of mode of access at first dialysis. However, referral to a surgeon occurred in 67% of patients who were known to the nephrologist for over a year and in 46% of patients who were known to nephrology less than a year but more than 90 days. Best practice tariffs of the National Health Service (NHS) payment by results program have set a target of 75% of prevalent HD occurring via an AVF or AVG in 2011/2012, rising to 85% in 2013/2014. We suggest that this target is best achieved by increasing timely referral to a surgeon for creation of access before HD is needed.

Winkelmayer, W. C. (2011). "Potential effects of the new Medicare Prospective Payment System on drug prescription in end-stage renal disease care." Blood Purif **31**(1-3): 66-69.

The Centers for Medicaid and Medicare Services have announced a new Prospective Payment System to reimburse the care furnished by dialysis centers to patients with end-stage renal disease (ESRD). As of January 2011, most aspects of the outpatient treatment of patients with ESRD will be included in a single payment. In addition to the items previously included in the Composite Rate, injectable drugs and their oral equivalents will be included in this new capitation payment, as will the laboratory tests required for monitoring maintenance dialysis. As of January 2014, oral-only medications will also be included. Physician payments and payments for inpatient care, as well as for care not directly related to ESRD care will continue to be reimbursed separately. Patterns of medication treatment of ESRD patients will likely be revisited, and one can expect pronounced adjustments. Treatment of anemia will likely shift towards less use of erythropoiesis-stimulating agents and somewhat towards higher use of intravenous iron supplements. Average hemoglobin concentrations will decline. Use of intravenous vitamin D analogues will likely be reduced and substituted with their oral equivalents in many patients. One can also expect a temporary trend towards higher use of calcimetics, since their inclusion in the payment bundle is deferred until 2014. Treatment of problems with vascular access patency and of access infections will likely shift to the inpatient setting, and there may be reluctance to quickly accept recovering patients back to the outpatient setting after vascular access intervention. On aggregate, these changes have the potential to alter patient outcomes, but it is currently unclear how these will be and can be monitored.

Wish, D. (2009). "Revisions in the end stage renal disease prospective payment system: implications for nephrology nurses." Nephrol Nurs J **36**(6): 635-641.

A revised end stage renal disease prospective payment system that expands the bundle of services payed for under the capitated rate will be gradually phased in beginning January 1, 2011. This article provides an overview of some primary components of the new payment system that will affect nephrology nurses, with an emphasis on the need to continually focus on quality initiatives that will improve overall patient outcomes.

Wish, D., Johnson, D. et Wish, J. (2014). "Rebasing the Medicare payment for dialysis: rationale, challenges, and opportunities." Clin J Am Soc Nephrol **9**(12): 2195-2202.

After Medicare's implementation of the bundled payment for dialysis in 2011, there has been a predictable decrease in the use of intravenous drugs included in the bundle. The change in use of erythropoiesis-stimulating agents, which decreased by 37% between 2007, when its allowance in the bundle was calculated, and 2012, was because of both changes in the Food and Drug Administration labeling for erythropoiesis-stimulating agents in 2011 and cost-containment efforts at the facility level. Legislation in 2012 required Medicare to decrease (rebase) the bundled payment for dialysis in 2014 to reflect this decrease in intravenous drug use, which amounted to a cut of 12% or $30 per treatment. Medicare subsequently decided to phase in this decrease in payment over several years to offset the increase in dialysis payment that would otherwise have occurred with inflation. A 3% reduction from the rebasing would offset an approximately 3% increase in the market basket that determines a facility's costs for 2014 and 2015. Legislation in March of 2014 provides that the rebasing will result in a 1.25% decrease in the market basket adjustment in 2016 and 2017 and a 1% decrease in the market basket adjustment in 2018 for an aggregate rebasing of 9.5% spread over 5 years. Adjusting to this payment decrease in inflation-adjusted dollars will be challenging for many dialysis providers in an industry that operates at an average 3%-4% margin. Closure of facilities, decreases in services, and increased consolidation of the industry are possible scenarios. Newer models of reimbursement, such as ESRD seamless care organizations, offer dialysis providers the opportunity to align incentives between themselves, nephrologists, hospitals, and other health care providers, potentially improving outcomes and saving money, which will be shared between Medicare and the participating providers.

Wish, J. B. (2009). "Past, present, and future of chronic kidney disease anemia management in the United States." Adv Chronic Kidney Dis **16**(2): 101-108.

The management of anemia in the United States during the past 2 decades and since the introduction of erythropoietin (EPO) has continuously evolved, shaped by the interplay of reimbursement, evidence, clinical performance measurement, and, most recently, risk management. A fee-for-service reimbursement system has driven average EPO doses higher than anywhere else in the world, despite opportunities to decrease such dosing through more effective iron management and subcutaneous administration. Calls by Congress for Medicare to constrain ESA costs and FDA relabeling of erythropoietic-stimulating agents (ESAs), in the wake of The Correction of Hemoglobin and Outcomes in Renal Insufficiency and The Cardiovascular risk Reduction by Early Anemia Treatment with Epoetin Beta trials, have in 2007 led to the first decrease in mean hemoglobin levels in US hemodialysis patients since EPO was introduced in 1989. The implementation of a case-mixed adjusted bundled payment system for ESRD services in 2011 will turn ESAs from a profit center to a cost center for dialysis providers. This is likely to have profound implications regarding anemia management directed at curtailing ESA dosing, including subcutaneous administration, more aggressive iron therapy, and decreased target hemoglobin levels. Medicare has developed a third generation of clinical performance measures (CPMs) for ESRD providers (facilities and physicians) to ensure that quality is maintained in the new fiscal environment. Unlike the previous generations, these new CPMs emphasize an upper limit of hemoglobin as well as a lower one. Payment for performance based on these CPMs will likely be a key driver of future practice patterns for anemia management.

Woody, I. O. (2005). "The fundamentals of the US Medicare physician reimbursement process." J Am Coll Radiol **2**(2): 139-150.

The Medicare program, enacted in 1965, is a federally funded health care coverage plan for people aged 65 years and older, for those who are disabled, and for those needing renal dialysis or kidney transplants for the treatment of end-stage renal disease. Today, nearly 40 million Americans rely on Medicare for their health care services. The purpose of the Medicare program is to increase access to quality care for the elderly while maintaining a financially viable federal fund from which health care reimbursements can be appropriately and efficiently allocated to health care providers. This paper has three main objectives: (1) introduce the functioning of the Medicare payment system, (2) explain in more detail how the program currently reimburses physicians, and (3) discuss the current challenges facing the physician reimbursement system.

La prise en charge de la maladie et les pratiques médicales

Atlas IRC 2018

Le Neindre, C., Bricard, D., Sermet, C., et al. (2018). Atlas de l'insuffisance rénale chronique terminale en France, Paris : Irdes
http://www.irdes.fr/recherche/ouvrages/004-atlas-de-l-insuffisance-renale-chronique-terminale-en-france.pdf

LE PARCOURS DE SOINS

Études françaises

(2013). Les Etats généraux du Rein. Paris : EGR**:** 258, tabl., graph., fig.
http://www.renaloo.com/images/stories/EGR/rapport%20final.pdf

Fruit de dix-huit mois de travaux et de débats, ce rapport présente les résultats d'une grande enquête réalisée auprès des malades souffrant de maladies rénales. Il formule des propositions en vue d'améliorer la prise en charge de ces patients et de réduire notamment les inégalités d'accès aux soins.

Anap (2016). Démarche d'organisation des structures de dialyse. Paris Anap**:** 5 , tab., graph., fig.
http://www.anap.fr/fileadmin/user_upload/outils_et_publications/Publications/Organiser_la_prise_en_charge/Services_cliniques_et_medico-techniques/Dialyse/demarches_orga_structures_dialyse.pdf

La stratégie nationale de santé propose de développer une approche intégrée des modalités de prise en charge des patients atteints de maladie chronique, dont l'insuffisance rénale chronique, grâce à de nouveaux modes d'organisation centrés sur le parcours. Après un bilan de l'existant, ce rapport propose des pistes d'amélioration de l'organisation interne des structures de dialyse existantes, à l'aune de l'organisation en parcours.

ARS (2011). Insuffisance rénale chronique terminale : état des lieux et perspectives. Nantes ARS**:** 29 , tab., graph., fig.
http://www.ars.paysdelaloire.sante.fr/fileadmin/PAYS-LOIRE/F_actualites/etudes_publications/etudes_QE/ars_insuffisance-renale-chronique-terminale_.pd

ARS (2012). Les métiers de l'insuffisance rénale chronique en Champagne-Ardenne. Chalons-sur-Marne ARS**:** 16 , tab., graph., fig.
http://www.ars.champagne-ardenne.sante.fr/fileadmin/CHAMPAGNE-ARDENNE/ARS_Internet/votre_ars/Etudes_Pub/Livrets_ONDPS/Livret_ONDPS_ARS_IRC_2012.pdf

Après une définition de l'insuffisance rénale chronique et une présentation de données épidémiologiques, ce rapport décrit l'offre de soins en néphrologie de la Champagne-Ardenne.

Baubeau, D. et Trigano, L. (2004). "La prise en charge de l'insuffisance rénale chronique." Etudes Et Resultats(327): 8 , 3 tabl., 3 graph., 2 carte.
http://www.sante.gouv.fr/drees/etude-resultat/er-pdf/er327.pdf

Ce document analyse la prise en charge de l'insuffisance rénale chronique de 1994 à 2001 : évolution de la couverture géographique (nombre de centres de dialyse et d'unités d'autodialyse) ; évolution du nombre de séances d'hémodialyse ; nombre de centres de dialyse par secteur hospitalier ; disparités régionales d'accès aux soins. Un indicateur de temps moyen d'accès au centre le plus proche est proposé en fin de document.

Baudelot, C., Caille, Y., Godechot, O., et al. (2016). "Maladies rénales et inégalités sociales d'accès à la greffe en France." Population **71**(1): 23-52 tabl., fig.

> Les maladies rénales sont invisibles et silencieuses jusqu'à un stade avancé. La transplantation est aujourd'hui le traitement le plus efficient à tous les âges de la vie en termes de survie et de qualité de vie, mais aussi pour le système de santé. Or, quels que soient le sexe ou l'âge, les patients les moins instruits y ont moins souvent accès que les autres en France. De nombreux facteurs indépendants concourent à ces inégalités sociales : la nature des pathologies rénales en partie produites par le mode de vie, l'attention prêtée aux premiers symptômes, mais aussi l'existence de deux traitements de suppléance (la dialyse et la transplantation) qui se pratiquent dans des univers professionnels différents. Les mieux armés pour s'orienter dans ce système sont les patients les plus instruits. Les inégalités d'accès aux traitements entraînent à leur tour de fortes inégalités d'accès ou de maintien dans l'emploi. Les moins diplômés héritent d'emplois éprouvants physiquement qui sont rarement compatibles avec les séances de dialyse et un organisme affaibli.

Bayat, S., Macher, M. A., Couchoud, C., et al. (2015). "Individual and regional factors of access to the renal transplant waiting list in France in a cohort of dialyzed patients." Am J Transplant **15**(4): 1050-1060.

> Several studies have investigated geographical variations in access to renal transplant waiting lists, but none has assessed the impact on these variations of factors at both the patient and geographic levels. The objective of our study was to identify medical and non-medical factors at both these levels associated with these geographical variations in waiting-list placement in France. We included all incident patients aged 18-80 years in 11 French regions who started dialysis between January 1, 2006, and December 31, 2008. Both a multilevel Cox model with shared frailty and a competing risks model were used for the analyses. At the patient level, old age, comorbidities, diabetic nephropathy, non-autonomous first dialysis, and female gender were the major determinants of a lower probability of being waitlisted. At the regional level, the only factor associated with this probability was an increase in the number of patients on the waiting list from 2005 to 2009. This finding supports a slight but significant impact of a regional organ shortage on waitlisting practices. Our findings demonstrate that patients' age has a major impact on waitlisting practices, even for patients with no comorbidity or disability, whose survival would likely be improved by transplantation compared with dialysis.

Beauger, D. et Gentile, S. (2014). "Évolution de la qualité de vie des patients atteints d'insuffisance rénale chronique terminale entre 2005-2007 et 2011 : résultats des enquêtes de surveillance épidémiologique en France." Bulletin Epidemiologique Hebdomadaire(37-38): 631-640.
http://www.invs.sante.fr/beh/2014/37-38/2014_37-38_5.html

> [BDSP. Notice produite par InVS R0xBmrC9. Diffusion soumise à autorisation]. Introduction : le Réseau épidémiologie et information en néphrologie (REIN) assure, depuis 2001, le suivi épidémiologique et la prise en charge de l'insuffisance rénale chronique terminale (IRCT) en France. La connaissance d'indicateurs de qualité de vie (QDV) relative à la santé est capitale pour mieux comprendre les domaines touchés par la maladie et ainsi proposer des actions appropriées visant à mieux vivre avec sa pathologie. Dans ce contexte, deux études transversales visant à estimer le niveau de QDV liée à la santé des patients en IRCT ont été mises en place en 2005 (enquête dialyse) et 2007 (enquête greffe) sur un échantillon de patients français, puis reconduites en 2011. L'objectif de cet article est de les comparer et d'analyser l'évolution de la QDV des patients atteints d'IRCT entre ces deux enquêtes. Méthodes : les études ont été réalisées sur un échantillon représentatif de sujets âgés de 18 ans et plus, en dialyse (quelles que soient les modalités de dialyse) ou porteurs d'un greffon rénal fonctionnel depuis un an, suivis dans un centre de dialyse et/ou de transplantation dans l'une des huit régions françaises sélectionnées. Le recueil des données a été réalisé par auto-questionnaires adressés par voie postale au domicile des patients. La QDV a été mesurée par un questionnaire générique, le MOS SF36 et deux questionnaires spécifiques, le KDQoL version courte (Kidney Disease Quality of Life) pour les dialysés et le ReTransQol V2 (RTQ V2) pour les patients greffés. L'évolution des scores a été mesurée au moyen d'analyses multivariées, du calcul d'un score de propension et de pondération afin de prendre en compte les différences de profil des patients entre les périodes d'enquêtes. Résultats : la QDV s'est légèrement dégradée entre 2005-2007 et 2011, et ce quel que soit le questionnaire utilisé (générique ou spécifique). Il n'y a cependant que peu de dimensions affectées, avec 2 ou 3 domaines

par outil de mesure. Pour le MOS SF36, ce sont les dimensions "santé générale", "douleurs physiques" et "vie et relation avec les autres" qui diminuent de manière significative (-3,2, - 3,7 et - 3,8 points). Pour les questionnaires spécifiques, la dimension "traitement" du RTQ V2 est la plus affectée (-2,5 points), ainsi que la dimension "symptôme/problèmes" du KDQoL (-2,4 points). La variation des scores de QDV est peu significative dans l'ensemble, allant de - 1,6 à - 3,8 points pour la plus forte baisse, selon les méthodes statistiques utilisées. Cette diminution reste toujours inférieure au seuil des 5 points considéré comme cliniquement signifiant. Conclusion : la QDV chez les patients dialysés ou greffés s'est légèrement dégradée entre 2005-2007 et 2011, sans significativité au plan clinique.

Bechade, C. (2017). Etude du parcours de soins du patient insuffisant rénal chronique : voies d'optimisation des phases de transition. Caen Université de Caen Normandie, Université de Cean Normandie. Caen. FRA. **Thèse de doctorat ; Université de Caen Normandie:** 154, tab., graph., fig.
https://tel.archives-ouvertes.fr/tel-01593460/document

Les phases de transitions entre les différentes stratégies de prise en charge de l'insuffisance rénale chronique terminale peuvent être associées à une augmentation de la morbidité et de la mortalité lorsqu'elles ne sont pas anticipées. Il faut donc pouvoir définir des trajectoires de patient et faire en sorte de maîtriser les changements d'état afin d'améliorer la prise en charge du patient insuffisant rénal chronique. Cela ne peut être atteint sans une phase exploratoire préalable visant à étudier les phases de transition du parcours de soins intégrés. L'objectif de ce travail était donc d'étudier trois transitions présentes dans le parcours de soins du patient atteint d'insuffisance rénale chronique.

Bechade, C., Daireaux, G., Henri, P., et al. (2014). "[Who is the physician in charge with the primary care of the dialysis patients?]." Nephrol Ther **10**(2): 106-111.

INTRODUCTION: The role played by nephrologists in hemodialysis patients' primary care is not well known. We hypothesized that primary care are provided by nephrologists and not by general practitioners for most of these patients. The aim of this study was to estimate the rate of hemodialysis patients having a nephrologist as primary care provider, and to determine which factors were associated with non-resort to a general practitioner for primary care. METHODS: Patients older than 18 years treated by hemodialysis for more than 3 months in the Calvados district were included and were interviewed with a standardized questionnaire. A log-binomial regression was used to study factors associated with non-resort to a general practitioner for primary care. RESULTS: Only 26% of patients had a general practitioner involved in the primary care; whereas 47% considered that nephrologists were the physician in charge of the primary care. Time spent in hemodialysis was associated with non-resort to a general practitioner, while patients living in nursing home were more likely to have regularly a regular follow up by a general practitioner. Dialysis center was a factor associated with the general practitioner as a primary care provider. CONCLUSION: Primary care of the hemodialysis patient is provided by nephrologists.

Belenfant, X. (2009). "Dossier : insuffisance rénale chronique." Concours Medical **131**(19): 757-773, tabl., graph.

[BDSP. Notice produite par ORSRA BR0xBJ87. Diffusion soumise à autorisation]. Ce dossier aborde plusieurs aspects de l'insuffisance rénale chronique : son épidémiologie (facteurs de risque), l'offre de soins néphrologiques en France, le coût de la prise en charge, la prise en charge coordonnée dans le réseau Tircel (région lyonnaise), le dépistage de l'insuffisance rénale chronique, son suivi et son traitement.

Bourel, M. et Ardaillou, R. (2004). "[Prevention and screening of chronic renal failure]." Bull Acad Natl Med **188**(8): 1455-1468.

Chronic renal failure represents a major problem of public health. Incidence for patients arrived at the terminal stage of the disease is in France 126.4/million inhabitants and the cost of medical care reaches 2 % of the expenses of the National Health Insurance. The progression of the disease is divided into 5 stages that are defined by the level of creatinine clearance from the stage of renal diseases with a normal renal function (clearance>90 ml/min) to the terminal stage (clearance <15 ml/min). Prevalence of patients at this ultimate stage is around 50,000. Prevalence for the totality of patients with a renal disease is evaluated between 2 and 3 millions. Renal diseases must be screened because they are silent and because an early pre-dialysis nephrological care allows renal replacement therapy to be delayed and the number of cardiovascular accidents to be diminished. Screening must be performed in the high-risk populations, essentially patients with diabetes, hypertension, coronary ischemia, renal tract diseases and all subjects treated with drugs toxic for the kidneys. Screening in the total population seems inadequate because of a high cost to benefit ratio. Screening is based on testing for the presence of proteinuria, quantifying the number of formed elements and plasma creatinine determination, the latter allowing, together with age and weight, glomerular filtration rate to be evaluated according to Cockcroft's formula. Prevention of renal diseases in the whole population necessitates the same life style as that recommended for prevention of cardiac and metabolic diseases. In the high-risk populations, one must control glycemia, blood pressure and cholesterol plasma level. In patients that have been already screened, renal function decay has to be slowed down by blocking the renin angiotensin system with converting enzyme inhibitors, controlling plasma cholesterol with statins and diminishing dietary proteins. In the light of these various data, the National Academy of medicine recommends: 1 - in the field of public health, to extend to the whole country the registries containing data on patients with terminal chronic renal failure, to support the creation of medical networks for the screening of renal diseases, to vaccine the patients against hepatitis B, flue and pneumococcal infections and to verify whether a low birth weight is associated with a greater risk of renal diseases in adulthood; 2 - in the field of teaching and research, to stop the decrease in the number of nephrologists, to promote research in genetics, to evaluate the efficacy of antifibrosis drugs and the possible renal toxicity of all new drugs.

Bourel, M. et Ardaillou, R. (2004). "Prévention et dépistage de l'insuffisance rénale chronique." Bulletin De L'academie Nationale De Medecine **188**(8): 1455-1468.

[BDSP. Notice produite par INIST-CNRS R0xh0d4X. Diffusion soumise à autorisation]. L'insuffisance rénale chronique représente un problème majeur de santé publique. L'incidence des patients arrivés au stade ultime de la maladie est en France de 126,4/million d'habitants et le coût des soins correspond à 2% du total des dépenses de l'assurance maladie. L'évolution de la maladie passe par 5 phases définies par le niveau de la clairance de la créatinine depuis la néphropathie sans insuffisance rénale (clairance>90 ml/min) jusqu'à l'insuffisance rénale au stade terminal (clairance<15 ml/min). La prévalence des malades à ce dernier stade est de 50 000 environ. La prévalence globale des maladies rénales serait de 2 à 3 millions. Les maladies rénales doivent être dépistées parce qu'elles sont silencieuses et qu'un traitement précoce retarde la mise en route des traitements substitutifs et diminue les risques d'accidents cardiovasculaires. Le dépistage doit cibler la population à risques, c'est-à-dire les malades atteints de diabète, hypertension artérielle, ischémie coronarienne, uropathies, maladies auto-immunes et ceux traités par des médicaments néphrotoxiques. Le dépistage de l'ensemble de la population serait d'un coût disproportionné par rapport au bénéfice attendu. La mise en place de réseaux de soins assure le meilleur dépistage en diffusant l'information et coordonnant l'activité des spécialistes et des généralistes. Ce dépistage est basé essentiellement sur la recherche de la protéinurie, l'examen du sédiment urinaire et le dosage de la créatininémie, ce dernier permettant avec l'âge et le poids d'évaluer la filtration glomérulaire en utilisant la formule de Cockcroft. Prévenir les maladies rénales réclame de l'ensemble de la population le style de vie déjà conseillé pour prévenir les maladies cardiovasculaires. Chez les sujets à risque, il faut particulièrement contrôler la pression artérielle, la glycémie et la cholestérolémie. Chez les malades déjà dépistés, il faut pour freiner l'évolution, bloquer le système rénine-angiotensine par des inhibiteurs de l'enzyme de conversion, utiliser les statines pour contrôler la cholestérolémie et restreindre le régime en protéines. Au vu de ces éléments, l'Académie Nationale de Médecine propose les mesures suivantes : 1 - dans le domaine de la santé publique, étendre à toute la France les registres regroupant les malades en phase ultime, encourager la création de réseaux de dépistage et soins, vacciner les malades contre l'hépatite B, la grippe et les affections à pneumocoque et vérifier si les sujets hypotrophiques à la naissance sont plus particulièrement atteints ; 2 - dans le domaine de l'enseignement et de la recherche, enrayer la diminution du nombre de néphrologues, encourager les études génétiques, évaluer l'efficacité des médicaments anti-fibrosants et les effets toxiques possibles des nouveaux médicaments.

Bournot, M. C., Cercier, E., Tallec, A., et al. (2012). Les médecins généralistes des Pays de la Loire face à la maladie rénale chronique. Panel en médecine générale - 2010-2012 - Pays de la Loire; 3. Nantes ORS Pays de la Loire**:** 4 , fig.
http://www.santepaysdelaloire.com/ors/sites/ors/files/publications/PanelMG/2012_3_malrenale_panel2mgpdl.pdf

[BDSP. Notice produite par ORSRA rpB7mR0x. Diffusion soumise à autorisation]. Les données présentées dans ce document ont été recueillies début 2011 auprès d'un échantillon représentatif des médecins généralistes (hors mode d'exercice particulier) des Pays de la Loire. Ces 450 médecins ligériens font partie du Panel d'observation des pratiques et des conditions d'exercice qui compte au total plus de 2 600 médecins et associe un échantillon national (France métropolitaine) et 3 échantillons régionaux (Bourgogne, Pays de la Loire et Provence-Alpes-Côte d'Azur). Les médecins généralistes jouent un rôle central dans le dépistage et la prise en charge précoce de la maladie rénale chronique, qui touche environ 1 adulte sur 10, et notamment les personnes atteintes de diabète ou d'hypertension artérielle [1]. L'enquête met en évidence une collaboration plutôt satisfaisante avec les médecins néphrologues, mais une coordination avec les centres de dialyse qui pourrait être améliorée. Elle témoigne également de la difficulté pour certains praticiens de poser un diagnostic d'insuffisance rénale chronique, et des progrès qui restent à accomplir dans le partage des recommandations élaborées par la Haute autorité de santé.

Bouvier, N., Durand, P. Y., Testa, A., et al. (2009). "Regional discrepancies in peritoneal dialysis utilization in France: the role of the nephrologist's opinion about peritoneal dialysis." Nephrol Dial Transplant **24**(4): 1293-1297.

BACKGROUND: Peritoneal dialysis (PD) is underused in France compared with other countries. In addition, there are tremendous regional discrepancies concerning the utilization rate of PD. This study was carried out to evaluate the opinion of French nephrologists regarding the optimal rate of PD utilization and to determine which factors limit PD development in France. METHODS: Of the 22 French regions, 2 regions with a high rate of PD utilization (prevalence >15%) and 3 regions with a low rate of PD utilization (prevalence <10%) were selected. In June 2007, nephrologists from the five regions were surveyed by questionnaire. Responses were compared between 'low-prevalence' and 'high-prevalence' groups. RESULTS: The response rate was 70% and there was no significant difference between the two groups regarding the response rate. In the two groups, a majority of nephrologists were in charge of PD patients (30/34 in 'high-prevalence' group versus 61/80 in 'low-prevalence' group, P = 0.14). Information about PD in the predialysis clinics was provided by nephrologists from high- and low-prevalence regions (32/34 versus 65/80, P = 0.08). Opinions on the optimal rate of PD for prevalent and incident dialysis patients were significantly different between 'high-prevalence' and 'low-prevalence' groups [31 +/- 15% versus 25 +/- 14% (P < 0.03) and 25 +/- 14% versus 19 +/- 9% (P < 0.02)]. There was a significant difference concerning the optimal rate of PD in incident dialysis patients between nephrologists working in public centres (29 +/- 15%), those working in non- profit clinics (27 +/- 12%) and nephrologists working in the private sector (14 +/- 8%). Lack of nurses available for the patient care (48%), low reimbursement of PD (25%), limited training (23%) and hospital care facilities (23%) were the main barriers limiting PD utilization. CONCLUSIONS: In France, like in other countries, there are factors limiting PD development; however, regional discrepancies regarding PD utilization seem to be linked to the nephrologist's opinion.

Brechat, P.-H., Wang, J., Galland, A., et al. (2009). "Globalisation : l'impact sur la prise en charge des soins. L'exemple de la dialyse des insuffisants rénaux terminaux." Gestions Hospitalieres(483): 92-98.

[BDSP. Notice produite par EHESP DR0x9Hr9. Diffusion soumise à autorisation]. La dialyse des patients insuffisants rénaux terminaux peut être un exemple de la globalisation des soins - venue de capitaux et de matériels en France, ingénieurs français recrutés hors des frontières..., modifiant des équilibres nationaux et régionaux. L'un des risques est une augmentation des inégalités d'accès à ces soins si la concurrence entre entreprises étrangères leaders industriels du marché et établissements de santé publics, privés et associatifs nationaux n'est pas organisée et si les tarifs de la dialyse diminuent. Des propositions sont faites pour favoriser le maintien d'offres, notamment dans des régions déficitaires.

Caillette-Beaudoin, A., Grangier, J.-P., Huguet, G., et al. (2014). "La télésurveillance en dialyse péritonéale." Gestions Hospitalieres(534): 141-142.

> [BDSP. Notice produite par EHESP R0xpBD8k. Diffusion soumise à autorisation]. Calydial, établissement de santé lyonnais, s'est lancé dans le développement d'un programme de télémédecine sur tous ses domaines d'activité autorisés : dialyse péritonéale, hémodialyse et insuffisance rénale chronique non dialysée. Convaincu que la coconstruction joue un rôle majeur dans la création de solutions innovantes, Calydial participe à un "living lab" pour le développement de la télésurveillance en dialyse péritonéale.

Caillette-Beaudoin, A., Zaoui, P., Colin, C., et al. (2016). "Évaluation de l'efficacité d'un télésuivi à domicile de patients insuffisants rénaux chroniques, stade 3 et 4, sur la fréquence d'événements porteurs de risques et la progression de la maladie rénale chronique." European Research in Telemedicine / La Recherche Européenne en Télémédecine **5**(4): 119-135.
http://www.sciencedirect.com/science/article/pii/S2212764X16300334

> Avec une prévalence estimée à 3 millions de personnes en France, soit 5 % de la population, la maladie rénale chronique est un réel enjeu de santé publique. Elle est en progression constante en rapport avec le vieillissement de la population et l'augmentation des pathologies cardiovasculaires et diabétiques. Dans sa forme la plus évoluée, au stade terminal, la maladie rénale chronique nécessite le recours à la dialyse et la transplantation. Elle mobilise alors une part non négligeable des dépenses de santé (environ 2 %), soit 2 milliards d'euros. En 2014, près de 80 000 patients étaient traités en France par épuration extrarénale : 56 % par dialyse (hémodialyse et dialyse péritonéale) et 44 % par greffe rénale. Avant ce stade, les recommandations de la Haute Autorité en santé et de la Société française de néphrologie dialyse et transplantation mettent l'accent sur l'information du patient et l'intérêt d'une prise en charge pluriprofessionnelle intégrée, planifiée, basée sur les preuves et plaçant le patient au centre d'un dispositif de prise en charge et de surveillance. C'est à ce niveau que la télémédecine prend toute son importance avec le développement de la télésurveillance à domicile. En permettant la collecte et l'analyse rapide de paramètres cliniques et biologiques simples, elle renforce la surveillance et le suivi des patients à haut risque cardiovasculaire, traités par blocage du système rénine angiotensine, traitement de référence dans le cadre d'une néphroprotection. Cette étude compare deux modes de suivi des patients insuffisants rénaux chroniques, stades 3 et 4 : l'un appelé « télésuivi », incluant la télésurveillance à domicile et l'autre appelé « suivi conventionnel », relevant des recommandations actuelles faites par la Haute Autorité en santé. Notre hypothèse : la télésurveillance à domicile de patients insuffisants rénaux chroniques stades 3 et 4 améliorerait la sécurité des soins en intensifiant la surveillance des patients à haut risque. Par ailleurs, elle contribuerait à une plus grande satisfaction concernant leur prise en charge et à terme contribuerait au ralentissement de l'évolution de la maladie rénale.

Couchoud, C., Couillerot, A. L., Dantony, E., et al. (2015). "Economic impact of a modification of the treatment trajectories of patients with end-stage renal disease." Nephrol Dial Transplant **30**(12): 2054-2068.

> BACKGROUND: This study assumed that some patients currently treated at hospital-based haemodialysis centres can be treated with another renal replacement therapy (RRT) modality without any increase in mortality risk and sought to evaluate the monthly cost impact of replacing hospital-based haemodialysis, for which fees are highest, by different proportions of other modalities. METHODS: We used a deterministic model tool to predict the outcomes and trajectories of hypothetical cohorts of incident adult end-stage renal disease (ESRD) patients for 15 years of RRT (10 different modalities). Our estimates were based on data from 67 258 patients in the REIN registry and 65 662 patients in the French national health insurance information system. Patients were categorized into six subcohorts, stratified for age and diabetes at ESRD onset, and analyses run for each subcohort. We simulated new strategies of care by changing any or all of the following: initial distributions in treatment modalities, transition rates and some costs. Strategies were classified according to their monthly per-patient cost compared to current practices (cost-minimization analysis). RESULTS: Simulations of the status quo for the next 15 years predicted a per-patient monthly cost of euro2684 for a patient aged 18-45 years without diabetes and euro7361 for one older than 70 years with diabetes. All of the strategies we analysed had monthly per-patient costs lower than the status quo,

except for daily home HD. None impaired expected survival. Savings varied by strategy. CONCLUSIONS: Alternative strategies may well be less expensive than current practices. The decision to implement new strategies must nonetheless consider the number of patients concerned, feasibility of renal care reorganization, and investment costs. It must also take into account the role of patients' choice and the availability of professionals.

Chantrel, F., Lassalle, M., Couchoud, C., et al. (2010). "Démarrage d'un traitement par dialyse chronique en urgence. Quels patients ? Quelles conséquences ?" Bulletin Epidemiologique Hebdomadaire(9-10): 81-86.
http://www.invs.sante.fr/beh/2010/09_10/beh_09_10_2010.pdf

[BDSP. Notice produite par InVS 7m89nR0x. Diffusion soumise à autorisation]. Objectif - Décrire les caractéristiques et le devenir des patients démarrant le traitement par dialyse pour insuffisance rénale chronique terminale dans un contexte d'urgence. Méthodes - À partir du registre du Réseau épidémiologie et information en néphrologie (Rein), ont été inclus les 5 921 patients ayant démarré un traitement de suppléance par dialyse en 2006 dans 15 régions administratives. La notion de prise en charge en urgence est définie par une première séance de dialyse réalisée immédiatement après une évaluation par un néphrologue en raison d'un risque vital. Les caractéristiques cliniques et biologiques initiales des patients, les probabilités de survie et d'accès à la liste nationale d'attente de transplantation rénale sont comparées selon le type de prise en charge. Le seuil pour les intervalles de confiance est fixé à 95%. Résultats - Un traitement de suppléance a été réalisé de manière programmée pour 73,6% des patients et en urgence pour 26,4%. Les comorbidités et handicaps sont plus fréquents en cas de démarrage en urgence, tandis que l'inscription sur liste de transplantation, le recours à l'érythropoïétine (EPO), la création d'un abord vasculaire sont plus rares. Il apparaît que 93,9% des patients démarrant en urgence sont en hémodialyse en centre lourd, alors que 25,2% des patients, en cas de dialyse programmée, sont en hémodialyse hors centre ou en dialyse péritonéale à domicile. Les taux de survie à 3 et 12 mois sont respectivement de 95,9% [95,3-96,5] et 87,4% [86,3-88,3] pour les suppléances programmées et de 88,0% [86,3-89,5] et 74,2% [72,0-76,3] pour celles réalisées en urgence. Alors que 8,4% des dialyses programmées se font chez des patients déjà inscrits sur la liste et que 30,8% le sont 12 mois après le démarrage, seuls 22,1% des patients ayant démarré en urgence sont inscrits à 12 mois. Conclusion - Le démarrage de la dialyse en urgence est associé à des résultats défavorables. Il semble consécutif à un faisceau de causes médicales, mais aussi socio-économiques et organisationnelles. Ces résultats plaident pour l'élaboration d'un programme médical garantissant la continuité des soins. (R.A.).

Charpentier, B., Francois, H., Beaudreuil, S., et al. (2013). "Une coordination des soins nécessaires mais parfois compliquée : exemple de l'insuffisance rénale chronique." Bulletin De L'academie Nationale De Medecine **197**(8): 1523-1530.
http://www.academie-medecine.fr/wp-content/uploads/2013/03/2013.8.pdf

Le développement des moyens diagnostiques et thérapeutiques, la spécialisation des activités médicales, la complexité croissante des prises en charge, rendent de plus en plus nécessaire la coordination des soins, notamment dans le domaine du suivi thérapeutique. Les prescriptions émanent de plus en plus, non seulement du médecin généraliste coordinateur, que des multiples spécialistes et des Services hospitaliers ou des Cliniques. La difficulté réside donc dans la centralisation des informations seule garante d'une stratégie cohérente. Il n'existe aucun outil qui permette à chaque prescripteur d'avoir connaissance des autres traitements ordonnés. Le pharmacien dispensateur se trouve isolé du prescripteur même s'il bénéficie du dossier pharmaceutique du malade qui lui permet d'identifier seulement les traitements effectivement délivrés. La situation est particulièrement délicate pour les prescriptions multiples des personnes âgées, relevant des poly-pathologies mais aussi des difficultés intellectuelles et mnésiques propres à ces patients. La coordination des soins entre les acteurs de santé est l'objet de cette séance qui se déroulera en trois étapes : un exposé liminaire illustré par des exemples et incluant les associations de patients ; celles-ci sont souvent nées de la nécessité d'une information qui n'est pas suffisamment dispensée et, à la condition qu'elles ne se transforment pas en machine de revendications excessives, doivent être encouragées parce qu'elles constituent un lien indispensable entre soignants et soignés ; les difficultés propres à certaines affections : diabète, asthme, dermatite atopique ou à certains traitements : anti-cancéreux, anti-vitamines K, à certaines populations (sujets âgés) ou à certaines circonstances à risques (passage de l'hôpital à la ville, etc.) ; — enfin un message aux acteurs administratifs et politiques au moment où va être discutée une nouvelle loi relative à la santé publique.

Cnamts (2005). Enquête Nationale Schéma Régional d'Organisation Sanitaire de l'Insuffisance Rénale Chronique Terminale (SROS/IRCT) - juin 2003 : Volet dépenses. Paris Cnamts**:** 62, tabl.

L'enquête Schéma régional d'organisation sanitaire de l'insuffisance rénale chronique terminale (enquête SROS IRCT) a été réalisée dans toutes les structures, publiques et privées, pratiquant la dialyse, la semaine du 2 au 8 juin 2003. Cette enquête, réalisée par la CNAMTS en collaboration avec la Direction de l'hospitalisation et de l'organisation des soins (DHOS) du ministère de la Santé, comprend 3 volets. Ce document présente le volet " Dépenses " qui étudie les remboursements du régime général reçus par les patients dialysés. Deux autres publications complètent l'enquête : le volet " Patients " qui évalue pour la première fois la prévalence de l'IRCT traitée par dialyse, analyse les caractéristiques socio-démographiques et cliniques des patients dialysés ainsi que leur répartition dans les différentes modalités de prise en charge et le volet " Structures " qui décrit les moyens dont disposaient les structures pratiquant la dialyse et apprécie la situation existante au regard des nouveaux textes.

Cnamts (2010). L'insuffisance rénale chronique : situation actuelle et enjeux, Paris : Cnamts
http://www.ameli.fr/fileadmin/user_upload/documents/DP_Insuffisance_renale_chronique.pdf

Cette étude inédite de l'Assurance Maladie propose des informations sur les modalités de prise en charge de l'insuffisance rénale chronique, sur les caractéristiques des 61 000 patients concernés et sur les coûts de traitement.

Couchoud, C., Bayat, S., Villar, E., et al. (2012). "A new approach for measuring gender disparity in access to renal transplantation waiting lists." Transplantation **94**(5): 513-519.

BACKGROUND: Gender inequity in access to renal transplantation waiting lists, in favor of men, has long since been demonstrated in a number of studies. Discrepancies between the results of the available studies might be explained by different analytical approaches or different national contexts. In this study we analyzed French end-stage renal disease registry data using a novel model to determine whether the female gender is associated with a lower probability of being listed on the transplant waiting list or with a longer time from dialysis start until registration, or both. METHODS: The effect of gender on access to the national renal transplantation waiting list was assessed in 9497 men and 5386 women aged 18 to 74 years who started dialysis between 2002 and 2009. We used a semiparametric regression cure model adjusted for age, work status, and 11 comorbidities or disabilities. RESULTS: Women were younger and less likely to work or have associated comorbidities. At the study endpoint, 33.8% of the men and 34.1% of the women were placed on the renal transplantation waiting list. After taking potential confounders into account, our model shows that women demonstrated a lower probability of being registered on the national transplant waiting list (odds ratio=0.69; 95% confidence interval, 0.62-0.78) and a longer time from dialysis start to registration (hazard ratio=0.89; 95% confidence interval, 0.84-0.95) than men. This disparity affects predominantly older women who do not work or have diabetes and is more pronounced in some geographic areas. CONCLUSIONS: These poorly understood gender-based inequities require further consideration.

Couchoud, C., Frimat, L., Aldigier, J. C., et al. (2005). "Incidence et évaluation des traitements de suppléance de l'insuffisance rénale chronique dans sept régions françaises en 2003." Bulletin Epidemiologique Hebdomadaire(37-38): 188-190, 183 tabl., 182 fig.

[BDSP. Notice produite par InVS 99LaYR0x. Diffusion soumise à autorisation]. Dans le cadre des nouvelles modalités de régulation de l'activité de traitement de l'insuffisance rénale chronique (Décrets nos 2002-1197 et 2002-1198 de septembre 2002) et des priorités de la loi de santé publique de 2004, le registre du Réseau épidémiologie et information en néphrologie (Rein) a deux objectifs essentiels : estimer et prévoir les besoins de la population en matière de dialyse et de greffe rénale de façon continue, et évaluer la prise en charge des malades. En 2003, l'enquête nationale Sros-IRCT a permis de déterminer la prévalence de la dialyse en France, sur la base d'indicateurs définis en commun avec le Rein. Dans le présent article, l'incidence des traitements de suppléance de l'insuffisance rénale chronique, l'état des patients et leur prise en charge à l'initiation de la dialyse ainsi que les taux de greffe et de survie à un an sont décrits à partir des données de sept régions ayant contribué au Rein en 2003 : Auvergne, Bretagne, Champagne-Ardenne, Languedoc-Roussillon, Limousin, Lorraine, Rhône-Alpes. (Extrait introduction).

Couchoud, C., Villar, E., Frimat, L., et al. (2008). "L'insuffisance rénale chronique terminale associée à un diabète : fréquence et conditions d'initiation du traitement de suppléance, France, 2006." Bulletin Epidemiologique Hebdomadaire(43): 414-418.
http://www.invs.sante.fr/beh/2008/43/beh_43_2008.pdf

[BDSP. Notice produite par InVS pqpR0xo7. Diffusion soumise à autorisation]. Objectif - Estimer l'incidence 2006 de l'insuffisance rénale chronique terminale (IRCT) liée au diabète en France, et décrire les caractéristiques à l'initiation du traitement de suppléance chez les diabétiques. Méthodes - L'incidence 2006 de l'IRCT liée au diabète a été estimée dans 16 régions à partir des données du registre Rein. L'incidence de l'IRCT chez les diabétiques a été estimée en rapportant les effectifs attendus d'IRCT liée au diabète à la prévalence du diabète traité pharmacologiquement. Résultats - Parmi les 6 438 nouveaux patients en IRCT en 2006 dans 16 régions, 2 262 (35%) étaient diabétiques : 261 de type 1 (12%) et 1 897 (84%) de type 2. L'incidence de l'IRCT liée au diabète était estimée à 48 par million d'habitants et 126 pour 100 000 personnes diabétiques. Comparées aux personnes en IRCT sans diabète, celles ayant un diabète avaient davantage de comorbidités cardiovasculaires. Elles avaient démarré plus précocement le traitement de suppléance et plus souvent dans un contexte d'urgence pour celles ayant un diabète de type 2. Conclusion - Chaque année environ 3 000 personnes diabétiques débutent une dialyse et ce chiffre devrait continuer à croître dans les années à venir. Cette étude souligne l'importance d'organiser une prise en charge néphrologique précoce et adaptée. (R.A.).

Dany, L. (2011). "Quand le traitement se fait maladie. Commentaire." Sciences Sociales Et Sante **29**(3): 75-80.

[BDSP. Notice produite par ORSMIP lrJsR0xq. Diffusion soumise à autorisation]. L'analyse présentée dans ce commentaire repose sur l'idée que le traitement de l'insuffisance rénale terminale se substituerait à la pathologie elle-même pour la définir. En ce sens, l'hémodialyse serait une maladie. Ce commentaire fait suite à un article de ce même numéro de Sciences sociales et santé "" L'hémodialyse, cette maladie ". Approche anthropologique d'un amalgame" (p. 41-73).

Daudelin, G., Lehoux, P. et Sicotte, C. (2008). "La recomposition des patients et des pratiques médicales en télénéphrologie. Les présences décalées." Sciences Sociales Et Sante **26**(3): 81-104.

La télémédecine apparaît comme un moyen séduisant de rendre présents les uns aux autres, patients et spécialistes. Toutefois, si les acteurs peuvent mobiliser les technologies dans des projets cliniques spécifiques, les technologies leur imposent leurs propres possibilités et limites et, ce faisant, agissent sur eux, recomposant les pratiques médicales d?une manière potentiellement problématique. La reconstitution des patients et des pratiques médicales par les technologies de l?information et de communication est au centre de l?analyse d?un cas de télénéphrologie. Elle montre comment l?introduction de technologies peut être lourde de possibles, parfois incompatibles avec les projets de ses acteurs, ce qui pourrait expliquer la sous-utilisation de ces technologies.

Daugas, E., Dussol, B., Henri, P., et al. (2012). "[Prepare: cross-sectional study on management of chronic kidney disease by nephrologists before dialysis in France]." Nephrol Ther **8**(6): 439-450.

There are few epidemiologic data on Chronic Kidney Disease management before replacement therapy. The two objectives of the PREPARE study were (1) to describe the characteristics of these patients and accordance to clinical practice guidelines (2) to study nephrologists preference for renal replacement therapy in case of progression to end stage renal disease. PREPARE is a non-interventional cross-sectional study. All the French nephrologists had been solicited to collect information about CKD outpatients not on dialysis, not transplanted, with glomerular filtration rate

> lower than 60mL/min/1,73m(2), followed on any day between 23 and 27 November 2009. Three hundred and eight investigators included 2089 patients, 59% of them were male, they were on average 69 years old, 15, 37 and 48% had respectively a CKD stage V, stage IV and stage III, the nephropathy was the most often (43%) vascular. The most frequently reported cardiovascular risk factors were hypertension (88%), hypercholesterolemia (53%), diabetes (37%). The average time between diagnosis of nephropathy and the first nephrology consultation was too long 1,5 years. The implementation measures of nephroprotection and treatment of complications of CKD were generally satisfactory. However, preparation for replacement therapy was often too late, haemodialysis was more likely scheduled instead of peritoneal dialysis and without preparation for renal transplantation. PREPARE can therefore highlight the qualities of the current management of CKD by nephrologists in France. Nevertheless, PREPARE also shows weaknesses in preparation for replacement therapy. One can suggest that they could be reduced by systematic access of patients with risk of progression to stage V, as soon as the stage IV, to structured multidisciplinary care.

Dunbavand, A., Cohen, S., Tuppin, P., et al. (2001). "Disparités régionales de l'offre et de la demande de greffons rénaux en 1998 : influence des flux de patients sur la pénurie." Bulletin Epidemiologique Hebdomadaire(4): 13-15, carte.

> [BDSP. Notice produite par ENSP R0xAP6l6. Diffusion soumise à autorisation]. L'insuffisance chronique terminale est un problème de santé publique. Il existe une thérapeutique curative et considérablement moins coûteuse que la dialyse, la greffe qui, limitée par l'offre de greffons, pose le problème de l'allocation d'une ressource rare. En 1998,993 donneurs décédés en état de mort encéphalique ont été prélevés permettant de mettre à disposition des équipes de greffe 1 919 greffons rénaux. Au cours de la même année 1 883 greffes rénales ont effectivement été réalisées dont 73 greffes à partir de donneurs vivants. En regard de cette offre et de cette activité, 4 506 patients restaient inscrits sur la LNA au 31/12/1998. Il existe donc une inadéquation entre l'offre de greffons rénaux et les besoins exprimés. Une des principales causes de cette pénurie est le faible taux de donneurs prélevés en France. En France, la demande d'une autorisation de prélèvement d'organes ou de tissus par un centre hospitalier ne dépend que de sa propre volonté. Fin 1999,219 établissements dans 76 départements, sont autorisés à prélever des organes et des tissus, mais dans 22 départements français aucun établissement n'y est autorisé. Et parmi les 76 départements possédant au moins un établissement autorisé, 20 (25%) n'ont pratiqué aucun prélèvement en 1999. Ce document décrit dans chaque région, l'offre et les besoins de greffons rénaux et l'influence des flux des patients sur la pénurie afin de permettre aux décideurs de lutter contre cette pénurie dans leur région.

Foglia, S. et Université de Nice Sophia Antipolis. Nice, F. R. A. c. (2007). Prise en charge de l'insuffisance rénale chronique modérée chez le patient diabétique de type 2 et/ou hypertendu en médecine générale. **Thèse pour le diplôme d'état de docteur en médecine.:** 86p.

Gentile, S., Boini, S., Germain, L., et al. (2010). "Qualité de vie des patients dialysés et transplantés rénaux : résultats de deux enquêtes multirégionales, France." Bulletin Epidemiologique Hebdomadaire(9-10): 92-96.
http://www.invs.sante.fr/beh/2010/09_10/beh_09_10_2010.pdf

> [BDSP. Notice produite par InVS B8rR0x97. Diffusion soumise à autorisation]. Objectif - Estimer le niveau de qualité vie (QV) des patients atteints d'insuffisance rénale chronique terminale (dialysés ou transplantés) et identifier les facteurs associés. Méthodes - Deux études transversales ont été menées en 2005 et 2007 auprès des patients de plus de 18 ans, suivis dans une des huit régions du Réseau épidémiologie et information en néphrologie (Rein) de 2005, respectivement dialysés et greffés. Les patients ont été tirés au sort après stratification sur l'âge et la région. La QV a été mesurée avec le MOS-SF36 et un questionnaire spécifique, le KDQOL (Kidney Disease Quality of Life) chez les patients dialysés, le ReTransQol chez les transplantés, et comparée à celle de la population générale. Résultats - 832 patients dialysés et 1 061 transplantés ont été inclus, avec une participation respective de 67,1% et 72,5%. Les scores de QV étaient plus élevés (de 10 à 30,6 points) chez les greffés que chez les dialysés sur toutes les dimensions du SF-36. Les principaux facteurs associés étaient le sexe, l'âge, la durée de dialyse et la présence de comorbidités. Chez les greffés, les effets secondaires des traitements avaient un effet délétère marqué. Conclusion - Les différences de qualité de vie entre

dialysés et greffés en comparaison à la population générale objectivent le bénéfice de la greffe rénale. Les facteurs associés permettent de proposer des pistes d'amélioration. (R.A.).

HAS (2009). Les conditions de mise en oeuvre de la télémédecine en unité de dialyse médicalisée. Evaluation des programmes et politiques de santé publique. Saint-Denis : HAS**:** 177.
http://www.has-sante.fr/portail/upload/docs/application/pdf/2010-01/argumentaire_conditions_telemedecine_udm_vf.pdf

[BDSP. Notice produite par HAS R0xEJHFF. Diffusion soumise à autorisation]. Le contexte dans lequel s'inscrit cette demande est caractérisé par l'augmentation continue du nombre de patients en insuffisance rénale chronique terminale traités par épuration extrarénale et la volonté de procéder à un déploiement opérationnel de la télémédecine dans la restructuration de l'offre de soins. La HAS décrit dans ses recommandations l'ensemble des conditions de mise en oeuvre de la télémédecine dans le fonctionnement d'une UDM permettant de garantir la qualité des soins et la sécurité de la prise en charge : modèle organisationnel lié à la télédialyse, modalités d'organisation et d'implantation des UDM, organisation des soins par télémédecine et procédures face aux urgences, aspects techniques du système de télédialyse, aspects économiques, juridiques, déontologiques. Un cadre global pour l'évaluation des projets pilotes est également proposé. Ces recommandations pourront servir de support à la mise en place de projets pilotes autorisés par les agences régionales de santé. Elles pourront également évoluer en fonction de la définition du cadre réglementaire d'exercice de la télémédecine, des retours d'expériences et de l'élargissement du champ de développement de la télémédecine aux autres modalités de traitement de l'insuffisance rénale chronique terminale.

Hoelt, B. et Montagnier, B. (2004). "Dialyse rénale : analyse comparative entre malades diabétiques et non diabétiques (Alsace, 2002)." Revue Medicale De L'assurance Maladie(3): 157-165.

[BDSP. Notice produite par CNAMTS sYKR0x7x. Diffusion soumise à autorisation]. A partir d'une recherche rétrospective des modalités du suivi avant dialyse pour les patients dialysés depuis moins d'un an, cette étude a suivi deux objectifs : - déterminer et comparer les caractéristiques et les modalités d'épuration extra-rénale des malades dialysés diabétiques et non diabétiques, - comparer les modalités d'orientation vers le néphrologue de ces deux populations avant le stade terminal nécessitant la mise en dialyse.

Hogan, J., Savoye, E., Macher, M. A., et al. (2014). "Rapid access to renal transplant waiting list in children: impact of patient and centre characteristics in France." Nephrol Dial Transplant **29**(10): 1973-1979.

BACKGROUND: Major inequalities in access to renal transplant waiting lists have been demonstrated among adult patients both in the USA and Europe. In this French nationwide study, we sought to ascertain the influence of patient and centre characteristics. METHODS: We included all children (<18 years) in the French End-Stage Renal Disease National Registry, who started renal replacement therapy (RRT) between 1 January 2002 and 31 December 2011. The primary outcome was the probability of being listed within 6 months after starting RRT. Hierarchical logistic regression models were used to study the association between the patient or the centre characteristics and the outcome. Centre effects were assessed by studying the centre-level residual variance. RESULTS: A total of 614 incident patients treated in 54 centres were included; 421 (68.6%) were listed within 6 months after starting RRT. A higher risk of not being listed was found in patients younger than 2 years or with a renal disease with a high risk of recurrence after transplantation [odds ratio (OR): 2.61; 95% confidence interval (CI): 1.37-4.97]. We found a significant vintage effect: the probability of not being listed decreased over time (OR per 1 year +0.83, 95% CI: 0.74-0.94). Although we found no significant gender effect, a trend towards disfavouring girls persisted over the study period. We found a significant centre effect that remained after adjusting for patient characteristics. However, none of the centre characteristics that we studied (centre size, pre-emptive transplantation program, paediatric versus adult centres and the proportion of patients on the waiting list placed on inactive status during the first month after listing) explained this variability. CONCLUSIONS: Our study confirms inequalities among children in rapid access to the renal transplant waiting list and shows that patient and centre characteristics play a role in these inequalities. Further studies focusing on the organization and practices of the centres are needed to explain the remaining variability.

Inserm (1998). Insuffisance rénale chronique. Etiologies, moyens de diagnostic précoce, prévention ?, Paris : Les Editions INSERM

> Cet ouvrage a été réalisé par un groupe pluridisciplinaire d'experts, réunis par l'INSERM à la demande du Haut Comité de la Santé Publique. Ce travail fait l'analyse des connaissances les plus récentes, des données cliniques et épidémiologiques, sur l'insuffisance rénale chronique et les principales atteintes rénales qui en sont la cause. Dans chaque chapitre, les auteurs, s'attachent à envisager des actions de santé permettant de freiner la progression vers l'insuffisance rénale terminale. En fin de rapport, la synthèse comporte des recommandations élaborées collectivement et des propositions en vue d'améliorer le diagnostic précoce et la prévention de l'insuffisance rénale chronique.

Jacquelinet, C., Ekong, E. et Labeeuw, M. (2010). "Évolution des modalités de traitement de suppléance de l'insuffisance rénale terminale en France entre 2005 et 2008." Bulletin Epidemiologique Hebdomadaire(9-10): 86-92.
http://www.invs.sante.fr/beh/2010/09_10/beh_09_10_2010.pdf

> [BDSP. Notice produite par InVS R0x9lk8H. Diffusion soumise à autorisation]. Ce travail s'intéresse à l'évolution effective des différentes modalités de traitement de l'insuffisance rénale, au regard des décrets de 2002 et des objectifs quantitatifs des Schémas régionaux d'organisation sanitaire modifiant l'organisation de la dialyse. Il décrit l'évolution des modalités de traitement et des caractéristiques des malades en traitement au 31 décembre de chaque année pour la période 2005-2008 dans l'une des 12 régions qui contribuaient au registre du Rein, avec des données exhaustives. Il donne aussi une image des flux entre modalités en détaillant l'état au 31 décembre 2005 et le devenir au 31 décembre 2007 des malades en traitement au 31 décembre 2006. Le nombre de patients traités pour insuffisance rénale terminale a augmenté annuellement de+4,7% pendant la période étudiée, avec une augmentation persistante du nombre de malades hémodialysés en centre, une stagnation du nombre de malades en dialyse péritonéale et une diminution des malades dialysés hors centre. On observe dans le même temps une montée en charge progressive des unités de dialyse médicalisée dont le développement se fait par redistribution des malades les moins sévères de l'hémodialyse en centre et des malades les plus lourds en dialyse hors centre. Le développement de la greffe rénale vient lui aussi limiter de manière positive l'expansion de la dialyse hors centre et de la dialyse péritonéale. Les caractéristiques des patients présents dans les différentes modalités de traitement vont dans le sens d'une adéquation macroscopique avec leur modalité de traitement. Cette étude suggère que les bilans qui seront tirés des volets Insuffisance rénale chronique des Schémas régionaux d'organisation sanitaire (SROS) mettront en évidence des décalages entre les objectifs quantitatifs attendus et ceux qui seront observés à l'horizon 2011. La planification sanitaire devra tenir compte de l'état des malades, de la réalité des transitions possibles d'une modalité à une autre et des perspectives en matière de greffe rénale. (R.A.).

Jacquelinet, C., Savoye, E., Kessler, M., et al. (2005). "Tendances et perspectives de la greffe rénale en France. Numéro thématique. L'insuffisance rénale chronique." Bulletin Epidemiologique Hebdomadaire(37-38): 191-192, 193 fig, 191 tabl.

> [BDSP. Notice produite par InVS XR0xHpZT. Diffusion soumise à autorisation]. La greffe rénale représente la majorité des greffes d'organe réalisées dans notre pays : 2 423 des 3 948 greffes réalisées en 2004 (61,4%). La greffe rénale est génératrice de qualité de vie et de quantité de vie. Entre une année de dialyse et une année de prise en charge d'un porteur de greffon fonctionnel, il existe un différentiel de coûts conséquent qui se cumule durant toute la vie du greffon : un greffon rénal supplémentaire représente au moins dix années de dialyse épargnées. La filière insuffisance rénale chronique terminale faisait partie des stratégies prioritaires de l'Établissement français des greffes (EFG) dès sa création, l'Agence de la biomédecine en reprend maintenant les missions. Des moyens sont dégagés en faveur du prélèvement chez les donneurs décédés et le cercle des donneurs vivants est élargi (Loi de bioéthique du 6 août 2004). Le bilan que l'on peut dresser aujourd'hui démontre l'efficacité de la stratégie établie en 1998 pour le prélèvement d'organes chez les donneurs décédés en mort encéphalique. L'année 2004 vient définitivement confirmer les tendances notées depuis 2002 : la mise en place du "plan greffe", avec un renforcement significatif des moyens et de

l'organisation du prélèvement, a permis d'atteindre un niveau d'activité jusqu'alors inégalé : 2 423 greffes en 2004 contre 1 629 en 1994 (+48,7%) à la création de l'EFG. Avec 164 greffes rénales issues de donneurs vivants, l'année 2004 atteint aussi un niveau historiquement le plus élevé, mais la part des donneurs vivants dans l'activité de greffe rénale reste réduite : 6,7%. L'augmentation régulière du nombre de greffes à partir de donneurs vivants, qui a plus que doublé depuis 1996, reste modeste au regard de la plupart des pays européens et des États-Unis. La survie du greffon continue de s'améliorer avec un effet cohorte significatif au profit des cohortes de malades greffés les plus récentes. (Inspiré introduction).

Joly, D. (2005). "Dialyse rénale chronique chez les personnes très âgées : Insuffisance rénale chronique chez le sujet âgé." Rev Prat **55**(20): 2255-2262.

La prise en charge décisionnelle et pratique de l'insuffisance rénale terminale après 80 ans est délicate du fait des fréquentes comorbidités et des troubles cognitifs des patients, et d'une espérance de vie réputée brève. Certains patients ne sont en effet pas dialysés et bénéficient d'un traitement "conservateur". La plupart cependant commencent un programme de dialyse chronique (hémodialyse ou dialyse péritonéale), offrant une prolongation substantielle de la durée de vie et une qualité de vie satisfaisante. Ces bons résultats doivent toutefois être améliorés la prise en charge néphrologique précoce et un soutien psychosocial actif devraient permettre de prendre les décisions thérapeutiques de façon sereine et d'améliorer les résultats de l'épuration extrarénale dans cette tranche d'âge.

Jungers, P., Joly, D., Nguyen-Khoa, T., et al. (2006). "Retard persistant au suivi néphrologique de l'insuffisance rénale chronique : Causes, conséquences et moyens d'amélioration." LA PRESSE MEDICALE **35**(1): 17-22.

Objectifs : Une prise en charge néphrologique tardive des patients atteints d'insuffisance rénale chronique (IRC) a de multiples conséquences défavorables. Nous avons cherché si une amélioration avait été observée au cours des années récentes en réponse aux efforts de sensibilisation à ce problème. Méthodes : Cette étude a porté sur la totalité des 1 391 patients atteints d'IRC ayant commencé la dialyse de suppléance à l'hôpital Necker entre 1989 et 2000. La proportion des patients ayant eu ou non un suivi néphrologique précoce (au moins 6 mois avant le début de la dialyse) a été déterminée au cours de 4 périodes triennales. Résultats : La fréquence d'un suivi néphrologique tardif (<6 mois) est restée inchangée et voisine de 30% au cours des 4 périodes triennales, y compris la période 1998-2000. Par comparaison avec la période initiale 1989-1991, une amélioration nette de la condition clinique et biologique des patients suivis précocement a été observée, alors qu'aucune amélioration n'a été notée chez les patients vus tardivement. Globalement, la prévalence d'une atteinte cardio-vasculaire majeure (infarctus myocardiaque ou cérébral, artérite, insuffisance cardiaque) a été près de 2 fois plus élevée chez les patients suivis moins de 6 mois et même 6-35 mois que chez ceux suivis 36 mois et plus, et la mortalité ultérieure en dialyse a suivi une évolution parallèle. L'analyse en modèle de Cox proportionnel a identifié la durée du suivi néphrologique comme facteur indépendant et significatif du risque de mortalité en dialyse. Conclusion : Une prise en charge néphrologique tardive de l'IRC reste fréquente, observée encore chez près de 30% des patients, alors qu'elle est évitable dans la plupart des cas. Elle prive les patients des bénéfices d'un traitement néphro-et cardioprotecteur institué précocement et associé à une réduction de la comorbidité cardiovasculaire. Une coopération mieux structurée entre médecins généralistes et néphrologues, grâce à la création de réseaux de santé régionaux, apparaît comme le moyen le plus efficace pour améliorer la prise en charge des patients atteints d'IRC.

Kessler, M. et Loos- Ayav, C. (2010). "Évolution dans le temps des caractéristiques des patients en insuffisance rénale chronique terminale lors de l'initiation du traitement de suppléance par dialyse, France, 2004-2007." Bulletin Epidemiologique Hebdomadaire(9-10): 77-80.
http://www.invs.sante.fr/beh/2010/09_10/beh_09_10_2010.pdf

[BDSP. Notice produite par InVS kR0xC7HC. Diffusion soumise à autorisation]. Les tendances évolutives concernant l'incidence, les caractéristiques sociodémographiques et les comorbidités des patients débutant un premier traitement de suppléance par dialyse, ont été étudiées dans neuf régions françaises participant au registre Rein (Réseau épidémiologie et information en néphrologie) de 2004 à 2007. Elles se caractérisent par une stabilité du nombre de patients pris en charge et une augmentation de leur âge. Globalement, le nombre des comorbidités reste stable mais, après ajustement sur l'âge, il existe une diminution des comorbidités cardiovasculaires. Ces résultats, associés à l'évolution des paramètres biologiques, suggèrent que malgré le vieillissement des patients il n'y a pas d'aggravation de leur état de santé et que la prise en charge de l'insuffisance rénale chronique s'est améliorée, générant ainsi un optimisme prudent pour l'avenir. (R.A.).

Kihal, W., Vigneau, C., Dequen, S., et al. (2016). "Inégalités sociales et insuffisance rénale chronique terminale. ." Revue d'Epidémiologie et de Santé Publique **64**(S4): PS176.

Contexte
Plusieurs études ont mis en évidence une relation entre la défaveur sociale et les différents aspects de l'insuffisance rénale chronique terminale (IRCT) : l'incidence de l'IRCT, la prise en charge tardive par un néphrologue et l'accès à la transplantation rénale. À notre connaissance, aucune étude n'a investigué le lien entre les inégalités sociales et l'IRCT à l'échelle géographique infra-communale en France. L'objectif de notre étude est d'examiner l'association entre les données contextuelles du lieu de résidence et l'accès à la greffe rénale (accès à la liste puis à la greffe) ainsi que la survie des patients en IRCT à partir du registre REIN. L'adresse de 2006 cas incidents de l'IRCT ayant démarré la dialyse, entre 2004 et 2009, en Bretagne a été géocodée à l'échelle infra-communale de l'IRIS (Ilôts regroupés pour l'information statistique). Chaque IRIS a été caractérisé par le degré d'urbanisation et le niveau de défaveur socio-économique. Un modèle de Cox ajusté sur les données démographiques et bio-cliniques des patients a été mis en place pour étudier le lien entre la défaveur sociale et : i) l'accès à la liste d'attente ; ii) l'accès à la greffe, et iii) la survie des patients. Après l'ajustement sur l'âge et les comorbidités, le niveau de défaveur sociale et le degré d'urbanisation du lieu de résidence n'influencent pas significativement l'accès à la liste, à la greffe ou la survie. Bien que la défaveur sociale joue un rôle dans les variations spatiales de l'incidence de l'IRCT, elle ne constitue pas un frein à l'accès à la liste d'attente ou à la greffe en Bretagne. Une des hypothèses avancées est que la politique de santé en France garantit une prise ne charge à 100 % des patients en IRCT quel que soit leur niveau de défaveur, contrairement aux pays anglo-saxons.

Kihal-Talantikite, W., Vigneau, C., Deguen, S., et al. (2016). "Influence of Socio-Economic Inequalities on Access to Renal Transplantation and Survival of Patients with End-Stage Renal Disease." PLoS One **11**(4): e0153431.

BACKGROUND: Public and scientific concerns about the social gradient of end-stage renal disease and access to renal replacement therapies are increasing. This study investigated the influence of social inequalities on the (i) access to renal transplant waiting list, (ii) access to renal transplantation and (iii) patients' survival. METHODS: All incident adult patients with end-stage renal disease who lived in Bretagne, a French region, and started dialysis during the 2004-2009 period were geocoded in census-blocks. To each census-block was assigned a level of neighborhood deprivation and a degree of urbanization. Cox proportional hazards models were used to identify factors associated with each study outcome. RESULTS: Patients living in neighborhoods with low level of deprivation had more chance to be placed on the waiting list and less risk of death (HR = 1.40 95%CI: [1.1-1.7]; HR = 0.82 95%CI: [0.7-0.98]), but this association did not remain after adjustment for the patients' clinical features. The likelihood of receiving renal transplantation after being waitlisted was not associated with neighborhood deprivation in univariate and multivariate analyses. CONCLUSIONS: In a mixed rural and urban French region, patients living in deprived or advantaged neighborhoods had the same chance to be placed on the waiting list and to undergo renal transplantation. They also showed the same mortality risk, when their clinical features were taken into account.

Laville, M. et Duru, G. (2001). "Comment optimiser le moment de la prise en charge des insuffisances rénales chroniques ?" THERAPIE - PARIS **56**(5): 533-543.

L'optimisation de la prise en charge de l'insuffisance rénale chronique (IRC) a pour but de diminuer la morbidité et la mortalité des patients en insuffisance rénale chronique, directement liées à la progression vers l'IRC terminale, et aux complications mettant en jeu le pronostic vital et/ou fonctionnel. La progression'spontanée'vers l'IRC terminale résulte de facteurs propres à la néphropathie initiale, et de facteurs non spécifiques liés notamment à l'hypertension artérielle, et aux adaptations fonctionnelles à la réduction néphronique. La prévention secondaire de l'IRC passe ainsi par l'identification précoce de la néphropathie en vue d'un éventuel traitement spécifique ; le traitement de l'hypertension ; la normalisation des apports en protéines ; la prévention des événements notamment iatrogènes susceptibles d'aggraver irréversiblement la fonction rénale. Les événements cliniques n'apparaissent que très tardivement au cours de l'IRC, à la suite d'anomalies présentes longtemps avant le stade de la dialyse (hypertension, dyslipidémies, anomalies phosphocalciques anémie, malnutrition) qui doivent être dépistées et traitées dans une démarche de prévention tertiaire. Enfin, lorsque la dialyse apparaît inévitable, une information précoce et une préparation médicale planifiée du patient sont nécessaires pour donner à la méthode choisie, les meilleures chances de succès. Malheureusement, de nombreux patients ne sont encore pris en charge qu'à un stade d'IRC sévère, auquel les effets des interventions thérapeutiques sont plus limités : ces patients ont des durées d'hospitalisation plus longues, une incidence plus élevée de complications durant les premiers mois de dialyse, et ont deux fois moins de chances de pouvoir être autonomisés sur une méthode de dialyse hors-centre type autodialyse, dialyse à domicile, ou dialyse péritonéale.

Le Neindre, C., Bricard, D., Sermet, C., et al. (2018). Atlas de l'insuffisance rénale chronique terminale en France, Paris : Irdes
http://www.irdes.fr/recherche/ouvrages/004-atlas-de-l-insuffisance-renale-chronique-terminale-en-france.pdf

La maladie rénale chronique touche, en 2015, environ 5,7 millions d'adultes en France. Parmi eux, 82 295 sont traités pour insuffisance rénale chronique terminale, soit par dialyse (56 %), soit par greffe (44 %). Le taux de mortalité à ce stade de la maladie est élevé (10,6 %) et la qualité de vie des personnes atteintes peut également être altérée. Les enjeux en matière d'accès aux soins et de prise en charge des patients, dimensions pour lesquelles des disparités sociales et territoriales sont signalées, sont donc importants. Les enjeux économiques ne sont pas non plus négligeables. Cet atlas propose une photographie de l'insuffisance rénale chronique terminale et de sa prise en charge en France, ainsi que dans les six territoires visés par les expérimentations des parcours de soins des personnes atteintes de cette maladie. Il regroupe des informations jusqu'alors dispersées sur le contexte démographique et socio-économique, l'état de santé et l'offre de soins, ainsi que sur l'incidence et la prévalence de la maladie et le parcours des patients dialysés et greffés. L'atlas s'appuie pour ce faire sur des indicateurs standardisés construits au niveau d'une unité d'observation commune, le département. Il s'agit en effet de disposer d'une situation de référence qui permettra de mesurer les évolutions, de comparer les territoires et de mieux comprendre les problématiques spécifiques à cette pathologie afin d'améliorer l'accès et la qualité des soins.

Massol, J., Janin, G., Bachot, C., et al. (2017). "Pilot non dialysis chronic renal insufficiency study (P-ND-CRIS): a pilot study of an open prospective hospital-based French cohort." BMC Nephrol **18**(1): 46.

BACKGROUND: Before establishing a prospective cohort, an initial pilot study is recommended. However, there are no precise guidelines on this subject. This paper reports the findings of a French regional pilot study carried out in three nephrology departments, before realizing a major prospective Non Dialysis Chronic Renal Insufficiency study (ND-CRIS). METHODS: We carried out an internal pilot study. The objectives of this pilot study were to validate the feasibility (regulatory approval, providing patients with information, availability of variables, refusal rate of eligible patients) and quality criteria (missing data, rate of patients lost to follow-up, characteristics of the patients included and non-included eligible patients, quality control of the data gathered) and estimate the human resources necessary (number of clinical research associates required). RESULTS: The authorizations obtained (CCTIRS - CNIL) and the contracts signed with hospitals have fulfilled the regulatory requirements. After validating the information on the study provided to patients, 1849 of them were included in three centres (university hospital, intercommunal hospital, town hospital) between April 2012 and September 2015. The low refusal rate (51 patients) and the characteristics of non-included patients have confirmed the benefit for patients of participating in the study and provide evidence of the feasibility and representativeness of the population studied. The lack of missing data on the variables studied, the quality of the data analyzed and the low number of patients lost to follow-up are evidence of the quality of the study. By taking into account the time spent by CRAs to enter data and to travel, as well as the annual patient numbers in each hospital, we estimate that five CRAs will be required in total. CONCLUSION: With no specific guidelines on how to realize a pilot study before implementing a major prospective cohort, we considered it pertinent to report our experience of P-

ND-CRIS. This experience confirms that i) feasibility, ii) quality of data and iii) evaluating the resources required must be validated before carrying out a large prospective cohort study such as ND-CRIS.

Megas, F., Pouteil-Noble, C. et Colin, C. (1997). "Description et valorisation des soins d'hôpital de jour après transplantation rénale : pourquoi et comment enrichir la classification médico-économique des séjours." Journal D'economie Medicale **15**(7-8): 473-488, rés., ann., tabl., fig.

[BDSP. Notice produite par ORS-RA 3OsUaR0x. Diffusion soumise à autorisation]. L'hôpital de jour exerce dans le suivi ambulatoire des patients transplantés rénaux une fonction de soins essentielle (surveillance, premier recours, relais) dont nous avons valorisé les principaux coûts en 1994 à l'hôpital E. Herriot de Lyon. Trois types de séjours décrivent simplement son spectre d'activité : le grand bilan préétabli fonctionnel immunitaire et infectieux, le petit bilan de surveillance et l'hôpital de jour non prévu qui rend compte de la prise en charge diagnostique ou thérapeutique des complications courantes de la transplantation. La classification par groupe homogène de malades (GHM) de ces séjours ne décrit pas de façon précise l'activité développée et son poids économique, ce qui rend souhaitable l'utilisation de critères complémentaires au groupe GHM.

Ministère chargé de la Santé (2017). Plan 2017-2021 pour la greffe d'organes et de tissus. Paris : Ministère chargé de la santé.

Monnot Delaveau, C. et Université de la Méditerranée Aix-Marseille 2. Marseille, F. R. A. c. (2009). Suivi de l'insuffisance rénale chronique modérée en médecine générale : enquête auprès des médecins généralistes du Var. **Thèse pour le diplôme d'état de docteur en médecine.:** 56p.

Moranne, O., Couchoud, C. et Vigneau, C. (2012). "Characteristics and treatment course of patients older than 75 years, reaching end-stage renal failure in France. The PSPA study." J Gerontol A Biol Sci Med Sci **67**(12): 1394-1399.

BACKGROUND: The age of patients with end-stage renal disease is increasing in Europe and United States. In France, patients older than 75 years represent 40% of the patients who start renal replacement therapy (dialysis or renal transplantation). In these elderly patients with many comorbidities, the benefit of dialysis remains controversial. To provide clear information to patients about diagnosis, prognosis, and all treatment options, more data are needed on their clinical characteristics, therapeutic projects, and outcome. METHODS: Researchers present here the ongoing Parcours de Soins des PersonnesAgees (PSPA) multicenter prospective study, which includes 581 patients with a mean age of 82+/-5 years and an estimated glomerular filtration rate (by sMDRD) of 14+/-4ml/min/1.73m(2) without dialysis. RESULTS: Despite a high prevalence of associated comorbidities, most of the patients are autonomous, living at home. Less than 10% are followed jointly by a nephrologist and a geriatrician. At inclusion, postponed dialysis decision due to stable estimated glomerular filtration rate was reported in 43%, 17% of the patients are under evaluation, the decision to start dialysis was chosen in 24% of the patients, nondialysis decision was decided in 16%. CONCLUSIONS: Geriatricians' expertise may help nephrologists to identify patients at high risk of early death for who nondialysis care may be discussed. They also may be more able to evaluate and anticipate the impact of such restricting treatments. A multidisciplinary approach of these old and frail patients' needs to be reinforced.

ONDPS (2009). Analyse des professions. Insuffisance rénale chronique, masseur-kinésithérapeute. Rapport 2008-2009 de l'ONDPS. Tome 2. Paris Ondps**:** 115.
http://www.sante.gouv.fr/IMG/pdf/tome2_Analyse_professions_insuffisance_renale_chronique_masseur_kine.pdf

Le tome 2 du rapport annuel de l'Ondps, Analyse des professions : Insuffisance rénale chronique, masseur kinésithérapeute, fournit une analyse de la prise en charge médicale de l?insuffisance rénale chronique. L?état des lieux, plus particulièrement approfondi dans quatre régions, permet de mettre en lumière les liens entre les données démographiques, la patientèle et l?implantation territoriale des structures de soins, mais aussi d?étudier les comportements des plus jeunes. Trois scenarii d?évolutions illustrent les questions à débattre et les choix qui pourraient s?opérer. Ce tome

comporte également la synthèse d?une étude consacrée au métier de masseur-kinésithérapeute. Elle rassemble les principales données démographiques et identifie les diverses facettes de l?exercice du métier.

Parmier, M., Gourieux, B., Krummel, T., et al. (2016). "Évaluation d’interventions éducatives auprès du patient dialysé." Nephrol Ther **12**(7): 516-524.
http://www.sciencedirect.com/science/article/pii/S1769725516300876

Résumé Le traitement de l’insuffisance rénale chronique terminale comporte un nombre élevé de médicaments dont la gestion quotidienne peut s’avérer complexe : nombre important de prises, effets indésirables, manque de perception du bénéfice clinique… L’objectif de cette étude proposée aux patients d’un centre de dialyse était d’évaluer l’impact d’un accompagnement réalisé par le pharmacien en s’appuyant sur des interventions éducatives. L’étude, contrôlée versus un groupe témoin au suivi rétrospectif, s’est déroulée sur 3 mois pour des patients hémodialysés ayant une hyperphosphatémie malgré un traitement chélateur de phosphate. Le critère de jugement principal était la variation de phosphatémie. Les critères secondaires concernaient l’évolution de l’adhésion thérapeutique, les connaissances acquises et la satisfaction sur le programme d’accompagnement. Seize patients dans chacun des groupes ont participé à l’étude. La phosphatémie moyenne en fin d’étude était réduite de 0,25 mmol/L dans le groupe intervention, diminution amplifiée à 0,41 mmol/L pour les patients ayant comme attente cette réduction, tandis qu’elle était de 0,11 mmol/L dans le groupe témoin. Cinq patients ont normalisé leur phosphatémie dans le groupe intervention contre trois patients dans le groupe témoin. Le score moyen d’adhésion thérapeutique a diminué de 1,75 à 1,50 avec comme principaux freins identifiés, l’oubli ou la négligence dans les prises et le nombre trop important d’unités à administrer. Cette étude met en évidence la faisabilité d’une amélioration de la phosphatémie et de l’adhésion thérapeutique par des mesures éducatives, dont l’impact est fortement amplifié par la motivation suscitée au cours de l’accompagnement. Les patients soulignent l’intérêt de l’implication du pharmacien dans leur parcours. The treatment of end-stage renal disease requires a significant number of drug treatments. At patient level, daily management is somewhat difficult: Number of prescribed pills, medication side effects, treatment of asymptomatic diseases… The objective of the study was to investigate the effect of guidance tailored to each patient receiving hemodialysis, performed by the pharmacist (educational interventions). Adult haemodialysis patients with hyperphosphatemia despite phosphate binders were eligible for study entry. The study was controlled with a retrospective group. The primary end point was a change in serum phosphate levels. The secondary end points were therapy adherence, knowledge regarding phosphate management and patient satisfaction with the programme. Sixteen patients in each group participated in the study. The mean serum phosphate level at endpoint was decreased by 0.25 mmol/L in the intervention group (0.41 mmol/L for patients with expectancy for this reduction) and by 0.11 mmol/L in the control group. Five patients normalized their serum phosphate level in the intervention group against three patients in the control group. The mean score of adherence decreased from 1.75 to 1.50. The main factors affecting adherence were forgetfulness or carelessness in taking medications and number of daily doses. This study showed the feasibility of an improvement in serum phosphate level and adherence driven by therapeutic education, though effect was highly amplified by the motivation induced by pharmaceutical guidance. Patients emphasize the importance of the involvement of pharmacist in their care.

Penfornis, A., Blickle, J. F., Fiquet, B., et al. (2014). "How are patients with type 2 diabetes and renal disease monitored and managed? Insights from the observational OREDIA study." Vasc Health Risk Manag **10**: 341-352.

BACKGROUND AND AIM: Chronic kidney disease (CKD) is frequent in type 2 diabetes mellitus (T2DM), and therapeutic management of diabetes is more challenging in patients with renal impairment (RI). The place of metformin is of particular interest since most scientific societies now recommend using half the dosage in moderate RI and abstaining from use in severe RI, while the classic contraindication with RI has not been removed from the label. This study aimed to assess the therapeutic management, in particular the use of metformin, of T2DM patients with CKD in real life. METHODS: This was a French cross-sectional observational study: 3,704 patients with T2DM diagnosed for over 1 year and pharmacologically treated were recruited in two cohorts (two-thirds were considered to have renal disease [CKD patients] and one-third were not [non-CKD patients]) by 968 physicians (81%

general practitioners) in 2012. RESULTS: CKD versus non-CKD patients were significantly older with longer diabetes history, more diabetic complications, and less strict glycemic control (mean glycated hemoglobin [HbA(1c)] 7.5% versus 7.1%; 25% of CKD patients had HbA1c >/=8% versus 15% of non-CKD patients). Fifteen percent of CKD patients had severe RI, and 66% moderate RI. Therapeutic management of T2DM was clearly distinct in CKD, with less use of metformin (62% versus 86%) but at similar mean daily doses (~2 g/d). Of patients with severe RI, 33% were still treated with metformin, at similar doses. For other oral anti-diabetics, a distinct pattern of use was seen across renal function (RF): use of sulfonylureas (32%, 31%, and 20% in normal RF, moderate RI, and severe RI, respectively) and DPP4-i (dipeptidyl peptidase-4 inhibitors) (41%, 36%, and 25%, respectively) decreased with RF, while that of glinides increased (8%, 14%, and 18%, respectively). CKD patients were more frequently treated with insulin (40% versus 16% of non-CKD patients), and use of insulin increased with deterioration of RF (19%, 39%, and 61% of patients with normal RF, moderate RI, and severe RI, respectively). Treatment was modified at the end of the study-visit in 34% of CKD patients, primarily to stop or reduce metformin. However, metformin was stopped in only 40% of the severe RI patients. CONCLUSION: Despite a fairly good detection of CKD in patients with T2DM, RI was insufficiently taken into account for adjusting anti-diabetic treatment.

Pladys, A., Vigneau, C., Hourmant, M., et al. (2018). "Association between daily haemodialysis, access to renal transplantation and patients' survival in France." Nephrology (Carlton) **23**(3): 269-278.

AIM: Daily haemodialysis improves patients' quality of life and blood purification, but its effect on survival remains controversial. The aim of this study was to analyze the association between daily haemodialysis and renal transplantation and survival in France. METHODS: This was an observational cohort study based on the French REIN registry. All incident patients >/=18 years old who started daily haemodialysis in France between 2003 and 2012 were included. Using a propensity score, 575 patients on daily haemodialysis were matched with 1696 patients receiving thrice-weekly haemodialysis. Survival analysis was performed using the Cox model. Access to the renal transplant waiting list and renal transplantation were analyzed using the Fine and Gray model. RESULTS: Daily haemodialysis was not independently associated with reduced access to transplant waiting list, whereas, major comorbidities remained associated with restricted waitlisting after multivariate analysis adjusted for confounding factors. After being waitlisted, the cumulative incidence of renal transplantation was lower for the daily haemodialysis than for the thrice-weekly haemodialysis group (SHR = 0.72, 95%CI: 0.56-0.91). The risk of death was significantly higher in the daily haemodialysis group (HRadjusted = 1.58, 95%CI: 1.4-1.8). Major comorbidities were associated with higher risk of death and lower likelihood of receiving a renal transplant during the follow-up period. CONCLUSION: Our study showed that in France, the likelihood of undergoing renal transplantation after being waitlisted was lower for patients on daily haemodialysis than those on thrice-weekly haemodialysis. Moreover, daily haemodialysis was associated with higher risk of death, even after taking into account age and all major comorbidities.

Prevost, P., Chaperon, D., Taillanter, L., et al. (1997). "Prise en charge de l'insuffisance rénale chronique terminale en Bretagne." Revue Medicale De L'assurance Maladie(4): 31-37, graph., tabl.

[BDSP. Notice produite par ENSP DcR0x8cL. Diffusion soumise à autorisation]. Cette étude, réalisée dans le cadre du Protocole Régional d'Actions Concertées, est une photographie de la prise en charge de l'insuffisance rénale chronique terminale (IRCT) en Bretagne en 1995. Voulue comme un état des lieux le plus exhaustif possible, elle aborde l'ensemble des domaines épidémiologiques, structurels et fonctionnels, et constitue à l'heure actuelle un document de travail adopté par les instances régionales responsables de l'organisation sanitaire en matière d'insuffisance rénale. Cet article résume les principaux constats, relate un certain nombre de faits marquants, et évoque les préconisations du service Médical de l'Assurance maladie.

Riffaut, N., Lobbedez, T., Hazzan, M., et al. (2015). "Access to preemptive registration on the waiting list for renal transplantation: a hierarchical modeling approach." Transpl Int **28**(9): 1066-1073.

Preemptive kidney transplantation is associated with both longer patient and graft survival. This study was carried out to estimate the association between the renal units and preemptive registration on

the waiting list for first deceased donor renal transplantation in a French network of care. From 2008 to 2012, 1529 adult patients followed in 48 units of the French North-West network and registered on the waiting list for a first deceased donor renal allograft were included. We used a mixed logistic regression with renal units as random-effects term for statistical analysis. Of the 1529 patients included, 407 were placed on the waiting list preemptively. There was a significant variability across renal units (variance 0.452). In multivariate analysis, factors independently associated with preemptive registration were cardiovascular disease (odds ratio (OR) 0.57, [95% CI: 0.42-0.79]), social deprivation (OR 0.73, [95% CI 0.57-0.94]), and renal units' characteristics (ownership of the facility: academic hospital, reference-community hospital, OR 0.44, [95% CI 0.24-0.80]-private hospital, OR 0.35, [95% CI 0.18-0.69] and transplant center; P < 0.10]. Variability between renal units was reduced after taking into account their characteristics but was not influenced by patient characteristics. Preemptive registration is associated with renal units, transplant centers, and social deprivation and can be partly explained by disparities in practices.

Sanesco (1995). IRC 2000 : livre blanc de la néphrologie. Paris Sanesco**:** 103.

Scherrer Kirrmann, A. et Université Paris 7. (2013). Dépistage de la maladie rénale chronique en médecine générale : audit de pratique. **Thèse pour le diplôme d'état de docteur en médecine.:** 105p.

Simon, P. (2005). "La télédialyse. Une application de la télémédecine à la surveillance médicale de séances d'hémodialyse réalisées à distance." Techniques Hospitalieres(692): 60-64, phot.

[BDSP. Notice produite par ENSP Mq43R0xx. Diffusion soumise à autorisation]. La télédialyse, devenue légale par la loi du 14 août 2004 de l'assurance maladie (article 12), est l'usage de la télémédecine pour la réalisation à distance de l'acte médical de surveillance des insuffisants rénaux traités dans un centre de dialyse éloigné du centre de référence. Elle est expérimentée depuis l'été 2001 entre les centres hospitaliers de Saint-Brieuc et de Lannion. Le but de cet article est de faire le point sur le développement actuel et à venir de cette méthode, notamment pour faire face au problème de la démographie médicale néphrologique.

Societe Francophone de Nephrologie Dialyse Et, Transplantation (2006). Le livre blanc de la dialyse à domicile : 23 propositions pour lever les freins à son développement. Paris Société Française de Néphrologie Dialyse et Transplantation**:** 21.
http://www.sfndt.org/sn/eaccueil/actualites/fiche.php?recordID=46

5 sur 10 insuffisants rénaux qui ont besoin d'une technique de suppléance, 1 seul est pris en charge à domicile. Pourtant ce ratio pourrait atteindre 1 sur 4. En effet, médicalement, un quart des personnes atteintes d'insuffisance rénale chronique terminale ont un état de santé et des conditions psychologiques et socio-économiques compatibles avec une prise en charge à domicile. Ce livre rassemble des propositions afin de développer la dialyse à domicile.

Societe Francophone de Nephrologie Dialyse Et, Transplantation (2016). Rapport sur la dialyse chronique en France en 2016. Avignon Société Francophone de Néphrologie Dialyse et Transplantation**:** 49 , tabl.
http://www.sfndt.org/sn/PDF/actualites/2016/05/rapport_dialyse_chronique_France_2016_SFNDT.pdf

Ce rapport de la Société Francophone de Néphrologie Dialyse et Transplantation (SFNDT) dresse un état des lieux le plus exhaustif et le plus documenté possible sur la dialyse en France. Il a pour but de préciser les organisations qui sont importantes en 2016 pour maintenir une dialyse de haute qualité. Il comprend également des propositions pour faire évoluer la prise en charge des malades.

Societe Francophone de Nephrologie Dialyse Et, Transplantation (2017). "[Report on chronic dialysis in France in 2016]." Nephrol Ther **13**(2): 105-126.

The report on dialysis in France in 2016 from the French Speaking Society of Nephrology Dialysis and Transplantation (SFNDT) provides an exhaustive and documented inventory on dialysis in France. It underlines the organizations that are important in 2016 to maintain a high quality dialysis. Several measures are proposed to maintain and improve the care of dialysis in France: (1) The regulation of

dialysis treatment in France must be maintained; (2) a burden of care indicator is proposed to ensure that patients requiring the most care are treated in the centers. Proposals are also made to stimulate peritoneal dialysis offers, (3) to improve the calculation of the cost of dialysis and warn against lower reimbursement rates of dialysis, (4) to reduce transport costs by minimizing transport by ambulance (5). The SFNDT recalls recent recommendations concerning access to the renal transplant waiting list, are recalled; (6) as well as recommendations that require waiting until clinical signs are present to start dialysis (7). The SFNDT makes the proposal to set up advanced renal failure units. These units are expected to develop care that is not supported today: consultation with a nurse, a dietician, a social worker or psychologist, palliative care, and coordination (8). Finally, the financial and human resources for pediatric dialysis should be maintained.

Speyer, E., Gentile, S., Isnard-Bagnis,S. C., et al. (2014). "Qualité de vie des personnes en insuffisance rénale chronique terminale en France en 2011." Bulletin Epidemiologique Hebdomadaire(37-38): 623-630.
http://www.invs.sante.fr/beh/2014/37-38/2014_37-38_4.html

[BDSP. Notice produite par InVS 9R0x9n88. Diffusion soumise à autorisation]. Objectif : estimer le niveau de qualité de vie (QDV) des patients atteints d'insuffisance rénale chronique terminale (dialysés ou greffés). Méthodes. Enquête transversale par auto-questionnaire menée en 2011 auprès de patients de plus de 18 ans suivis dans l'une des 21 régions participant au Réseau épidémiologie et information en néphrologie (REIN) en 2009. Les patients ont été tirés au sort après stratification sur l'âge et la région. La QDV a été mesurée avec le questionnaire générique MOS SF36, et des questionnaires spécifiques, le KDQoL pour les patients dialysés et le ReTransQoL pour les greffés. Résultats : 1 251 patients dialysés et 1 658 patients transplantés ont participé à l'enquête. Les scores de QDV étaient plus élevés (de 10 à 30,6 points) chez les greffés que chez les dialysés, et ce sur toutes les dimensions du MOS SF36, avec des différences régionales. Chez les greffés, ces scores tendaient à se rapprocher de ceux de la population générale. Les dialysés inscrits sur liste d'attente de greffe présentaient une meilleure QDV que les dialysés non inscrits sur toutes les dimensions, avec des différences variant de 3,9 (dimension vitalité générale) à 7,5 (fonctionnement physique). De même, les greffés préemptifs déclaraient une meilleure QDV que les non préemptifs, avec des différences variant de 4,2 points (santé mentale) à 8,5 (limitations dues à l'état physique). Conclusion : les résultats de ces études de QDV donnent des arguments en faveur de la greffe aux cliniciens. Ces derniers pourraient indiquer à leurs patients que, lorsque la transplantation est réalisable et à pathologies associées comparables, la vie après la greffe est de meilleure qualité, notamment du fait d'une augmentation de leurs capacités physiques, de moindres limitations physiques et d'une amélioration de leurs relations sociales.

Thilly, N., Boini, S., Laurain, E., et al. (2013). "[The pharmaco-epidemiology to evaluate clinical practices and their impact on health, regarding an example in nephrology: the AVENIR study]." Nephrol Ther **9**(4): 195-201.

The AVENIR study is a pharmaco-epidemiological study, lead in Lorraine region (France) between 1st January, 2005 and 31st December, 2006, which aim at: evaluating the quality of therapeutic practices, delivered by nephrologists, for chronic kidney disease patients during the year preceding dialysis onset, assessing the association between quality of predialysis therapeutic practices and survival and hospitalization during the first year of dialysis, and health-related quality of life at dialysis onset. Several data were collected for the AVENIR study: demographic, clinical, biological and therapeutic data before dialysis, morbidity and mortality during dialysis treatment. These data were used for secondary analyses investigating the decline in glomerular filtration rate over the year preceding dialysis, the management of hypertension and proteinuria before dialysis, and characteristics and outcomes of patients with delayed dialysis initiation. Results from the AVENIR study have been published in various international journals. The aim of this manuscript is to present a summary of these results and the lessons we can learn for the nephrological practice.

Tliba, L. et Le Dastumer, B. (2010). "[Screening and care of chronic renal insufficiency in the elderly population]." Soins Gerontol(86): 10-13.

The prevalence of chronic renal insufficiency (CRI) increases with age. This growth shall result in it becoming a public health issue for the most elderly In this age group, chronic renal insufficiency primarily stems from diabetes and vascular and glomerular origins. The limiting point is the assessment of the glomerular filtration rate which remains imprecise. Care aims to limit the development of renal insufficiency and to prevent its complications, which are sources of fragility.

Tuppin, P., Bessou, A., Legeai, C., et al. (2018). "Two-year management after renal transplantation in 2013 in France: Input from the French national health system database." Nephrol Ther.

The objective of this study was to describe the management of patients undergoing renal transplantation in 2013 and over the following two years on the basis of healthcare consumption data. The National Health Insurance Information System was used to identify 1876 general scheme beneficiaries undergoing a first isolated renal transplantation (median age: 53 years; men 63%). Overall, 1.2% of patients died during the transplantation hospital stay (>65 years 3.3%) and 87% of patients had a functional graft at 2 years. Thirty-three percent of patients were readmitted to hospital for 1 day or longer during the first month, 73% the first year and 55% the second year. At least 10% of patients were hospitalised for antirejection treatment during the first quarter after renal transplantation, 16% the first year and 9% the second year. The first year, 32% of patients were hospitalised for renal disease (12% the second year), 14% were hospitalised for cardiovascular disease (9% the second year), 13% for infectious disease (5% the second year) and 2% for a malignant tumour (2% the second year). Almost 80% of patients consulted their general practitioner each year (almost 50% consulted every quarter). During the second year, 83% of patients were taking antihypertensives, 45% lipid-lowering drugs, 26% antidiabetic drugs, 77% tacrolimus, 18% ciclosporin, 88% mycophenolic acid and 69% corticosteroids. This study highlights the important contribution of healthcare consumption data to a better understanding of the modalities of management of renal transplant recipients in France, allowing improvement of this management in line with guidelines.

Tuppin, P., Cuerq, A., Torre, S., et al. (2017). "[Management of patients with end-stage renal disease prior to initiation of renal replacement therapy in 2013 in France]." Nephrol Ther **13**(2): 76-86.

This study evaluated the management of patients with end-stage renal disease prior to initiation of renal replacement therapy. Among the 51 million national health insurance general scheme beneficiaries (77% of the population), persons 18 years and older, starting dialysis or undergoing preemptive renal transplantation in 2013, were included in this study. Data were derived from the French national health insurance system (SNIIRAM). In this population of 6674 patients (median age: 68 years), 88% initiated renal replacement therapy by haemodialysis, 8% by peritoneal dialysis, and 4% by renal transplantation. During the year preceding initiation of dialysis, 76% of patients had been hospitalised with at least one diagnostic code for renal disease in 83% of cases, 16% had not received any reimbursements for serum creatinine assay and 32% had not seen a nephrologist; 87% were taking at least one antihypertensive drug (60% were taking at least a renin-angiotensin system inhibitor) and 30% were taking a combination of 4 or more classes of antihypertensive drugs. For patients initiating haemodialysis in a haemodialysis centre, 39% had undergone a procedure related to arteriovenous fistula and 10% had been admitted to an intensive care unit. This study, based on the available reimbursement data, shows that, despite frequent use of the health care system by this population, there is still room for improvement of screening and management of patients with end-stage renal disease and preparation for renal replacement therapy.

Études internationales

Aiyegbusi, O. L., Kyte, D., Cockwell, P., et al. (2017). "A patient-centred approach to measuring quality in kidney care: patient-reported outcome measures and patient-reported experience measures." Curr Opin Nephrol Hypertens **26**(6): 442-449.

PURPOSE OF REVIEW: Chronic kidney disease (CKD) is associated with symptoms that can significantly reduce the health-related quality of life (HRQOL) of patients. Patient-reported outcome and experience measures (PROMs and PREMs) may assist with the evaluation of HRQOL and quality of care from the patient perspective. This review focuses on evidence from recent studies exploring the role of PROMs and PREMs in the measurement of quality in CKD care. RECENT FINDINGS: PROMs are

> increasingly used in CKD research as measures of clinical effectiveness, whereas the current use of PROMs in routine clinical settings and PREMs in all settings is more limited. Electronic PROMs may be sensitive enough to detect clinically relevant patient-reported outcomes changes. Patients on frequent shorter-hours daily haemodialysis may experience better HRQOL compared with those on conventional haemodialysis. PROM data may correlate significantly with clinical parameters. PREMs are being utilized by healthcare professionals to inform service improvements. SUMMARY: PROMs and PREMs may facilitate the measurement of quality in renal care and aid the tailoring of care to individual patients. PROMs may have a potential role as prognostic markers.

Aiyegbusi, O. L., Kyte, D., Cockwell, P., et al. (2017). "Measurement properties of patient-reported outcome measures (PROMs) used in adult patients with chronic kidney disease: A systematic review." PLoS One **12**(6): e0179733.

> BACKGROUND: Patient-reported outcome measures (PROMs) can provide valuable information which may assist with the care of patients with chronic kidney disease (CKD). However, given the large number of measures available, it is unclear which PROMs are suitable for use in research or clinical practice. To address this we comprehensively evaluated studies that assessed the measurement properties of PROMs in adults with CKD. METHODS: Four databases were searched; reference list and citation searching of included studies was also conducted. The COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) checklist was used to appraise the methodological quality of the included studies and to inform a best evidence synthesis for each PROM. RESULTS: The search strategy retrieved 3,702 titles/abstracts. After 288 duplicates were removed, 3,414 abstracts were screened and 71 full-text articles were retrieved for further review. Of these, 24 full-text articles were excluded as they did not meet the eligibility criteria. Following reference list and citation searching, 19 articles were retrieved bringing the total number of papers included in the final analysis to 66. There was strong evidence supporting internal consistency and moderate evidence supporting construct validity for the Kidney Disease Quality of Life-36 (KDQOL-36) in pre-dialysis patients. In the dialysis population, the KDQOL-Short Form (KDQOL-SF) had strong evidence for internal consistency and structural validity and moderate evidence for test-retest reliability and construct validity while the KDQOL-36 had moderate evidence of internal consistency, test-retest reliability and construct validity. The End Stage Renal Disease-Symptom Checklist Transplantation Module (ESRD-SCLTM) demonstrated strong evidence for internal consistency and moderate evidence for test-retest reliability, structural and construct validity in renal transplant recipients. CONCLUSIONS: We suggest considering the KDQOL-36 for use in pre-dialysis patients; the KDQOL-SF or KDQOL-36 for dialysis patients and the ESRD-SCLTM for use in transplant recipients. However, further research is required to evaluate the measurement error, structural validity, responsiveness and patient acceptability of PROMs used in CKD.

Aiyegbusi, O. L., Kyte, D., Cockwell, P., et al. (2016). "Measurement properties of patient-reported outcome measures (PROMs) used in adult patients with chronic kidney disease: a systematic review protocol." BMJ Open **6**(10): e012014.

> INTRODUCTION: Chronic kidney disease (CKD) is associated with symptoms that can significantly reduce the quality of life (QoL) of patients. Patient-reported outcome measures (PROMs) may facilitate the assessment of the impact of disease and treatment on the QoL, from a patient perspective. PROMs can be used in research and routine clinical practice. METHODS AND ANALYSIS: A systematic review of studies evaluating the measurement properties of PROMs in adults with CKD will be conducted. MEDLINE, EMBASE, PsycINFO and CINAHL Plus will be systematically searched from inception. Hand searching of reference lists and citations of included studies will be carried out. 2 reviewers will independently screen the titles and abstracts of all the studies retrieved during the systematic search to determine their eligibility. The COnsensus-based Standards for the selection of health Measurement Instruments (COSMIN) checklist will be used to appraise the methodological quality of the selected studies following the full-text review. Data on the study population, questionnaire characteristics and measurement properties will be extracted from the selected papers. Finally, a narrative synthesis of extracted data will be undertaken. ETHICS AND DISSEMINATION: Ethical permissions are not required for this study as data from published research articles will be used. Findings will be disseminated through publication in a peer-reviewed journal and presented at

conferences. This systematic review will provide a comprehensive assessment of the measurement properties of PROMs currently available for use in adult patients with CKD and present evidence which may inform the selection of measures for use in research and clinical practice. TRIAL REGISTRATION NUMBER: CRD42016035554.

Arulkumaran, N., Annear, N. M. et Singer, M. (2013). "Patients with end-stage renal disease admitted to the intensive care unit: systematic review." Br J Anaesth **110**(1): 13-20.

The number of patients with end-stage renal disease (ESRD) is increasing worldwide, with a growing demand on healthcare services. A systematic review of the literature was performed to determine the requirement for intensive care unit (ICU) services, reasons for admission, predictors of mortality, and short- and long-term outcomes of ESRD patients admitted to ICU. Sixteen studies were identified, comprising 6591 ICU admissions. Cardiovascular disease and sepsis accounted for the majority of admissions. Acute illness severity scores tend to overestimate mortality among ESRD patients. Critical illness associated with acute kidney injury (AKI) requiring renal replacement therapy (RRT) is associated with significantly higher hospital mortality compared with ESRD patients admitted to the ICU [odds ratio (OR) 3.9; 3.5-4.4; P<0.0001]. However, hospital mortality of ESRD patients is less favourable compared with matched patients with mild AKI (OR 1.5; 1.4-1.6; P<0.0001). Although the mortality rate remains high shortly after hospital discharge, the duration of increased mortality risk is unclear. Patients with ESRD frequently benefit from ICU admission, despite chronic co-morbidity. Further studies are required to modify and validate existing illness severity scores for ESRD patients admitted to the ICU, and to establish the duration of increased mortality risk after discharge from ICU.

Beaulieu, M. et Levin, A. (2009). "Analysis of multidisciplinary care models and interface with primary care in management of chronic kidney disease." Semin Nephrol **29**(5): 467-474.

Public policy efforts and education have led to an increased appreciation of the prevalence of chronic kidney disease (CKD) in general outpatient populations. The complexity of the care of individuals with established CKD has led to the development of multidisciplinary care models, which have been shown to improve the clinical outcomes of those with CKD. The interface between specialty and primary care in various systems remains necessary and desired, albeit a continuing challenge. This overview reviews various models of specialty care for CKD patients, including those that emphasize multidisciplinary team approaches, and highlight the essential role(s) of primary care physicians. Importantly, there is a need for improved definition of CKD populations and individuals, review and refinement of proposed care pathways, and the need to define essential elements of care for the patient. Models of care often are not subject to the same rigor that other interventions applied to this population are; nonetheless, we offer here a framework for establishing and evaluating care models for the CKD populations at various stages of disease and with various comorbidities.

Bello, A. K., Levin, A., Manns, B. J., et al. (2015). "Effective CKD care in European countries: challenges and opportunities for health policy." Am J Kidney Dis **65**(1): 15-25.

Chronic kidney disease (CKD) is an important global public health problem that is associated with adverse health outcomes and high health care costs. Effective and cost-effective treatments are available for slowing the progression of CKD and preventing its complications, including cardiovascular disease. Although wealthy nations have highly structured schemes in place to support the care of people with kidney failure, less consideration has been given to health systems and policy for the much larger population of people with non-dialysis-dependent CKD. Further, how to integrate such strategies with national and international initiatives for control of other chronic noncommunicable diseases (NCDs) merits attention. We synthesized the various approaches to CKD control across 17 European countries and present our findings according to the key domains suggested by the World Health Organization framework for NCD control. This report identifies opportunities to strengthen CKD-relevant health systems and explores potential mechanisms to capitalize on these opportunities. Across the 17 countries studied, we found a number of common barriers to the care of people with non-dialysis-dependent CKD: limited work force capacity, the nearly complete absence of mechanisms for disease surveillance, lack of a coordinated CKD care strategy, poor integration of CKD care with other NCD control initiatives, and low awareness of the significance of CKD. These common challenges faced by diverse health systems reflect the need for international cooperation to strengthen health systems and policies for CKD care.

Bonner, A., Gillespie, K., Campbell, K. L., et al. (2018). "Evaluating the prevalence and opportunity for technology use in chronic kidney disease patients: a cross-sectional study." BMC Nephrol **19**(1): 28.

BACKGROUND: Chronic kidney disease (CKD) is increasing worldwide and early education to improve adherence to self-management is a key strategy to slow CKD progression. The use of the internet and mobile phone technologies (mHealth) to support patients is considered an effective tool in many other chronic disease populations. While a number of mHealth platforms for CKD exist, few studies have investigated if and how this population use technology to engage in self-management. METHODS: Using a cross-sectional design across five health districts in Queensland (Australia), a 38-item self-report survey was distributed to adults with CKD attending outpatient clinics or dialysis units to measure current use and type of engagement with mHealth, perceived barriers to use, and opportunities to support CKD self-management. Odds ratio (OR) were calculated to identify associations between demographic characteristic and mHealth use. RESULTS: Of the 708 participants surveyed, the majority had computer access (89.2%) and owned a mobile phone (83.5%). The most likely users of the internet were those aged </= 60 years (OR: 7.35, 95% confidence interval [CI]: 4.25-12.75, p < 0.001), employed (OR: 7.67, 95% CI: 2.58-22.78, p < 0.001), from non-indigenous background (OR: 6.98, 95% CI: 3.50-13.93, p < 0.001), or having completed higher levels of education (OR: 3.69, CI: 2.38-5.73, p < 0.001). Those using a mobile phone for complex communication were also younger (OR: 6.01, 95% CI: 3.55-10.19, p < 0.001), more educated (OR: 1.99, 95% CI: 1.29-3.18, p < 0.01), or from non-indigenous background (OR: 3.22, 95% CI: 1.58-6.55, p < 0.001). Overall, less than 25% were aware of websites to obtain information about renal healthcare. The mHealth technologies most preferred for communication with their renal healthcare teams were by telephone (56.5%), internet (50%), email (48.3%) and text messages (46%). CONCLUSION: In the CKD cohort, younger patients are more likely than older patients to use mHealth intensively and interactively although all patients' technology literacy ought to be thoroughly assessed by renal teams before implementing in practice. Further research testing mHealth interventions to improve self-management in a range of patient cohorts is warranted.

Bonner, A., Havas, K., Douglas, C., et al. (2014). "Self-management programmes in stages 1-4 chronic kidney disease: a literature review." J Ren Care **40**(3): 194-204.

BACKGROUND: Chronic kidney disease (CKD) is a complex health problem, which requires individuals to invest considerable time and energy in managing their health and adhering to multifaceted treatment regimens. OBJECTIVES: To review studies delivering self-management interventions to people with CKD (Stages 1-4) and assess whether these interventions improve patient outcomes. DESIGN: Systematic review. METHODS: Nine electronic databases (MedLine, CINAHL, EMBASE, ProQuest Health & Medical Complete, ProQuest Nursing & Allied Health, The Cochrane Library, The Joanna Briggs Institute EBP Database, Web of Science and PsycINFO) were searched using relevant terms for papers published between January 2003 and February 2013. RESULTS: The search strategy identified 2,051 papers, of which 34 were retrieved in full with only 5 studies involving 274 patients meeting the inclusion criteria. Three studies were randomised controlled trials, a variety of methods were used to measure outcomes, and four studies included a nurse on the self-management intervention team. There was little consistency in the delivery, intensity, duration and format of the self-management programmes. There is some evidence that knowledge- and health-related quality of life improved. Generally, small effects were observed for levels of adherence and progression of CKD according to physiologic measures. CONCLUSION: The effectiveness of self-management programmes in CKD (Stages 1-4) cannot be conclusively ascertained, and further research is required. It is desirable that individuals with CKD are supported to effectively self-manage day-to-day aspects of their health.

Bouaoun, L., Villar, E., Ecochard, R., et al. (2013). "Excess risk of death increases with time from first dialysis for patients on the waiting list: implications for renal allograft allocation policy." Nephron Clin Pract **124**(1-2): 99-105.

BACKGROUND: Subgroups of patients registered on a kidney transplant waiting list have higher than usual mortality levels. This study used data from the French Renal Epidemiology and Information Network (REIN) Registry to quantify the impact over time of various comorbidities on the excess risk of death among patients on the waiting list. METHODS: Lexis diagrams were used to analyze time since onset of end-stage renal disease and time since registration on the waiting list. The number of excess deaths was calculated by comparison with the number of expected deaths in the general population of the same age and sex. RESULTS: During 45,013 person-years of follow-up, 7,224 patients died, 5,956 (82%) more than expected relative to the general population. There were 101 deaths among wait-listed dialysis patients, 76 more than expected. The excess risk of death increased by 45% per additional year on the waiting list (18-79%, p = 0.0005). Time from end-stage renal disease onset until list registration (p = 0.004), time since registration (p < 0.001), age >65 years (p = 0.008), the presence of a primary renal disease (p = 0.028), and the number of comorbidities (p = 0.035) were independent predictors of death while on the waiting list. CONCLUSIONS: The excess risk of death while on the waiting list increased faster in patients with comorbidities. These results require consideration of ways to accelerate access to transplantation in high-risk patients.

Brand, S. et Pollock, K. (2018). "How is continuity of care experienced by people living with chronic kidney disease?" J Clin Nurs **27**(1-2): 153-161.

AIMS AND OBJECTIVES: To explore patients' perceptions of continuity of care within a hospital-based specialist service. BACKGROUND: Patient journeys through health care are becoming increasingly complex. For patients with chronic conditions, the longevity of their illness and common multiple co-morbidities make this complexity more pronounced. Continuity of care is most challenging to provide for these patients. A multifaceted model of continuity is widely accepted, but despite this, much literature focuses exclusively on relational aspects. In addition, the majority of the literature has focused on primary and family care settings whilst continuity within specialist and hospital care has not been widely researched. DESIGN: A qualitative descriptive design was used. METHODS: Thirteen semi-structured interviews with patients accessing services as at a Renal and Transplant Unit at a UK hospital were conducted in 2014. Data were analysed thematically to identify commonality as well as diversity amongst participants. RESULTS: Five themes of time, being known, knowledge, knowing the system and responsibility were identified within patient experiences of continuity. The multidisciplinary team was more important in relational continuity than literature has previously suggested. Patients' expectations in relation to continuity were notably different in their interactions with hospital-based services in comparison with community and family-based care. CONCLUSIONS: Patients accessing specialist care services may perceive continuity differently to those receiving care in the community. Generic guidance concerned with patient experience outcomes may be difficult to implement in practice. RELEVANCE TO CLINICAL PRACTICE: Nurses and the wider healthcare team play a fundamental role within the provision of continuity, even in predominantly medically led specialist services. The differences between primary and secondary care in terms of patient expectation and experience should be recognised to ensure effective models of care are implemented which both meet patient expectations and improve their experience of care.

Chambers, S., Healy, H., Hoy, W. E., et al. (2018). "Health service utilisation during the last year of life: a prospective, longitudinal study of the pathways of patients with chronic kidney disease stages 3-5." BMC Palliat Care **17**(1): 57.

BACKGROUND: Chronic kidney disease (CKD) is a growing global problem affecting around 10% of many countries' populations. Providing appropriate palliative care services (PCS) to those with advanced kidney disease is becoming paramount. Palliative/supportive care alongside usual CKD clinical treatment is gaining acceptance in nephrology services although the collaboration with and use of PCS is not consistent. METHODS: The goal of this study was to track and quantify the health service utilisation of people with CKD stages 3-5 over the last 12 months of life. Patients were recruited from a kidney health service (Queensland, Australia) for this prospective, longitudinal study. Data were collected for 12 months (or until death, whichever was sooner) during 2015-17 from administrative health sources. Emergency department presentations (EDP) and inpatient admissions (IPA) (collectively referred to as critical events) were reviewed by two Nephrologists to gauge if the events were avoidable. RESULTS: Participants (n = 19) with a median age of 78 years (range 42-90), were

> mostly male (63%), 79% had CKD stage 5, and were heavy users of health services during the study period. Fifteen patients (79%) collectively recorded 44 EDP; 61% occurred after-hours, 91% were triaged as imminently and potentially life-threatening and 73% were admitted. Seventy-four IPA were collectively recorded across 16 patients (84%); 14% occurred on weekends or public holidays. Median length of stay was 3 days (range 1-29). The median number of EDP and IPA per patient was 1 and 2 (range 0-12 and 0-20) respectively. The most common trigger to both EDP (30%) and IPA (15%) was respiratory distress. By study end 37% of patients died, 63% were known to PCS and 11% rejected a referral to a PCS. All critical events were deemed unavoidable. CONCLUSIONS: Few patients avoided using acute health care services in a 12 month period, highlighting the high service needs of this cohort throughout the long, slow decline of CKD. Proactive end-of-life care earlier in the disease trajectory through integrating renal and palliative care teams may avoid acute presentations to hospital through better symptom management and planned care pathways.

Chettiar, A. (2014). "Management of primary care issues common to CKD and ESRD patients: a brief primer for the nephrology provider." Adv Chronic Kidney Dis **21**(4): 371-376.

> This article provides a brief overview of the diagnosis and management of selected primary care issues that are common to CKD and ESRD patients. The elements of diagnosis and management unique to kidney patients and controversies and updates in management will be presented. The topics reviewed are neuropathy, pruritus, zoster, hyperuricemia, gout, and gastroparesis.

Donald, M., Kahlon, B. K., Beanlands, H., et al. (2018). "Self-management interventions for adults with chronic kidney disease: a scoping review." BMJ Open **8**(3): e019814.

> OBJECTIVE: To systematically identify and describe self-management interventions for adult patients with chronic kidney disease (CKD). SETTING: Community-based. PARTICIPANTS: Adults with CKD stages 1-5 (not requiring kidney replacement therapy). INTERVENTIONS: Self-management strategies for adults with CKD. PRIMARY AND SECONDARY OUTCOME MEASURES: Using a scoping review, electronic databases and grey literature were searched in October 2016 to identify self-management interventions for adults with CKD stages 1-5 (not requiring kidney replacement therapy). Randomised controlled trials (RCTs), non-RCTs, qualitative and mixed method studies were included and study selection and data extraction were independently performed by two reviewers. Outcomes included behaviours, cognitions, physiological measures, symptoms, health status and healthcare. RESULTS: Fifty studies (19 RCTs, 7 quasi-experimental, 5 observational, 13 pre-post intervention, 1 mixed method and 5 qualitative) reporting 45 interventions were included. The most common intervention topic was diet/nutrition and interventions were regularly delivered face to face. Interventions were administered by a variety of providers, with nursing professionals the most common health professional group. Cognitions (ie, changes in general CKD knowledge, perceived self-management and motivation) were the most frequently reported outcome domain that showed improvement. Less than 1% of the interventions were co-developed with patients and 20% were based on a theory or framework. CONCLUSIONS: There was a wide range of self-management interventions with considerable variability in outcomes for adults with CKD. Major gaps in the literature include lack of patient engagement in the design of the interventions, with the majority of interventions not applying a behavioural change theory to inform their development. This work highlights the need to involve patients to co-developed and evaluate a self-management intervention based on sound theories and clinical evidence.

Elliott, M. J., Gil, S., Hemmelgarn, B. R., et al. (2017). "A scoping review of adult chronic kidney disease clinical pathways for primary care." Nephrol Dial Transplant **32**(5): 838-846.

> Background: Chronic kidney disease (CKD) affects approximately 10% of the adult population. The majority of patients with CKD are managed by primary care physicians, and despite the availability of effective treatment options, the use of evidence-based interventions for CKD in this setting remains suboptimal. Clinical pathways have been identified as effective tools to guide primary care physicians in providing evidence-based care. We aimed to describe the availability, characteristics and credibility of clinical pathways for adult CKD using a scoping review methodology. Methods: We searched Medline, Embase, CINAHL and targeted Internet sites from inception to 31 October 2014 to identify

studies and resources that identified adult CKD clinical pathways for primary care settings. Study selection and data extraction were independently performed by two reviewers. Results: From 487 citations, 41 items were eligible for review: 7 published articles and 34 grey literature resources published between 2001 and 2014. Of the 41 clinical pathways, 32, 24 and 22% were from the UK, USA and Canada, respectively. The majority (66%, n = 31) of clinical pathways were static in nature (did not have an online interactive feature). The majority (76%) of articles/resources reported using one or more clinical practice guidelines as a resource to guide the clinical pathway content. Few articles described a dissemination and evaluation plan for the clinical pathway, but most reported the targeted end-users. Conclusions: Our scoping review synthesized available literature on CKD clinical pathways in the primary care setting. We found that existing clinical pathways are diverse in their design, content and implementation. These results can be used by researchers developing or testing new or existing clinical pathways and by practitioners and health system stakeholders who aim to implement CKD clinical pathways in clinical practice.

Gallagher, H., de Lusignan, S., Harris, K., et al. (2010). "Quality-improvement strategies for the management of hypertension in chronic kidney disease in primary care: a systematic review." Br J Gen Pract **60**(575): e258-265.

BACKGROUND: Chronic kidney disease (CKD) is a relatively recently recognised condition. People with CKD are much more likely to suffer from cardiovascular events than progress to established renal failure. Controlling systolic blood pressure should slow the progression of disease and reduce mortality and morbidity. However, no systematic review has been conducted to explore the effectiveness of quality-improvement interventions to lower blood pressure in people with CKD. AIM: To assess the effectiveness of quality-improvement interventions to reduce systolic blood pressure in people with CKD in primary care, in order to reduce cardiovascular risk and slow the progression of renal disease. METHOD: Papers were identified from the trial data bases of the Cochrane Effective Practice and Organisation of Care Group (EPOC) and Cochrane renal groups. In a three-round process, at least two investigators read the papers independently. Studies were initially excluded based on their abstracts, if these were not relevant to primary care. Next, full papers were read, and again excluded on relevance. Quantitative and, where this was not possible, qualitative analyses of the findings were performed. RESULTS: The selected studies were usually carried out on high-risk populations including ethnic minorities. The interventions were most often led by nurses or pharmacists. Three randomised trials showed a combined effect of a reduction in systolic blood pressure of 10.50 mmHg (95% confidence interval [CI] = 5.34 to 18.41 mmHg). One non-randomised study showed a reduction in systolic blood pressure of 9.30 mmHg (95% CI = 3.01 to 15.58 mmHg). CONCLUSION: Quality-improvement interventions can be effective in lowing blood pressure, and potentially in reducing cardiovascular risk and slowing progression in CKD. Trials are needed in low-risk populations to see if the same improvements can be achieved.

Hamoda, R. E., Gander, J. C., McPherson, L. J., et al. (2018). "Process evaluation of the RaDIANT community study: a dialysis facility-level intervention to increase referral for kidney transplantation." BMC Nephrol **19**(1): 13.

BACKGROUND: The Reducing Disparities in Access to kidNey Transplantation Community Study (RaDIANT) was an End-Stage Renal Disease (ESRD) Network 6-developed, dialysis facility-level randomized trial testing the effectiveness of a 1-year multicomponent education and quality improvement intervention in increasing referral for kidney transplant evaluation among selected Georgia dialysis facilities. METHODS: To assess implementation of the RaDIANT intervention, we conducted a process evaluation at the conclusion of the intervention period (January-December 2014). We administered a 20-item survey to the staff involved with transplant education in 67 dialysis facilities randomized to participate in intervention activities. Survey items assessed facility participation in the intervention (fidelity and reach), helpfulness and willingness to continue intervention activities (sustainability), suggestions for improving intervention components (sustainability), and factors that may have influenced participation and study outcomes (context). We defined high fidelity to the intervention as completing 11 or more activities, and high participation in an activity as having at least 75% participation across intervention facilities. RESULTS: Staff from 65 of the 67 dialysis facilities completed the questionnaire, and more than half (50.8%) reported high adherence (fidelity) to RaDIANT intervention requirements. Nearly two-thirds (63.1%) of facilities reported that RaDIANT intervention activities were helpful or very helpful, with 90.8% of facilities willing to continue at least one intervention component beyond the study period. Intervention components with high participation emphasized staff and patient-level education, including in-service staff orientations, patient and family education programs, and patient educational materials. Suggested improvements for intervention activities emphasized addressing financial barriers to transplantation, with financial education materials perceived as most helpful among RaDIANT educational materials. Variation in facility-level fidelity of the RADIANT intervention did not significantly influence the mean difference in proportion of patients referred pre- (2013) and post-intervention (2014). CONCLUSIONS: We found high fidelity to the RaDIANT multicomponent intervention at the majority of intervention facilities, with sustainability of select intervention components at intervention facilities and feasibility for dissemination across ESRD Networks. Future modification of the intervention should emphasize financial education regarding kidney transplantation and amend intervention components that facilities perceive as time-intensive or non-sustainable. TRIAL REGISTRATION: Clinicaltrials.gov number NCT02092727 . Registered 13 Mar 2014 (retrospectively registered).

Harambat, J., van Stralen, K. J., Schaefer, F., et al. (2013). "Disparities in policies, practices and rates of pediatric kidney transplantation in Europe." Am J Transplant **13**(8): 2066-2074.

We aimed to provide an overview of kidney allocation policies related to children and pediatric kidney transplantation (KTx) practices and rates in Europe, and to study factors associated with KTx rates. A survey was distributed among renal registry representatives in 38 European countries. Additional data were obtained from the ESPN/ERA-EDTA and ERA-EDTA registries. Thirty-two countries (84%) responded. The median incidence rate of pediatric KTx was 5.7 (range 0-13.5) per million children (pmc). A median proportion of 17% (interquartile range 2-29) of KTx was performed preemptively, while the median proportion of living donor KTx was 43% (interquartile range 10-52). The median percentage of children on renal replacement therapy (RRT) with a functioning graft was 62%. The level of pediatric prioritization was associated with a decreased waiting time for deceased donor KTx, an increased pediatric KTx rate, and a lower proportion of living donor KTx. The rates of pediatric KTx, distribution of donor source and time on waiting list vary considerably between European countries. The lack of harmonization in kidney allocation to children raises medical and ethical issues. Harmonization of pediatric allocation policies should be prioritized.

Helou, N., Dwyer, A., Shaha, M., et al. (2016). "Multidisciplinary management of diabetic kidney disease: a systematic review and meta-analysis." JBI Database System Rev Implement Rep **14**(7): 169-207.

BACKGROUND: The increasing prevalence of diabetes poses significant challenges to healthcare systems around the world. Diabetes is the leading cause of end-stage renal disease. Diabetic kidney disease (DKD) is becoming a global health concern because it is a progressive disease associated with major health complications and increased health costs. The treatment goals for DKD are to slow the progression of the renal disease and prevent cardiovascular events. Accordingly, patients are expected to adhere to prescribed treatments and manage a wide range of daily self-care activities. Multidisciplinary management of chronic diseases, like diabetes and kidney disease, has been suggested as a means to improve patients' adherence to treatment and enhance health-related outcomes. This systematic review of multidisciplinary management of DKD is an important step in evaluating if such a management approach is effective in delaying disease progression. OBJECTIVES: The goal of this systematic review was to identify the best available evidence regarding multidisciplinary management of DKD and to determine if a multidisciplinary management of DKD can improve patient outcomes. Specifically the review question was: What is the impact of multidisciplinary management of DKD on patient outcomes? INCLUSION CRITERIA TYPES OF PARTICIPANTS: The current review considered adults aged 18 years and older who had been diagnosed with type 1 or type 2 diabetes and chronic kidney disease. TYPES OF INTERVENTION(S)/PHENOMENA OF INTEREST: The current review examined studies that compared multidisciplinary interventions with usual standard care in ambulatory settings for patients with DKD. OUTCOMES: The current review considered studies with the following primary outcomes: kidney function, incidence of kidney failure, generic or specific health-related quality of life, patient self-care abilities, adherence to treatment recommendations or goals; and the following secondary clinical outcomes: mortality rates secondary to DKD, glycemic control, blood pressure (BP) control, lipid profile, incidence of cardiovascular disease/events, patient knowledge on diabetes or DKD, patient empowerment or self-efficacy, generic or specific patient satisfaction with care and patient healthcare utilization. TYPES OF STUDIES: The current review will consider randomized and quasi-experimental trials but included only randomized controlled trials (RCTs). SEARCH STRATEGY: A three-step search strategy was utilized starting with a search of MEDLINE and CINAHL for the identification of keywords, followed by a search using keywords and index terms across MEDLINE, CINAHL and Embase databases and clinical trials registry platforms, and finally a search of the reference list of all identified papers. Studies published from the time of the respective database inception to November 2014 in English, German and French were considered. METHODOLOGICAL QUALITY: Two independent reviewers assessed the methodological validity of the papers prior to inclusion in the review using the standardized critical appraisal instruments from the Joanna Briggs Institute Meta-Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI). DATA EXTRACTION: Data were extracted from papers included in the review using the standardized data extraction tool from JBI-MAStARI. DATA SYNTHESIS: Quantitative data were pooled using the RevMan 5 software for kidney function using estimated Glomerular Filtration Rate (eGFR), glycated hemoglobin, BP and total cholesterol (TC). Results were considered significant for P < 0.05. RESULTS: Three RCTs were included in this review. Meta-analysis showed that multidisciplinary management was associated with a statistically significant improvement of glycated hemoglobin as compared with standard usual care (Relative Risk [RR] -0.49, at 95% confidence interval [CI] -0.83, -0.16, P < 0.01). The meta-analysis for eGFR showed a tendency to favor standard care; however, this finding cannot be conclusive because the CI was too wide (RR -3.30, at 95% CI -6.55, -0.05, P = 0.05). Meta-analysis results for BP and TC failed to show a difference between the multidisciplinary management of DKD and the usual standard care. Only one study measured patient-oriented primary and secondary outcomes and showed an improvement in health-related quality of life, patient self-care abilities, patient level of knowledge on diabetes and exercise self-efficacy. CONCLUSION: Multidisciplinary management of DKD has the potential for improving glycemic control and thus preventing complications. Its effect on other clinical and patient-oriented outcomes, especially on delaying the progression of the disease through preserving and preventing the decline in kidney function, has yet to be determined. There is not enough evidence to recommend multidisciplinary management for preserving kidney function. Further studies are needed.

Ho, Y. F. et Li, I. C. (2016). "The influence of different dialysis modalities on the quality of life of patients with end-stage renal disease: A systematic literature review." Psychol Health **31**(12): 1435-1465.

OBJECTIVES: This study aims to generate evidence regarding the relationships of different dialysis modalities with HR-QOL. DESIGN: A systematic review was conducted to investigate the HR-QOL of patients treated with different dialysis modalities. METHODS: A literature search was conducted for English language articles in the CINAHL, Medline and PubMed databases published from January 1990 through May 2016. Specifically, we sought articles that would compare the HR-QOL of hemodialysis (HD) and peritoneal dialysis (PD) patients in terms of physiological, psychological and social functioning, as well as disease symptoms. Thirty-four articles met the study inclusion criteria and were included into the analysis. RESULTS: The research results indicated no significant differences in HR-QOL between HD and PD treatment. However, a higher percentage of patients who received PD had a better HR-QOL in terms of physiological, psychological, social and disease symptoms. CONCLUSIONS: Despite the fact that the results of this study showed no difference in HR-QOL between HD and PD treatment, its review of relevant references can serve as a reference for health professionals. However, patients' conditions must still be taken into account when making suggestions about which dialysis modality a patient should use.

Hogan, J., Audry, B., Harambat, J., et al. (2015). "Are there good reasons for inequalities in access to renal transplantation in children?" Nephrol Dial Transplant **30**(12): 2080-2087.

BACKGROUND: Studies in the USA and Europe have demonstrated inequalities in adult access to renal transplants. We previously demonstrate that the centre of treatment was impacting the time to be registered on the renal waiting list. In this study, we sought to ascertain the influence of patient and centre characteristics on the probability of transplantation within 1 year after registration on the waiting list for children. METHODS: We included patients <18 years awaiting transplantation from the

French ESRD National Registry. The effects of patient and centre characteristics were studied by hierarchical logistic regression. Centre effects were assessed by centre-level residual variance. A descriptive survey was performed to investigate differences in the centres' practices, and linear regression was used to confirm findings of different HLA compatibility requirements between centres. RESULTS: The study included 556 patients treated at 54 centres; 450 (80.9%) received transplants in the year after their listing. HLA group scarcity, time of inactive status during the year, pre-emptive listing and listing after age 18 were associated with lower probabilities of transplantation. Patient characteristics explained most of the variability among centres, but patients treated in paediatric centres had a lower probability of transplantation within 1 year because of higher HLA compatibility requirements for transplants. CONCLUSIONS: Although patient characteristics explained most of the inter-centre variability, harmonization of some practices might enable us to reduce some inequalities in access to renal transplantation while maintaining optimal transplant survival and chances to get a second transplant when needed.

Hussain, J. A., Flemming, K., Murtagh, F. E., et al. (2015). "Patient and health care professional decision-making to commence and withdraw from renal dialysis: a systematic review of qualitative research." Clin J Am Soc Nephrol **10**(7): 1201-1215.

BACKGROUND AND OBJECTIVE: To ensure that decisions to start and stop dialysis in ESRD are shared, the factors that affect patients and health care professionals in making such decisions must be understood. This systematic review sought to explore how and why different factors mediate the choices about dialysis treatment. DESIGN, SETTING, PARTICIPANTS, & MEASUREMENTS: MEDLINE, Embase, CINAHL, and PsychINFO were searched for qualitative studies of factors that affect patients' or health care professionals' decisions to commence or withdraw from dialysis. A thematic synthesis was conducted. RESULTS: Of 494 articles screened, 12 studies (conducted from 1985 to 2014) were included. These involved 206 patients (most receiving hemodialysis) and 64 health care professionals (age ranges: patients, 26-93 years; professionals, 26-61 years). For commencing dialysis, patients based their choice on "gut instinct," as well as deliberating over the effect of treatment on quality of life and survival. How individuals coped with decision-making was influential: Some tried to take control of the problem of progressive renal failure, whereas others focused on controlling their emotions. Health care professionals weighed biomedical factors and were led by an instinct to prolong life. Both patients and health care professionals described feeling powerless. With regard to dialysis withdrawal, only after prolonged periods on dialysis were the realities of life on dialysis fully appreciated and past choices questioned. By this stage, however, patients were physically dependent on treatment. As was seen with commencing dialysis, individuals coped with treatment withdrawal in a problem- or emotion-controlling way. Families struggled to differentiate between choosing versus allowing death. Health care teams avoided and queried discussions regarding dialysis withdrawal. Patients, however, missed the dialogue they experienced during predialysis education. CONCLUSIONS: Decision-making in ESRD is complex and dynamic and evolves over time and toward death. The factors at work are multifaceted and operate differently for patients and health professionals. More training and research on open communication and shared decision-making are needed.

Kanda, H., Hirasaki, Y., Iida, T., et al. (2017). "Perioperative Management of Patients With End-Stage Renal Disease." J Cardiothorac Vasc Anesth **31**(6): 2251-2267.

End-stage renal disease (ESRD) is associated with significant alterations in cardiovascular function; homeostasis of body fluid, electrolytes, and acid-base equilibrium; bone metabolism, erythropoiesis; and blood coagulation. The prevalence of ESRD is increasing rapidly worldwide, as is the number of patients requiring surgery under general anesthesia. Patients with ESRD have significantly higher risks of perioperative morbidity and mortality due to multiple comorbidities. The perioperative management of patients with ESRD under general anesthesia therefore requires special considerations and a careful multidisciplinary approach. In this review, the authors summarize the available literature to address common issues related to patients with ESRD and discuss the best perioperative approach for this patient subgroup.

Kotwal, S., Gallagher, M., Cass, A., et al. (2017). "Effects of health service geographic accessibility in patients with treated end stage kidney disease: Cohort study 2000-2010." Nephrology (Carlton) **22**(12): 1008-1016.

AIM: Patients in rural areas experience poor access to health services. There are limited data on patterns of health service utilization in rural patients treated with renal replacement therapy (RRT). METHODS: All prevalent patients over the age of 18 and resident in New South Wales who were receiving RRT on 01/07/2000 and incident patients who started RRT between 01/07/2000 up until 31/07/2010 were included in the study. The Accessibility Remoteness Index of Australia was used to measure rurality and to categorize participant postcode of residence at the time of their first use of a New South Wales healthcare facility after the start of RRT. We assessed (1) rates of hospitalization, (2) rates of inter-hospital transfer (IHT), (3) length of hospital stay (LOS) and (4) survival. Day-only and dialysis admissions were excluded. Negative binomial regression was used to calculate incidence rate ratios (IRR) for hospitalizations, IHT and LOS. Cox proportional hazards was used to calculate hazard ratios (HR) for survival. RESULTS: Of the 10 505 patients included in the analysis, 1527 (15%) were rural residents while 8978 (85%) resided in urban areas. Median follow up time from start of RRT/study to end of study/death was 4.2 years (IQR 2.0 to 8.2). After allowing for differences in baseline characteristics, rural residence increased the rates of hospitalization by 8% (IRR 1.08: 95% CI 1.01-1.15; P = 0.02), rates of IHT by 176% (IRR 2.76: 95% CI 2.44-3.13; P < 0.001) and the hazard of death by 14% (HR 1.14 95% CI: 1.05-1.24; P = 0.003) LOS was similar (Median 4.0; P = 0.07). CONCLUSIONS: Rural residents receiving RRT have higher hospitalization rates, markedly higher rates of IHT and higher long-term mortality compared with their urban counterparts.

Levin, A., Tonelli, M., Bonventre, J., et al. (2017). "Global kidney health 2017 and beyond: a roadmap for closing gaps in care, research, and policy." Lancet **390**(10105): 1888-1917.

The global nephrology community recognises the need for a cohesive plan to address the problem of chronic kidney disease (CKD). In July, 2016, the International Society of Nephrology hosted a CKD summit of more than 85 people with diverse expertise and professional backgrounds from around the globe. The purpose was to identify and prioritise key activities for the next 5-10 years in the domains of clinical care, research, and advocacy and to create an action plan and performance framework based on ten themes: strengthen CKD surveillance; tackle major risk factors for CKD; reduce acute kidney injury-a special risk factor for CKD; enhance understanding of the genetic causes of CKD; establish better diagnostic methods in CKD; improve understanding of the natural course of CKD; assess and implement established treatment options in patients with CKD; improve management of symptoms and complications of CKD; develop novel therapeutic interventions to slow CKD progression and reduce CKD complications; and increase the quantity and quality of clinical trials in CKD. Each group produced a prioritised list of goals, activities, and a set of key deliverable objectives for each of the themes. The intended users of this action plan are clinicians, patients, scientists, industry partners, governments, and advocacy organisations. Implementation of this integrated comprehensive plan will benefit people who are at risk for or affected by CKD worldwide.

Lopez-Vargas, P. A., Tong, A., Sureshkumar, P., et al. (2013). "Prevention, detection and management of early chronic kidney disease: a systematic review of clinical practice guidelines." Nephrology (Carlton) **18**(9): 592-604.

AIM: In response to the increase in Chronic Kidney Disease (CKD) worldwide, several professional organizations have developed clinical practice guidelines to manage and prevent its progression. This study aims to compare the scope, content and consistency of published guidelines on CKD stages I-III. METHODS: Electronic databases of the medical literature, guideline organizations, and the websites of nephrology societies were searched to November 2011. The Appraisal of Guidelines for Research and Evaluation (AGREE) II instrument and textual synthesis was used to appraise and compare recommendations. RESULTS: One consensus statement and 15 guidelines were identified and included. Methodological rigour across guidelines was variable, with average domain scores ranging from 24% to 95%. For detection of CKD, all guidelines recommended estimated glomerular filtration rate measurement, some also recommended serum creatinine and dipstick urinalysis. The recommended protein and albumin creatinine ratios and proteinuria definition thresholds varied (>150-300 mg/day to >500 mg/day). Blood pressure targets ranged (<125/75 to <140/90 mmHg). Angiotensin converting enzyme inhibitor and angiotensin receptor blockers were recommended for hypertension, as combined or as monotherapy. Protein intake recommendations varied (no restriction

> or 0.75 g/kg per day-1.0 g/kg per day). Salt intake of 6 g/day was recommended by most. Psychosocial support and education were recommended by few but specific strategies were absent. CONCLUSION: CKD guidelines were consistent in scope but were variable with respect to their recommendations, coverage and methodological quality. To promote effective primary and secondary prevention of CKD, regularly updated guidelines that are based on the best available evidence and augmented with healthcare context-specific strategies for implementation are warranted.

Mason, J., Khunti, K., Stone, M., et al. (2008). "Educational interventions in kidney disease care: a systematic review of randomized trials." Am J Kidney Dis **51**(6): 933-951.

> BACKGROUND: There is increasing evidence that educational interventions aimed at empowering patients are successful in chronic disease management. Our aim was to conduct a systematic review of the effectiveness of such educational interventions in people with kidney disease. SYSTEMATIC REVIEW: A comprehensive search strategy was applied by using major electronic databases from 1980 to March 2007. Researchers independently reviewed titles and abstracts and extracted data from identified studies. SETTING & POPULATION: Patients in any of the following stages of chronic kidney disease: early, predialysis, and dialysis. Kidney transplant recipients were excluded because this group has additional educational needs that are beyond the scope of this review. SELECTION CRITERIA FOR STUDIES: Randomized controlled trials. INTERVENTIONS: Structured educational interventions (involving informational and psychological components) with usual care. OUTCOMES: Clinical, behavioral, psychological, and knowledge outcomes were considered. RESULTS: 22 studies were identified involving a wide range of multicomponent interventions with variable aims and outcomes depending on the area of kidney disease care. 18 studies provided significant results for at least 1 of the outcomes. The majority of studies aimed to improve diet and/or fluid concordance in dialysis patients and involved short- and medium-term follow-up. A single major long-term study was a 20-year follow-up of a predialysis educational intervention that showed increased survival rates. No study was found that addressed chronic kidney disease at an earlier stage. LIMITATIONS: Meta-analysis was not possible because of study heterogeneity. CONCLUSIONS: Multicomponent structured educational interventions were effective in predialysis and dialysis care, but the quality of many studies was suboptimal. Effective frameworks to develop, implement, and evaluate educational interventions are required, especially those that target patients with early stages of chronic kidney disease. This could lead to possible prevention or delay in progression of kidney disease.

Matsumoto, Y., Ogawa, T. et Kashima, S. (2012). "The impact of rural hospital closures on equity of commuting time for haemodialysis patients: simulation analysis using the capacity-distance model." International Journal of Health Geographics **11**(1): 19 , tabl., graph., fig., carte.
http://www.ij-healthgeographics.com/content/pdf/1476-072X-11-28.pdf

> Frequent and long-term commuting is a requirement for dialysis patients. Accessibility thus affects their quality of lives. In this paper, a new model for accessibility measurement is proposed in which both geographic distance and facility capacity are taken into account. Simulation of closure of rural facilities and that of capacity transfer between urban and rural facilities are conducted to evaluate the impacts of these phenomena on equity of accessibility among dialysis patients. Post code information as of August 2011 of all the 7,374 patients certified by municipalities of Hiroshima prefecture as having first or third grade renal disability were collected. Information on post code and the maximum number of outpatients (capacity) of all the 98 dialysis facilities were also collected. Using geographic information systems, patient commuting times were calculated in two models: one that takes into account road distance (distance model), and the other that takes into account both the road distance and facility capacity (capacity-distance model). Simulations of closures of rural and urban facilities were then conducted. The median commuting time among rural patients was more than twice as long as that among urban patients (15 versus 7 minutes, $p < 0.001$). In the capacity-distance model 36.1 % of patients commuted to the facilities which were different from the facilities in the distance model, creating a substantial gap of commuting time between the two models. In the simulation, when five rural public facilities were closed, Gini coefficient of commuting times among the patients increased by 16 %, indicating a substantial worsening of equity, and the number of patients with commuting times longer than 90 minutes increased by 72 times. In contrast, closure of four urban public facilities with similar capacities did not affect these values. Closures of dialysis facilities in rural areas have a

substantially larger impact on equity of commuting times among dialysis patients than closures of urban facilities. The accessibility simulations using the capacity-distance model will provide an analytic framework upon which rational resource distribution policies might be planned.

Morton, R. L., Schlackow, I., Mihaylova, B., et al. (2016). "The impact of social disadvantage in moderate-to-severe chronic kidney disease: an equity-focused systematic review." Nephrol Dial Transplant **31**(1): 46-56.

It is unclear whether a social gradient in health outcomes exists for people with moderate-to-severe chronic kidney disease (CKD). We critically review the literature for evidence of social gradients in health and investigate the 'suitability' of statistical analyses in the primary studies. In this equity-focused systematic review among adults with moderate-to-severe CKD, factors of disadvantage included gender, race/ethnicity, religion, education, socio-economic status or social capital, occupation and place of residence. Outcomes included access to healthcare, kidney disease progression, cardiovascular events, all-cause mortality and suitability of analyses. Twenty-four studies in the pre-dialysis population and 34 in the dialysis population representing 8.9 million people from 10 countries were included. In methodologically suitable studies among pre-dialysis patients, a significant social gradient was observed in access to healthcare for those with no health insurance and no home ownership. Low income and no home ownership were associated with higher cardiovascular event rates and higher mortality [HR 1.94, 95% confidence interval (CI) 1.27-2.98; HR 1.28, 95% CI 1.04-1.58], respectively. In methodologically suitable studies among dialysis patients, females, ethnic minorities, those with low education, no health insurance, low occupational level or no home ownership were significantly less likely to access cardiovascular healthcare than their more advantaged dialysis counterparts. Low education level and geographic remoteness were associated with higher cardiovascular event rates and higher mortality (HR 1.54, 95% CI 1.01-2.35; HR 1.21, 95% CI 1.08-1.37), respectively. Socially disadvantaged pre-dialysis and dialysis patients experience poorer access to specialist cardiovascular health services, and higher rates of cardiovascular events and mortality than their more advantaged counterparts.

Nicoll, R., Robertson, L., Gemmell, E., et al. (2018). "Models of care for chronic kidney disease: A systematic review." Nephrology (Carlton) **23**(5): 389-396.

AIM: Chronic kidney disease (CKD) is common and presents an increasing burden to patients and health services. However, the optimal model of care for patients with CKD is unclear. We systematically reviewed the clinical effectiveness of different models of care for the management of CKD. METHODS: A comprehensive search of eight databases was undertaken for articles published from 1992 to 2016. We included randomized controlled trials that assessed any model of care in the management of adults with pre-dialysis CKD, reporting renal, cardiovascular, mortality and other outcomes. Data extraction and quality assessment was carried out independently by two authors. RESULTS: Results were summarized narratively. Nine articles (seven studies) were included. Four models of care were identified: nurse-led, multidisciplinary specialist team, pharmacist-led and self-management. Nurse and pharmacist-led care reported improved rates of prescribing of drugs relevant to CKD. Heterogeneity was high between studies and all studies were at high risk of bias. Nurse-led care and multidisciplinary specialist care were associated with small improvements in blood pressure control. CONCLUSION: Evidence of long term improvements in renal, cardiovascular or mortality endpoints was limited by short follow up. We found little published evidence about the effectiveness of different models of care to guide best practice for service design, although there was some evidence that models of care where health professionals deliver care according to a structured protocol or guideline may improve adherence to treatment targets.

Pippias, M., Stel, V. S., Kramer, A., et al. (2018). "Access to kidney transplantation in European adults aged 75-84 years and related outcomes: an analysis of the European Renal Association-European Dialysis and Transplant Association Registry." Transpl Int **31**(5): 540-553.

To what extent access to, and allocation of kidney transplants and survival outcomes in patients aged >/=75 years have changed over time in Europe is unclear. We included patients aged >/=75-84 years (termed older adults) receiving renal replacement therapy in thirteen European countries between 2005 and 2014. Country differences and time trends in access to, and allocation of kidney transplants

> were examined. Survival outcomes were determined by Cox regression analyses. Between 2005 and 2014, 1392 older adult patients received 1406 transplants. Access to kidney transplantation varied from ~0% (Slovenia, Greece and Denmark) to ~4% (Norway and various Spanish regions) of all older adult dialysis patients, and overall increased from 0.3% (2005) to 0.9% (2014). Allocation of kidney transplants to older adults overall increased from 0.8% (2005) to 3.2% (2014). Seven-year unadjusted patient and graft survival probabilities were 49.1% (95% confidence interval, 95% CI: 43.6; 54.4) and 41.7% (95% CI: 36.5; 46.8), respectively, with a temporal trend towards improved survival outcomes. In conclusion, in the European dialysis population aged >/=75-84 years access to kidney transplantation is low, and allocation of kidney transplants remains a rare event. Though both are increasing with time and vary considerably between countries. The trend towards improved survival outcomes is encouraging. This information can aid informed decision-making regarding treatment options.

Ramar, P., Ahmed, A. T., Wang, Z., et al. (2017). "Effects of Different Models of Dialysis Care on Patient-Important Outcomes: A Systematic Review and Meta-Analysis." Popul Health Manag **20**(6): 495-505.

> Ongoing payment reform in dialysis necessitates better patient outcomes and lower costs. Suggested improvements to processes of care for maintenance dialysis patients are abundant; however, their impact on patient-important outcomes is unclear. This systematic review included comparative randomized controlled trials or observational studies with no restriction on language, published from 2000 to 2014, involving at least 5 adult dialysis patients who received a minimum of 6 months of follow-up. The effect size was pooled and stratified by intervention strategy (multidisciplinary care [MDC], home dialysis, alternate dialysis settings, and electronic health record implementation). Heterogeneity (I(2)) was used to assess the variability in study effects related to study differences rather than chance. Of the 1988 articles screened, 25 international studies with 74,833 maintenance dialysis patients were included. Interventions with MDC or home dialysis were associated with a lower mortality (hazard ratio [HR] = 0.72, 95% confidence interval [CI] 0.61, 0.84, I(2) = 41.6%; HR = 0.57, 95% CI 0.41, 0.81, I(2) = 89.0%; respectively) and hospitalizations (incidence rate ratio [IRR] = 0.68, 95% CI 0.51, 0.91, I(2) = NA; IRR = 0.88, 95% CI 0.64, 1.20, I(2) = 79.6%; respectively). Alternate dialysis settings also were associated with a reduction in hospitalizations (IRR = 0.41, 95% CI 0.25, 0.69, I(2) = 0.0%). This systematic review underscores the importance of multidisciplinary care, and also the value of telemedicine as a means to increase access to providers and enhance outcomes for those dialyzing at home or in alternate settings, including those with limited access to nephrology expertise because of travel distance.

Rao, M. K., Morris, C. D., O'Malley, J. P., et al. (2013). "Documentation and management of CKD in rural primary care." Clin J Am Soc Nephrol **8**(5): 739-748.

> BACKGROUND AND OBJECTIVES: Recognition of CKD by primary care practitioners is essential in rural communities where nephrology access is limited. This study determined the prevalence of undocumented CKD in patients cared for in rural primary care practices and evaluated characteristics associated with undocumented CKD as well as CKD management. DESIGN, SETTING, PARTICIPANTS, & MEASUREMENTS: A retrospective cohort study, conducted within the Oregon Rural Practice Based Research Network, consisted of 865 CKD patients with serum creatinine>/=1.5 mg/dl in males and >/=1.3 mg/dl in females and an estimated GFR<60 ml/min per 1.73 m(2). Documentation of a CKD diagnosis and laboratory values were abstracted by chart review. RESULTS: Of CKD patients, 51.9% had no documentation of CKD. Undocumented CKD occurred more frequently in female patients (adjusted odds ratio=2.93, 95% confidence interval=2.04, 4.21). The association of serum creatinine reporting versus automating reporting of estimated GFR on CKD documentation was dependent on patient sex, years of practitioner experience, and practitioner clinical training. Hypertensive patients with documented CKD were more likely to have a BP medication change than patients with undocumented CKD (odds ratio=2.07, 95% confidence interval=1.15, 3.73). Only 2 of 449 patients with undocumented CKD were comanaged with a nephrologist compared with 20% of patients with documented CKD (odds ratio=53.20, 95% confidence interval=14.90, 189.90). CONCLUSIONS: Undocumented CKD in a rural primary care setting is frequent, particularly in female patients. Depending on practitioner characteristics, automatic reporting of estimated GFR might improve documentation of CKD in this population.

Regan, M. E. (2017). "Implementing an evidence-based clinical decision support tool to improve the detection, evaluation, and referral patterns of adult chronic kidney disease patients in primary care." J Am Assoc Nurse Pract **29**(12): 741-753.

> BACKGROUND AND PURPOSE: Chronic kidney disease (CKD) is undertreated and under-recognized in primary care. The majority of primary care providers (PCPs) are not aware or knowledgeable of current CKD guidelines. The purpose of this project was to develop a quality improvement intervention for PCPs through the delivery of evidence-based guidelines at the point of care. METHODS: An evidence-based clinical algorithm was developed in the electronic medical record for providers to access within one organization comprising 11 primary care offices with 80 PCPs. Baseline knowledge surveys and baseline data were obtained in August 2016. A CKD educational intervention and tutorial on a clinical decision support (CDS) tool was presented to physicians, nurse practitioners, and physician assistants. Postimplementation data and knowledge surveys were collected in December 2016. CONCLUSIONS: Most PCPs were willing to use a CKD CDS tool to help them with CKD patients. A CDS tool in addition to an educational intervention can improve PCP knowledge and identification of CKD and early referral to nephrology. IMPLICATIONS FOR PRACTICE: CDS tools can promote evidence-based guided care for PCPs and CKD patients. By using these applications, patients can be properly identified, managed, treated, and appropriately referred to nephrology.

Rewa, O. G., Villeneuve, P. M., Lachance, P., et al. (2017). "Quality indicators of continuous renal replacement therapy (CRRT) care in critically ill patients: a systematic review." Intensive Care Med **43**(6): 750-763.

> OBJECTIVES: Renal replacement therapy is increasingly utilized in the intensive care unit (ICU), of which continuous renal replacement therapy (CRRT) is most common. Despite CRRT being a relatively invasive and resource intensive technology, there remains wide practice variation in its application. This systematic review appraised the evidence for quality indicators (QIs) of CRRT care in critically ill patients. DESIGN: A comprehensive search strategy was developed and performed in five citation databases (Medline, Embase, CINAHL, Cochrane Library, and PubMed) and select grey literature sources. Two reviewers independently screened, selected, and extracted data using standardized forms. Each retrieved citation was appraised for quality using the Newcastle-Ottawa Scale (NOS) and Cochrane risk of bias tool. Data were summarized narratively. MEASUREMENTS AND MAIN RESULTS: Our search yielded 8374 citations, of which 133 fulfilled eligibility. This included 97 cohort studies, 24 randomized controlled trials, 10 case-control studies, and 2 retrospective medical audits. The quality of retrieved studies was generally good. In total, 18 QIs were identified that were mentioned in 238 instances. Identified QIs were classified as related to structure (n = 4, 22.2 %), care processes (n = 9, 50.0 %), and outcomes (n = 5, 27.8 %). The most commonly mentioned QIs focused on filter lifespan (n = 98), small solute clearance (n = 46), bleeding (n = 30), delivered dose (n = 19), and treatment interruption (n = 5). Across studies, the definitions used for QIs evaluating similar constructs varied considerably. When identified, QIs were most commonly described as important (n = 144, 48.3 %), scientifically acceptable (n = 32, 10.7 %), and useable and/or feasible (n = 17, 5.7 %) by their primary study authors. CONCLUSIONS: We identified numerous potential QIs of CRRT care, characterized by heterogeneous definitions, varying quality of derivation, and limited evaluation. Further study is needed to prioritize a concise inventory of QIs to measure, improve, and benchmark CRRT care for critically ill patients. SYSTEMATIC REVIEW REGISTRATION: PROSPERO CRD42015015530.

Salgado, T. M., Moles, R., Benrimoj, S. I., et al. (2012). "Pharmacists' interventions in the management of patients with chronic kidney disease: a systematic review." Nephrol Dial Transplant **27**(1): 276-292.

> BACKGROUND: Patients with chronic kidney disease have multiple comorbidities and require complicated therapeutic regimens. The role of pharmacists caring for these patients has been documented, but no review of the impact of these interventions has occurred to date. The aim of this work is to assess the impact of pharmacists' interventions in patients with chronic kidney disease. METHODS: Medline, International Pharmaceutical Abstracts, Pharmacy Abstracts and the Cochrane Library were searched for quantitative studies addressing the contribution of pharmacists' interventions in patients with chronic kidney disease. Quality of controlled studies was assessed using the Downs and Black scale. RESULTS: The search identified 37 studies (38 articles), involving 4743

participants, eligible for inclusion in the review. An uncontrolled design corresponded with 80% of the studies. Twenty-one articles (55.3%) reported outcome measures and process indicators, 4 (10.5%) reported only outcome measures and 13 (34.2%) reported only process indicators. Pharmacists identified 2683 drug-related problems in 1209 patients. The results from eight controlled studies (average quality score 0.57, SD = 0.10) demonstrated that pharmacists' interventions reduced all-cause hospitalisations [mean (SD) 1.8 (2.4) versus 3.1 (3.0), P = 0.02] and cumulative time hospitalised [mean (SD) 9.7 (14.7) versus 15.5 (16.3) days, P = 0.06], reduced the incidence of end-stage renal disease or death in patients with diabetic nephropathy (14.8 versus 28.2 per 100 patient-years, adjusted relative risk 60%, P < 0.001), improved management of anemia (mean 69.8 versus 43.9%, P = 0.0001 and 64.8 versus 40.4%, P = 0.043 patients on goal hemoglobin and transferrin saturation, respectively), blood pressure [systolic mean (SD) 145.3 (16.8) versus 175.8 (33.9) mmHg, P = 0.029; diastolic mean (SD) 77.0 (10.2) versus 91.8 (12.0) mmHg, P = 0.020], calcium and phosphate parameters [serum phosphate levels mean (SD) 1.81 (0.54) versus 2.07 (0.25) mmol/L, P = 0.03; calcium-phosphate product mean (SD) 4.43 (1.20) versus 4.80 (0.51) mmol(2)/L(2), P = 0.04] and lipid management [total cholesterol mean (SD) 4.4 (1.1) versus 5.0 (1.4) mmol/L, P = 0.06; low density lipoprotein cholesterol mean (SD) 2.3 (0.9) versus 2.8 (1.0) mmol/L, P = 0.013]. Results from uncontrolled studies revealed positive impact of pharmacists' interventions on reduced number of transplant rejections [mean (SD) 0.22 (0.42) versus 0.50 (0.51) episodes, P = 0.008] and adverse events (49 in 16.0% patients versus 73 in 21.3% patients, P < 0.05). CONCLUSIONS: The evidence of pharmacists' interventions in patients with chronic kidney disease is sparse, of variable quality and with heterogeneous outcomes. On the basis of best available evidence, pharmacists' interventions may have a positive impact on outcomes of patients with chronic kidney disease.

Samuel, S. M., Tonelli, M. A., Foster, B. J., et al. (2010). "Overview of the Canadian pediatric end-stage renal disease database." BMC Nephrol **11**: 21.

BACKGROUND: Performing clinical research among pediatric end-stage renal disease patients is challenging. Barriers to successful initiation and completion of clinical research projects include small sample sizes and resultant limited statistical power and lack of longitudinal follow-up for hard clinical end-points in most single center studies. DESCRIPTION: Existing longitudinal organ failure disease registry and administrative health datasets available within a universal access health care system can be used to study outcomes of end-stage renal disease among pediatric patients in Canada. To construct the Canadian Pediatric End-Stage Renal Disease database, registry data were linked to administrative health data through deterministic linkage techniques creating a research database which consists of socio-demographic variables, clinical variables, all-cause hospitalizations, and relevant outcomes (death and renal allograft loss) for this patient population. The research database also allows study of major cardiovascular events using previously validated administrative data definitions. CONCLUSION: Organ failure registry linked to health administrative data can be a powerful tool to perform longitudinal studies in pediatric end-stage renal disease patients. The rich clinical and demographic information found in this database will facilitate study of important medical and non-medical risk factors for death, graft loss and cardiovascular disease among pediatric end-stage renal disease patients.

Segall, L., Nistor, I., Pascual, J., et al. (2016). "Criteria for and Appropriateness of Renal Transplantation in Elderly Patients With End-Stage Renal Disease: A Literature Review and Position Statement on Behalf of the European Renal Association-European Dialysis and Transplant Association Descartes Working Group and European Renal Best Practice." Transplantation **100**(10): e55-65.

During the last 20 years, waiting lists for renal transplantation (RT) have grown significantly older. However, elderly patients (ie >/=65 years of age) are still more rarely referred or accepted to waiting lists and, if enlisted, have less chances of actually receiving a kidney allograft, than younger counterparts. In this review, we looked at evidence for the benefits and risks of RT in the elderly trying to answer the following questions: Should RT be advocated for elderly patients? What should be the criteria to accept elderly patients on the waiting list for RT? What strategies might be used to increase the rate of RT in waitlisted elderly candidates? For selected elderly patients, RT was shown to be superior to dialysis in terms of patient survival. Virtually all guidelines recommend that patients should not be deemed ineligible for RT based on age alone, although a short life expectancy generally might preclude RT. Concerning the assessment of comorbidities in the elderly, special attention should be paid to cardiac evaluation and screening for malignancy. Comorbidity scores and frailty assessment scales might help the decision making on eligibility. Psychosocial issues should also be evaluated. To overcome the scarcity of organ donors, elderly RT candidates should be encouraged to consider expanded criteria donors and living donors, as alternatives to deceased standard criteria donors. It has been demonstrated that expanded criteria donor RT in patients 60 years or older is associated with higher survival rates than remaining on dialysis, whereas living donor RT is superior to all other options.

Shi, Y., Xiong, J., Chen, Y., et al. (2018). "The effectiveness of multidisciplinary care models for patients with chronic kidney disease: a systematic review and meta-analysis." Int Urol Nephrol **50**(2): 301-312.

AIM: To assess the efficacy of the multidisciplinary care (MDC) model for patients with chronic kidney disease (CKD). BACKGROUND: The MDC model has been used in clinical practice for years, but the effectiveness of the MDC model for patients with CKD remains controversial. METHODS: Embase, PubMed, Medline, the Cochrane Library, and China National Knowledge Infrastructure databases were used to search for relevant articles. Only randomized controlled trials and cohort studies were pooled. Two independent authors assessed all articles and extracted the data. The efficacy was estimated from the odds ratios and corresponding 95% confidence intervals. A random effects model was used according to the heterogeneity. RESULTS: Twenty-one studies including 10,284 participants were analyzed. Compared with the non-MDC group, MDC was associated with a lower risk of all-cause mortality and lower hospitalization rates for patients with CKD. In addition, MDC also resulted in a slower eGFR decline and reduced temporary catheterization for patients receiving dialysis. However, according to the subgroup analysis, the lower rates of all-cause mortality in the MDC group were observed only in patients in stage 4-5 and when the staff of the MDC consisted of nephrologists, nurse specialists and professionals from other fields. The most prominent effect of reducing the hospitalization rates was also observed in patients with stage 4-5 but not in patients with stage 4-5 CKD. CONCLUSIONS: MDC can lower the all-cause mortality of patients with CKD, reduce temporary catheterization for patients receiving dialysis, decrease the hospitalization rate, and slow the eGFR decline. Moreover, the reduction in all-cause mortality crucially depends on the professionals comprising the MDC staff and the stage of CKD in patients. In addition, the CKD stage influences the hospitalization rates.

Singh, T. K., Arya, V. et Navaratnarajah, N. (2014). "Chronic kidney disease and cardiovascular disease: a focus on primary care." Cardiovasc Hematol Disord Drug Targets **14**(3): 212-218.

The prevalence of chronic kidney disease (CKD) in the United States has increased in the last 20 years. As CKD and cardiovascular disease (CVD) are interrelated, it is important to note that trends in the prevalence of CKD and common risk factors it shares with CVD, such as hypertension and diabetes, are likely to affect the burden of both diseases in the future. While preventing and treating CVD is of high priority in the primary care setting, a major reason why CKD continues to burden the US healthcare system is because it remains under-recognized by primary care physicians and specialists, partly due to a lack of uniform screening recommendations. This paper will review the public health implications of CKD, including its epidemiology and economic burden in the United States, its risk factor commonalities with CVD, current screening recommendations and possible prevention strategies for improvement in the future. Additionally, an emphasis will be made on encouraging primary care physicians to play a more prominent role in CKD screening and primary prevention.

Smits, K. P., Sidorenkov, G., Bilo, H. J., et al. (2016). "Process quality indicators for chronic kidney disease risk management: a systematic literature review." Int J Clin Pract **70**(10): 861-869.

BACKGROUND AND OBJECTIVES: Quality indicators (QIs) can be used for measuring the quality of actions of healthcare providers. This systematic review gives an overview of such QIs measuring processes of care for chronic kidney disease (CKD), and identifies the QIs that have content, face, operational and/or predictive validity. METHODS: PubMed and Embase were searched using a strategy combining the terms "quality of care," "quality indicators" and "chronic kidney disease". Papers were included if they focused on developing, testing or applying QIs for assessing the quality of care in adult

> patients with CKD not on renal replacement therapy. RESULTS: Two hundred and seventy-three QIs from thirty-one papers were extracted, including QIs on adequate monitoring of kidney function and vascular risk factors, on indicated treatment, drug safety, adherence and referral to a specialist. The QIs that were considered content, face and operational valid focused on monitoring of glomerular filtration rate, albumin-creatinine ratio, lipid levels and blood pressure, the use of non-steroidal anti-inflammatory drugs, nitrofurantoin and biphosphonates in patients with CKD, and QIs on monitoring haemoglobin and treatment with angiotensin-converting-enzyme-inhibitors/angiotensin-receptor-II-blockers in patients with CKD and comorbidities. No QIs were tested for predictive validity. In addition, only two QIs focused on diet and no other QIs focused on lifestyle management. CONCLUSIONS: Based on this review, sufficiently validated QIs can be selected for measuring the quality of CKD care. This review provides insight in QIs that need further validation, and in areas of care where QIs are still lacking.

St Peter, W. L., Schoolwerth, A. C., McGowan, T., et al. (2003). "Chronic kidney disease: issues and establishing programs and clinics for improved patient outcomes." Am J Kidney Dis **41**(5): 903-924.

> The spectrum of chronic kidney disease (CKD) extends from the point at which there is slight kidney damage, but normal function, to the point at which patients require either a renal transplant or renal replacement therapy to survive. Epidemiological studies suggest there are approximately 20,000,000 patients with various stages of CKD. These patients have many comorbidities, including cardiovascular disease, hypertension, diabetes, anemia, nutritional and metabolic derangements, and fluid overload. Unfortunately, evidence shows that current CKD care in the United States is suboptimal, and late referral to a nephrologist is often the rule and not the exception. Roles of primary care physicians (PCPs) and nephrologists in the care of patients with CKD remain undefined. Several studies have suggested that care provided by multidisciplinary nephrology teams can improve patient outcomes. Currently, there are published evidence-based clinical practice guidelines for anemia management, nutritional therapy, and vascular access placement, with other CKD guidelines under development. The intent of this review includes providing compelling evidence for earlier screening, identification, and management of patients with CKD; showing that current CKD care is suboptimal; encouraging the development of multidisciplinary teams that provide collaborative care to patients with CKD, suggesting roles for PCPs and nephrologists in the care of these patients; describing CKD initiatives from national organizations; and providing a comprehensive checklist that can guide the development of CKD clinics and programs.

Strand, H. et Parker, D. (2012). "Effects of multidisciplinary models of care for adult pre-dialysis patients with chronic kidney disease: a systematic review." Int J Evid Based Healthc **10**(1): 53-59.

> AIM: To compare the effectiveness of multidisciplinary care with traditional medical care on the progression of chronic kidney disease (CKD) in adult pre-dialysis patients (stages 3-5). METHODS: Eleven databases were searched for articles published between January 1990 and July 2009. The Joanna Briggs Institute-Meta Analysis of Statistics Assessment and Review Instrument was used to assess the methodological quality of retrieved articles and extract data. RESULTS: Only four articles out of 927 were included in the systematic review. Two reported the results of randomised controlled trials and two reported observational studies. The data were not presented in a format that allowed a meta-analysis to be performed and therefore a narrative summary of these articles is presented. CONCLUSION: Multidisciplinary care is deemed to be effective in delaying the progression of CKD in adults who are in the pre-dialysis phase of this condition. Education that aims to increase the knowledge and understanding of the causes of CKD is an important component of the care. IMPLICATIONS FOR PRACTICE: Members of the multidisciplinary team should draw on their specific expertise to educate the patient about CKD. The nephrologist or a nurse practitioner should devise a management plan jointly with the patient and provide regular reviews.

Thorsteinsdottir, B., Ramar, P., Hickson, L. J., et al. (2017). "Care of the dialysis patient: Primary provider involvement and resource utilization patterns - a cohort study." BMC Nephrol **18**(1): 322.

> BACKGROUND: Efficient and safe delivery of care to dialysis patients is essential. Concerns have been raised regarding the ability of accountable care organizations to adequately serve this high-risk

> population. Little is known about primary care involvement in the care of dialysis patients. This study sought to describe the extent of primary care provider (PCP) involvement in the care of hemodialysis patients and the outcomes associated with that involvement. METHODS: In a retrospective cohort study, patients accessing a Midwestern dialysis network from 2001 to 2010 linked to United States Renal Database System and with >90 days follow up were identified (n = 2985). Outpatient visits were identified using Current Procedural Terminology (CPT)-4 codes, provider specialty, and grouped into quartiles-based on proportion of PCP visits per person-year (ppy). Top and bottom quartiles represented patients with high primary care (HPC) or low primary care (LPC), respectively. Patient characteristics and health care utilization were measured and compared across patient groups. RESULTS: Dialysis patients had an overall average of 4.5 PCP visits ppy, ranging from 0.6 in the LPC group to 6.9 in the HPC group. HPC patients were more likely female (43.4% vs. 35.3%), older (64.0 yrs. vs. 60.0 yrs), and with more comorbidities (Charlson 7.0 vs 6.0). HPC patients had higher utilization (hospitalizations 2.2 vs. 1.8 ppy; emergency department visits 1.6 vs 1.2 ppy) and worse survival (3.9 vs 4.3 yrs) and transplant rates (16.3 vs. 31.5). CONCLUSIONS: PCPs are significantly involved in the care of hemodialysis patients. Patients with HPC are older, sicker, and utilize more resources than those managed primarily by nephrologists. After adjusting for confounders, there is no difference in outcomes between the groups. Further studies are needed to better understand whether there is causal impact of primary care involvement on patient survival.

Tong, A., Hanson, C. S., Chapman, J. R., et al. (2014). "The preferences and perspectives of nephrologists on patients' access to kidney transplantation: a systematic review." Transplantation **98**(7): 682-691.

> We aimed to describe nephrologists' attitudes to patients' access to kidney transplantation. Studies that assessed nephrologists' perspectives toward patient referral, screening, and eligibility for kidney transplantation were synthesized. Twenty-four studies (n>/=4695) were included. Patients with comorbidities, were nonadherent, of older age, ethnic minorities, or low socioeconomic status were less likely to be recommended. Six themes underpinned nephrologists' perspectives: prioritizing individual benefit and safety, maximizing efficiency, patient accountability, justifying gains, protecting unit outcomes, and reluctance to raise patients' expectations. Evidence-based guidelines may support systematic and equitable decision-making. Interventions for high-risk or disadvantaged patient populations could reduce disparities in access to transplantation.

Vale, L., Cody, J., Wallace, S., et al. (2003). "Continuous ambulatory peritoneal dialysis (CAPD) versus hospital or home haemodialysis for end-stage renal disease in adults." Cochrane Review **1**: 1-8.

Vart, P., Gansevoort, R. T., Joosten, M. M., et al. (2015). "Socioeconomic disparities in chronic kidney disease: a systematic review and meta-analysis." Am J Prev Med **48**(5): 580-592.

> CONTEXT: Evidence on the strength of the association between low SES and chronic kidney disease (CKD; measured by low estimated glomerular filtration rate [eGFR], high albuminuria, low eGFR/high albuminuria, and renal failure) is scattered and sometimes conflicting. Therefore, a systematic review and meta-analysis was performed to summarize the strength of the associations between SES and CKD and identify study-level characteristics related to this association. EVIDENCE ACQUISITION: Studies published through January 2013 in MEDLINE and Embase were searched. From 35 studies that met the inclusion criteria, association estimates were pooled per CKD measure in the meta-analysis (performed between 2013 and 2014). Meta-regression analysis was used to identify study-level characteristics related to the strength of the SES-CKD association. EVIDENCE SYNTHESIS: Low SES was associated with low eGFR (OR=1.41, 95% CI=1.21, 1.62), high albuminuria (OR=1.52, 95% CI=1.22, 1.82), low eGFR/high albuminuria (OR=1.38, 95% CI=1.03, 1.74), and renal failure (OR=1.55, 95% CI=1.40, 1.71). Differences in SES measures across studies were not related to the strength of associations between low SES and any of the CKD measures (low GFR, p=0.63; high albuminuria, p=0.29; low eGFR/high albuminuria, p=0.54; renal failure, p=0.31). Variations in the strength of associations were related to the level of covariate adjustment for low eGFR (p<0.001) and high albuminuria (p<0.001). CONCLUSIONS: Socioeconomic disparities in CKD were fairly strong, irrespective of how SES was measured. Variations in the strength of the associations were related to the level of covariate adjustment, particularly for low eGFR and high albuminuria.

Wang, S. M., Hsiao, L. C., Ting, I. W., et al. (2015). "Multidisciplinary care in patients with chronic kidney disease: A systematic review and meta-analysis." Eur J Intern Med **26**(8): 640-645.

> BACKGROUND: Multidisciplinary care (MDC) was widely used in multiple chronic illnesses but the effectiveness of MDC in patients with chronic kidney disease (CKD) was inconclusive. The aim of this meta-analysis is to estimate the effectiveness of MDC for CKD. METHODS: We searched PubMed, Web of Science, Google Scholar, Cochrane Library, and China Journal Full-text Database for relevant articles published in English or Chinese. Studies investigating MDC and non-MDC in patients with CKD were included. Random effect model was used to compare all-cause mortality, dialysis, risk of temporal catheterization, and hospitalization in the two treatment entities. RESULTS: We analyzed 8853 patients of 18 studies in patients with CKD stages 3-5, aged 63+/-12 years. MDC was associated with lower risk of all-cause mortality with an odds ratio (OR) of 0.52 [95% confidence interval (CI): 0.44-0.88, p=0.01], mainly in cohort studies. MDC was associated with a lower risk of starting dialysis (p=0.02) and lower risk of temporal catheterization for dialysis (p<0.01). MDC was not associated with a higher chance of choosing peritoneal dialysis (p=0.18) or a lower chance of hospitalization for dialysis (p=0.13). CONCLUSIONS: Limited evidence from randomized controlled trials is currently available to support the benefit of MDC in patients with CKD. MDC is associated with lower all-cause mortality, lower risk of starting dialysis, and lower risk of temporal catheterization for dialysis in cohort studies. MDC is not associated with a higher chance of choosing peritoneal dialysis or a lower chance of hospitalization for dialysis. More studies are needed to determine the optimal professional that should be included in MDC.

Wang, V., Diamantidis, C. J., Wylie, J., et al. (2017). "Minding the gap and overlap: a literature review of fragmentation of primary care for chronic dialysis patients." BMC Nephrol **18**(1): 274.

> BACKGROUND: Care coordination is a challenge for patients with kidney disease, who often see multiple providers to manage their associated complex chronic conditions. Much of the focus has been on primary care physician (PCP) and nephrologist collaboration in the early stages of chronic kidney disease, but less is known about the co-management of the patients in the end-stage of renal disease. We conducted a systematic review and synthesis of empirical studies on primary care services for dialysis patients. METHODS: Systematic literature search of MEDLINE/PubMED, CINAHL, and EmBase databases for studies, published until August 2015. Inclusion criteria included publications in English, empirical studies involving human subjects (e.g., patients, physicians), conducted in US and Canadian study settings that evaluated primary care services in the dialysis patient population. RESULTS: Fourteen articles examined three major themes of primary care services for dialysis patients: perceived roles of providers, estimated time in providing primary care, and the extent of dialysis patients' use of primary care services. There was general agreement among providers that PCPs should be involved but time, appropriate roles, and miscommunication are potential barriers to good primary care for dialysis patients. Although many dialysis patients report having a PCP, the majority rely on primary care from their nephrologists. Studies using administrative data found lower rates of preventive care services than found in studies relying on provider or patient self-report. DISCUSSION: The extant literature revealed gaps and opportunities to optimize primary care services for dialysis patients, foreshadowing the challenges and promise of Accountable Care / End-Stage Seamless Care Organizations and care coordination programs currently underway in the United States to improve clinical and logistical complexities of care for this commonly overlooked population. Studies linking the relationship between providers and patients' receipt of primary care to outcomes will serve as important comparisons to the nascent care models for ESRD patients, whose value is yet to be determined.

Wasylynuk, B. A. et Davison, S. N. (2016). "An overview of advance care planning for patients with advanced chronic kidney disease: The basics." Cannt j **26**(1): 24-29.

> As the number of Canadians living with end-stage kidney disease (ESKD) continues to grow, even higher numbers are living with advanced chronic kidney disease (CKD). Many of these people will eventually require renal replacement therapy (RRT), either dialysis or transplantation. More than 50% of patients starting RRT today are aged 65 or older, with the fastest growing group being patients 75 years and older. Despite advances to dialysis technology and dialysis care, the mortality rates remain

high and dialysis patients' end-of-life care may not align with their preferences or values. Advance care planning (ACP) is an essential component of quality comprehensive kidney care. Kidney care teams develop strong relationships with their patients and are well positioned to integrate ACP into routine kidney care. This article defines ACP, outlines the essential components of ACP, and discusses the benefits, challenges, and special considerations of ACP. By enhancing the kidney care team's understanding of ACP, this article aims to assist in integrating ACP into routine kidney care for patients with advanced CKD.

Weckmann, G. F. C., Stracke, S., Haase, A., et al. (2018). "Diagnosis and management of non-dialysis chronic kidney disease in ambulatory care: a systematic review of clinical practice guidelines." BMC Nephrol **19**(1): 258.

BACKGROUND: Chronic kidney disease (CKD) is age-dependent and has a high prevalence in the general population. Most patients are managed in ambulatory care. This systematic review provides an updated overview of quality and content of international clinical practice guidelines for diagnosis and management of non-dialysis CKD relevant to patients in ambulatory care. METHODS: We identified guidelines published from 2012-to March 2018 in guideline portals, databases and by manual search. Methodological quality was assessed with the Appraisal of Guidelines for Research and Evaluation II instrument. Recommendations were extracted and evaluated. RESULTS: Eight hundred fifty-two publications were identified, 9 of which were eligible guidelines. Methodological quality ranged from 34 to 77%, with domains "scope and purpose" and "clarity of presentation" attaining highest and "applicability" lowest scores. Guidelines were similar in recommendations on CKD definition, screening of patients with diabetes and hypertension, blood pressure targets and referral of patients with progressive or stage G4 CKD. Definition of high risk groups and recommended tests in newly diagnosed CKD varied. CONCLUSIONS: Guidelines quality ranged from moderate to high. Guidelines generally agreed on management of patients with high risk or advanced CKD, but varied in regarding the range of recommended measurements, the need for referrals to nephrology, monitoring intervals and comprehensiveness. More research is needed on efficient management of patients with low risk of CKD progression to end stage renal disease.

LES RECOMMANDATIONS MEDICALES

Études françaises

Haute Autorité de Santé (2009). Les conditions de mise en oeuvre de la télémédecine en unité de dialyse médicalisée. Evaluation des programmes et politiques de santé publique.: 177.
http://www.has-sante.fr/portail/upload/docs/application/pdf/2010-01/argumentaire_conditions_telemedecine_udm_vf.pdf

[BDSP. Notice produite par HAS R0xEJHFF. Diffusion soumise à autorisation]. Le contexte dans lequel s'inscrit cette demande est caractérisé par l'augmentation continue du nombre de patients en insuffisance rénale chronique terminale traités par épuration extrarénale et la volonté de procéder à un déploiement opérationnel de la télémédecine dans la restructuration de l'offre de soins. La HAS décrit dans ses recommandations l'ensemble des conditions de mise en oeuvre de la télémédecine dans le fonctionnement d'une UDM permettant de garantir la qualité des soins et la sécurité de la prise en charge : modèle organisationnel lié à la télédialyse, modalités d'organisation et d'implantation des UDM, organisation des soins par télémédecine et procédures face aux urgences, aspects techniques du système de télédialyse, aspects économiques, juridiques, déontologiques. Un cadre global pour l'évaluation des projets pilotes est également proposé. Ces recommandations pourront servir de support à la mise en place de projets pilotes autorisés par les agences régionales de santé. Elles pourront également évoluer en fonction de la définition du cadre réglementaire d'exercice de la télémédecine, des retours d'expériences et de l'élargissement du champ de développement de la télémédecine aux autres modalités de traitement de l'insuffisance rénale chronique terminale.

Haute Autorité de Santé (2012). Évaluation médico-économique des stratégies de prise en charge de l'insuffisance rénale chronique terminale en France. Volet : analyse des possibilités de développement de la transplantation rénale en France. Recommandations professionnelles.: 122.

http://www.has-sante.fr/portail/upload/docs/application/pdf/2012-09/argu_irct_volet_greffe_vf.pdf

[BDSP. Notice produite par HAS 8R0x8ls9. Diffusion soumise à autorisation]. Ce volet spécifique au développement de la transplantation rénale constitue la première partie d'un rapport actuellement en cours concernant l'évaluation médico-économique de l'ensemble des modalités de traitement des patients atteints d'insuffisance rénale chronique terminale. La transplantation rénale apparaît comme une stratégie dominante dans la prise en charge de cette pathologie c'est-à-dire qu'elle est à la fois la moins coûteuse et la plus efficace. L'objectif de ces recommandations est d'examiner les possibilités de développement de la transplantation rénale en France en tenant compte notamment des aspects organisationnels, économiques et éthiques.

Haute Autorité de Santé (2014). Évaluation médico-économique des stratégies de prise en charge de l'insuffisance rénale chronique terminale en France. Rapport d'évaluation médico-économique. Saint-Denis Haute Autorité de Santé**:** 324.
https://www.has-sante.fr/portail/jcms/c_1775180/fr/evaluation-medico-economique-des-strategies-de-prise-en-charge-de-linsuffisance-renale-chronique-terminale-en-france

L'insuffisance rénale chronique terminale affecte une part croissante de la population française et représente un enjeu économique majeur pour la plupart des pays. Son coût humain est particulièrement élevé, notamment en termes de morbi-mortalité et d'impact sur la qualité de vie du patient.. Cette évaluation médico-économique de la HAS révèle que le développement de la transplantation rénale est la stratégie de prise en charge la plus efficiente pour tous les groupes d'âge.

Haute Autorité de Santé (2012). Maladie Rénale Chronique de l'adulte. Guide du parcours de soins. Saint-Denis, HAS

Le guide du parcours de soins décrit la prise en charge usuelle d'une personne ayant une maladie rénale chronique. Il cible principalement les professionnels impliqués dans la prise en charge globale des patients. Tenant compte de la pluri-professionnalité de la prise en charge, le guide aborde aussi le rôle, la place et les modalités de coordination des différents professionnels. Le guide du parcours de soins est accompagné d'une synthèse focalisée sur les points critiques de la prise en charge et d'un schéma du parcours du patient.

Haute Autorité de Santé (2014). "Insuffisance rénale chronique terminale : la transplantation est la stratégie la plus efficiente dans tous les groupes d'âge. Focus." HAS ACTUALITES ET PRATIQUES(63): 1.

L'insuffisance rénale chronique terminale affecte une part croissante de la population française et représente un enjeu économique majeur pour la plupart des pays. Son coût humain est particulièrement élevé, notamment en termes de morbi-mortalité et d'impact sur la qualité de vie du patient. La HAS a réalisé une évaluation médico-économique qui révèle que le développement de la transplantation rénale est la stratégie de prise en charge la plus efficiente pour tous les groupes d'âge.

Haute Autorité de Santé (2015). Transplantation rénale. Accès à la liste d'attente nationale**:** 274p.

Les objectifs de cette recommandation sont de favoriser l'accès à la transplantation rénale et de réduire les disparités d'accès et les délais d'inscriptions. Les critères médicaux justifiant de ne pas orienter le patient vers un parcours de transplantation, ainsi que ceux justifiant de ne pas inscrire le patient ont été définis, ainsi que le bilan prétransplantation commun à toute personne envisageant une transplantation rénale. Les messages clés sont : Repérer 12 à 18 mois avant la nécessité d'un traitement de suppléance, les patients susceptibles d'être orientés vers un parcours de greffe ; Informer et échanger avec les patients sur l'ensemble des traitements de suppléance, dont la greffe avec donneur décédé ou donneur vivant. Après accord du patient, débuter le bilan prétransplantation et/ou orienter vers une équipe de transplantation tout patient de moins de 85 ans, avec une maladie rénale chronique irréversible, de stade 4 évolutive ou de stade 5, dialysé ou non, si sa situation ne figure pas dans les orientations non justifiées ou à discuter entre néphrologue référent et équipe de transplantation.

Haute Autorité de Santé et Agence de la biomédecine (2014). Évaluation médico-économique des stratégies de prise en charge de l'insuffisance rénale chronique terminale en France. Saint-Denis La Plaine, HAS**:** 324p.

> La HAS et l'Agence de la biomédecine ont conduit une évaluation médico-économique des stratégies de prise en charge des patients traités pour insuffisance rénale chronique terminale (IRCT). L'objectif était d'évaluer l'impact clinique et économique de possibilités de changements dans la trajectoire de soins des patients entre différentes modalités de traitement de suppléance : hémodialyse en centre, en unité de dialyse médicalisée, en unité d'autodialyse, à domicile ; dialyse péritonéale automatisée (DPA) et dialyse péritonéale continue ambulatoire (DPCA) assistée ou non assistée par une infirmière ; transplantation rénale à partir de donneur décédé ou vivant. L'évaluation s'est fondée d'une part, sur une étude de coût à partir des données de l'Assurance maladie et, d'autre part, sur un modèle alimenté par les trajectoires observées dans le registre français des traitements de suppléance de l'IRCT (REIN). Ce modèle a permis d'évaluer l'efficience de différentes stratégies de prise en charge, en tenant compte des possibilités d'évolutions par rapport à la situation actuelle, en particulier le développement de la transplantation rénale, le développement de la prise en charge hors centre de dialyse et à domicile.

Inserm (1998). Insuffisance rénale chronique. Etiologies, moyens de diagnostic précoce, prévention ?, Paris : Les Editions INSERM

> Cet ouvrage a été réalisé par un groupe pluridisciplinaire d'experts, réunis par l'INSERM à la demande du Haut Comité de la Santé Publique. Ce travail fait l'analyse des connaissances les plus récentes, des données cliniques et épidémiologiques, sur l'insuffisance rénale chronique et les principales atteintes rénales qui en sont la cause. Dans chaque chapitre, les auteurs, s'attachent à envisager des actions de santé permettant de freiner la progression vers l'insuffisance rénale terminale. En fin de rapport, la synthèse comporte des recommandations élaborées collectivement et des propositions en vue d'améliorer le diagnostic précoce et la prévention de l'insuffisance rénale chronique.

Laville, M. et Duru, G. (2001). "Comment optimiser le moment de la prise en charge des insuffisances rénales chroniques ?" THERAPIE - PARIS **56**(5): 533-543.

> L'optimisation de la prise en charge de l'insuffisance rénale chronique (IRC) a pour but de diminuer la morbidité et la mortalité des patients en insuffisance rénale chronique, directement liées à la progression vers l'IRC terminale, et aux complications mettant en jeu le pronostic vital et/ou fonctionnel. La progression'spontanée'vers l'IRC terminale résulte de facteurs propres à la néphropathie initiale, et de facteurs non spécifiques liés notamment à l'hypertension artérielle, et aux adaptations fonctionnelles à la réduction néphronique. La prévention secondaire de l'IRC passe ainsi par l'identification précoce de la néphropathie en vue d'un éventuel traitement spécifique ; le traitement de l'hypertension ; la normalisation des apports en protéines ; la prévention des événements notamment iatrogènes susceptibles d'aggraver irréversiblement la fonction rénale. Les événements cliniques n'apparaissent que très tardivement au cours de l'IRC, à la suite d'anomalies présentes longtemps avant le stade de la dialyse (hypertension, dyslipidémies, anomalies phosphocalciques anémie, malnutrition) qui doivent être dépistées et traitées dans une démarche de prévention tertiaire. Enfin, lorsque la dialyse apparaît inévitable, une information précoce et une préparation médicale planifiée du patient sont nécessaires pour donner à la méthode choisie, les meilleures chances de succès. Malheureusement, de nombreux patients ne sont encore pris en charge qu'à un stade d'IRC sévère, auquel les effets des interventions thérapeutiques sont plus limités : ces patients ont des durées d'hospitalisation plus longues, une incidence plus élevée de complications durant les premiers mois de dialyse, et ont deux fois moins de chances de pouvoir être autonomisés sur une méthode de dialyse hors-centre type autodialyse, dialyse à domicile, ou dialyse péritonéale.

Muller, C., Bazin Kara, D., Fourtage, M., et al. (2016). "[Compliance and leaflet's reading, which link and which media? Results from a French population with chronic kidney disease]." Nephrol Ther **12**(6): 443-447.

> Leaflets inside drug boxes are complex and often poorly understood. Patients consulting in nephrology are mostly old and often suffer from multiple comorbidities. As so, they are often subject to various contra-indications and drug interactions. This paper aims to evaluate if patients actually read leaflets

or other medical information on others medias such as Internet and whether this could, potentially, interfere with their observance. Results showed that leaflets were read by 65.1% of patients, leading to 12% of withdrawal or not taking drugs. Furthermore, compliance to medical guidance was deemed e-read by 65.1% of patients, leading to 12% of withdrawal or not taken drugs. Furthermore, this study showed no clear profile for non-compliant patients. Even the youngest patients (under 50 years old) have had a good compliance, with not more withdrawal or not taking pills. Nonetheless, youngest patients used more often to consult alternative medias and did not read much of the leaflets' information. Patients who were reading leaflets however, tended to search further information on other medias. This situation would create new challenges in health care, as it seems that data available on new medias are not systematically validated or adapted to the needs of the patients.

Études internationales

(2016). "KDIGO releases living kidney donor guideline for public review." Nephrol News Issues **30**(1): 27-28.

Abecassis, M. M., Burke, R., Klintmalm, G. B., et al. (2009). "American Society of Transplant Surgeons transplant center outcomes requirements--a threat to innovation." Am J Transplant **9**(6): 1279-1286.

The transplant center regulations recently published by the Centers for Medicare and Medicaid (CMS) mandate that observed program-specific survival outcomes to fall within expected risk-adjusted outcomes. Meeting these outcomes is essential to continued participation in the Medicare program. Both donor and recipient variables not considered in current risk adjustment models can result in inferior outcomes and therefore may cause an overestimation of transplant center expected performance, precluding participation in the federally funded Medicare program. We reviewed the most recent four reporting periods published by the Scientific Registry for Transplant Recipients on their public website. We identified kidney, liver and heart transplant programs that were flagged for having outcomes statistically lower than expected as well as those that failed to meet CMS criteria. We also analyzed whether center volumes correlated with outcomes in these centers. We highlight the need for mitigating factors that could justify inferior outcomes under specific circumstances. Failure to reach consensus on such a mechanism for appeal may result in risk-averse behavior by transplant centers with respect to innovation and therefore hamper the ability to advance the field of transplantation. We propose a methodology that may address this emerging dilemma.

Abramowicz, D., Cochat, P., Claas, F. H., et al. (2015). "European Renal Best Practice Guideline on kidney donor and recipient evaluation and perioperative care." Nephrol Dial Transplant **30**(11): 1790-1797.

The European Best Practice Guideline group (EBPG) issued guidelines on the evaluation and selection of kidney donor and kidney transplant candidates, as well as post-transplant recipient care, in the year 2000 and 2002. The new European Renal Best Practice board decided in 2009 that these guidelines needed updating. In order to avoid duplication of efforts with kidney disease improving global outcomes, which published in 2009 clinical practice guidelines on the post-transplant care of kidney transplant recipients, we did not address these issues in the present guidelines.The guideline was developed following a rigorous methodological approach: (i) identification of clinical questions, (ii) prioritization of questions, (iii) systematic literature review and critical appraisal of available evidence and (iv) formulation of recommendations and grading according to Grades of Recommendation Assessment, Development, and Evaluation (GRADE). The strength of each recommendation is rated 1 or 2, with 1 being a 'We recommend' statement, and 2 being a 'We suggest' statement. In addition, each statement is assigned an overall grade for the quality of evidence: A (high), B (moderate), C (low) or D (very low). The guideline makes recommendations for the evaluation of the kidney transplant candidate as well as the potential deceased and living donor, the immunological work-up of kidney donors and recipients and perioperative recipient care.All together, the work group issued 112 statements. There were 51 (45%) recommendations graded '1', 18 (16%) were graded '2' and 43 (38%) statements were not graded. There were 0 (0%) recommendations graded '1A', 15 (13%) were '1B', 19 (17%) '1C' and 17 (15%) '1D'. None (0%) were graded '2A', 1 (0.9%) was '2B', 8 (7%) were '2C' and 9 (8%) '2D'. Limitations of the evidence, especially the lack of definitive clinical outcome trials, are discussed and suggestions are provided for future research.We present here the complete recommendations about the evaluation of the kidney transplant candidate as well as the potential deceased and living donor, the immunological work-up of

kidney donors and recipients and the perioperative recipient care. We hope that this document will help caregivers to improve the quality of care they deliver to patients. The full version with methods, rationale and references is published in Nephrol Dial Transplant (2013) 28: i1-i71; doi: 10.1093/ndt/gft218 and can be downloaded freely from http://www.oxfordjournals.org/our_journals/ndt/era_edta.html.

Allen, M. B. et Reese, P. P. (2016). "Transforming Living Kidney Donation with a Comprehensive Strategy." PLoS Med **13**(2): e1001948.

Matthew Allen and Peter Reese argue that evidence-based efforts should be implemented to expand living kidney donation.

Andrews, P. A. (2014). "Summary of the British Transplantation Society Guidelines for Management of the Failing Kidney Transplant." Transplantation **98**(11): 1130-1133.

The British Transplantation Society "Guideline for Transplantation Management of the Failing Kidney Transplant" was published in May 2014. This is the first national guideline in this field. In line with previous guidelines published by the British Transplantation Society, the guideline has used the GRADE system to rate the strength of evidence and recommendations.This article summarizes the Statements of Recommendation contained in the guideline, which provide a framework for the management of the failing kidney graft in the United Kingdom and may be of wide international interest. It is recommended that the full guideline document is consulted for details of the relevant references and evidence base. This may be accessed at: http://www.bts.org.uk/MBR/Clinical/Guidelines/Current/Member/Clinical/Current_Gui delines.aspx.

Arunachalam, C., Garrues, M., Biggins, F., et al. (2013). "Assessment of living kidney donors and adherence to national live donor guidelines in the UK." Nephrol Dial Transplant **28**(7): 1952-1960.

BACKGROUND: As in most industrialized countries, living kidney donation has increased considerably in the UK and now amounts to 38% of the total UK kidney transplant activity. Living kidney donation guidelines have been formulated by the relevant national societies. We were interested to study whether or not renal units across the UK adhere to those guidelines and to delineate areas of inconsistency and controversy. METHODS: Twenty-four adult kidney transplant centres and 50 adult non-transplant renal units across the UK were contacted by a postal questionnaire from January to April 2011. RESULTS: Twenty-one of 24 (88%) transplanting units and 23 of 50 (46%) non-transplanting units responded. Eighty-one per cent of the responding transplanting units and only 30% of the non-transplanting units have a dedicated live donor clinic. Eighty-six per cent of all units are without a set upper age limit for donors, whereas 7% of units excluded all potential donors older than 70 years. Twenty per cent of units accept donors with body mass indices (BMIs) up to 35, whereas 9% of units did not have an upper limit for BMI. Thirty-two per cent of centres exclude hypertensive donors on more than one antihypertensive drug, whereas 64% of units exclude donors only if they are on more than two anti-hypertensive drugs. of units rely on a spot urine sample to assess proteinuria, while 30% of units still perform 24 h urine collection. Sixty one per cent of units perform computed tomography (CT) angiography to assess the renal vessels prior to donation, while 32% use magnetic resonance (MR) angiography. Seventy-five per cent of centres assess split kidney function by radionuclide testing in all cases, whereas 25% perform this test only if there is a discrepancy in kidney size. The practice of suspension of recipients with potential living donor from the deceased waiting list is also remarkably inconsistent, whereby some centres suspend once a decision for living donation has been made in principle, whereas others suspend the recipient only once a date for surgery has been agreed. CONCLUSIONS: We demonstrate significant variability in accepting living kidney donors, particularly regarding age, BMI, and hypertension. Infrastructure setting for living donation and the live donor assessment are also remarkably inconsistent across the UK. It remains unclear as to why nephrologists decide not to adhere to established guidelines and further research should aim to find the lacking evidence in areas causing inconsistency in living donor assessment.

Baskin-Bey, E. S., Kremers, W., Stegall, M. D., et al. (2005). "United Network for Organ Sharing's expanded criteria donors: is stratification useful?" Clin Transplant **19**(3): 406-412.

> The United Network for Organ Sharing (UNOS) Expanded Criteria Donor (ECD) system utilizes pre-transplant variables to identify deceased donor kidneys with an increased risk of graft loss. The aim of this study was to compare the ECD system with a quantitative approach, the deceased donor score (DDS), in predicting outcome after kidney transplantation. We retrospectively reviewed 49 111 deceased donor renal transplants from the UNOS database between 1984 and 2002. DDS: 0-39 points; >or=20 points defined as marginal. Recipient outcome variables were analyzed by ANOVA or Kaplan-Meier method. There was a 90% agreement between the DDS and ECD systems as predictors of renal function and graft survival. However, DDS identified ECD- kidneys (10.7%) with a significantly poorer outcome than expected (DDS 20-29 points, n = 5,252). Stratification of ECD+ kidneys identified a group with the poorest outcome (DDS >or=30 points). Predictability of early post-transplant events (i.e. need for hemodialysis, decline of serum creatinine and length of hospital stay) was also improved by DDS. DDS predicted outcome of deceased donor renal transplantation better than the ECD system. Knowledge obtained by stratification of deceased donor kidneys can allow for improved utilization of marginal kidneys which is not achieved by the UNOS ECD definition alone.

Batabyal, P., Chapman, J. R., Wong, G., et al. (2012). "Clinical practice guidelines on wait-listing for kidney transplantation: consistent and equitable?" Transplantation **94**(7): 703-713.

> BACKGROUND: Apparent variability in wait-listing criteria globally has raised concern about inequitable access to kidney transplantation. This study aimed to compare the quality, the scope, and the consistency of international guidelines on wait-listing for kidney transplantation. METHODS: Electronic databases and guideline registries were searched to December 2011. The Appraisal of Guidelines for Research and Evaluation II instrument and textual synthesis was used to assess and compare recommendations. RESULTS: Fifteen guidelines published from 2001 to 2011 were included. Methodological rigor and scope were variable. We identified 4 major criteria across guidelines: recipient age and life expectancy, medical criteria, social and lifestyle circumstances, and psychosocial considerations. Whereas some recommendations were consistent, there were differences in age cutoffs, estimated life expectancy (2-5 years), and glomerular filtration rate at listing (15-20 mL/min/1.73 m). Cardiovascular contraindications were broadly defined. Recommended cancer-free periods also varied substantially, and whereas uncontrolled infections were universally contraindicated, human immunodeficiency virus thresholds and adherence to highly active antiretroviral therapy were inconsistent. Most guidelines recommended psychological screening but were not augmented with specific clinical assessment tools. CONCLUSIONS: Wait-listing recommendations in current guidelines are based on life expectancy, comorbidities, lifestyle, and psychosocial factors. Some recommendations are different across guidelines or broadly defined. There is a case for developing comprehensive, methodologically robust, and regularly updated guidelines on wait-listing for kidney transplantation.

Bertoni, E., Merciai, C., Becherelli, P., et al. (2006). "[Kidney transplant failure and retransplantation.]." G Ital Nefrol **23**(5): 471-479.

> Transplant failure is a more and more frequent cause of end stage renal failure and dialysis. Patient survival rate after graft failure is very varied according to different reports. Better survival is mainly a consequence of good continuum of care thanks to improved interaction between dialysis and transplant center. Diabetic and elderly patients, as well as patients affected by cardiovascular disease are the subjects at higher risk: if judged clinically adequate to enter the waiting list, they should be retransplanted as soon as possible. Dialysis survival of patients with failed kidney transplant is strictly linked to adequate dialysis dose. Second transplant survival rate is higher in the case of a living donor and if the first transplant survived longer. Good immunologic match is also a condition linked to higher graft and patient survival rate. High body mass index, smoking and severe cardiovascular comorbidity should be avoided. Whether to keep low immunosuppression levels after first graft failure and whether to excise the failed kidney, even though it shows no clinical problems, are issues still under debate. Low-dose immunosuppression is not recommended since it may result in higher rate of infectious and neoplastic diseases. The failed kidney should be removed not only in the case of clinical disease, but also when the retained failed kidney is associated with chronic inflammation, as shown by high C-reactive protein levels and erythropoietin resistance.

Beto, J. A. et Bansal, V. K. (2004). "Medical nutrition therapy in chronic kidney failure: integrating clinical practice guidelines." J Am Diet Assoc **104**(3): 404-409.

This review updates earlier published recommendations and integrates current clinical practice guidelines for nutritional care in chronic kidney disease as recommended by the National Kidney Foundation Kidney Dialysis Outcome Quality Initiative (K/DOQI). The scope covers chronic kidney disease in adults prior to kidney failure (Stages 1-4), chronic kidney failure with hemodialysis or peritoneal dialysis replacement therapy (Stage 5), and management after kidney transplantation. Multiple diet parameters are necessary to provide optimal nutritional health, including monitoring of calories, protein, sodium, fluid, potassium, calcium, and phosphorus, as well as other individualized nutrients. Emphasis is placed on continuity of care within changing kidney function and treatment modality status. The rising incidence of chronic kidney disease will increase the probability of the non-renal specialist dietetics professional delivering care to this patient population.

Bia, M., Adey, D. B., Bloom, R. D., et al. (2010). "KDOQI US commentary on the 2009 KDIGO clinical practice guideline for the care of kidney transplant recipients." Am J Kidney Dis **56**(2): 189-218.

In response to recently published KDIGO (Kidney Disease: Improving Global Outcomes) guidelines for the care of kidney transplant recipients (KTRs), the National Kidney Foundation's Kidney Disease Outcomes Quality Initiative (KDOQI) organized a working group of transplant nephrologists and surgeons to review these guidelines and comment on their relevance and applicability for US KTRs. The following commentaries on the KDIGO guidelines represent the consensus of our work group. The KDIGO transplant guidelines concentrated on aspects of transplant care most important to this population in the posttransplant period, such as immunosuppression, infection, malignancy, and cardiovascular care. Our KDOQI work group concurred with many of the KDIGO recommendations except in some important areas related to immunosuppression, in which decisions in the United States are largely made by transplant centers and are dependent in part on the specific patient population served. Most, but not all, KDIGO guidelines are relevant to US patients. However, implementation of many may remain a major challenge because of issues of limitation in resources needed to assist in the tasks of educating, counseling, and implementing and maintaining lifestyle changes. Although very few of the guidelines are based on evidence that is strong enough to justify their being used as the basis of policy or performance measures, they offer an excellent road map to navigate the complex care of KTRs.

Blume, C., Pischke, S., von Versen-Hoynck, F., et al. (2014). "Pregnancies in liver and kidney transplant recipients: a review of the current literature and recommendation." Best Pract Res Clin Obstet Gynaecol **28**(8): 1123-1136.

In this article, we focus on the biggest groups of organ transplant recipients, patients with a kidney or liver graft. Among these patients, about one sixth included women of childbearing potential. Therefore, the wish of getting pregnant is frequent in these peculiar patients, and careful planning and management of the pregnancies requires the expertise of obstetricians, midwives and transplant experts. Altogether, the outcome of the pregnancies in these women is acceptable. About 75% off all pregnancies ended successfully with live births, and this is comparable if not superior to pregnancies in healthy women. This success might be caused not only by the special and intensive care provided to these high-risk pregnancies by the transplant centres but also by the low rate of unplanned pregnancies. The risk of rejections and organ loss after delivery is about 10%, and it is slightly enhanced in liver transplant recipients (LTRs) in comparison to kidney graft recipients (KTRs) but the number of organ losses in direct association with a pregnancy is rare. However, there is not only a higher frequency of pregnancy-associated disorders such as pre-eclampsia and preterm delivery but also an acceleration of hypertension, new-onset diabetes mellitus and newly arising infections also favoured by the maintained immunosuppressive therapy. This implies a specialized 'control system' for these pregnant women that comprises ultrasound and Doppler investigation for risk assessment, infection screening, suitable therapy and the choice of non-teratogenic immunosuppressives. Antihypertensive treatment must be well balanced and adjusted to the possible growth-retarding effect on the foetus as well as on the co-morbidity of the mother. Finally, supplementation of vitamin D and iron is much more important in these transplanted women than in healthy pregnant women as vitamin D deficiency and anaemia are discussed to have an impact on pre-eclampsia and preterm delivery. These claims are widely discussed. Furthermore, the current literature is systematically reviewed by Scopus analysis.

Bolignano, D., Catalano, C., Locatelli, F., et al. (2014). "[Italian adaptation of the European Renal Best Practice (ERBP) guideline on kidney donor and recipient evaluation and perioperative care]." G Ital Nefrol **31**(2).

> Recently, the ERBP (European Renal Best Practice) guideline on kidney donor and recipient evaluation and perioperative care has been published and disseminated to the international nephrology community. This guideline aims at providing evidence-based recommendations on the evaluation of the kidney transplant candidate. They evaluate the immunologic workup of kidney donors and recipients, they recommend the evaluation, selection and preparation of deceased and living kidney donors and the perioperative care of the kidney transplant recipient. We report here the Italian adaptation of these guidelines, with a focus on the main statements elaborated for each single clinical question.

Bucsa, C., Stefan, G., Tacu, D., et al. (2014). "Does the KDIGO CKD risk stratification based on GFR and proteinuria predict kidney graft failure?" Int Urol Nephrol **46**(9): 1857-1865.

> PURPOSE: The 2012 Kidney Disease: Improving Global Outcomes (KDIGO) guidelines on chronic kidney disease (CKD) introduced risk classes for adverse outcome based on estimated glomerular filtration rate (eGFR) and albuminuria categories (low-LR, moderately-MR, high-HR, very high risk-VHR). We aimed to investigate if such risk stratification is suitable in kidney transplant (KTx) recipients. METHODS: This single-center prospective study enrolled 231 prevalent KTx recipients [36 (34-48) years, 62 % male, eGFR 53.7 (50.9-56.4) mL/min]. The patients were stratified in risk classes in January 2011; clinical and laboratory data were collected every 6 months till June 2013. Individual slope of linear regression of all eGFR and time-averaged proteinuria (TAP) were computed. The composite endpoint was defined as >30 % decline in eGFR from 6 months after KTx to June 2013, dialysis initiation or death. RESULTS: Fifty-one patients reached the endpoint. They were younger, more often female, donor specific anti-HLA antibodies positive, noncompliant and smokers. TAP was 4 time greater ($p < 0.0001$) and eGFR abruptly declined [eGFR slope: -3.17 (-4.13 to -2.21) vs. 0.81 (0.45-1.3) mL/min per year, $p < 0.0001$] in the endpoint group. At baseline: 36 % LR, 23 % MR, 23 % HR and 18 % VHR, without differences between the groups. In the binary logistic regression model, VHR as compared to the other risk classes was an independent risk factor for poorer outcome. The final model also included female gender, cardiovascular events, smoking, GFR slope and BK virus infection. CONCLUSIONS: Risk group stratification according to KDIGO guideline on CKD may prove useful in predicting graft outcome, but this should be confirmed in larger cohorts.

Chapman, J. R. (2010). "The KDIGO clinical practice guidelines for the care of kidney transplant recipients." Transplantation **89**(6): 644-645.

> The clinical guideline for care of renal transplant recipients was written by a committee of 15 people from nine countries, supported by an evidence review team The scope of the review was care of the patient after a renal transplant-not evaluation or selection of recipients and donors, focusing on the issue specific to the immunosuppressed transplant patient. A total of 12,327 articles comprising 3168 randomized controlled trials, 7543 cohort studies, and 1609 reviews were selected by a formal search. Each article was formally evaluated for the quality of the data from A to D. A consistent set of statements were based on the strength of the evidence. Level 1 evidence: "we recommend" means that if you were a patient, most people would want to do this; if a clinician, you should recommend this course of action to most patients; and if a policy maker, you should adopt this as a reasonable standard. Level 2 evidence: "we suggest" means the majority of patients would want do this; to the clinician, it means that different solutions may well be needed for different patients; whereas to the health policy maker, this is a strong warning to engage stakeholders in the creation of a particular local policy. Because 69% of the advice is "suggested" on the basis of level C or D evidence, one outcome of this work is to make it clear where the current evidence for clinical decisions runs out of data.

Chung, R., Howard, K., Craig, J. C., et al. (2014). "Economic evaluations in kidney transplantation: frequency, characteristics, and quality-a systematic review." Transplantation **97**(10): 1027-1033.

> BACKGROUND: Economic evaluation provides a unique tool for informing healthcare decisions by explicitly quantifying limited resources required to achieve health gains and are widely used by policy makers to inform regulatory and subsidy decisions, but the validity of these studies in the field of transplantation is unknown. AIM: The objective of this study is to describe and evaluate the quality and reporting of recently published economic evaluations in kidney transplantation. METHODS: A comprehensive literature search was undertaken for economic evaluations of interventions used in

kidney transplantation published between January 2000 and December 2011. RESULTS: A total of 66 studies were identified, with the majority (>60%) being supported by academia. About 80% of the included studies reported highly favorable cost-effectiveness ratios, with the majority showing dominance against the comparator. The overall qualities of the studies were adequate, but there was no improvement in the overall quality and frequency of economic evaluations over time. On a continuous scale between 0 and 1, studies that used a broader (societal) perspective, assessed health gains in quality adjusted life years, were supported by academia, and evaluated non-pharmaceutical interventions were associated with a 5% to 10% increase in the overall quality of the studies compared to studies that employed a narrower perspective, assessed health gains in natural units, were supported by industry, and evaluated pharmaceutical interventions. CONCLUSIONS: Economic evaluations are infrequently published in transplantation, but the overall methodological quality is high. Publication bias appears highly prevalent, with under-representation of studies that find small health gains and less favorable cost-effectiveness ratios published.

Cienfuegos-Belmonte, I. R., Leon-Duenas, E., Roman-Martin, A. A., et al. (2016). "Evaluation of the Spanish Urological Association quality care indicators in a kidney transplantation programme." Actas Urol Esp.

INTRODUCTION: Indicators show the presence of a phenomenon and its intensity. They assess the level of quality care and identify potential situations for improvement. Our objective is to assess the 2013 and 2014 quality care indicators of our department's kidney transplantation area. MATERIAL AND METHOD: For 2013 and 2014, we reviewed 88 and 106 kidney transplants and 47 and 66 extractions. We evaluated the quality care indicators developed by the Spanish Urological Association, analysing the results with the SPSS v 21.0 programme. RESULTS: The mean cold ischaemia time (CIT) was 14.96hours in 2013 and 18.07hours in 2014. The CIT was </=18h in 53% and 56% of cadaveric donor kidneys in 2013 and 2014, respectively. The rate of relevant early onset urinary fistulae was 1.14% and 2.83% for each year. The rate of early transplantectomy due to a vascular complication was 3.41% and 2.83% for 2013 and 2014, respectively. Overall patient survival at 1 year was 100% for both periods, and graft survival at 1 year was 95% and 94.34% for 2013 and 2014, respectively. The rate of living-donor transplantation was 14.77% and 17.92%, and 92.31% and 68.42% of the living-donor extractions were laparoscopic for 2013 and 2014, respectively. Resident medical interns were the first surgeon in 6.67% and 12.64% of the transplantations and in 55.88% and 19.14% of the cadaveric extractions during 2013 and 2014, respectively. CONCLUSIONS: During the evaluated period, all quality care standards in kidney transplantation were met, except for CIT in both years and resident medical intern participation in kidney implantation in 2013. This analysis promotes improvements in quality care, highlighting weak spots that need work.

Colaneri, J. (2014). "An Overview of Transplant Immunosuppression--History, Principles, and Current Practices in Kidney Transplantation." Nephrol Nurs J **41**(6): 549-560; quiz 561.

From the historical first transplant in 1954 to the current transplant era, tremendous strides have been made in transplant immunology and immunosuppression. The most common immunosuppressive regimens use a combination of agents with differing modes of action to maximize efficacy and minimize the toxicities associated with each class of agent. The general categories of immunosuppressives are glucocorticoids, antimetabolites, calcineurin inhibitors, anti-lymphocyte antibody therapies (monoclonal and polyclonal), costimulation blockers, and mTOR inhibitors. This article reviews immunosuppressant medications, their actions, and significant side effects; discusses clinical management issues of immunosuppression; and describes future directions for the development of immunosuppressive medications.

Cozzi, E., Biancone, L., Lopez-Fraga, M., et al. (2016). "Long-term Outcome of Living Kidney Donation: Position Paper of the European Committee on Organ Transplantation, Council of Europe." Transplantation **100**(2): 270-271.

Crawford, P. W. et Lerma, E. V. (2008). "Treatment options for end stage renal disease." Prim Care **35**(3): 407-432, v.

The latest National Health and Nutrition Study revealed an increasing incidence of kidney disease among aging baby boomers, as the incidence of diabetes mellitus and hypertension rises. Because of this trend, a greater proportion of a primary care physician's practice will involve patients with chronic kidney disease, and consequently, end stage renal disease. Unfortunately, far too many of these chronic kidney

disease patients are referred to a nephrologist very late. More often than not, the opportunity for secondary preventive intervention, with the goal of avoiding renal replacement therapy, is lost. This article addresses the various treatment options for patients with end stage renal disease.

Cubero, J. J., Fernandez Fresnedo, G., Luna, E., et al. (2009). "[Impact of advanced kidney disease on transplanted patients and their return to dialysis]." Nefrologia **29 Suppl 1**: 3-6.

Although long-term outcomes also improved, graft loss caused by chronic allograft nephropathy remains an important obstacle. This situation, together with the progressive increase in the number of renal transplant patients, means that the population of transplant patients readmitted to a dialysis program will be progressively greater. The mortality rate in patients starting dialysis after graft loss has been reported as variable, though higher than that observed in patients with a functioning graft and that observed in patients on dialysis treatment. However, it is not known how the management of chronic kidney disease patients in the transplant setting differs from that of patients with native kidney disease with a similar degree of renal dysfunction. Many patients in stages 4T-5T have chronic kidney disease related complications that fall below targets established for nontransplant chronic kidney disease patients. A limited number of studies have evaluated patients returning to dialysis after graft failure and the different guidelines in the setting of transplantation have not analyzed this crucial aspect so important. Parting from this premise, a working group of the Spanish Society of Nephrology in the field of kidney transplantation and dialysis has reviewed in-depth each of the clinical aspects of care of patients with kidney transplant failure coming back to dialysis and drawn up a consensus document in order to optimize the management of this condition.

Davis, C. L., Gonwa, T. A. et Wilkinson, A. H. (2002). "Identification of patients best suited for combined liver-kidney transplantation: part II." Liver Transpl **8**(3): 193-211.

Liver-kidney transplantation (LKT) should be reserved for those recipients with primary disease affecting both organs. However, increasing transplant list waiting times have increased the development and duration of acute renal failure before liver transplantation. Furthermore, the need for posttransplant calcineurin inhibitors can render healing from acute renal failure difficult. Because of the increasing requests for and controversy over the topic of a kidney with a liver transplant (OLT) when complete failure of the kidney is not known, the following article will review the impact of renal failure on liver transplant outcome, treatment of peri-OLT renal failure, rejection rates after LKT, survival after LKT, and information on renal histology and progression of disease into the beginnings of an algorithm for making a decision about combined LKT.

del Pozo-Fernandez, C., Lopez-Menchero-Martinez, R., Alvarez-Avellan, L., et al. (2013). "Compliance with objectives based on different guidelines (KDIGO/S.E.N.) and analysis of the individual variability of mineral metabolism in haemodialysis patients in the medium term." Nefrologia **33**(5): 675-684.

OBJECTIVE: To assess the level of compliance and variability of mineral metabolism parameters over time in a sample of haemodialysis patients for the different ranges proposed (KDIGO guidelines/S.E.N recommendations) in both groups and individuals continuously. MATERIAL AND METHOD: Every four months, we collected data on calcium, phosphorus, PTH and treatment in a sample of 44 patients followed up continuously for 32 months. We established the percentages of patients who complied with the objectives set for each parameter in both ranges: optimal (KDIGO) and acceptable (S.E.N.) in each control and the percentage that individually complied with the objectives in at least 75% of the determinations. RESULTS: Compliance with the objective using the optimal range improved, although PTH did not exceed 50%. Using the acceptable range, the objective was achieved in the three parameters in over 70% and over 50% of patients achieved the three simultaneously while using the optimal range, 30% was never achieved. Individually, compliance with the optimal range was continuously achieved in 52.3% (calcium), 45.5% (phosphorus) and in only one patient in PTH, while when using the acceptable range, compliance was achieved in 84.1% (calcium) and 70.5% (phosphorus and PTH). CONCLUSIONS: The use of less stringent criteria than the KDIGO guidelines in calcium, phosphorus and PTH objectives allows patients to remain continuously within appropriate ranges with less intervention and less individual variability.

Delmonico, F. L. et Dew, M. A. (2007). "Living donor kidney transplantation in a global environment." Kidney Int **71**(7): 608-614.

> Live donor kidney transplantation has become a widely sought treatment by patients with end-stage renal failure. As the outcome for the genetically and emotionally related live donor transplants is the same, this review considers live kidney transplantation from the broad scope of current international practice. Unrelated live donor transplantation can now be performed for incompatible donor recipient pairs via a simultaneous paired kidney donation. However, acceptance of the scientific data that an unrelated live donor transplant can now be performed successfully should not be misconstrued as an acceptance that an unrelated kidney may be purchased via a vendor sale. At a recent World Health Organization (WHO) conference of Middle East transplant professionals a statement of unequivocal opposition to commercialism was drafted. In the United States, the Institute of Medicine has recently published a significant report that affirms the legal prohibition of organ sales. These documents are in accord with the guiding principles of the WHO and the membership policy of The Transplantation Society. The person who gives consent to be a donor should be competent, willing to donate, free of coercion, medically and psychosocially suitable, and fully informed of the risks and benefits as a donor. With these principles established, the Amsterdam Forum has set forth a comprehensive list of medical criteria that is now used internationally in the evaluation of potential kidney donors. Guidelines of a psychosocial evaluation are also presented in this report for individuals who come forward through internet solicitation and other public appeals. It is now evident that the annual number of available deceased donors will not resolve the ongoing shortage of organs. Nevertheless, live donor kidney transplantation may not be the realistic final solution to an international public health epidemic of renal failure that is the result of an aging population of patients that have had inadequate preventive medical care.

Dmitrienko, S., Yu, A., Balshaw, R., et al. (2007). "The use of consensus guidelines for management of cytomegalovirus infection in renal transplantation." Kidney Int **72**(8): 1014-1022.

> Cytomegalovirus (CMV) infection imposes a significant economic burden on susceptible patients after renal transplantation. Our study was conducted to determine the prediction, probability, consequences, and treatment costs of CMV infection under Canadian consensus guidelines in 270 sequential transplant patients. Transplant patients from donors positive (D(+)) for CMV into recipients negative (R(-)) for CMV received antiviral prophylaxis for 14 weeks and all but donor negative (D(-))/R(-) patients were monitored weekly for the CMVpp65 marker expression. Marker-positive patients and patients with CMV infection or disease received antiviral treatment. Within the first 6 months, 27% of the 270 patients tested had incidences of asymptomatic CMV infection, while 9% had CMV syndrome or disease. Only 1% of patients had infection after 6 months. The CMVpp65 marker levels were significantly greater in patients with syndrome or disease; but post-test probabilities and predictive value of the marker assay were low. Mean direct costs for care were $2256 and ranged from $927 for D(-)/R(-) patients to $7069 in the D(+)/R(-) patients. Extension of antiviral prophylaxis to D(+) or D(+)/R(+) patients significantly increased the estimated mean costs for an absolute reduction to 4% in CMV syndrome or disease. Our studies show that current guidelines for treatment enable effective control of CMV infection; however, alternative strategies have different economic impact.

Dounousi, E., Mitsis, M., Spanos, G., et al. (2012). "Assessment of nonimmunologic factors in kidney transplant recipients according to Kidney Disease Improving Global Outcomes." Transplant Proc **44**(9): 2709-2711.

> INTRODUCTION: Cardiovascular disease is the primary cause of death among kidney transplant recipients (KTRs), whereas chronic allograft nephropathy (CAN) is the main reason leading to end-stage chronic kidney disease. The etiologies of both entities include immunologic and nonimmunologic factors. The management of modifiable nonimmunologic parameters has recently been identified by the Kidney Disease Improving Global Outcomes (KDIGO) guidelines. The aim of our study was to assess the implementation of these guidelines in the outpatient kidney transplantation clinic of our hospital. PATIENT AND METHODS: We retrospectively monitored the records of 48 transplanted KTRs including 32 males of overall mean age 45.1 +/- 10.7 years regarding control of anemia, dyslipidemia, mineral bone disorder (MBD), and blood pressure (BP) levels. Data were recorded every 6 months for 2 years, starting 1 year after renal transplantation. RESULTS: The estimated glomerular filtration rate of patients at baseline was 60.3 +/- 18.8 mL/min/1.73 m(2) with no significant change during 2 years of follow-up. The control

of anemia was satisfactory in 42 patients (88%) with hemoglobin values >/= 11 g/dL during the follow-up. Regarding dyslipidemia management, the aggregate of patients showed fasting triglycerides </=500 mg/dL in all measurements. The percentage of KTRs with LDL </=100 mg/dL tended to improve from baseline versus the end of the study period (20.8% vs 41.7%). Serum calcium was satisfactorily controlled in 77% of patients, serum phosphorus in all patients, whereas parathyroid hormone (PTH) was abnormal in 60% of KTRs with chronic kidney disease stages 3-5. Finally, the BP goal of <130/80 mm Hg was achieved in approximately half of the patients. CONCLUSION: Control of nonimmunologic factors was satisfactory in terms of renal anemia and MBD, whereas dyslipidemia and BP levels were inadequately controlled. There is a clear need for better integration into clinical practice of KDIGO guidelines with regard to modifiable nonimmunologic factors.

Dreihaupt, M., Ott, U., Wolf, G., et al. (2006). "Realization of the sixth modification of guidelines for organ placement in renal transplantation-a single-center experience." Transplant Proc **38**(3): 682.

Because of the recommendation of the standing commission on organ transplantation, the Board of Bundesarztekammer agreed to a modification of the guidelines for organ transplantation under section 16 of the transplantation law regarding organs from extended donors who have grave diseases. In our case all patients on our waiting list were contacted to be informed about the guideline changes. Only 6 of 322 patients (1.9%) on our waiting list who were transplantable agreed to allow organ placement from a donor with extended criteria.

Duerinckx, N., Timmerman, L., Van Gogh, J., et al. (2014). "Predonation psychosocial evaluation of living kidney and liver donor candidates: a systematic literature review." Transpl Int **27**(1): 2-18.

Evaluating a person's suitability for living organ donation is crucial, consisting not only of a medical but also of a thorough psychosocial screening. We performed a systematic literature review of guidelines, consensus statements, and protocols on the content and process of psychosocial screening of living kidney and liver donor candidates. We searched PubMed, Embase, CINAHL, and PsycINFO until June 22, 2011, following the PRISMA guidelines, complemented by scrutinizing guidelines databases and references of identified publications. Thirty-four publications were identified, including seven guidelines, six consensus statements, and 21 protocols or programs. Guidelines and consensus statements were inconsistent and lacked concreteness for both their content and process, possibly explaining the observed variability in center-specific evaluation protocols and programs. Overall, recommended screening criteria are not evidence-based and an operational definition of the concept "psychosocial" is missing, causing heterogeneity in terminology. Variation also exists on methods used to psychosocially evaluate potential donors. The scientific basis of predonation psychosocial evaluation needs to be strengthened. There is a need for high-quality prospective psychosocial outcome studies in living donors, a uniform terminology to label psychosocial screening criteria, and validated instruments to identify risk factors.

Dunn, B. L., Teusink, A. C., Taber, D. J., et al. (2010). "Management of hypertension in renal transplant patients: a comprehensive review of nonpharmacologic and pharmacologic treatment strategies." Ann Pharmacother **44**(7-8): 1259-1270.

OBJECTIVE: To review the guidelines and literature for the treatment of hypertension in renal transplant patients and to provide guidance to practitioners in the selection of appropriate nonpharmacologic and pharmacologic treatment options. DATA SOURCES: A PubMed search (January 1948-March 2010) was performed using the search terms hypertension, antihypertensive agents, blood pressure, and cardiovascular disease, in combination with renal transplant and kidney transplant. The search was limited to articles published in English. All relevant peer-reviewed original studies, meta-analyses, guidelines, consensus statements, and review articles were examined. In addition, reference citations from publications identified were reviewed. STUDY SELECTION AND DATA EXTRACTION: All literature found was evaluated for inclusion. Review articles as well as prospective and retrospective original research articles were reviewed. DATA SYNTHESIS: Hypertension after solid organ transplantation is a problem commonly encountered in patients during their posttransplantation clinic visits. Effective management of these patients' hypertension is crucial, as hypertension left untreated may lead to increased morbidity and mortality as well as graft loss. The unique, multifactorial etiology of hypertension in this population makes treatment choices more challenging compared to treatment of a

nontransplant patient. Therefore, to guide practitioners in this process, we developed a hypertension management protocol, taking into account the unique considerations faced in the adult renal transplant population. The review guides practitioners from the initial assessment of patients' hypertension through the evaluation and selection of nonpharmacologic and pharmacologic treatment options and provides information about the discontinuation of certain antihypertensive medications. It also provides a concise, but comprehensive review of the major antihypertensive drug classes and economic considerations. CONCLUSIONS: The management of hypertension in posttransplantation patients is challenging and complicated, yet necessary to prevent morbidity, mortality, and graft loss for these patients. Therapy should be individualized based on patient assessment, response to previous therapy, and economic considerations.

Escudier, B., Porta, C., Schmidinger, M., et al. (2014). "Renal cell carcinoma: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up." Ann Oncol **25 Suppl 3**: iii49-56.

Famure, O., Sultan, H., Phan, N., et al. (2016). "Engaging health care providers to improve the referral and evaluation processes for potential transplant candidates--The Toronto General Hospital Experience." Cannt j **26**(1): 12-16.

The Kidney Transplant Program (KTP) at the Toronto General Hospital has taken great strides in preparing to meet the needs of patients and health care providers, as the number of end-stage renal disease patients in Ontario increases. The KTP has begun the process of increasing engagement and collaboration with various stakeholders from the pre- to the post-transplant phase through (1) the development of innovative programs to increase the number of live kidney donations, (2) the development and maintenance of information technology solutions that work simultaneously to provide data to manage and treat patients, and conduct research, and (3) the development, implementation, and delivery of educational presentations and tools to various stakeholders both at the referring centres and the transplant program. Future steps for the KTP include evaluating the impact of these programmatic tools and activities on the number of referrals received and the subsequent effect on the number of transplants performed.

Fernandez Fresnedo, G. (2009). "Improvement in the care of patients with kidney transplant failure: recommendations of the Spanish Society of Nephrology." Transplant Proc **41**(6): 2092-2094.

Although long-term outcomes have improved, graft loss caused by chronic allograft nephropathy remains an important obstacle. This situation, together with the progressive increase in the number of renal transplant patients, means that the population of transplant patients readmitted to a dialysis program will be progressively greater. The variable mortality rates among patients starting dialysis after graft loss are consistently higher than those observed among patients with functioning grafts or on dialysis treatment. However, the manner in which the management of chronic kidney disease patients in the transplant setting differs from that of patients with native kidney disease who display a similar degree of renal dysfunction is not known. Many patients in stages 4T-5T have chronic kidney disease-related complications that fall below the targets established for nontransplant chronic kidney disease subjects. A limited number of studies have evaluated patients returning to dialysis after graft failure. The distinct guidelines in the setting of transplantation have not analyzed this important aspect. From this premise, a working group of the Spanish Society of Nephrology specializing in the field of kidney transplantation and dialysis reviewed each clinical aspect of care of kidney transplant patients with renal failure returning to dialysis, yielding this consensus document to optimize management.

Fernandez Fresnedo, G. (2009). "[S.E.N. recommendations regarding transplanted patients returning to dialysis. Objectives and methods]." Nefrologia **29 Suppl 1**: 1.

Fernandez Fresnedo, G., Sanchez Plumed, J., Arias, M., et al. (2009). "[Progression factors in chronic kidney disease. Non-immunological mechanisms]." Nefrologia **29 Suppl 1**: 16-24.

Non-immunological factors in the progression of kidney disease in transplant patients are the following: high blood pressure, proteinuria, dislypidemia, etc. 1. Arterial hypertension treatment: Blood pressure must be measured periodically in all transplant patients. Similarly to native kidneys, in renal transplant

patients arterial hypertension is a risk factor in the progression of kidney disease. Arterial hypertension represent a clinical marker of chronic allograft nephropathy and contributes to graft loss and to the morbid- mortality of these patients (Evidence level C). Blood pressure control should be < 130/80 mm Hg for renal transplant patients without proteinuria and 125/75 mm Hg for proteinuric patients (> 1 g/24 hours). Hypertension and proteinuria are frequently associated in the same patients, a global treatment of both seems more rational (Evidence level C). General measures should be instigated first with pharmacological therapy. All antihypertensive drugs are useful in renal transplant patients and the majority of patients will need two or more drugs. In proteinuric patients an angiotensin receptor antagonist or an ACE-inhibitor should be initiated. It is advisable to monitor the serum potassium and creatinine after the start of this drugs or during the treatment periodically, especially in patients with chronic kidney disease stage IV-V. 2. Proteinuria treatment: Proteinuria has been strongly correlated with reduced function and graft survival. Lowering proteinuria to values as near to normal as possible (< 0.5 g/24 hours). To reduce proteinuria, an angiotensin receptor antagonist, an ACE-inhibitor or a combination of both are required, with serum potassium or creatinine monitoring, especially in patients with chronic kidney disease stage IV-V. 3. Dyslipidemia treatment: For kidney transplant recipients the assessment of dyslipidemias should include a complete fasting lipid profile with total cholesterol, LDL, HDL, and triglycerides. Evidence from the general population indicates that treatment of dyslipidemias reduces cardiovascular disease and evidence in kidney transplant patients suggests that judicious treatment can be safe and effective in improving dyslipidemia. Therapeutic goal must be LDL < 100 mg/dl. (Evidence level C). 4. Others: Cigarette smoking, glucose intolerance or diabetes control and obesity should be assessed.

Friedman, S. E., Palac, R. T., Zlotnick, D. M., et al. (2011). "A call to action: variability in guidelines for cardiac evaluation before renal transplantation." Clin J Am Soc Nephrol **6**(5): 1185-1191.

BACKGROUND AND OBJECTIVES: Candidates for renal transplantation are at increased risk for complications related to cardiovascular disease; however, the optimal strategy to reduce this risk is not clear. The aim of this study was to evaluate the variability among existing guidelines for preoperative cardiac evaluation of renal transplant candidates. DESIGN, SETTING, PARTICIPANTS, & MEASUREMENTS: A consecutive series of renal transplant candidates (n=204) were identified, and four prominent preoperative cardiac evaluation guidelines, pertaining to this population, were retrospectively applied to determine the rate at which each guideline recommended cardiac stress testing. RESULTS: The rate of pretransplant cardiac stress testing would have ranged from 20 to 100% depending on which guideline was applied. The American Heart Association/American College of Cardiology (ACC/AHA) guideline resulted in the lowest rate of testing (20%). In our population, 178 study subjects underwent stress testing: 17 were found to have ischemia and 10 underwent revascularization. The ACC/AHA approach would have decreased the number of noninvasive tests from 178 to 39; it would have identified only 4 of the 10 patients who underwent revascularization. The three other guidelines (renal transplant-specific guidelines) recommended widespread pretransplant cardiac testing and thus identified nearly all patients who had ischemia on stress testing. CONCLUSIONS: The ACC/AHA perioperative guideline may be inadequate for identifying renal transplant candidates with coronary disease; however, renal transplant-specific guidelines may provoke significant overtesting. An intermediate approach based on risk factors specific to the ESRD population may optimize detection of coronary disease and limit testing.

Fritsche, L., Vanrenterghem, Y., Nordal, K. P., et al. (2000). "Practice variations in the evaluation of adult candidates for cadaveric kidney transplantation: a survey of the European Transplant Centers." Transplantation **70**(10): 1492-1497.

BACKGROUND: This survey was conducted to investigate similarities and differences in the diagnostic evaluation of adult candidates for cadaveric renal transplantation and the criteria for acceptance to the cadaveric renal transplant waiting-list in the European transplant centers. METHODS: A questionnaire listing 45 diagnostic procedures (consultations of 9 specialties, 18 imaging techniques and 18 laboratory investigations), 45 medical conditions constituting possible reasons for exclusion from renal transplantation, and 10 properties characterizing the responding transplant center was sent to 214 European transplant centers. RESULTS: A completed questionnaire was returned by 154 of 214 centers (72%). Significant disagreement (P<0.001) exists about the necessity of 28 of the 45 surveyed diagnostic procedures and about the acceptability of transplant candidates for 15 of the 45 surveyed medical conditions. The influence of center characteristics on the observed practice variations was examined by multinomial logistic regression (factors: Center size, waiting-list pressure, responsibility for organizing the diagnostic work-up, status of transplant center, responsibility for decision about acceptance of candidates and geographic location of center): In 13 of 28 controversial diagnostic procedures, geographic location of the centers turned out to be the only significant determining factor (P<0.001), whereas the dissent about medical conditions is not influenced significantly by the analyzed factors. CONCLUSION: The detected significant practice variations in the evaluation of renal transplant candidates may either indicate where scientific evidence is missing and more clinical research is needed or where the existing evidence has not been adequately disseminated and convincing guidelines should be established.

Frutos, M. A., Sola, E., Mansilla, J. J., et al. (2006). "Expanded criteria donors for kidney transplantation: quality control and results." Transplant Proc **38**(8): 2371-2373.

Although the number of kidneys from expanded criteria deceased donors (ECDs) is growing in most transplant centers, the limits for acceptance of these kidneys and the safety standards have still not been fully established. We evaluated 342 kidney transplants performed between January 1999 and December 2004. In 77 (22.5%) of these, the kidneys were from ECDs, that is, donors age >60 years and with one of the following characteristics: hypertension, death due to cerebrovascular accident (CVA) or glomerular filtration rate (GFR) <70 mL/min. The results of the ECD transplants were compared with 265 transplants during the same period from standard donors (SDs), that is, donors age <60 years and GFR > 70 mL/min. All the ECD kidneys underwent biopsy and were accepted for transplantation only if the score was <7. The ECDs (66.5 +/- 4.3 years) in comparison with the SDs (48.0 +/- 16.0 years) had a greater frequency of death due to CVA (94.8% vs 49.8%) and a lower GFR (80.4 +/- 25.0 vs 111 +/- 41.6 mL/min; P < .05). Of the ECDs, 97.4% had a history of hypertension versus 24.3% of the SDs. Kidney biopsies were performed in 116 SD kidneys because the donor age was >55 years or there was a history of hypertension. The median score for the kidney biopsies of the ECD kidneys was 3 versus 2 for the SD kidneys. Graft survival was not significantly different until the fifth year. The GFR at 12 months was significantly different (SDs, 58.0 +/- 22.7 vs ECDs, 48.9 +/- 16.5 mL/min; P < .05). Although the GFR in the ECD kidneys was lower than that of the SD kidneys, it could still be adequate for recipients older than 50 years of age. Accordingly, the acceptance criteria for ECD kidneys based mainly on the kidney biopsy score and donor GFR benefit the recipients.

Fry, K., Patwardhan, A., Ryan, C., et al. (2009). "Development of evidence-based guidelines for the nutritional management of adult kidney transplant recipients." J Ren Nutr **19**(1): 101-104.

OBJECTIVE: This article documents the development of evidence-based guidelines for the nutritional management of adult kidney transplant recipients. Dietary interventions play an important role in preventing and managing common post-transplant health problems, such as cardiovascular disease and diabetes. However, there are currently no comprehensive, evidence-based guidelines for the nutritional management of kidney transplant recipients. METHODS AND RESULTS: Thirteen guideline topics were identified, including obesity, diabetes, dyslipidemia, and bone disease, following broad consultation with clinicians and transplant recipients in Australia and New Zealand. A systematic review of the scientific literature was undertaken, the protocol for which is published in the Cochrane Library. The evidence was graded and synthesized, and evidence-based recommendations formulated consistent with National Health and Medical Research Council of Australia standards. A total of 119 scientific papers were assessed. CONCLUSION: There was no level I or II evidence to support any guideline; however, there was sufficient level III and IV evidence to support Grade C and D recommendations for six guideline topics. Experts from 18 transplant units in Australia and New Zealand were consulted to generate consensus-based recommendations for the remaining seven topics, using the Delphi method. Using evidence from a comprehensive literature search and expert opinion, guidelines that represent current best practice have been produced. These guidelines have been evaluated in transplant units throughout Australia and New Zealand and have been submitted to the Dietitians Association of Australia (DAA) and Caring for Australasians with Renal Impairment (CARI) for endorsement.

Garcia Lopez, F. J. et Amenabar Iribar, J. J. (2000). "The intricate relationship between evidence and clinical practice in kidney transplantation." J Nephrol **13**(6): 405-414.

Clinical practice is supposed to be evidence-based but it always conveys underlying values, judgements, moral principles or axioms. We explore the evidence-based nature of clinical practice in the fast-changing field of kidney transplantation and its relationship with values in five different interventions: those well supported on evidence, focussed on the use of immunosuppressant drugs like cyclosporine, mycophenolate mofetil and tacrolimus, and the elective withdrawal of cyclosporine or steroids; disputable interventions where evidence, focussed on anti-lymphocyte antibodies, is strong but not strong enough to be applied on the majority of occasions; interventions not supported by randomised controlled trials with focus on primary treatment of vascular graft rejection and rescue treatment for acute graft rejection; interventions not widely applied despite strong evidence from sources other than randomised controlled trials, with focus on HLA-matched kidney transplants in cadaver donor and living donor transplants; and finally, a variety of interventions when evidence is lacking. Being aware of the factors influencing every clinical decision we can make the strength of evidence and the nature of the values underlying them explicit and we will find it easier to improve the process of transferring evidence into practice and openly face and acknowledge the values involved.

Garg, S., Carroll, R. P., Walker, R. G., et al. (2009). "Skin cancer surveillance in renal transplant recipients: re-evaluation of U.K. practice and comparison with Australian experience." Br J Dermatol **160**(1): 177-179.

BACKGROUND: Nonmelanoma skin cancer (NMSC) is the most common tumour following solid organ transplantation. In 2000 a survey of U.K. centres managing renal transplant recipients (RTRs) showed that only 21% offered skin cancer surveillance. OBJECTIVES: The survey was repeated in 2006 in the U.K. and Australia. The aims were to determine if U.K. practice had changed since 2000, to define skin cancer surveillance practice in Australian RTRs and to compare this with that in the U.K. METHODS: Questionnaires were sent to 84 U.K. and 45 Australian centres providing long-term RTR follow-up. RESULTS: Fifty-six (67%) U.K. centres caring for 82% (n = 16 349) of the RTR population replied. Sixty-six per cent provided annual skin cancer surveillance and 39% offered full skin examination (FSE) compared with 21% and 20% in 2000. Eighty-one per cent of surveillance was performed by nondermatologists (n = 30), nine (30%) of whom had received formal training for the role. Thirty-one (69%) Australian centres covering 86% (n = 5392) of the RTR population responded. Ninety-seven per cent provided skin cancer surveillance, and 61% offered FSE. Forty per cent (n = 12) of skin cancer surveillance was conducted by nondermatologists. Two nondermatologists had received formal training. CONCLUSIONS: Despite a substantial improvement in the provision of skin cancer surveillance for RTRs in the U.K. between 2000 and 2006, only 39% of units offer FSE. In contrast, virtually all Australian centres offer annual skin cancer surveillance, with more dermatology involvement. Lack of training for nondermatologists involved in skin cancer surveillance is evident in both countries. The availability of dermatologists and the variation in NMSC risk between the populations may explain the different practices observed.

Gupta, G., Unruh, M. L., Nolin, T. D., et al. (2010). "Primary care of the renal transplant patient." J Gen Intern Med **25**(7): 731-740.

There has been a remarkable rise in the number of kidney transplant recipients (KTR) in the US over the last decade. Increasing use of potent immunosuppressants, which are also potentially diabetogenic and atherogenic, can result in worsening of pre-existing medical conditions as well as development of post-transplant disease. This, coupled with improving long-term survival, is putting tremendous pressure on transplant centers that were not designed to deliver primary care to KTR. Thus, increasing numbers of KTR will present to their primary care physicians (PCP) post-transplant for routine medical care. Similar to native chronic kidney disease patients, KTRs are vulnerable to cardiovascular disease as well as a host of other problems including bone disease, infections and malignancies. Deaths related to complications of cardiovascular disease and malignancies account for 60-65% of long-term mortality among KTRs. Guidelines from the National Kidney Foundation and the European Best Practice Guidelines Expert Group on the management of hypertension, dyslipidemia, smoking, diabetes and bone disease should be incorporated into the long-term care plan of the KTR to improve outcomes. A number of transplant centers do not supply PCPs with protocols and guidelines, making the task of the PCP more difficult. Despite this, PCPs are expected to continue to provide general preventive medicine, vaccinations and management of chronic medical problems. In this narrative review, we examine the common medical problems seen in KTR from the PCP's perspective. Medical management issues related to immunosuppressive medications are also briefly discussed.

Harrison, E. M., Oniscu, G. C. et Forsythe, J. L. (2012). "Equity of access to kidney transplantation: to what extent should international guidelines differ?" Transplantation **94**(7): 669-670.

Heemann, U., Abramowicz, D., Spasovski, G., et al. (2011). "Endorsement of the Kidney Disease Improving Global Outcomes (KDIGO) guidelines on kidney transplantation: a European Renal Best Practice (ERBP) position statement." Nephrol Dial Transplant **26**(7): 2099-2106.

> KDIGO (Kidney Disease: Improving Global Outcomes) is an international independent body aiming to 'improve the care and outcomes of kidney disease patients worldwide, through the development and implementation of clinical practice guidelines'. Recently, the KDIGO work group has produced comprehensive clinical practice guidelines for the care of kidney transplant recipients (KTRs). The guideline makes recommendations for immunosuppression, graft monitoring, as well as prevention and treatment of infection, cardiovascular disease, malignancy and other complications that are common in KTRs, including haematological and bone disorders. Because most guidelines were 'soft' rather than 'strong', and because global guidelines need to be adapted and implemented into the regional context where they are used, the European Renal Best Practice (ERBP) Advisory Board appointed a work group of transplant nephrologists and surgeons to review the newest KDIGO guideline and comment on its relevance and applicability for European KTRs. In this article, we concentrate only on those guidelines which we considered worth amending or adapting. All guidelines not mentioned are fully endorsed.

Icardi, A., Sacco, P. et Salvatore, F. (2008). "[Long-term management of renal transplant recipients]." G Ital Nefrol **25**(3): 325-341.

> Transplantation has been demonstrated to improve the quality of life and long-term survival of patients with end-stage renal disease (ESRD) when compared with dialysis. This has resulted in a progressive increase in patients living with a functioning kidney graft as a percentage of the total ESRD population. Renal transplant recipients require complex long-term medical care, which is straining the limited resources of transplant centers. Moreover, due to considerations of geography or individual preference, a large number of patients, once their condition has stabilized, move away from the transplant center to the local nephrology unit. To facilitate and enhance the specialized care of these patients, it is crucial that nephrology units understand and manage the medical problems affecting long-term transplant recipients (e.g., chronic graft dysfunction, toxicity of immunosuppressive therapy, cardiovascular, infectious and neoplastic complications, hematological issues, bone disease, pregnancy and nonadherence to prescriptions). Regular interactive communication between the nephrology unit and the transplant center optimizes the continuity of care. Practice guidelines and the available literature on the subject are revised and critically analyzed in this paper.

Jager, K. J. et Zoccali, C. (2005). "QUality European STudies (QUEST)--a step forward in the quality of RRT care." Nephrol Dial Transplant **20**(9): 2005-2006.

Kaysi, S., Hadj Abdelkader, M., Aniort, J., et al. (2012). "Chronic renal failure complications and management in kidney transplanted and nontransplanted patients." Transplant Proc **44**(10): 2997-3000.

> BACKGROUND: Our purpose was to compare the management of chronic kidney disease (CKD) according to Kidney Disease Quality Initiative (K/DOQI) recommendations in kidney transplanted patients (T) and nontransplanted ones (NT). METHODS: Data concerning CKD complications were collected retrospectively. Patients seen in consultations in our department from May 2009 to June 2010 were selected if they had at least 6 months of follow-up, CKD stage 4 or 5, and no exclusion criteria namely hospitalization, active cancer, or infection in the 3 months before data collection. RESULTS: Fifty-eight T were compared with 85 NT matched by CKD stage (4-5). Anemia within K/DOQI target was better controlled among NT (51.2% versus 41.3%); however, ferritin levels within K/DOQI target were higher (80% T versus 51.7% NT). Average arterial blood pressure was similar in both groups but 51.7% of T were in K/DOQI target versus 41% of NT. Dyslipidemia within cholesterol K/DOQI target was better controlled in 60% (NT) versus 35% NT with 63.5% versus 38% NT within low-density lipoprotein K/DOQI targets. Phosphorus level was better controlled among T; parathyroid was better controlled in among 65% NT versus 50% T within the target level. CONCLUSION: Most complications of CKD were better managed among NT.

LaPointe Rudow, D., Hays, R., Baliga, P., et al. (2015). "Consensus conference on best practices in live kidney donation: recommendations to optimize education, access, and care." Am J Transplant **15**(4): 914-922.

> Live donor kidney transplantation is the best treatment option for most patients with late-stage chronic kidney disease; however, the rate of living kidney donation has declined in the United States. A consensus conference was held June 5-6, 2014 to identify best practices and knowledge gaps pertaining to live donor kidney transplantation and living kidney donation. Transplant professionals, patients, and other key stakeholders discussed processes for educating transplant candidates and potential living donors about living kidney donation; efficiencies in the living donor evaluation process; disparities in living donation; and financial and systemic barriers to living donation. We summarize the consensus recommendations for best practices in these educational and clinical domains, future research priorities, and possible public policy initiatives to remove barriers to living kidney donation.

Lledo-Garcia, E., Riera, L., Passas, J., et al. (2014). "Spanish consensus document for acceptance and rejection of kidneys from expanded criteria donors." Clin Transplant **28**(10): 1155-1166.

> In the recent years, more than 60% of available deceased donors are either older than 50 yr or have significant vascular comorbidities. This makes the acceptance and rejection criteria of renal allografts very rigorous, especially in cases of younger recipients, and at the same time encourages live donations. In our country, there is a lack of homogeneity in the percentages of use of expanded criteria donor (ECD) allografts between the different autonomous communities. Furthermore, the criteria vary greatly, and in some cases, great importance is given to the biopsy while in others very little. In this study, we present a unified and homogenous criteria agreed upon by consensus of a 10-member Panel representing major scientific societies related to renal transplantation in Spain. The criteria are to be used in accepting and/or rejecting kidneys from the so-called ECDs. The goal was to standardize the use of these organs, to optimize the results, and most importantly to provide for the maximum well being of our patients. Finally, we believe that after taking into account the Panel's thorough review of specific scientific literature, this document will be adaptable to other national renal transplant programmes.

Mandelbrot, D. A. et Pavlakis, M. (2012). "Living donor practices in the United States." Adv Chronic Kidney Dis **19**(4): 212-219.

> Living kidney donation is a common procedure in the United States. Substantial variation exists between transplant centers in their protocols and exclusion criteria for potential living donors. In the absence of clinical trial data to guide decisions about exclusion criteria, knowledge of current practices is an important first step in guiding the formulation of donor protocols and future studies. Certain trends in living donation practices have become apparent from surveys of transplant programs over the past few decades. Over the past 25 years, opposition to living unrelated donation in the United States has gone from strong to essentially nonexistent. With respect to donor age, programs have become less strict regarding upper age limits but stricter regarding younger donor candidates. Protocols regarding kidney function, blood pressure, and diabetes screening also continue to evolve. Although donor follow-up is mandated by the Organ Procurement and Transplantation Network for 2 years after donation, a majority of donors are lost to follow-up by 1 year. The most commonly cited barriers to donor follow-up include donor inconvenience, cost issues including reimbursement to care providers, and direct and indirect costs to donors. In this article, we review the current knowledge about living donor practices in the United States.

Mariat, C., Alamartine, E., Afiani, A., et al. (2005). "Predicting glomerular filtration rate in kidney transplantation: are the K/DOQI guidelines applicable?" Am J Transplant **5**(11): 2698-2703.

> The kidney disease outcomes quality initiative (K/DOQI) guidelines introduced a classification of chronic kidney disease (CKD) based on the level of kidney function. In order to predict the glomerular filtration rate (GFR), they specifically recommended the use of the modification of diet in renal disease (MDRD) study and Cockcroft-Gault (C-G) equations. Since the performance of these estimates has been questioned, we sought to determine whether these recommendations might be applicable in renal transplantation. Following the K/DOQI methodology, we compared the GFR estimated by the MDRD and C-G equations with 476 inulin clearances performed in 284 renal transplant recipients. Even though the MDRD equations provided a better prediction than C-G formula, none of them reached the level of

accuracy required by the K/DOQI standards. At least, 25% of the calculated GFR gave a prediction beyond 30% of the corresponding inulin clearance value. In addition, when classified according to their predicted GFR, less than two-thirds of the transplant patients turned out to be assigned to the correct stage of CKD. We conclude that, in renal transplantation, the predictive performance of both C-G and MDRD study equations appears to be particularly impaired and may potentially compromise the validity of the K/DOQI guidelines if implemented in their current form.

Marsicano Ede, O., Fernandes Nda, S., Colugnati, F., et al. (2013). "Transcultural adaptation and initial validation of Brazilian-Portuguese version of the Basel assessment of adherence to immunosuppressive medications scale (BAASIS) in kidney transplants." BMC Nephrol **14**: 108.

BACKGROUND: Transplant recipients are expected to adhere to a lifelong immunosuppressant therapeutic regimen. However, nonadherence to treatment is an underestimated problem for which no properly validated measurement tool is available for Portuguese-speaking patients. We aimed to initially validate the Basel Assessment of Adherence to Immunosuppressive Medications Scale (BAASIS(R)) to accurately estimate immunosuppressant nonadherence in Brazilian transplant patients. METHODS: The BAASIS(R) (English version) was transculturally adapted and its psychometric properties were assessed. The transcultural adaptation was performed using the Guillemin protocol. Psychometric testing included reliability (intraobserver and interobserver reproducibility, agreement, Kappa coefficient, and the Cronbach's alpha) and validity (content, criterion, and construct validities). RESULTS: The final version of the transculturally adapted BAASIS(R) was pretested, and no difficulties in understanding its content were found. The intraobserver and interobserver reproducibility variances (0.007 and 0.003, respectively), the Cronbach's alpha (0.7), Kappa coefficient (0.88) and the agreement (95.2%) suggest accuracy, preciseness and reliability. For construct validity, exploratory factorial analysis demonstrated unidimensionality of the first three questions (r = 0.76, r = 0.80, and r = 0.68). For criterion validity, the adapted BAASIS(R) was correlated with another self-report instrument, the Measure of Adherence to Treatment, and showed good congruence (r = 0.65). CONCLUSIONS: The BAASIS(R) has adequate psychometric properties and may be employed in advance to measure adherence to posttransplant immunosuppressant treatments. This instrument will be the first one validated to use in this specific transplant population and in the Portuguese language.

Menon, M., Sood, A., Bhandari, M., et al. (2014). "Robotic kidney transplantation with regional hypothermia: a step-by-step description of the Vattikuti Urology Institute-Medanta technique (IDEAL phase 2a)." Eur Urol **65**(5): 991-1000.

BACKGROUND: We recently reported on preclinical and feasibility studies (Innovation, Development, Exploration, Assessment, Long-term study [IDEAL] phase 0-1) of the development of robotic kidney transplantation (RKT) with regional hypothermia. This paper presents the IDEAL phase 2a studies of technique development. OBJECTIVES: To describe the technique of RKT with regional hypothermia developed at two tertiary care institutions (Vattikuti Urology Institute and Medanta Hospital). We report on the safety profile and early graft function in these patients. DESIGN, SETTING, AND PARTICIPANTS: This is a prospective study of 50 consecutive patients who underwent live-donor RKT at Medanta Hospital following a 3-yr planning/simulation phase at the Vattikuti Urology Institute. Demographic details, and perioperative and postoperative outcomes are reported for the initial 25 recipients who have completed a minimum 6-mo follow-up. SURGICAL PROCEDURE: Positioning and port placement were similar to that used for robotic radical prostatectomy. Allograft cooling was achieved by ice slush delivered through a GelPOINT device. The accompanying video details the operative technique. OUTCOME MEASUREMENTS AND STATISTICAL ANALYSIS: The primary outcome was posttransplant graft function. Secondary outcomes included technical success or failure and complication rates. RESULTS AND LIMITATIONS: Fifty patients underwent RKT successfully, 7 in the phase 1 and 43 in the phase 2 stages of the study. For the initial 25 patients, mean console, warm ischemia, arterial, and venous anastomotic times were 135, 2.4, 12, and 13.4 min, respectively. All grafts were cooled to 18-20 degrees C with no change in core body temperature. All grafts functioned immediately posttransplant and the mean serum creatinine level at discharge was 1.3mg/dl (range: 0.8-3.1mg/dl). No patient developed anastomotic leaks, wound complications, or wound infections. At 6-mo of follow-up, no patient had developed a lymphocele detected on CT scanning. Two patients underwent re-exploration, and one patient died of congestive heart failure (1.5 mo posttransplant). CONCLUSIONS: RKT with regional hypothermia is safe

> and reproducible when performed by a team skilled in robotic surgery. PATIENT SUMMARY: RKT is safe and effective when performed by surgeons experienced in robotic techniques.

Mosconi, G., Mosconi, G., Scolari, M. P., et al. (2009). "[Preventing and reducing comorbidity in candidates for kidney transplantation for the improvement of post-operative results]." G Ital Nefrol **26 Suppl 45**: S37-45.

> The correct and constant management of transplant waiting lists is necessary for the optimal utilization of the limited number of organs available for transplantation. The guidelines regarding placement on transplant waiting lists (absolute and relative contraindications) are well documented, even though they are in constant development. The criteria for the monitoring of patients on waiting lists, however, are not so well defined; this aspect is subject to careful evaluation on account of the widening of the criteria for transplantation suitability, the increase in the average age of patients, a rise in the number of enrolments and, as a result, prolonged waiting time (in Italy, the average time spent on a waiting list is 37 months). During the waiting period, a greater risk of clinically significant comorbidities and mortality, above all from cardiovascular events, has been noted (the annual mortality is 5-7% in the US, 1.3% in Italy). An in-depth clinical and instrumental study of patients with chronic renal failure is necessary when screening eligible candidates for transplant programs, individualizing therapeutic strategies, and identifying patients for whom the risks outweigh the potential benefits. Clinical and instrumental monitoring, as well as adequate treatment of comorbidities during the waiting period, can help improve the post-transplant outcome. This work examines the study algorithms and monitoring procedures for patients on kidney transplant waiting lists.

Mueller, T. F., Solez, K. et Mas, V. (2011). "Assessment of kidney organ quality and prediction of outcome at time of transplantation." Semin Immunopathol **33**(2): 185-199.

> The critical importance of donor organ quality, i.e., number of surviving nephrons, ability to withstand injury, and capacity for repair in determining short- and long-term outcomes is becoming increasingly clear. This review provides an overview of studies to assess donor kidney quality and subsequent transplant outcomes based on clinical pathology and transcriptome-based variables available at time of transplantation. Prediction scores using clinical variables function when applied to large data sets but perform poorly for the individual patient. Histopathology findings in pre-implantation or post-reperfusion biopsies help to assess structural integrity of the donor kidney, provide information on pre-existing donor disease, and can serve as a baseline for tracking changes over time. However, more validated approaches of analysis and prospective studies are needed to reduce the number of discarded organs, improve allocation, and allow prediction of outcomes. Molecular profiling detects changes not seen by morphology or captured by clinical markers. In particular, molecular profiles provide a quantitative measurement of inflammatory burden or immune activation and reflect coordinated changes in pathways associated with injury and repair. However, description of transcriptome patterns is not an end in itself. The identification of predictive gene sets and the application to an individualized patient management needs the integration of clinical and pathology-based variables, as well as more objective reference markers of transplant function, post-transplant events, and long-term outcomes.

Nordio, M., Nichelatti, M., Maggiore, U., et al. (2011). "[Assessment of treatment quality by hierarchical models in the Italian dialysis and transplantation registry]." G Ital Nefrol **28**(2): 195-200.

> Given the operative difficulties and expenses inherent in a clinical audit, we explored whether the Italian Dialysis and Transplantation Registry (RIDT) might offer a valid alternative for quality analysis about two aspects of renal replacement therapy: how widespread is the practice of peritoneal dialysis, and how often is a temporary catheter used as first vascular access for dialysis. We analyzed the data of all patients recorded in the RIDT in 2007 with regard to the type of first treatment, age, gender and primary kidney disease. For peritoneal dialysis we compared all Italian regions having scattered data. With regard to the types of vascular access and the comorbidities at the start of treatment, we evaluated patients from Veneto only. The performance of regions and centers were evaluated using a random-effects multilevel logistic model. Only 65% of Italian regions were available in RIDT; 13.8% of patients began RRT with peritoneal dialysis, with only 3 regions exceeding 20%. Differences among regions were due more to differences in patient characteristics than to between center differences in treatment strategies. Data on vascular access were available for 83% of the patients. Almost 40% began RRT with a temporary catheter; in 12 of 22 centers this was less than 35%. Also in this case, differences were due to patient

characteristics. Incomplete data limit the strength of the interpretation of our study results. At any rate, differences among regions or centers seem due more to patient characteristics than to treatment strategies.

O'Donoghue, K. J. M., Reed, R. D., Knight, S. R., et al. (2018). "Critical Appraisal of International Clinical Practice Guidelines in Kidney Transplantation Using the Appraisal of Guidelines for Research and Education II Tool: A Systematic Review." Transplantation **102**(9): 1419-1439.

BACKGROUND: Although clinical practice guidelines (CPGs) are used for the development of local protocols in kidney transplantation (Ktx), the quality of their methodology is variable. This systematic review aimed to critically appraise international CPGs in all aspects of Ktx using the Appraisal of Guidelines for Research and Evaluation II tool. METHODS: Clinical Practice Guidelines in Ktx and donation published between 2010 and 2017 were identified from MEDLINE, Embase, National Guideline Clearinghouse, National Health Service and National Institute for Health and Care Excellence Evidence Searches, and the websites of transplant societies. Using Appraisal of Guidelines for Research and Evaluation II, 3 appraisers assessed the quality of CPGs. Interrater reliability was measured using the intraclass correlation coefficient (ICC). RESULTS: Searches identified 3168 records, and 115 CPGs were included. The highest scoring Appraisal of Guidelines for Research and Evaluation II domain was "scope and purpose" (80%; range, 30%-100%), followed by "clarity of presentation" (77%; range, 43%-98%), "editorial independence" (52%; range, 0%-94%), "rigor of development" (47%; range 6%-97%) and "stakeholder involvement" (41%; range, 11%-85%). The poorest scoring domain was "applicability" (31%; range, 3%-74%). Most CPGs were recommended for future use either with (63%) or without (18%) modifications. A small number (14%) were not recommended for future use or reviewers (5%) did not agree on recommending the CPG. The overall mean CPG quality score was 4 of 7 (range, 2-7). The mean ICC of 0.74 indicated substantial agreement between reviewers. CONCLUSIONS: The quality of international CPGs in Ktx was variable, and most CPGs lacked key aspects of methodological robustness and transparency. Improvements in methodology, patient involvement, and strategies for implementation are required.

Okechukwu, C. N., Hulbert-Shearon, T. E., Wiggins, R. C., et al. (2002). "Lack of correlation between facility-based standardized rates of transplantation and mortality." Am J Kidney Dis **40**(2): 381-384.

The standardized mortality ratio (SMR) has been used to provide information about adjusted survival outcomes at dialysis facilities. There has been concern that high rates of transplantation could unjustly lead to unfavorable SMR profiles for individual dialysis units because healthier patients would be removed from dialysis therapy, leaving less healthy patients in the dialysis pool. We correlated 1999 overall adjusted SMR and 1999 standardized transplantation ratio (STR) weighted for mortality patient count and count of first transplantations of patients younger than 65 years. A total of 2,362 facilities were included in analyses. We found no correlation between rates of transplantation (by STR) and overall mortality profile (by SMR) based on Pearson's correlation coefficients (r), either unweighted, weighted by number of patients included in the 1999 mortality calculation (SMR), or weighted by number of patients included in the 1999 transplantation calculation (r = -0.016, r = -0.015, and r = -0.015, respectively; P > 0.40 for each). Sensitivity analyses using SMR and STR over 3- and 3.5-year periods (January 1997 to June 2000) also showed no correlation between SMR and STR, respectively. We conclude that reported standardized rates for transplantation do not correlate with those reported for mortality by dialysis facilities.

Panchal, H., Muskovich, J., Patterson, J., et al. (2015). "Expanded criteria donor kidneys for retransplantation United Network for Organ Sharing update: proceed with caution." Transpl Int **28**(8): 990-999.

This study analyzed outcomes of retransplantation from expanded criteria donors (ECD) over the last two decades to determine the benefits and risks of using ECD kidneys for retransplantation. Data from the United Network for Organ Sharing database were collected and analyzed. Graft survival, death-censored graft survival, and patient survival for retransplantation with ECD kidneys (re-ECD) were reported and compared with primary transplantation with ECD kidneys (prim-ECD) and retransplantation with standard criteria donor kidneys (re-SCD). Re-ECD kidneys had higher risk of graft failure compared with prim-ECD (hazard ratio [HR] = 1.19) and to re-SCD (HR = 1.76). Patient survival was better in re-ECD compared with prim-ECD (HR = 0.89) but was worse than re-SCD (HR = 1.82). After censoring the patients who died with

a functioning graft, re-ECD had a higher mortality risk compared with prim-ECD (HR = 1.45) and re-SCD (HR = 1.79). Transplantation improves quality of life and reduces healthcare costs, and due to the risk associated with resumption of hemodialysis and the longer waiting list times for SCD kidneys, there is a benefit to accepting ECD kidneys for select patients requiring retransplantation. Although this benefit exists for select patients, retransplantation with ECD kidneys should be undertaken with trepidation, and appropriate informed consent should be obtained.

Pascual, J., Abramowicz, D., Cochat, P., et al. (2014). "European renal best practice guideline on the management and evaluation of the kidney donor and recipient." Nefrologia **34**(3): 293-301.

The purpose of this Clinical Practice Guideline is to provide guidance on evaluation of the kidney donor and transplant recipient as well as on the management of the recipient in the perioperative period. It is designed to provide information and aid decision-making. It is not intended to deﬁne a standard of care, and should neither be construed as one nor should it be interpreted as prescribing an exclusive course of management. The original version of this guideline was published in Nephrology, Dialysis and Transplantation and this current version is a reduced article aiming to disseminate the guideline into Spanish-speaking countries and transplant communities.

Patzer, R. E., Gander, J., Sauls, L., et al. (2014). "The RaDIANT community study protocol: community-based participatory research for reducing disparities in access to kidney transplantation." BMC Nephrol **15**: 171.

BACKGROUND: The Southeastern United States has the lowest kidney transplant rates in the nation, and racial disparities in kidney transplant access are concentrated in this region. The Southeastern Kidney Transplant Coalition (SEKTC) of Georgia, North Carolina, and South Carolina is an academic and community partnership that was formed with the mission to improve access to kidney transplantation and reduce disparities among African American (AA) end stage renal disease (ESRD) patients in the Southeastern United States. METHODS/DESIGN: We describe the community-based participatory research (CBPR) process utilized in planning the Reducing Disparities In Access to kidNey Transplantation (RaDIANT) Community Study, a trial developed by the SEKTC to reduce health disparities in access to kidney transplantation among AA ESRD patients in Georgia, the state with the lowest kidney transplant rates in the nation. The SEKTC Coalition conducted a needs assessment of the ESRD population in the Southeast and used results to develop a multicomponent, dialysis facility-randomized, quality improvement intervention to improve transplant access among dialysis facilities in GA. A total of 134 dialysis facilities are randomized to receive either: (1) standard of care or "usual" transplant education, or (2) the multicomponent intervention consisting of transplant education and engagement activities targeting dialysis facility leadership, staff, and patients within dialysis facilities. The primary outcome is change in facility-level referral for kidney transplantation from baseline to 12 months; the secondary outcome is reduction in racial disparity in transplant referral. DISCUSSION: The RaDIANT Community Study aims to improve equity in access to kidney transplantation for ESRD patients in the Southeast. TRIAL REGISTRATION: Clinicaltrials.gov number NCT02092727.

Patzer, R. E., Perryman, J. P., Pastan, S., et al. (2012). "Impact of a patient education program on disparities in kidney transplant evaluation." Clin J Am Soc Nephrol **7**(4): 648-655.

BACKGROUND AND OBJECTIVES: In 2007, the Emory Transplant Center (ETC) kidney transplant program implemented a required educational session for ESRD patients referred for renal transplant evaluation to increase patient awareness and decrease loss to follow-up. The purpose of this study was to evaluate the association of the ETC education program on completion of the transplant evaluation process. DESIGN, SETTING, PARTICIPANTS, & MEASUREMENTS: Incident, adult ESRD patients referred from 2005 to 2008 were included. Patient data were abstracted from medical records and linked with data from the United States Renal Data System. Evaluation completion was compared by pre- and posteducational intervention groups in binomial regression models accounting for temporal confounding. RESULTS: A total of 1126 adult ESRD patients were examined in two transplant evaluation eras (75% pre- and 25% postintervention). One-year evaluation completion was higher in the post- versus preintervention group (80.4% versus 44.7%, P<0.0001). In adjusted analyses controlling for time trends, the adjusted probability of evaluation completion at 1 year was higher among the intervention versus nonintervention group (risk ratio=1.38, 95% confidence interval=1.12-1.71). The effect of the intervention was stronger among black patients and those patients living in poor neighborhoods (likelihood ratio test for interaction, P<0.05).

CONCLUSIONS: Standardizing transplant education may help reduce some of the racial and socioeconomic disparities observed in kidney transplantation.

Plantinga, L. C., Patzer, R. E., Drenkard, C., et al. (2015). "Comparison of quality-of-care measures in U.S. patients with end-stage renal disease secondary to lupus nephritis vs. other causes." BMC Nephrol **16**: 39.

> BACKGROUND: Patients with end-stage renal disease (ESRD) due to lupus nephritis (LN-ESRD) may be followed by multiple providers (nephrologists and rheumatologists) and have greater opportunities to receive recommended ESRD-related care. We aimed to examine whether LN-ESRD patients have better quality of ESRD care compared to other ESRD patients. METHODS: Among incident patients (7/05-9/11) with ESRD due to LN (n = 6,594) vs. other causes (n = 617,758), identified using a national surveillance cohort (United States Renal Data System), we determined the association between attributed cause of ESRD and quality-of-care measures (pre-ESRD nephrology care, placement on the deceased donor kidney transplant waitlist, and placement of permanent vascular access). Multivariable logistic and Cox proportional hazards models were used to estimate adjusted odds ratios (ORs) and hazard ratios (HRs). RESULTS: LN-ESRD patients were more likely than other ESRD patients to receive pre-ESRD care (71% vs. 66%; OR = 1.68, 95% CI 1.57-1.78) and be placed on the transplant waitlist in the first year (206 vs. 86 per 1000 patient-years; HR = 1.42, 95% CI 1.34-1.52). However, only 24% had a permanent vascular access (fistula or graft) in place at dialysis start (vs. 36%; OR = 0.63, 95% CI 0.59-0.67). CONCLUSIONS: LN-ESRD patients are more likely to receive pre-ESRD care and have better access to transplant, but are less likely to have a permanent vascular access for dialysis, than other ESRD patients. Further studies are warranted to examine barriers to permanent vascular access placement, as well as morbidity and mortality associated with temporary access, in patients with LN-ESRD.

Schold, J. D., Buccini, L. D., Goldfarb, D. A., et al. (2014). "Association between kidney transplant center performance and the survival benefit of transplantation versus dialysis." Clin J Am Soc Nephrol **9**(10): 1773-1780.

> BACKGROUND AND OBJECTIVES: Despite the benefits of kidney transplantation, the total number of transplants performed in the United States has stagnated since 2006. Transplant center quality metrics have been associated with a decline in transplant volume among low-performing centers. There are concerns that regulatory oversight may lead to risk aversion and lack of transplantation growth. DESIGN, SETTING, PARTICIPANTS, & MEASUREMENTS: A retrospective cohort study of adults (age>/=18 years) wait-listed for kidney transplantation in the United States from 2003 to 2010 using the Scientific Registry of Transplant Recipients was conducted. The primary aim was to investigate whether measured center performance modifies the survival benefit of transplantation versus dialysis. Center performance was on the basis of the most recent Scientific Registry of Transplant Recipients evaluation at the time that patients were placed on the waiting list. The primary outcome was the time-dependent adjusted hazard ratio of death compared with remaining on the transplant waiting list. RESULTS: Among 223,808 waitlisted patients, 59,199 and 32,764 patients received a deceased or living donor transplant, respectively. Median follow-up from listing was 43 months (25th percentile=25 months, 75th percentile=67 months), and there were 43,951 total patient deaths. Deceased donor transplantation was independently associated with lower mortality at each center performance level compared with remaining on the waiting list; adjusted hazard ratio was 0.24 (95% confidence interval, 0.21 to 0.27) among 11,972 patients listed at high-performing centers, adjusted hazard ratio was 0.32 (95% confidence interval, 0.31 to 0.33) among 203,797 patients listed at centers performing as expected, and adjusted hazard ratio was 0.40 (95% confidence interval, 0.35 to 0.45) among 8039 patients listed at low-performing centers. The survival benefit was significantly different by center performance (P value for interaction <0.001). CONCLUSIONS: Findings indicate that measured center performance modifies the survival benefit of kidney transplantation, but the benefit of transplantation remains highly significant even at centers with low measured quality. Policies that concurrently emphasize improved center performance with access to transplantation should be prioritized to improve ESRD population outcomes.

Schold, J. D., Buccini, L. D., Heaphy, E. L., et al. (2013). "The prognostic value of kidney transplant center report cards." Am J Transplant **13**(7): 1703-1712.

> SRTR report cards provide the basis for quality measurement of US transplant centers. There is limited data evaluating the prognostic value of report cards, informing whether they are predictive of prospective patient outcomes. Using national SRTR data, we simulated report cards and calculated

standardized mortality ratios (SMR) for kidney transplant centers over five distinct eras. We ranked centers based on SMR and evaluated outcomes for patients transplanted the year following reports. Recipients transplanted at the 50th, 100th and 200th ranked centers had 18% (AHR = 1.18, 1.13-1.22), 38% (AHR = 1.38, 1.28-1.49) and 91% (AHR = 1.91, 1.64-2.21) increased hazard for 1-year mortality relative to recipients at the top-ranked center. Risks were attenuated but remained significant for long-term outcomes. Patients transplanted at centers meeting low-performance criteria in the prior period had 40% (AHR = 1.40, 1.22-1.68) elevated hazard for 1-year mortality in the prospective period. Centers' SMR from the report card was highly predictive (c-statistics > 0.77) for prospective center SMRs and there was significant correlation between centers' SMR from the report card period and the year following (rho = 0.57, p < 0.001). Although results do not mitigate potential biases of report cards for measuring quality, they do indicate strong prognostic value for future outcomes. Findings also highlight that outcomes are associated with center ranking across a continuum rather than solely at performance margins.

Schold, J. D., Buccini, L. D., Kattan, M. W., et al. (2012). "The association of community health indicators with outcomes for kidney transplant recipients in the United States." Arch Surg **147**(6): 520-526.

OBJECTIVE: To evaluate the association of community health indicators with outcomes for kidney transplant recipients. DESIGN: Retrospective observational cohort study using multivariable Cox proportional hazards models. SETTING: Transplant recipients in the United States from the Scientific Registry of Transplant Recipients merged with health indicators compiled from several national databases and the Centers for Disease Control and Prevention, including the National Center for Health Statistics, the Behavioral Risk Factor Surveillance System, and the National Center for Chronic Disease Prevention and Health Promotion. PATIENTS: A total of 100 164 living and deceased donor adult (aged 18 years) kidney transplant recipients who underwent a transplant between January 1, 2004, and December 31, 2010. MAIN OUTCOME MEASURES: Risk-adjusted time to posttransplant mortality and graft loss. RESULTS: Multiple health indicators from recipients' residence were independently associated with outcomes, including low birth weight, preventable hospitalizations, inactivity rate, and smoking and obesity prevalence. Recipients in the highest-risk counties were more likely to be African American (adjusted odds ratio, 1.59, 95% CI, 1.51-1.68), to be younger (aged 18-39 years; 1.46; 1.32-1.60), to have lower educational attainment (<high school; 1.84; 1.62-2.08), and to have public insurance (1.46; 1.38-1.54). Proportions of recipients from higher-risk counties varied dramatically by center and region. There was an independent graded effect between health indicators and posttransplant mortality, including notable hazard associated with the highest-risk counties (adjusted hazard ratio, 1.26; 95% CI, 1.13-1.40). CONCLUSIONS: In a national cohort of patients undergoing complex medical procedures, health indicators from patients' communities are strong independent predictors of all-cause mortality. Findings highlight the importance of community conditions for risk stratification of patients and development of individualized treatment protocols. Findings also demonstrate that standard risk adjustment does not capture important factors that may affect unbiased performance evaluations of transplant centers.

Schold, J. D., Srinivas, T. R., Howard, R. J., et al. (2008). "The association of candidate mortality rates with kidney transplant outcomes and center performance evaluations." Transplantation **85**(1): 1-6.

Timely access to transplantation for eligible patients with end-stage renal disease (ESRD) is critical. However, pressures exist to improve efficiencies in transplantation and to achieve high center performance ratings, including the recently submitted "Final Rule" by Center for Medicare and Medicaid Services. This policy may affect the availability of public funding for as many as 10% of kidney transplant centers in the United States. This study examined adult solitary kidney transplant candidates from 1995 to 2005 using a national database. Mortality rates were calculated for candidates at individual centers prior to transplantation. Posttransplant survival and center's standardized mortality ratios were then calculated and compared to rates of candidate mortality. Candidate mortality rates varied substantially across centers (highest quartile with almost 2-fold elevated mortality). Recipients at centers with the highest candidate mortality rates had approximately 1.9 years reduced median graft survival for deceased donor transplants and decreased patient survival even after risk adjustment (adjusted hazard ratio=1.33, 95% confidence interval 1.25-1.41). This association was greater among living transplants (adjusted hazard ratio=1.49, 95% confidence interval 1.31-1.70). For 1-year outcomes, 19% (43/224) of centers met criteria for low performance for either graft loss or patient death in living or deceased donor transplants. Of these, 51% were among centers with the highest candidate mortality as compared to 7% of centers with the lowest candidate mortality. The health status of centers' transplant candidate pool is a significant determinant of outcomes and performance ratings. Centers with a higher risk candidate pool are significantly more likely to be identified for poor performance and could potentially lose public funding. Pressures to enhance outcomes may lead centers to exclude high-risk but otherwise viable transplant candidates.

Schold, J. D., Srinivas, T. R., Poggio, E. D., et al. (2010). "Hidden selection bias deriving from donor organ characteristics does not affect performance evaluations of kidney transplant centers." Med Care **48**(10): 907-914.

> BACKGROUND: Transplant center performance evaluations have garnered substantial attention in recent years. Among sources of bias that may affect measured performance are underlying characteristics of donor organs. An unresolved question is whether centers accepting higher-risk donations are placed in jeopardy for lower evaluations independent of actual quality of care. OBJECTIVE: The primary aim was to assess whether unmeasured characteristics of donor organs impact risk-adjusted outcomes used for center performance evaluations. SUBJECTS: The study included adult kidney transplant recipients (n = 53,791) from 1994 to 2008 from a national registry. RESEARCH DESIGN: We compared adjusted graft survival with use of paired-donor kidneys (allocated to high- and low-performing centers) and unpaired donor kidneys to investigate whether measured center performance was consistent with organs derived from the same donor (minimizing the influence of noncodified risk factors). RESULTS: The primary finding was that differences between centers were unaffected by use of paired or unpaired donations (hazard ratio for patients transplanted at high performing centers with paired kidneys = 0.63 [95% CI, 0.53-0.74] and with unpaired kidneys = 0.66 [95% CI, 0.62-0.70], P value for interaction = 0.52). This finding was consistent over 5 consecutive cohorts, based on either concurrent or prospective outcomes and by altering the threshold criteria for identification of performance outliers. CONCLUSIONS: Results indicate that underlying selection bias from donor characteristics does not impact transplant center evaluations. This is important evidence that donor selection is not a primary driver for evaluated quality of care among transplant centers and acceptance of higher-risk kidneys should not be perceived as a primary threat to measured performance.

Shaheen, F. A. et Souqiyyeh, M. Z. (2005). "Improving transplantation programs and patient care." Transplant Proc **37**(7): 2909-2910.

> Organ transplantation is the preferred mode of replacement therapy. Currently acceptable 5-year posttransplantation survival rates are 85% for renal grafts, 70% for liver, and 65% for heart. Organ donation, however, remains a significant factor in organ transplantation, as humans are the only possible donors and the numbers of patients on waiting lists remain high. Several factors affect organ transplantation in countries in the Middle East Society for Organ Transplantation (MESOT) region, including inadequate preventive medicine, differing health infrastructures, poor awareness within the medical community and lay public regarding the importance of organ donation and transplantation, a high level of ethnicity, and poor government support of organ transplantation. Moreover, there is lack of team spirit among transplant physicians, a lack of coordination between groups that manage organ procurement and the transplant centers, and a lack of effective health insurance coverage for many persons. Three models of organ donation and transplantation exist in the MESOT region-the Saudi, Iranian, and Pakistani models. Living-organ donation, the most widely practiced form of donation in countries in the MESOT region, includes kidney and partial liver. Cadaveric organ donation has significant potential in the MESOT region. However, numerous obstacles must be overcome in MESOT countries. Resolution of these obstacles will require continuous work on many fronts. Experiences from all sources must be incorporated into new and improved models that can overcome current inadequacies. Solutions will require continued focus within the medical community, steady support from the lay public and religious institutions, as well as governmental assistance.

Singh, S. K. et Kim, S. J. (2013). "Does expanded criteria donor status modify the outcomes of kidney transplantation from donors after cardiac death?" Am J Transplant **13**(2): 329-336.

> The outcomes of kidney transplants that simultaneously exhibit donation after cardiac death (DCD) and expanded criteria donor (ECD) characteristics have not been well studied. We examined the outcomes of DCD versus non-DCD kidney transplants as a function of ECD status and the kidney donor risk index (KDRI). A cohort study of 67 816 deceased donor kidney transplant recipients (KTR), including 562 ECD/DCD KTR, from January 1, 2000 to December 31, 2009 was conducted using the Scientific Registry of

Transplant Recipients. In a multivariable Cox proportional hazards model, the modestly increased risk of total graft failure in DCD versus non-DCD KTR was not significantly modified by ECD status (hazard ratio1.07 [95% CI: 1.01, 1.15] for non-ECD vs. 1.21 [95% CI: 1.04, 1.40] for ECD, p for interaction = 0.14).Moreover, the hazard ratios did not significantly vary by KDRI quintiles (p = 0.40). Similar trends were seen for death-censored graft failure and death with graft function. In conclusion, ECD status or higher KDRI score did not appreciably increase the relative hazard of adverse graft and patient outcomes in DCD KTR. These findings suggest that the judicious use of ECD/DCD donor kidneys may be an appropriate strategy to expand the donor pool.

Skelton, S. L., Waterman, A. D., Davis, L. A., et al. (2015). "Applying best practices to designing patient education for patients with end-stage renal disease pursuing kidney transplant." Prog Transplant **25**(1): 77-84.

Despite the known benefits of kidney transplant, less than 30% of the 615 000 patients living with end-stage renal disease (ESRD) in the United States have received a transplant. More than 100 000 people are presently on the transplant waiting list. Although the shortage of kidneys for transplant remains a critical factor in explaining lower transplant rates, another important and modifiable factor is patients' lack of comprehensive education about transplant. The purpose of this article is to provide an overview of known best practices from the broader literature that can be used as an evidence base to design improved education for ESRD patients pursuing a kidney transplant. Best practices in chronic disease education generally reveal that education that is individually tailored, understandable for patients with low health literacy, and culturally competent is most beneficial. Effective education helps patients navigate the complex health care process successfully. Recommendations for how to incorporate these best practices into transplant education design are described. Providing more ESRD patients with transplant education that encompasses these best practices may improve their ability to make informed health care decisions and increase the numbers of patients interested in pursuing transplant.

St Peter, W. L., Schoolwerth, A. C., McGowan, T., et al. (2003). "Chronic kidney disease: issues and establishing programs and clinics for improved patient outcomes." Am J Kidney Dis **41**(5): 903-924.

The spectrum of chronic kidney disease (CKD) extends from the point at which there is slight kidney damage, but normal function, to the point at which patients require either a renal transplant or renal replacement therapy to survive. Epidemiological studies suggest there are approximately 20,000,000 patients with various stages of CKD. These patients have many comorbidities, including cardiovascular disease, hypertension, diabetes, anemia, nutritional and metabolic derangements, and fluid overload. Unfortunately, evidence shows that current CKD care in the United States is suboptimal, and late referral to a nephrologist is often the rule and not the exception. Roles of primary care physicians (PCPs) and nephrologists in the care of patients with CKD remain undefined. Several studies have suggested that care provided by multidisciplinary nephrology teams can improve patient outcomes. Currently, there are published evidence-based clinical practice guidelines for anemia management, nutritional therapy, and vascular access placement, with other CKD guidelines under development. The intent of this review includes providing compelling evidence for earlier screening, identification, and management of patients with CKD; showing that current CKD care is suboptimal; encouraging the development of multidisciplinary teams that provide collaborative care to patients with CKD, suggesting roles for PCPs and nephrologists in the care of these patients; describing CKD initiatives from national organizations; and providing a comprehensive checklist that can guide the development of CKD clinics and programs.

Stratta, R. J., Rohr, M. S., Sundberg, A. K., et al. (2006). "Intermediate-term outcomes with expanded criteria deceased donors in kidney transplantation: a spectrum or specter of quality?" Ann Surg **243**(5): 594-601; discussion 601-593.

OBJECTIVE: To compare intermediate-term outcomes in adult recipients of expanded criteria (ECD) versus concurrent standard criteria (SCD) deceased donor kidney transplants at a single center using a standardized approach. SUMMARY BACKGROUND DATA: Expanded criteria donors (ECDs) are a source of kidneys that increase the donor organ pool, but the value of transplanting these kidneys has been questioned because of concerns regarding diminished survival and predicted poorer intermediate-term outcomes. METHODS: Over a 47-month period, we performed 244 deceased donor kidney transplants into adult recipients, including 143 from SCDs and 101 from ECDs. Management algorithms were implemented to preserve nephron function, and recipient selection for an ECD kidney transplant was based on low immunologic risk. All patients received depleting antibody induction in combination with tacrolimus and mycophenolate mofetil. A total of 188 patients (77%) had at least a 1-year follow-up. RESULTS: ECDs were older, had a higher BMI, had an increased incidence of cerebrovascular brain death and preexisting donor hypertension, and had a lower estimated creatinine clearance (CrCl, all P < 0.01) compared with SCDs. Cold ischemic times were similar between groups, but more ECD kidneys were preserved with pulsatile perfusion (P < 0.01). ECD kidney recipients were older, less sensitized, had a lower BMI, had fewer 0-antigen mismatches, and had a shorter waiting time (all P < 0.01) compared with SCD kidney recipients. Actual patient (93%) and kidney graft (83%) survival rates were similar between groups with a mean follow-up of 24 months. The rates of delayed graft function (DGF), acute rejection, readmissions, operative complications, major infections, and resource utilization were comparable between groups. Renal function followed longitudinally was consistently better in SCD patients (P < 0.05). Black recipients had higher rates of DGF, acute rejection, and graft loss (P < 0.05), but the effects were less pronounced in the ECD group. CONCLUSIONS: By appropriate donor and recipient profiling and the use of management algorithms to project and protect renal function, excellent intermediate-term outcomes can be achieved with ECD kidney transplants that are comparable to SCD kidney transplants.

Struijk, G. H., Lammers, A. J., Brinkman, R. J., et al. (2015). "Immunization after renal transplantation: current clinical practice." Transpl Infect Dis **17**(2): 192-200.

BACKGROUND: The use of potent immunosuppressive drugs and increased travel by renal transplant recipients (RTR) has augmented the risk for infectious complications. Immunizations and changes in lifestyle are protective. The Kidney Disease: Improving Global Outcomes (KDIGO) Transplant Work Group has developed guidelines on vaccination following solid organ transplantation. The degree of adherence to these guidelines is unknown, as is which barriers must be overcome to improve adherence. METHODS: We performed a cross-sectional national survey among Dutch nephrologists to assess vaccination policy and adherence to the KDIGO guidelines. In addition, to investigate awareness and attitude of RTR regarding their risk of infection, we performed a cross-sectional survey of RTR in our outpatient clinic. RESULTS: A total of 132 (63%) nephrologists completed the survey. Reported immunization rates were 90.8% for influenza and 27.3% for hepatitis B. However, pneumococcal, tetanus toxoid, and meningococcal immunization rates were low. Twenty-seven percent of respondents were familiar with the guideline contents. The most frequent perceived barrier to guideline adherence was expectation of low effectiveness. A total of 403 RTR (62%) completed the survey. Sixty-eight percent perceived more risk for complicated infection. A significant correlation was found between education level and variables concerning awareness and attitude toward risk of infection. CONCLUSIONS: Our results show that nephrologists' knowledge of and adherence to the recommendations regarding immunization after renal transplantation is suboptimal. Most Dutch RTR are aware of their increased risk and the possible seriousness of infectious complications. However, their behavior does not match their awareness. This disparity points to an important role for nephrologists in providing adequate counseling.

Sulanc, E., Lane, J. T., Puumala, S. E., et al. (2005). "New-onset diabetes after kidney transplantation: an application of 2003 International Guidelines." Transplantation **80**(7): 945-952.

BACKGROUND: The 2003 International Consensus Guidelines defined new-onset diabetes after transplantation. This study determined the risk of new-onset diabetes following kidney transplantation using these criteria. METHODS: Consecutive nondiabetic patients who received kidney transplantation between August 2001 and March 2003 (recent, n=61) and before August 2001 (earlier, n=61) were retrospectively evaluated. RESULTS: In all, 74% in the recent group and 56% in the earlier group developed diabetes by 1 year posttransplant. Median time to diabetes development was 23 days in the recent vs. 134 days in the earlier group (P=0.0304). Most patients developed diabetes within 60 days after transplantation. Immunosuppression was the strongest correlate of diabetes development; tacrolimus and cyclosporine A treatments were associated with increased risk. The rate of development was also greater when rapamycin was added to tacrolimus, compared to when it was not. The risk was double in African-Americans compared to whites. Age, body mass index, family history of diabetes, and etiology of renal failure did not predict diabetes; however, the mean age of patients was greater than previously reported. CONCLUSIONS: The majority of patients are at risk of developing new-onset diabetes within a short time after kidney transplantation. The risk may be due to preexisting risk factors, immunosuppressive agents, or older age. The significance of these findings is not clear, but demands

appropriate follow-up studies related to glycemia, end-organ complications, and graft function. It remains to be determined whether the 2003 International Consensus Guidelines are adequate to appropriately diagnose diabetes in the posttransplant time period, with special emphasis on the first 3 months.

Sultan, H., Famure, O., Phan, N. T., et al. (2013). "Performance measures for the evaluation of patients referred to the Toronto General Hospital's kidney transplant program." Healthc Manage Forum **26**(4): 184-190.

Given the increasing number of patients with end-stage renal disease in Ontario, there is a need to improve the efficiency and effectiveness of the pretransplant evaluation, to allow for a seamless progression through the various steps in the process. Toronto General Hospital's kidney transplant program is evaluating various performance measures, specifically looking at waiting times from referral to initial evaluation and initial evaluation to final disposition, to use as metrics for monitoring program performance and stimulate quality improvement.

Taber, D. J., McGillicuddy, J. W., Bratton, C. F., et al. (2014). "The concept of a composite perioperative quality index in kidney transplantation." J Am Coll Surg **218**(4): 588-597.

BACKGROUND: Public reporting of patient and graft outcomes in a national registry and close Centers for Medicare and Medicaid Services oversight has resulted in transplantation being a highly regulated surgical discipline. Despite this, transplantation surgery lacks comprehensive tracking and reporting of perioperative quality measures. Therefore, the aim of this study was to determine the association between a kidney transplantation centers' perioperative quality benchmarking and graft and patient outcomes. STUDY DESIGN: This was an analysis of 2011 aggregate data compiled from 2 national datasets that track outcomes from member hospitals and transplantation centers. The transplantation centers included in this study were composed of accredited US kidney transplantation centers that report data through the national registry and are associate members of the University HealthSystem Consortium. RESULTS: A total of 16,811 kidney transplantations were performed at 236 centers in the United States in 2011, of which 10,241 (61%) from 93 centers were included in the analysis. Of the 6 perioperative quality indicators, 3 benchmarked metrics were significantly associated with a kidney transplantation center's underperformance: mean ICU length of stay (C-statistic 0.731; $p = 0.002$), 30-day readmissions (C-statistic 0.697; $p = 0.012$) and in-hospital complications (C-statistic 0.785; $p = 0.001$). The composite quality index strongly correlated with inadequate center performance (C-statistic 0.854; $p < 0.001$, R(2) = 0.349). The centers in the lowest quartile of the quality index performed 2,400 kidney transplantations in 2011, which led to 2,640 more hospital days, 4,560 more ICU days, 120 more postoperative complications, and 144 more patients with 30-day readmissions, when compared with centers in the 3 higher-quality quartiles. CONCLUSIONS: An objective index of a transplantation center's quality of perioperative care is significantly associated with patient and graft survival.

Tai, E. et Chapman, J. R. (2010). "The KDIGO review of the care of renal transplant recipient." Pol Arch Med Wewn **120**(6): 237-242.

This review highlights the key messages from the KDIGO (Kidney Disease: Improving Global Outcomes) clinical practice guidelines for care of kidney transplant recipients, which were written to be global guidelines irrespective of the regulatory, fiscal, cultural, socioeconomic, or geographical environment. The distillation of 3168 randomized control trials, 7543 cohort studies, and 1609 reviews led to recommendations rated by the strength of supporting evidence and the quality of the data from A to D. Despite this, the quality of the evidence is surprisingly low for the majority of decisions that are routinely taken in all transplant units throughout the world, highlighting the needs for properly designed randomized controlled trials. The principle areas covered in the guidelines include immunosuppression, management of acute rejection, monitoring of the patient and graft, chronic allograft injury, kidney biopsy, nonadherence, vaccination, infectious diseases, cardiovascular risk management, malignancy, bone disease, pediatric growth, lifestyle, fertility, and mental health. This review highlights a number of these areas for consideration focusing on the different types of evidence that we use in daily clinical practice.

Tan, L., Tai, B. C., Wu, F., et al. (2011). "Impact of Kidney Disease Outcomes Quality Initiative guidelines on the prevalence of chronic kidney disease after living donor nephrectomy." J Urol **185**(5): 1820-1825.

PURPOSE: We evaluated the prevalence of chronic kidney disease stage 3 or worse based on the National Kidney Foundation Kidney Disease Outcomes Quality Initiative guidelines after living kidney donation at a single institution. MATERIALS AND METHODS: The collected data of 86 consecutive patients who underwent uneventful donor nephrectomy between 1987 and 2008 were evaluated retrospectively. Estimated glomerular filtration rate was determined using the Modification of Diet in Renal Disease from serum creatinine levels collected before and after surgery in kidney donor followup clinics. Chronic kidney disease was defined as an estimated glomerular filtration rate of less than 60 ml/minute/1.73 m(2) according to the Kidney Disease Outcomes Quality Initiative guidelines. Cox regression analyses were then used to determine the impact of predictors on the development of chronic kidney disease. RESULTS: All donors (mean age 41.2, SD 9.9 years) had a mean preoperative estimated glomerular filtration rate of 88.7 ml/min/1.73 m(2) (SD 16.3). Median followup was 6.4 years (range 0.9 to 21.0). Progression to stage 3 or worse chronic kidney disease was seen in 24.4% (95% CI 15.2-33.7) of patients. There were 2 patient deaths secondary to cancer and none required dialysis. Multivariable analysis showed that preoperative estimated glomerular filtration rate less than 82 ml/minute/1.73 m(2) was an independent risk factor for post-donation chronic kidney disease. For every 1 ml/minute/1.73 m(2) increase in baseline estimated glomerular filtration rate, the hazard of postoperative chronic kidney disease was reduced by 7% (HR 0.93, 95% CI 0.89-0.97, p = 0.001). CONCLUSIONS: Kidney Disease Outcomes Quality Initiative stage 3 chronic kidney disease or worse occurs in 24.4% of kidney donors. Long-term prospective studies and closer followup of donors are needed to identify its implications, given the associated risk of cardiovascular diseases with chronic kidney disease in the general population.

Thys, K., Van Assche, K., Nobile, H., et al. (2013). "Could minors be living kidney donors? A systematic review of guidelines, position papers and reports." Transpl Int **26**(10): 949-960.

The purpose of this study is to systematically review guidelines, position papers, and reports on living kidney donation by minors. We systematically searched the databases such as Medline, Embase, ISI Web of knowledge, Google scholar as well as the websites of various bioethics committees, transplant organizations and societies. Guidelines were included if they provided recommendations for or against living kidney donation by minors. Data were analyzed using qualitative content analysis. We included 39 documents in this study. Twenty seven of these endorse an absolute prohibition of living kidney donation by minors, because of concerns regarding the decision-making capacity of minors, the impartiality of parental authorization, the best interests of the minor, and the necessity of the donation. Twelve guidelines, however, would exceptionally allow living kidney donation by minors, provided that adequate safeguards are put in place, including an assessment of the minor's autonomy and maturity, authorization by an independent body, assuring that the anticipated psychosocial benefits outweigh the medical and psychosocial risks for the donor and the restriction to situations of last resort. A more adequate medical and psychosocial follow-up of living kidney donors may likely contribute to a more unified approach towards living kidney donation by minors.

Tokumoto, T., Tanabe, K., Toma, H., et al. (2004). "[Treatment of bone disease in chronic kidney disease and in renal transplant recipients under K/DOQI clinical practice guidelines]." Clin Calcium **14**(5): 710-718.

The National Kidney Foundation's Kidney Disease Outcomes Quality Initiative (K/DOQI) provides evidence based clinical practice guidelines developed for all phases of kidney disease and related complications, from diagnosis to monitoring and management. Bone disease sets in during the early stages of Chronic Kidney Disease (CKD). Bone disease is observed in almost patients with chronic renal failure and after renal transplantation. Hyperparathyroid (high turnover) bone disease in patients with chronic renal failure is found most frequently followed by mixed osteodystrophy, low-turn over bone disease, and osteomalasia. Ninety to one hundred percent of kidney transplant patients have histological evidence of osteodystrophy and osteopenia (reduction of bone mass) following renal transplantation. Furthermore, osteoporosis is also appeared in many renal transplant recipients. After renal transplantation, renal osteodystrophy generally improves but bone mineral density (BMD) often worsens. When renal bone disease is assessed using a combination of biochemical markers, histology and bone densitometry, early intervention and carefully effective therapies might be reduced the morbidity associated with these common problems.

Tong, A., Chapman, J. R., Wong, G., et al. (2011). "Screening and follow-up of living kidney donors: a systematic review of clinical practice guidelines." Transplantation **92**(9): 962-972.

> To minimize the health risks faced by living kidney donors, multiple clinical practice guidelines have been developed on the assessment and care of potential donors. This study aims to compare the quality, scope, and consistency of these guidelines. We searched for guidelines on living kidney donation in electronic databases, guideline registries, and relevant Web sites to February 21, 2011. Methodological quality was assessed using the Appraisal of Guidelines for Research and Education (AGREE) instrument. Textual synthesis was used to compare guideline recommendations. Ten guidelines, published from 1996 to 2010, were identified. Although generally comprehensive, scope varied considerably and mostly appeared to lack methodological rigor. Many recommendations were consistent, but important differences were evident, particularly for thresholds for comorbidities which precluded donation; obesity/overweight (body mass index, 30-35 kg/m), diabetes/prediabetes (fasting blood glucose level, 6.1-7.0 mmol/L and oral glucose tolerance test, 7.8-11.1 mmol/L), hypertension (130/85 to 140/90 mm Hg), cardiovascular disease, malignancy, and nephrolithiasis. The importance of informed voluntary consent, genuine motivation, support, and psychological health were recognized but difficult to implement as specific tools for conducting psychosocial assessments were not recommended. Multiple major guidelines for living kidney donation have been published recently, resulting in unnecessary duplicative efforts. Most do not meet standard processes for development, and important recommendations about thresholds for exclusion based on comorbidities are contradictory. There is an urgent need for international collaboration and coordination to ensure, where possible, that guidelines for living donation are consistent, evidence based, and comprehensive to promote best outcomes for a precious resource.

Toussaint, N. D., McMahon, L. P., Dowling, G., et al. (2015). "Implementation of renal key performance indicators: promoting improved clinical practice." Nephrology (Carlton) **20**(3): 184-193.

> AIM: In the Australian state of Victoria, the Renal Health Clinical Network (RHCN) of the Department of Health Victoria established a Renal Key Performance Indicator (KPI) Working Group in 2011. The group developed four KPIs related to chronic kidney disease and dialysis. A transplant working group of the RHCN developed two additional KPIs. The aim was to develop clinical indicators to measure performance of renal services to drive service improvement. METHODS: A data collection and benchmarking programme was established, with data provided monthly to the Department using a purpose-designed website portal. The KPI Working Group is responsible for analysing data each quarter and ensuring indicators remain accurate and relevant. Each indicator has clear definitions and targets, and assess (i) patient education, (ii) timely creation of vascular access for haemodialysis, (iii) proportion of patients dialysing at home, (iv) incidence of dialysis-related peritonitis, (v) incidence of pre-emptive renal transplantation, and (vi) timely listing of patients for deceased donor transplantation. RESULTS: Most KPIs have demonstrated improved performance over time with limited gains notably in two: the proportion of patients dialysing at home (KPI 3) and timely listing patients for transplantation (KPI 6). CONCLUSION: KPI implementation has been established in Victoria for 2 years, providing performance data without additional funding. The six Victorian KPIs are measurable, relevant and modifiable, and implementation relies on enthusiasm and goodwill of physicians and nurses involved in collecting data. The KPIs require further evaluation, but adoption of a similar programme by other jurisdictions could lead to improved national outcomes.

Traino, H. M., Nonterah, C. W., Cyrus, J. W., et al. (2015). "Disparities in the completion of steps to kidney transplantation: protocol for a systematic review." BMJ Open **5**(9): e008677.

> INTRODUCTION: Disparities in access to transplantation have been well documented. The extant literature, however, focuses largely on disparities and related barriers for African-American patients and none has used the steps to transplantation as a guiding framework. This review will catalogue disparities in the steps to transplantation as well as the barriers and facilitators to completion of each step identified in the extant literature. The results of the review will be used to generate recommendations for future research to improve equity in access to kidney transplantation. METHODS AND ANALYSIS: Standard procedures will be used in the conduct of the review. Searches will be performed using the following electronic databases: PubMed/Medline, PsycINFO, CINHAL, EMBASE, Cochrane library and Web of Science. Reports of original research will be eligible for inclusion if they are published from 2005 to

> present, written or available in English language, performed in the USA, enrol adult participants (18 years of age or more), and employ descriptive or observational designs. Two authors will independently screen retrieved articles for inclusion. MaxQDA will be used for data analysis and management. All included reports will be coded for article characteristics; disparities identified; barriers and motivators of completion of steps to transplantation; and proposed solutions to disparities and barriers. Each report will be coded independently by two authors and discrepancies resolved by discussion among the full team. A qualitative approach to data analysis is planned. Risk of bias will be assessed using standard procedures. ETHICS AND DISSEMINATION: The findings will provide crucial information on the current status of disparities in access to transplantation. PRISMA guidelines will be followed in reporting the results of the review. It is anticipated that these results will inform research which seeks to increase parity in access to transplantation. SYSTEMATIC REVIEW REGISTRATION: PROSPERO CRD42014015027.

Tuttle-Newhall, J. E., Lentine, K. L., Axelrod, D., et al. (2013). "Transplant certification and quality assessment: time to take the front line?" Prog Transplant **23**(3): 206-212.

> In the beginning of the past decade, a series of highly publicized events led the general public to question the ability of the transplant community to effectively police itself. Common to the events was the perception that insufficient regulation of the transplant community allowed both unintentional errors and, rarely, purposeful violations of policy, to affect the safety and justice of organ allocation and transplant practice. The goal of this article is to discuss the resulting regulatory responses to these events and to highlight one transplant center's experience with the current external review process. The potential benefits of using process control charts to prospectively monitoring a center's outcomes, as well as the benefits of implementing procedures that ensure the quality of publically reported data, are described. Specifically, the critical need for each center to understand the components, limitations, and implications of public outcome reporting and to define processes that promote real time self-evaluation and quality improvement are demonstrated.

van der Veer, S. N., Jager, K. J., Nache, A. M., et al. (2011). "Translating knowledge on best practice into improving quality of RRT care: a systematic review of implementation strategies." Kidney Int **80**(10): 1021-1034.

> Recent studies showed wide variation in the extent to which guidelines and other types of best practice have been implemented as part of routine health care. This is also true for the delivery of renal replacement therapy (RRT) for ESRD patients. Increasing uptake of best practice within such complex care systems requires an understanding of implementation strategies and specific quality improvement (QI) techniques. Therefore, we systematically reviewed over 5000 titles published since 1990 and included papers describing planned attempts to accelerate uptake of best RRT practice into daily care. This resulted in a list of 93 QI initiatives, categorized in order to expedite shared learning. The majority of the initiatives were executed within the domains of vascular access, nutrition, and anemia management. Strategies oriented at patients were most common and many initiatives pre-defined an improvement target before starting implementation. Of the 93 initiatives, 22 were sufficiently robust methodologically to be analyzed in more detail. Our results tend to support previous findings that multifaceted strategies are more effective than single strategies. Improving our understanding of how to successfully implement best practice can inform system-level change and is the only way to close the gap between knowledge on what works and the actual care delivered to ESRD patients. Research into implementation, using specific QI techniques, should therefore be given priority in future.

van der Veer, S. N., Tomson, C. R., Jager, K. J., et al. (2014). "Bridging the gap between what is known and what we do in renal medicine: improving implementability of the European Renal Best Practice guidelines." Nephrol Dial Transplant **29**(5): 951-957.

> The increasing volume of evidence on how to treat kidney patients makes it difficult for nephrologists and renal nurses to keep up-to-date. This potentially widens the gap between what is known about best practice and how daily renal care is provided. Rigorously developed clinical practice guidelines can be important tools to bridge this gap. However, just developing and publishing guidelines does not ensure their use in actual practice. In this paper, we distinguish and illustrate three types of modifiable factors (i.e. barriers) that potentially impede renal healthcare professionals to provide care according to the guidelines: barriers related to knowledge, to attitudes and to behaviour. European Renal Best Practice (ERBP) produces guidelines for care of kidney patients in Europe and neighbouring regions. To facilitate

implementation of its guidelines, ERBP aims to optimize 'guideline implementability', which regards the intrinsic characteristics of guidelines (i.e. format and content). The last section of this paper describes some of the associated ERBP activities, which are planned or pending.

Venkat, K. K. et Eshelman, A. K. (2014). "The evolving approach to ethical issues in living donor kidney transplantation: a review based on illustrative case vignettes." Transplant Rev (Orlando) **28**(3): 134-139.

Living donor kidney transplantation which involves performing a major surgical procedure on a healthy person solely to benefit another person has always involved dealing with difficult ethical issues. Beneficence, non-maleficence, donor autonomy, altruistic donor motivation, coercion-free donation, fully informed consent and avoidance of medical paternalism have been the dominant ethical principles governing this field ever since the first successful living donor kidney transplant in 1954. The increasing reliance on living donors due to the rapidly growing disparity between the number of patients awaiting transplantation and the availability of deceased donor kidneys has brought with it a variety of new ethical issues of even greater complexity. Issues such as confidentiality of donor and recipient medical information, the appropriateness of the invented medical excuse to avoid donation and the approach to misattributed paternity discovered during work-up for living donor transplantation have made the information to be disclosed prior to obtaining donor's consent much more extensive. In this article, we review the current thinking and guidelines (which have evolved considerably over the past several decades) regarding these ethical issues using five illustrative case vignettes based on donors personally evaluated by us over the past 35 years.

Warrens, A. N., Baboolal, K., Buist, L., et al. (2008). "Interpreting regulatory authority guidance on immunosuppressive therapy for renal transplantation: a response to the UK's National Institute for Clinical Excellence (NICE)." Clin Nephrol **69**(2): 67-76.

AIMS: A group of UK consultant transplant physicians and surgeons (the Consensus Group) met to consider the implications and interpretation of the National Institute for Clinical Excellence's (NICE) Technology Appraisal No. 85 on the use of immunosuppressive therapy for renal transplantation in adults. METHODS: This group considered what the implications of these guidelines might be for clinical practice and consensus was developed on those areas which were potentially open to different interpretations. A wider survey of nephrologists and transplant surgeons throughout the UK was also performed to gauge the impact of the NICE recommendations. RESULTS AND CONCLUSIONS: The outcome of the discussions of the Consensus Group are presented with particular reference to the recommendations of how to respond to calcineurin inhibitor (CNI) intolerance. The survey suggested that the publication of this NICE guidance has resulted in relatively few changes in prescribing practice: UK transplant centers continue to use a wide range of locally developed protocols for immunosuppressive therapy. These include the use of agents such as mycophenolate mofetil (MMF) and sirolimus, despite the fact that both drugs appeared to receive only conditional acceptance in the NICE Guidelines.

Weckmann, G. F. C., Stracke, S., Haase, A., et al. (2018). "Diagnosis and management of non-dialysis chronic kidney disease in ambulatory care: a systematic review of clinical practice guidelines." BMC Nephrol **19**(1): 258.

BACKGROUND: Chronic kidney disease (CKD) is age-dependent and has a high prevalence in the general population. Most patients are managed in ambulatory care. This systematic review provides an updated overview of quality and content of international clinical practice guidelines for diagnosis and management of non-dialysis CKD relevant to patients in ambulatory care. METHODS: We identified guidelines published from 2012-to March 2018 in guideline portals, databases and by manual search. Methodological quality was assessed with the Appraisal of Guidelines for Research and Evaluation II instrument. Recommendations were extracted and evaluated. RESULTS: Eight hundred fifty-two publications were identified, 9 of which were eligible guidelines. Methodological quality ranged from 34 to 77%, with domains "scope and purpose" and "clarity of presentation" attaining highest and "applicability" lowest scores. Guidelines were similar in recommendations on CKD definition, screening of patients with diabetes and hypertension, blood pressure targets and referral of patients with progressive or stage G4 CKD. Definition of high risk groups and recommended tests in newly diagnosed CKD varied. CONCLUSIONS: Guidelines quality ranged from moderate to high. Guidelines generally agreed on management of patients with high risk or advanced CKD, but varied in regarding the range of recommended measurements, the need for referrals to nephrology, monitoring intervals and comprehensiveness. More research is needed on efficient management of patients with low risk of CKD progression to end stage renal disease.

Weimann, A., Ebener, C., Holland-Cunz, S., et al. (2009). "Surgery and transplantation - Guidelines on Parenteral Nutrition, Chapter 18." Ger Med Sci **7**: Doc10.

In surgery, indications for artificial nutrition comprise prevention and treatment of catabolism and malnutrition. Thus in general, food intake should not be interrupted postoperatively and the re-establishing of oral (e.g. after anastomosis of the colon and rectum, kidney transplantation) or enteral food intake (e.g. after an anastomosis in the upper gastrointestinal tract, liver transplantation) is recommended within 24 h post surgery. To avoid increased mortality an indication for an immediate postoperatively artificial nutrition (enteral or parenteral nutrition (PN)) also exists in patients with no signs of malnutrition, but who will not receive oral food intake for more than 7 days perioperatively or whose oral food intake does not meet their needs (e.g. less than 60-80%) for more than 14 days. In cases of absolute contraindication for enteral nutrition, there is an indication for total PN (TPN) such as in chronic intestinal obstruction with a relevant passage obstruction e.g. a peritoneal carcinoma. If energy and nutrient requirements cannot be met by oral and enteral intake alone, a combination of enteral and parenteral nutrition is indicated. Delaying surgery for a systematic nutrition therapy (enteral and parenteral) is only indicated if severe malnutrition is present. Preoperative nutrition therapy should preferably be conducted prior to hospital admission to lower the risk of nosocomial infections. The recommendations of early postoperative re-establishing oral feeding, generally apply also to paediatric patients. Standardised operative procedures should be established in order to guarantee an effective nutrition therapy.

Wettstein, D., Opelz, G. et Susal, C. (2014). "HLA antibody screening in kidney transplantation: current guidelines." Langenbecks Arch Surg **399**(4): 415-420.

BACKGROUND: In organ transplantation, the introduction of the solid phase immunoassay technology radically changed the practice of antibody monitoring against human leukocyte antigens (HLA). PURPOSE: Precise identification of antibody specificities in complex sera of sensitized patients and monitoring of low levels of donor-specific HLA antibodies in the posttransplant phase became possible. However, at the same time, new technical problems and great variation emerged in the interpretation of test results, indicating a need for standardization. CONCLUSION: In May 2012, The Transplantation Society (TTS) recruited a panel of laboratory and clinical experts to discuss emerging testing and clinical management issues that are associated with antibody testing in organ transplantation. In this article, we provide a summary of the TTS recommendations formulated in this international effort on the standardization of antibody monitoring in kidney transplantation.

Wheeler, D. C. et Becker, G. J. (2013). "Summary of KDIGO guideline. What do we really know about management of blood pressure in patients with chronic kidney disease?" Kidney Int **83**(3): 377-383.

The Kidney Disease: Improving Global Outcomes Clinical Practice Guideline for management of blood pressure (BP) in chronic kidney disease (CKD) supersedes the 2004 Kidney Disease Quality Outcomes Initiative document on this topic. The new guideline has been designed to assist clinical decision making in patients with CKD who are not receiving dialysis. The recommendations in the guideline acknowledge that no single BP target is optimal for all CKD patients and encourage individualization of treatment depending on age, the severity of albuminuria, and comorbidities. In general, the available evidence indicates that in CKD patients without albuminuria the target BP should be </=140 mm Hg systolic and </=90 mm Hg diastolic. However, in most patients with an albumin excretion rate of >/=30 mg/24 h (i.e., those with both micro- and macroalbuminuria), a lower target of </=130 mm Hg systolic and </=80 mm Hg diastolic is suggested. In achieving BP control, the value of lifestyle changes and the need for multiple pharmacological agents is acknowledged. Use of agents that block the renin-angiotensin-aldosterone system is recommended or suggested in all patients with an albumin excretion rate of >/=30 mg/24 h. Recommendations are almost identical in CKD patients with and without diabetes. Special considerations relevant to children and those of older age and those who have received a kidney transplant are included. Ongoing controversies in BP management in the context of CKD are highlighted along with key areas for future research.

White, S. L., Zinsser, D. M., Paul, M., et al. (2015). "Patient selection and volume in the era surrounding implementation of Medicare conditions of participation for transplant programs." Health Serv Res **50**(2): 330-350.

OBJECTIVE: To evaluate evidence of practice changes affecting kidney transplant program volumes, and donor, recipient and candidate selection in the era surrounding the introduction of Centers for Medicare and Medicaid Services (CMS) conditions of participation (CoPs) for organ transplant programs. DATA: Scientific Registry of Transplant Recipients; CMS ESRD and Medicare claims databases. DESIGN: Retrospective analysis of national registry data. METHODS: A Cox proportional hazards model of 1-year graft survival was used to derive risks associated with deceased-donor kidney transplants performed from 2001 to 2010. FINDINGS: Among programs with ongoing noncompliance with the CoPs, kidney transplant volumes declined by 38 percent (n = 766) from 2006 to 2011, including a 55 percent drop in expanded criteria donor transplants. Volume increased by 6 percent (n = 638) among programs remaining in compliance. Aggregate risk of 1-year graft failure increased over time due to increasing recipient age and obesity, and longer ESRD duration. CONCLUSIONS: Although trends in aggregate risk of 1-year kidney graft loss do not indicate that the introduction of the CoPs has systematically reduced opportunities for marginal candidates or that there has been a systematic shift away from utilization of higher risk deceased donor kidneys, total volume and expanded criteria donor utilization decreased overall among programs with ongoing noncompliance.

Wicke, C., Teichmann, R., Holler, T., et al. (2004). "[Design and use of patient pathways in general surgery]." Chirurg **75**(9): 907-915.

BACKGROUND: Clinical pathways are a new initiative intended to reduce costs while maintaining or even improving the quality of care. Based on treatment guidelines, patient pathways display an optimal sequence of staff actions in the preoperative, operative, and postoperative in- and outpatient treatment. METHODS: In this study, patient pathways were developed for selected elective general surgical disease entities following a new modular approach. All elements of care and their direct costs to the hospital were identified. Multidisciplinary teams of physicians, nurses, and administrative staff constructed and implemented the patient pathways. RESULTS: In the 1-year pilot phase, we developed and implemented 7 pathways with 16 subpathways: open herniorrhaphy, laparoscopic cholecystectomy and fundoplication, thyroidectomy, surgical treatment of diverticulitis and colon carcinoma and kidney transplantation. CONCLUSIONS: Patient pathways combine the management of care, hospital processes, and costs in a new integrated concept. Patient pathways streamline and standardize care, facilitate communication, and contribute to cost control efforts.

Woodrow, G., Fan, S. L., Reid, C., et al. (2017). "Renal Association Clinical Practice Guideline on peritoneal dialysis in adults and children." BMC Nephrol **18**(1): 333.

These guidelines cover all aspects of the care of patients who are treated with peritoneal dialysis. This includes equipment and resources, preparation for peritoneal dialysis, and adequacy of dialysis (both in terms of removing waste products and fluid), preventing and treating infections. There is also a section on diagnosis and treatment of encapsulating peritoneal sclerosis, a rare but serious complication of peritoneal dialysis where fibrotic (scar) tissue forms around the intestine. The guidelines include recommendations for infants and children, for whom peritoneal dialysis is recommended over haemodialysis.Immediately after the introduction there is a statement of all the recommendations. These recommendations are written in a language that we think should be understandable by many patients, relatives, carers and other interested people. Consequently we have not reworded or restated them in this lay summary. They are graded 1 or 2 depending on the strength of the recommendation by the authors, and A-D depending on the quality of the evidence that the recommendation is based on.

Zhao, L., Shi, J., Shearon, T. H., et al. (2015). "A Dirichlet process mixture model for survival outcome data: assessing nationwide kidney transplant centers." Stat Med **34**(8): 1404-1416.

Mortality rates are probably the most important indicator for the performance of kidney transplant centers. Motivated by the national evaluation of mortality rates at kidney transplant centers in the USA, we seek to categorize the transplant centers based on the mortality outcome. We describe a Dirichlet process model and a Dirichlet process mixture model with a half-cauchy prior for the estimation of the risk-adjusted effects of the transplant centers, with strategies for improving the model performance,

interpretability, and classification ability. We derive statistical measures and create graphical tools to rate transplant centers and identify outlying groups of centers with exceptionally good or poor performance. The proposed method was evaluated through simulation and then applied to assess kidney transplant centers from a national organ failure registry.

Pour poursuivre la recherche

Recommandations médicales

HAS

http://www.has-sante.fr/portail/jcms/c_39085/fr/recherche?portlet=c_39085&text=transplantation+r%C3%A9nale&opSearch=&lang=fr

> Recommandations d'inscription sur la liste d'attente et pré-transplantation

http://www.has-sante.fr/portail/jcms/c_1751188/fr/transplantation-renale-acces-a-la-liste-d-attente-nationale

> Suivi à trois mois de l'adulte transplanté

http://www.has-sante.fr/portail/upload/docs/application/pdf/suivi_du_transplante_renal_-_argumentaire.pdf

> ALD 28

http://www.has-sante.fr/portail/jcms/c_689330/fr/ald-n-28-suite-de-transplantation-renale-de-l-adulte

HAS – Parcours de soins
http://www.has-sante.fr/portail/jcms/c_2050086/fr/outils-de-declinaison-du-parcours-des-patients-insuffisants-renaux-en-pretraitement-de-suppleance

Insuffiisance rénale chronique terminale : la transplantation est la stratégie la plus efficiente dans tous les groupes d'âge
https://www.has-sante.fr/portail/jcms/c_1776908/fr/insuffisance-renale-chronique-terminale-la-transplantation-strategie-la-plus-efficiente

Greffe rénale : réduire les inégalités d'accès
La HAS a réalisé une recommandation sur les critères d'accès à la liste d'attente nationale d'une greffe de rein.

Agence de la biomédecine

Recommandations pour prélèvement et greffe

http://www.agence-biomedecine.fr/Recommandations-d-experts

Les étapes du don du rein

http://www.agence-biomedecine.fr/IMG/pdf/brochure_don_etapes_vdef.pdf

European Renal Best practice (ERBP)

http://www.agence-biomedecine.fr/Recommandations-d-experts

- Voir aussi sur Cismef : http://www.chu-rouen.fr/page/transplantation-renale
- Et sur Trip database : https://www.tripdatabase.com/search?criteria=renal+transplantation&lang=en

Recherche des guidelines par pays

Épidémiologie

Agence de la Biomédecine
Registre des maladies REIN
- Résumé 2016 de l'activité de greffe rénale

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