Will Population Ageing Necessarily Lead to an Increase in the Number of Persons with Disabilities? Alternative Scenarios for the European Union

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Abstract

There is widespread expectation that the combination of significant population ageing in Europe over the coming decades, along with the fact that the elderly are more likely to have disabilities, will result in a large increase in the total prevalence of disability and the need for significantly expanded care facilities for the elderly. Recent evidence from the U.S., however, suggests that the disability rates of the elderly are declining and that further declines could be expected in the future. In this paper we present alternative demographic scenarios for the European Union (EU-15) that distinguish between people with and without disabilities by age and sex. The results show that under the assumption of a constant age-specific disability profile, we indeed expect a significant increase in the total number of people with disabilities due to population ageing. However, if the age profile of disability is shifted to the right (i.e., to higher ages) by one, two, or three years per decade, the scenarios show a much lower increase or no increase in the number of persons with disabilities in Europe over the coming decades.

European Demographic Research Papers are working papers that deal with all-European issues or with issues that are important to a large number of European countries. All contributions have received only limited review.

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THE RESEARCH QUESTION

It is evident as a feature of human life that the number of all kinds of functional disabilities increases with age. It is equally evident and uncontested that the age structure of Europe's population will become significantly older over the coming decades. According to the median forecast, the proportion of the population above age 60 is expected to increase from currently 20 percent in Western Europe to an expected 35 percent by the middle of the century and 45 percent by the end of the century (Lutz et al. 2001). Because of uncertainty in the future paths of fertility and migration and most importantly in the future evolution of old age mortality, recent probabilistic population projections give rather broad uncertainty intervals for this proportion of elderly. Lutz et al. (2001) estimate that by the end of this century the proportion above age 60 in Western Europe will lie within the range of 32-58 percent with a probability of roughly 80 percent. In other words, if life expectancy continues to increase markedly and fertility stays at a low level or declines further (and there is no significant immigration), then Europe may well develop into a society with more than half of the population above age 60. The proportion above age 80 is likely to increase even more rapidly. Toward the end of the century Europe may have more inhabitants above age 80 than young people below age 20 (Sanderson et al. forthcoming).

Combining the evident observation about increasing disability with age with the expectation of massive population ageing in Europe, one can easily conclude that the number of people with disabilities in Europe is likely to increase rapidly over the coming decades because more and more elderly people will enter the ages of high disability rates. This commonsensical conclusion from combining two obvious premises is frequently drawn by policy makers, journalists and scientists alike. The logical conclusion is, however, based on one tacit assumption, namely, that the age profile of disability risks does not change over time. As will be shown in more detail below, empirical evidence from the U.S. suggests that during the 1970s almost all increases in life expectancy resulted in more years of disability, but that since the 1980s this has radically changed and the proportion disabled decreased at all ages (Crimmins et al. 1997; Manton and Gu 2001). This implies that as life expectancy improves, disability-free life expectancy may also improve. One way this can happen is through a gradual shift to the right (i.e., to higher ages) of age-specific proportions disabled.

If, in the future, Europe will indeed see a shift to the right of the age profile of disability, implying declining disability rates at each age – as has been reported for the U.S. – will this change the general expectation that population ageing will lead to significant increases in the number of people in need of long-term care? This question is of utmost importance for the longer-term planning of the care-giving infrastructure and for the future financial balance of social and health insurance schemes.

The answer to this important research question will obviously depend on the degree to which the age pattern of disability will change in the future. Although we do not yet know how the future will evolve in this respect, one can shed some light on this question by performing sensitivity analyses by combining likely future trajectories of population ageing with alternative future declines in age-specific disability rates. To our knowledge there has not yet been a systematic quantitative analysis of this sort for the European Union. In this paper we take a first tentative step in this direction by calculating four exploratory scenarios that combine one likely population path with four different shifts of the age profile of disability.

A VIEW TO THE USA

Using a series of National Long-Term Care Surveys (MLTCS) as well as information from Medicare and other sources, scientists in the United States are able to study the evolution of disability more consistently than is currently possible in Europe. A recent influential summary article of the evidence (Manton and Gu 2001) suggests that a reduction in disability in the elderly population of the United States has been occurring since the early

1980s. Their analysis shows that the decline was even more rapid during the 1990s than during the 1980s. The age-standardised disability decline from 1982 to 1989 was 0.26 percent per year; from 1989 to 1994 it was 0.38 percent per year; and from 1994 to 1999 it was 0.56 percent per year. One important reason for this decline in the United States was the changing educational composition of the population. As shown in Table 1, disability rates tend to be significantly lower for the more highly educated population, especially in the age group 65-74. The composition of the elderly population by level of education has changed significantly and is expected to continue to change. These differential disability rates imply a decline in the total proportion disabled in addition to the changes within each educational group. Preston (1992) calculated that the prevalence of persons with eight or less years of schooling at ages 85-89 would decline from 65 percent in 1980 to 15 percent in 2015.

At the level of the European Union we do not yet have comparable data and projections, but it can be assumed that a similar structural change is affecting the European elderly population. For selected European countries Egidi (2003) shows decreases in disability rates of the elderly over the past two decades, although there are problems concerning the compatibility of data. Jacobzone et al. (1998) calculated two scenarios for the prevalence of severe disabilities for six European countries showing that constant disability rates would result in higher numbers of persons with disabilities in the future, while a declining trend in disability rates may even lead to lower numbers by 2020.

Table 1 Distribution (percent) in age- and education-specific estimates of disability for U.S. nonblacks. Source: Manton and Gu (2001).

	U.S. Nonblack Population			
Education	**1982**	**1994**	**1999**	**Δ82-99**
Age 65-74				
Grade 0-8	16.4	15.5	16.1	–0.3
Grade 9-12	10.5	10.3	9.0	–1.5
Grade 13+	13.4	8.0	6.7	–6.7
Age 75-84				
Grade 0-8	35.8	30.8	30.2	–5.6
Grade 9-12	20.5	23.9	23.3	+2.8
Grade 13+	31.3	22.1	18.1	–13.2
Age 85+				
Grade 0-8	69.2	57.2	56.6	–12.6
Grade 9-12	48.0	61.1	55.8	+7.8
Grade 13+	60.1	57.5	47.2	–12.9

DATA AND METHODS

The tentative calculations presented in this paper have been performed for the total population of the European Union (EU-15) taking the year 2000 as the starting point for the projections. Age and sex as well as the fertility and mortality levels for 2000 have been derived from Eurostat (2002) and Council of Europe (2001). The fertility, mortality, and migration assumptions to the year 2050 correspond to the median paths as given in Lutz et al. (2001) for Western Europe. This includes a gain in life expectancy of around two years per decade for both men and women, a total fertility rate of around 1.5, and average annual migration gains of 600,000 per year.

The age profile of disability for the EU-15 is based on the data of the European Community Household Panel (ECHP) for the years 1994 and 1996 (unpublished working tables; personal communication by Jean-Marie Robine). This data source gives age-specific information (in five-year age groups above age 15) for men and women separately for all member countries of the European Union. Age-specific proportions disabled are given in two categories: moderately disabled and severely disabled. The data show, for instance, that on average only 2 percent of the women aged 25-34 are severely disabled. This proportion reaches 10 percent for the age group 55-64 and further increases to almost 30 percent for women above age 85. The proportion moderately disabled increases more rapidly, from 7.5 percent in the age group 25-34 to 36 percent for women above age 85.

For this exploratory analysis we only use the total proportion disabled at each age group. The data from both surveys and for all countries were combined (applying appropriate weights) and graduated into single-year age groups. Because there were no data for the younger age groups, for the purpose of this analysis we simply assumed that the proportion would decline to 4 percent in the youngest age group. This could easily be replaced by other assumptions about the younger age groups, if empirical data become available. The comparative analysis of the different scenarios is not affected by this assumption, which is identical across scenarios. The results depend entirely on the different proportions disabled in the older age groups. Figure 1 gives the age-specific proportions disabled in five-year age groups for men and women for the EU-15 as derived from the ECHP data. Figure 2 shows the data graduated into single-year age groups from age 1 to 100. It is worthwhile to note that female proportions disabled are higher than males at every age beyond 25, although age-specific mortality rates are higher for men.

Figure 1 Data on total proportions disabled by age and sex for the EU-15 as given by the ECHP 1994-96 (see text).

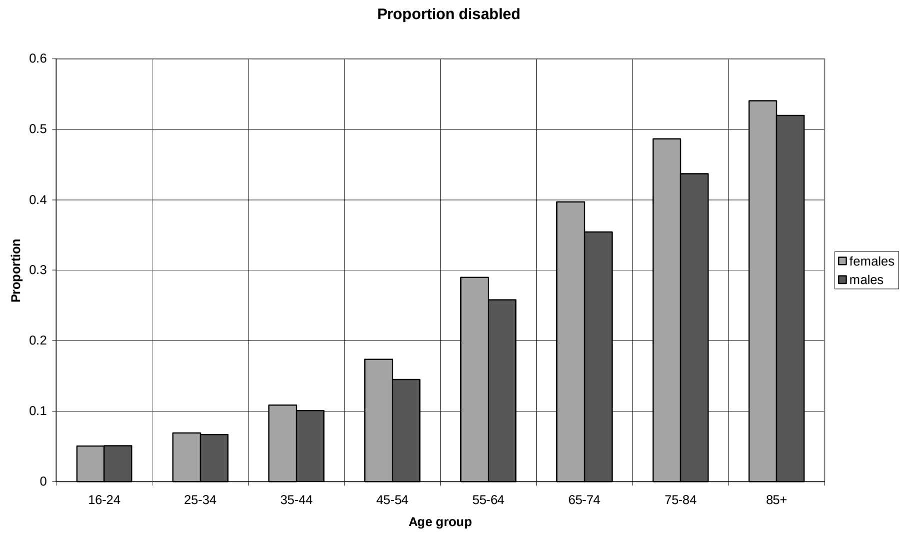
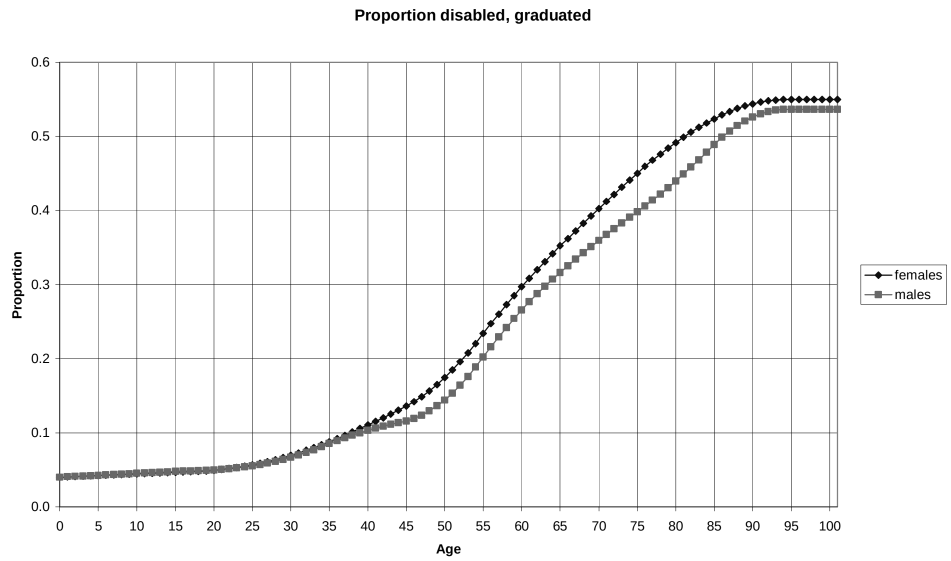


Figure 2 Proportion disabled graduated to single-year age groups.



It was our initial intention to perform true multi-state projections in which the two sub-populations (people with disabilities and people without) have separate fertility, mortality, and migration schedules. It would be particularly important to include differential mortality at a higher age in the model. It turned out to be impossible, however, to find any meaningful empirical information on differential mortality by disability status. For this reason we had to choose the alternative approach in which we superimpose age-specific proportions disabled on an exogenously-given population projection. This approach is isomorphic, e.g., to the way the UN Population Division produces projections of the urban and rural populations of all countries (United Nations 2002). It also has the advantage of comparative analysis across scenarios as population size and structure for all four scenarios are identical and therefore age-specific proportions and absolute numbers of disabled can be directly compared across scenarios.

The four scenarios given below follow a simple principle: The total population is projected in single-year steps, while the age pattern of the proportions disabled is moved every year to the right by a certain interval x. In the reference scenario, x is zero, i.e., the current age-specific pattern remains unchanged. The three other scenarios assume that $x = 0.1$, 0.2 and 0.3 per year, respectively. Expressed differently, the four scenarios assume that the age profile is moved to the right by 0, 1, 2 and 3 years per decade. This is the denomination of the scenarios that we will use for the rest of this paper.

RESULTS OF FOUR EXPLORATORY SCENARIOS

Figure 3 shows the population of the EU-15 in 2000 by age and sex, and disability status. This two-state age pyramid results from combining the single-year age and sex structure with the graduated proportions disabled as given in Figure 2. As indicated above, the dark area includes both categories of those who are severely and moderately disabled in the ECHP survey data.

The age pyramid shows that presently there is a particularly large number of women with disabilities aged 55 to 80.

Figure 3 Pyramid of the EU-15 in 2000 by disability status (dark shading indicates persons with disabilities).

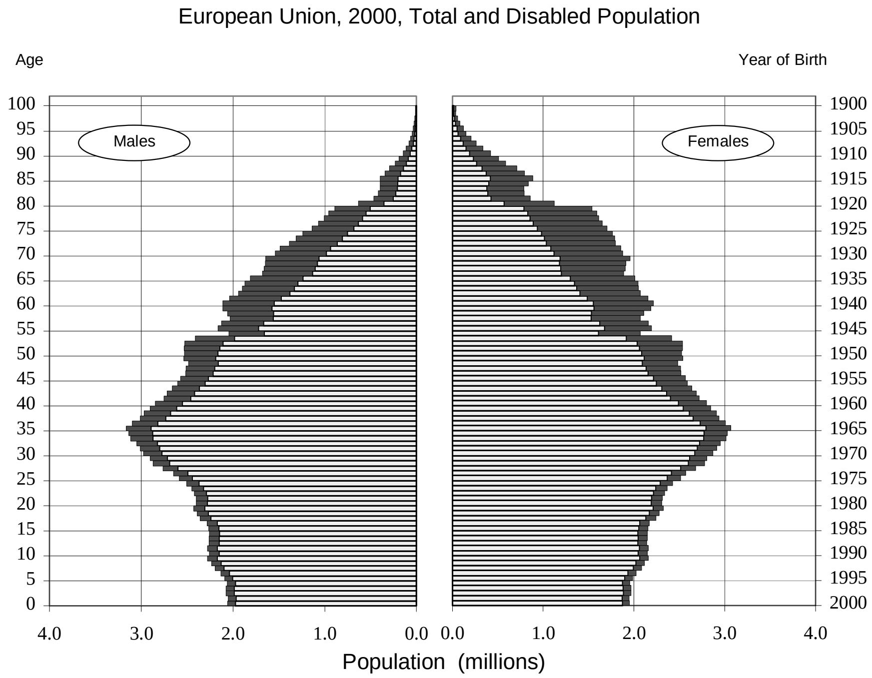


Figure 4 compares the results of the four scenarios over time. It gives the absolute number of people with disabilities resulting from a shift in the age profiles by zero to three years per decade as discussed above. The line at the top gives the scenario with constant age-specific proportions disabled. These results confirm the general expectation that population ageing in Europe will lead to a significant increase in the number of people with disabilities. The total disabled population (moderately and severely disabled together) will increase from currently 60 million to over 80 million over the coming decades under this scenario. The next scenario that assumes a shift in the age pattern of disability by one year per decade already cuts the increase in the disabled population by half. A shift by two years per decade will only temporarily lead to a minor increase in the number of disabled and in the longer run come back to the current number of roughly 60 million. Should the age pattern of disability shift by three years per decade, Europe would experience a real decline in the number of people with disabilities, despite the rapid population ageing ahead.

Figure 4 Results of the four alternative scenarios shifting the age profile of disability by 0, 1, 2 and 3 years per decades (in millions of disabled).

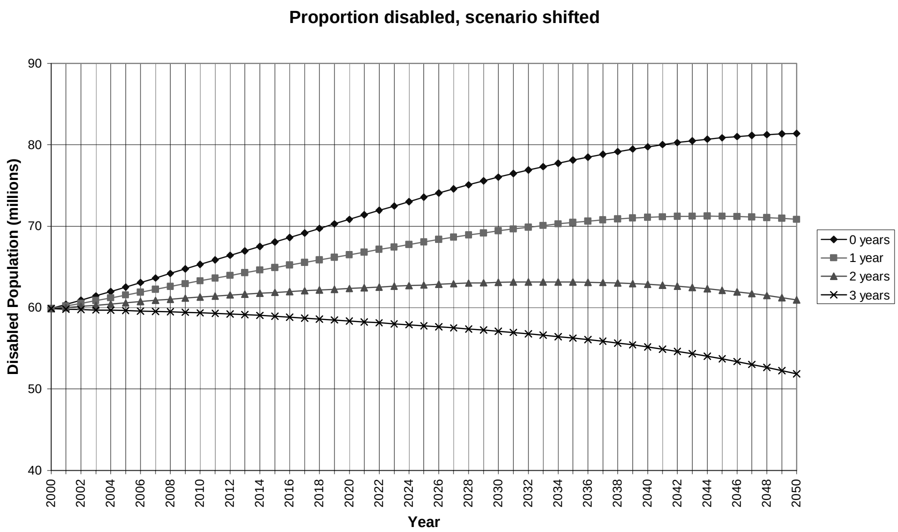


Figure 5 shows the same results for the four scenarios in terms of proportions disabled of the total EU-15 population. Since the total population size of the 15 current EU member countries is not expected to change much over the next three decades, the pattern looks similar to that of Figure 4. After 2030 the population projections show the beginning of a decline in the total population size of the EU, which in Figure 5 results in a continued increase in the proportion disabled under the first two scenarios and does not show the levelling off that is visible for the absolute number of disabled in Figure 4. Tables 2 and 3 give the numerical data corresponding to Figures 4 and 5, respectively. For the full annual data, see Appendix Tables 1 and 2.

Figure 5 Results of the four alternative scenarios in terms of proportions disabled of the total population of the EU-15.

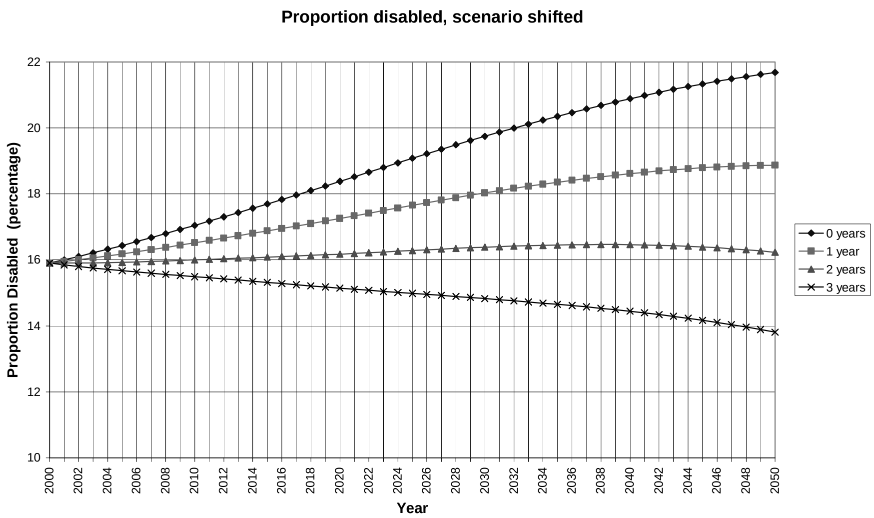


Table 2 Results of the four scenarios in terms of absolute number disabled in the EU-15 (in millions).

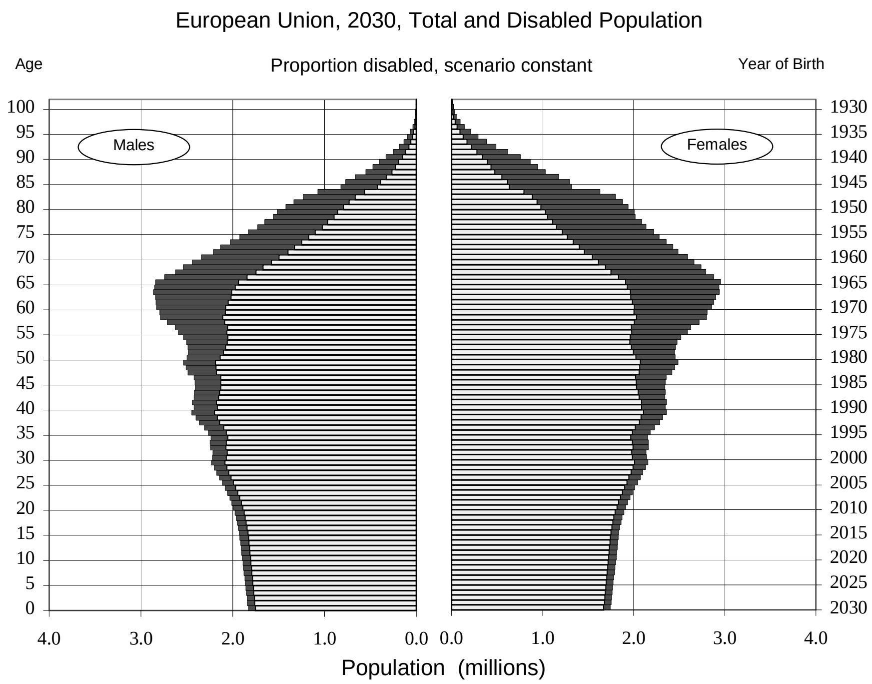
	Shift			
Year	**0 years**	**1 year**	**2 years**	**3 years**
2000	59.87	59.87	59.87	59.87
2010	65.30	63.28	61.29	59.35
2020	70.83	66.50	62.34	58.36
2030	76.03	69.43	63.09	57.09
2040	79.76	71.09	62.86	55.16
2050	81.39	70.84	60.94	51.86

Table 3 Results of the four scenarios in terms of proportions disabled in the EU-15 (in percentages).

	Shift			
Year	**0 years**	**1 year**	**2 years**	**3 years**
2000	15.90	15.90	15.90	15.90
2010	17.05	16.52	16.00	15.49
2020	18.38	17.25	16.17	15.14
2030	19.74	18.03	16.38	14.83
2040	20.88	18.61	16.46	14.44
2050	21.68	18.87	16.23	13.81

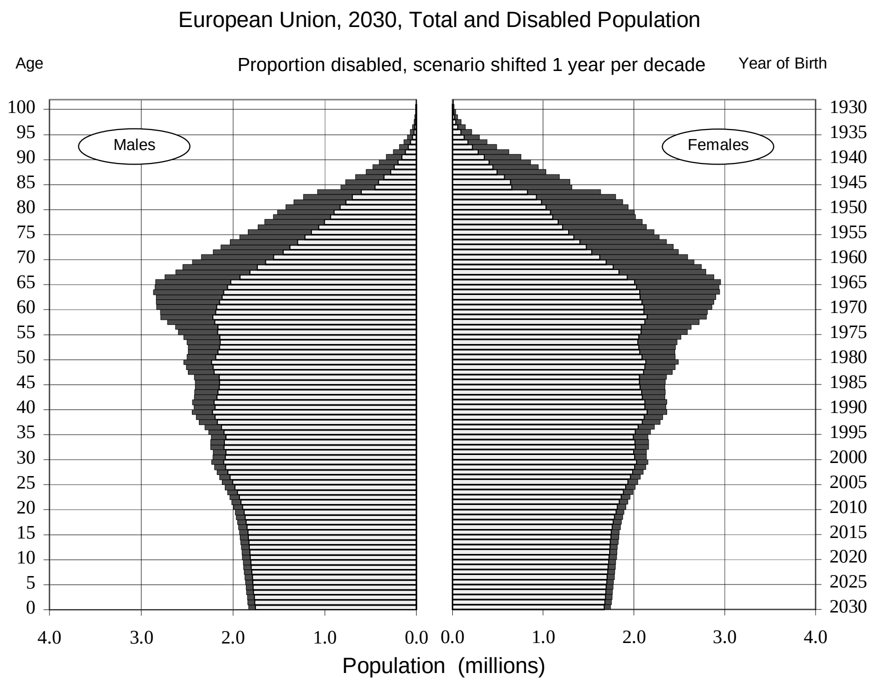
Figures 6 to 9 show the age pyramids of the total and the disabled population under the four scenarios for 2030. The labels on the left-hand side show the age and on the right-hand side the year of birth of the cohort. In 2030 as today, the cohort born around 1965 will be the largest. It is likely to be almost twice as big as the youngest cohort. The graphs also show that the disabled population is likely to be disproportionately female, which results from a combination of the facts that women have a higher life expectancy, hence there are more elderly women than men, and that women have a higher prevalence of disabilities.

Figure 6 Projected age pyramid of the disabled population under the scenario with zero shift, i.e., constant age-specific profile (dark shading indicates persons with disabilities).



When comparing Figures 6 and 9, showing the two most different scenarios, the alternative patterns of disability are clearly visible. Because the graduated age pattern of disability (see Figure 2) shows the steepest slope between ages 50 and 75, in 2030 the large number of cohorts born during the baby boom are most strongly affected by a shift in this age pattern. For these cohorts the number of people with disabilities is almost twice as large under the constant scenario as under the scenario of a shift by three years per decade, implying nine years over the given projection period. This means that by the year 2030 the risk of being disabled, e.g., at age 70 under this scenario, is equal to that at age 61 in 2000.

Figure 7 Projected age pyramid of the disabled population under the scenario with a one-year shift per decade (dark shading indicates persons with disabilities).



It is also interesting to see that the scenario that shifts the age pattern by only two years per decade is sufficient to practically stop the increase in the total number of people with disabilities in Europe. This came as a surprise to us because before performing these calculations, we had assumed that the ageing of this bulk of people born during the baby boom would be such a dominating force, leading to rapid increases in the number of elderly, that it would far outweigh the assumed improvements in the age-specific proportions disabled. This is, of course, based on a highly non-linear process, which is hard to project intuitively. These plausible shifts in the age profile of disability have such a strong effect on reducing the number of persons with disabilities in these big cohorts because the slope of the age profile is particularly steep for those ages and therefore a shift implies sizable declines in the age-specific proportions disabled. Since we assumed in the underlying population projections that life expectancy will increase on average by two years per decade – which is about the pace at which it increased over the past decades in Europe – the assumption of this third scenario, namely, that the age profile is shifted up the age scale by two years per decade, does not seem implausible. And this scenario leads to an essentially stable size of the disabled population in Europe.

Figure 8 Projected age pyramid of the disabled population under the scenario with a two-year shift per decade (dark shading indicates persons with disabilities).

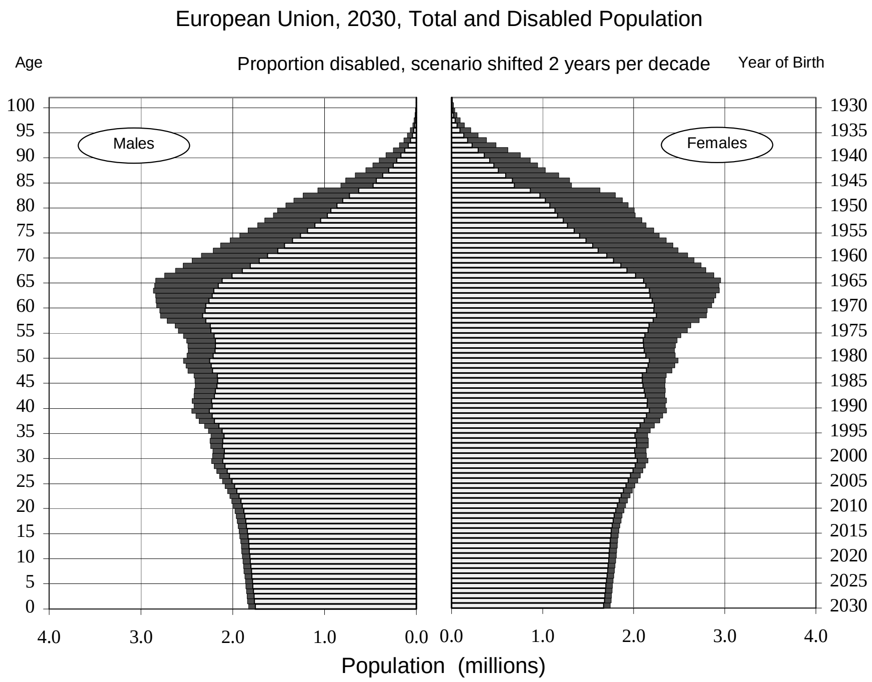
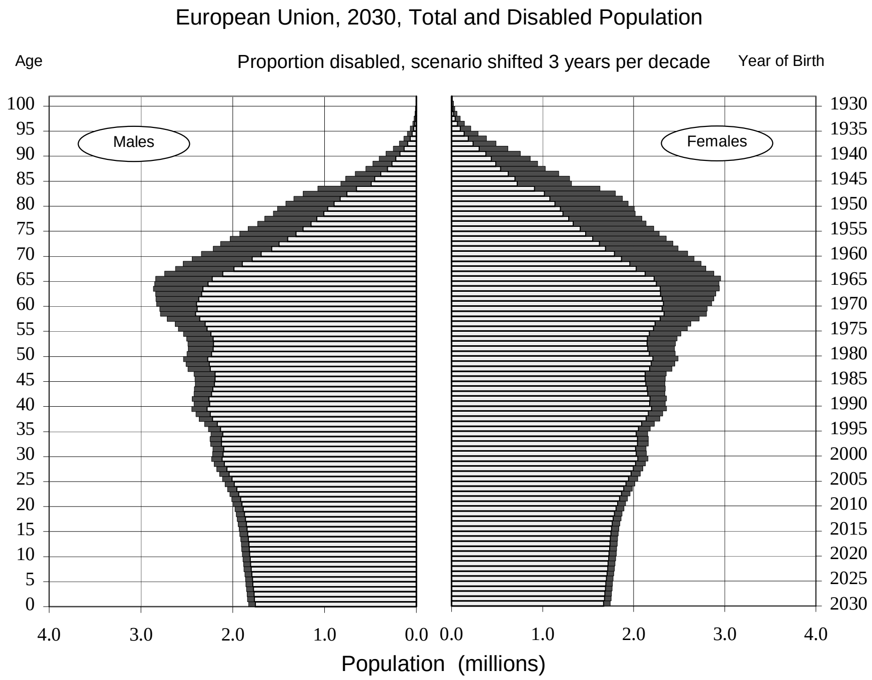


Figure 9 Projected age pyramid of the disabled population under the scenario with a three-year shift per decade (dark shading indicates persons with disabilities).



OUTLOOK AND CONCLUSIONS

The exploratory calculations presented here are rather simple approximations to a very complex process that is still poorly understood and for which the available database at the European level is very limited. New, internationally consistent surveys that include disability information are currently in the planning stage, and better data for Europe should become available in the not so distant future.

Extensions of the calculations presented here can go in several directions:

First, it might be useful to explicitly distinguish between different degrees of disability. Because these different degrees require very different care and public support, it would be important to know something about the future distributions of such disability levels.

More attention should be given to the changing patterns of age-specific transition rates to disability over time. In particular, is a shift in the whole age profile the right way to model this process, or would proportional declines or other models be more appropriate?

Furthermore, it would be beneficial to try to include these kinds of projections into the framework of probabilistic population projections, from which the population projections of this study are taken. The additional challenge would be to define an uncertainty distribution about the way in which the age profile of disability changes. But such an approach would not only give alternative scenarios of unknown likelihood – as has been done here – but would also provide an age- and sex-specific risk function for the number of people that will be in need of care, which can then be combined with cost functions to assist rational planning of future social and health care services.

Finally, a closer look should be taken at educational differentials in disability combined with a forecast of future changes in the educational composition of the elderly. The methods for such multi-state projections by age, sex and level of education are readily available (see Lutz and Goujon 2001) and could well be applied to the countries of Europe. This would at least quantitatively cover the proportion of possible future improvements in disability status that are due to a changing educational composition as demonstrated for the U.S. above, and leave less room to be filled by speculation as expressed through alternative scenarios of unknown likelihood, as was done in this paper.

The purpose of this paper is primarily to give a preliminary analytical approach to the important research question: Does the expected massive population ageing in Europe mean that a significant increase in the number of people with disabilities is inevitable? The results were surprising to us and very different from the common perception of this issue. It has identified an interesting and highly-relevant research topic that clearly deserves further exploration.

In conclusion, these exploratory calculations of Europe's future disabled population indicate that the number of elderly people who will be in need of assistance and care, will not necessarily increase as a consequence of population ageing. The key factor will be the future trend in age-specific risks to become disabled. This seems to be an area where preventive medicine, changing lifestyles and public health measures can make a big difference.

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Appendix Table 1 Results of the four scenarios in terms of absolute number disabled in the EU-15 (in millions), annual data.

	Shift			
Year	**0 years**	**1 year**	**2 years**	**3 years**
2000	59.87	59.87	59.87	59.87
2001	60.38	60.19	60.00	59.81
2002	60.90	60.52	60.14	59.76
2003	61.43	60.86	60.28	59.71
2004	61.98	61.20	60.43	59.66
2005	62.52	61.55	60.57	59.62
2006	63.08	61.90	60.73	59.57
2007	63.63	62.25	60.88	59.52
2008	64.19	62.59	61.02	59.47
2009	64.75	62.94	61.16	59.42
2010	65.30	63.28	61.29	59.35
2011	65.86	63.62	61.43	59.29
2012	66.41	63.95	61.55	59.21
2013	66.97	64.28	61.66	59.12
2014	67.52	64.60	61.77	59.03
2015	68.07	64.92	61.87	58.93
2016	68.62	65.24	61.97	58.82
2017	69.17	65.56	62.07	58.71
2018	69.72	65.87	62.16	58.60
2019	70.28	66.19	62.25	58.48
2020	70.83	66.50	62.34	58.36
2021	71.38	66.82	62.43	58.25
2022	71.93	67.13	62.52	58.13
2023	72.48	67.45	62.61	58.01
2024	73.02	67.75	62.69	57.89
2025	73.55	68.06	62.77	57.77
2026	74.08	68.35	62.86	57.64
2027	74.59	68.64	62.93	57.51
2028	75.08	68.91	63.00	57.38
2029	75.57	69.18	63.05	57.24
2030	76.03	69.43	63.09	57.09
2031	76.48	69.66	63.13	56.94
2032	76.91	69.88	63.15	56.78

			Shift	
Year	**0 years**	**1 year**	**2 years**	**3 years**
2033	77.32	70.09	63.16	56.61
2034	77.73	70.28	63.16	56.44
2035	78.11	70.46	63.15	56.26
2036	78.48	70.62	63.12	56.06
2037	78.83	70.76	63.08	55.86
2038	79.16	70.89	63.03	55.64
2039	79.47	71.00	62.95	55.41
2040	79.76	71.09	62.86	55.16
2041	80.02	71.15	62.75	54.90
2042	80.27	71.20	62.63	54.63
2043	80.49	71.23	62.48	54.33
2044	80.69	71.24	62.31	54.03
2045	80.86	71.22	62.13	53.71
2046	81.01	71.19	61.93	53.37
2047	81.14	71.13	61.71	53.01
2048	81.25	71.06	61.47	52.65
2049	81.33	70.96	61.21	52.26
2050	81.39	70.84	60.94	51.86

Appendix Table 2 Results of the four scenarios in terms of proportions disabled in the EU-15 (in percentages), annual data.

		Shift		
Year	**0 years**	**1 year**	**2 years**	**3 years**
2000	15.90	15.90	15.90	15.90
2001	16.00	15.95	15.90	15.85
2002	16.10	16.00	15.90	15.80
2003	16.21	16.06	15.91	15.76
2004	16.32	16.12	15.91	15.71
2005	16.44	16.18	15.92	15.67
2006	16.55	16.24	15.94	15.63
2007	16.67	16.31	15.95	15.60
2008	16.80	16.38	15.97	15.56
2009	16.92	16.45	15.98	15.53
2010	17.05	16.52	16.00	15.49
2011	17.17	16.59	16.02	15.46
2012	17.30	16.66	16.03	15.42
2013	17.43	16.73	16.05	15.39
2014	17.56	16.81	16.07	15.35
2015	17.69	16.88	16.08	15.32
2016	17.83	16.95	16.10	15.28
2017	17.96	17.03	16.12	15.25
2018	18.10	17.10	16.14	15.21
2019	18.24	17.18	16.16	15.18
2020	18.38	17.25	16.17	15.14
2021	18.52	17.33	16.20	15.11
2022	18.66	17.41	16.22	15.08
2023	18.80	17.49	16.24	15.04
2024	18.94	17.57	16.26	15.01
2025	19.08	17.65	16.28	14.98
2026	19.22	17.73	16.31	14.95
2027	19.35	17.81	16.33	14.92
2028	19.49	17.88	16.35	14.89
2029	19.62	17.96	16.37	14.86
2030	19.74	18.03	16.38	14.83
2031	19.87	18.10	16.40	14.79
2032	19.99	18.16	16.42	14.76

	Shift			
Year	**0 years**	**1 year**	**2 years**	**3 years**
2033	20.11	18.23	16.43	14.72
2034	20.23	18.29	16.44	14.69
2035	20.35	18.35	16.45	14.65
2036	20.46	18.41	16.46	14.62
2037	20.57	18.47	16.46	14.58
2038	20.68	18.52	16.46	14.54
2039	20.78	18.57	16.46	14.49
2040	20.88	18.61	16.46	14.44
2041	20.98	18.66	16.45	14.40
2042	21.08	18.70	16.44	14.34
2043	21.17	18.73	16.43	14.29
2044	21.25	18.76	16.41	14.23
2045	21.33	18.79	16.39	14.17
2046	21.41	18.81	16.37	14.10
2047	21.48	18.83	16.34	14.04
2048	21.55	18.85	16.31	13.97
2049	21.62	18.86	16.27	13.89
2050	21.68	18.87	16.23	13.81