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GPs teamed up with nurses: a skill mix experiment improves management of type 2 diabetes patients

Main results of the ASALEE experiment

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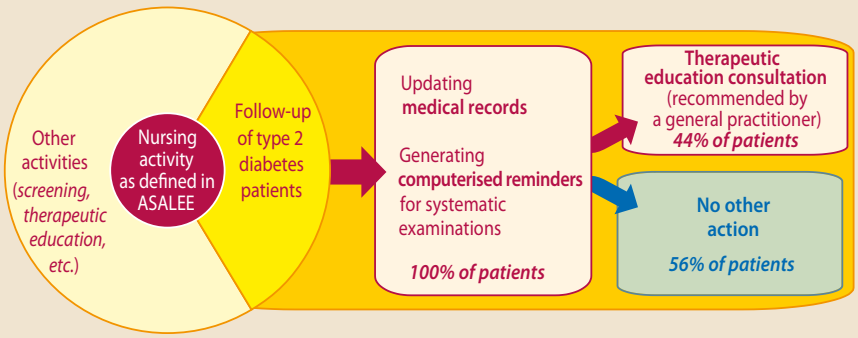
ASALEE, French acronym for Health Action by Teams of Self-employed Health Professionals, associates 41 GPs and 8 nurses in the Deux-Sèvres department (FRANCE) in view to improve the quality of healthcare, especially for patients suffering from chronic disease. Launched in 2004, it is the only natural experiment on healthcare professionals skill mix with focus given to primary care use. In accordance with a specific protocol, the doctors entrust the nurses with the computerized management of certain patient data and therapeutic education consultations.

This medico-economic evaluation of the ASALEE natural experiment focused specifically on type 2 diabetes patients, which represents a third of nurses activity. The study shows that the improvement of the glycemic control of patients treated in the ASALEE experiment is better than that of a control group. They also perform more systematic follow-up examinations without significant additional cost for Health Insurance. Nontheless, the methods used in the study require that these results be validated by further analyses.

The role of nurses in following up type 2 diabetes patients in the ASALEE experiment



In the ASALEE experiment, following-up type 2 diabetes patients takes up a third of nurses activity.

An aging population, spread of chronic disease, expected reduction of medical workforce and possible local shortages, doctors' desire for new conditions of practice, strong demand for recognition by the paramedical professions, and control of health expenditure are all factors that plead for a new organisation of primary healthcare in France. In October 2003, Professor Berland recommended in-the-field natural experiments on the transfer of tasks between professionals in the health sector (Berland, 2003). The experimental procedure lasted four and a half years and was carried out in two successive waves. The first wave occurred after the publication of the decree of 13 December 2004, which approved five experiments.

And, the second wave followed the publication of the decree of 30 March 2006 authorising seven new projects and three renewals. All the experiments were reported in several publications, in particular an initial evaluation in 2006 (Berland and Bourgueil, 2006) and a recommendation by the French National Authority for Health (HAS) in collaboration with the National Observatory of Health Professions Demography (ONDPS) in April 2008 (*Cf.* box page 3).

In 2004, an experiment was set up in the Deux-Sèvres department by GPs and supported by the Regional Union of Self-Employed Doctors of Poitou-Charentes and was named ASALEE (French acronym for Health Action by Teams of Self-employed Health Professionals). It was recognised as an innovative project of skill mix between GPs and nurses and was consequently included in the skill mix experiments. The ASALEE experiment not only associates doctors and nurses as a team in the same practice, but it also gives importance to preventive actions and therapeutic education intended to improve patients' health, by distinguishing them from curative treatment. In 2006, HAS entrusted IRDES with the medico-economic evaluation of this system. Here, we present the main results relating to the follow-up of type 2 diabetes patients.

ASALEE: an opportunity for evaluating skill mix between doctors and nurses

An original method of cooperation for providing primary care in France

ASALEE is the one and only skill mix experiment that associates self-employed GPs and nurses for the primary care provided in private practice. The aim of ASALEE is to improve healthcare quality, by delegating to nurses therapeutic education consultations for diabetes and high blood pressure, as well as responsibility for screening for cognitive problems and cardiovascular risk factors in individuals over 75 years old. These nurses also assist doctors in collective screening campaigns, especially those carried out against breast cancer and colorectal cancer. The nurses are employees of ASALEE, a non-profit organisation, which groups several GP practices. Each nurse works at two or three practices. ASALEE started with 3 practices in 2004, linking 12 GPs and 3 nurses. In 2007, 18 practices, *i.e.* 41 GPs and 8 nurses, participated in the experiment. The collaboration between GPs and nurses is defined according to specific protocols.

The medico-economic evaluation of the ASALEE experiment took place retrospectively from May 2007 to January 2008. For reasons of feasibility and lack of time, it focused only on patients suffering from type 2 diabetes which takes up a third of the activity of ASALEE nurses. In what follows, we present the nurse activity as defined in the ASALEE experiment.

Nursing activity focuses on the management of patient data and therapeutic education

In the ASALEE experiment, qualified nurses (holders of a State diploma) have received a training specific to the ASALEE protocol. For type 2 diabetes patients, the activity provided by the nurse complements in two ways that of the doctor (*Cf.* figure p. 1):

– data management and electronic reminders: on arriving in the practice, the nurse identifies all the type 2 diabetes patients in the doctors' electronic medical records. Then the nurse completes these patients' files with certain data, mainly the results of biological analyses and, if necessary, the nurse enters computerised reminders. The purpose of these reminders is to inform the doctor about when to make an appointment with the patient and the examinations to be performed according to professional recommendations. Furthermore, the nurse updates the ASALEE database in which the evaluations are stored;

– therapeutic education consultations: following referrals by the patient's GP, the nurse provides consultations for therapeutic education and counselling for less than half of the patients (44%). The aim of those consultations is to provide these patients with nutritional-hygienic and treatment compliance advices.

BACKGROUND...

This publication is a synthesis of the full report of the medico-economic evaluation of the ASALEE project (French acronym for Health Action by Teams of Self-employed Health Professionals, Action Santé Libérale En Équipe), carried out by the researchers of IRDES (Bourgueil et al., 2008). The evaluation was part of 16 health professional skill mix experiments directed by the National Observatory of Health Professions (ONDPS) and the French National Authority for Health (HAS). All the works related to these cooperation experiments are available on the HAS website. Since its foundation, the ASALEE experiment has been subjected to qualitative and quantitative assessments, including this study on medico-economic aspects performed in 2007/08. This study is part of the research work done at IRDES on the organisation of ambulatory healthcare and will give rise to the submission of articles in peer review journals.

A retrospective study method with three analyses

A controlled 'before-after' study design was chosen in order to control as well as possible the changes related to the practices and treatments not attributable to the ASALEE experiment and to measure the specific effect resulting from cooperation between GPs and nurses. This method was adapted to the constraints linked to the retrospective nature of the study, the available data and the agenda of the whole national experiment.

The hypothesis tested for the evaluation was the following: a qualified nurse who works in a GP practice improves the efficacy (biological results and follow-up quality) and the efficiency of treatment (cost/efficacy ratio) because of her intervention (before and after interventions), and also in comparison to the usual care delivered by GPs (between ASALEE patients and control patients). The efficacy

and cost progression of the treatment provided to type 2 diabetes patients included in the ASALEE experiment from June 2004 and May 2007 was compared *a posteriori* to that of groups of patients used as controls. The medico-economic evaluation was established by using three analyses (*Cf.* table 1 page 4):

- the first focuses on the progression over one year[1] of efficacy regarding biological results, ie; the rate of glycosylated haemoglobin (l'HbA1c)[2], which is an indicator of glycemic control[3];
- the second studied the progression between two consecutive years of follow-up results, corresponding to the frequency of carrying out the examinations recommended by the French National Authority for Health[4];
- the third focused on the cost progression between two consecutive years from the viewpoint of Health Insurance.

The ASALEE experiment is considered efficient if the biological and follow-up results improve. As for efficiency, it was judged positive if both an improvement of these results was observed (first and second analyses) and if the cost progression was non significant for ASALEE patients in comparison to that of a control group (third analysis). Therefore we do not assess cost effectiveness on the basis of a simultaneous analysis of efficacy and cost for the same sample, but on the conclusions of efficacy analyses on the one hand, and the conclusion relating the cost analysis on the other.

HAS recommendations for developing collaboration between doctors and nurses

In April 2008, in collaboration with ONDPS, HAS issued a recommendation (HAS, 2008) which is based on:

- quantitative and qualitative assessments of experiments (available on the HAS website);
- analysis of the survey launched by HAS on its website in May 2007 on current skill mix practices (334 questionnaires collected);
- The works carried out by the three expert groups on determinants of the development of new forms of skill mix between the health professions: legal framework of practicing a health profession, training, economic and organisational context of health professions;
- public consultation on the recommendation project.

HAS above all observed that the new forms of skill mix represent a real opportunity for changing the health system:

- although, and mainly due to the need for training, it is not possible to expect an immediate reduction in health costs by the introduction of these new forms of cooperation, maintaining and possibly improving healthcare quality is a primordial and essential objective in terms of health system efficiency;
- they represent a key element in the attractiveness of the health professions: for doctors who currently suffer from their individual and isolated working conditions; for the other health professions that claim increased responsibility and recognition of the progression of their competences.

However, new forms of cooperation come up against major barriers related to education modalities and practice organisation of health professions. Structural changes appear desirable. This recommendation proposes favouring the development of these new forms of cooperation in view to improving the health system by:

- renovating education curriculum to reduce the hiatus between the medical and paramedical professions;
- remodelling the legal definitions of the health professions, by using a reference base for missions rather than confining them exclusively to predefined acts;
- providing recognition to cooperation by appropriate remuneration or career perspectives;
- Setting up a structure intended to provide assistance aimed at guaranteeing the general interest and the quality of new forms of cooperation.

Efficiency and costs: promising results

Method and samples

The efficacy evaluation mainly relies on the control or improvement of the glycemia expressed by the biological value of HbA1c rates (*Cf.* table 1 page 4). The progression of this measurement was available for 588 ASALEE patients before and after intervention by a nurse. It is compared for the same periods to that of a group composed of 202 type 2 diabetes patients, of a comparable gender and age structure, established by the GP's of the General Medicine Observatory (OMG) of the French Society of General Medicine (SFMG).

The efficacy evaluation is also based on the progression, between two consecutive years, of rates of performing examinations in conformity with HAS guidelines (follow-up results). According to these guidelines, a "well followed-up" patient must undergo at least three controls per year for HbA1c rates and a biological examination once a year (creatinemia, microalbuminuria, lipid check-up), an electrocardiogram or consultation with a

1 Between 2004 and 2007, according to the patients' date of entry in the experiment.

2 Glycosylated haemoglobin (HbA1c), glycated haemoglobin or more simply blood sugar provides the measurement of red blood cells fixing glucose in the haemoglobin of the organism. This concentration depends on cumulated variations of glycemia (rate of glucose in the blood) during the last 2-3 months. HbA1c expresses the glycemic control of a type 2 diabetes patient. This is why it is recommended to dose it every three months. In a non-diabetic individual, less than 6% of haemoglobin is glycated.

3 According to the professional recommendation update issued in November 2006 from HAS and AFSSAPS on drug treatment for type 2 diabetes patient, the ideal value of HbA1c must be less than or equal to 6.5%. However, only a value higher than 8% is considered as an indicator of very poor glycemic control.

4 According to the recommendations in force at the time, the HbA1c rate of patients suffering from diabetes must be controlled at least three times a year and these patients must also be subjected to a biological examination every year (creatinemia, microalbuminuria, lipid check-up), an electrocardiogram or a consultation with a cardiologist, and funduscopy.

cardiologist and a funduscopy. For each of these indicators, we modelled the probability of remaining or becoming "well followed-up" between two consecutive years, on the basis of claims data collected from both farmers' and salaried workers' health insurance funds in the Deux-Sèvres department. They were reconstituted for 838 ASALEE patients and compared with those of a control sample of 1,018 persons in the Deux-Sèvres department, treated with at least one oral anti-diabetic (assimilated with type 2 diabetes patients) with the same structure of age, gender and localisation in the Deux-Sèvres department (north or south) as the ASALEE patients (*Cf.* table 1 below).

As for the cost evaluation, it compares the additional cost that could be generated by cooperation between GPs and nurses in comparison to a traditional practice. The cost for ASALEE patients is increased by the expenses specific to the experiment (nurses' salaries, training expenses, etc.), *i.e.* €60/year per patient. This is the cost estimated by ASALEE on the basis of its accounts and its own records of nurse working time. On this basis, the comparison focuses on the variation of average direct cost for one year between ASALEE patients (795) and the control group (956 patients) (*Cf.* table 1 below).

The comparison highlights:

– total costs: all healthcare expenses of type 2 diabetes patients reimbursed by Health Insurance;

– The costs that we have allocated to diabetes[5] by using the coding of medical procedures and services stemming from claims data: all the expenses of

5 *Cf.* the rules of allocation in the full report (Bourgueil *et al.*, 2008), appendix no. 4.

Table 1. Descriptive statistics

	Eligible ASALEE population		Nature of the evaluation											
			Efficacy according to the criterion of final result (glycemic control)				Efficacy according to the criterion of follow-up results (process indicators)				Cost			
			ASALEE sample		Control sample		ASALEE sample		Control sample		ASALEE sample		Control sample	
	Effectif	%	Effectif	%	Effectif	%	Effectif	%	Effectif	%	Effectif	%	Effectif	%
Gender														
Female	704	41.8	254	43.2	89	44.1	362	43.2	448	44.0	347	43.7	428	44.8
Male	980	58.2	334	56.8	113	55.9	476	56.8	570	56.0	448	56.4	528	55.2
Age in 5 classes														
Less than 49	129	7.7	22	3.7	-	-	72	8.6	88	8.6	63	7.9	76	8.0
From 50 to 59	315	18.7	103	17.5	-	-	172	20.5	201	19.7	166	20.9	187	19.6
From 60 to 69	438	26.0	148	25.2	-	-	218	26.0	273	26.8	203	25.5	261	27.3
From 70 to 79	552	32.8	202	34.4	-	-	286	34.1	343	33.7	274	34.5	326	34.1
Over 80	250	14.9	113	19.2	-	-	90	10.7	113	11.1	89	11.2	106	11.1
Age in 2 classes														
Less than 65	659	39.1	198	33.7	69	34.2	-	-	-	-	-	-	-	-
65 and over	1 025	60.9	390	66.3	133	65.8	-	-	-	-	-	-	-	-
Type of follow-up by nurse since inclusion														
Data management (+/- electronic reminder)	987	58.6	304	51.7	-	-	435	51.9	-	-	409	51.5	-	-
Data management (+/- electronic reminder) and visit for education and counselling	697	41.4	284	48.3	-	-	403	48.1	-	-	386	48.6	-	-
Localisation in the Deux-Sèvres department														
North	-	-	-	-	-	-	229	27.3	269	26.4	218	27.4	260	27.2
South	-	-	-	-	-	-	609	72.7	749	73.6	577	72.6	696	72.8
National health Insurance scheme														
National Health Insurance Fund for Salaried Workers (CPAM 79)	-	-	-	-	-	-	611	72.9	714	70.1	572	72.0	664	69.5
National Health Insurance Fund for Agricultural Workers and farmers (MSA 79)	-	-	-	-	-	-	227	27.1	304	29.9	223	28.1	292	30.5
Waves of inclusion in ASALEE (in 4 classes)														
June 2004 to March 2005	348	20.7	-	-	-	-	188	22.4	-	-	185	23.3	-	-
April 2005 to January 2006	255	15.1	-	-	-	-	122	14.6	-	-	115	14.5	-	-
February 2006 to June 2006	302	17.9	-	-	-	-	146	17.4	-	-	139	17.5	-	-
July 2006 to May 2007	779	46.3	-	-	-	-	382	45.6	-	-	356	44.8	-	-
Waves of inclusion in ASALEE (in 3 classes)														
June to December 2004	-	-	184	31.3	65	32.2	-	-	-	-	-	-	-	-
February to July 2005	-	-	171	29.1	70	34.7	-	-	-	-	-	-	-	-
January to June 2006	-	-	233	39.6	67	33.2	-	-	-	-	-	-	-	-
Total	**1 684**	**100**	**588**	**100**	**202**	**100**	**838**	**100**	**1 018**	**100**	**795**	**100**	**956**	**100**

Description. The table shows the comparison of ASALEE patient samples and control patients for the three analyses of the medico-economic evaluation (final result, follow-up results and cost). Each analysis was performed on a set of distinct ASALEE sample patients and control patients and was based on variables and modalities that can be different. On the basis of the eligible ASALEE population (1 684 type 2 diabetic patients), three distinct samples were composed of 588, 838 and 795 patients respectively.

Source: IRDES. Data: ASALEE database, claimsdata from Health Insurance Funds of the Deux-Sèvres department, General Medicine Observatory (OMG) of the French Society of General Medicine (SFMG)

Table 2. Modelling of glycemic control

	OMG Patients *vs* ASALEE Patients						OMG Patients vs ASALEE Patients with/without visit for therapeutic education					
	Probability of maintaining or reducing HbA1c:						Probability of maintaining or reducing HbA1c:					
	≤ 6.5%		≤ 7%		≤ 8%		≤ 6.5%		≤ 7%		≤ 8%	
	Odds-ratio	p	Odds-ratio	p	Odds-ratio	p	Odds-ratio	p	Odds-ratio	p	Odds-ratio	p
Sample												
OMG (Observatory of general practice)	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
ASALEE	1.3	0.174	1.2	0.375	**1.8**	**0.021**	-	-	-	-	-	-
ASALEE without visit for therapeutic education	-	-	-	-	-	-	1,2	0.534	1.0	0.922	1.4	0.239
ASALEE with visit for therapeutic education	-	-	-	-	-	-	**1.8**	**0.026**	**1.6**	**0.057**	**2.7**	**0.002**
Patient's age												
Less than 65	**1.5**	**0.035**	1.2	0.389	0.9	0.742	**1.5**	**0.026**	1.2	0.360	0.9	0.659
65 and over	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
Patient's gender												
Female	0,7	0,091	1,0	0,948	1,2	0,532	**0,7**	**0,066**	1,0	0,824	1,1	0,624
Male	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
HbA1c												
HbA1c as baseline	**0.2**	**<.0001**	**0.2**	**<.0001**	**0.4**	**<.0001**	**0.2**	**<.0001**	**0.2**	**<.0001**	**0.4**	**<.0001**
Number of HbA1c checks in the year following the inclusion	0.9	0.753	1.1	0.527	1.0	0.934	0.9	0.604	1.1	0.679	1.0	0.903
Number of months separating two HbA1c measurements	0.9	0.200	1.0	0.236	09	0.058	0.9	0,209	1.0	0.253	0.9	0.072
Wave of inclusion (season)												
June to Decembre 2004	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
February to July 2005	0.9	0.651	1.2	0.436	1.2	0.472	1.0	0.943	1.4	0.183	1.4	0.221
January to June 2006	**1.7**	**0.016**	**1.9**	**0.004**	**1.6**	**0.095**	**1.9**	**0.006**	**2.1**	**0.001**	**1.8**	**0.043**
Adjustment statistics												
Pseudo R^2	0.2974	-	0.2764	-	0.2236	-	0.3009	-	0.2803	-	0.2306	-
Concordant pairs	85.90	-	84.80	-	84.20	-	86.00	-	85.00	-	84.90	-

Description. For type 2 diabetes patients in the Deux-Sèvres department with insurance coverage, the table shows the analysis models of the impact of being followed up by an OMG doctor or in the framework of the ASALEE experiment, according to the threshold value of glycemic control, HbA1c. The reference modalities are always in italics. The odds-ratio is in bold type when significant, with an error risk of ≤ 5% (value of p).

Interpretation guide. Value 1.8 indicated in the third column, on the line "Follow-up done by ASALEE", means that a patient followed up in the framework of ASALEE has 1.8 times higher probability of having their HbA1c held or reduced to 8% or lower, in comparison to a patient followed up by a general practitioner of the OMG, with an error risk lower than or equal to 2% (value of p=0,021).

Source: IRDES. Data: ASALEE database and the Observatory of General Practice (OMG).

following up diabetes, including those related to the risk factors of diabetes (e.g. expenses attributable to visits or anti-tobacco treatment) and its complications (e.g. treatment for ischemic cardiopathy).

METHOD

Definition of odds-ratio

The odds-ratio (OR) is a measurement of the strength of association between a variable and the occurrence of an event. The direction of the association is measured by comparing the OR to 1. The association is positive (increases probability) if the OR is higher than 1 and, conversely, negative (decreases probability) if the OR is lower than 1.

Therapeutic education consultation improves glycemic control

With respect to the indicator of glycemic control (rate of HbA1c), the analyses show the efficacy of cooperation between GPs and nurses in the framework of the ASALEE experiment for following up type 2 diabetes patients (*Cf.* table 2 above).

Indeed, the probability of maintaining one's HbA1c or reducing it to 8% or less in one year is 1.8 times higher for the type 2 diabetes patients in the ASALEE group than for those in the OMG control group (odds-ratio=1.8 for p<5%), ceteris paribus[6]. Nevertheless, when seeking a more severe judgement criterion, *i.e.* when the HbA1c threshold chosen is 7%, or 6.5%, no significant differences were observed between the two groups.

That being said, when patients are distinguished according to whether they were given a therapeutic education consultation, there is a very significant improvement of glycemic control. Indeed we observed that the highest probability of having a HbA1c rate maintained at the same level or reduced to 8% or less over one year only significantly concerned patients who had had at least one therapeutic education consultation (odds-ratio=2.7 for p < 1%).

The result is robust when applying a severer judgement criterion, *i.e.* a HbA1c threshold reduced to 7% or 6.5% (odds-

6 The analysis was carried out by controlling for the following variables: age, gender, the HbA1c status (value at baseline, number of HbA1c tests in the year following inclusion, number of months separating the measurements before and after) and the seasonality (wave of inclusion).

Table 3. Modelling of the follow-up indicators

	Probability of remaining or becoming well followed up for...											
	HbA1c		Microalbuminuria		Fundoscopy		Creatinemia		Electrocardiogram		Lipid check-up	
	OR	p	OR	p	OR	p	OR	p	OR	p	OR	p
Sample	**Control patients *vs* ASALEE patients**											
Control sample (CPAM 79-MSA 79)	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
ASALEE	**2.1**	**<.0001**	**6.8**	**<.0001**	**1.3**	**0.046**	**2.5**	**<.0001**	**2.4**	**<.0001**	**2.6**	**<.0001**
Age of patient												
Under 49	0.5	<.0001	0.7	0.084	0.7	0.166	**0.5**	**0.002**	**0.5**	**0.001**	0.7	0.099
From 50 to 59	**0.7**	**0.009**	0.8	0.089	1.0	0.987	0.7	0.105	0.8	0.251	0.9	0.687
From 60 to 69	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
From 70 to 79	1.1	0.450	0.9	0.633	1.2	0.184	**1.5**	**0.040**	**1.5**	**0.003**	0.9	0.382
Over 80	1.3	0.155	**0.6**	**0.008**	1.0	0.983	1.7	0.061	1.1	0.714	**0.4**	**<.0001**
Gender of patient												
Female	1.0	0.737	1.0	0.728	1.3	0.010	1.1	0.619	**0.8**	**0.009**	1.0	0.769
Male	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
Localisation in the Deux-Sèvres department												
North	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
South	**0.7**	**0.001**	**0.8**	**0.025**	1.0	0.815	1.0	0.926	**0.6**	**<.0001**	0.9	0.270
National health insurance scheme												
National Health Insurance Fund for Salaried Workers (CPAM79)	0.8	0.080	1.2	0.211	-	-	0.9	0.537	1.2	0.217	1.1	0.346
National Health Insurance Fund for Argricultural Workers and Farmers (MSA 79)	*Ref.*	-	*Ref.*	-	-	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
Presence of drug treatments indicating lipidic problems and/or diabetes complications												
Yes	1.0	0.857	0.9	0.652	1.5	0.086	**1.5**	**0.052**	**2.0**	**0.001**	**1.9**	**0.001**
No	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
Diabetes treatment procedure												
One oral anti-diabetic	**0.5**	**<.0001**	**0.6**	**<.0001**	1.0	0.789	**0.6**	**0.004**	**0.7**	**0.011**	0.9	0.479
Association of two oral anti-diabetics	**0.8**	**0.050**	0.8	0.135	1.2	0.168	0.8	0.226	0.9	0.317	1.1	0.501
Association of an oral anti-diabetic and insulin	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
Adjustment statistics												
Pseudo R^2	0.0611	-	0.1563	-	0.0142	-	0.0620	-	0.0682	-	0.0572	-
Sample	**Sample of control patients *vs* ASALEE patients according to wheter or not they had had a therapeutic education consultation**											
Control sample(CPAM 79-MSA 79)	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
ASALEE without visit for therapeutic education	**1.9**	**<.0001**	**6.7**	**<.0001**	1.2	0.180	**2.8**	**<.0001**	**2.5**	**<.0001**	**2.2**	**<.0001**
ASALEE with visit for therapeutic education	**2.4**	**<.0001**	**6.9**	**<.0001**	1.3	0.060	**2.3**	**<.0001**	**2.7**	**<.0001**	**2.7**	**<.0001**
Age of patient												
Less than 49	**0.4**	**<.0001**	0.7	0.083	0.7	0.162	**0.5**	**0.002**	0.7	0.097	**0.5**	**0.001**
From 50 to 59	**0.7**	**0.007**	0.8	0.088	1.0	0.995	0.7	0.107	0.9	0.683	0.8	0.235
From 60 à 69	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
From 70 to 79	1.1	0.468	0.9	0.631	1.2	0.189	**1.5**	**0.039**	0.9	0.379	**1.5**	**0.004**
Over 80	1.3	0.144	**0.6**	**0.008**	1.0	0.989	1.7	0.062	**0.4**	**<.0001**	1.1	0.688
Gender of patient												
Female	1.0	0.845	1.0	0.743	1.3	0.011	1.1	0.590	1.0	0.786	0.8	0.007
Male	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
Localisation in the Deux-Sèvres department												
North	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
South	**0.7**	**0.002**	**0.8**	**0.026**	1.0	0.832	1.0	0.949	0.9	0.279	**0.6**	**<.0001**
National health insurance scheme												
National Health Insurance Fund for Salaried Workers (CPAM79)	0.8	0.073	1.2	0.214	-	-	0.9	0.545	1.1	0.351	1.1	0.233
National Health Insurance Fund for Argricultural Workers and Farmers (MSA 79)	*Ref.*	-	*Ref.*	-	-	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
Presence of drug treatments indicating lipidic problems and/or diabetes complications												
National Health Insurance Fund for Salaried Workers (CPAM79)	1.0	0.829	0.9	0.649	1.5	0.087	**1.5**	**0.051**	**1.9**	**0.001**	**2.0**	**0.002**
National Health Insurance Fund for Argricultural Workers and Farmers (MSA 79)	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
Diabetes treatment procedure												
One oral anti-diabetic	**0.5**	**<.0001**	**0.6**	**<.0001**	1.0	0.800	**0.6**	**0.004**	0.9	0.481	**0.7**	**0.012**
Association of two oral anti-diabetics	**0.8**	**0.051**	0.8	0.135	1.2	0.165	0.8	0.225	1.1	0.500	0.9	0.317
Association of one oral anti-diabetic and insulin	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-	*Ref.*	-
Adjustment statistics												
Pseudo R^2	0.0624	-	0.1563	-	0.0143	-	0.0623	-	0.0572	-	0.0693	-
Concordant pairs	66.50	-	75.30	-	0.16	-	66.90	-	65.50	-	66.90	-

Description. For type 2 diabetes patients covered by Health Insurance in the Deux-Sèvres department, the table shows the analysis models of the impact of being followed up in the framework of the ASALEE experiment or not according to 6 different follow-up criteria. The reference modalities are always in italics. The odds-ratio (OR) is in bold type when significant, with an error risk of ≤ 5 % (value of p). For fundoscopy, the data of patients insured with National Health Insurance Fundfor Agricultural workers and farmers in the Deux-Sèvres department (MSA 79) were not taken into account as they did not permit distinguishing ophthalmology consultations. In this case the model concerns 611 ASALEE patients and 714 patients in the control group.

Interpretation guide. Value 2.1 indicated in the first column on the "ASALEE sample" line, means that a patient followed up in the framework of ASALEE has a 2.1 times higher probability of having a sufficient number of HbA1c measurements in one year than another patient in the Deux-Sèvres, with an error risk less than or equal to 1% (value of p<0.0001).

Source: IRDES. Data: ASALEE database, claims data from Health Insurance Funds of the Deux-Sèvres department.

Table 4. Modelling of expenditure from July 2006 to June 2007

	Total expenditure		Total expenditure attributable to diabetes, its risk factors and complications	
	Coefficient	p	Coefficient	p
Constant	**2092.24**	**<.0001**	**2083.64**	**<.0001**
Sample				
Control sample (CPAM 79-MSA 79)	*Ref.*	-	*Ref.*	-
ASALEE	-81.28	0.465	-60.75	0.388
Expenditure from July 2006 to June 2007	**0.48**	**<.0001**	**0.46**	**<.0001**
Age of patient				
Under 49	-504.82	0.026	-178.94	0.212
From 50 to 59	-111.73	0.496	22.50	0.829
From 60 to 69	*Ref.*	-	*Ref.*	-
From 70 to 79	-65.78	0.650	102.99	0.261
Over 80	**563.87**	**0.005**	**324.13**	**0.011**
Gender of patient				
Female	-120.57	0.280	-106.51	0.132
Male	*Ref.*		*Ref.*	
Localisation in the Deux-Sèvres department				
North	*Ref.*		*Ref.*	
South	184.18	0.142	163.81	0.039
National health insurance scheme				
National Health Insurance Fund for Salaried Workers (CPAM79)	57.62	0.644	-25.58	0.747
National Health Insurance Fund for Argricultural Workers and Farmers (MSA 79)	*Ref.*		*Ref.*	
Presence of drug treatment indicating lipidic troubles and/or cardiovascular complications of diabetes				
Yes	**684.60**	**0.002**	**287.73**	**0.040**
No	*Ref.*		*Ref.*	
Diabetes treatment procedure				
An oral anti-diabetic	**-1942.58**	**<.0001**	**-1920.74**	**<.0001**
Association of two oral anti-diabetic	**-1827.36**	**<.0001**	**-1749.99**	**<.0001**
Association of an oral anti-diabetic and insulin	*Ref.*		*Ref.*	
Hospitalisation (*t-1* : July 2005-June 2006 ; *t* : July 2006-June 2007)				
At least one hospitalisation in *t-1*	**-1350.82**	**<.0001**	**-517.71**	**<.0001**
At least one hospitalisation in *t*	**3757.56**	**<.0001**	**1385.47**	**<.0001**
At least one hospitalisation in *t-1* and in *t*	**2524.80**	**<.0001**	**927.66**	**<.0001**
No hospitalisation	*Ref.*		*Ref.*	
Adjustment statistics				
R^2 adjusted	0.5153	-	0.4772	-
R^2 ajusted	0.5111	-	0.4727	-

Description. The table shows models of total expenditure and expenditure attributable to type 2 diabetes from July 2006 to June 2007 (t), as a function of expenditure from July 2005 and June 2006 (t-1), other control variables and according to whether the diabetic patients are followed up or not in the ASALEE experiment. For the ASALEE patients, expenses include the increase due to the cost of the experiment (€60 per year per patient). The coefficient is in bold type when significant with an error risk of ≤ 5% (value of p).

Interpretation guide. The value -81.28 linked to the value of p 0.465 means that being followed up in ASALEE leads to an expense in t that is not significantly different from that of the control group. On the contrary, the presence of drug treatment indicating lipid problems or cardiovascular complications relating to diabetes increases the expense in t by €685, thus significantly (value of p = 0.002).

Source : IRDES.
Data: ASALEE database, claims data from Health Insurance Funds of the Deux-Sèvres department.

ratio of 1.6 and 1.8 respectively with p ≤ 5%).

In all, this shows that there is a specific effect of consultation with a nurse in the year following inclusion in ASALEE, on the efficacy of healthcare for glycemic control in comparison to "standard" practice.

Management of patient data and consultations for education and counselling also improve follow-up

The analyses show that, apart for fundoscopy follow-up, the ASALEE patients are significantly better served than the other control patients in the Deux-Sèvres department. The quality of the model for fundoscopy follow up was poor and thus could not be interpreted (*Cf.* table 3 page 6).

We therefore observe, *ceteris paribus*[7], that a type 2 diabetes patient followed up in ASALEE has more chance than one followed up by another general practitioner in the Deux-Sèvres department of remaining or becoming well followed up over a period of one year from 2006 to 2007 (2.1 times more than for the rate of HbA1c over one year to 6.8 times more for carrying out micoalbumin tests)[7].

The fact of having a therapeutic education consultation increases the probability of being "better followed up" more for all the indicators except for carrying out creatinemia measurements. The period during which the patients are included in the ASALEE experiment does not modify these results significantly.

Collaboration is not significantly more expensive for Health Insurance

We estimated the total expenditure and the expenditure attributable to type 2 diabetes, its risk factors and complications between July 2006 and June 2007 (t) and between July 2005 and June 2006 (t-1). It appears that the expenses of ASALEE patients are equivalent to those of control patients for the two periods. By way of indication, for total expenditure, they are in the region of €3,000 in t and €2,400 in t-1[8]. A model permits concluding on the absence of statistical difference in the progression of

7 The analysis was performed by controlling for: age, gender, localisation in the Deux-Sèvres department, the health insurance fund, the presence of drug treatment relating to a cardiovascular or lipid related illness, modalities of drug treatment for type 2 diabetes.

8 It should be mentioned that expenditure over one year is less here than that estimated by National Health Insurance for types 1 and 2 diabetes in long-duration disease (Vallier et al 2006). This difference can mainly be explained by the fact that our sample is not made up in the same way and that it is limited to patients covered by Health Insurance in the Deux-Sèvres department. It does not represent diabetic patients with complications leading to high expenses (e.g. diabetes patients under dialysis). Furthermore, it was not possible to take public hospital expenses into account in full. The exhaustiveness of the collection is better in t than in t-1, explaining part of the increase in expenditure between the two periods.

Limitations of the study

Here are presented the main limitations inherent with the medico-economic evaluation of the ASALEE experiment (all the limitations are described in Bourgueil *et al.*, 2008).

The representativeness of the populations studied is limited by the bias of selection of health professionals (GPs and nurses) and ASALEE patients:

- due to its nature, the ASALEE experiment relies on the doctors and nurses voluntarily involved in an innovative activity that differs from "standard" practice in ambulatory care;
- ASALEE patients exit the ASALEE experiment mainly due to change of place of residence or death (13% patients);
- the evaluation of the evolution of glycemic control is based only on 40% of eligible ASALEE patients, taking into account the selection criteria chosen (availability of HbA1c values before /after the different inclusion periods);
- the evaluations of follow-up results and costs are based on 47% and 49% of eligible ASALEE patients respectively, taking into account the selection criteria chosen (Health Insurance Fund for farmers or salaried workers, treatment by oral anti-diabetes drug and not only by insulin or by hygienic-nutritional measures).

The data characterising the patients and the area of evaluation are limited, and restrict comparisons between ASALEE and control samples:

- the available clinical and socio-economic data (age, gender and modality of drug treatment of diabetes in particular) do not allow taking account of individual characteristics (occupation, level of wealth, education, body mass index, etc.) which are known to influence both the intensity and perspective of the illness which can be affected by adopting the hygienic-nutritional changes recommended ;
- the measurement of the final result, obtained only from the biological indicator (rate of HbA1c) for practical reasons, is questionable as it excludes other clinical measurements (weight and body mass index, occurrence of cardiovascular complications, etc.) and other factors of importance (quality of life, satisfaction, etc.).

The conclusions in terms of efficiency are not based on a joint analysis of the dimensions of results (final and follow-up) and costs at individual level, but on separate analyses focusing on three distinct groups of samples.

Lastly, the durations of observation chosen also constitute a limit for the analysis of chronic diseases such as type 2 diabetes.

expenditure between ASALEE patients and control group (*Cf.* table 4).

These figures hold, *ceteris paribus* and after having increased the expense of ASALEE patients with the additional cost observed for the ASALEE intervention, *i.e.* €60 per type 2 diabetic patient included and per year. Furthermore, we determined the thresholds of "theoretical" additional cost on the basis of which we could consider that the differences in the progression of expenses would be significant between ASALEE patients and control patients.

Using a step-by-step model on the basis of our samples we estimate these thresholds at €640 for the total cost and at €430 for the cost attributable to diabetes, its risk factors and complications.

Finally, given, that the results obtained for the ASALEE patients are better than those of the control group, moreover for a cost that is not significantly higher for Health Insurance Funds, the model of GP/nurse skill mix developed during the ASALEE experiment can be considered as efficient.

It should be remembered that the ASALEE natural experiment is one of the rare experiments of cooperation in the ambulatory care field and the only one in the general practice area. Our evaluation is innovative and much inspired by the methodology used in equivalent works mainly carried out in Anglo-Saxon countries. The controlled 'before–after' reference study design used as the basis for most evaluations of healthcare organisation in these countries is quite rare in the French context. Although the ex post evaluation carried out in a framework limited both by time and resources led us to make methodological and pragmatic choices requiring further in-depth analysis of the results (Cf. box above), it clearly shows that this type of study is possible and deserved to be developed in the framework of research into the organisation and performance of primary care.

Further information

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