

## Frailty and Preventing the Loss of Autonomy A Health Economics Approach

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In a global context of population ageing, gaining better knowledge of the mechanisms leading to loss of autonomy has become a major objective, notably with the aim of implementing effective preventive health policies. The concept of 'frailty', originally introduced in gerontology and geriatrics as a precursor state to functional dependency, appears as a useful tool in this specific context. If several approaches co-exist, Fried's model of frailty, based on five physiological criteria, (fatigue, loss of appetite, muscle weakness, slow walking pace, decreased physical activity), appears to be the most operational in measuring frailty and targeting populations at risk of dependency sufficiently upstream in the disablement process.

In terms of health economics, the loss of autonomy approach retained here is particularly interested in the economic and social causes and consequences of the onset of frailty in older adults, and examines the challenges not only in terms of health system efficiency but also in terms of social protection.

**D**emographic projections for the coming decades are now well known; the number of individuals aged 65 or over will increase and their percentage within the population will increase significantly in France and other European countries. The main cause is the trend towards a higher life expectancy and the generational effect of the baby-boomers.

Expected changes in the health outcomes of these ageing populations, of concern to policy-makers, is a little less well known. The most recent research seems to indicate an increase in severe disabilities in France among the 50-54 age group. This result, corroborated by studies conducted in Sweden and the United States, indicate a downward bias in the rate of progression of life expectancy in good health: on average

the younger elderly will have a longer lifespan but a diminished health-span (Cambois, Blachier and Robine, 2012). The main action area envisaged to curb the above trends largely consists in implementing effective prevention policies. The strategy consists in defining and implementing interventions in favour of persons at risk of becoming 'dependent' on the one hand, and on

the other, targeting vulnerable populations sufficiently early and finally, evaluating these interventions in terms of their effectiveness and efficiency.

The challenge consists in ensuring the sustainability of the overall social protection system, not only from the perspective of old age and autonomy, but also that of the National Health Insurance. The need for knowledge is twofold: on the one hand it involves gaining a clearer indication of the overall costs of loss of autonomy and the different financiers' contributions (National Health Insurance, National Pension Fund (CNAV), National Solidarity Fund for Autonomy (CNSA), households etc.). The macroeconomic accounting approach (by expenditure items) should be completed by a complementary approach focusing on individual needs in order to obtain a clearer view of the situation experienced by the individuals concerned. On the other hand, the search for sources of efficiency within the health system should permit a better allocation of rare resources. The main focus is on improving the care pathway (healthcare, medical-social and social): 'one of the most likely causes of 'dependant' persons' excessive health expenditures is that the care pathway, involving successive care and treatment regimens, is far from optimal due to belated interventions and the lack of appropriate responses': (High Council for the Future of Health Insurance (HCAAM) 2011, p. 43.) Furthermore, the search for sources of efficiency within an overall framework of prevention can be effectuated outside the healthcare system, for example by more effectively coordinating the different components making up the social protection system (old age, health, work, and family) with social policy.

At the heart of the preceding challenges, gaining knowledge of the processes leading to loss of autonomy constitutes a

major objective. Firstly, a better understanding of the mechanisms leading to severe disability could make it easier to detect individuals at risk of becoming dependent both within the health system and within the general population. Secondly, it would take new risk factors into account and finally, by analysing the role played by the socioeconomic factors determining loss of autonomy, it would broaden the scope of possible interventions outside the health system. The recent development of studies on frailty in older adults opens up new possibilities for research.

### Several approaches to define frailty

The term 'frailty' used in gerontology and geriatrics literature aims to describe the multi-systemic<sup>1</sup> reduction in functional reserves affecting certain elderly people, and an increased vulnerability to stressors, even minor. This state of physiological instability exposes the individual to the risk of functional de-compensation, loss of autonomy, institutionalisation and death. Several medical approaches to frailty have been presented in the literature in recent years. Two models predominate, depending on whether the authors and professionals refer to the works of Rockwood (1994, 2005) or Fried (2001). The first uses the holistic<sup>2</sup> approach and is based on a very high number of varied criteria (physiological and cognitive) certain of which are fairly imprecise. This approach makes it possible to create frailty indicators that predict elderly persons' institutionalisation and survival rates fairly accurately but not to distinguish between the concepts of frailty, comorbidity<sup>3</sup> and disability<sup>4</sup>. In this respect, the Rockwood model is often referred to as 'black box epidemiology'. The second model, developed by Linda Fried, is based on an analysis of physiological changes in certain individuals, provoked by senescence



The study of frailty covers several research topics: the first, FRESH (Frailty Research in Economics, Society and Health), the result of a partnership between France (IRDES Canada (SOLIDAGE, Montreal and McGill Universities) and Switzerland (IUMP, Lausanne), uses SHARE data to identify the individual determinants of loss of autonomy. In a more operational aim, complementary research using the first results of FRESH is being conducted in 2013 to test the feasibility of targeting frail elderly populations from data available from the Retirement and Occupational Health Insurance Funds (CARSAT). This project, financed by the CNAV, is part of the development of frailty observatories. Finally, a third project COMPAS (Connaissance des populations en perte d'autonomie et leurs consommations de soins: Knowledge of Populations with Loss of Autonomy and their Health Expenditures) financed by the CNSA, is based on the introduction of a questionnaire module measuring frailty in the ESPS 2012 survey; the main objective being a better characterisation of frail persons in France, their use of healthcare and their health expenditures.

and age-related functional changes in skeletal muscle. The frailty phenotype identified by Fried consists of the five following dimensions: fatigue or poor endurance, loss of appetite, muscular weakness, slow walking pace, sedentariness or low physical activity.

### The Fried model, based on five functional criteria, appears to be more operational than other frailty models

The Fried model takes into account a specific process underlying changes in physiological reserves. By restricting it to the functional aspect, this model has a greater internal coherence and allows the distinction to be made between frailty, comorbidity and disability.

<sup>1</sup> That is to say that several organs function poorly.  
<sup>2</sup> An approach that consists in considering the phenomena as totalities.  
<sup>3</sup> In medicine, comorbidity refers to the presence of one or more illnesses associated with a specific disease.  
<sup>4</sup> In the health domain, disability refers to any restrictions in the ability to carry out an activity normally (or within the limits considered as normal for a human being) following a deficiency (normally as the result of a disease, an accident, ageing etc.).

The Rockwood model is often difficult to use due to the high number of variables required. In contrast, the Fried model based on only five criteria appears to be more operational (low cost, reproducible and comparable as it can be applied to the specificity of many health surveys) and more economical than other frailty models, not only because of the lower number of variables, but also because the variables retained in the construction of the phenotype provide additional information not included in comorbidity and disability measurements. The popularity of the Fried model is also due to its simple construction. A dichotomous variable (sometimes built up from several modalities) indicates whether one of the five criteria under consideration has been met. In general, one considers that the different dimensions all contribute equally so that the frailty score is obtained directly from the sum of the five variables. It thus varies between 0, for a robust individual without deficiencies, to 5 for an individual with simultaneous deficiencies in the five dimensions. In medical practice, where it is useful to have decision-making rules, two thresholds are applied to the frailty score: an individual is considered pre-frail when one or two criteria are met, and frail from three criteria (Table).

The Fried model has two main limitations. First, considering that each criterion contributes identically to the frailty phenotype is a strong hypothesis. The studies conducted at SOLIDAGE in Québec<sup>5</sup> indicate that all the criteria do not contribute equally in defining frailty. Other recent studies based on SHARE data show that the respective contribution of each dimension differs from one European country to the next. Moreover, the Fried model does not integrate a cognitive dimension that nevertheless constitutes a signifi-

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**Distribution of the frailty index (Fried phenotype) in the population aged 50 and over in France, 2011**

Variables	Population as a whole			Sub-population without limitations in everyday life activities		
	Robust (%)	Pre-frail (%)	Frails (%)	Robust (%)	Pre-frail (%)	Frail (%)
<b>Men</b>						
[50-54]	52.6	43.7	3.7	54.2	43.2	2.5
[55-59]	53.6	43.5	3.0	56.2	41.8	2.1
[60-64]	60.1	36.8	3.1	62.3	35.8	1.9
[65-69]	62.9	32.2	4.9	65.0	31.1	3.9
[70-74]	42.9	42.4	14.8	45.3	41.6	13.1
[75-79]	26.0	57.8	16.2	27.3	60.1	12.7
80+	16.5	51.4	32.1	22.2	56.5	21.3
Total Men	49.1	42.7	8.2	52.2	42.1	5.7
<b>Women</b>						
[50-54]	47.5	47.0	5.5	49.3	47.9	2.9
[55-59]	42.8	51.3	6.0	44.7	51.2	4.1
[60-64]	46.9	48.9	4.2	48.6	48.6	2.8
[65-69]	42.7	52.0	5.3	43.2	52.9	3.9
[70-74]	35.0	55.2	9.8	35.6	56.5	7.9
[75-79]	21.6	58.0	20.4	23.7	58.0	18.3
80+	11.8	48.0	40.1	15.6	55.3	29.1
Total Women	37.2	50.9	11.9	39.9	52.0	8.1
<b>Combined</b>						
[50-54]	49.9	45.5	4.7	51.5	45.8	2.7
[55-59]	48.3	47.3	4.4	50.6	46.4	3.1
[60-64]	53.4	43.0	3.6	55.2	42.5	2.3
[65-69]	52.8	42.1	5.1	54.1	42.0	3.9
[70-74]	38.3	49.8	11.9	39.7	50.2	10.1
[75-79]	23.7	57.9	18.4	25.4	59.0	15.6
80+	13.5	49.2	37.3	17.9	55.7	26.4
Total Combined	42.7	47.1	10.2	45.7	47.4	6.9

Adjusted statistics representative of the population in metropolitan France living in ordinary housing in the year 2011.

Robust: frailty index = [0]; Pr-frail: frailty index = [1,2]; Frail: frailty index = [3,4,5].

**Reading.** 52.6% of men aged between 50 and 54 have no symptoms of frailty corresponding to the Fried phenotype within the population concerned. 6.7% of women in their 60's (2.8% + 3.9%) who do not self-report functional limitations in activities of daily living (ADL) are frail.

**Data:** SHARE wave 4 (Irdes).

 **Data download:** [www.irdes.fr/Donnees/Qes184\\_Fragilite.xls](http://www.irdes.fr/Donnees/Qes184_Fragilite.xls)

<sup>5</sup> Future publication: [www.solidage.ca](http://www.solidage.ca)

cant factor in elderly persons' loss of autonomy. However, the simple addition of cognitive problems as a sixth dimension clashes with the theoretical framework whose coherence lies in the functional approach<sup>6</sup>. Houles *et al.* (2012) recommend not adding cognitive dimensions without more empirical and theoretical references. In general, as gerontology and geriatrics literature has yet to resolve these methodological issues, the Fried model remains more suitable for reasons of simplicity and comparability.

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### Frailty: a new risk factor among elderly adults, distinct from chronic diseases

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The interest in using frailty as an approach to public health and solidarity issues related to ageing is three-fold. First, frailty represents a new disability risk factor among the elderly, distinct from the traditional chronic disease factors. Recent empirical studies based on longitudinal general population surveys and clinical tests have revealed an aggravation in health problems (notably functional limitations) within a short period (two years for example) among frail adults in comparison with evolutions in health status observed among initially pre-frail or robust individuals. In addition, the Fried model permits isolating independent risk situations related to chronic illness and activity limitations. Individuals within the general population presenting a risk of functional decompensation that were not previously detectable outside a geriatric assessment for example, can now be identified on the basis of elemental physical tests or simple questions concerning their functional limitations.

<sup>6</sup> Similarly, if measurements of cognitive deficiency are included in the Rockwood model, they do not occupy a specific place.

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### Using the frailty approach as a means of targeting preventive actions

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Using the frailty approach to develop preventive strategies in favour of the elderly seems interesting for several reasons. Firstly, frailty is recognised as a measurement more in line with biological age; it avoids resorting to chronological age which describes heterogeneous health situations and identifies at-risk populations more precisely without stigmatising all members of a same age group. Secondly, whereas chronic disease and activity limitation criteria often appear too late for preventive action, frailty describes the early stages of progressive loss of autonomy whose effects may be reversible. The frailty measurement thus allows envisaging interventions sufficiently upstream of the process, for certain individuals, to prevent or delay disability, or at least diminish its damaging consequences (adapting the home, physical activities, etc.) Finally, frailty is a concept that is directly operational. Specific statistical tools are already in use in clinical practice (Romero-Ortuno *et al.*, 2010) and within the population (Vermeulen *et al.*, 2011) to detect frail adults.

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### A bridge across several disciplines opening-up the scope of research

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The frailty approach creates a bridge between several disciplines concerned with ageing, in particular public health and economics, and opens up new possibilities for research. On the one hand, the frailty indicator enables creating an analogy between the concept of physiological reserve and that of 'health capital'. In the Grossman (1972) model, an individual's health is conceived as a form of capital that depreciates over time. It is the individual's 'health investments'

(reducing health risk behaviours, prevention, use of the health system, etc.) that allows the individual to compensate for the natural phenomenon of deterioration and maintain a good health status. Following the model's logic in which an individual's resources (time, budget) are limited, the choice of health investments are subject to a trade-off with other consumption choices. In other words, from an economics point of view, health is determined by budgetary constraints and individual preferences. Applied to the frailty framework, use of the theoretical behaviour model concerning the demand for healthcare (or Grossman model) legitimises taking into account the economic and social dimension in the process leading to the loss of autonomy, and allows us to enrich a purely medical approach through the analysis of individual behaviours. This interdisciplinary bridge opens the way to several research projects.

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### Two areas of research at IRDES notably based on the SHARE and ESPS surveys

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In health economics, loss of autonomy is approached from the socio-economic causes and consequences of the onset of frailty in elderly adults, both in terms of social protection and health system efficiency. The areas of research developed at IRDES have a twofold objective: on the one hand, to produce applied knowledge on the social and economic dimension of populations experiencing loss of autonomy and on the other, to elaborate and test different methods of identifying vulnerable elderly populations using statistical tools that can also be used to assess the actions implemented. This process relies on the production and exploitation of specific health-care-related data bases. In particular, two national general population surveys, the European Survey on Health,

Ageing and Retirement (SHARE) and the Health, Healthcare and Insurance survey (ESPS produced by IRDES since 1998), in which a specific questionnaire aimed at the 50+ population was added in 2012 to broach loss of autonomy and related issues.

### Analysing the socioeconomic determinants of frailty

The first area of research concerns the socio-economic determinants of frailty in adults aged 50 and over. It involves first testing the existence of a stable relationship between living conditions and degree of frailty. The first results obtained from SHARE panel data indicate that the disablement process is accompanied by financial difficulties (Sirven, 2012); preliminary results from ESPS 2012 cross-sectional data tend to confirm this relationship (Insert 1). These studies provide information on the Social Security system's effectiveness in producing equity in health. They also make it possible to envisage identifying vulnerable individuals from economic data (income, situation vis-à-vis the labour market, healthcare consumption etc.) rarely taken into account in clinical practice regarding frailty. As part of a strategy aimed at targeting vulne-

rable elderly populations, IRDES is carrying out research financed by the CNAV. Its aim is to elaborate an algorithm to detect individuals at risk of losing their autonomy using individual data contained in the administrative pension insurance<sup>7</sup> databases. As these databases only contain socio-economic data, the SHARE data grouping together elements relating to both frailty and socioeconomic data are used. A model of the determinants of frailty is first estimated from SHARE panel data on comparable variables and populations meeting the same criteria as those in the administrative database. The model predictions are then calculated for individuals belonging in the administrative database which allows us to obtain an estimated frailty score to target individuals.

### Gaining better knowledge of frail adults' healthcare consumption

The second research area concerns healthcare consumption among the frail elderly. The self-reported SHARE data provided a first glimpse of this relationship, but the need to have precise data available on reimbursements

<sup>7</sup> <http://www.irdes.fr/EspaceAnglais/AboutIrdes/Documents/ResearchProgram.pdf>

and healthcare consumption in France led to the inclusion of frailty measurements in the 2012 ESPS survey so as to obtain data matched with Health Insurance files. Here, it involves gaining better knowledge of frail adults' use of healthcare, the ideal situation being to renew the measurements following the survey's biannual rhythm so as to obtain panel data and carry out the analyses in relation to healthcare usage modalities. Furthermore, it is useful to isolate the share of health expenditures due to frailty but independent of chronic diseases to which the National Health Insurance already contributes in preventing loss of autonomy. This research is supported by specific funding from the CNSA<sup>8</sup>.

### Is frailty one of the determinants of subscribing to private dependency insurance?

The third area of research examines the underlying conditions and development of the private dependency insurance market. A specific questionnaire was developed in ESPS that included both the traditional determinants of dependency insurance (risk aversion, preference for the present) and less traditional determinants such as frailty or individuals' ability to envisage being dependent (for example denial of death and disability, the ability to carry out economic calculations, the fact of having had dependent parents, etc.). Preliminary results seem to indicate that the ability to carry out prospective economic calculations is one of the main factors determining subscriptions to private dependency insurance, before the risk of losing one's autonomy or even the perception of this risk.

<sup>8</sup> <http://www.irdes.fr/EspaceRecherche/ProgRecherche/ProgrammeDeRecherche.pdf>

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#### The socioeconomic determinants of frailty

The frailty index retained here is a synthetic measurement of the Fried phenotype widely used in the literature. Each of the five dimensions of frailty is determined from binary variables indicating whether the individual has the symptom or not. The index is constructed from the sum of these values: a discrete variable with values ranging between 0 – no symptoms, and 5 – all symptoms. The table on page 3 presents the distribution of frailty for the population aged 50 and over in France in 2011 where we observe that women are more affected by frailty than men.

The SHARE panel data for the years 2004-2011 ([www.share-project.org](http://www.share-project.org)) with a cross-section for ESPS 2012 ([www.irdes.fr](http://www.irdes.fr)) are used for the socioeconomic determinants of frailty in individuals aged 50 and over. Even if the variables that enter into the composition of the frailty index are not measured in exactly the same way in the two surveys (for example, in SHARE muscular strength is measured with a dynamometer whereas in ESPS it is measured by means of a subjective question), the first results are in fact comparable.

Whatever the database used, the estimations seem to indicate that the frailty process in elderly adults is accompanied by financial difficulties. The use of retrospective data in both surveys also suggests that financial difficulty during the course of a person's life favours the onset of frailty in later life. The studies also underline the harmful effects of at-risk behaviours (alcohol consumption) or loneliness and isolation on the subsequent degree of frailty.

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## FURTHER INFORMATION

In a context of population ageing with pessimistic perspectives regarding the evolution of disability, frailty appears as a new knowledge tool at the service of action and notably prevention. This concept, initially devised to detect the risk of disability in individuals and prescribe effective preventive measures where possible, can also be used to target populations faced with loss of autonomy so that effective preventive policies can be implemented. The economic analysis of frailty can thus aim to study the coordination between the health system and the social protection system from the premise that the first is more often called upon than the second when dealing with health issues whereas the most efficient answers can in fact be mixed. The concept of frailty thus extended beyond its purely clinical dimension makes it possible to envisage implementing a combination of policies (prevention, care pathway, private insurance) either through time or simultaneously, and sufficiently upstream of the process leading to loss of autonomy. ♦

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