The effect of education and the postponement of the onset of health limitations on the number of people suffering from health impairments in Austria, 2006 to 2051.

Elke Loichinger
Wittgenstein Centre for Human Capital and Development, Vienna/Austria
(Vienna University of Economics and Business (WU),
International Institute for Applied Systems Analysis (IIASA))
loiching@iiasa.ac.at

Motivation

Many existing estimates of the future number of people with specified health conditions (e.g. self-reported severe ill-health or not being able to perform certain ADLs) are done using a method that Batljan et al. call 'simple demographic extrapolation' (Batljan, Lagergren et al. 2009). This means that current (observed or estimated) prevalence rates of ill-health by age (and possibly sex) are multiplied with the respective future population numbers (e.g. Pickard, Comas-Herrera et al. 2007, Comas-Herrera, Wittenberg et al. 2006). This approach is based on the assumption that current rates of ill-health will prevail into the future and that only the composition of the population by age and sex will change. Since all developed countries are going to see an increase in the absolute number of their elder population, this approach inevitably leads to a projected increase in the number of people with ill-health.

There are a few studies that go beyond this wide-spread approach and consider educational attainment besides age and sex (e.g. Freedman and Martin 1999, Joung, Kunst et al. 2000, Batljan, Lagergren et al. 2009, K.C. and Letzner 2010). Their mutual result is that adding information and assumptions about the prevalence of health limitations by highest level of educational attainment to projections of populations' future health leads to significantly different results compared to analyses that do not include this factor.

The prevalence of disability that is observed at any point in time is the result of three processes that are going on: the timing of the onset of disability, the degree of recovery, and the mortality pattern of disabled and non-disabled people (Crimmins, Hayward et al. 2009). Hence, any observed changes over time are also the result of changes in these three processes. These considerations are just as valid when analyzing any form of functional limitation, not just disability. I do not model these processes themselves but make assumptions about the effect changes in them have on the proportions with health impairment by age, sex and education.

Freedman and Martin give four reasons why it is worth focusing on education when analyzing and projecting functional limitations of older Americans (Freedman and Martin 1999): there is a strong association between education and health-related

behavior over the life-cycle; contrary to other measures of socio-economic status, education is easy to measure and does for the great majority of the population not change after a certain age; educational attainment can be projected quite accurately; and the elderly's educational attainment has been and is projected to keep increasing.

The following analysis of current health limitations of the Austrian population, and, based on the results, projections of future distributions of health limitations, will answer three questions:

- **How are health impairments (defined as a health problem that has been hampering the respondent in the execution of daily activities for 6 months or longer) distributed by age, sex and education?**
- **What is the effect of different assumptions about the future development of educational attainment on the total number of people who suffer from health impairments?**
- **What is the effect of different assumptions about the future development of age-, sex- and education-specific patterns of health impairments on total number of people who will suffer from them?**

Data and methods

The data source for calculations of age-, sex- and education-specific rates of health limitations is the latest national health survey, which was conducted in 2006 and 2007 (*Österreichische Gesundheitsbefragung 2006/2007*). It is a representative stratified random sample of the Austrian population age 15 and over, based on the central population register. It can be used to calculate prevalences of different kinds of health impairment (Statistik Austria 2007). This dataset has two main advantages over other possible data sources. First, it does include people living in institutions (e.g. in nursing homes). Second, its size of 15,474 persons is much larger than in any other survey that has comparable questions about health limitations (e.g. SILC, SHARE). The definition of impairment used for the present analysis is to what extent someone reports a health problem that has been hampering him or her in the execution of daily activities for 6 months or longer. The answer categories are „severely limited", „somewhat limited", and „not limited".[1] Only those who reported being severely limited are labeled as having a health impairment.

[1] Original question in the questionnaire: „Wie sehr sind Sie zumindest seit einem halben Jahr durch ein gesundheitliches Problem bei Tätigkeiten des normalen Alltagslebens eingeschränkt? 1. Stark eingeschränkt. 2. Etwas eingeschränkt. 3. Nicht eingeschränkt."

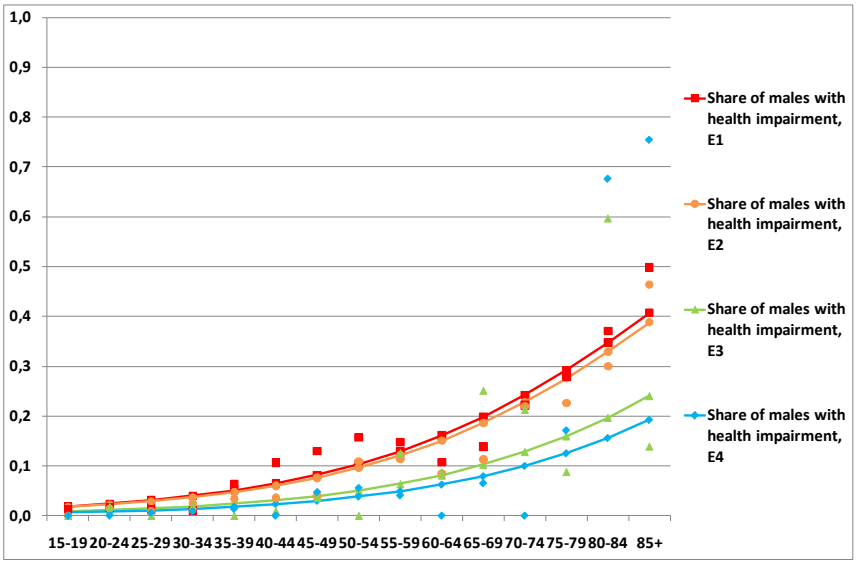
The four categories of highest educational attainment chosen and the respective ISCED categories are:

E1: compulsory schooling or less (ISCED 2)

E2: Apprenticeship training or VET school (ISCED 3B)

E3: Secondary academic school or VET college (ISCED 3A/4A/4B)

E4: University, “Fachhochschule”, Post-secondary VET college and courses, or University college of education (ISCED 5/6)



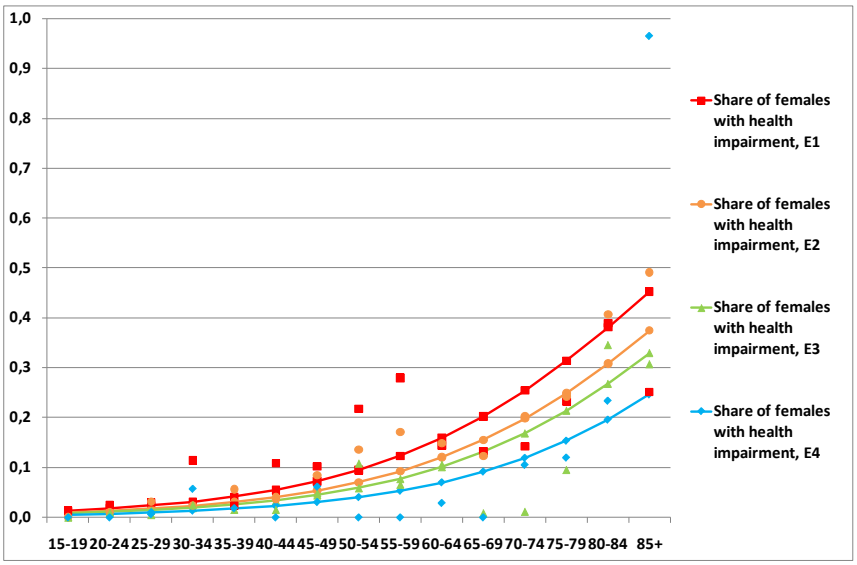


Figure 1: Proportions of people reporting having a health problem that has been severely hampering him or her in the execution of daily activities for at least the last 6 months, by age, sex and education (source: Austrian National Health Survey 2006/07). Estimates calculated directly (dots) and by logistic regression (lines).

The values for age-, sex- and education-specific prevalences of impairment have been estimated by logistic regressions (run separately for men and women). The rates could not be calculated directly from the data, since – particularly for older age-groups and the

highest level of educational attainment – there were very few observations. This is the same approach Batljan et al. use in their study for Sweden in order to obtain stable data for their estimates of people with severe ill-health (Batljan, Lagergren et al. 2009). Age enters the logistic regression as a metric variable (5-year age-groups) and the four categories of educational attainment enter as dummys. With the exception of males with B2 (vocational training or VET school) as their highest level of educational attainment, all coefficients are significant at the 99% level.

The proportion of people who report being severely impaired in the execution of daily activities due to a health problem increases with age for both sexes. Higher levels of educational attainment are associated with lower levels of impairment (see Figure 1). With the exception of E2, the prevalence of impairment is always higher for females than for males. For males, persons with E1 and E2 as highest educational attainment have similar rates of impairment, as do those with E3 and E4. As far as women are concerned, there is no such affiliation.

In order to be able to estimate future number of people suffering from health impairments, the estimated rates are combined with population projections by age, sex, and highest level of educational attainment. These population projections are done using the multi-state cohort component method. Thus, differences in fertility, mortality and migration by highest educational attainment are being accounted for. The general projection approach is based on the one described in KC et al. 2010.

Scenarios

In a next step, the estimated age-, sex- and education-specific rates of impairment are multiplied with the population projections by education. This allows assessing the effect of changes in educational attainment of the elderly population on the total number of people with functional limitations. In order to be able to compare this approach to the simpler approach where educational differentials are not considered, there is also a reference scenario that does not consider educational differences but does only uses prevalence rates by age and sex.

I define three education scenarios. In the first education scenario, the transitions between educational categories are kept constant at current levels (**Constant scenario**).
In the second education scenario, I assume that the trend of highest educational attainment that was observed since 1971 continue until 2031 (**Trend scenario**). After that, attainment rates are kept constant until 2051.
The third education scenario is the benchmark scenario. Here, I assume that the educational attainment of the 30- to 34-year-olds that are observed in Finland today will be attained in Austria in 2031 (**Finish scenario**) and kept constant thereafter.

In addition to these four scenarios with varying educational compositions of the population, there are three more that have the purpose to demonstrate what a shift in the onset of impairment to higher ages has on the aggregate number of people who are impaired. Technically, this assumption about a later onset is implemented by shifting the age pattern of the proportion impaired to the right. Since it is unclear how the increase in life-expectancy that is part of our model of the population projections will be distributed between healthy and hampered additional years of life, we assume three different scenarios of distribution: age-, sex- and education-specific prevalence rates are shifted to higher ages by one, two and three years, respectively. This means in the case of a shift of two years, for instance, that the rates of a 70- to 74-year-old 2031 will be equivalent to those observed in 2006 for a 65- to 69-year-old. This procedure is identical to the approach taken by Lutz and Scherbov (2005) and by the European Commission (2003).

Impairment scenario → **Education scenario ↓**	**Age- and sex-specific rates**	**Age-, sex- and education-specific rates**
Constant scenario	**Constant rates**	**Constant rates**
		Shifted rates (one year per decade)
		Shifted rates (two years per decade)
		Shifted rates (three years per decade)
Trend scenario	**-**	**Constant rates**
Finish scenario	**-**	**Constant rates**

Overview of the seven health scenarios.

Results

645,275 persons reported having a continuing health impairment in 2006 that severely hampered them in the execution of daily activities. The combination of education-specific impairment rates with education-specific population projections shows that there are significant differences in the total number of people with impairment that are purely due to changes in the educational composition of the elderly. Until 2051, this number is projected to increase for each of the four education scenarios (see Figure 2). However, once educational attainment is taken into account, the increases are significantly lower compared to the approach where only age- and sex-specific rates are considered. In the latter, the number of persons with a severe health impairment

increases continuously to slightly more than 1 million. Under the Finish scenario, the respective number peaks in 2046 at 824,000 and starts to decline afterward.
The effect of changes in the educational composition of the population will play out much more after 2051, when the first cohorts that were at young ages exposed to the different education scenarios reach age-groups where the proportions of persons with limitations increase.

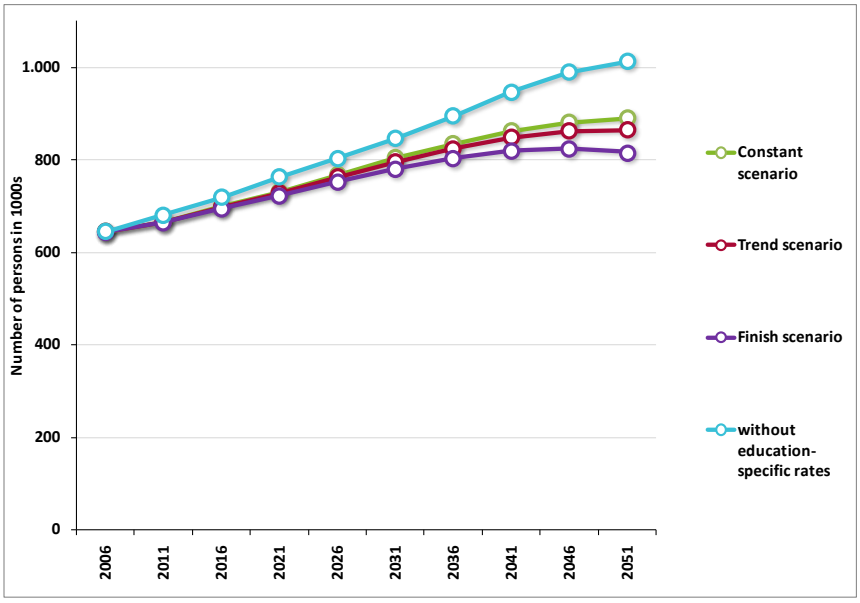


Figure 2: Number of persons reporting having a health problem that has been hampering him or her in the execution of daily activities during the last 6 months, by age, sex and education, 2006 to 2051. Education-scenarios.

Contrary to the variation in educational attainment where each scenario considered leads to an increase in the number of people with severe limitations, shifting age-, sex- and education-specific rates to the right leads to an increase only in the case where a moderate shift of one year is assumed (see Figure 3). Already a shift of two years leads to a decline in the absolute number of impaired persons until 2051 (613,000). A shift of three years would entail a reduction to 501,000 persons.

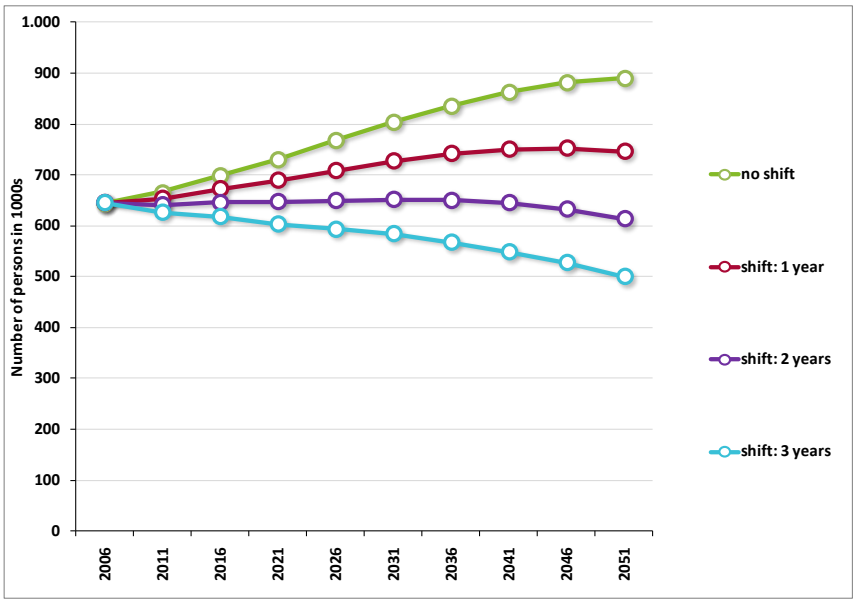


Figure 3: Number of persons reporting having a health problem that has been hampering him or her in the execution of daily activities during the last 6 months, by age, sex and education, 2006 to 2051. Shift-scenarios.

Discussion

One point up for debate it how stable the observed gradient between the different education levels is, i.e. how likely it is that the educational differences observed today will persist into the future. When more and more people obtain higher education and the group of higher educated makes up an increasing share of the overall population, it can be argued that this will change the meaning of higher education, and hence the association between education and health. The same argument holds for the lower educated as well: if fewer and fewer people fall into the lowest category of educational attainment, in our case compulsory education or less, belonging to this group might mean something different in the future compared to today, too. Batljan et al. discuss this point in detail for the Swedish case (Batljan, Lagergren et al. 2009). They demonstrate that, depending on the explanation that one assumes to be responsible for the observed gradient (material/behavioural vs. psychosocial), various future paths are thinkable. Also (Freedman and Martin 1999) discuss the possible changing nature of the relationship between additional years of education and health in the case of the US, where a significant increase in the elderly population with a high school diploma is projected until 2030: “It may be, for example, that as the high-school graduate population becomes larger and more heterogeneous, the advantage conveyed by additional years of education will dissipate.” This consideration is based on the notion that it is relative status that matters in the end, not absolute status. In addition, (Freedman and Martin 1999) point out that it is possible that the quality of past and future high-school education is not the same. At the same time, they provide arguments why the correlation between education and better health might become even stronger in the future: illness prevention and treatment of illness and disability is becoming

increasingly complex, as are the regulations insurances establish when looking for treatment and care.

What will be done next is to do the analysis again, using different definitions of health impairment (e.g. the inability to perform one or more ADLs/IADLs) and to compare outcomes. Also, a further scenario to look at is based on the thought that the health status of people with higher educational attainment represents the best outcome that is possible and that can potentially be achieved by people with lower levels of education as well (compare Batljan, Lagergren et al. 2009). Hence, I calculate a scenario where the rates observed for the highest education category will be achieved by everyone in 2051.

References

Batljan, I., M. Lagergren, et al. (2009). "Population ageing in Sweden: the effect of change in educational composition on the future number of older people suffering severe ill-health." European Journal of Ageing **6**(3): 201-211.

Comas-Herrera, A., R. Wittenberg, et al. (2006). "Future long-term care expenditure in Germany, Spain, Italy and the United Kingdom." Ageing & Society **26**: 285-302.

Crimmins, E. M., M. D. Hayward, et al. (2009). "Change in Disability-Free Life Expectancy for Americans 70 Years Old and Older." Demography **46**(3): 627-646.

Cutler, D. M. and A. Lleras-Muney (2006). Education and Health: Evaluating Theories and Evidence, National Bureau of Economic Research, Inc, NBER Working Papers: 12352.

European Commission (2003). The social situation in the European Union 2003.

Freedman, V. A. and L. G. Martin (1999). "The Role of Education in Explanining and Forecasting Trends in Functional Limitations among Older Americans." Demography **36**(4): 461-473.

Joung, I. M. A., A. E. Kunst, et al. (2000). "Education, aging, and health: to what extent can the rise in educational level relieve the future health (care) burden associated with population aging in the Netherlands?" Journal of Clinical Epidemiology **53**: 955–963.

K.C., S. and H. Letzner (2010). "The effect of education on adult mortality and disability: a global perspective." Vienna Yearbook of Population Research **8**: 201-235.

KC, S., B. Barakat, et al. (2010). "Projection of populations by level of educational attainment, age, and sex for 120 countries for 2005-2050." Demographic Research **22**(15): 383-472.

Klotz, J. (2010). "Convergence or divergence of educational disparities in mortality and morbidity? The evolution of life expectancy and health expectancy by educational attainment in Austria in 1981-2006." Vienna Yearbook of Population Research **8**: 139-174.

Lleras-Muney, A. and D. M. Cutler (2010). "Understanding differences in health behaviors by education." Journal of Health Economics **29**(1): 1-28.

Lutz, W. and S. Scherbov (2005). "Will Population Ageing Necessarily Lead to an Increase in the Number of Persons with Disabilities? Alternative Scenarios for the European Union." Vienna Yearbook of Population Research **2005**: 219-234

Pickard, L., A. Comas-Herrera, et al. (2007). "Modelling an entitlement to long-term care services for older people in Europe: projections for long-term care expenditure to 2050." Journal of European Social Policy **17**(1): 33-48.

Statistik Austria (2007). Österreichische Gesundheitsbefragung 2006/2007. Hauptergebnisse und methodische Dokumentation. Statistik Austria im Auftrag des Bundesministerium für Gesundheit, Familie und Jugend. Wien.