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Working paper

Biases in health expectancies due to educational differences in survey participation of older Europeans: It's worth weighting for

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Abstract

Health expectancies are widely used by policymakers and scholars to analyse the number of years a person can expect to live in good health. Their calculation requires life tables in combination with prevalence rates of good or bad health from survey data. The structure of typical survey data, however, rarely resembles the education distribution in the general population. Specifically, low-educated individuals are frequently underrepresented in surveys, which is crucial given the strong positive correlation between educational attainment and good health. This is the first study to evaluate if and how health expectancies for 13 European countries are biased by educational differences in survey participation. To this end, calibrated weights that consider the education structure in the 2011 censuses are applied to measures of activity limitation in the Survey of Health, Ageing and Retirement in Europe (SHARE). The results show that health expectancies at age 50 are biased by an average of 0.3 years when the education distribution in the general population is ignored. For most countries, health expectancies are overestimated, yet remarkably, the measure underestimates health for many Central and Eastern European countries by up to 0.9 years. These biases are significant, especially in light of the European Commission's aim to add 2 years of healthy life for the average European by 2020. The findings of this study highlight the need to adjust for distortion in health expectancies, especially when the measure serves as a base for health-related policy targets or policy changes.

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1. Introduction

Life expectancy continues to increase in Europe. We live longer, but do we live healthier? Answering this question is of utmost importance in the presence of demographic change. How long and how healthy we live is necessary information for public and private healthcare providers to plan health coverage and care services. Furthermore, policymakers are interested in the employability of older generations when adapting pension systems, in particular, when adjusting the retirement age. Whether we spend our additional life years in good or bad health is frequently analysed via health expectancy (HEX), an indicator that captures the number of years a person can expect to live in good health.[1] This concept was developed half a century ago (Sanders 1964; Sullivan 1971) and has garnered increasing attention from both scholars and policymakers. For example, the European Commission aims to add 2 years of healthy life for the average European by 2020 (European Commission 2010). Furthermore, many European governments use HEX to set health-related targets and make policy changes based on this measure (Bogaert et al. 2018).

HEX usually combines information on mortality with prevalence rates of good or bad health from survey data; therefore, it captures both the quantity and quality of additional life years. A key problem with this approach, however, is that the education distribution of survey participants rarely resembles the distribution of the general population. A common deviation is that highly educated individuals are more likely to participate in surveys than low-educated individuals, leading to an overrepresentation of the highly educated in samples (Reinikainen et al. 2018; Demarest et al. 2013; Korkeila et al. 2001). This mismatch is crucial given the strong positive correlation between education and good health (Mirowsky 2003; Eide & Showalter 2011; Cutler & Lleras-Muney 2006; Schurer et al. 2014). Overrepresenting healthy, well-educated individuals in surveys makes countries appear to have healthier populations than is actually the case.

The aim of this study is to explore if and how HEX differs when the education structure in the general population is considered. Although there has been vast research on HEX, to the best of my knowledge, no previous work has addressed whether biases in the education composition distort the measure. Given the widespread use of HEX among scholars and policymakers, knowing the reliability of the measure in the context of flawed survey data is pivotal. Moreover, this study contributes to the literature by illustrating how bias can be adjusted for when auxiliary information on the true population structure is available.

For this purpose, weights are calibrated via iterative proportional fitting (IPF) to adjust for education bias in the survey structure. Auxiliary information that is expected to capture the actual education distribution in the general population is taken from Eurostat's Census database, which provides Population and Housing Censuses for Europe. The most recent census was conducted in 2011. Thus, this study analyses 13 European countries in 2011. HEX is calculated with Sullivan's method. To this end, person-years lived according to Eurostat life tables are divided into years with good and bad health based on prevalence rates from the Survey of Health, Ageing and Retirement in Europe (SHARE). The survey is one of the most commonly used sources for the computation of HEX in Europe. Like in previous work, prevalence of bad health is based on the Global Activity Limitation Indicator (GALI), making my results comparable to those in the literature (Bogaert et al. 2018; Robine 2003). As a robustness analysis, prevalence of bad health is also estimated based on grip strength. Analyses of if and

[1]Other commonly used terms for health expectancies are healthy life years, healthy life expectancy, disability-free life expectancy, health-adjusted life expectancy, active life expectancy, and years of life without functional disabilities.

how deviation between surveys and the general population biases HEX are conducted by comparing HEX with and without education-adjusted weights (EW).

The remainder of this paper is structured as follows. In Section 2, relevant literature is summarised. The datasets and methods are introduced in Sections 3 and 4, respectively. The results are presented in Section 5 and discussed in Section 6. Section 7 concludes by summarising the study's findings.

2. Background

Educational attainment affects health

The positive correlation between educational attainment and good health is well established (Mirowsky 2003). For example, the average life expectancy at birth of well-educated Europeans is 7 years higher than that of low-educated individuals (Eurostat 2011b). Furthermore, low-educated persons report higher activity limitations (Eurostat 2011d) and higher levels of bodily pain (Schurer et al. 2014). This can be partially explained with economic rationales, such as the positive link between education and income or correlations between education and occupational choice (Cutler & Lleras-Muney 2006). Additionally, differences in health behaviour are potential drivers of the education gradient in health. On one hand, low-educated persons are more likely to smoke, drink heavily, and be obese than highly educated persons. On the other hand, they are less likely to use preventive care, drive safely, and live in safe houses (Cutler & Lleras-Muney 2010). While the positive relationship between socio-economic advantages and health is found throughout Europe, the magnitude of that correlation varies by gender and country. First, the education gradient is larger for men than for women in life expectancy (Luy et al. 2011) as well as in HEX (Matthews et al. 2006). Second, in Central and Eastern European (CEE) countries, highly educated individuals are much healthier than low-educated individuals, whereas the difference is small in, for example, Denmark (Cambois et al. 2015).

Educational attainment affects survey participation

Educational attainment is associated not only with health but also with survey participation. Low-educated persons are frequently underrepresented in health surveys, for example, in Belgium (Van Der Heyden et al. 2017; Demarest et al. 2013), Denmark (Ekholm et al. 2010), and Finland, where the gap in survey participation by low- and well-educated individuals has substantially widened over time (Reinikainen et al. 2018). This violation of the "missing at random" assumption can be attributed to coverage errors, sampling errors, and non-response errors (Groves et al. 2009). Coverage errors stem from the mismatch between the survey's target population and its sampling frame, for example, when phone registers serve as sampling frames, although low-educated persons are less likely to own phones than the highly educated. Sampling errors denote the gap between sampling frame and the sample, which emerges because not all individuals in the sampling frame can be surveyed due to time and money constraints. To account for the unequal selection probabilities of sample units, surveys frequently provide sampling weights. Finally, non-response errors stem from differences between the sample and the actual respondents.

The strong association between non-response and low education (Christensen et al. 2014) can be explained by three channels (Groves et al. 2009). First, low-educated persons are harder to contact due to their socio-demographic and social-environmental attributes. For example, they might have unstable life paths and are consequently more likely to change their address. Second, participation in surveys is usually voluntary and low-educated persons are more likely to refuse to participate than the highly educated. Finally, low-educated individuals may be less likely to provide the requested survey data for reasons such as being too sick to participate or because they are less aware of certain domains such as their health or financial situation.

Education is not the only characteristic corresponding with lower response rates. Gender and age also impact survey participation, which is why these variables are commonly considered in survey weights. Furthermore, characteristics such as race (Shavers et al. 2002) or relationship status (Korkeila et al. 2001) are associated with non-response. This study, however, only focuses on education-related biases. First and foremost, education is a common proxy for socio-economic status that is rather stable over lifetime with relatively low measurement error. Furthermore, the education gradient in response-behaviour is well established. Finally, register or census data on the education structure in the general population is more readily available than auxiliary information on other socio-economic characteristics, making it more possible to compare the education distribution in the general population to that in the survey data.

Educational differences in survey participation bias the prevalence of good and bad health

In summary, highly educated individuals are, on average, healthier than low-educated individuals and are more likely to participate in surveys. Thus, both the variable of interest (health) and the likelihood to participate in a survey are influenced by educational attainment. When inferences about the health of the general population are made based on unweighted prevalence rates from such flawed surveys, the general population appears healthier than what is true in reality. For example, Van Der Heyden et al. (2017) found that the prevalence of people with diabetes and asthma in Belgium is underestimated when the actual education distribution in the general population is not considered. In the Netherlands, education-related non-response leads to negative biases in the prevalence of low self-assessed health, smoking, alcohol intake, and low physical activity (Van Loon et al. 2003).

Prevalence of good or bad health is needed to calculate HEX

Prevalence rates of good or bad health are one of the main components needed when calculating HEX, which makes the education-related bias in survey data a major concern. Similar to life expectancy, HEX varies substantially among European countries and is particularly low in CEE countries (Jagger et al. 2011). Around 2010, HEX at birth was 70.1 years for Swedish men but only 52.6 years for Slovakian men. For women, HEX at birth ranged from 71.5 years in Malta to 52.7 years in Slovakia (Jagger et al. 2013). Overall, women spend more years in good health, but live a larger proportion of their life disabled due to their longer survival (Luy & Minagawa 2014; Pongiglione et al. 2015). While life expectancy has clearly increased throughout Europe, evidence on HEX is less conclusive. For example, Salomon et al. (2012) find an overall increase in HEX globally as well as in Europe between 1990 and 2010. By contrast, Jagger et al. (2013) report little change between 2005 and 2009 in Europe. The lack of a consistent time trend in HEX might be partly explained by the small sample sizes in the surveys utilised. Analysing prevalence by country, gender, and age requires sufficient numbers of observations in each country-gender-age cell. This is often not the case, especially at older ages. Consequently, prevalence rates based on these small cells are often not reliable and have large confidence intervals: the small cell sizes make it difficult to separate the signal from the noise.

Regardless of the evidence on the inadequate representation of the low-educated persons in surveys, studies typically do not adjust for prevalence rates of HEX. One explanation for this might be that auxiliary information on the actual education distribution in the general population is not readily available. Register data are only accessible for some European countries and censuses are only conducted with long time intervals. Yet whenever available, auxiliary data on the actual education distribution in the general population can be utilised to calibrate weights so that they account for deviations between the true distribution and the survey distribution.

3. Data

The following sections describe analyses of whether adjusting for the education distribution in the general population via calibrated weights changes the prevalence of bad health and consequently the HEX for European countries. The analyses rely on three different data sources. Data from the 2011 Population and Housing Censuses provides information on the actual education distribution in the general population, which is utilised to generate calibrated weights. In addition, life tables from Eurostat (Eurostat 2011c) along with prevalence of bad health from SHARE are taken to compute HEX with Sullivan's method (Sullivan 1971; Saito et al. 2014). Analyses and comparisons of HEX in Europe are most commonly based on SHARE, making it the obvious choice for analysing non-response-related biases.

3.1 The Survey of Health, Ageing and Retirement in Europe (SHARE)

Prevalence rates of bad health are extracted from the fourth wave of SHARE, which was mainly conducted in 2011, and consequently corresponds with the census data (Malter & Börsch-Supan 2013; Börsch-Supan, Brandt, Litwin, et al. 2013; Börsch-Supan 2018; Börsch-Supan, Brandt, Hunkler, et al. 2013). Although some interviews took place in 2010 and 2012, 94% of all observations stem from 2011. In total, 16 European countries participated in the fourth wave; however, 3 of these countries do not provide reliable census data via Eurostat for the requested year (see Section 3.2). Therefore, the sample is restricted to 13 countries including Austria, Belgium, Czechia, Denmark, Estonia, France, Germany, Hungary, Italy, Poland, Portugal, Slovenia, and Spain.

The target population of SHARE consists of all non-institutionalised individuals aged 50 and older who regularly live in and speak the respective survey country's language(s). Spouses of target individuals are included in the sample regardless of their age; however, for this study, all individuals younger than 50 years old are excluded (Börsch-Supan, Brandt, Hunkler, et al. 2013; Lynn et al. 2013; Bergmann et al. 2017). The remaining country sample size lies between 1,615 observations in Germany and 6,754 observations in Estonia. Some countries only provide small numbers of observations per gender-age-education cell, especially at higher ages. Samples for Germany, Poland, and Portugal are particularly small: all three samples have less than 2,000 observations. Details on the sample sizes and cell sizes for each country are summarised in Appendix A.1.

The survey is based on probability samples with close to full target population coverage for all countries, yet details regarding the sample design, in particular the sampling frame, vary by country (for an overview, see Lynn, De Luca, and Ganninger 2013; De Luca and Rossetti 2018; Bergmann et al. 2017). Respondents were surveyed in their homes by interviewers using computer-assisted personal interviews. For details on response rates, consult Bergmann et al. (2017).

For the calibration of weights, information on sample proportions by country, gender, age, and educational attainment is required. Educational attainment is split into three groups in accordance with the International

Standard Classification of Education (Eurostat 2018b). The "low-educated" group includes individuals whose educational attainment is lower secondary education and less. The "medium-educated" group includes individuals with upper secondary or post-secondary non-tertiary education. The "high-educated" group include all individuals with higher than post-secondary non-tertiary education. A fourth category was added to capture all individuals with missing values in their education variable (2.2%). The education categories are directly comparable to the categories in the census data. By construction, country information has no missing values in SHARE. The gender variable also has no missing values. Age information is available for all observations save four individuals in Czechia, who are subsequently excluded. To calculate the sample proportions, age is grouped into 10-year age groups with 90+ serving as an open-ended category. Details regarding the survey proportions by country, gender, age, and education are presented in Appendix A.1.

Prevalence of bad health π is calculated by country, gender, and 5-year age group using the GALI; 85 years of age served as an open-ended category. Evaluations show that GALI similarly measures function and disability across European countries (Jagger et al. 2010), allowing cross-country comparisons. In particular, GALI is based on the reply to the following survey question: "For the past six months at least, to what extent have you been limited because of a health problem in activities people usually do?" The question is answered by each survey participant based on three categories: "severely limited", "limited but not severely", and "not limited". For the purpose of this study, GALI is dichotomised into a binary variable with (1) "severely limited" and (0) "not severely limited". In the final sample, GALI has missing values for only 0.58% of the survey participants. Because there is no evidence of an education-related pattern in item non-response concerning GALI, this study only focuses on unit non-response.

GALI is a self-assessed health measure, and as such, is likely biased depending on the respondent's individual characteristics (Srisurapanont et al. 2017; Peracchi & Rossetti 2012; Schneider et al. 2012; Bago d'Uva, O'Donnell, et al. 2008) and cultural background (Hardy et al. 2014; Bago d'Uva, Van Doorslaer, et al. 2008; Jürges 2007). Low-educated survey respondents are particularly prone to misreporting their health. Some evidence suggests that low-educated individuals have the tendency to overestimate their physical health, whereas highly educated persons tend to underestimate their physical health (Spitzer & Weber 2019). If that is the case, the bias in HEX that is associated with underrepresentation of low education could appear smaller than it actually is, because low-educated individuals are overstating their physical abilities. Furthermore, self-assessed measures are often upward biased at older ages (Idler 1993), presumably due to peer effects (Henchoz et al. 2008). Thus, as a robustness analysis, the prevalence of bad health is also estimated based on grip strength, a tested measure that is expected to be less biased by systematic misreporting.

Grip strength is primarily used to measure sarcopenia, the age-related decrease in muscle mass (Cruz-Jentoft et al. 2010). Furthermore, it is a strong predictor of mortality (Steiber 2016), mobility, and cognition (Rijk et al. 2016). While GALI only captures activity limitations, grip strength is often considered a proxy for overall health. In SHARE, grip strength is ascertained twice per hand for each participant via a handheld Smedley dynamometer (for details, see Andersen-Ranberg et al. 2009). In accordance with the literature, the maximum of these four measurements is used for robustness analysis (Andersen-Ranberg et al. 2009; Steiber 2016; Roberts et al. 2011). Grip strength is measured in kilograms, yet the calculation of HEX requires a binary outcome variable. Consequently, thresholds have to be applied, dividing the participants into groups of impaired and unimpaired. The European Working Group on Sarcopenia in Older People (EWGSOP) suggests cut-off values < 20 kg for women and <30 kg for men to determine the onset of sarcopenia (Cruz-Jentoft et al. 2010). More recent evidence, however, suggests that such pragmatic thresholds do not fully capture critically weak hand grip

(Steiber 2016). Moreover, grip strength varies by factors such as body height and country of residence (Andersen-Ranberg et al. 2009), implying that thresholds should be adapted accordingly. Because the purpose of this study is not to analyse grip strength as such, the pragmatic approach suggested by EWGSOP is deemed satisfactory. If the thresholds are indeed inaccurate, they would affect both the adjusted and unadjusted prevalence rates and therefore would not distort the results.

3.2 Eurostat data for post-stratification weights and life tables

The calibration of weights requires auxiliary information on the actual population structure. To this end, it is assumed that the auxiliary information captures the true structure in the population with respect to certain characteristics such as gender, age, and education. For this study, the European Population and Housing Censuses are utilised as auxiliary data (Eurostat 2018a). Along with the National Statistical Institutes, Eurostat combined national censuses from 2011 for 32 European countries and structured them in a comparable manner. Sixteen of these countries overlap with the countries from SHARE Wave 4. Because the Netherlands, Sweden, and Switzerland show irregularities in the census data provided by Eurostat, these countries are not included in the current analysis, leaving a sample of 13 countries.

For each country, population totals by gender, age, and education for individuals over 50 years of age are extracted from the censuses. The totals are used as control totals when calibrating weights. Some countries have missing information on educational attainment, which is why four education categories are constructed. The education groups "low-educated", "medium-educated", and "high-educated" are based on the same criterion as adopted in SHARE, which were described in Section 3.1. In addition, an education category denoted "unknown education" is created. Regarding gender and age, missing values are negligible, which is why this analysis is only based on the known population, and census cells for unknown gender and age are excluded. The census does not differentiate between institutionalised and non-institutionalised persons, which is why it is assumed that both groups are comparable. For details regarding the population proportions by country, gender, age, and education based on the censuses, consult Appendix A.1.

In addition to prevalence rates, the calculation of HEX with Sullivan's method relies on life tables provided by Eurostat for 2011 (Eurostat 2011c). They are prepared to resemble standard abridged period life tables by country, gender, and 5-year age group, with 85+ considered an open-ended category.

3.3 Education distribution in SHARE versus that in the censuses

By comparing the education distribution of participants in SHARE with that in the respective censuses, three country groups can be differentiated: SHARE country samples that fit the education distribution in the population, country samples in which highly educated individuals are overrepresented and low-educated individuals are underrepresented, and remarkably, country samples in which this trend is reversed. Tables comparing the distributions can be found in Appendix A.1.

The only two SHARE samples resembling the education distribution in the population are those for Italy and Spain. The fit for Italy is close to perfect (Table 9). Spain shows slight deviations in the younger age groups, but overall achieves concordance between SHARE and the census (Table 13). Both countries have little variation in education within age groups. For example, the vast majority of the 70+ population was low educated. This pattern might explain the good fit with respect to the education distribution. However, Portugal also has little variation in education within age groups, but the education distribution in SHARE varies strongly from that in the census (Table 11). Hence, non-complex education distributions do not guarantee concordance between the education structure in surveys and the general population.

In most country samples provided by SHARE, high-educated individuals are overrepresented and low-educated individuals are underrepresented. This finding is in line with the literature discussed in Section 2. The countries belonging to that category are Austria, Belgium, Denmark, Germany, Hungary, Portugal, and to a lesser extent France and Slovenia. The deviation is particularly strong in Denmark, where the proportions in SHARE differ from those in the census on average by 51% for men and 52% for women in the age group of 50–89 (Table 4).

Interestingly, three CEE countries show the opposite pattern. In Czechia, Estonia, and Poland, low-educated individuals are overrepresented in the survey. Deviations are minor for Estonia (Table 5) and Poland (Table 10). For Czechia, however, SHARE proportions deviate from the census by 95% for men and 38% for women on average (Table 3). While high-educated individuals are underrepresented in the Estonian and Polish sample, medium-educated individuals are underrepresented in the Czech sample. Overall, the findings presented in this subsection suggest a need for EW when making inferences based on survey data.

4. Method

To determine if distortions in the education distribution of survey data affect HEX, SHARE sampling design weights are adjusted via IPF so that the education structure in SHARE would match the education structure in the respective census. Following that, two sets of prevalence rates of severe activity limitations are computed. The first set π^{EW} is calculated using the EW, whereas the control set π^{RW} uses standard weights without adjustment. Finally, Sullivan's method is applied to calculate HEX^{EW} with education-adjusted prevalence rates and HEX^{RW} with the unadjusted rates. Comparing the two sets of HEX reveals if and how the measure is biased by educational differences in survey participation.

4.1 Generating calibrated weights via IPF

Frequently, the proportions of certain characteristics in survey data deviate from the proportions of the same characteristics in the general population. Assuming that the distribution in the general population is known, calibrated weights can be generated for each survey respondent to account for these discrepancies. Calibrated weights are usually based on sampling design weights, which compensate for unequal selection probabilities of sample units, and in the case of SHARE, are provided with the survey data. They are defined as the inverse of the probability of being included in the sample. These design weights account for the unequal selection of sample units, but not for unit non-response (Lynn et al. 2013).

A common method for calibrating sampling design weights is IPF, also known as raking. For this approach, marginal totals for each variable on which the weights are calibrated are taken from an auxiliary source that is assumed to capture the true distribution in the general population. When applying IPF, sampling design weights are iteratively modified by a multiplicative factor until convergence is achieved and the marginal totals of the adjusted weights conform to the corresponding marginal totals from the auxiliary source (Battaglia et al. 2009; Winter 2018). After the adjustment, groups that were formerly underrepresented have relatively larger weights, whereas groups that were formerly overrepresented have relatively smaller weights. Importantly, the original information provided by the sampling design weights is maintained, since the weights within a group increase proportionally. The empirical strategy of this study evolves around three different sets of calibrated weights, which are discussed in more detail below.

SHARE weights (SW)

SHARE provides its own set of calibrated weights to account for differences in response behaviour. However, their weights do not consider the education structure in the general population (De Luca & Rossetti 2018). For the remainder of this paper, these weights are referred to as SHARE weights (SW). The SW are generated based on a calibration approach by Deville and Särndal (1992), which is implemented using Stata's `sreweight` command by Pacifico (2014). Control totals for the SW stem from the Eurostat regional database. The weights are calculated separately for each country, considering NUTS 1 regions as well as eight gender-age groups, with cutoffs at 50–59 years, 60–69 years, 70–79 years, and an open-ended category of 80+ years. In some countries, finer partitions are made below age 59 (De Luca 2018; De Luca & Rossetti 2018).

Replicated weights (RW)

In a first step, the SW are replicated; this second set of weights is referred to as replicated weights (RW). The goal is for these RW to be as close as possible to the SW. However, some amendments in the method are made, so that later, education could be added as an additional control total. First, control totals are used for each calibration variable separately, instead of cross-classification. For example, instead of using age-gender totals, separate totals for age and gender are applied. The rationale behind this modification in the method is that calibrated weights are generally less stable and less likely to converge when observations are thinly spread over the calibration cells (Battaglia et al. 2009). Using separate totals increases the number of observations by calibration cell. As a second amendment, Stata's `survwgt` rake algorithm by Winter (2018) is used to generate the RW because it appears more robust than the `sreweight` command (Kolenikov 2014). Third, control totals for NUTS 1 regions are not considered in this study, again, to increase the weight's stability. The control total was included for a robustness analysis, but did not alter the results. Fourth, an additional age category of 80–89 years is included, making 90+ the open-ended category. Finally, the Eurostat regional database does not provide information by education, which is why the 2011 census is used for this paper instead. Although these five changes were made, prevalence rates calculated based on the SW are almost identical to those calculated based on the RW, which confirms the approach.

Education-adjusted weights (EW)

Following the replication of SW, the EW are calculated. They are identical to the RW, except that an additional control total for education is considered for the calibration. Hence, EW vary for each individual observation, depending on the individual's sampling design weight, gender, age, and educational attainment. In addition, the 2.2% of individuals with missing values for education receive a calibrated weight, since both the prevalence rates by education and the control totals include a category for "unknown education".

Weighted prevalence rates of bad health π are calculated based on all three sets of calibrated weights: SW (π^{SW}), RW (π^{RW}), and EW (π^{EW}). In particular, the prevalence rates for the main analysis are based on the binary GALI measures, and prevalence rates for the robustness analysis are based on dichotomised grip strength. The means are calculated separately by country, gender, and 5-year age group, which follows the most common approach to calculate HEX in Europe. The statistical difference among the three sets of prevalence rates is assessed by applying the Delta method (Oehlert 1992), similar to the approach by Van Der Heyden et al. (2017). The prevalence rates based on GALI along with the confidence intervals are presented in Appendix A.2.

4.2 Calculating HEX with Sullivan's method

HEX is computed by applying Sullivan's method (Sullivan 1971; Saito et al. 2014). According to the standard life table notation[2], let

l_x = Number of survivors at exact age x (beginning of age interval i)

L_i = Number of person-years lived in age interval i

π_i = Prevalence of severe activity limitations in age interval i.

Then HEX at age x is calculated separately by country and gender as follows:

$$HEX_x = \frac{1}{l_x} \sum_{i=x}^{A} (1 - \pi_i) * L_i$$

where the 5-year age groups range from i = 0 to A. More specifically, prevalence rates π_i were used to divide person-years lived according to the Eurostat life tables into years with and without severe activity limitations. Following that, HEX was calculated by dividing the number of individuals surviving to a certain age x by the total years lived healthily from age x onwards. Two sets of HEX are calculated. HEX^{EW} is based on π^{EW}, the prevalence of severe activity limitations in age interval i weighted with EW. HEX^{RW} is based on π^{RW}, the prevalence of severe activity limitations in age interval i weighted with RW.

An alternative to calculating HEX via Sullivan's method is the multistate life table method, which is sometimes said to be more accurate (Rogers et al. 1990; Rogers et al. 1989); however, Mathers and Robine (1997) report that differences between the two methods are small. Furthermore, Sullivan's method is the most common approach to calculate HEX in Europe, especially in the context of the European Commission's goal for 2020, which makes the results of this study comparable.

[2] For an introduction into life table methods consult, for example, Preston *et al.* (2001)

5. Results

5.2 Prevalence of bad health with and without adjusted weights

The differences between adjusted (π^{EW}) and unadjusted (π^{RW}) prevalence rates correspond to the deviation in education structure in SHARE from the census (see tables in Appendix A.2). For Italy and Spain, π^{RW} and π^{EW} are rather similar. For all country samples in which high-educated individuals are overrepresented and low-educated individuals are underrepresented, π^{RW} is smaller than π^{EW}, indicating a downward bias in mean activity limitation. This finding is in line with the evidence that education and good health are positively correlated. The size of the bias depends on the deviation between SHARE data and the census. It is minor for countries such as France, where the deviation is small: π^{RW} at age 50 is 0.095 (0.097) for men (women) and π^{EW} at age 50 is 0.105 (0.107) for men (women). Yet the bias is severe for countries such as Denmark, where the deviation is large: π^{RW} at age 50 is 0.074 (0.076) for men (women) and π^{EW} at age 50 is 0.107 (0.110) for men (women).

For the three countries in which low-educated individuals are overrepresented, π^{RW} is larger than π^{EW}, indicating an upward-bias in mean activity limitation. Consequently, these countries appear healthier once the education structure in the general population is considered. The countries concerned are Czechia, Estonia, and Poland. The shift is most pronounced for Czechia, which is in line with the finding that the Czech SHARE sample is particularly distorted.

Confidence intervals show that the differences between π^{EW} and π^{RW} are not always statistically significant, most likely due to the small numbers of observations in some age-gender-education cells. For example, the male age group 90+ in Germany only consists of five men, and that in Slovenia only has it is four men only. In Austria, the male age group 90+ consisted of 20 men, of which 7 are low educated, 6 are medium educated, 6 are high educated, and 1 has unknown education. When analysing the correlation between education and good health on the aggregated level, the positive link is obvious. Yet in these small gender-age cells, the correlation is sometimes the opposite. For example, the seven low-educated men in the Austrian 90+ group reported on average better health than the six high-educated men. Due to the reversal, prevalence of bad health is slightly lower for that group, once EW are applied. Given the small number of observations in certain cells and the subsequently large confidence intervals, HEX as well as differences in HEX have to be interpreted cautiously, especially for Portugal and Germany, where confidence intervals are particularly large and no clear age gradient in severe activity limitations for men is visible.

Comparing prevalence rates based on grip strength measures with those based on GALI leads to similar findings as described above. Yet for most countries, the age gradient in bad health is steeper when measured via grip strength, so the prevalence of bad health at old age is usually higher. This finding could be explained with the evidence that participants rate their health relatively better at old age than at young age (see Section 3.1.). Most notably, Portuguese and German men show a clear age gradient in education when health is tested with grip strength, while no such age gradient is visible when health is measured with GALI.

5.2 Bias in HEX

Figure 1 shows how HEX at age 50 are biased because of educational differences in survey participation. The countries are ranked based on the average bias in all age groups. In addition to Figure 1, HEX^{RW} and HEX^{EW} are presented in Appendix A.2 for all age groups, along with the respective bias denoted as ΔHEX. In both the graph and the tables, the bias is given in absolute years. Consequently, ΔHEX mostly decreases with age, since life expectancy decreases with age.

On average, HEX at age 50 is biased by 0.3 years, yet the deviation varies substantially between countries and genders. It is larger for women (0.4 years) than for men (0.2 years), presumably due to the higher life expectancy of women in general. For most parts, the bias resembles the deviations between SHARE and the census, and consequently, the deviation between π^{RW} and π^{EW}. As a result, HEX^{RW} and HEX^{EW} are similar for Italy and Spain, since SHARE mimics the censuses in those countries. At age 50, ΔHEX for Spanish men (women) is only -0.04 (0.00) years. For Italian men (women), the bias is only -0.07 (-0.06) years. Overall, the deviations are even smaller at older ages.

By contrast, HEX at age 50 are upward-biased in countries for which high-educated persons are overrepresented in the SHARE sample. This is the case for Belgium, Denmark, Austria, Germany, Hungary, France, and Slovenia. Without EW, these countries appear to have a healthier population than is actually the case. At age 50, the upward bias is largest for women in Belgium, where HEX is overestimated by 0.87 years or 3.5%. The opposite is true for Estonia, Czech Republic, and Poland, where low-educated individuals are overrepresented in the SHARE samples. Consequently, these countries appear unhealthier than they actually are. At age 50, the downward bias is largest for Czech women, whose HEX is 0.85 years or 3.2% lower when the education structure in the general population is ignored. Since the bias has different magnitudes, and more importantly, different directions, it affects the country ranking of HEX. For example, Danish men aged 50 appear to have relatively high HEX without the EW (rank 4 of 13) but drop to the lower middle field (rank 7 of 13) when adjustments are made.

Overall, the findings described for age 50 also hold for older age groups. Due to uncertainty in the data, however, some age groups in some countries (e.g., male age group 90+ in Austria) do not show the expected sign for ΔHEX. As indicated in the previous sections, the results for Germany and Portugal have to be treated especially carefully due to the small cell sizes. HEX at age 50 for Portuguese men appear to be severely underestimated, although the data clearly shows that high-educated men are overrepresented in the Portuguese SHARE sample (Table 11).

As a robustness analysis, HEX based on grip strength are also provided (Figure 2). The overall bias appears smaller when the tested indicator is applied: average ΔHEX at age 50 is reduced to 0.17 years, but is still larger for women (0.23 years) than for men (0.11 years). Even though the overall level of the bias is lower when grip strength is utilised, the overall findings are confirmed. The bias is still negligible for Italy and Spain. The countries showing an upward bias based on GALI also show an upward bias based on grip strength; the same holds for all countries showing downward biases. Moreover, the inconsistencies in the Portuguese data disappear once grip strength is used. HEX at age 50 for both Portuguese men and women appeared to be overestimated without the EW, just as expected when comparing the Portuguese SHARE sample with the census. By contrast, the results for German women suggest an unexpected downward bias of HEX, which indicates once again that results based on small sample sizes must be handled with care.

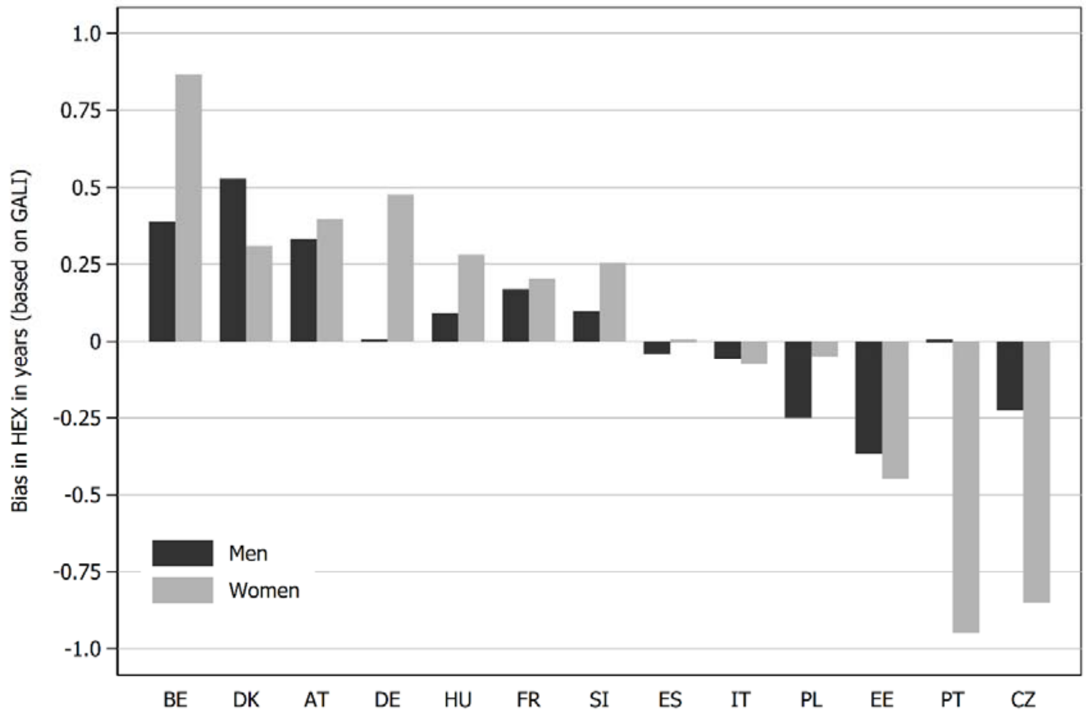

Figure 1: Bias in HEX based on GALI at age 50 in 2011

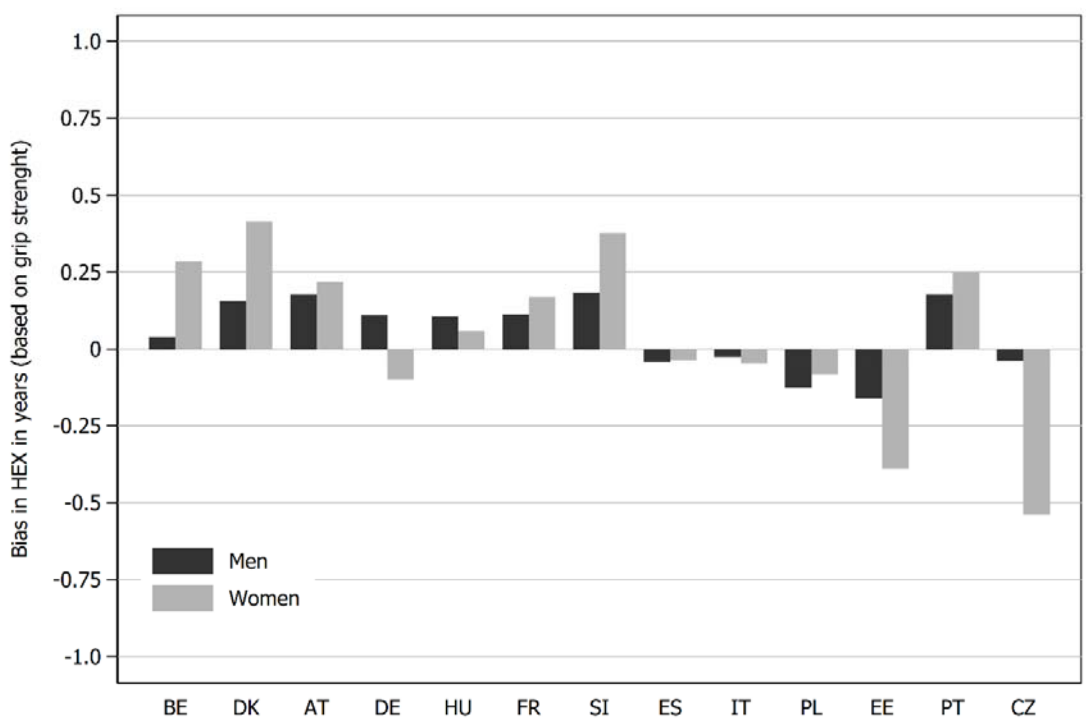

Figure 2: Bias in HEX based on grip strength at age 50 in 2011

6. Discussion

This study is the first to evaluate if HEX in Europe is biased by educational differences in survey participation. The analysis showed that 11 of the 13 SHARE country samples analysed did not resemble the education structure in the general population. In most countries, high-educated individuals were overrepresented, leading to an upward bias in HEX by up to 0.87 years, because of the positive correlation between educational attainment and good health. Contrary to what is suggested in the literature, most CEE countries analysed showed the opposite pattern that high-educated individuals were less likely to participate in surveys. As a consequence, HEX was underestimated by up to 0.85 years in those countries. These biases are crucially important, especially in the context of the European commission's aims to increase HEX for the average European by 2 years by 2020 (European Commission 2010). The average bias in HEX of 0.3 years does not allow for an accurate assessment of the Commission's goal unless the flawed education structure in survey data is accounted for.

Related literature suggests that the biases are in fact larger and that the results ascertained in this study constitute a lower bound. First and foremost, this is because the low-educated individuals that participate in surveys are most likely healthier than the low-educated individuals that are not captured. Studies have shown that low-educated respondents have lower mortality (Jousilahti et al. 2005), better self-reported health (Chinn et al. 2006; Lorant et al. 2007; Jones et al. 2006), and suffer less from psychosis (Haapea et al. 2007) than low-educated non-respondents. Thus, being included in the survey is a collider that creates an artificial negative correlation between educational attainment and health. Importantly, this collider bias introduces an even larger bias for all countries in which high-educated persons are overrepresented. In addition, measurement errors in education might increase the biases. For example, Bingley and Martinello (2014) found that a substantial proportion of Danish SHARE participants exaggerated their level of education, especially when they were low educated. If unhealthy low-educated individuals exaggerate their level of education, they artificially narrow the health gap between low- and high-educated participants, adding to the bias. Finally, the survival bias might increase the bias in HEX if unhealthier low-educated persons have higher mortality and consequently do not appear in the survey.

An important finding of this study was that, in contrast to common results from the literature, low-educated individuals are not necessarily more likely to be underrepresented in surveys than the highly educated. The education structures in the Italian and Spanish SHARE are almost identical to those in the respective censuses. Consequently, HEX appears to be unbiased for these countries. Potentially, this is because educational attainment hardly varies within age groups in both nations, making it easier to survey the "correct" distribution. However, Portugal has similar education patterns across age but a still highly biased HEX. What could also explain the good fit for Italy and Spain is that the effect of education on health appears to be weaker than that for other countries. Both nations are among the countries with the highest life expectancy in Europe (Eurostat 2011c), even though their overall level of education is low compared to Western and Northern European countries (Eurostat 2018a). Moreover, the education gradient in life expectancy is very pronounced in most of Europe, yet interestingly, Italy was the only country in the sample in which life expectancy at age 50 was slightly lower for the highly educated (34.6 years) than for the medium educated (35.2 years) (Eurostat 2011b).[3] Luy et al. (2011) found similar results for Italian women during the 1990s, although not for men. The evidence suggests that the association between education and health might be weaker in both countries than in other European countries. If the link between education and survey participation is weaker too, this would be an additional explanation for their unbiased HEX.

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[3] Unfortunately, Eurostat does not provide life expectancy by education for Spain.

The CEE countries Czechia, Estonia, and Poland also did not follow the expected pattern in terms of educational differences in survey participation. Contrary to what is generally found in the literature, high-educated individuals were underrepresented in all three countries, most profoundly so in Czechia. One explanation for this curious finding is that in all three countries, high-educated individuals are much more likely to keep working at older ages, presumably due to low pension replacement rates. This pattern holds for both men and women. For the age group of 65–74, Estonian academics had the highest employment rate in the sample (26.9%), followed by the highly educated in Czechia (20.5%), Italy (19.7%), and Poland (18.6%) (Eurostat 2011a). As a result, the highly educated might be less likely to participate in surveys due to time constraints: when an interviewer knocks on their doors, they might simply be at work. A second, somewhat speculative, explanation for the low participation of high-educated individuals in Czechia, Estonia, and Poland could be related to trust or the lack thereof. It is well established that post-communist societies in Europe have, on average, lower levels of trust in institutions (Zmerli & Van der Meer 2014) and lower levels of social trust (Uslaner 2003). If the highly educated were more distrustful than low-educated individuals, this could explain the participation pattern in the three countries. What contradicts this speculation is the fact that Slovenia is also a CEE country with a similar history. However, the Slovenian SHARE sample follows the common pattern of too few low-educated respondents.

HEX is calculated by combining the prevalence of good and bad health from survey data with life tables. This study analysed how distortion in the education structure of surveys affects HEX via biases in prevalence rates. In addition, one could analyse whether educational differences in life expectancy also add to the bias. Due to data restrictions, it is commonly assumed that all educational groups share the same life expectancies when applying Sullivan's method. However, Eurostat data for a small sample of European countries show that all countries but Italy have a clear education gradient in life expectancy. The educational differences are most pronounced in the CEE countries, save Slovenia, and are weakest in the Nordic countries (Eurostat 2011b). If and how these differences bias HEX in the context of distorted surveys cannot be said a priori, as the bias depends on the interactions between the education distribution in the general population and the education-related response behaviour in the respective country. Thus, this study only focused on distortions due to prevalence rates to stay within scope. Furthermore, this study evaluated HEX in its most common form, which is without education-specific mortality. However, future studies should explore how educational differences in life expectancy affect the bias in HEX, especially in countries where the education gradient in mortality is strong.

Overall, the findings of this study highlight the need to account for distortions in the education structure of survey data. First and foremost, this can be achieved by preventing the misrepresentation of certain educational groups in the first place, and if prevention does not lead to accurate representation, by adjusting for deviations with survey methods such as calibrated weights. Literature has shown that survey modes (Christensen et al. 2014), recruitment methods (Tolonen et al. 2015), interviewer experience, and the number of attempted contacts (Groves et al. 2009) affect survey participation and consequently might be helpful for counteracting heterogeneities in survey representation. However, past evidence has also revealed that response rates have declined over time (Groves et al. 2009), and that the gap in response behaviour between high- and low-educated individuals has increased (Reinikainen et al. 2018). If this pattern continues, survey methods that adjust for misrepresentation will become even more important in the future. Although auxiliary information on the education structure in the general population is not available for each European country at any given year, censuses might still allow for the calibration of weights since the education structure at old age changes slowly (KC et al. 2014), or as Schumacher (1973) puts it: "education does not 'jump'".

7. Conclusion

Survey participation differs substantially among educational groups, which leads to biased health expectancies (HEX) when the discrepancies are not accounted for. This study was the first to explore the magnitude and direction of the bias in HEX for 13 European countries based on the Survey of Health, Ageing and Retirement in Europe (SHARE) for 2011. To this end, calibrated weights were generated so that the education structure in SHARE would resemble that of the respective Population and Housing Census.

The analysis revealed that 11 of the 13 SHARE country samples did not accurately resemble the education structure in the general population, which lead to substantial biases in HEX. In most of the survey samples, high-educated individuals were overrepresented. Due to the positive correlation between educational attainment and good health, HEX were upward-biased for these countries by as much as 0.87 years. Remarkably, most CEE countries showed the opposite pattern that high-educated individuals were underrepresented. As a result, HEX were underestimated for these countries by up to 0.85 years.

Understanding the sensitivity of HEX measures is crucial because of their immense scientific and political influence. In the context of ever decreasing survey response rates, it is of utmost importance that the flawed education structure in survey data is prevented and adjusted for. Only then, it is possible to accurately assess policy targets such as the European Commission's aim to increase HEX by 2 years until 2020.

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Appendix

A.1 Proportions in SHARE versus those in the censuses

Table 1: Austria

		Men				Women			
Age	**Education**	**SHARE**		**Census**		**SHARE**		**Census**	
		N	%	N	%	N	%	N	%
50-59	Low	63	9.5	86887	15.4	206	23.9	170957	29.6
	Medium	405	61.3	367802	65	394	45.8	326967	56.6
	High	187	28.3	111220	19.7	240	27.9	79609	13.8
	Unknown	6	.9	0	0	21	2.4	0	0
	Total	**661**	**100**	**565909**	**100**	**861**	**100**	**577533**	**100**
60-69	Low	98	13	79259	18.8	255	25.4	176335	38.1
	Medium	416	55.2	263463	62.6	519	51.7	249273	53.9
	High	230	30.5	78097	18.6	218	21.7	37067	8
	Unknown	10	1.3	0	0	11	1.1	0	0
	Total	**754**	**100**	**420819**	**100**	**1003**	**100**	**462675**	**100**
70-79	Low	92	16.5	86735	29	316	43.3	215302	57.6
	Medium	284	51	164705	55.1	272	37.3	143121	38.3
	High	176	31.6	47386	15.9	132	18.1	15268	4.1
	Unknown	5	.9	0	0	10	1.4	0	0
	Total	**557**	**100**	**298826**	**100**	**730**	**100**	**373691**	**100**
80-89	Low	47	25.1	41385	33.6	152	50.5	151359	63.9
	Medium	81	43.3	64003	51.9	103	34.2	77106	32.6
	High	51	27.3	17831	14.5	41	13.6	8221	3.5
	Unknown	8	4.3	0	0	5	1.7	0	0
	Total	**187**	**100**	**123219**	**100**	**301**	**100**	**236686**	**100**
90+	Low	7	35	4742	36.4	20	58.8	29223	66.7
	Medium	6	30	6016	46.2	11	32.4	12972	29.6
	High	6	30	2262	17.4	2	5.9	1647	3.8
	Unknown	1	5	0	0	1	2.9	0	0
	Total	**20**	**100**	**13020**	**100**	**34**	**100**	**43842**	**100**

Table 2: Belgium

		Men				Women			
Age	**Education**	**SHARE**		**Census**		**SHARE**		**Census**	
		N	%	N	%	N	%	N	%
50-59	Low	298	35.7	295514	39.9	329	31.1	296759	40
	Medium	217	26	210435	28.4	339	32	213803	28.8
	High	297	35.6	180721	24.4	364	34.4	183135	24.7
	Unknown	23	2.8	54628	7.4	26	2.5	48576	6.5
	Total	**835**	**100**	**741298**	**100**	**1058**	**100**	**742273**	**100**
60-69	Low	299	38.4	264576	48	331	40.4	315593	54.4
	Medium	203	26.1	122045	22.2	240	29.3	117672	20.3
	High	265	34	121519	22.1	236	28.8	102593	17.7
	Unknown	12	1.5	42791	7.8	13	1.6	44314	7.6
	Total	**779**	**100**	**550931**	**100**	**820**	**100**	**580172**	**100**
70-79	Low	213	46.1	223675	59.3	294	53	312619	66.1
	Medium	103	22.3	58576	15.5	131	23.6	64268	13.6
	High	142	30.7	56867	15.1	122	22	44972	9.5
	Unknown	4	.9	37802	10	8	1.4	51189	10.8
	Total	**462**	**100**	**376920**	**100**	**555**	**100**	**473048**	**100**
80-89	Low	140	56.5	106684	61.5	247	69	217454	69.8
	Medium	50	20.2	25946	14.9	59	16.5	34466	11.1
	High	54	21.8	20467	11.8	50	14	18623	6
	Unknown	4	1.6	20457	11.8	2	.6	41186	13.2
	Total	**248**	**100**	**173554**	**100**	**358**	**100**	**311729**	**100**
90+	Low	16	64	9905	61.3	42	73.7	35935	69.7
	Medium	6	24	2155	13.3	6	10.5	4791	9.3
	High	2	8	2004	12.4	8	14	3018	5.9
	Unknown	1	4	2087	12.9	1	1.8	7835	15.2
	Total	**25**	**100**	**16151**	**100**	**57**	**100**	**51579**	**100**

Table 3: Czechia

		Men				Women			
Age	**Education**	**SHARE**		**Census**		**SHARE**		**Census**	
		N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
50-59	Low	284	45.4	60953	8.8	373	42.4	143319	20
	Medium	244	39	495476	71.2	397	45.1	468487	65.5
	High	93	14.9	108342	15.6	98	11.1	82322	11.5
	Unknown	5	.8	31312	4.5	12	1.4	20992	2.9
	Total	**626**	**100**	**696083**	**100**	**880**	**100**	**715120**	**100**
60-69	Low	423	46	62905	10.4	545	43.8	180716	25.9
	Medium	360	39.1	443380	73	558	44.8	441352	63.3
	High	117	12.7	84381	13.9	122	9.8	59052	8.5
	Unknown	20	2.2	16975	2.8	20	1.6	16155	2.3
	Total	**920**	**100**	**607641**	**100**	**1245**	**100**	**697275**	**100**
70-79	Low	219	41.5	47015	16.4	372	53.6	173996	42.4
	Medium	205	38.8	190935	66.6	249	35.9	202787	49.4
	High	94	17.8	41874	14.6	62	8.9	22715	5.5
	Unknown	10	1.9	6933	2.4	11	1.6	11118	2.7
	Total	**528**	**100**	**286757**	**100**	**694**	**100**	**410616**	**100**
80-89	Low	76	39.4	23055	20	181	63.7	120760	50.6
	Medium	69	35.8	69424	60.3	77	27.1	100546	42.1
	High	44	22.8	19280	16.7	19	6.7	8445	3.5
	Unknown	4	2.1	3399	3	7	2.5	8933	3.7
	Total	**193**	**100**	**115158**	**100**	**284**	**100**	**238684**	**100**
90+	Low	4	33.3	1816	23	14	51.9	13684	54.6
	Medium	3	25	4571	57.9	11	40.7	9393	37.5
	High	4	33.3	1158	14.7	1	3.7	736	2.9
	Unknown	1	8.3	352	4.5	1	3.7	1242	5
	Total	**12**	**100**	**7897**	**100**	**27**	**100**	**25055**	**100**

Table 4: Denmark

		Men				Women			
Age	**Education**	**SHARE**		**Census**		**SHARE**		**Census**	
		N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
50-59	Low	40	10.5	86106	24	58	13.1	100625	28.2
	Medium	177	46.3	172014	47.9	126	28.4	131424	36.8
	High	158	41.4	91671	25.5	255	57.6	117706	32.9
	Unknown	7	1.8	9572	2.7	4	.9	7650	2.1
	Total	**382**	**100**	**359363**	**100**	**443**	**100**	**357405**	**100**
60-69	Low	33	9.6	92455	27.4	54	14.7	124807	36.1
	Medium	168	48.8	155927	46.3	130	35.3	135091	39.1
	High	136	39.5	82314	24.4	179	48.6	80054	23.1
	Unknown	7	2	6145	1.8	5	1.4	5932	1.7
	Total	**344**	**100**	**336841**	**100**	**368**	**100**	**345884**	**100**
70-79	Low	36	17.8	67694	37.9	77	35.3	112258	54
	Medium	101	50	72763	40.8	77	35.3	60975	29.3
	High	64	31.7	33064	18.5	61	28	29855	14.3
	Unknown	1	.5	4901	2.7	3	1.4	4969	2.4
	Total	**202**	**100**	**178422**	**100**	**218**	**100**	**208057**	**100**
80-89	Low	16	16.8	35204	48.7	74	50	78481	66.6
	Medium	41	43.2	23873	33	48	32.4	25763	21.9
	High	33	34.7	11782	16.3	25	16.9	11554	9.8
	Unknown	5	5.3	1437	2	1	.7	2045	1.7
	Total	**95**	**100**	**72296**	**100**	**148**	**100**	**117843**	**100**
90+	Low	4	30.8	335	3.5	15	60	1263	4.4
	Medium	5	38.5	166	1.7	8	32	309	1.1
	High	3	23.1	278	2.9	1	4	190	.7
	Unknown	1	7.7	8912	92	1	4	26913	93.9
	Total	**13**	**100**	**9691**	**100**	**25**	**100**	**28675**	**100**

Table 5: Estonia

		Men				Women			
Age	**Education**	**SHARE**		**Census**		**SHARE**		**Census**	
		N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
50-59	Low	156	19.5	6936	8.5	137	12.6	5282	5.5
	Medium	481	60.1	47118	57.8	628	57.9	46585	48.3
	High	162	20.3	26085	32	318	29.3	43609	45.2
	Unknown	1	.1	1425	1.7	1	.1	921	1
	Total	**800**	**100**	**81564**	**100**	**1084**	**100**	**96397**	**100**
60-69	Low	278	31.2	9704	17	232	19.8	11609	14.4
	Medium	419	47	29786	52.3	696	59.4	40115	49.8
	High	193	21.7	16698	29.3	242	20.7	28206	35
	Unknown	1	.1	779	1.4	1	.1	688	.9
	Total	**891**	**100**	**56967**	**100**	**1171**	**100**	**80618**	**100**
70-79	Low	318	41.6	11188	28.9	476	39.6	24889	33.4
	Medium	281	36.7	16107	41.6	483	40.1	28996	38.9
	High	165	21.6	10877	28.1	243	20.2	19706	26.5
	Unknown	1	.1	509	1.3	1	.1	882	1.2
	Total	**765**	**100**	**38681**	**100**	**1203**	**100**	**74473**	**100**
80-89	Low	147	52.9	5698	42.8	295	57.4	20559	51.9
	Medium	75	27	4154	31.2	157	30.5	11561	29.2
	High	55	19.8	3230	24.3	61	11.9	6599	16.6
	Unknown	1	.4	220	1.7	1	.2	916	2.3
	Total	**278**	**100**	**13302**	**100**	**514**	**100**	**39635**	**100**
90+	Low	7	53.8	441	48.3	31	67.4	2893	62.3
	Medium	3	23.1	277	30.3	11	23.9	1114	24
	High	2	15.4	163	17.9	3	6.5	411	8.9
	Unknown	1	7.7	32	3.5	1	2.2	222	4.8
	Total	**13**	**100**	**913**	**100**	**46**	**100**	**4640**	**100**

Table 6: France

		Men				Women			
Age	**Education**	**SHARE**		**Census**		**SHARE**		**Census**	
		N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
50-59	Low	181	22.5	1303815	31.3	304	30.2	1703720	38.8
	Medium	402	49.9	1959813	47.1	414	41.1	1716270	39.1
	High	203	25.2	895551	21.5	262	26	969392	22.1
	Unknown	20	2.5	144	0	28	2.8	113	0
	Total	**806**	**100**	**4159323**	**100**	**1008**	**100**	**4389495**	**100**
60-69	Low	284	34.4	1264695	40	406	41.8	1748789	51.3
	Medium	315	38.2	1277057	40.4	320	32.9	1106511	32.5
	High	201	24.4	617162	19.5	220	22.6	552731	16.2
	Unknown	25	3	51	0	26	2.7	29	0
	Total	**825**	**100**	**3158965**	**100**	**972**	**100**	**3408060**	**100**
70-79	Low	271	50.6	1182924	57	461	67.7	1910878	70.9
	Medium	166	31	645923	31.1	130	19.1	576136	21.4
	High	90	16.8	247312	11.9	70	10.3	207284	7.7
	Unknown	9	1.7	0	0	20	2.9	0	0
	Total	**536**	**100**	**2076159**	**100**	**681**	**100**	**2694298**	**100**
80-89	Low	194	69.5	712663	68.2	368	79.7	1476693	78
	Medium	52	18.6	220702	21.1	52	11.3	291174	15.4
	High	27	9.7	111301	10.7	30	6.5	125780	6.6
	Unknown	6	2.2	0	0	12	2.6	0	0
	Total	**279**	**100**	**1044666**	**100**	**462**	**100**	**1893647**	**100**
90+	Low	15	53.6	80282	67.6	60	85.7	277819	74.4
	Medium	7	25	23167	19.5	4	5.7	59599	16
	High	5	17.9	15255	12.9	5	7.1	35760	9.6
	Unknown	1	3.6	0	0	1	1.4	0	0
	Total	**28**	**100**	**118704**	**100**	**70**	**100**	**373178**	**100**

Table 7: Germany

Age	Education	Men SHARE N	%	Census N	%	Women SHARE N	%	Census N	%
50-59	Low	5	4.8	662600	11.6	22	11.6	1061130	18.2
	Medium	53	51	3137380	54.7	103	54.5	3164500	54.4
	High	41	39.4	1936590	33.8	54	28.6	1590890	27.4
	Unknown	5	4.8	0	0	10	5.3	0	0
	Total	**104**	**100**	**5736570**	**100**	**189**	**100**	**5816520**	**100**
60-69	Low	13	4.4	531050	12.4	41	12.7	1184640	26
	Medium	160	54.2	2256210	52.8	176	54.5	2468540	54.1
	High	106	35.9	1486110	34.8	98	30.3	907790	19.9
	Unknown	16	5.4	0	0	8	2.5	0	0
	Total	**295**	**100**	**4273370**	**100**	**323**	**100**	**4560970**	**100**
70-79	Low	10	3.7	609250	16.7	56	23.4	1936480	43.3
	Medium	152	55.9	1983600	54.2	141	59	2023110	45.2
	High	100	36.8	1064890	29.1	38	15.9	513770	11.5
	Unknown	10	3.7	0	0	4	1.7	0	0
	Total	**272**	**100**	**3657740**	**100**	**239**	**100**	**4473360**	**100**
80-89	Low	5	6	246230	20.1	39	41.9	1278640	54.4
	Medium	47	56.6	656190	53.5	36	38.7	884140	37.6
	High	29	34.9	325090	26.5	15	16.1	189760	8.1
	Unknown	2	2.4	0	0	3	3.2	0	0
	Total	**83**	**100**	**1227510**	**100**	**93**	**100**	**2352540**	**100**
90+	Low	1	20	21300	19.7	3	25	225740	55.8
	Medium	2	40	56130	52	6	50	149430	37
	High	1	20	30450	28.2	2	16.7	29180	7.2
	Unknown	1	20	0	0	1	8.3	0	0
	Total	**5**	**100**	**107880**	**100**	**12**	**100**	**404350**	**100**

Table 8: Hungary

Age	Education	Men SHARE N	%	Census N	%	Women SHARE N	%	Census N	%
50-59	Low	52	12.3	120662	17.8	152	27.3	217215	28.6
	Medium	309	72.9	453647	66.8	323	58.1	406335	53.5
	High	62	14.6	104882	15.4	80	14.4	135941	17.9
	Unknown	1	.2	0	0	1	.2	0	0
	Total	**424**	**100**	**679191**	**100**	**556**	**100**	**759491**	**100**
60-69	Low	93	17.9	125036	24.3	200	33.3	271885	41.1
	Medium	318	61.3	293669	57	296	49.3	297272	44.9
	High	107	20.6	96653	18.8	104	17.3	92447	14
	Unknown	1	.2	0	0	1	.2	0	0
	Total	**519**	**100**	**515358**	**100**	**601**	**100**	**661604**	**100**
70-79	Low	79	29.5	177620	63.8	203	55.9	352237	73.9
	Medium	133	49.6	52768	18.9	117	32.2	88451	18.6
	High	55	20.5	48165	17.3	42	11.6	35676	7.5
	Unknown	1	.4	0	0	1	.3	0	0
	Total	**268**	**100**	**278553**	**100**	**363**	**100**	**476364**	**100**
80-89	Low	39	41.1	68943	64.7	118	77.1	212204	84.8
	Medium	37	38.9	17325	16.3	25	16.3	25654	10.3
	High	18	18.9	20313	19.1	9	5.9	12365	4.9
	Unknown	1	1.1	0	0	1	.7	0	0
	Total	**95**	**100**	**106581**	**100**	**153**	**100**	**250223**	**100**
90+	Low	4	44.4	7092	67.5	12	60	27893	87.4
	Medium	2	22.2	1606	15.3	6	30	2657	8.3
	High	2	22.2	1806	17.2	1	5	1374	4.3
	Unknown	1	11.1	0	0	1	5	0	0
	Total	**9**	**100**	**10504**	**100**	**20**	**100**	**31924**	**100**

Table 9: Italy

		Men				Women			
Age	Education	SHARE		Census		SHARE		Census	
		N	%	N	%	N	%	N	%
50-59	Low	169	46.8	1896312	49.5	280	55.2	2072038	51.3
	Medium	156	43.2	1453862	37.9	167	32.9	1462737	36.2
	High	32	8.9	484544	12.6	51	10.1	502340	12.4
	Unknown	4	1.1	0	0	9	1.8	0	0
	Total	**361**	**100**	**3834718**	**100**	**507**	**100**	**4037115**	**100**
60-69	Low	346	60.6	2079003	63.3	516	73.6	2586617	72.4
	Medium	171	29.9	874563	26.6	135	19.3	711707	19.9
	High	40	7	333239	10.1	41	5.8	275036	7.7
	Unknown	14	2.5	0	0	9	1.3	0	0
	Total	**571**	**100**	**3286805**	**100**	**701**	**100**	**3573360**	**100**
70-79	Low	384	78.9	1972475	78.6	413	81.1	2684196	86.1
	Medium	69	14.2	374245	14.9	68	13.4	336083	10.8
	High	30	6.2	161577	6.4	19	3.7	95823	3.1
	Unknown	4	.8	0	0	9	1.8	0	0
	Total	**487**	**100**	**2508297**	**100**	**509**	**100**	**3116102**	**100**
80-89	Low	144	83.7	936638	82.8	165	93.2	1778669	89.4
	Medium	14	8.1	125891	11.1	9	5.1	161484	8.1
	High	11	6.4	68965	6.1	2	1.1	48485	2.4
	Unknown	3	1.7	0	0	1	.6	0	0
	Total	**172**	**100**	**1131494**	**100**	**177**	**100**	**1988638**	**100**
90+	Low	18	85.7	110847	83.4	27	87.1	354613	91.5
	Medium	1	4.8	12692	9.5	2	6.5	24650	6.4
	High	1	4.8	9432	7.1	1	3.2	8174	2.1
	Unknown	1	4.8	0	0	1	3.2	0	0
	Total	**21**	**100**	**132971**	**100**	**31**	**100**	**387437**	**100**

Table 10: Poland

		Men				Women			
Age	Education	SHARE		Census		SHARE		Census	
		N	%	N	%	N	%	N	%
50-59	Low	29	16.7	421166	15	57	20.9	478116	16.1
	Medium	115	66.1	1981997	70.8	156	57.1	2018930	67.8
	High	11	6.3	330327	11.8	21	7.7	423912	14.2
	Unknown	19	10.9	67063	2.4	39	14.3	57925	1.9
	Total	**174**	**100**	**2800553**	**100**	**273**	**100**	**2978883**	**100**
60-69	Low	73	22.6	420733	24.7	144	38.9	672145	32.7
	Medium	161	49.8	1019057	59.9	190	51.4	1116799	54.3
	High	39	12.1	230425	13.5	15	4.1	238273	11.6
	Unknown	50	15.5	31166	1.8	21	5.7	29409	1.4
	Total	**323**	**100**	**1701381**	**100**	**370**	**100**	**2056626**	**100**
70-79	Low	80	46	395289	40.8	136	66	843444	55.3
	Medium	57	32.8	432775	44.7	51	24.8	543307	35.6
	High	19	10.9	125120	12.9	7	3.4	113995	7.5
	Unknown	18	10.3	14640	1.5	12	5.8	23721	1.6
	Total	**174**	**100**	**967824**	**100**	**206**	**100**	**1524467**	**100**
80-89	Low	47	60.3	199977	53.3	79	75.2	619859	73.2
	Medium	21	26.9	120999	32.3	10	9.5	170244	20.1
	High	5	6.4	47888	12.8	2	1.9	32531	3.8
	Unknown	5	6.4	6312	1.7	14	13.3	24220	2.9
	Total	**78**	**100**	**375176**	**100**	**105**	**100**	**846854**	**100**
90+	Low	3	50	17756	62.4	13	81.3	73860	77.2
	Medium	1	16.7	7120	25	1	6.3	14091	14.7
	High	1	16.7	2691	9.5	1	6.3	2219	2.3
	Unknown	1	16.7	891	3.1	1	6.3	5478	5.7
	Total	**6**	**100**	**28458**	**100**	**16**	**100**	**95648**	**100**

Table 11: Portugal

Age	Education	Men SHARE N	%	Census N	%	Women SHARE N	%	Census N	%
50-59	Low	184	69.7	517091	77.4	285	74.4	558254	76.3
	Medium	35	13.3	79694	11.9	46	12	79177	10.8
	High	40	15.2	71558	10.7	48	12.5	94237	12.9
	Unknown	5	1.9	0	0	4	1	0	0
	Total	**264**	**100**	**668343**	**100**	**383**	**100**	**731668**	**100**
60-69	Low	258	78.2	469350	85.1	299	77.5	556689	87.7
	Medium	40	12.1	38466	7	33	8.5	29058	4.6
	High	30	9.1	43734	7.9	37	9.6	49145	7.7
	Unknown	2	.6	0	0	17	4.4	0	0
	Total	**330**	**100**	**551550**	**100**	**386**	**100**	**634892**	**100**
70-79	Low	158	78.6	364241	90.9	181	86.2	493050	93.8
	Medium	16	8	16569	4.1	6	2.9	12310	2.3
	High	23	11.4	19782	4.9	15	7.1	20192	3.8
	Unknown	4	2	0	0	8	3.8	0	0
	Total	**201**	**100**	**400592**	**100**	**210**	**100**	**525552**	**100**
80-89	Low	49	77.8	155428	92	92	82.9	279326	95.2
	Medium	5	7.9	6162	3.6	8	7.2	6897	2.4
	High	4	6.3	7370	4.4	7	6.3	7061	2.4
	Unknown	5	7.9	0	0	4	3.6	0	0
	Total	**63**	**100**	**168960**	**100**	**111**	**100**	**293284**	**100**
90+	Low	4	57.1	18068	91.4	6	60	48108	95.8
	Medium	1	14.3	748	3.8	1	10	1109	2.2
	High	1	14.3	952	4.8	1	10	990	2
	Unknown	1	14.3	0	0	2	20	0	0
	Total	**7**	**100**	**19768**	**100**	**10**	**100**	**50207**	**100**

Table 12: Slovenia

Age	Education	Men SHARE N	%	Census N	%	Women SHARE N	%	Census N	%
50-59	Low	87	20.8	39279	25.3	152	29.1	51986	34.8
	Medium	270	64.4	92682	59.7	263	50.4	71200	47.6
	High	61	14.6	23315	15	106	20.3	26313	17.6
	Unknown	1	.2	0	0	1	.2	0	0
	Total	**419**	**100**	**155276**	**100**	**522**	**100**	**149499**	**100**
60-69	Low	61	16	26630	25.5	167	36.9	51794	45.9
	Medium	239	62.7	60974	58.3	204	45	46809	41.5
	High	79	20.7	17011	16.3	81	17.9	14298	12.7
	Unknown	2	.5	0	0	1	.2	0	0
	Total	**381**	**100**	**104615**	**100**	**453**	**100**	**112901**	**100**
70-79	Low	91	32.5	20867	31.6	206	59.2	59259	63.2
	Medium	134	47.9	35849	54.3	108	31	28520	30.4
	High	52	18.6	9365	14.2	33	9.5	6036	6.4
	Unknown	3	1.1	0	0	1	.3	0	0
	Total	**280**	**100**	**66081**	**100**	**348**	**100**	**93815**	**100**
80-89	Low	42	38.2	8192	36.2	114	63.7	36409	67.1
	Medium	45	40.9	10734	47.4	55	30.7	15386	28.4
	High	22	20	3729	16.5	9	5	2434	4.5
	Unknown	1	.9	0	0	1	.6	0	0
	Total	**110**	**100**	**22655**	**100**	**179**	**100**	**54229**	**100**
90+	Low	1	25	608	36.4	17	85	4361	67.1
	Medium	1	25	751	45	1	5	1877	28.9
	High	1	25	310	18.6	1	5	266	4.1
	Unknown	1	25	0	0	1	5	0	0
	Total	**4**	**100**	**1669**	**100**	**20**	**100**	**6504**	**100**

Table 13: Spain

		Men				Women			
Age	Education	SHARE		Census		SHARE		Census	
		N	%	N	%	N	%	N	%
50-59	Low	252	62.1	1644040	55.9	347	63.2	1807090	60.4
	Medium	77	19	585055	19.9	105	19.1	555465	18.6
	High	63	15.5	711115	24.2	71	12.9	627870	21
	Unknown	14	3.4	0	0	26	4.7	0	0
	Total	**406**	**100**	**2940210**	**100**	**549**	**100**	**2990425**	**100**
60-69	Low	370	72.5	1522130	68.2	467	82.8	1900160	78.8
	Medium	52	10.2	279630	12.5	32	5.7	241585	10
	High	53	10.4	428610	19.2	38	6.7	268510	11.1
	Unknown	35	6.9	0	0	27	4.8	0	0
	Total	**510**	**100**	**2230370**	**100**	**564**	**100**	**2410255**	**100**
70-79	Low	401	84.6	1253700	80.2	458	88.8	1763050	89.3
	Medium	26	5.5	115365	7.4	19	3.7	105125	5.3
	High	28	5.9	193660	12.4	17	3.3	106470	5.4
	Unknown	19	4	0	0	22	4.3	0	0
	Total	**474**	**100**	**1562725**	**100**	**516**	**100**	**1974645**	**100**
80-89	Low	209	87.1	663570	85.5	292	91	1185560	92.4
	Medium	5	2.1	41485	5.3	3	.9	49605	3.9
	High	15	6.3	70815	9.1	11	3.4	48465	3.8
	Unknown	11	4.6	0	0	15	4.7	0	0
	Total	**240**	**100**	**775870**	**100**	**321**	**100**	**1283630**	**100**
90+	Low	25	83.3	80655	84	54	94.7	226135	91.9
	Medium	2	6.7	6185	6.4	1	1.8	9610	3.9
	High	1	3.3	9170	9.6	1	1.8	10450	4.2
	Unknown	2	6.7	0	0	1	1.8	0	0
	Total	**30**	**100**	**96010**	**100**	**57**	**100**	**246195**	**100**

A.2 Prevalence rates and HEX based on GALI by weighting strategy

Table 14: Austria

		Replicated weights				Education-adjusted weights				
Gender	Age	π	95% CI		HEX	π	95% CI		HEX	Δ HEX
Men	50-54	.112	.071	.152	25.876	.127	.08	.174	25.545	.331
	55-59	.144	.099	.189	21.986	.166	.114	.217	21.726	.26
	60-64	.116	.084	.148	18.451	.129	.092	.166	18.294	.157
	65-69	.101	.068	.134	15.067	.1	.066	.135	14.968	.099
	70-74	.166	.127	.206	11.754	.175	.132	.218	11.644	.11
	75-79	.137	.085	.188	8.867	.16	.099	.221	8.792	.076
	80-84	.226	.151	.3	6.196	.231	.15	.312	6.234	-.038
	85+	.281	.176	.387	4.393	.267	.159	.375	4.484	-.091
Women	50-54	.056	.032	.08	29.338	.063	.034	.092	28.941	.397
	55-59	.106	.075	.138	24.945	.118	.081	.156	24.576	.369
	60-64	.086	.062	.11	20.914	.092	.065	.119	20.599	.315
	65-69	.092	.064	.12	16.902	.098	.068	.128	16.609	.293
	70-74	.169	.134	.204	13.033	.176	.138	.214	12.756	.276
	75-79	.241	.186	.296	9.625	.254	.195	.313	9.366	.259
	80-84	.263	.2	.325	6.836	.287	.219	.355	6.61	.226
	85+	.366	.279	.453	4.597	.387	.296	.479	4.446	.151

Table 15: Belgium

		Replicated weights				Education-adjusted weights				
Gender	**Age**	**π**	**95% CI**		**HEX**	**π**	**95% CI**		**HEX**	**Δ HEX**
Men	50-54	.083	.041	.126	24.815	.145	.04	.251	24.427	.389
	55-59	.158	.125	.192	20.765	.17	.127	.213	20.681	.085
	60-64	.155	.122	.189	17.299	.169	.125	.213	17.271	.028
	65-69	.137	.1	.175	14.01	.142	.102	.183	14.051	-.041
	70-74	.145	.101	.19	10.784	.136	.092	.18	10.855	-.071
	75-79	.246	.187	.304	7.756	.238	.178	.299	7.785	-.029
	80-84	.285	.214	.355	5.46	.284	.209	.359	5.454	.006
	85+	.392	.302	.482	3.709	.394	.289	.499	3.697	.012
Women	50-54	.188	.13	.247	25.555	.262	.161	.363	24.689	.867
	55-59	.204	.168	.239	21.836	.218	.17	.265	21.328	.507
	60-64	.193	.156	.229	18.322	.22	.172	.268	17.874	.448
	65-69	.227	.183	.271	14.825	.249	.194	.303	14.501	.324
	70-74	.262	.212	.313	11.57	.277	.219	.335	11.343	.226
	75-79	.319	.261	.377	8.621	.343	.274	.412	8.455	.166
	80-84	.348	.286	.411	6.157	.356	.29	.422	6.095	.061
	85+	.428	.357	.499	4.225	.433	.356	.509	4.191	.034

Table 16: Czechia

		Replicated weights				Education-adjusted weights				
Gender	**Age**	**π**	**95% CI**		**HEX**	**π**	**95% CI**		**HEX**	**Δ HEX**
Men	50-54	.125	.062	.188	22.033	.1	.037	.164	22.258	-.225
	55-59	.195	.148	.242	18.338	.198	.144	.253	18.443	-.105
	60-64	.15	.11	.19	15.245	.152	.106	.197	15.375	-.13
	65-69	.148	.108	.188	12.213	.132	.091	.172	12.363	-.15
	70-74	.151	.106	.197	9.389	.149	.098	.199	9.474	-.086
	75-79	.243	.181	.305	6.669	.238	.169	.308	6.758	-.089
	80-84	.342	.238	.447	4.588	.32	.202	.437	4.682	-.094
	85+	.366	.225	.508	3.296	.365	.191	.54	3.301	-.005
Women	50-54	.121	.072	.17	25.901	.097	.046	.148	26.75	-.849
	55-59	.152	.113	.191	21.842	.136	.09	.182	22.581	-.739
	60-64	.11	.084	.136	18.079	.088	.064	.111	18.754	-.675
	65-69	.147	.113	.18	14.241	.133	.097	.168	14.827	-.586
	70-74	.196	.152	.241	10.755	.189	.139	.24	11.306	-.551
	75-79	.281	.219	.342	7.669	.239	.178	.301	8.242	-.573
	80-84	.323	.234	.412	5.246	.278	.183	.373	5.707	-.46
	85+	.442	.338	.546	3.44	.378	.265	.491	3.832	-.393

Table 17: Denmark

		Replicated weights				Education-adjusted weights				
Gender	**Age**	**π**	**95% CI**		**HEX**	**π**	**95% CI**		**HEX**	**Δ HEX**
Men	50-54	.074	.035	.114	25.935	.107	.047	.168	25.406	.528
	55-59	.092	.047	.136	21.878	.134	.063	.205	21.503	.375
	60-64	.059	.021	.096	18.125	.077	.022	.132	17.949	.175
	65-69	.075	.035	.114	14.343	.106	.045	.167	14.252	.091
	70-74	.125	.063	.187	10.852	.123	.057	.188	10.917	-.065
	75-79	.215	.127	.303	7.814	.213	.115	.31	7.879	-.064
	80-84	.206	.101	.31	5.591	.164	.066	.262	5.66	-.07
	85+	.375	.24	.51	3.501	.404	.246	.561	3.341	.16
Women	50-54	.076	.039	.114	29.179	.11	.049	.172	28.869	.31
	55-59	.082	.044	.12	24.973	.095	.046	.145	24.829	.144
	60-64	.091	.05	.133	20.945	.108	.05	.166	20.866	.08
	65-69	.063	.027	.099	17.103	.069	.024	.113	17.105	-.003
	70-74	.115	.056	.175	13.264	.102	.046	.159	13.298	-.034
	75-79	.099	.04	.158	9.951	.098	.033	.163	9.919	.031
	80-84	.199	.117	.281	6.904	.215	.119	.311	6.86	.044
	85+	.323	.218	.428	4.613	.318	.208	.428	4.648	-.035

Table 18: Estonia

		Replicated weights				Education-adjusted weights				
Gender	**Age**	**π**	**95% CI**		**HEX**	**π**	**95% CI**		**HEX**	**Δ HEX**
Men	50-54	.142	.102	.182	19.551	.134	.095	.172	19.918	-.367
	55-59	.177	.139	.215	16.119	.16	.124	.195	16.462	-.343
	60-64	.192	.155	.229	13.132	.175	.14	.21	13.414	-.282
	65-69	.215	.173	.257	10.42	.198	.157	.24	10.644	-.225
	70-74	.267	.224	.311	8.041	.252	.209	.295	8.216	-.175
	75-79	.314	.261	.366	5.917	.304	.251	.357	6.049	-.132
	80-84	.446	.376	.516	4.114	.43	.359	.501	4.24	-.126
	85+	.397	.279	.514	3.326	.377	.256	.499	3.433	-.107
Women	50-54	.104	.075	.132	24.905	.098	.07	.126	25.352	-.446
	55-59	.146	.117	.176	20.8	.132	.105	.16	21.226	-.426
	60-64	.178	.146	.209	16.972	.167	.136	.198	17.336	-.364
	65-69	.174	.141	.208	13.413	.164	.131	.197	13.736	-.323
	70-74	.236	.203	.27	9.948	.218	.185	.251	10.237	-.289
	75-79	.374	.33	.417	6.921	.36	.315	.405	7.139	-.218
	80-84	.435	.381	.489	4.773	.412	.357	.467	4.956	-.183
	85+	.53	.459	.6	3.177	.512	.439	.586	3.293	-.116

Table 19: France

		Replicated weights				Education-adjusted weights				
Gender	**Age**	**π**	**95% CI**		**HEX**	**π**	**95% CI**		**HEX**	**Δ HEX**
Men	50-54	.095	.061	.13	25.708	.105	.066	.143	25.538	.169
	55-59	.102	.073	.13	21.853	.108	.077	.138	21.727	.126
	60-64	.111	.082	.141	18.209	.117	.086	.149	18.109	.1
	65-69	.115	.079	.151	14.701	.122	.083	.16	14.627	.075
	70-74	.179	.133	.226	11.293	.186	.137	.235	11.246	.047
	75-79	.194	.143	.244	8.311	.197	.146	.249	8.291	.02
	80-84	.356	.286	.427	5.578	.36	.288	.432	5.574	.004
	85+	.43	.334	.526	3.921	.428	.33	.525	3.937	-.016
Women	50-54	.097	.065	.129	30.198	.107	.071	.143	29.994	.204
	55-59	.103	.076	.131	26.054	.109	.08	.139	25.899	.155
	60-64	.079	.056	.102	22.014	.081	.057	.105	21.885	.129
	65-69	.109	.079	.139	17.909	.122	.088	.156	17.789	.121
	70-74	.152	.113	.191	14.015	.156	.115	.198	13.957	.058
	75-79	.201	.157	.245	10.431	.202	.157	.248	10.391	.039
	80-84	.271	.216	.325	7.281	.279	.223	.336	7.243	.038
	85+	.454	.389	.519	4.781	.454	.388	.519	4.781	0

Table 20: Germany

		Replicated weights				Education-adjusted weights				
Gender	**Age**	**π**	**95% CI**		**HEX**	**π**	**95% CI**		**HEX**	**Δ HEX**
Men	50-54	.554	-.131	1.24	21.468	.52	-.173	1.213	21.463	.004
	55-59	.184	.101	.268	19.758	.179	.095	.263	19.579	.179
	60-64	.166	.102	.23	16.41	.177	.101	.252	16.197	.213
	65-69	.14	.084	.196	13.133	.148	.08	.217	12.963	.17
	70-74	.182	.123	.241	9.859	.169	.109	.229	9.714	.145
	75-79	.224	.143	.305	6.897	.222	.138	.306	6.659	.238
	80-84	.424	.291	.556	4.33	.46	.321	.599	4.014	.316
	85+	.503	.3	.707	2.933	.546	.337	.755	2.682	.251
Women	50-54	.133	-.008	.274	26.026	.18	-.012	.372	25.549	.476
	55-59	.204	.133	.276	22.012	.219	.137	.301	21.768	.244
	60-64	.139	.086	.193	18.453	.158	.091	.225	18.276	.177
	65-69	.216	.143	.289	14.682	.219	.142	.295	14.595	.086
	70-74	.222	.15	.293	11.36	.245	.162	.328	11.281	.079
	75-79	.25	.155	.345	8.169	.254	.145	.363	8.206	-.037
	80-84	.366	.22	.511	5.342	.373	.21	.537	5.406	-.064
	85+	.509	.368	.65	3.351	.49	.341	.639	3.481	-.13

Table 21: Hungary

		Replicated weights				Education-adjusted weights				
Gender	Age	π	95% CI		HEX	π	95% CI		HEX	Δ HEX
Men	50-54	.135	.051	.218	18.337	.145	.048	.242	18.245	.092
	55-59	.252	.138	.366	15.07	.255	.141	.369	15.026	.044
	60-64	.199	.122	.275	12.672	.206	.131	.281	12.64	.032
	65-69	.216	.112	.32	10.197	.214	.119	.308	10.199	-.002
	70-74	.18	.096	.265	7.837	.187	.103	.271	7.83	.008
	75-79	.372	.185	.56	5.373	.358	.18	.536	5.404	-.031
	80-84	.584	.368	.801	3.957	.593	.359	.828	3.918	.039
	85+	.288	.09	.485	4.086	.289	.089	.489	4.08	.007
Women	50-54	.145	.045	.245	23.636	.176	.054	.298	23.355	.282
	55-59	.159	.077	.241	19.931	.16	.087	.234	19.8	.131
	60-64	.143	.054	.233	16.423	.162	.056	.269	16.293	.131
	65-69	.186	.06	.311	12.953	.186	.079	.293	12.912	.04
	70-74	.245	.164	.325	9.766	.237	.159	.316	9.724	.042
	75-79	.258	.16	.356	7.034	.27	.165	.375	6.948	.086
	80-84	.481	.343	.619	4.579	.481	.356	.607	4.539	.04
	85+	.42	.25	.591	3.607	.43	.26	.6	3.548	.059

Table 22: Italy

		Replicated weights				Education-adjusted weights				
Gender	Age	π	95% CI		HEX	π	95% CI		HEX	Δ HEX
Men	50-54	.009	-.006	.024	26.852	.009	-.006	.025	26.91	-.058
	55-59	.066	.03	.102	22.312	.065	.029	.1	22.373	-.061
	60-64	.065	.035	.095	18.202	.065	.035	.095	18.258	-.056
	65-69	.131	.088	.173	14.255	.129	.087	.171	14.312	-.058
	70-74	.118	.078	.159	10.829	.114	.074	.154	10.881	-.052
	75-79	.217	.158	.277	7.484	.215	.156	.275	7.521	-.037
	80-84	.297	.211	.384	4.843	.291	.205	.378	4.878	-.035
	85+	.536	.399	.673	2.787	.533	.397	.67	2.802	-.014
Women	50-54	.088	.029	.147	28.763	.083	.025	.14	28.837	-.073
	55-59	.085	.049	.121	24.47	.085	.049	.121	24.518	-.047
	60-64	.091	.061	.121	20.239	.091	.06	.121	20.286	-.047
	65-69	.103	.069	.138	16.118	.104	.069	.138	16.164	-.046
	70-74	.163	.118	.207	12.156	.162	.118	.207	12.207	-.051
	75-79	.257	.192	.322	8.602	.248	.184	.313	8.655	-.053
	80-84	.362	.271	.454	5.714	.357	.266	.449	5.73	-.016
	85+	.517	.4	.634	3.617	.518	.4	.635	3.608	.009

Table 23: Poland

		Replicated weights				Education-adjusted weights				
Gender	Age	π	95% CI		HEX	π	95% CI		HEX	Δ HEX
Men	50-54	0	.	.	21.117	0	.	.	21.366	-.249
	55-59	.176	.114	.238	17.042	.162	.099	.226	17.303	-.262
	60-64	.184	.127	.242	14.057	.178	.117	.238	14.267	-.21
	65-69	.19	.123	.257	11.302	.173	.102	.245	11.5	-.199
	70-74	.244	.155	.333	8.744	.236	.148	.324	8.883	-.14
	75-79	.297	.19	.404	6.557	.303	.173	.433	6.685	-.128
	80-84	.39	.248	.533	4.822	.346	.199	.494	5.036	-.214
	85+	.314	.154	.474	3.916	.303	.144	.461	3.979	-.063
Women	50-54	.024	-.022	.07	24.106	.035	-.033	.103	24.156	-.05
	55-59	.131	.087	.176	19.624	.132	.085	.179	19.732	-.109
	60-64	.105	.064	.146	15.779	.097	.057	.137	15.893	-.114
	65-69	.21	.135	.285	11.899	.204	.129	.28	11.979	-.08
	70-74	.384	.292	.476	8.596	.391	.296	.486	8.65	-.054
	75-79	.404	.292	.516	6.235a	.396	.281	.511	6.333	-.099
	80-84	.489	.375	.603	4.136	.468	.348	.588	4.207	-.072
	85+	.608	.449	.768	2.688	.612	.45	.774	2.662	.026

Table 24: Portugal

		Replicated weights				Education-adjusted weights				
Gender	**Age**	**π**	**95% CI**		**HEX**	**π**	**95% CI**		**HEX**	**Δ HEX**
Men	50-54	.05	-.003	.102	25.919	.046	.001	.091	25.916	.003
	55-59	.182	.032	.332	21.913	.184	.019	.35	21.892	.02
	60-64	.039	.007	.071	18.666	.044	.008	.081	18.656	.01
	65-69	.215	.067	.364	14.822	.229	.072	.385	14.84	-.018
	70-74	.09	.026	.153	12.054	.08	.02	.139	12.145	-.091
	75-79	.225	.101	.349	8.915	.216	.09	.342	8.966	-.051
	80-84	.244	.046	.443	6.84	.231	.016	.446	6.853	-.014
	85+	.035	-.02	.09	5.665	.045	-.024	.115	5.602	.062
Women	50-54	.206	.068	.344	26.158	.212	.067	.358	27.107	-.949
	55-59	.088	.034	.141	22.473	.087	.031	.143	23.465	-.992
	60-64	.158	.054	.262	18.259	.104	.043	.165	19.264	-1.005
	65-69	.1	.047	.153	14.447	.1	.043	.157	15.203	-.755
	70-74	.27	.098	.442	10.411	.197	.077	.317	11.195	-.785
	75-79	.211	.084	.337	7.366	.188	.07	.305	7.827	-.46
	80-84	.409	.228	.59	4.166	.378	.192	.565	4.569	-.403
	85+	.717	.499	.935	2.024	.668	.38	.955	2.376	-.352

Table 25: Slovenia

		Replicated weights				Education-adjusted weights				
Gender	**Age**	**π**	**95% CI**		**HEX**	**π**	**95% CI**		**HEX**	**Δ HEX**
Men	50-54	.068	.029	.107	26.008	.072	.03	.113	25.91	.098
	55-59	.055	.027	.082	21.979	.056	.027	.084	21.897	.082
	60-64	.086	.04	.133	18.191	.087	.042	.133	18.109	.082
	65-69	.084	.043	.124	14.724	.086	.045	.128	14.642	.082
	70-74	.174	.108	.241	11.456	.18	.111	.249	11.379	.077
	75-79	.198	.122	.275	8.945	.203	.126	.28	8.886	.059
	80-84	.136	.057	.215	7.045	.148	.062	.234	6.995	.05
	85+	.041	-.007	.089	5.537	.041	-.007	.09	5.535	.002
Women	50-54	.117	.072	.161	29.09	.129	.08	.179	28.837	.254
	55-59	.132	.034	.231	25.035	.147	.034	.261	24.841	.194
	60-64	.103	.045	.161	21.149	.11	.045	.175	21.026	.123
	65-69	.163	.074	.252	17.238	.171	.077	.265	17.149	.088
	70-74	.173	.072	.275	13.776	.182	.073	.292	13.724	.052
	75-79	.215	.113	.317	10.484	.215	.112	.318	10.475	.009
	80-84	.165	.096	.235	7.885	.167	.095	.238	7.873	.013
	85+	.208	.098	.317	5.56	.209	.099	.319	5.551	.009

Table 26: Spain

		Replicated weights				Education-adjusted weights				
Gender	**Age**	**π**	**95% CI**		**HEX**	**π**	**95% CI**		**HEX**	**Δ HEX**
Men	50-54	.03	.001	.058	29.048	.026	0	.052	29.09	-.041
	55-59	.048	.015	.08	24.794	.043	.013	.073	24.819	-.025
	60-64	.053	.025	.08	20.812	.048	.022	.074	20.815	-.004
	65-69	.042	.013	.071	17.04	.044	.014	.075	17.019	.021
	70-74	.037	.014	.059	13.404	.033	.012	.055	13.394	.01
	75-79	.099	.063	.136	10.011	.105	.066	.144	9.981	.03
	80-84	.158	.097	.219	7.241	.159	.096	.222	7.235	.006
	85+	.185	.11	.261	5.304	.186	.11	.261	5.304	.001
Women	50-54	.012	.001	.022	34.016	.013	0	.026	34.013	.003
	55-59	.013	0	.027	29.403	.013	0	.026	29.407	-.004
	60-64	.009	-.001	.019	24.864	.009	-.001	.018	24.864	0
	65-69	.042	.019	.065	20.361	.041	.017	.065	20.359	.002
	70-74	.05	.021	.08	16.127	.052	.021	.082	16.118	.008
	75-79	.088	.055	.121	12.126	.09	.055	.126	12.124	.003
	80-84	.138	.086	.19	8.647	.14	.087	.193	8.656	-.009
	85+	.253	.187	.318	5.931	.25	.184	.316	5.954	-.023