

Extended Abstract

'Expansion of morbidity' or 'dynamic equilibrium' in the case of diabetes?

Changes of disability rates between 2004 and 2015 in Germany and the role of co-morbidity

1. Background

Different theories have been proposed to describe the dynamics of health changes in the population within the context of increasing life expectancy. While Fries' (1980) hypothesis of 'morbidity compression' assumes that life years spent in morbidity will decrease, the 'expansion of morbidity hypothesis' (Gruenberg 1977) posits that the increased lifetime will entail an increase in the number of years spent in states of disease and disability. A third hypothesis, the 'dynamic equilibrium' (Manton 1982) postulates that longer survival is associated with an increase of life years in morbidity but due to medical advances and healthier lifestyles, times spent in severe disability will decline. For the case of type 2 diabetes evidence suggests a marked increase of prevalence rates over the past decades. These trends were accompanied by reductions of mortality rates leading to increasing number of years spent with diabetes. This development clearly contradicts the assumption of 'morbidity compression'. In order to decide whether 'morbidity expansion' or 'dynamic equilibrium' applies, additional information on trends on disease severity is required. Using this as a starting point, we wanted to investigate change of disability rates among older adults. In more detail and more specific, the study is guided by the following research questions:

1. Has the prevalence of diabetes increased between wave 1 (2004/5) and wave 6 (2015)?
2. How do disability rates in terms of ADL and IADL change in older adults with diabetes as compared with the population without the disease?
3. Do increasing comorbidity rates (additional chronic conditions, depression and obesity) account for changes in disability rates among individuals with diabetes?

2. Methods

Sample

Data were derived from the Survey of Health, Ageing, and Retirement in Europe (SHARE). Our analyses were restricted to Germany and included individuals over 49 years of age. We only used wave 1 (2004/5) and 6 (2015) as we aimed to compare two distinct samples with time-points as far apart as possible. Overall, 2,918 respondents in wave 1 (1,363 men / 1,555 women) and 3637 in wave 6 (1,738 men / 1,899 women) were included.

Disability assessment: ADL and IADL

The ADL index refers to everyday self-care activities such as dressing, walking, bathing, eating and toileting, in order to cover fundamental activities for maintaining independence. The IADL index describes the number of limitations of more complex instrumental activities of everyday life, such as managing payments, shopping, using a telephone, taking medication or doing work around the house. The modified version used in SHARE includes six activities of ADL and seven activities of IADL. In addition to sum scores, SHARE provides dichotomous categorical variables reclassifying ADL as well as IADL into two categories: 0 “no ADL limitations” and 1 “1+ ADL limitations”. We used these categorical variables as the frequency of more than one limitation was only 10.5% for ADL and 15.9% for IADL, respectively.

Statistical analysis

We estimated age- adjusted predicted probabilities of self-reported diabetes for each wave by means of logistic regression analyses. Based on the same regression model we estimated the ‘chance’ of having at least one disability in terms of ADL and IADL by age, gender and wave. In addition to odds ratio (OR), we reported predicted probabilities of disabilities using the post-estimation command ‘margins at means’.

Multivariate decomposition for nonlinear response models (Powers et al. 20011) was employed for the third research question in order to examine whether rising obesity, co-morbidity and depression rates may account for changes of disability rates among individuals with diabetes between 2004/5 (wave 1) and 2015 (wave 6). The technique uses the output from regression models to partitioning changes over time into components attributable to changing effects (*C*) and changing composition (*E*). We have chosen wave 6 as the comparison group and wave 1 as reference group. We decomposed observed changes of disability among individuals with diabetes between wave 1 and 6 using a logit model with a set of predictors including age, gender, obesity (BMI of 30.0 or higher), depression (EURO-D scale) and multi-morbidity (more than two additional chronic conditions). We used the Stata command ‘mvdcmp’ (Powers et al 2011) for carrying out the multivariate decomposition. All analyses were performed with STATA v13.1.

3. Results

Predicted probabilities of diabetes significantly increased from 10.7% in wave 1 (2004/5) to 12.4% in wave 6 (2015), corresponding to an OR = 1.19 ($p=0.025$) in wave 6 as compared to wave 1. Stratification by gender revealed that prevalence rose only in men from 11.2% to 15.4% (OR=1.45, $p=0.001$) while remained unchanged in women at nearly 10% (OR=0.99, $p=0.903$).

Among individuals with diabetes, predicted probabilities for having at least one ADL-limitation increased from 10.2% in wave 1 to 16.8% in wave 6 (OR=1.78, $p=0.008$). Stratified analyses showed that this holds for women as well as for men (fig. 1). By contrast, among the population without diabetes, predicted probabilities of suffering at least from one ADL-limitation among men remained unchanged and declined among women. With respect to IADL, proportions of individuals with limitations increased among men with diabetes, while decreasing slightly in women. In men without diabetes the proportion of having at least one IADL-limitation decreased significantly while in women decline was less pronounced.

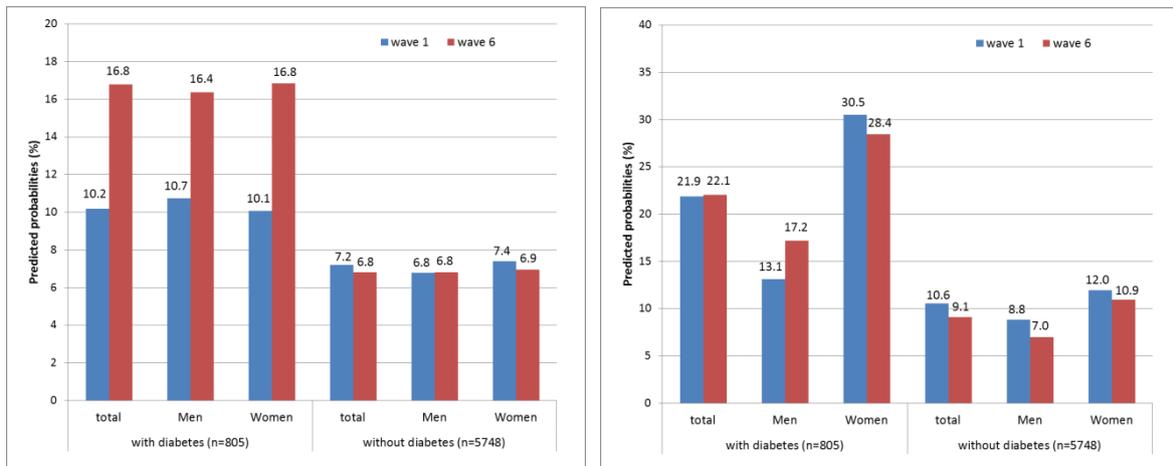


Fig. 1: Change in ADL (left side) and IADL (right side) among diabetics as compared with the general population without diabetes, predicted margins at means

Evaluating compositional differences between wave 1 and 6 revealed substantially higher multi-morbidity and obesity rates in wave 6 as compared to wave 1. By contrast, depression rates remained largely unchanged over time. Analyzing changes in the effects of predictors between wave 1 and 6, for both disability outcomes we found significantly higher effects of multi-morbidity and obesity in wave 6 as compared to wave 1.

Carrying out the decomposition, we found the prevalence of ADL among diabetic persons to increase by 5.9 percentage points from wave 1 to 6. *Changing composition* accounted for 52.9% while *changing effects* accounted for 47.1% of the change. Changes in prevalence of multi-morbidity and obesity rates between wave 1 and 6 contributed most to the changing composition, indicating that the increase in ADL in wave 6 would be reduced by 16.3% when shifting multi-morbidity levels from wave 1 to wave 6. Shifting obesity levels from wave 1 to 6 would result in a further decrease of 12.8%. With respect to *changing coefficients*, differences of intercepts (baseline logits) accounted for most of the higher prevalence of ADL in wave 6 as compared to wave 1. The IADL decomposition was only carried out for men as for women no increase over time was observed. Among males with

diabetes, prevalence of IADL increased by 5.4 percentage points from wave 1 to 6. Changes of composition accounted for the major share of this increase with a contribution of 97.3%. Shifting the age distribution from wave 1 to wave 6 would lead to a large decrease of the difference in IADL-disability between the two waves of 71.5%. In addition, shifting the distributions of multi-morbidity, obesity and depression from wave 1 to 6 would lead to a further decrease of 26%.

4. Discussion

In the light of the global trend of increasing prevalence of chronic conditions, the 'dynamic equilibrium hypothesis' provides an optimistic scenario of the future development of population health. It states that, although an aging population is likely to lead to an increase in chronic diseases, the impact of this increase may be partially offset by a shift from major to moderate limitations. As a consequence, quality of life of individuals affected by chronic conditions would improve while levels of disability and required care may decline. Contrary to this assumption, we found increasing disability rates in terms of ADL among older adults with diabetes. In men we also found increases in IADL-related disability, suggesting that also the rates of less severe functional limitations may have increased.

As our findings lend support to the hypothesis of expansion of morbidity, the German health care system may be facing higher demands in the future. Our findings suggest that this may be fueled by parallel increases of co-morbidity and obesity among individuals with diabetes.