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Projections of the dependent elderly population by age, sex, and household composition. Scenarios for Belgium

by

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Abstract

Projections of the dependent elderly population (65+ years old) have been made for Belgium as a whole, by age, sex, and composition of the household, for the period 2005-2050, taking into account the differences in prevalence rates of dependency by household type and possible future declines in these rates. Population projections are made by the Belgian national statistical institute (INS-NIS). The distribution of the population by five-year age groups and sex according to the composition of the household is taken from the Belgian population register. Only three categories are considered: single person private households, other private households, collective households. The latter category has been corrected using the national health insurance data (INAMI-RIZIV). In the absence of adequate data for Belgium, data on the elderly dependency rates by age, sex, and type of household are those of the French HID (Handicap-Invalidité-Dépendance) survey. Concerning trends, two scenarios have been adopted. In the first scenario, dependency rates are assumed to be stationary during the projection period. In the second

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scenario, rates decline in the future according to past trends observed in France. The projections show that even with declining dependency rates in the future, one can expect a significant increase in the absolute numbers of institutionalized population especially at older ages, for males and for females.

Keywords: *Population projection, Elderly, Disability.*

Introduction

Due to the positive correlation between the prevalence of impairments and age, on the one hand, and the ageing of the population resulting from low fertility and mortality rates, on the other hand, one can expect an increase in the burden of dependency in the future as the population grows older and older (1-3). It is highly improbable that populations will become much younger again in the years to come, as this would require much higher levels of fertility than can be expected in the developed countries. One can however consider that the dependency rates by age and sex may decrease in the future, even among the elderly. In fact, various studies (4-5) have indeed shown that dependency rates are presently declining in the elderly population, the latter being the particular focus of this study.

Most dependent elderly persons prefer living at home rather than being institutionalized (6-7). Public policies also have supported this preference, less however in order to respond to the wishes of individuals than to reduce the cost of institutionalization, as the cost of caring for the dependent elderly at home is shifted partly towards the informal network consisting mainly of spouse or partner and children. In projecting the elderly dependent population, one should therefore distinguish the individual according to the type of household (s)he lives in, a person living alone generally requiring more formal care than e.g. a person living together with his or her partner, at the same level of dependency. One should also take into account, if possible, the moves over one's lifetime, from e.g. living with one's partner to living alone, and finally to living in an institution, and/or the move from good health to dependency for example, i.e. the transition rates between the various states (household states but also health states). The scenarios presented in this article could fuel the debate on the future planning of health care management for the elderly.

Data and methods

The objective of this article is to present projections of the dependent elderly population aged 65 and over for Belgium as a whole, by age, sex,

and composition of the household, for the period 2005-2050, taking into account differences in rates of dependency by household type, age, and sex, and possible future declines in these rates. Due to lack of suitable data, a multi-state transition model based on incidence rates cannot be used in the case of Belgium and a prevalence-based approach has been considered instead, as described in the following section. As the end of the projection is 2050, all persons of 65 and older surviving that date have already been born; no prospective fertility assumptions will thus be needed. On the contrary one needs to project future trends in mortality and, possibly, international migration.

Population projections are made by the Belgian national statistical institute (INS-NIS) using the component method, taking into account future estimated trends in fertility, mortality, and migration. The baseline population is that of the year 2000. Concerning the mortality assumptions, the initial mortality schedule by age and sex is that for the years 1996-1998. The level of mortality at the end of the projection period, i.e. the year 2050, is assumed to correspond to 88.88 years of life expectancy for females and 83.9 years for males, on the basis of the projection of past experience (8). By comparison, the United Nations in their most recent publication of population projections for the world up to 2050, have taken an upper threshold of 82.5 years of life expectancy for men and 87.5 years of life expectancy for women.

The trends between the outer limits of the projection (2000 and 2050) are outlined in the publication cited. Concerning international migration, migration rates are assumed to be constant by level and age-pattern during the whole projection period, on the basis of the average migration rates observed during the period 1989-1997.

The distribution of the population by five-year age groups and sex according to the composition of the household is taken from the Belgian population register. Only three categories are considered in the present paper: one-person private households, multi-person (2 persons or more) private households, and collective households. The data in the latter category can be compared to those compiled by the National Institute of Sickness and Invalidity Insurance (INAMI-RIZIV) referring to the population by age and sex living in institutions subsidized by the health insurance system (MR/MRS-ROB/RVT). Table 1 presents the results of this comparison, the population register data referring to the year 2000 and the INAMI-RIZIV data to the year 2001. In the following sections, we assume that the two data sets are compatible even if the reference periods differ by one year, in order to correct the population register data for the year 2000 on the basis of the INAMI-RIZIV data as explained below.

TABLE 1.
Comparison of the institutionalized population 65+ by age and sex according to INAMI-RIZIV (2001) and the Belgian population register (2000)

	65-69	70-74	75-79	80-84	85-89	90+	Total 65+
Males							
a) INAMI	1799	2845	4401	4743	5498	4737	24023
b) Register	2468	3120	3951	3278	4308	2602	19727
Difference b-a	+669	+275	–450	–1465	–1190	–2135	–4296
Females							
a) INAMI	1984	5000	11887	17843	26092	27840	90646
b) Register	4091	6630	12317	14030	21761	17409	76238
Difference b-a	+2107	+1630	+430	–3813	–4331	–10431	–14408
Both sexes							
a) INAMI	3783	7845	16288	22586	31590	32577	114669
b) Register	6559	9750	16268	17308	26069	20011	95965
Difference b-a	+2776	+1905	–20	–5278	–5521	–12566	–18704

(Source: INAMI-RIZIV and Belgian population register).

As pointed out elsewhere (7), there are huge differences between the population numbers in collective households and those in subsidized institutions. One sees that the differences are firstly positive at “younger” ages and become negative at older ages. A tentative explanation is that at younger ages quite a few elderly persons in good health live in collective households that are not institutions recognized by the health insurance system (i.e. MR/MRS-ROB/RVT, in the Belgian terminology) and therefore would not appear in the INAMI-RIZIV data.

At older ages, a plausible reason for a negative difference is that many persons living in collective households still have their official domicile in the population register at their former home, therefore creating a difference between de jure and de facto residence. This has been shown for Norway, especially in the case where one partner is institutionalized and the other is alive and living in a private household; the former often still has his or her domicile at the residence of his/her partner (9). For single-person households, this would also be the case for owners of a house or flat who become institutionalized but keep their domicile for some time at their former home. We have therefore taken the INAMI-RIZIV data as reflecting the true number of institutionalized elderly. The difference by age and sex between this number and the number in collective households was then distributed among one-person and

multi-person households according to the population size in each category. For example, for males aged 65-69, the corrected numbers in institutions, one-person private households, and multi-person private households would be respectively 1799 (2468) (as seen in Table 1), 34,281 (34,186) and 206,418 (205,844), with the initial numbers from the population register between brackets. For example, for one-person private households, the corrected number will be (2468-1799) (34,186/(34,186 + 205,844)) + 34,186 = 34,281. The revised distribution of the population by type of household according to age and sex, derived from this correction, has then been assumed to be stationary during the whole projection period.

If one would calculate them, dependency rates for the elderly from the Belgian health interview survey data 2001 would be unreliable due to the small population numbers involved at higher ages and inadequate coverage of the institutionalized population. For individuals living in institutions, dependency rates can however be computed from the data provided by INAMI-RIZIV on the basis of the Katz scale. The latter evaluates the individuals' capacities concerning the basic activities of daily living (ADL), i.e. bathing, dressing, continence, feeding, going to the toilet, and transferring. Individuals are then graded on ordinal scales in relation to their ability to perform these activities. In addition to the ADL, the INAMI's scale adds two other criteria, spatial and temporal disorientation. Due to the unreliability of data on private households among the elderly population, and the unavailability of time-trends, we have imported data on elderly dependency rates by age, sex, and type of household (single person private households, multi-person private households, institutionalized population) from the French HID survey, using the EHPA 11-22 scale[2].

The HID survey (10) was conducted in four successive waves between October 1998 and the end of the year 2001, among both private households and institutions. Dependency levels were evaluated on the basis of the EHPA 11-22 scale (11), taking into account six groups of physical and/or mental dependence, the less dependent group of patients needing daily help for at least two ADL. The French data for the institutionalized population yield dependency rates rather close to those computed from the INAMI-RIZIV data based on the B + C dependency categories using the Katz scale (Table 2), though the latter are slightly higher than the former. The B + C categories imply physical dependency for at least three ADL or mental dependency and physical dependency for at least one ADL (12).

[1] Special tabulation made by the DREES, Paris, for this purpose.

We do not have the confidence intervals for the HID data in order to check if the differences are significant, but they probably are since the signs are the same for all ages. For coherence, we have nevertheless used the EHPA 11-22 rates derived from the HID survey for all three household categories (see annex A).

TABLE 2.
Comparison of dependency rates (%) in the institutionalized population by age and sex according to the French HID survey (EHPA 11-22 scale) and the Belgian INAMI-RIZIV register (Katz scale, B+C) (circa year 2000)

Age	Females		Males	
	HID (EHPA 11-22)	INAMI-RIZIV (Katz, B + C)	HID (EHPA 11-22)	INAMI-RIZIV (Katz, B + C)
65-69	47	54	38	49
70-74	52	58	52	54
75-79	60	60	43	59
80-84	54	61	52	59
85-89	60	63	54	57
90-94	64	68*	57	59*
95+	65	*Age group 90+	50	*Age group 90+

(Sources: DREES and INAMI-RIZIV).

The series of dependency rates by age, sex, and household type have then been smoothed by statistical modeling (see annex B), in order to attenuate random fluctuations; we have also considered the institutional rates as a maximum in each age group. The results are presented in figure 1 for males and for females.

As could be expected, one sees from both annex A and figure 1 that there are significant differences in dependency according to household type, one-person households having the lowest dependency levels and the institutionalized population having the highest. Dependency rates of persons in multi-person private households are close to the one-person category up to around age 80 but are much higher afterwards. One cannot conclude however that living alone represents the healthiest situation. Those in a poorer state of health in a one-person household have most probably moved into an institution.

Concerning dependency trends, two scenarios have been adopted. In the first scenario, dependency rates are assumed to be stationary

Figure 1a.
Adjusted dependency rates by age, sex, and household type – Males

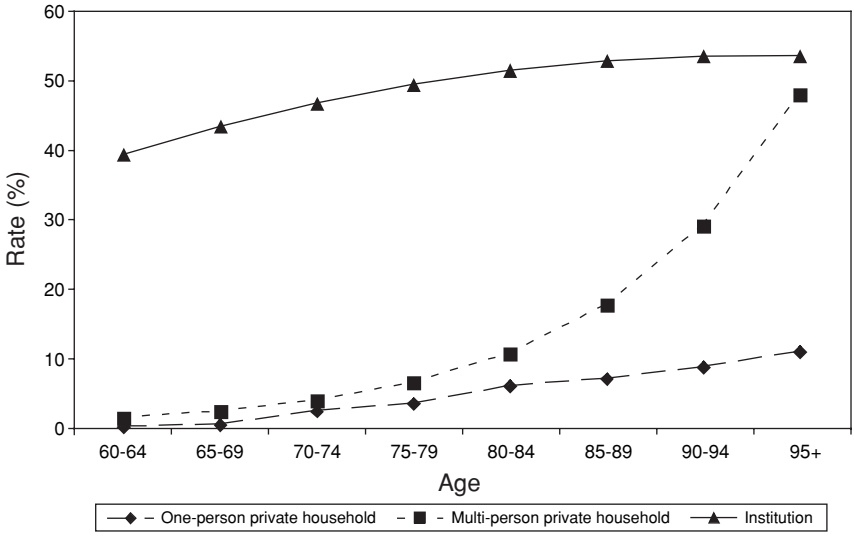
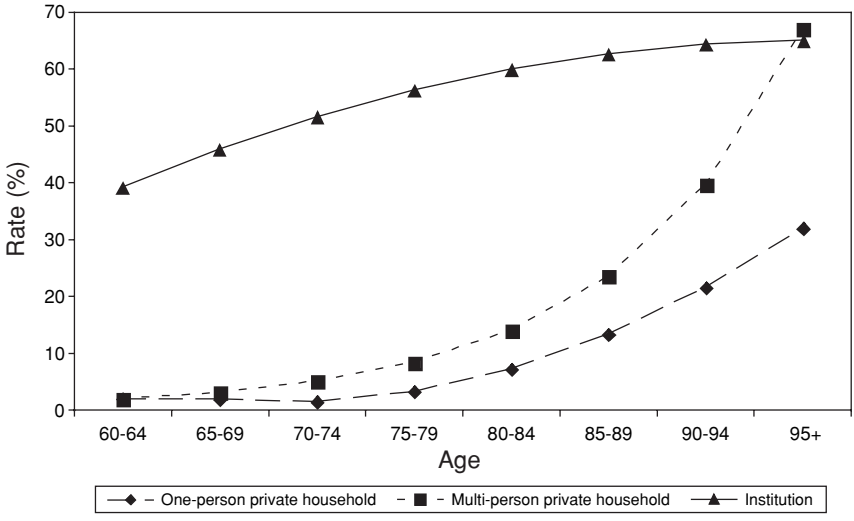


Figure 1b.
Adjusted dependency rates by age, sex, and household type – Females



during the projection period. This is a pessimistic assumption, as dependency seems to be declining even at older ages in several countries, as pointed out above. In the second more optimistic scenario, based on

past trends observed in France (11), dependency rates decline according to an assumption of disability compression. Following the central scenario in the French projection, every ten years the prevalence rates of dependency are shifted by –1.3 years for males and –1.4 years for females between ages 60 and 79, and by –1.1 and –1.3 respectively for ages 80+. For example, the dependency rate for a male aged 65 for the year 2010 would be equal in this scenario to the dependency rate at age 63.7 in the year 2000.

Results

Figure 2 presents the overall trends over time in the numbers of dependent elderly 65+ according to the two scenarios, i.e. stable dependency rates over the whole projection period or decreasing rates according to the French central scenario. As pointed out previously, the first scenario assuming constant rates is most probably too pessimistic, while the second scenario may be too optimistic as it assumes that the decrease in dependency recently observed at older ages will continue at the same pace in the future. The actual future situation could therefore be located somewhere in-between the results of both scenarios.

Figure 2.
Numbers of dependent elderly 65+ by sex, scenarios with stable and declining dependency rates – Belgium

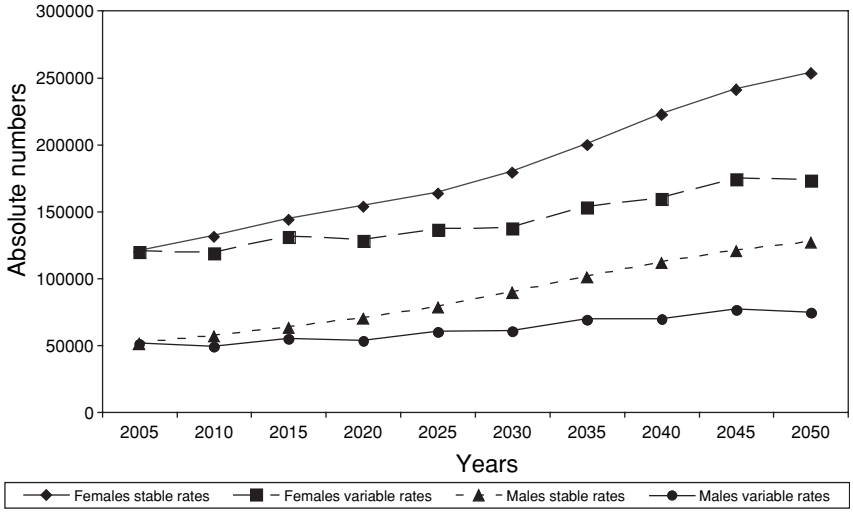


Figure 3 is slightly more complicated, as it presents for males and for females the future projected numbers of dependent elderly by age

Figure 3a.
Elderly females 65+ by age, household type, and years (2005, 2025, 2050), scenario with declining dependency rates – Belgium

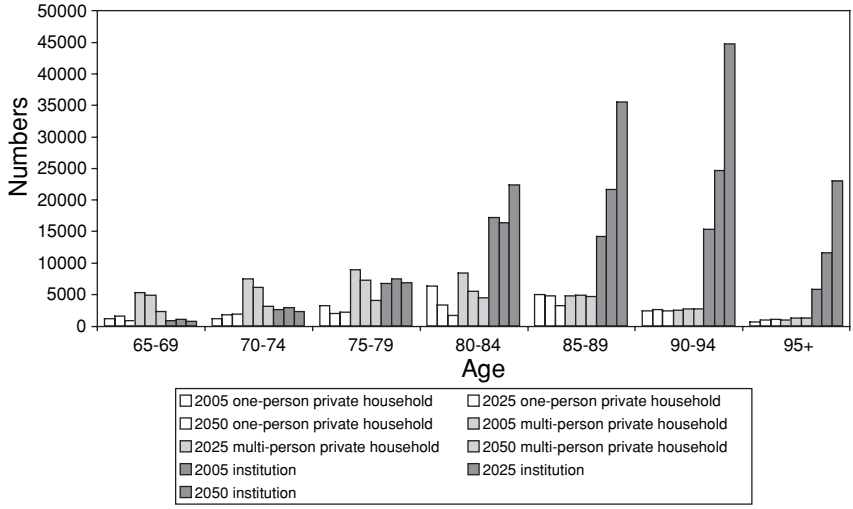
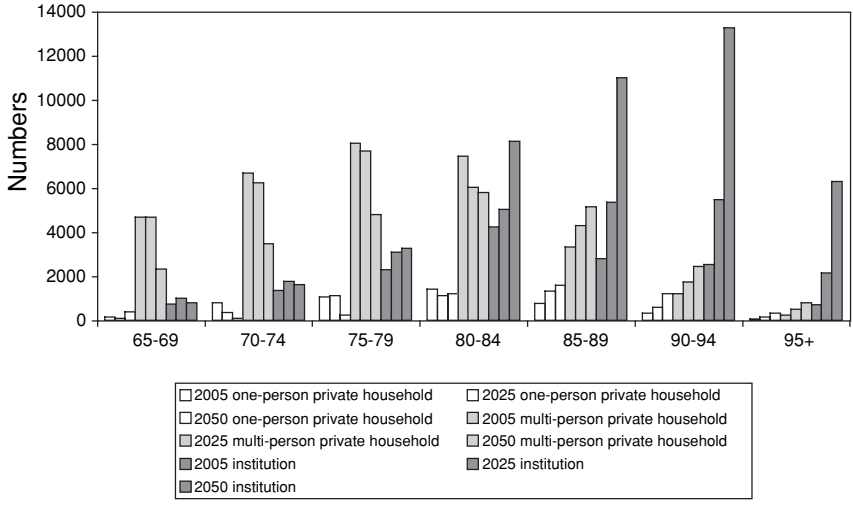


Figure 3b.
Elderly males 65+ by age, household type, and years (2005, 2025, 2050), scenario with declining dependency rates – Belgium



groups, by years (2005, 2025, 2050), and by type of households. For each age group, the first three left-side columns present the absolute numbers of dependent persons in one-person private households respectively for

the years 2005, 2025, and 2050, the three central columns relate to multi-person households for the same three years, and finally the three columns on the right concern the numbers in institutions for the same three years. Only the second scenario is considered here, i.e. the one assuming decreasing dependency rates over time.

Discussion

First, concerning the methodology of the projections, a probably minor improvement would be to obtain data from the INAMI-RIZIV and the Belgian national population register for the same baseline year. Furthermore, a better registration of collective households by the national population register would be required, in order to eliminate the gap between the *de jure* and the *de facto* population. A major problem is the lack of reliable dependency rates by age, sex, type of household, and possibly dependency level for the elderly population in Belgium. The new 2004 Belgian Health Interview Survey (13) should yield more adequate rates, as an increased sampling of the elderly population was done. We would still however lack information on the time-trends in these rates. These trends could also differ by household type, contrary to the assumption adopted in this paper. Finally, the composition of households could be projected into the future, a daunting task indeed as one would have to project the number of couples, their number of children, and future living arrangements, taking into account possible changes in health care policies!

As to the results of the projections, figure 2 shows that both in the case of stationary dependency rates and in the case of decreasing rates over time, the absolute numbers of dependent persons will increase as an effect of the aging of the population. In addition, the numbers of dependent women always remain higher than those of dependent men due to their lower mortality on the one hand and their generally higher age-specific dependency rates on the other hand (as seen in figure 1 and annex A). The increase is however much attenuated in the case of decreasing prevalence rates, even though this decrease in dependency rates cannot compensate for the aging of the population.

As the age- and sex-specific dependency rates vary greatly by type of household (see once again figure 1 and annex A), one may presume that the number of dependent persons will also be highly correlated with the latter. Figure 3a shows that the number of dependent females is concentrated at younger ages in the multi-person private household category and then increasingly shifts with age to the institution category. Relatively few dependent females are in a one-person private household.

One also observes a very significant increase in the institutionalized population aged 80 and over, from the year 2005 to 2050.

The proportion of males (figure 3b) in multi-person private households is much higher than that of females, as males aged x are more likely to still have a partner alive than females aged x, due to excess male mortality and the age difference between partners. Contrary to females, dependent males living in multi-person households are still more or less equal to the number in institutions even in the 80-84 age group. The numbers decrease however over the projection period, until age 85. The male institutionalized population becomes dominant after 85 and the numbers increase greatly over the projection period. Finally, one also notices that at all ages the number of dependent females is higher than that of men, as noted previously.

Conclusion

To conclude, even if individuals prefer staying at home, and this view is supported nowadays by the State for mainly financial reasons, our projections show that even with declining dependency rates in the future, one can expect a significant increase in the absolute numbers of institutionalized population especially at older ages, for males and for females, due to the aging of the population structure on the one hand, and the increase in dependency with age on the other hand. Only changing the age schedule of dependency would alter this conclusion, as mortality is still going down at older ages and the scenario adopted here for changes in dependency over time might be too optimistic. Notwithstanding the trend towards deinstitutionalization of care for the dependent elderly, severe multiple pathologies should remain the principal cause of institutionalization in the future. Due to the ageing of the institutionalized population, the proportion of elderly with severe dependency and the burden for carers should thus increase. It may happen however that in the future, both the age schedule of dependency *and* the time-trend in dependency will become more favorable than now. In that case, our projections will hopefully be wrong.

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Résumé

Des projections par âge, sexe et composition du ménage des personnes âgées dépendantes de 65 ans et plus ont été réalisées pour la Belgique, pour la période 2005-2050, en tenant compte des taux différents de prévalence de dépendance selon le type de ménages et d'une probable diminution de ces taux dans le futur. Les projections démographiques sont celles de l'Institut National de Statistique (INS-NIS). La distribution de la population par sexe et groupe quinquennal d'âge et selon le type de ménage est tirée du registre national. Trois catégories de ménages sont considérées: les ménages privés à une personne, les ménages privés à plusieurs personnes et les ménages collectifs. Cette dernière catégorie a été corrigée à l'aide des données de l'Institut National d'Assurance Maladie-Invalidité (INAMI-RIZIV). En l'absence de données adéquates pour la Belgique, les données sur les taux de dépendance par âge, sexe et type de ménages proviennent de l'enquête française HID (Handicap-Invalidité-Dépendance). En ce qui concerne les tendances, deux scénarios ont été retenus. Dans le premier les taux sont supposés stationnaires sur toute la période, dans le second les taux diminuent selon les tendances observées en France. Les projections montrent que même avec des taux de dépendance décroissants on peut s'attendre à un accroissement significatif de la population institutionnalisée, spécialement aux âges élevés, tant pour les hommes que pour les femmes.

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Annex I

Figure A1a.
HID dependency rates by age and household type - Females (EHPA 11-22 scale)

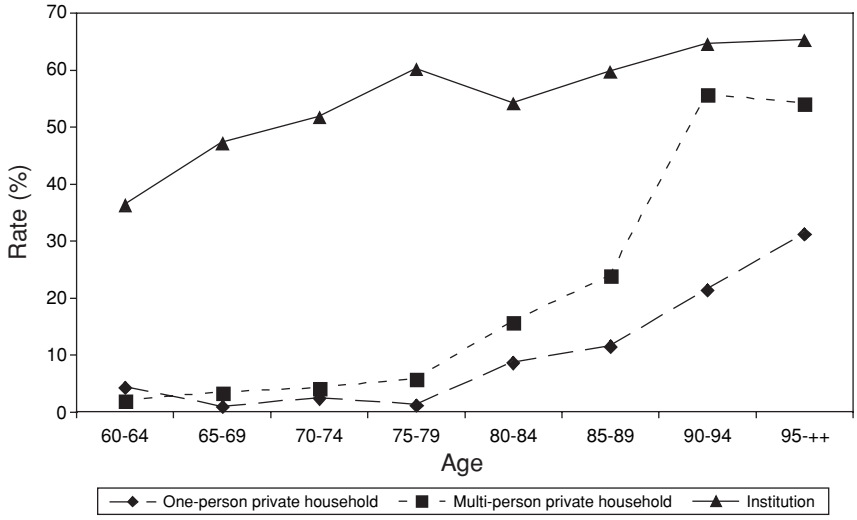
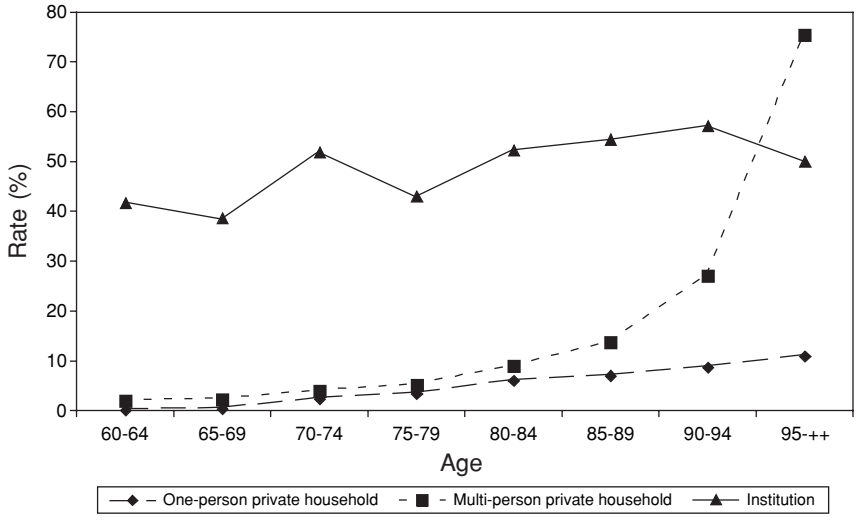


Figure A1b.
HID dependency rates by age and household type – Males (EHPA 11-22 scale).



Annex II. Statistical smoothing of dependency rates

Male dependency rates in one-person private households have not been smoothed, as the data seemed consistent. For males in multi-person private households, rates have been smoothed by the exponential equation $y = 0.0028e^{0.1x}$ yielding a R^2 of 95.9%. For males in institutions, the rates have been smoothed by a polynomial $y = -0.0134x^2 + 2.5498x - 67.743$ with a R^2 of 59.3%. For females, the rates for persons in one-person private households have been smoothed by the polynomial $y = 0.0429x^2 - 6.0831x + 216.72$ ($R^2 = 98.8\%$) and for multi-person private households by the exponential $y = 0.0023e^{0.1053x}$ ($R^2 = 96.9\%$). Finally, for women in institutions, the rates have been smoothed by a polynomial with an R^2 of 90.5%: $y = -0.0197x^2 + 3.885x - 127.36$. We have assumed that persons in institutions have the highest dependency rates.