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LONG-TERM CARE: REGIONAL DISPARITIES IN BELGIUM

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Abstract

In this paper we analyze the problem of population ageing in terms of non-medical care needs of persons who are dependent or have lost their autonomy, in order to provide the various public and private administrations active in these fields with some food for thought. The anticipated increase in dependency poses significant challenges in terms of needs evolution and financing. Using administrative data on the Belgian population to build indicators on the prevalence of dependency at home in the three regions in 2001, we find that the likelihood of a sustained increase in the Flemish prevalence rates ultimately amplifies the magnitude of the financing problems that the Flemish dependency insurance scheme has experienced since its first years of operation. Results also show that the smaller increases or the decreases (according to the scenario selected) expected in Wallonia and Brussels are likely to mitigate concern about the sustainability of any long-term care insurance in Wallonia and therefore to facilitate its eventual introduction.

Keywords : Long-term care, Old age assistance, Demographic changes, Regional inequalities, Projection

JEL-Codes : I12, I18, J11, J14

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1. INTRODUCTION

The expected increase in the number of elderly people, resulting from the fact that many cohorts born in the post-war period are reaching an advanced age, combined with the lengthening of individual lifespans, raises many questions about the evolution of public policy concerning the elderly. Demographic change has important potential consequences on the future number of dependants.

People who, because of age or disability, are in need of help for their daily activities at home or in an institution incur heavy financial and non-financial burdens. Dependency insurance, when it exists, supports these people with financial or material assistance (cash benefits or benefits in kind). The aforesaid demographic change presages a significant increase in the non-medical care needs of dependants. Despite the importance of this fact, projections of the number of dependants in Belgium are few in number and limited in most cases to assuming that prevalence rates by age do not vary.

In Belgium, the conditions governing community support for dependency and the situation in terms of dependency insurance are not uniform among the three regions of the country[1]. Some benefits associated with dependency are covered at the federal level, such as the allocation of aid to the elderly. Attempts to introduce federal dependency insurance have been hampered by the debate around the jurisdiction for assistance to the elderly, which results in differentiated situations between regions. Flanders has its own insurance (*Vlaamse Zorgverzekering*), which began to provide benefits in 2002[2]. Affiliation to this system is mandatory for anyone living in the Flemish Region. The Brussels Region being officially

[1] For different views on dependency insurance in Belgium, see Cantillon (2004), Breda (2004), Vansteenkiste (2004), Ruz Torres (2004), Jousten (2004) and Pacolet (2004) in a special issue of *Revue Belge de Sécurité Sociale (Belgian Review of Social Security)*.

[2] Decree of 30 March 1999 (published in *the Moniteur Belge* on May 28, 1999) on the organization of Flemish care insurance ("*Vlaamse zorgverzekering*").

bilingual, access to the Flemish dependency insurance scheme is optional for inhabitants of Brussels. No social insurance system covering specific needs for dependency-related non-medical assistance is in force in the French or German-speaking parts of the country.

Within the institutional framework of Belgium, the prospect of a differentiated evolution of dependency linked to demographic differences between regions could have consequences for the federal entities. On the one hand, ageing may potentially jeopardize the budgetary balance of the Flemish care insurance scheme, the only existing at the moment. On the other hand, an excessive increase in needs without adequate coverage would mean an unbearable increase in financial and non-financial burdens for the dependants. In order to provide an adequate response to this increase in responsibility, the possible introduction of dependency insurance where it does not exist should be considered only if it is viable in the long term. Overly pessimistic forecasts as to the future budgetary costs could deter the government from embarking upon the introduction of dependency insurance, so it is important to examine the impact of alternative scenarios regarding the evolution of dependency.

This paper attempts to assess the extent of dependency at home in all three Belgian regions using indicators based on administrative data, similar to those used in the Flemish dependency insurance scheme, and presents long-term development prospects up to 2050.

We use administrative data on the Belgian population to construct indicators of the prevalence of dependency at home in all three regions of the country in 2001. We then project these indicators on the basis of likely demographic changes by region until 2050. In order to evaluate other alternatives than the dependency rate by age constant, these projections are made according to four scenarios reflecting different assumptions about the evolution of life expectancy in dependency. Finally, an attempt to estimate the budgetary cost of dependency insurance identical to that of Flanders is conducted in Wallonia for the period 2002-2004.

This study is structured as follows. Section 2 gives a brief overview of the literature regarding the evolution of dependency. Section 3 presents the problem of quantification of dependants on the basis of indicators constructed using administrative data. Then, the methodology for projecting these indicators up to 2050 and the presentation of results constitute the fourth section. Section 5 attempts to assess the budgetary cost of dependency insurance in Wallonia. Finally, section 6 includes some comments on the results and their long-term consequences.

2. OVERVIEW OF THE LITERATURE

Dependency insurance, when it exists, provides long-term care services to people who are limited in their ability to function independently for their daily activities at home or in an institution. These services can be financial or material assistances. The long-term care needs are most prevalent for the oldest age groups who are most at risk of long-standing chronic conditions causing physical or mental disability (impairment, activity limitation and participation restriction).

The simplest approach to projecting dependency is to make the assumption that dependency prevalence rates by age are constant over time. Given the ageing population, empirical studies using this methodology indicate a significant increase in dependency. However, it represents only one of the approaches that are found in the demographic literature, in which we can identify three main theories about the evolution of health status and/or dependency in relation to the lengthening of lifespans (Robine *et al.* 1991).

The "*expansion of morbidity*" *theory* (Gruenberg, 1977, Kramer, 1980) attributes the drop in mortality observed to a decline in the lethality of chronic diseases rather than to a slowdown in their growth rate. A decrease in mortality or its deferral to an older age would lead to much more severe chronic disease. Therefore, life expectancy in dependency increases and the prevalence rates of dependency at every age are relatively high.

The "*compression of morbidity*" *theory* (Fries, 1980, 1989) points out that the onset of chronic disease is occurring increasingly late in life, postponing morbidity to older ages (end of life) thereby reducing the duration of dependency. This evolution, it is said, results from medical and technological advancements that increase the healthy lifespan while reducing the number of years spent in dependency, which means a decrease in the dependency rates by age.

According to the "*dynamic equilibrium*" *theory* that combines both the expansion and compression scenarios (Manton, 1982, Manton *et al.*, 1997), the decline in mortality is in particular attributable to a slowdown in the progression rate of chronic diseases with less severe chronic disease and disability conditions. Life expectancy in dependency therefore remains at a relatively constant level. The prevalence rate of dependency at every age decreases at a rate similar to the projected increases in life expectancy.

The recent economic literature also takes into account the prospects of a compression of morbidity. In a review of the economic literature on long-term care, Norton (2000) notes that the economic burden related to the ageing population and the increasing need for long-term care could be significantly less onerous that might be believed at first sight. The magnitude of the problem depends on the interrelationship between lifetime and expenditure.

Lakdawalla and Philipson (2002) incorporate these perspectives into a theoretical model. They assume that the number of dependants residing in institutions has risen more slowly than the population of the United States. In their model, the increase in life expectancy may have as a result, at the macroeconomic level, a reduction in the (medical and non-medical) costs of long-term care. Two factors are involved in this finding, paradoxical at first glance. On the one hand, longer lifespans in good health could increase the supply of care (provided by healthy people, even older ones, including healthy spouses) and therefore reduce the price. On the other hand, the narrowing of the gap in the life expectancy of men and women could have

the effect of reducing the number of widows whose isolation eventually leads them to enter an institution.

Various empirical studies have tried to take into account the potential effects of these various scenarios in Europe. Jacobzone (2000) presents projections, up to 2020, of the dependency rate for different OECD countries. Two methodologies are adopted to count dependants. The static approach combines demographic projections with the latest known prevalence figures using constant rates of disability or institutionalization by age (pessimistic scenario). The dynamic approach is to project the trend of declining disability and institutionalization rates (optimistic scenario). Extrapolations are based on data for the year 1995 and data before 1995. Jacobzone asserts that the number of dependent elderly people correlates with the evolution of the elderly population in a state of severe disability. The increase in the number of dependent elderly people is expected to be between 43% and 61% in Canada and between 25% and 43% in France according to this scenario.

In France, Bontout *et al.* (2002) have prepared projections, up to 2040, of the number of dependants aged 60 and over, on the basis of prevalence rates by sex and age from the survey *Handicaps-Incapacités-Dépendance (HID, INSEE)* and demographic projections by the *INSEE*. Data from *HID* come from surveys conducted with couples living at home and couples living in institutions. Dependency is measured using the indicators *AGGIR (Autonomie Gérontologique Groupe Iso-Ressources)* and *EHPA (Etablissements d'Hébergement Pour Personnes Agées)*. The projections are predicated on three dependency evolution scenarios based on trends observed in the past. The pessimistic scenario assumes that increases in life expectancy without dependency evolve in parallel with general life expectancy. The dependency prevalence rates then fall at the same rate as the increases in projected life expectancy. The optimistic scenario is based on the assumption that dependency prevalence rates decrease at a rate similar to what was observed during the 90s, i.e. at a faster

pace than the gains in life expectancy. In the central scenario, dependency prevalence rates decrease at a slower rate than in the optimistic scenario. Whatever the scenario, the ageing of the French population will likely increase the number of dependants aged 60 and over by 2040, to an extent which varies markedly according to the dependency scenario. Over the forty years, that increase was 35% for the optimistic scenario, 55% for the central scenario and 80% for the pessimistic scenario. In addition, the increase in dependency will be greatest among people of more than 80 years old.

The projections made by Duée and Rebillard (2004) are based on the same sources as those of Bontout *et al.* (2002). They implement three comparable scenarios to project the number of dependants aged 60 and older by 2040. Duée and Rebillard, however, use two successive waves of data from the *HID* survey, which allows them to simulate transitions in or out of dependency using the *Destinie* microsimulation model. Over the forty years, the increasing number of dependants over the age of 60 would be approximately 18% for the optimistic scenario, 43% for the central scenario and 84% for the pessimistic scenario. These rates are lower than those of Bontout *et al.* (2002) for the central and optimistic scenarios. Although the method based on dependency transitions should in theory allow the use of more precise information, the data that it draws on are less robust than when using prevalence. Ultimately, if we are to believe Le Bouler (2005), the choice of assumptions on the evolution of dependency is far more crucial than the use of either of these techniques.

For Belgium, to our knowledge, the existing projections of the number of dependants have been based on the assumption that the dependency rate by age remains constant over time. At the national level, the results obtained by the *Bureau fédéral du Plan* (Mestdagh and Lambrecht, 2003) on the basis of the dependency rate by age from the *Enquête de Santé par Interview (Health Survey by Interview)* involve very significant long-term changes. Between

2001 and 2050, the increase in the number of people receiving home care would be 124% and that in the number of people residing in institutions 166%.

There are also separate projections for Flanders and the French-speaking part of Belgium. Breda *et al.* (2000) include in their preparatory study for the introduction of the Flemish dependency insurance scheme a projection of the number of dependants in Flanders from two demographic forecasts. They point out that recent studies predict an increase in life expectancy in good health but are confined, however, to a projection based on constant dependency rates. Their results indicate a 58% growth in the number of dependants at home and in institutions between 2000 and 2050. A similar exercise was carried out by Ethgen *et al.* (2003) with regard to the projected number of people aged over 75 in high dependency at home, and of their cost for the French and German-speaking parts of the country. In all the cases considered, the cumulative reserves curve presents a parabolic aspect, which predicts a lack of financing related to the ageing population sooner or later. This unfavourable picture is highly determined by the assumption that dependency rates by age will be constant over time. The differences in the methodology, data and definition of dependency used make it difficult to compare the dependency rates obtained from these two studies.

The regional dimension of dependency in Belgium was also considered indirectly by studies on life expectancy in good health. Van Oyen *et al.* (1996) studied the inequalities between the Belgian regions in terms of general life expectancy and life expectancy in good health during the years 1989-1990. Life expectancy in good health is evaluated on the basis of subjective measures of health status calculated using a sample of 2,640 people, randomly selected, who are asked to describe their state of health. The interviewees are considered healthy if they answer that their health is very good, good or fair. In a more recent work, Van Oyen *et al.* (2002) measure health status according to three indicators of life expectancy in good health obtained on the basis of the *Health Survey by Interview* of 1997: a subjective indicator of

health status; an indicator based on the physical and functional limitations resulting from chronic disease; and an indicator of life expectancy in good mental health based on mental health and psycho-affective problems such as anxiety, psychological illness and depression.

Table 1: General life expectancy (GLE), healthy life expectancy (HLE), disability-free life expectancy (DFLE) and mental life expectancy (MLE) by region in Belgium, 1997 (1989-1990)

	Flemish region				Walloon region			
Age	GLE	HLE	DFLE	MLE	GLE	HLE	DFLE	MLE
Males								
15	(58.9)	(56.5)			(56.6)	(50.2)		
25	50.42	39.47	39.11	38.55	48.07	34.19	36.97	34.22
	(49.5)	(47.3)			(47.3)	(41.1)		
35	40.92	30.55	30.08	31.87	38.77	25.48	28.15	27.46
	(40.0)	(37.9)			(37.9)	(32.0)		
45	31.57	22.19	21.01	25.10	29.71	18.15	20.00	21.77
	(30.6)	(29.3)			(28.9)	(23.4)		
55	22.78	14.48	13.26	18.03	21.29	11.69	12.40	16.09
	(21.9)	(20.5)			(20.4)	(16.1)		
65	14.93	8.55	7.07	12.20	13.90	7.62	7.14	10.15
	(14.3)	(13.3)			(13.2)	(9.2)		
75	8.70	4.31	2.80	7.19	8.18	3.80	3.24	5.78
	(8.5)	(7.2)			(8.0)	(3.5)		
85	4.42	2.27	0.57	3.95	4.22	2.65	0.98	1.18
Females								
15	(65.2)	(61.3)			(63.9)	(58.1)		
25	56.06	39.82	40.35	39.10	54.96	33.48	36.65	32.76
	(55.5)	(52.0)			(54.1)	(48.7)		
35	46.28	30.87	31.05	32.11	45.27	25.39	27.98	26.95
	(45.7)	(42.4)			(44.5)	(39.6)		
45	36.74	23.67	22.57	26.05	35.86	18.55	20.30	21.44
	(36.2)	(33.3)			(35.1)	(30.7)		
55	27.56	16.36	14.70	19.58	26.85	12.62	12.44	16.15
	(27.1)	(24.3)			(26.0)	(22.1)		
65	18.85	9.96	8.18	12.89	18.36	6.97	6.26	10.89
	(18.5)	(16.0)			(17.7)	(14.3)		
75	11.18	5.00	3.65	7.45	10.86	3.76	2.13	6.97
	(11.2)	(9.1)			(10.6)	(8.2)		
85	5.36	2.73	1.03	4.33	5.18	1.66	0.73	2.28

Source: Van Oyen *et al.* (1996) and Van Oyen *et al.* (2002).
Note: Results for 1989-1990 in parentheses.

As shown in Table 1, both studies obtain general life expectancies and expectations of healthy life in the Flemish Region vastly superior to those of the Walloon Region, for men as well as for women. According to Van Oyen *et al.* (1996), general life expectancy and healthy life expectancy among 15-year-old men amount to 58.9 years and 56.5 years respectively for the Flemish Region, but only 56.6 years and 50.2 years for the Walloon Region. For men of 65, they correspond to 14.3 years and 13.3 years respectively for the Flemish Region, and only

13.2 years and 9.2 years for the Walloon Region. The life expectancies of women also reveal discrepancies between regions. In Flanders, about 3.3% of men and 4.3% of women answered that they suffer bad or very bad health, while these rates are 9.4% and 7.7% respectively for Wallonia[3].

The results for 1997 in Table 1 go in the same direction (Van Oyen *et al.*, 2002). The gap in general life expectancy and life expectancy without disability between Flanders and Wallonia is approximately 2 years in favour of Flemings, for 25-year-old men. For healthy life expectancy and life expectancy in good mental health, this difference rises to more than 4 years. For people older than 65, the differences in life expectancy become blurred and in some cases favor Wallonia. For 25-year-old women, the differences between regions are 1 year for general life expectancy, 4 years for life expectancy without disability, and 6 years for healthy life expectancy and mental life expectancy, again to the advantage of the Flemish Region. At age 65, the differences between regions fall to 0.5 years for general life expectancy, 2 years for life expectancy without disability and mental life expectancy, and 3 years for healthy life expectancy.

3. ASSESSMENT OF DEPENDENCY AT HOME IN 2001

In order to assess dependency in the different regions, we use an approach based on administrative data. The program will consist in developing various indicators for people likely to be supported/assisted by dependency insurance through data/information similar to those used by the Flemish dependency insurance scheme.

3.1. Difficulties in measuring dependency

The evaluation of assistance requirements has a multidimensional aspect. Ideally, it should take into account not only physical but also psychological dependency, as well as its ability or that of its environment to accept the consequences of dependency. The complexity of

[3] These results are not presented in Table 1.

measuring dependency and the lack of consensus as to its definition have prompted the development of a multitude of dependency indicators in the gerontological literature. In France, for instance, many indicators have been developed to assess dependency.

In Belgium, the available indicators of dependency are by no means so well developed. The *Enquête de Santé par Interview (Health Survey by Interview)* provides a set of indicators specifically geared to dependency: subjective health, mental health, limitations in daily life activities and social health. However, the data specifically geared to dependency are available only for a sample of individuals and could not be used to serve as a basis for a dependency insurance system.

The lack of data directly on dependency for the entire population and the concern to minimize the cost and time required for the introduction of long-term care insurance led the Flemish Government to base itself on existing administrative data to establish the severity and duration of dependency. Most of the criteria used since the introduction of the measure are based on the presence of one or more certificates issued under various federal or regional aid programs. The following criteria have been used for dependency at home:

- Katz scale revised for the *INAMI (Institut National d'Assurance Maladie-Invalidité)* in the context of home nursing care (minimum score of B);
- BEL-profile scale for family aid (minimum score of 35 on the BEL-profile scale);
- medico-social scale used to assess the degree of autonomy for the following benefits: integration, aid for the elderly and third-party assistance (minimum score of 15 on the medico-social scale);
- supplementary family allowances (for disabled children who suffer from a physical and/or mental incapacity of at least 66% and have at least 7 points as a degree of autonomy);

- supplementary family allowances (for at least 18 points on the medico-social scale) from 1 May 2003;

- request for attendance in a day or short-stay centre (a score of at least C on the rating scale justifying the request).

For dependency in an institution, from 1 July 2002, a minimum score of C on the assessment scale for residential care or a certificate of residence in a psychiatric care institution. From 1 January 2003, the procedure has been extended to include scores B and, from 1 January 2004, scores O and A.

This pragmatic solution reveals several limitations to measuring dependency.

a) Problems of validity of content, classification, interpretation and heterogeneity of the measures used were reported (Swine *et al.*, 2003). The indicators used, often developed from the Katz index for use in the context of a particular measure, have sometimes suffered further processing to allow their use in another context. Other indicators, such as the one used for the allocation of the "aid for the elderly" grant, combine daily life activities and activities instrumental in daily living by using items defined in a very broad way and combining ordinal variables in an additive way. As these authors point out, "*[i]t is interesting to note that all of the existing financing system of care for dependants is based on an incomplete scientific approach*" (Swine *et al.*, 2003, p. 11). Until recently, no evaluation of the dependency indicators used (or likely to be) has been specifically carried out for Belgium, particularly with regard to their sensitivity to the evaluator.

b) Although these indicators were defined in a more scientifically rigorous way, it should be noted that most of them are related to medical care, while the objective here is to measure non-medical needs. However, people's need of assistance is not strictly related to functional limitations. As Davin *et al.* (2005) recently showed, they are often related to the socio-environmental context.

c) A significant interaction between dependency insurance based on these measures and the level of federal jurisdiction should also be emphasized. Thus, an easing of conditions in order to benefit from one or the other of these federal measures will directly lead to an increase in the number of people eligible for dependency insurance. This insurance intervenes in a way as a complement to other federal and regional aids.

d) The quantification of dependency is based on the presence of certificates. Some people may have a certificate proving entitlement to benefits taken into account in the construction of indicators and may no longer need it. On the other hand, persons in a position to obtain certificates giving the right to care but having not applied for it might be tempted to do so if aid were to be granted to the beneficiaries of these services.

e) Some of these measures reflect the use of services and can thus be influenced by the supply of these services. So, the number of home care (*Forfaits/packages B or C*) beneficiaries is influenced by the availability of home-assistance services.

3.2. Why rely on administrative data?

Despite the various disadvantages listed in the previous section, given the way the entitlement to benefits for both formal and informal assistance will be decided in the Flemish dependency insurance scheme, it is interesting to examine the results of the calculation of a similar dependency indicator for all three regions of the country. This approach compensates for the lack of data in assessing the number of dependants (Ruz Torres, Karakaya and Plasman, 2002, Ruz Torres, 2004).

The great advantage of these administrative data is that they cover all of the Belgian population and not only a sample. Moreover, the use of data similar to those applied in Flanders helps us to evaluate to what extent this type of indicator can identify dependency. Finally, the use of a coherent database helps avoid double counting that might occur when calculating an index based on disparate sources.

Given the above-mentioned limitations, the regional differences reflected could be due in part not to people's health status and needs but to differences in applying or checking these criteria. It is worth recalling here the potential problems associated with the lack of scientific validation of most indicators, and the potential influence of supply. Since the effect of these limitations on the evaluation of the scale of dependency may vary from one region to another, we should be cautious when interpreting the results as reflecting dependency differentials between regions.

However, the weaknesses of our approach more or less faithfully reflect those of any system in which recognition of dependency were to be based on administrative criteria. The results for 2001 represent a quantification of people with some indicators expected to approximate the degree of dependency. In the event that such a system were introduced by federal entities other than the Flemish Region, the same problems would arise. Moreover, the use of data related to 2001, prior to the initiation of the Flemish long-term care insurance scheme, exclude the possibility that the regional differentials recorded may result from an entailment effect directly linked to the introduction of dependency insurance in Flanders.

3.3. Description of data

The construction of the dependency indicators is based on administrative data aggregated by mutual companies ("*mutualité*") relating to the year 2001. They include in particular variables determining the right to the social franchise and chronic disease packages. Both measures are aimed to help people in precarious social situations and/or requiring recurrent medical care in the context of federal health care insurance.

These data are broken down by age, sex and region. The variables used are as follows:

- beneficiaries of home nursing care (*Forfaits/packages B and C*);
- beneficiaries of physiotherapy packages *E*;
- beneficiaries of supplementary family allowances;

- beneficiaries fulfilling the conditions for the granting of the integration allowance in cat. III or IV (twelve points or more);

- beneficiaries fulfilling the conditions for the granting of the "aid for the elderly" allowance in cat. II, III or IV (twelve points or more);

- beneficiaries of the allowance for third-party assistance (allowances for the handicapped);

- beneficiaries of a disability benefit (permanent or not) paid to the disabled person who can be regarded as having a dependent person (needing the assistance of a third person);

- beneficiaries of the lump-sum allowance for third-party assistance;

- beneficiaries of an allowance for the handicapped.

These variables include fairly similar concepts to criteria for entitlement to assistance from the Flemish care insurance scheme. Their definition is, however, often less restrictive. For the aid to the elderly allowance and the integration allowance, the Flemish criteria require a minimum of 15 points on a revised Katz scale, while the indicators available concern those who receive more than 12 points. Similarly, entitlement to the supplementary allowance does not take into account the more restrictive conditions on handicap laid down in the Flemish provisions. The physiotherapy package *E* is not among the criteria considered for Flemish dependency insurance.

It is also worth noting that the data used do not give an indication either on the BEL scale for home care (a scale also featuring among the criteria taken into account for Flemish long-term care) or on stays in institutions.

3.4. Evaluation of dependency at home in 2001

Different combinations of criteria deemed relevant and appearing in the available administrative data enable the construction of alternative indicators of dependency. According to the choice of more or less strict criteria, the estimated number of persons considered in a situation of dependency varies widely. Several indicators quantifying dependants have been

calculated using various combinations of the above-mentioned variables. The two indicators giving the most extreme results are:

• *the most restrictive* indicator, taking into account only beneficiaries of home nursing care (packages B and/or C). These categories include in principle the most heavily dependent people not in an institution, but they are also the ones that present the greatest potential problems of comparability between regions.

• *the least restrictive* indicator, incorporating all the criteria that we have, offering as wide as possible an image of dependency at home. People are considered dependent if they satisfy at least one criterion related to the above-mentioned social franchise[4] or chronic disease packages. This indicator also includes beneficiaries of the physiotherapy package *E*, not taken into account for Flemish dependency insurance.

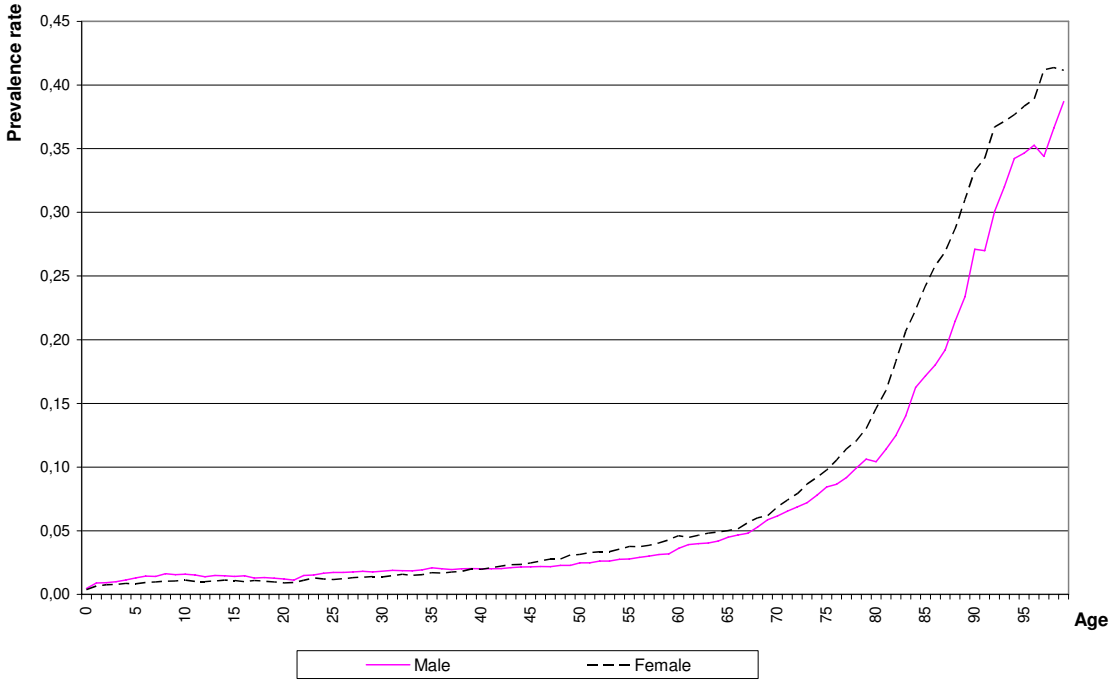
The estimated national prevalence rate at all ages varies from 3.43% according to the least restrictive indicator to only 0.36% according to the most restrictive indicator.

Our comments focus on the prevalence rates (ratio between people considered dependent and the total population) calculated by means of the least restrictive indicator. We present prevalence rates rather than life expectancies in dependency and in good health, since these rates, combined with population growth by age, determine the number of potentially dependent people projected later in this paper.

Furthermore, prevalence rates give an (admittedly imperfect) idea of the burden of dependency compared to the number of potential carers able to look after dependent people through the financing of the system or informal aid. Informal care is often provided by relatives or friends, and in nearly half of all cases the main carer is the spouse (a woman in two-thirds of cases). In only a third of cases, aid is given by the children (Bontout *et al.* 2002). A more precise approach relating to informal carers is proposed in section 4.3.

[4] Such as allowances for the handicapped and supplementary family allowances.

Figure 1: Prevalence rates of the least restrictive dependency indicator by sex and age (in 2001)

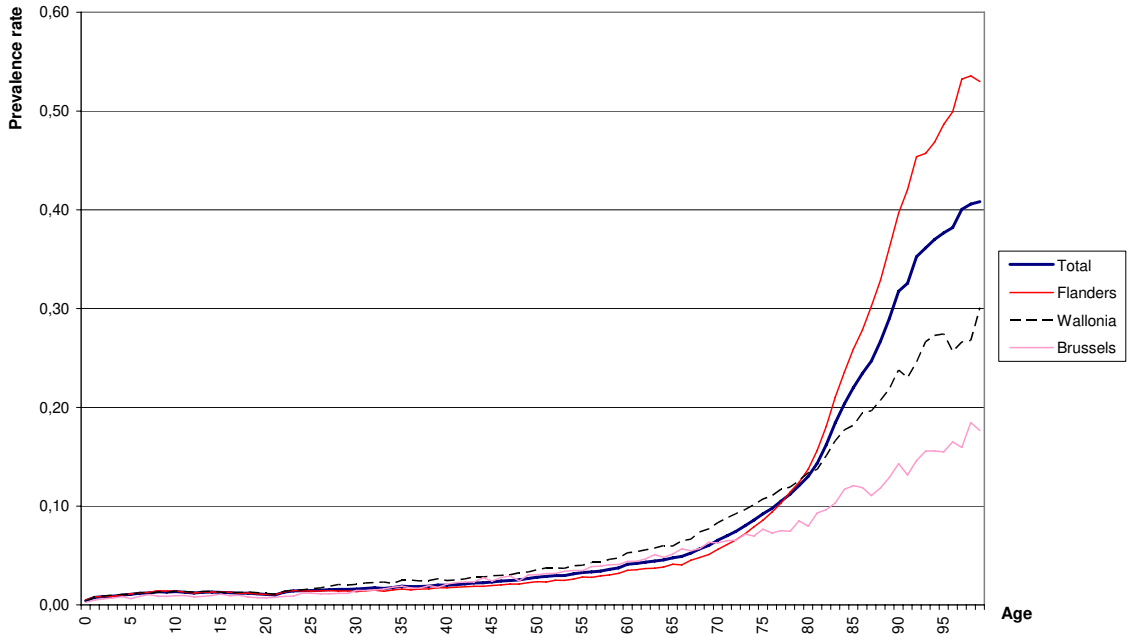


Source: Calculations based on data provided by the Belgian "*mutualités*".

Figure 1 gives an overall picture of national prevalence rates of the least restrictive dependency indicator by age and gender in 2001. Not surprisingly, the prevalence rates of the least restrictive indicator tend to grow with age: dependency and assistance needs are relatively significant among older people due to health deterioration with age. A second finding is the spectacular upsurge in the prevalence rates from the ages of 65-70. The prevalence rate at national level and for both sexes increased from 4.76% at the age of 65 to 31.75% at the age of 90. This acceleration is particularly important in the case of women aged between 70 and 80. For the youngest people, the prevalence rates show relatively little difference by gender. Up to the age of 40, the male rates are slightly higher than those of

women. From that age, the female rates exceed those of men but are still relatively close to them. Beyond 75 years, the gap between the male and female rates increases[5].

Figure 2: Prevalence rates of the least restrictive dependency indicator by region and age (in 2001)



Source: Calculations based on data provided by the Belgian "*mutualités*".

Figure 2 compares the prevalence rates relating to the three administrative regions of Belgium. For people under the age of 80, the Walloon prevalence rates are higher than those of the other two regions. Between 30 and 72 years, the Flemish rates are lower than those of the Region of Brussels-Capital. From the age of 80, the Flemish rates become far higher than those of the other two regions. These differences between regions increase with increasing age.

Given the above-mentioned limitations, caution is necessary in interpreting the data observed, notably in relation with the supply effect of assistance services. The image of dependency

[5] To give an idea of the sensitivity of the results obtained according the indicator used, it should be noted that the prevalence rates calculated by age on the basis of the most restrictive indicator (farthest from the one we are presenting) show a very similar profile if we disregard difference of scale. The widening of the gender gap, however, appears only from the age of 80.

reflected by the indicator used seems to indicate lower risks of becoming dependent in the regions of Wallonia and Brussels than in Flanders. The fact that the Region of Brussels-Capital records the lowest prevalence rates could suggest that it represents the Belgian region least affected by dependency. This may seem surprising, given the data from the *Belgian Health Survey by Interview (Enquête de Santé par Interview)* in 2001 (Tables A.1, A.2 and A.3 in appendix). For most of the indicators related to dependency and calculated through this survey, the gap between Brussels and the other regions is far smaller than the one that appears in our administrative data (Table A.4). According to the data on applications for official recognition of invalidity/disability shown in Table A.3, people with a pending application and persons who have not applied (whereas they would be in situation to do so) are relatively numerous in Brussels. This is a possible explanation for the underestimation of Brussels prevalence rates calculated on the basis of certificates, and it illustrates a deficiency in the administrative data for measuring dependency. The effects of this limitation inherent in the indicators used, however, appear much less marked in the other two regions. Moreover, the limitations to measure dependency (as above-mentioned) and in particular the lack of socio-economic and environmental parameters to estimate dependency are more pronounced in Brussels than in Flanders and Wallonia. Indeed, psycho-affective problems such as anxiety, psychological illness and depression are more present in urban-type sites (Van Oyen *et al.*, 2002). As a result, the non-consideration of socio-economic and environmental aspects contributes to explain the low prevalence rates calculated for Brussels.

In our results on the basis of administrative data, life expectancy in dependency is higher in Flanders than in Wallonia or Brussels in 2001. According to Van Oyen *et al.* (1996) and Van Oyen *et al.* (2002), as shown in Table 1, both the general life expectancy and healthy life expectancy of Walloons, calculated by subjective means, are lower than those of Flemings.

The difference between the two values is also much larger in Wallonia, particularly among men.

Several explanations for this apparent contradiction may be advanced. First, life expectancy in good health based on a subjective perception and life expectancy without dependency do not have the same meaning, regardless how dependency is measured. In addition, our dependency indicator is based on a mix of indicators referring for the most part to limitations in daily life activities and in the activities instrumental to daily living. But some physical limitations seem to be much more prevalent in Flanders than in the other regions (limitations concerning dressing and undressing, washing hands and face, cutting and eating food, going to the toilet, urinary continence, see Table A.1 in appendix)[6]. Indeed, Van Oyen *et al.* (2002) also obtain a greater life expectancy in dependency in Flanders from the age of 75 when using an indicator solely based on the functional limitations (see Table 1) described in Table A.1 (for 1997). Moreover, between 1997 and 2001, in Flanders, there was a relatively larger increase in the functional difficulties reflected by the ten items included in the two *Belgian Health Surveys by Interview*. Our results are clearly less surprising in the light of these findings.

A third point of comparison is the number of dependants at home having actually benefited from the Flemish care insurance scheme. Compared to the beneficiaries in 2003 (i.e. the second year of operation of care insurance), the number of dependants we find is much higher (59%), which is not surprising given that our indicators are much less restrictive than those actually employed in Flanders. However, the comparison of the number of dependants by age allows a reassuring finding about the quality of the indicator presented in this paper: the overestimation occurs mainly in the youngest age groups. The little restrictive nature of our dependency indicators, compared to Flanders, is therefore much more marked in the lower age groups. A first potential explanation is the non-consideration of more restrictive

[6] Caution is necessary in interpreting Table B.1 because of the subjective nature of data it collects.

conditions on handicap laid down in the Flemish provisions for the entitlement to the supplementary family allowance. A second potential explanation is the physiotherapy package *E* that is not among the criteria considered for Flemish dependency insurance. Indeed, the elderly beneficiaries of the physiotherapy package *E* often benefit from other supports ("aid for the elderly" allowance, home nursing care, allowance for third-party assistance), while the youngest may well be entitled only to the physiotherapy package *E* without fulfilling the other conditions used for dependency at home. As a consequence, taking into account the condition of physiotherapy package *E* will overestimate the dependency in the lower age groups. For people aged 65 and over, the overestimation rate is only 11%, and for those aged 75 and over the results are very similar: the difference is only 1.7%[7]. For this reason, our presentation will focus on the prevalence rates among the elderly.

4. PROJECTION BY 2050 OF PEOPLE IN DEPENDENCY

This section describes the projection by 2050 of dependency rates (at home) calculated for 2001 on the basis of population forecasts. Because of the methodology used, the projections of these rates reflect only the effects of expected demographic changes. They do not take into account the possible increase in demand for formal care directly caused by the introduction of the dependency insurance scheme or the modification of its terms, nor the potential problem of adverse selection inherent in the coexistence of competing insurance systems (see for instance Ruz Torres, 2004). The projection of the number of dependants does not take into account important aspects such as the change in methods of care.

4.1. Methodology

From the dependency prevalence rates computed for 2001, thanks to the indicators presented in the previous section, life expectancy in dependency by age was calculated for 2001 using Sullivan's method. To this end, we rely on the probabilities of death and life expectancy by

[7] More details are given in section 5.

age and region for the period 2001-2050 (*Institut National de Statistique* and *Bureau fédéral du Plan*, 2001).

Once life expectancy in dependency had been determined for 2001, we did it evolve according to four different scenarios. Thanks to these projections of life expectancy in dependency, it is possible to calculate future dependency prevalence rates until 2050.

4.1.1. Survival table and calculation of life expectancy with and without dependency

The method devised by Sullivan (1971) combines the prevalence of disability observed at each age in the population with survival table data to break down life expectancy according to different functional disability states[8]. Basically, the idea is to calculate life expectancy without disability or dependency after deducting the period of disability or dependency from the total lifetime.

The starting point is the survival table, which relates mortality conditions in a given year to a fictitious birth cohort (about 1,000,000 people), assuming that these people would know these specific conditions throughout their life, by deducting a theoretical life expectancy at birth or at each age, which is a reflection of the mortality conditions for that year. These probabilities of death, deriving from projections for 2001, represent the deaths of the year by age relative to the population of this age on 1 January 2001. Life expectancy calculated from the table is then split into life expectancies without and with dependency by means of the Sullivan's method.

Life expectancy without dependency is obtained by subtracting life expectancy in dependency (different in each scenario) from the total life expectancy (coming from demographic projections). The details of the calculations are given in appendix B.

4.1.2. Assumptions about the evolution of life expectancy in dependency

Projections of life expectancy with and without dependency have been conducted based on the situation in 2001 by considering four different scenarios. The first rests on the assumption

[8] For examples of its application, see Saito *et al.* (1991) or Bossuyt *et al.* (2000).

that the prevalence rates are invariable by age, while the other three consider different assumptions about the evolution of life expectancy in dependency.

Pessimistic scenario A: the prevalence rates by age calculated for 2001 remain constant up to 2050. This scenario assumes that the number of dependants varies in parallel with the total population. It does not take into account the actual downward trend in dependency rates for certain ages and consequently it potentially overestimates the number of dependants. For that reason, it may be regarded as the upper limit in the quantification of dependants. It also provides comparisons with existing projections based on the same hypothesis (Breda *et al.*, 2000; Ethgen *et al.*, 2003; Mestdagh and Lambrecht, 2003). This is a scenario of expanding morbidity.

Pessimistic scenario B: a situation where the lifetime spent in dependency changes in parallel with total life expectancy. Total life expectancy and life expectancy in dependency experience identical growth rates. It is a scenario of dynamic equilibrium. Formally, the difference between pessimistic scenario A and pessimistic scenario B becomes clear in the equation (C1) in our appendix. In the first scenario, the prevalence rates by age are held constant ($P_{i,t} = P_{i,2001}$). In the second scenario, life expectancy in dependency by age $EVD^*_{i,t}$ grows at the same rate as total life expectancy and the prevalence rates change accordingly.

Central scenario: life expectancy in dependency remains constant over time. The extra years of life are only years of life without dependency and the emergence of dependency shifts to older ages, which means a decrease in the dependency rates by age. This scenario of morbidity compression is our central scenario. Indeed, Bontout *et al.* (2002) and Duée and Rebillard (2004) cite several authors who report this scenario as the most likely.

Optimistic Scenario: life expectancy in dependency decreases over time. In other words, any increase in life expectancy would be accompanied by a decrease in life expectancy in dependency, which would mean a considerable improvement in the health status of the

population. We assume that the reduction in life expectancy in dependency between 2001 and 2050 is equivalent to half the general life expectancy growth rate over the same period. The average growth rate of the corresponding life expectancy in dependency is applied to determine the life expectancy in dependency for the intermediate years. This is a scenario of high morbidity compression.

As Bontout *et al.* (2002) note, the credibility of these scenarios depends on the timeframe considered. For instance, decisive progress to limit the development of dementia become more and more probable when we lengthen the projection period, and as a result the credibility of the most optimistic scenarios increases.

4.1.3. Projection methodology for dependency prevalence rates

Once the projections of life expectancy in dependency have been carried out, the dependency prevalence rates are calculated between 2001 and 2050 using the four above-mentioned scenarios.

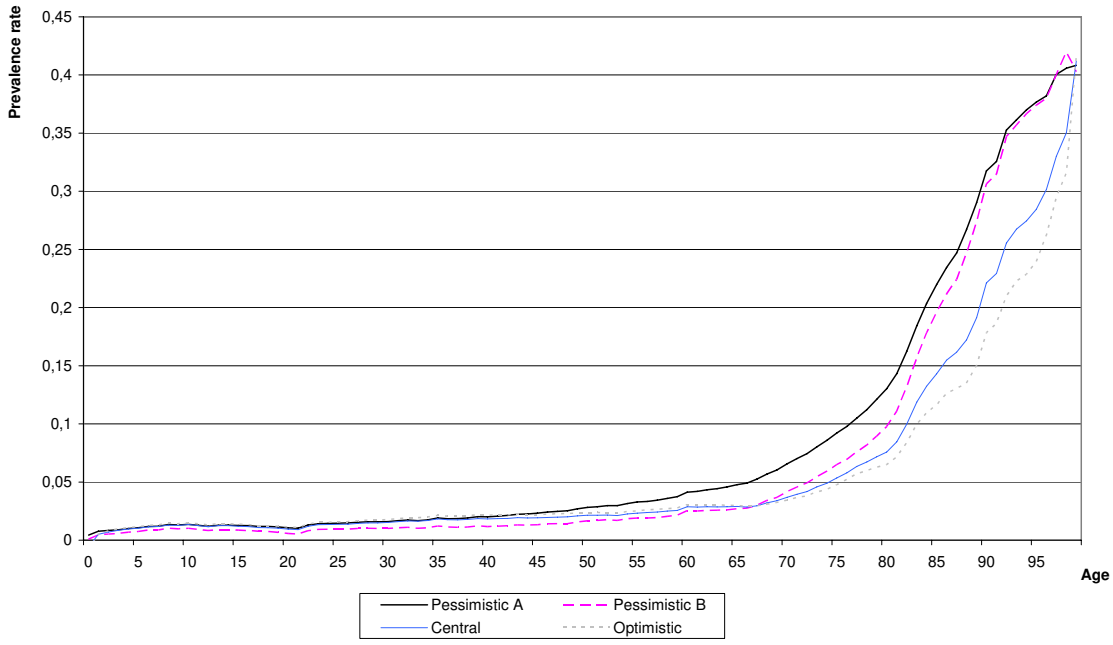
In the first (pessimistic A) scenario, the prevalence rates from 2001 to 2050 are assumed constant. Therefore, the number of dependants estimated for each year of life is directly obtained by multiplying the prevalence rates by the corresponding population.

The other three scenarios apply different assumptions on the evolution of general life expectancy and life expectancy in dependency (as mentioned above). The practical implementation is illustrated in appendix C. As the value of life expectancy in dependency by age varies according to the scenario used for the projection, the prevalence rates obtained by age will be different for each scenario.

Figure 3 presents the implications of these scenarios in terms of prevalence rates by age at the end of the period (2050) at national level. Compared to the pessimistic scenario A, the curves relating to the other scenarios also show a reduction in prevalence rates between 2001 and 2050. The decrease in prevalence rates is especially noticeable in the over-60 age groups. This

drop is all the more pronounced as the degree of optimism of the scenarios considered increases: it is mostly from the age of 60 that the differences between scenarios count[9].

Figure 3: Prevalence rates by age according to different scenarios, for Belgium in 2050



Source: Calculations based on data provided by the INS-BfP and the Belgian "*mutualités*".

4.2. Results of the projection of dependency at home

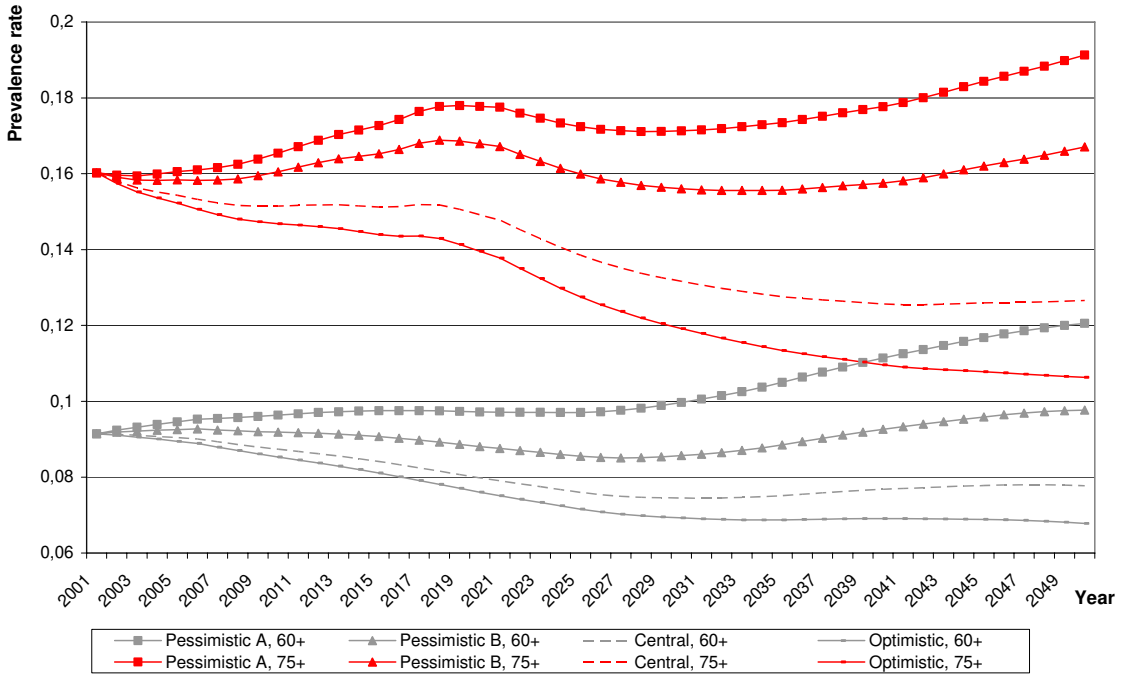
Projections were made for each year up to 2050 by using several alternative indicators of dependency and the four above-mentioned scenarios. Only the results obtained on the basis of the least restrictive dependency indicator are shown[10]. The presentation focuses on projections of the dependency prevalence rates for the elderly aged over 60 and for people over 75, age groups for which the number of dependants obtained is close to reality and the differences between scenarios are obvious.

[9] The peak observed beyond the age of 95 can be explained by the low number of population for this age group.
[10] In general, the evolutions of the other indicators calculated are relatively similar.

4.2.1. Projection of the national prevalence rates

Figure 4 shows a decrease in the national prevalence rates for people aged over 60 until the second half of 2020 for three out of four scenarios, with the exception (of course) of pessimistic scenario A, in which the prevalence rates by age remain hypothetically constant over time. This drop is even more pronounced when one brings in a more optimistic scenario. The total prevalence rates for people aged over 60 increase in the period from 2030 to 2050, except in the optimistic scenario. This growth is most pronounced in the most pessimistic scenarios. In addition, over the period 2001-2050, the prevalence rates decline only in the central and optimistic scenarios, while they increase in the other two scenarios. According to the scenario, the prevalence rates for Belgium are situated in a range from 67 to 120 dependants over 60 per thousand using the least restrictive indicator.

Figure 4: Projections of dependency prevalence rates at national level, for people aged over 60 and over 75 and according to different scenarios



Source: Calculations based on data provided by the INS-BfP and the Belgian "*mutualités*".

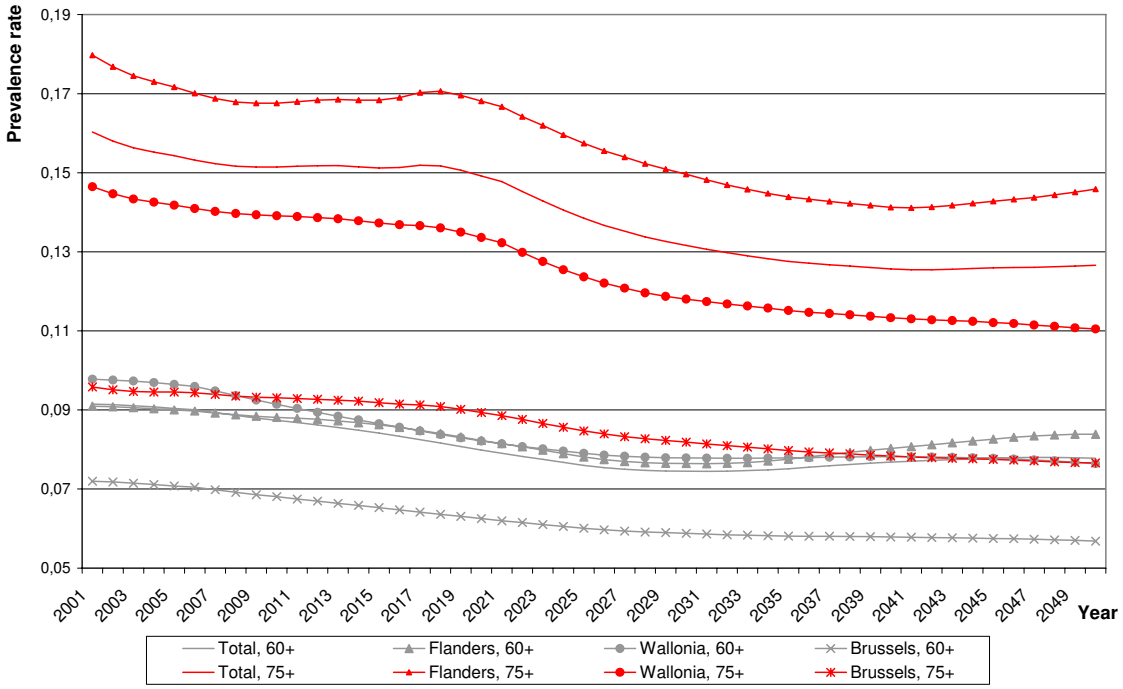
As dependency rises with age, the prevalence rates for those aged over 75 are relatively higher than those of people over 60. During the fifty years surveyed, these prevalence rates vary from 106 to 191 dependants over the age of 75 per thousand in Belgium. The evolution of the prevalence rates for people aged over 75 is parallel to that of people over 60. However, for those over 75, the drop in the prevalence rates occurs from the end of 2010. In addition, from 2001 to 2020, we even see an increase in the rates in the case of the two most pessimistic scenarios[11].

4.2.2. Projection of prevalence rates by region

Figure 5 shows the regional prevalence rates obtained on the basis of the central scenario, in which life expectancy in dependency remains unchanged over time. The prevalence rates for people aged over 75 decrease spectacularly from the late 2010 and up to the end of 2030, and then remain relatively constant (or even increase slightly) until 2050. These findings are valid for all three regions.

[11] The proportion of dependent people calculated with the most restrictive indicator shows a similar evolution, except that the prevalence rates are, of course, much lower. During the period 2001-2050, they range from 10 to 21 dependants over 60 years old per thousand and from 20 to 38 dependents over 75 years old per thousand in Belgium (calculated using the most restrictive indicator).

Figure 5: Projections of dependency prevalence rates by region, for people aged over 60 and over 75 using the central scenario



Source: Calculations based on data provided by the INS-BfP and the Belgian "*mutualités*".

The prevalence rates show a more marked dependency in Flanders at the beginning of the period. The evolution of the Flemish prevalence rates also differs from that of the other regions. From the beginning of 2040, there is an increase in the prevalence rates for Flanders while they decrease for the other two regions. The prevalence rates for Wallonia and Brussels seem, however, to be stabilizing by 2050. If the upward trend of the prevalence rate observed between 2045 and 2050 extended beyond our projection horizon, the Flemish Region could in the very long term experience a substantial increase in the number of dependants as measured by the indicator used. This evolution induced by the increase in the prevalence rates will be all the more pronounced since the older population will grow as well. The prevalence rates for all ages show similar growth: a slight decrease in Brussels and Wallonia and an increase in Flanders (in the case of the central scenario).

For those aged over 75, the differences in the prevalence rates between the regions remain relatively constant throughout the period analyzed (2001-2050). Individuals over the age of 75 living in Flanders are again more likely to become dependent than people of the same age group in the other two regions. We should once again read the Figure 5 keeping in mind the limitations of administrative data, in particular as regards the low prevalence rates recorded in Brussels.

For over 60-year-olds, the evolution of the prevalence rates throughout the period considered is similar to that observed for persons aged 75 and over, with less marked gradients. The national, Flemish and Walloon rates vary in the same direction and are very close to each other. At the beginning of the period, the Walloon rates are even higher than those of Flanders and Belgium as a whole, so that by 2050 the opposite situation prevails: the Flemish rates should be higher than the Walloon and national rates. Once again, Flanders could eventually face a considerable increase in the number of dependants in the long-term.

The differences between the regions do not evolve in the same way according to the scenario used. There is indeed a decreasing difference in the prevalence rates between the regions when using more optimistic scenarios about the evolution of life expectancy in dependency.

For people aged over 75 (Figure 6), the most significant differences in prevalence rates among the regions are obtained using pessimistic scenario A. They diminish over the study period as the degree of optimism of the considered scenarios increases. In other words, whereas the divergences increase significantly with pessimistic scenario A and in a less pronounced way with pessimistic scenario B throughout the period, they remain relatively constant over time under the central scenario and are even reduced in the case of the optimistic scenario. In 2001, the gaps between Wallonia and Flanders are 3.3 percentage points in favour of the Walloon Region. In 2050, they amount to 6 percentage points in the case of pessimistic scenario A, 4.1 percentage points with pessimistic scenario B, 3.5

percentage points with the central scenario and 3.2 percentage points with the optimistic scenario. In the latter case only, the differences between Flanders and Wallonia decline. As regards the inequalities between the Walloon Region and the Region of Brussels-Capital, the prevalence rate gaps, in favour of Brussels, rise from 5 percentage points in 2001 to 6.2 in 2050 for pessimistic scenario A, and to 2.4 percentage points for the optimistic scenario. Thus, the choice of scenario significantly influences the magnitude of the differences between the three regions.

According to Figure 7, the situation regarding the gap between regions depending on the optimism degree of scenario does not seem very different for people aged 60 and older. It should be noted that for this age group, the Flemish prevalence rates are initially lower than the Walloon rates but end up exceeding those of the other regions, whichever scenario is used.

Figure 6: Projections of dependency prevalence rates by scenario and region using the least restrictive indicator and for people aged over 75

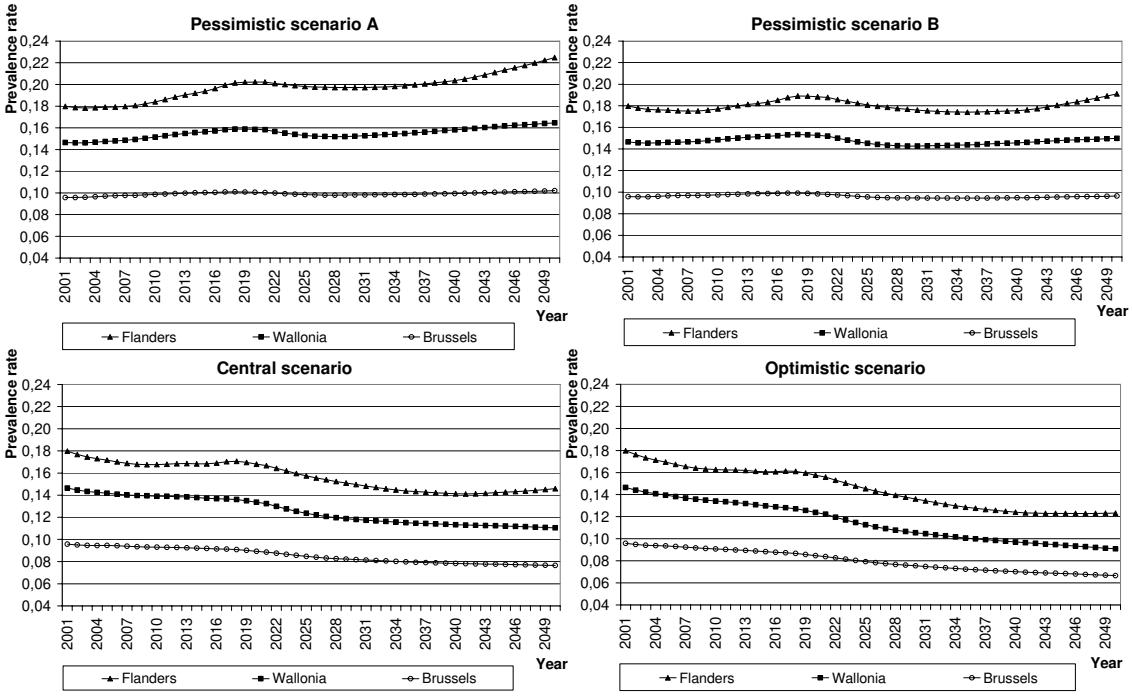
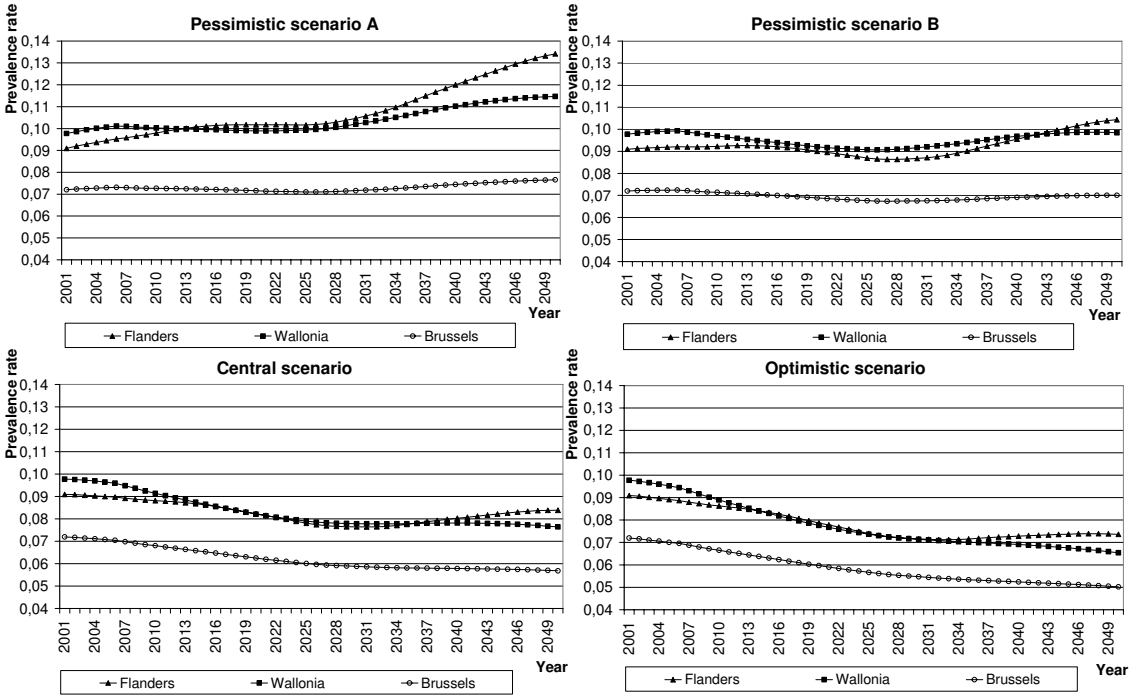


Figure 7: Projections of dependency prevalence rates by scenario and region using the least restrictive indicator and for people aged over 60



4.3. Projection of the number of dependants at home

Table 2 shows the growth rates between 2001 and 2050 in the number of dependants and in the population over the age of 60, over 75 and the total population[12]. Given the significant variations in the number of dependants obtained according to the indicator used, we do not present the number of dependants obtained, but the growth rates for dependants between 2001 and 2050. Indeed, these growth rates being largely determined by demographic change, they are relatively less sensitive to the definition of the indicator used than to the number of dependants.

Table 2: Evolution of the number of dependants between 2001 and 2050 (growth rates in %)

	Dependants (by scenario)				Population
	Pessimistic A	Pessimistic B	Central	Optimistic	
60+					
Belgium	105.54	67.34	33.64	16.82	57.55
Flanders	127.91	78.22	43.71	26.48	56.22
Wallonia	89.87	63.51	27.35	9.31	63.30
Brussels	54.23	41.45	15.06	1.90	45.73
75+					
Belgium	158.65	126.57	72.51	45.45	115.81
Flanders	186.37	144.38	87.40	58.88	127.73
Wallonia	139.10	118.06	61.66	33.45	112.22
Brussels	72.13	62.77	29.81	13.33	61.45
All age					
Belgium	58.67	21.48	10.64	5.25	6.18
Flanders	73.69	28.44	16.67	10.81	1.70
Wallonia	48.73	18.64	7.20	1.52	11.87
Brussels	32.86	12.31	5.29	1.81	13.98

Source: Calculations based on data provided by the INS-BfP and the Belgian "*mutualités*".

We saw that the least restrictive indicator overestimates the number of dependants belonging to the youngest age groups (i.e. below the age of 60)[13]. The effect of demographic changes is thereby attenuated, and we obtain relatively low growth rates for the total number of dependants in the overall population. That is why we have a growth rate for the number of

[12] As was the case for all the results presented, the number of dependants is obtained using the least restrictive indicator.
[13] More details are given in the next section.

dependants at home of only 58.67% using pessimistic scenario A (assuming the prevalence rates are constant over time), while Mestdagh and Lambrecht (2003) estimate the growth at 124%.

For the 60 and over and 75 and over age groups, however, our indicator gives results much closer to the number of people supported/assisted by the Flemish care insurance scheme. For these two age groups, our growth rates for the number of dependants are situated in the same order of magnitude as those of Mestdagh and Lambrecht (they estimate the growth at 170% and 130% for the 75 and over and 60 and over age groups respectively). Whatever the scenario and the age group selected, the growth rate between 2001 and 2050 in the number of Flemish dependants is higher than that for the other two regions.

The burden of dependency for informal carers can be determined in a more subtle way than with the prevalence rates previously studied, by comparing the evolution in the number of dependants with that of potential carers. As Bontout *et al.* (2002) report, the majority of informal carers consists of people aged between 50 and 79. The population of this age group increases by 23.89% in Belgium between 2001 and 2050, more slowly than the number of elderly dependants (except dependants aged 60 and over for the optimistic scenario). The growth in the number of potential carers, 19.82% for Flanders, 30.01% for Wallonia, and 29.19% for Brussels, accentuates the unfavorable findings for Flanders in terms of the dependency burden in all cases.

5. ASSESSING THE COST OF LONG-TERM CARE INSURANCE IN WALLONIA

The purpose of this section is to calculate the budgetary cost of introducing dependency insurance in Wallonia, beginning at the same time as the *Vlaamse Zorgverzekering* (Flemish insurance), equivalent to the latter and undergoing the same adjustments as those observed in Flanders. In other words, we assume that the scope, the financing and the services supplied by

the Walloon Region, and their adaptations, will be identical to the Flemish dependency insurance scheme.

The prevalence rates by region and age group, calculated using administrative data and the least restrictive indicator, are applied to the corresponding population in order to obtain the number of people fulfilling the conditions required to enjoy benefits paid out by the Flemish care insurance scheme. We should remember, however, that these conditions are quite similar, but often less restrictive than in Flanders. From the actual data related to the number of Flemish aid beneficiaries (in 2002, 2003 and 2004), we are able to adapt our results about Flanders to each age group. This "correction" by age group is then applied to the data calculated for the Walloon region (Table 3). This is done by multiplying, for each region and each age group, our estimations of the number of dependants by the ratio between the actual number of Flemish dependants and the number of Flemish dependants estimated on the basis of our prevalence rates. In addition to the evolution of the regional prevalence rates, this approach makes the implicit assumption that the propensity to resort to *MRS*, *MRPA* and *MSP* by age group is the same in Flanders and in Wallonia. It also takes into account the supply effect (insofar as it exists), but also the other factors such as changes, adjustments or amendments to the Flemish legislation observed since the birth of the *Vlaamse Zorgverzekering* until the end of 2004. As previously mentioned on several occasions, the data and criteria used in the calculation of our prevalence rates overestimate the number of dependants in Flanders for the youngest age groups, while this is not the case for others (Table 3). The column "known" shows the number of people actually receiving assistance in Flanders, while the column "before correction" shows the number of aid beneficiaries estimated using administrative data and the least restrictive indicator. Finally, the column "after correction" corrects our estimated results for each age group thanks to the actual

number of dependants in the Flemish Region (as mentioned above). The correction is then applied to the other two regions.

So on 31 December 2002, the number of Flemish dependants observed was 120,338, whereas it amounts to 200,153 in our estimations. The overestimation is mainly concentrated at the level of the lowest age groups (0-64). The correction to our estimations is used to solve the problem resulting from the administrative data and criteria used in the calculation of prevalence rates. These corrections have also focused on 2003 and 2004.

Table 3: Number of dependants (central scenario)

31/12/2002	Known	Before correction				After correction			
	Flanders	Flanders	Wallonia	Brussels	Belgium	Flanders	Wallonia	Brussels	Belgium
0-18	2,626	14,791	9,161	1,782	25,734	2,626	1,626	316	4,569
19-25	1,604	6,525	3,905	883	11,312	1,604	960	217	2,781
26-44	6,617	26,390	21,427	5,188	53,006	6,617	5,373	1,301	13,290
45-64	13,329	40,368	32,915	7,468	80,751	13,329	10,868	2,466	26,663
65-69	7,137	13,532	10,147	2,156	25,835	7,137	5,352	1,137	13,626
70-74	11,779	18,431	13,893	2,558	34,882	11,779	8,879	1,635	22,293
75-79	17,940	22,555	14,632	2,666	39,854	17,940	11,638	2,121	31,699
80-84	21,393	23,382	11,843	2,363	37,588	21,393	10,835	2,162	34,390
85-89	19,364	18,661	6,691	1,450	26,802	19,364	6,943	1,505	27,812
90-94	13,892	12,178	3,733	892	16,802	13,892	4,258	1,017	19,168
>=95	4,657	3,340	967	278	4,585	4,657	1,348	387	6,393
0-64	*24,176*	*88,074*	*67,407*	*15,322*	*170,803*	*24,176*	*18,827*	*4,300*	*47,303*
>=65	*96,162*	*112,079*	*61,906*	*12,363*	*186,348*	*96,162*	*49,254*	*9,964*	*155,380*
TOTAL	**120,338**	**200,153**	**129,314**	**27,684**	**357,151**	**120,338**	**68,081**	**14,264**	**202,683**

31/12/2003	Known	Before correction				After correction			
	Flanders	Flanders	Wallonia	Brussels	Belgium	Flanders	Wallonia	Brussels	Belgium
0-18	2,673	14,680	9,112	1,785	25,577	2,673	1,659	325	4,657
19-25	1,689	6,492	3,901	882	11,276	1,689	1,015	230	2,934
26-44	6,777	26,085	21,210	5,172	52,466	6,777	5,511	1,344	13,631
45-64	13,090	40,448	33,112	7,494	81,055	13,090	10,716	2,425	26,231
65-69	7,055	13,351	9,966	2,123	25,440	7,055	5,266	1,122	13,443
70-74	11,898	18,342	13,527	2,488	34,357	11,898	8,775	1,614	22,287
75-79	18,450	22,401	14,458	2,589	39,448	18,450	11,908	2,132	32,490
80-84	25,486	26,235	13,047	2,573	41,854	25,486	12,675	2,499	40,660
85-89	19,106	16,932	6,145	1,317	24,394	19,106	6,934	1,486	27,526
90-94	15,024	12,532	3,810	907	17,248	15,024	4,567	1,087	20,678
>=95	4,989	3,543	1,019	288	4,850	4,989	1,435	406	6,831
0-64	*24,229*	*87,704*	*67,335*	*15,333*	*170,373*	*24,229*	*18,901*	*4,323*	*47,453*
>=65	*102,008*	*113,336*	*61,971*	*12,285*	*187,592*	*102,008*	*51,560*	*10,347*	*163,914*
TOTAL	**126,237**	**201,040**	**129,307**	**27,618**	**357,965**	**126,237**	**70,460**	**14,670**	**211,367**

30/09/2004	Known	Before correction				After correction			
	Flanders	Flanders	Wallonia	Brussels	Belgium	Flanders	Wallonia	Brussels	Belgium
0-18	2,781	14,602	9,053	1,785	25,440	2,781	1,724	340	4,845
19-25	1,713	6,419	3,922	881	11,222	1,713	1,047	235	2,995
26-44	7,083	25,773	20,935	5,149	51,857	7,083	5,753	1,415	14,251
45-64	14,908	40,669	33,407	7,535	81,611	14,908	12,246	2,762	29,916
65-69	8,132	13,114	9,805	2,096	25,015	8,132	6,080	1,300	15,512
70-74	13,874	18,187	13,153	2,422	33,762	13,874	10,034	1,847	25,755
75-79	21,551	22,310	14,234	2,507	39,051	21,551	13,749	2,422	37,722
80-84	32,603	27,684	13,698	2,666	44,047	32,603	16,132	3,139	51,874
85-89	23,167	16,723	6,163	1,303	24,189	23,167	8,538	1,805	33,510
90-94	19,315	12,846	3,924	927	17,697	19,315	5,900	1,394	26,609
>=95	6,146	3,688	1,051	296	5,035	6,146	1,751	494	8,390
0-64	*26,485*	*87,464*	*67,317*	*15,349*	*170,130*	*26,485*	*20,770*	*4,752*	*52,007*
>=65	*124,788*	*114,552*	*62,027*	*12,217*	*188,795*	*124,788*	*62,183*	*12,400*	*199,372*
TOTAL	**151,273**	**202,016**	**129,344**	**27,566**	**358,925**	**151,273**	**82,953**	**17,152**	**251,379**

Source: Het Vlaams Zorgfonds.
Calculations based on data provided by the *Vlaams Zorgfonds*, the INS-BfP and the Belgian "*mutualités*".

After "correction", we use the average cost of Flemish care insurance for the Walloon Region. The average budgetary cost for Flemish care insurance in period t ($Cm_{F,t}$) corresponds to the ratio between the total Flemish expenditure in t ($D_{F,t}$) and the number of Flemish dependants in t ($N_{F,t}$):

$$Cm_{F,t} = \frac{D_{F,t}}{N_{F,t}} \qquad t = 31/12/2002, 31/12/2003 \text{ or } 30/09/2004$$

According to the actual Flemish data, the number of files accepted, or dependants, is 120,338 and the total expenditure is € 180,368,000 on 31 December 2002 (we do not take into account transfers to the budget for the following year). Thus, the average cost amounts to approximately € 1,500 (€ 180,368,000/120,338) in 2002. The average cost is about € 1,485 (€ 187,518,000/126,237) and € 1,375 (€ 205,188,000/149,459) on 31 December 2003 and 30 September 2004 respectively. We then apply these average budgetary costs to the Walloon Region in order to determine the total cost of a Walloon long-term care insurance scheme in 2002, 2003 and 2004.

The total budgetary cost of a long-term care insurance scheme in Wallonia in time t ($Ct_{W,t}$) corresponds to the product of the average budgetary cost in t ($Cm_{F,t}$) and the number of dependants in Wallonia in t "after correction" ($\tilde{N}_{W,t}$):

$$Ct_{W,t} = Cm_{F,t} * \tilde{N}_{W,t} \qquad t = 31/12/2002, 31/12/2003 \text{ or } 30/09/2004$$

The net budgetary cost of a dependency insurance scheme in Wallonia in time t ($Cn_{W,t}$) is equal to its total budgetary cost in t ($Ct_{W,t}$) minus the sum of contributions paid in t by the affiliates of the Walloon care insurance scheme ($R_{W,t}$, i.e. minus the number of affiliates multiplied by the annual personal fee which is € 10 in 2002 and € 25 from 1 January 2003).

Formally, the net budgetary cost is given by:

$$Cn_{W,t} = Ct_{W,t} - R_{W,t} \qquad t = 31/12/2002, 31/12/2003 \text{ or } 30/09/2004$$

Table 4 shows the total and net budgetary costs of a dependency insurance scheme in Wallonia in 2002, 2003 and 2004.

Table 4: Cost of a long-term care insurance scheme in Wallonia (in euros)

	Scenario	2002	2002	2003	2004
Personal contribution		€ 25	€ 10	€ 25	€ 25
Affiliates		2,294,347	2,294,347	2,303,085	2,311,668
Total of contributions		51,438,471	22,943,470	51,634,374	52,243,801
Total cost	Pessimistic A	102,262,916	102,262,916	105,108,898	120,009,333
	Pessimistic B	102,095,612	102,095,612	104,773,229	118,785,702
Net cost	Pessimistic A	50,824,445	79,319,446	53,474,524	67,765,532
	Pessimistic B	50,657,141	79,152,142	53,138,855	66,541,901

Source: Het Vlaams Zorgfonds and calculations based on data provided by the *Vlaams Zorgfonds*, the INS-BfP and the Belgian "*mutualités*".

In other words, the establishment of dependency insurance in Wallonia at the same time as the *Vlaamse Zorgverzekering* would need to find a new budget requiring a sacrifice amounting to about € 79 million in 2002 with an annual contribution per person of € 10 (as was the case at the beginning of the *Vlaamse Zorgverzekering*), whereas if it were € 25 from the beginning, the net cost would be only € 50 million (i.e. 36% lower). With adaptations to the Walloon long-term care insurance scheme similar to those of the *Vlaamse Zorgverzekering*, the net cost or the budget to be found would reach about 53 million and 67 million in 2003 and 2004 respectively. It should be noted that the increased costs in 2004 mainly result from the extension of Flemish care insurance.

Knowing the estimated number of dependants in the Walloon Region (Table 3), it is also possible to calculate the cost of long-term care insurance in Wallonia with a system more or less generous than the *Vlaamse Zorgverzekering* (in terms of average cost).

6. CONCLUSION

The lack of data about dependency in Belgium has prompted the Flemish Region to use certificates/attestations from administrative data to grant the right to benefit from Flemish long-term care insurance. The main objective of this study is to assess the extent of

dependency at home in the three Belgian regions using similar indicators, based on administrative data, and to obtain forecasts for its long-term evolution in the three regions of the country.

As a first step, we use administrative data on the Belgian population to construct indicators of the prevalence of dependency at home in the three regions in 2001. The results obtained indicate highly differentiated prevalence rates between the regions in 2001. *A priori*, the differences measured between the regions seem not unrealistic in view of the measurement tool selected, but they do not only measure differences in dependency. They must be interpreted in the light of the limitations of the indicator used, which is based on administrative data for the recognition of dependency. The administrative criteria used, especially taking into account the functional limitations, seem to show a better understanding of dependency in Flanders than in the other two regions. In particular, the measurement tool strongly underestimates dependency in the Region of Brussels.

In a second stage, we conduct several projections of the evolution of the prevalence rates obtained from population projections and life expectancy up to 2050. For this purpose, four scenarios are considered: constant prevalence rates by age, life expectancy in dependency increasing in parallel with general life expectancy, constant life expectancy in dependency (central scenario), and decreasing life expectancy in dependency.

With robust growth in the older population, we can expect an increase in the number of heavily dependent people, which presents significant long-term challenges in terms of needs evolution and financing. The magnitude of this effect, important in the scenario of unchanged prevalence rates by age, is significantly reduced when we consider more realistic scenarios.

The implementation of these more realistic scenarios concerning the evolution of morbidity offers more optimistic projections than with constant prevalence rates by age.

When comparing projections of the dependency indicator for the different regions, the quasi-stability of prevalence rates among the elderly in Wallonia and Brussels in the long term contrasts with the projected increase in Flanders. Since the prevalence rates presented for people over the age of 60 and those over 75 give an (imperfect) indication of the relationship between dependants and potential carers, lower rates in Brussels and Wallonia imply that the burden of long-term care might be divided among a larger number of non-dependent people.

However, the differences between the regions are reduced when we take into account more optimistic (and therefore more realistic) scenarios. The evolution of these differences between 2001 and 2050 also varies according to the scenario chosen. Despite these nuances, the different scenarios are in concord with each other: the Flemish Region should expect a more significant evolution in the burden of dependency at home (as measured by the indicator considered) than the other regions. The prevalence rates should even rise in Flanders in the final period, while remaining stable or declining in the other regions. Given that the relationship between the number of dependants and the number of people potentially supporting dependency evolves unfavorably at the end of the period, and perhaps beyond if the trend continues, the burden of long-term care may be more difficult to bear in Flanders in the very long term.

However, we must keep in mind the limitations of the indicator used to measure dependency. In addition, the projection methodology used is mainly based on demographic changes and does not take into account potential changes in behavior, particularly associated with a development in the supply of services, the introduction of Walloon dependency insurance or problems of adverse selection. The interactions with federal measures that provide the basis for the allocation of interventions are not taken into account either.

The prospects of a reduction in the Walloon and Brussels prevalence rates are likely to temper concerns about the sustainability of any long-term care insurance in Wallonia and thus to

facilitate its eventual introduction. The increase expected in Flanders ultimately reinforces the magnitude of the financing problems that the Flemish dependency insurance scheme has experienced since its initial years of operation.

These findings will have different consequences according to how much responsibility the dependency insurance organization would have.

A possible second system of long-term care insurance, introduced concurrently with the Flemish insurance scheme and based on administrative criteria, would cover a population with relatively low and declining prevalence rates (resulting from a better situation in terms of dependency). We can therefore imagine that in the very long term, this system will be in a position to offer more generous benefits than the Flemish long-term care insurance scheme, all other things being equal. In Brussels, where the choice between the two systems should in any case remain possible, such a situation could exacerbate the problem of adverse selection.

The differences in dependency measured between the regions appear to decrease when we choose more optimistic evolution scenarios for life expectancy in dependency, but this does not totally compensate for the initial high divergences. It would seem necessary to find an adequate response to the problem of the quality of the dependency indicator so as to take better account of dependency in all three regions. This is particularly important for Wallonia and Brussels, and is seen as a necessary step before the introduction of long-term care insurance in Wallonia although the French and German-speaking parts of the country can not afford to finance such an insurance and they deem this long-term care insurance falls within the competence of Social Security (a federal jurisdiction) contrary to the Flanders that considers this insurance as a part of the assistance policy to the elderly (a regionalized jurisdiction). Or, if we wish to dream, before the establishment of a hypothetical federal system of dependency insurance.

Our findings have also enabled us to draw some conclusions in terms of regional policy on the dependency or loss of autonomy of the elderly.

Thus, the fact that the dependency prevalence rates measured using administrative data are higher in Flanders means that the inhabitants of this region would benefit more than others from a uniform application of long-term care insurance based on the same administrative criteria throughout the country. In the hypothetical case that dependency insurance based on identical administrative criteria were to be introduced at federal level, inequalities in support/assistance between regions could be perceived as unfair in cases where they were mainly determined not by different needs but by imperfections in the measuring instrument. According to this assessment of dependency insurance, establishing a federal system of dependency insurance would be beneficial only for Flanders, to the detriment of Wallonia and Brussels.

7. APPENDIX

Appendix A: Tables

Table A.1: People aged 65 and over with physical limitations (%)

Region	Physical limitations	Moderate limitation	Severe limitation
Flanders	Mobility	15.2%	10.9%
Wallonia		19.6%	9.6%
Brussels		14.3%	12.3%
Flanders	Getting up and going to bed	13.9%	4.7%
Wallonia		16.5%	3.2%
Brussels		17.0%	3.9%
Flanders	Sitting and standing	15.8%	2.8%
Wallonia		15.0%	1.9%
Brussels		15.7%	2.7%
Flanders	Dressing and undressing	16.3%	6.7%
Wallonia		9.7%	3.8%
Brussels		12.8%	3.8%
Flanders	Washing hands and face	6.7%	5.6%
Wallonia		4.4%	2.4%
Brussels		4.4%	2.5%
Flanders	Cutting and eating food	6.4%	3.5%
Wallonia		3.3%	2.7%
Brussels		5.2%	2.5%
Flanders	Going to the toilet	8.5%	2.3%
Wallonia		5.1%	1.6%
Brussels		5.8%	1.7%
Flanders	Urinary continence	4.9%	11.2%
Wallonia		3.1%	14.4%
Brussels		3.1%	16.6%
Flanders	Hearing	17.8%	2.4%
Wallonia		20.5%	2.3%
Brussels		19.7%	2.9%
Flanders	Vision	7.8%	0.5%
Wallonia		9.9%	1.5%
Brussels		12.3%	2.3%
Flanders	Biting and chewing hard food	8.2%	17.1%
Wallonia		9.2%	15.2%
Brussels		10.9%	13.7%

Source: Enquête de santé par Interview, Belgique 2001 – Institut Scientifique de la Santé Publique (Gisle *et al.* 2002).

Table A.2: People aged 65 and over considering their health status as very poor to medium according to the subjective survey (%)

Region	Very poor to medium health status
Flanders	46.0%
Wallonia	48.9%
Brussels	45.4%

Source: Enquête de santé par Interview, Belgique 2001 (Subjective Survey) – Institut Scientifique de la Santé Publique (Gisle *et al.* 2002).

Table A.3: People aged 65 and over having an officially recognized disability or handicap (%)

Region	Officially recognized	Application underway	No application
Flanders	11.19%	0.94%	6.31%
Wallonia	16.16%	0.60%	4.94%
Brussels	13.03%	1.93%	5.86%

Source: Enquête de santé par Interview, Belgique 2001 – Institut Scientifique de la Santé Publique (Gisle *et al.* 2002).

Table A.4: People aged 65 and over having at least one of the social franchise and chronic disease packages on the basis of administrative data (%)

Region	With the least restrictive indicator
Flanders	10.8%
Wallonia	11.0%
Brussels	7.9%

Source: Calculations based on data provided by the Belgian "*mutualités*".

Appendix B: Survival table and calculation of life expectancy with and without dependency

The method devised by Sullivan (1971) combines the disability (or dependency) prevalence observed at each age in the population with the data from a survival table to break down life expectancy according to different functional disability states. The idea is to calculate life expectancy without disability or dependency after deducting the period of disability or dependency from the total number of years lived.

Table B.1 corresponds to a Belgian survival table for the year t = 2001, from which we calculate life expectancy and then split it into life expectancy without dependency and with dependency by using the Sullivan method. This table includes the number of years lived for a cohort given the risk of death (in 2001) regarding each age *i* of the population (*i* = 0 year,…, over 99)[14].

Table B.1: Survival table and calculation of life expectancy according to the Sullivan method (2001)

$A_{i,t}$	$Q_{i,t}$	$l_{i,t}$	$D_{i,t}$	$L_{i,t}$	$T_{i,t}$	$P_{i,t}$	$P_{i,t}\ L_{i,t}$	SUM $P_{i,t}\ L_{i,t}$	$EV_{i,t}$	$EVSD_{i,t}$	$EVD_{i,t}$
00	0.006	1,000,000	6,029	996,986	78,541,010	0.004	4,239	3,123,553	78.541	75.417	3.124
01	0.001	993,971	912	993,515	77,544,024	0.008	7,692	3,119,313	78.014	74.876	3.138
02	0.000	993,059	463	992,827	76,550,509	0.008	8,335	3,111,622	77.086	73.952	3.133
03	0.000	992,596	172	992,510	75,557,682	0.009	8,838	3,103,287	76.121	72.995	3.126
04	0.000	992,424	161	992,344	74,565,172	0.010	9,968	3,094,449	75.134	72.016	3.118
05	0.000	992,263	169	992,179	73,572,829	0.011	10,643	3,084,481	74.147	71.038	3.109
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
95	0.245	68,007	16,634	59,690	203,902	0.377	22,486	79,882	3.003	1.828	1.175
96	0.261	51,373	13,400	44,672	144,212	0.382	17,068	57,397	2.813	1.696	1.117
97	0.281	37,972	10,687	32,629	99,540	0.400	13,066	40,329	2.629	1.567	1.062
98	0.302	27,285	8,240	23,165	66,911	0.406	9,403	27,263	2.463	1.464	0.999
99+		19,045		43,746	43,746	0.408	17,860	17,860	2.010	1.073	0.938

Source: Calculations based on data provided by the INS-BfP and the Belgian "*mutualités*".

The second column of the table ($Q_{i,t}$) shows the risk or probability of death related to the age $A_{i,t}$. The $Q_{i,t}$ come from the data observed and relate that year's deaths by age to the population of this age on 1 January. This rate is, in fact, the ratio between the number of

[14] In order to remain consistent with population projections until 2050 (INS-Bureau fédéral du Plan, 2001), our calculations for 2001 are based on these projected data and not on the actual data observed. The use of either of these data sources does not fundamentally affect the life expectancy in dependency obtained.

deceased people ($D_{i,t}$) in the age interval ($A_{i,t}$, $A_{i+1,t}$) and the number of people present at the beginning of the age interval ($l_{i,t}$).

In other words:

$$Q_{i,t} = \frac{D_{i,t}}{l_{i,t}} \tag{B1}$$

The column $l_{i,t}$ represents the number of people surviving at the age $A_{i,t}$. The first line of this column $l_{00,t}$ corresponds to an arbitrary number of births in 2001. The number of survivors decreases with age because of the deaths occurring during the age interval.

We therefore have:

$$l_{i,t} = (1-Q_{i-1,t})\, l_{i-1,t} \tag{B2}$$

The column $D_{i,t}$ corresponds to the number of deceased people in the age interval ($A_{i,t}$, $A_{i+1,t}$) and depends on the risk of death, i.e.:

$$D_{i,t} = Q_{i,t}\, l_{i,t} \tag{B3}$$

The variable $L_{i,t}$ shows the total number of years lived by the cohort during the age interval ($A_{i,t}$, $A_{i+1,t}$). A survival table (or mortality table) reports the mortality conditions of a given year to a fictitious birth cohort (about 1,000,000 people), assuming that these people would know these specific conditions throughout their life, and finally deduces a theoretical life expectancy at birth or at each age, which is the reflection of that year's mortality conditions. As in our case the interval corresponds to one year, we can say that the number of people present at the end of the interval ($A_{i+1,t}$) is equal to the total number of years lived during the period ($A_{i,t}$, $A_{i+1,t}$). However, it should be noted that those who died had lived for a certain number of months in the interval before dying.

Assuming they have lived on average for half of the interval, or half a year before dying, we obtain:

$$L_{i,t} = \underbrace{(l_{i,t} - D_{i,t})}_{l_{i+1,t}} + 0{,}5D_{i,t} \quad \text{(B4)}$$

The column $T_{i,t}$ corresponds to the total number of years lived by the cohort from the age $A_{i,t}$. We therefore obtain:

$$T_{i,t} = L_{i,t} + L_{i+1,t} + L_{i+2,t} + \ldots + L_{99+,t} \quad \text{(B5)}$$

The variable $P_{i,t}$ is the dependency prevalence rate assigned to each age. In Table B.1, $P_{i,t}$ is calculated using the least restrictive indicator, i.e. when a person has at least one of the social franchise and the chronic disease packages.

The calculation of the prevalence rate corresponds to:

$$P_{i,t} = \frac{\text{number of people fulfilling the conditions of the dependency indicator}_{\text{i,t}}}{\text{population}_{\text{i,t}}} \quad \text{(B6)}$$

The column $P_{i,t}\ L_{i,t}$ represents the total number of years lived *in dependency* by the cohort during the age interval ($A_{i,t}$, $A_{i+1,t}$).

The variable *SUM* $P_{i,t}\ L_{i,t}$ shows the total number of years lived *in dependency* by the cohort from the age $A_{i,t}$. In other words, we have:

$$SUM\ P_{i,t}\ L_{i,t} = P_{i,t}L_{i,t} + P_{i+1,t}L_{i+1,t} + P_{i+2,t}L_{i+2,t} + \ldots + P_{99+,t}L_{99+,t} \quad \text{(B7)}$$

The last three columns correspond to general life expectancy ($EV_{i,t}$), life expectancy without dependency ($EVSD_{i,t}$) and life expectancy in dependency ($EVD_{i,t}$).

The calculation of general life expectancy is based on all the years lived by the cohort from the age $A_{i,t}$, while life expectancy *in/without dependency* relates only to the total number of years lived *in/without dependency* by the cohort from the age $A_{i,t}$.

Formally, we can write:

$$EV_{i,t} = \frac{T_{i,t}}{l_{i,t}} \quad \text{(B8)}$$

$$EVD_{i,t} = \frac{SUMP_{i,t}L_{i,t}}{l_{i,t}} \quad \text{(B9)}$$

As $EV_{i,t} = EVD_{i,t} + EVSD_{i,t}$ (B10)

therefore $EVSD_{i,t} = EV_{i,t} - EVD_{i,t}$ (B11)

Life expectancy without dependency is obtained by subtracting the life expectancy in dependency (different in each scenario) from the total life expectancy coming from the demographic projections of the *Institut National de Statistique* and the *Bureau fédéral du Plan*.

Appendix C: Projection of the prevalence rates by age for each year until 2050

In the first scenario (*pessimistic A)*, the prevalence rates from 2001 to 2050 are assumed constant. Therefore, the number of dependants estimated for each year of life is directly obtained by multiplying the prevalence rates by the corresponding population.

For the other three scenarios, the assumptions about the relative evolution of life expectancy and life expectancy in dependency, described in section 4.1.2., are applied to the life expectancy in dependency obtained in 2001. For each of these scenarios, we get a projected life expectancy EVD*. To find the prevalence rates corresponding to this projection, we use the relationship between life expectancy in dependency and the prevalence rates. From the equations (B7) and (B9), and for each age *i*,

$$EVD^*_{i,\,t+1} = \frac{P_{i,t+1} L_{i,t+1}}{l_{i,t+1}} \qquad \text{(C1)}$$

Specifically, for the last age group, the life expectancy in dependency in t+1 is equal to the total number of years lived in dependency.

$$EVD^*_{99+,t+1} = \frac{P_{99+,t+1} L_{99+,t+1}}{l_{99+,t+1}} \qquad \text{(C2)}$$

With $L_{99+,t+1}$, $l_{99+,t+1}$ and $EVD^*_{99+,t+1}$ (t+1 = 2002) determined from the projected risks of death and the life expectancy (*INS* and *BfP*), we find the value of the dependency prevalence rates for people over 99 in 2002 ($P_{99+,t+1}$):

$$P_{99+,t+1} = \frac{EVD^*_{99+,t+1} l_{99+,t+1}}{L_{99+,t+1}} \qquad \text{(C3)}$$

By following this reasoning and in an iterative way, we obtain the prevalence rates relative to the other years of life. The prevalence rate for 98 year-olds in 2002 ($P_{98,t+1}$) will thus be:

$$EVD^{*}_{98,t+1} = \frac{P_{99+,t+1}L_{99+,t+1} + P_{98,t+1}L_{98,t+1}}{l_{98,t+1}} \quad \text{(C4)}$$

$$\Rightarrow \qquad P_{98,t+1} = \frac{EVD^{*}_{98,t+1}l_{98,t+1} - P_{99+,t+1}L_{99+,t+1}}{L_{98,t+1}} \quad \text{(C5)}$$

Finally, for the first year of life (0 year), we obtain:

$$P_{00,t+1} = \frac{EVD^{*}_{00,t+1}l_{00,t+1} - P_{99+,t+1}L_{99+,t+1} - P_{98,t+1}L_{98,t+1} - \ldots - P_{01,t+1}L_{01,t+1}}{L_{00,t+1}} \quad \text{(C6)}$$

This is the method that was used for the projection of the prevalence rates for each year up to 2050.

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