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Causes, mortality rates and risk factors of death in community-dwelling Europeans aged 50 years and over: Results from the Survey of Health, Ageing and Retirement in Europe 2013-2015

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ABSTRACT

Objective: To determine mortality rates and to rank the causes and predictors of mortality using a wide range of sociodemographic and clinical variables.

Materials and Methods: It is a prospective population-based cohort study of adults living in the community, 2013-15 (N = 48,691, age ≥50; deceased = 1,944). Clinical and sociodemographic data were obtained from the Survey of Health, Ageing and Retirement in Europe (SHARE): Age, Gender, Marital Status, Years of Schooling, Income, Loneliness, Cognition, Self-Rated Health, Diseases, Activities of daily living (ADL), and Frailty. Mortality rates were calculated. A Cox proportional hazards model were used to determine risk-adjusted mortality ratios.

Results: The crude mortality rate was 18.39 (1000 person-years at risk), (99% CI, 18.37-18.42). The factors most associated with an increased mortality risk were older age, lower self-rated health, lower cognition, male gender, ADL deficits, higher comorbidity, frailty and loneliness. The diseases with a higher mortality risk were: cancer (Hazard ratio, HR = 2.67), dementia (HR = 2.19), depressive symptoms (HR = 2.10), fractures (hip, femur) (HR = 1.57), stroke (HR = 1.55), chronic lung disease (HR = 1.52), diabetes (HR = 1.36) and heart attack (HR = 1.21).

Conclusions: The main mortality risk factors, associated independently in the eight diseases were: older age, poor self-rated health, ADL deficits, male gender, lower cognition, comorbidity and the presence of depressive symptoms, with a different influence in the European regions. The need to evaluate and treat the depressive symptoms that accompanies diseases with higher risk of mortality is stressed.

Keywords: aging; mortality risk; diseases; comorbidity; depressive symptoms

1. Introduction

People aged over 65 years in Europe represented 19.4% of the population in 2016 and this number is forecast to grow continuously until 2050 (European Comission, 2017). This aging population presents new challenges related to chronic diseases and their associated functional and cognitive consequences. It is essential to identify the causes of mortality and its associated risk factors and to design preventive measures to be able to improve quality of life among the elderly.

Data from Eurostat (2014a), showed that the gross mortality rate (per 1,000 inhabitants) of people aged over 50 years in the EU-28 was 18.10, although distribution by age brackets showed large differences: 3.81 at 50-64 years, 21.36 at 65-79 years and 100.21 at ≥ 80 years.

In another Eurostat report (2014b), the main causes of death (per 1,000 inhabitants) in people aged over 65 years in Europe were ranked as follows: circulatory system diseases category 17.27, cancer 10.54, cerebrovascular diseases 4.02, respiratory system diseases 3.65, mental illnesses 1.82, and external causes 1.25. Several community studies have identified older age and, to a lesser degree, male gender as mortality risk factors (Zhang et al., 2012; Huang et al., 2017).

An increase in the risk of mortality has been related to the presence of depressive symptoms (Vilalta-Franch et al., 2012; Teng, Yeh, Lee, Lin, & Lai, 2013; Péquignot et al., 2019), associated with disability (Murphy et al., 2016), or cognitive deficits (Georgakis et al., 2016). Living alone or having feelings of loneliness were independent factors associated with increased mortality (Tabue Teguo et al., 2016). Cognitive impairment has also been associated with increased risk of mortality in general (Park, Lee, Suh, Kim, & Cho, 2014; Hu et al., 2019), and in various chronic diseases (Batty, Deary, & Zaninotto, 2016).

Self-rated health was found to be an independent predictor of mortality (Falk et al., 2017; Szybalska et al., 2018), and showed a similar predictive power when objective health measures were used (Lima-Costa, Cesar, Chor, & Proietti, 2012). Greater frailty (Garre-Olmo, Calvó-Perxas, López-Pousa, de Gracia Blanco, & Vilalta-Franch, 2013; Ravindrarajah et al., 2013), and deficits in Activities of Daily Living (ADL) were associated with higher mortality risk (Formiga et al., 2016; Nascimento, Oliveira, Firmo, Lima-Costa, & Peixoto, 2018). Finally, higher comorbidity (Gagne, Glynn, Avorn, Levin, & Schneeweiss, 2011; Nunes, Flores, Mielke,

Thumé, & Facchini, 2016) and the accumulation of geriatric syndromes (Huang et al., 2017) were relevant risk factors.

While certain studies analysed some of the risk factors in isolation, the aim of the present study was to determine mortality rates and the main risk factors, using a wide range of sociodemographic and clinical variables from a large population sample of people aged over 50 years in Europe (2013-15), exploring the differences in four European regions.

2. Materials and Methods

2.1. Design and Participants

The study is a prospective population cohort study including data from the waves 5 and 6 of the "Survey of Health, Aging and Retirement in Europe" (SHARE), corresponding to the years 2013 and 2015. People aged over 50 years with complete data in both waves were included, in addition to people who died between 2013 and 2015 (Malter, & Börsch-Supan, 2015, 2017).The study was approved by the Ethics Committee of the Institute of Biomedical Research of Girona Dr Josep Trueta.

Participants were selected from countries with longitudinal data for Waves 5 and 6: Denmark, Sweden, Switzerland, Luxemburg, Austria, Germany, Belgium, France, Slovenia, Czechia, Estonia, Spain, Italy and Israel. Response rates in the countries varied from 57.9% in France, to 85.0% in Estonia (Malter, & Börsch-Supan, 2015, 2017). The final study sample consisted of 48,691 subjects, with complete data on both waves 5 and 6, among which 1,944 died between the two waves.

Mortality data were registered using a standardized interview that collects information on the cause and on several circumstances of the death.

2.2. Measures

The variables and instruments used from the SHARE interview for the present study were the following:

2.2.1. Sociodemographic data: Age (50-64 / 65-79 / ≥80 years), Gender (male/female), Marital status (married/widowed/single-divorced), Years of schooling (> 12 / 8-12 / <8),

Economic household income in percentiles (100-70 / 60-10), Ever smoked daily (yes / no) and Physical exercise (no / yes).

2.2.2. Loneliness: Was measured using a short scale of Loneliness (Hughes, Waite, Hawkley, & Cacioppo, 2004), consisting of three items (lack of companionship, feeling left out, feeling isolated) and with a score range of 3 to 9. Cronbach's alpha in the original scale was 0.72. Scores above 3 were regarded as reflecting feelings of loneliness.

2.2.3. Depressive symptoms. The scale used was the EURO-D (Prince et al., 1999), consisting of 12 items (depressive symptoms, pessimism, death wish, guilt, irritability, crying, fatigue, sleep problems, loss of interest and appetite, reduced ability to concentrate and capacity to enjoy things over the last month). Answers were dichotomous with a range of 0-12 points. The cut-off point for clinically significant depressive symptoms was ≥4, with a mean sensitivity of 74.8% and a mean specificity of 82% among different European countries. Cronbach's alpha showed moderate values (0.69).

2.2.4. Physical Health. It was assessed using the following variables: Self rated health (Excellent/Very good - Good – Fair/Poor), Self-referred presence of diseases (heart attack, hypertension, cholesterol, stroke, diabetes, chronic lung, cancer, ulcer, Parkinson's disease, fractures: hip-femur, other fractures, dementia, cataracts, rheumatoid arthritis, other emotional disorders, other diseases) and presence of Deficits in Activities of Daily Living (ADL - six basic and seven instrumental activities).

2.2.5. Cognition. The following measurements were used to assess participants' cognitive status: immediate recall (score range = 0-10), delayed recall (score range = 0-10), numeric ability to subtract (score range = 0-5), and verbal fluency (score range = 1-10). A global cognitive score was calculated as the sum of all these scores, and it had a range from 0 to 35. This variable was further stratified into three equivalent groups in terms of number of participants (>18 / 14-17 / <14).

2.2.6. Frailty. It was measured using the following four items of the SHARE interview: falling, fear of falling down, dizziness, and fatigue. It was categorized as presence / absence.

2.3. Statistical analysis

A bivariate analysis of the variable frequencies was performed to examine the differences between survivors and deceased using the chi square test (χ^2). To assess the magnitude of the effect of the difference between percentages, Cohen's d (d*)* was used for continuous

variables (weak <0.50, moderate 0.50-0.80, strong> 0.80) and Cramer's V (V), for categorical variables (df_1 = small: ≤0.10, medium: 0.11-0.49, large: ≥0.50; df_2 = small: ≤0.07, medium: 0.08-0.34, large: ≥0.35; df_3 = small: ≤0.06, medium: 0.07-0.28, large: ≥0.29) (Cohen, 1988).

Crude mortality rates were calculated for each variable and disease: number of deaths divided by the total number of years at risk x 1000. Confidence intervals (99.9% CI) were based on Poisson exact distribution. The standardized rate was calculated based on the direct method (Schoenbach, & Rosamond, 2000), taking the analysed age groups into account.

Cox multivariate regression analyses were performed using clinical and sociodemographic factors and diseases to determine the hazard ratio of each variable and the confidence intervals (99.9% CI). The effect size of the Hazard ratio (HR) was evaluated as small (<1.22), medium (1.23-2.99) and large (> 3.00) (Olivier, May, & Bell, 2017). Kaplan-Meier survival curves and log-rank tests were used for the most relevant variables.

To identify the variables associated with deaths in European regions, countries were grouped into four regions according to social welfare models (Whelan and Maître, 2010): Northern (Denmark, Sweden), Continental (Switzerland, Luxembourg, Austria, Germany, Belgium, France), Eastern (Slovenia, Czech Republic, Estonia) and Southern (Spain, Italy, Israel).

Calibrated longitudinal individual weights provided by SHARE (Malter, & Börsch-Supan, 2015) were used for the bivariate analysis and mortality rate calculation. The level of statistical significance used was <0.05 and 99.0% confidence intervals. Statistical analysis was performed using SPSS v24.0 for Windows (IBM SPSS Corp., Amonk, NY), and STATA v15.1 (StataCorp LLC, College Station, Texas).

3. Results

3.1. Differences between valid and missing participants

The initial Wave 5 sample included 60,919 participants, of which 12,228 were lost to follow-up. Thus, the final sample consisted of 48,691 (46,747 survivors and 1,944 deceased over Waves 5 and 6). Lost cases showed only minimal differences with the individuals in the final sample: younger age (66.3 vs 67.4, P < 0.001, d = 0.10), lower presence of women

(54.0% vs 55.7 %, P < 0.001, V = 0.01), lower cognitive function (15.4 vs 15.7, P < 0.001, d = 0.07), lower number of diseases (2.01 vs 2.09, P < 0.001, d = 0.04), and somewhat greater depressive symptoms (2.53 vs 2.46, P = 0.003, d = 0.03).

3.2. Differences between survivors and deceased

In the bivariate analysis (Table 1), the most relevant differences between survivors and deceased were that the latter were older (V = 0.23), had more ADL deficits (V = 0.22), a worsened self-rated health (V = 0.16), a lower cognitive function (V = 0.16), no practice of physical exercise (V= 0.14), more physical diseases (V = 0.13) and with the presence of depressive symptoms (V = 0.13). Deceased participants also showed greater frailty difficulties with moderate differences (V = 0.12). In the four European regions there were higher death rates in the Eastern and Southern regions (V = 0.07).

Finally, widowers (V = 0.11), and those with lower schooling (V = 0.10) were also associated with a greater number of deaths, although in smaller proportions. Loneliness, lower income, gender and ever smoked daily, were seen to have a weak effect on mortality.

3.3. Mortality rates

The crude death rate (per 1000 hab.) was 18.39 (99.0% CI, 18.37-18.42) people-years at risk for the whole sample. Some categories had higher than average mortality rates across all factors, which became more relevant with age, ≥80 years (rate, r = 72.04) and with ADL deficits (r = 61.47). Lower cognitive function (r = 41.11), widowers (40.88), fair/poor self-rated health (r = 36.91), less schooling (r = 36.25), frailty (r = 34.05), no physical exercise (r = 33.21), loneliness (r = 28.83), lower income (r = 23.61), ever smoked daily (r = 21.79) and men (r = 19.53), also had higher than average rates. Regarding the European regions, the Eastern (r = 26.58) and Southern (r = 27.41) regions had the highest mortality rates.

All diseases had higher than average mortality rates, with highest rates detected in dementia (r = 166.57), Parkinson's disease (r = 87.13), fractures (hip/femur) (r = 72.14), stroke (r = 65.73), cancer (r = 61.13), chronic lung disease (r = 47.68), heart attack (r = 45.30), depressive symptoms (r = 41.58), cataracts (r = 40.29) and diabetes (r = 66.18). (See Supplementary Table 1).

3.4. Factors associated with an increased risk of mortality

In the Cox multivariate regression, the most relevant factor associated with the deceased cases was age (HR = 5.16 to 2.23). A second group of factors (HR = 2.11 to 1.31) included: lower self-rated health, ADL deficits, male gender, lower cognitive function, no physical exercise, comorbidity and ever smoking daily . A third group with lower HR (HR = 1.20 to 1.19) included widowhood, loneliness and depression. Economic income and fragility did not present significant risks in the global sample, except in some European regions. Area location and education did not show any significant risk increase (Table 2).

Some differences were observed between the European regions associated with a higher risk. Compared to the mean risk of all cases, the Nordic region had a higher risk with the older age (HR = 9.89 vs. HR = 5.16) and with the lowest income (HR = 1.72 vs. HR = 1.03). Among the deceased cases with lower income (≤ 60 perc.), the highest percentages corresponded to Sweden (90.4%) and Denmark (95.2%), above the percentage corresponding to all the cases (82.3%).

In the Continental region, a greater risk with comorbidity (HR = 2.18 vs. H = 1.72) and with ADL deficits (HR = 2.30 vs. HR = 1.90) was seen, while in the Eastern region, there was a lower relevance of self-perceived health (HR = 1.15 vs. HR = 2.11) and a greater fragility (H = 1.40 vs. HR = 1.12). In the Southern region, older age (HR = 6.05 vs. HR = 5.16), worse health self-perception (HR = 2.56 vs. HR = 2.11), widowhood (HR = 1.34 vs. HR = 1.20), loneliness (HR = 1.33 vs. HR = 1.19) and depression (HR = 1.29 vs. HR = 1.19) were the most relevant differences (Table 2).

Supplementary Table 2 shows the proportions of deaths, and crude and adjusted risks, in each of the 14 countries, grouped by region.

3.5. Diseases associated with an increased mortality

In the Cox multivariate regression, participants with cancer, dementia, depressive symptoms, fractures (hip/femur), stroke, chronic lung disease, diabetes and heart attack, had an increased risk of death (HR = 2.67 to 1.21). Participants having more than two of these eight diseases (>2 comorbidity, rate = 104.81) had the highest mortality risk.

Parkinson disease, other diseases, other fractures, other emotional disorders, rheumatoid arthritis, hypertension, stomach ulcers, and cataracts did not increase the risk of death.

Cholesterol (HR = 0.77) and Osteoarthritis (HR = 0.88), however, seemed to be protective factors (Table 3).

Supplementary Table 3 shows the frequency of survivors and deceased for each disease and the mean age of death.

3.6. Factors and comorbidity associated with increased mortality

The factors associated in the Cox regression (adjusted for countries), with the eight diseases as a whole with the highest risk of mortality (cancer, dementia, depression, fractures-hip/femur, stroke, chronic lung disease, diabetes and heart attack), were: age (65-79 years, HR = 2.07, 99.0%CI = 1.63-2.64; ≥ 80 years, HR = 4.80, 99.0%CI = 3.76-6.14), self-rated health (good, HR = 1.55, 99.0%CI = 0.94-2.57; fair-poor, HR = 2.41, 99.0%CI = 1.48-3.92), ADL deficits (HR = 2.06, 99.0%CI = 1.74-2.45), no physical exercise (HR = 1.99, 99.0%CI = 1.62-2.44), male gender (HR = 1.81, 99.0%CI = 1.56-2.11), comorbidity (>2, HR = 1.68, 99.0%CI = 1.44-1.95), cognition (<14, HR = 1.63, 99.0%CI = 1.24-2.15), loneliness (HR = 1.23, 99.0%CI = 1.06-1.42), ever smoked daily (HR = 1.21, 99.0%CI = 1.04-1.41) and frailty (HR = 1.12, 99.0%CI = 0.94-1.33).

The Hazard ratios (adjusted for country, gender and age) of the eight diseases as a whole were: cancer (HR = 2.47, 99.0%CI = 2.09-2.92), dementia (HR = 2.24, 99.0%CI = 1.85-2.71), depressive symptoms (HR = 1.93, 99.0%CI = 1.66-2.24), fractures (HR = 1.52, 99.0%CI = 1.19-1.93), stroke (HR = 1.48, 99.0%CI = 1.23-1.78), chronic lung disease (HR = 1.44, 99.0%CI = 1.21-1.71), diabetes (HR = 1.23, 99.0%CI = 1.06-1.43), and heart attack (HR = 1.13, 99.0%CI = 0.97-1.30).

Table 4 shows the risk factors associated with each of the diseases that have the highest risk of mortality. Comorbidity and depression were associated with an increased risk for each of the 8 diseases.

Figure 1 shows the survival curves of Kaplan-Meier with the mortality trajectories for each of the diseases with greater risk, as well as for comorbidity. By analysing the diseases independently, the order of highest to lowest risk (HR) was modified: dementia (HR = 9.26, 99.0%CI = 7.79-11.02), fractures (hip or femoral) (HR = 3.71, 99.0%CI = 2.93-4.70), stroke (HR = 3.54, 99.0%CI = 2.98-4.22), cancer(HR = 3.38, 99.0%CI = 2.88-3.96), depressive symptoms (HR = 3.27, 99.0%CI = 2.90-3.67), heart attack (HR = 2.65, 99.0%CI = 2.32-3.03), chronic lung

disease (HR = 2.54, 99.0%CI = 2.14-3.00), diabetes (HR = 1.98, 99.0%CI = 1.73-2.28) and comorbidity (HR = 6.13, 99.0%CI = 5.35-7.04)

4. Discussion

4.1. Mortality rates and predictive factors

The main objective of this study was to determine the mortality rate in Europeans aged 50 years and over, and to quantify the effect of several sociodemographic and clinical variables, using data from a large representative cohort of the European population.

The estimated mortality rate in people aged 50 and over in our study was 18.39, which is in line with the crude rate for 28 European countries (18.10) and the standardized rate (18.47), calculated using Eurostat data (2014a) for 15 countries (Supplementary Table 4).

In addition to older age, the most relevant predictors of mortality in our study were, in order of importance: lower self-rated health, ADL deficits, male gender, no physical exercise, lower cognitive function, higher comorbidity and ever smoking daily. These predictors were in agreed with previous research. The lower self-rated health factor is interesting: though it is a simple measure, several authors have indicated that it is a strong predictor of mortality risk (Lima-Costa et al., 2012; Falk et al., 2017; Szybalska et al., 2018). ADL deficits (Formiga et al., 2016; Nascimento et al., 2018), and lower cognitive function (Park et al., 2014; Batty et al., 2016; Hu et al., 2019) have also been considered as a relevant mortality factor. Also, the presence of feelings of loneliness or living alone were associated a higher risk (Tabue Teguo et al., 2016). Comorbidity, as a risk factor, was widely present in most studies (Gagne et al., 2011; Nunes et al., 2016), associated with ADL deficits (Formiga et al., 2016) and the accumulation of geriatric syndromes (Huang et al., 2017).

Finally, the practice of physical exercise was associated with lower mortality (Georgiopoulou et al., 2017; Pedisic et al., 2020) and, on the contrary, smoking regularly was associated with higher mortality (Nash, Liao, Harris, & Freedman, 2017).

The aspects related to health (Self-Rated Health, ADL deficits and Comorbidity), were highly related to mortality according to our study. The greater presence of diseases in older people is associated with greater ADL deficits and, regarding self-perceived health, they themselves are aware of their health deficits. Self-reported health deficits are therefore as predictive of mortality as objective health measures (Lima-Costa et al., 2012)

4.2. Diseases presenting a higher risk of mortality

Our results identify eight diseases that had the highest mortality rates, most of which are included within the WHO's top ten causes of death (WHO, 2016). Nevertheless, depression and hip/femur fractures are not included in this list but had also higher than average mortality rates in our study.

Depression has been previously linked to increased mortality (Cuijpers et al., 2014) and it has been reported that this association has a long-term effect (Gilman et al., 2017). The effect of depression on excess mortality has been related to an increased suicide risk, but also to many major medical causes, which is in line with our results where depression is comorbid with many other diseases (Zivin et al., 2015). It should also be borne in mind that depression and loneliness combined in older people constitute an important predictor of mortality (Holwerda et al., 2016).

Our results also highlighted hip/femur fractures as a risk for mortality, which has been widely studied in the recent years. Thus, these fractures have been described to have short- and long-term effect increasing mortality, and that this risk is increased regardless of the gender (von Friesendorff et al., 2016; Katsoulis et al., 2017).

According to our results, some factors amplified the risk when associated with the eight diseases we found to be related to excess mortality: other comorbidities (i.e. concomitant diabetes, or hypertension, among others), deficits in ADL performance, worsened self-rated health, and as previously discussed, depression.

Increased comorbidity has been identified as a general risk factor for mortality (Nunes et al., 2016) and specifically in cancer (Ferrat et al., 2015), dementia (Zekry et al., 2011; Todd, Barr, Roberts, & Passmore, 2013) or some fractures (Chang et al., 2018). In the same line, pulmonary diseases were seen to present a higher risk in patients with heart failure (Matsushita, Sakata, Satoh, & Yoshino, 2019), and heart disease had an increased risk with cholesterol (Liao, Zeng, Zhao, Guo, & Zhang, 2017). Moreover, diabetes was associated with higher mortality in patients with stroke, cholesterol (Araki et al., 2012), and pulmonary diseases (Ho et al., 2017). A relevant aspect of comorbidity is the inverse relationship between cancer and dementia; older people with cancer have a reduced risk of dementia and vice versa (Musicco et al., 2013).

Functional deficits in ADL were also previously associated with greater mortality in dementia (Zekry et al., 2011; Todd et al., 2013), depressive symptoms (Murphy et al., 2016), and with Parkinson's disease (Santos-García et al., 2018). Regarding poorer self-rated health, it has been reported to predict mortality in cancer (Giltay, Vollaard, & Kromhout, 2012), depression (Falk et al., 2017), lung diseases and stroke (Fernández-Ruiz et al., 2013) and heart failure (Johansson, Broström, Dahlström, & Alehagen, 2008).

As previously discussed, our results highlight depression as a risk factor for increased mortality, both by itself, and when it appears comorbid with other diseases such as dementia, chronic lung disease, hip/femur fracture, heart attack, cancer, stroke, diabetes and Parkinson's disease. Some authors have questioned whether depression constitutes an independent mortality factor and have emphasized that the severity of one's physical health condition is a determinant of mortality (Batterham, Christensen, & Mackinnon, 2012; Benabarre et al., 2014). However, our own results and those of many other authors, show that depression is a risk factor for mortality in general (Teng et al., 2013; Murphy et al., 2016; Péquignot et al., 2019) and acts as a booster of this risk when it appears comorbid with cancer (Parpa, Tsilika, Gennimata, & Mystakidou, 2015), dementia (Lara, Haro, Tang, Manly, & Stern, 2016), stroke (Krivoy et al., 2017), heart failure (Gathright, Goldstein, Josephson, & Hughes, 2017), diabetes (Limongi, Noale, Crepaldi, & Maggi, 2014), and Parkinson's disease (Shoval et al., 2017).

Despite the importance of mortality data, several studies show the ability to reduce risk factors and mortality rates. Thus, the application of the recommendations of the medical guidelines for prevention of cancer and cardiovascular diseases have reduced mortality rates (Greenlee et al., 2017), programs to reduce mortality in patients with hip fracture (Mahran et al., 2019) or programs to prevent falls in older people, related to increased mortality (Pahor, 2019; Liu-Ambrose et al., 2019), are some examples. Specifically, the programs of evaluation and prevention of health in geriatrics have shown their effectiveness by reducing mortality by 20% in people over 70 years, with a mean follow-up of 6.2 years (Frese, Deutsch, Keyser, & Sandholzer, 2012).

4.3. European regions, mortality and public health services

Data from our study indicate higher mortality rates in Eastern European countries. The OECD / EU data (2018) that refer to the 2013-15 period show avoidable mortality rates

through optimal quality medical care. With respect to the European average (rate = 127, standardized rates by age per 100,000 inhabitants), Eastern European countries had higher avoidable mortality rates, especially the Czech Republic (r = 179) and Estonia (r = 224) that could be lowered through an improvement of the public health system.

A recent article (Anderson, Wilkinson, & Schafer, 2019) related the quality of medical care, measured with the Objective quality of the health system (HAQ Amenable Mortality Index; Barber et al., 2017), with the reduction of the disease and disability in older age. Continental countries such as Belgium, France, Germany, Switzerland, Spain or Sweden had a higher HAQ index, while countries such as the Czech Republic, Slovenia, Israel and Denmark had a lower HAQ. In our study, the adjusted mortality risk confirms that continental countries have a lower mortality risk, while the Czech Republic and Denmark have a higher risk (see Supplementary Table 2).

Undoubtedly, the public resources dedicated to the health system, in terms of Gross Domestic Product (GPD), of the year 2015 (OECD / EU, 2016) are relevant for its improvement. The Eastern European countries have an investment less than the mean of Europe, although this could also apply to the countries of Southern Europe. Some authors have already pointed out that the decrease in public spending on health is associated with an increase in mortality in the short and long term (Budhdeo et al., 2015).

Regarding the surprising fact of the higher risk of mortality with low incomes in the Nordic countries, Mackenbach (2017) analyses the paradoxes that occur in the European context. Socio-economic inequalities in mortality and morbidity also occur in countries with broad welfare policies, such as in the Nordic countries, while they are lower in southern European countries with their more family-based welfare models. The author argues that in the Nordic countries there would be people with a higher educational level ≃ higher income, those who better implemented prevention interventions, in contrast to those with a lower educational level ≃ lower income. In the countries of southern Europe, economic, social and cultural modernization, which occurred later, would preserve traditional values, with the family as a source of social protection to mitigate inequalities. In Eastern European countries, inequality in mortality would be related to the difficulties of political transition: poverty, excessive consumption of alcohol and tobacco and collapse of social protection and public health institutions.

4.4. Limitations

The study has certain limitations that should be mentioned. First, all the diseases were reported by the participants through a question asking if a doctor ever diagnosed them with these diseases, and no medical record was obtained. Second, all the information was obtained from a population survey and the lack of clinical data difficult to specifically analyse the variables that may influence the diseases. Third, there is no information on the cases lost in Wave 6 (12,228; 20.1% of the total), although the differences with the follow-up cases were minimal and the mortality rates were consistent with Eurostat's epidemiological data. Fourth, pharmaceuticals used by the participants to treat the diseases analysed in this study were not considered, and this may be a source of variability we did not control for. Fifth, comment that the study assesses the risk of short-term mortality, with only two years of follow-up. Finally, despite analysing the predictors for the four European regions, the country-specific predictors could not be analysed due to lack of space, a pending issue for future research.

5. Conclusions

The overall mortality rates in people older than 50 years were: crude, 18.39 and standardized, 18.47 (per 1,000 persons-year at risk). The most relevant factors associated with excess mortality were, in the following order: older age, lower self-rated health, ADL deficits, male gender, lower cognitive function, lack of physical exercise, higher comorbidity, smoke, loneliness and depression.

Diseases presenting the highest mortality risk were cancer, dementia, depressive symptoms, lung diseases, stroke, fractures, heart attacks and diabetes. When these diseases occurred together with older age, comorbidities, depressive symptoms, ADL deficits and lower self-rated health, the risk of mortality increased.

Identifying the risk factors in these eight diseases with a relevant comorbidity rate, the implementation of medical prevention guidelines, and treating potentially modifiable diseases – such as loneliness, cholesterol, hypertension, diabetes and depressive symptoms in particular – may make it possible to reduce the mortality risk.

The improvement of public health services would undoubtedly allow the prevention and avoidance of mortality rates, especially in those countries with the greatest health investment

deficits. However, the lower mortality would not only be related to an improvement of the health system or greater economic investment, but also to other relevant factors, such as the implementation of formal and informal support systems, inequalities in education, lifestyle , diet, poverty and toxic habits. Health systems and social protection for the elderly, especially in situations of loneliness and depression, would require more specific attention to this group.

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Table 1
Sociodemographic and clinical factors in Wave 5. Differences between survivors and deaths

	Survivors	Deaths
N	46747	1944 (4%)
Age, years		
mean (SD)	66.3 (10.5)	78.8 (10.5)
t, P, d	< 0.001, **1.19**	
Groups (%)		
50-64	99.2	0.8
65-79	96.6	3.4
≥ 80	86.5	13.5
χ^2 (df = 2), P, V	< 0.001, **0.23**	
Gender (%)		
Male	96.6	3.4
Female	96.2	3.8
χ^2 (df = 1), P, V	< 0.001, 0.01	
Marital status (%)		
Married	97.3	2.7
Single /Divorced	97.5	2.5
Widowed	92.1	7.9
χ^2 (df = 2), P, V	< 0.001, **0.11**	
Schooling, years (%)		
>12	98.2	1.8
12-8	96.7	3.3
<8	93.0	7.0
χ^2 (df = 2), P, V	< 0.001, **0.10**	
Income, percent. (%)		
70-100	97.6	2.4
10-60	95.0	5.0
χ^2 (df = 1), P, V	< 0.001, 0.07	
Loneliness (%)		
No	97.8	2.2
Yes	94.4	5.6
χ^2 (df = 1), P, V	< 0.001, 0.09	
Ever smoked daily		
No	96.2	3.8
Yes	95.8	4.2
χ^2 (df = 1), P, V	< 0.001, 0.01	
Physical exercise		
Yes	98.9	1.1
No	93.6	6.4
χ^2 (df = 1), P, V	< 0.001, **0.14**	
Cognition (%)		
>18	99.2	0.8
18-14	97.9	2.1
<14	92.1	7.9
χ^2 (df = 2), P, V	< 0.001, **0.16**	
Self-R Health (%)		
Excel. / Very good	99.3	0.7
Good	98.3	1.7
Fair / Poor	92.8	7.2
χ^2 (df = 2), P, V	< 0.001, **0.16**	
Diseases (18) (%)		
0-1	98.7	1.3
2-3	96.6	3.4
> 3	91.1	8.9
χ^2 (df = 2), P, V	< 0.001, **0.15**	
ADL deficits (%)		
No	98.5	1.5
≥ 1	88.4	11.6
χ^2 (df = 1), P, V	< 0.001, **0.22**	
Frailty (%)		
No	98.1	1.9
≥ 1	93.4	6.6
χ^2 (df = 1), P, V	< 0.001, **0.12**	
EURO-D (%)		
<4	97.9	2.1
≥4	92.7	7.3
χ^2 (df = 1), P, V	< 0.001, **0.13**	
European regions		
Continental	97.5	2.5
Nordic	96.8	3.2
Eastern	94.9	5.1
Mediterranean	94.9	5.1
χ^2 (df = 3), P, V	< 0.001, **0.07**	

Weighted data. ADL, Activities of daily living; EURO-D, Depression scale; df, degrees of freedom; V, Cramer's; d, Cohen's d; t, Student t test; χ^2, Chi-Square test. Effect size, for Cohen's d (weak< 0.50), moderate 0.50-0.80), strong > 0.80). Effect size for Cramer's V (df_1 = small: ≤0.10, medium: 0.11-0.49, large: ≥0.50; df_2 = small: ≤0.07, medium: 0.08-0.34, large: ≥0.35; df_3 = small: ≤0.06, medium: 0.07-0.28, large: ≥0.29). Effect size medium and large, in bold.

Table 2
Cox regression. Multivariate analysis of factors in Wave 5, for countries. Cases of death from wave 6

		All cases†		Nordic		Continental		Eastern		Southern	
	Groups	HR	99.0% CI	HR	99.0% CI	HR	99.0% CI	HR	99.0% CI	HR	99.0% CI
Age groups	R: 50-64										
	65-79	2.23	1.81-2.73***	4.42	1.88-10.4***	2.21	1.51-3.24***	1.81	1.31-2.51***	2.45	1.61-3.73***
	≥80	5.16	4.13-6.44***	9.89	4.02-24.3***	4.92	3.23-7.50***	4.10	2.86-5.88***	6.05	3.88-9.43***
Self-Health	R: Exc./V. good										
	Good	1.29	0.96-1.72*	1.31	0.70-2.45	1.24	0.74-2.09	0.77	0.42-1.42	1.47	0.79-2.73
	Fair / Poor	2.11	1.58-2.81***	2.01	1.10-3.69**	1.83	1.08-3.11**	1.15	0.64-2.07	2.56	1.40-4.66***
ADL deficits	≥1	1.90	1.64-2.21***	2.16	1.40-3.33***	2.30	1.70-3.13***	1.48	1.14-1.91***	2.15	1.63-2.85***
Gender	male	1.90	1.65-2.19***	1.94	1.31-2.86***	1.64	1.24-2.17***	2.03	1.58-2.61***	2.04	1.57-2.65***
Cognition	R: >18										
	14-18	1.27	1.00-1.61*	0.95	0.50-1.81	1.11	0.73-1.67	1.29	0.88-1.89	1.73	0.79-3.83
	<14	1.88	1.48-2.40***	1.94	1.03-3.64**	1.73	1.14-2.62**	2.07	1.42-3.03***	1.78	0.81-3.90
Physical exercise	No	1.85	1.57-2.18***	1.85	1.16-2.96**	2.09	1.49-2.92***	1.96	1.49-2.56***	1.67	1.20-2.34***
Comorbidity	>2	1.72	1.47-2.01***	1.88	1.14-3.09**	2.18	1.59-2.98***	1.69	1.28-2.24***	1.44	1.10-1.87***
Ever smoking daily	Yes	1.31	1.15-1.50***	1.30	0.89-1.91	1.42	1.09-1.85**	1.33	1.05-1.68**	1.16	0.90-1.49
Marital status	R: Married										
	widowed	1.20	1.03-1.41**	1.37	0.88-2.14	1.10	0.81-1.50	1.14	0.87-1.50	1.34	1.02-1.75**
Loneliness	Yes	1.19	1.04-1.37**	1.06	0.71-1.58	1.04	0.80-1.35	1.18	0.93-1.48	1.33	1.04-1.69**
Depression	≥ 4 EURO-D	1.19	1.03-1.38**	1.14	0.74-1.75	1.20	0.89-1.60	1.09	0.85-1.40	1.29	0.97-1.71*
Frailty	≥1	1.12	0.96-1.30	1.08	0.69-1.69	1.07	0.79-1.45	1.40	1.07-1.82**	0.98	0.76-1.27
Income (percent.)	<60	1.03	0.89-1.20	1.72	0.87-3.41*	1.15	0.85-1.56	1.04	0.80-1.34	0.89	0.69-1.14

Unweighted data; † Adjusted for country; †Method: Forward Wald; R, Reference group; HR, Hazard ratio; CI, Confidence interval; ADL, Activities of daily living; EURO-D, Depression scale. Time = Years at risk. Event = Death. *P < 0.05, **P < 0.010, ***P < 0.001.

Table 3

Cox regression. Multivariate analysis of diseases in wave 5. Cases of death from wave 6

	B	(SE)	HR	99.0% CI	P-value
Cancer	0.981	(0.063)	**2.67**	2.26-3.14	**< 0.001**
Dementia	0.785	(0.075)	**2.19**	1.81-2.66	**< 0.001**
Depressive Symptoms	0.745	(0.051)	**2.10**	1.84-2.40	**< 0.001**
Fractures (hip/femur)	0.451	(0.095)	**1.57**	1.23-2.00	**< 0.001**
Stroke	0.440	(0.071)	**1.55**	1.29-1.86	**< 0.001**
Chronic Lung	0.419	(0.068)	**1.52**	1.28-1.81	**< 0.001**
Diabetes	0.308	(0.057)	**1.36**	1.17-1.57	**< 0.001**
Heart Attack	0.188	(0.055)	1.21	1.05-1.39	**0.001**
Parkinson	0.179	(0.126)	1.19	0.86-1.65	0.155
Other diseases	0.080	(0.059)	1.08	0.93-1.26	0.177
Other fractures	0.032	(0.086)	1.03	0.83-1.29	0.710
Other emotional disorders	-0.020	(0.085)	0.98	0.79-1.22	0.816
Rheumatoid arthritis	-0.024	(0.067)	0.97	0.82-1.16	0.716
Hypertension	-0.029	(0.049)	0.97	0.86-1.10	0.556
Stomach ulcer	-0.094	(0.100)	0.91	0.70-1.18	0.350
Cataracts	-0.112	(0.063)	0.89	0.76-1.05	0.077
Osteoarthritis	-0.125	(0.061)	0.88	0.75-1.03	**0.041**
Cholesterol	-0.259	(0.057)	0.77	0.66-0.89	**< 0.001**

B, coefficient regression; SE, Standard error; HR, Hazard ratio; CI, Confidence interval; Depression, Euro-D ≥4.

Unweighted data. Time = Years at risk. Event = Death. Method: Enter. Adjusted for country, gender and age. Effect size for HR: small: <1.22, medium: 1.23-2.99, large: ≥3.00. Effect size medium and large, in bold.

Table 4

Cox regression. Multivariate analysis. Risk factors and comorbidities in the eight diseases with the highest risk of mortality

		Cancer		Dementia		Depression		Fract. (hip/fem.)		Stroke		Chronic Lung		Diabetes		Heart Attack	
		HR	99,0% CI	HR	99,0% CI	HR	99,0% CI	HR	99,0% CI	HR	99,0% CI	HR	99,0% CI	HR	99,0% CI	HR	99,0% CI
FACTORS†																	
Comorbidity	>2	1.90	1.39-2.61*	2.57	1.83-3.62*	1.40	1.18-1.66*	3.58	2.21-5.81*	3.69	2.60-5.24*	4.70	3.36-6.57*	3.85	2.99-4.95*	3.20	2.52-4.06*
Age	cont.	0.98	0.96-0.99*	1.04	1.02-1.06*	.....		1.03	1.00-1.06″	.....		0.98	0.97-1.00′	.....		1.01	1.00-1.02′
Self-Health	fair/poor	6.10	1.64-22.6*	.....		2.40	1.11-5.17″	.....		.....		3.81	0.84-17.3′	.....		7.32	1.64-32.7″
ADL deficit	≥1	.....		5.67	2.18-14.7*	1.58	1.25-1.98*	4.39	1.73-11.1*	2.66	1.65-4.27*	.....		.....		.....	
Gender	male	1.27	0.93-1.72′	.....		.....		0.54	0.33-0.89″	1.71	1.21-2.41*	.....		.....		1.44	1.13-1.83*
Physical ex.	no	.....		2.85	0.97-8.39′	1.44	1.08-1.92″	.....		.....		.....		1.36	0.94-1.96′	.....	
Loneliness	yes	0.68	0.50-0.92″	1.91	1.21-3.02*	1.39	1.16-1.68*	.....		.....		0.73	0.53-1.02′	.....		.....	
Cognition	<14	0.63	0.38-1.03′	4.32	0.68-27.4′	.....		.....		.....		.....		.....		.....	
Frailty	≥1	.....		.....		1.37	1.09-1.72*	.....		.....		.....		.....		.....	
Smoking	yes	.....		.....		.....		.....		.....		1.51	1.08-2.10″	.....		.....	
COMORBIDITY‡																	
Depression		1.63	1.19-2.32*	3.19	2.02-5.03*	.....		1.71	1.00-2.93′	1.73	1.20-2.50*	1.81	1.28-2.56*	1.30	1.00-1.68′	1.40	1.09-1.80*
Heart Attack		.....		.....		1.23	1.03-1.46″	.....		1.37	0.96-1.94′	1.73	1.23-2.41*	1.37	1.06-1.78″	.....	
Cholesterol		.....		.....		.....		0.54	0.28-1.05′	.....		1.32	0.92-1.88′	1.75	1.33-2.29*	1.33	1.02-1.74″
Other emotional		.....		2.31	1.52-3.51*	1.42	1.11-1.82*	.....		1.90	1.19-3.04*	.....		.....		.....	
Chronic Lung		.....		.....		1.21	0.97-1.49′	.....		.....		.....		1.29	0.95-1.76′	1.41	1.05-1.89″
Hypertension		0.78	0.57-1.06′	.....		.....		.....		1.47	1.03-2.08″	.....		1.49	1.13-1.96*	.....	
Diabetes		0.72	0.48-1.07′	.....		.....		.....		.....		1.44	1.01-2.05″	.....		1.36	1.04-1.77″
Other diseases		0.57	0.36-0.89″	0.62	0.38-1.02′	1.35	1.10-1.65*	.....		.....		.....		.....		.....	
Dementia		0.56	0.30-1.06′	.....		1.74	1.40-2.16*	.....		.....		.....		.....		.....	
Parkinson		.....		1.89	1.12-3.21″	.....		.....		.....		0.37	0.11-1.18′	.....		.....	
Cancer		.....		0.54	0.28-1.01′	1.45	1.17-1.79*	.....		.....		.....		.....		.....	
Osteoarthritis		.....		.....		.....		.....		0.53	0.33-0.87″	1.38	0.94-2.03′	.....		.....	
Other fractures		.....		.....		.....		2.79	1.58-4.92*	.....		.....		.....		.....	

Unweighted data; HR, Hazard ratio; CI, confidence interval; Depression, EURO-D ≥4; Time = Years at risk. Event = Death by disease. Method: Forward Wald (only significant variables).
† Adjusted for country; ‡ Adjusted for country, gender and age. ′P < 0.05; ″P < 0.01; *P < 0.001.

Supplementary Table 1
Mortality rates. Factors & diseases in wave 5 of cases of death (wave 6)

Sociodemographic factors & rates†

	CR Rate	99.0% CI
Age groups		
50-64	4.22	4.20 - 4.24
65-79	17.51	17.47-17.55
≥ 80	72.04	71.91-72.18
Gender		
Female	17.47	17.44-17.51
Male	19.53	19.49-19.57
Marital status		
Single/Divorced	12.70	12.65-12.75
Married	13.52	13.49-13.55
Widowed	40.88	40.79-40.98
Schooling		
>12 years	9.14	9.11- 9.17
12-8 years	16.81	16.78-16.85
<8 years	36.25	36.17-36.33
Income, percent.		
70-100	9.09	9.06 - 9.12
10-60	23.61	23.58-23.65
Loneliness		
No	11.01	10.98-11.03
Yes	28.83	28.78-28.88
Cognition		
>18	3.80	3.78 - 3.82
14-18	10.68	10.65-10.71
<14	41.11	41.04-41.18
Self-Health		
Exc. / V. good	3.32	3.30 - 3.35
Good	8.39	8.37 - 8.42
Fair / Poor	36.91	36.86-36.97
ADL deficits		
No	7.56	7.54 - 7.58
≥ 1	61.47	61.36-61.57
Frailty		
No	9.40	9.37 - 9.42
≥ 1	34.05	33.99-34.11
Ever smoked daily		
No	19.45	17.90-21.09
Yes	21.79	19.96-23.73
Physical exercise		
Yes	5.28	5.26- 5.30
No	33.21	33.16-33.26

	CR Rate	99.0% CI
European Regions		
Continental	12.47	12.44-12.50
Nordic	18.71	18.59-18.84
Southern	26.58	26.53-26.63
Eastern	27.41	27.26-27.57

Diseases. Frequency of deaths & rates‡

	% §	CR Rate	99.0% CI
Dementia	28.3	166.57	140.93-195.6
Parkinson	16.3	87.13	62.15-118.5
Fractures (hip/femur)	13.3	72.14	56.72-90.33
Stroke	12.3	65.73	55.52-77.22
Cancer	11.2	61.13	52.50-70.72
Chronic Lung	9.0	47.68	40.44-55.66
Heart Attack	8.7	45.30	40.26-50.78
Depressive symptoms	8.0	41.58	38.36-44.99
Cataracts	7.6	40.29	34.87-46.29
Diabetes	6.9	36.18	31.92-40.82
Rheumatoid arthritis	6.2	31.86	27.26-36.99
Emotional dis.	5.6	29.19	23.65-35.60
Stomach ulcer	5.5	28.45	22.00-36.14
Other fractures	5.2	27.16	21.88-33.28
Hypertension	4.8	24.84	22.82-26.99
Other diseases	4.4	22.55	19.58-25.83
Osteoarthritis	4.3	22.53	19.67-25.68
Cholesterol	3.9	20.03	17.69-22.60
None disease	1.2	6.06	4.74- 7.62
Comorbidity (8 dis.)			
0-2	3.2	16.44	15.36-17.58
> 2	18.4	104.81	92.94-117.7
Global crude rate		18.39	18.37-18.42
Standardized rate		18.47	

CR, Crude rate; CI, Confidence Interval; ADL, Activities of daily living; EURO-D, Depression scale. † Weighted data; ‡ Unweighted data; § Deaths respect to each disease. Crude and standardized mortality rates: deaths *1000 person-years at risk; Poisson 99.0%CI. Comorbidity (8 dis.) according to Cox regression, table 3 = Cancer, Dementia, Depressive symptoms, Fractures (Hip / Femur), Stroke, Chronic Lung, Diabetes and Heart attack.

Supplementary Table 2

Cox regression. Bivariate analysis of diseases for countries in wave 5. Cases of death from wave 6

	Survivors	Deaths	Crude values		Adjusted	
	n (%)	n (%)	HR (99%CI)	P	HR (99%CI)	P
Ref. All countries			1.00		1.00	
Continental						
France	3117 (97.4)	82 (2.6)	0.63 (0.47-0.85)	**< 0.001**	0.58 (0.43-0.78)	**< 0.001**
Germany	4204 (97.8)	93 (2.2)	0.45 (0.34-0.60)	**< 0.001**	0.67 (0.51-0.89)	**< 0.001**
Luxembourg	1089 (98.4)	18 (1.6)	0.54 (0.29-1.00)	**0.011**	0.73 (0.40-1.35)	0.186
Austria	3045 (97.2)	88 (2.8)	1.48 (1.19-1.96)	**< 0.001**	0.84 (0.63-1.12)	0.116
Belgium	4273 (96.6)	149 (3.4)	0.82 (0.66-1.03)	**0.025**	0.85 (0.68-1.07)	0.078
Switzerland	2546 (97.9)	55 (2.1)	0.50 (0.35-0.71)	**< 0.001**	0.99 (0.69-1.42)	0.966
Nordic						
Sweden	3512 (97.4)	93 (2.6)	0.75 (0.57-0.99)	**0.010**	1.08 (0.82-1.43)	0.454
Denmark	3295 (96.6)	116 (3.4)	0.91 (0.71-1.16)	0.306	1.52 (1.18-1.97)	**< 0.001**
Eastern						
Estonia	4533 (94.0)	287 (6.0)	1.32 (1.12-1.56)	**< 0.001**	1.01 (0.85-1.21)	0.834
Slovenia	2366 (96.3)	92 (3.7)	0.97 (0.73-1.27)	0.766	1.12 (0.90-1.41)	0.286
Czechia	4340 (94.6)	249 (5.4)	1.53 (1.28-1.83)	**< 0.001**	1.62 (1.35-1.95)	**< 0.001**
Southern						
Italy	3596 (96.1)	144 (3.9)	0.99 (0.79-1.23)	0.903	0.82 (0.65-1.03)	**0.029**
Israel	1768 (93.7)	118 (6.3)	1.55 (1.20-1.95)	**< 0.001**	0.96 (0.74-1.24)	0.665
Spain	5063 (93.4)	360 (6.6)	1.79 (1.54-2.09)	**< 0.001**	1.12 (0.95-1.32)	0.069
Regions						
Continental	18274 (97.4)	485 (2.6)	0.51 (0.45-0.59)	**< 0.001**	0.69 (0.60-0.79)	**< 0.001**
Southern	10427 (94.4)	622 (5.6)	1.59 (1.41-1.81)	**< 0.001**	0.99 (0.87-1.13)	0.885
Eastern	11239 (94.7)	628 (5.3)	1.41 (1.24-1.60)	**< 0.001**	1.29 (1.13-1.47)	**< 0.001**
Nordic	6807 (97.0)	209 (3.0)	0.82 (0.68-0.99)	**0.008**	1.32 (1.08-1.60)	**< 0.001**

HR, Hazard ratio; CI, Confidence interval

Unweighted data. Time = Years at risk. Event = Death. Method for Cox regression: Enter. Adjusted for age, gender, marital status, self-health, cognition, ADL deficits, comorbidity, loneliness, depression, frailty and income. Effect size for HR: small: <1.22, medium: 1.23-2.99, large: ≥3.00. Effect size medium and large, in bold.

Supplementary Table 3
Frequency of diseases and age of death

	Survivors		Deaths		Differences		Age at death			
N	46747	(%)	1944	(%)	χ^2 (P)	V	Mean (SD)		Median	IQR
Dementia	644	(71.7)	254	(28.3)	**< 0.001**	0.17	85.7	(7.1)	86.2	9.46
Depressive symptoms	12213	(92.0)	1066	(8.0)	**< 0.001**	0.12	80.9	(9.8)	82.0	13.50
Stroke	1792	(87.7)	252	(12.3)	**< 0.001**	0.09	80.7	(8.3)	81.1	11.56
Cancer	2439	(88.8)	308	(11.2)	**< 0.001**	0.09	76.1	(9.8)	77.0	14.02
Heart attack	5310	(91.3)	506	(8.7)	**< 0.001**	0.09	80.7	(9.1)	82.1	12.50
Fractures (hip/femur)	836	(86.7)	128	(13.3)	**< 0.001**	0.07	84.2	(8.5)	85.3	11.44
Chronic lung	2734	(91.0)	272	(9.0)	**< 0.001**	0.07	78.1	(10.5)	79.6	15.08
Diabetes	6049	(93.1)	449	(6.9)	**< 0.001**	0.06	79.2	(9.2)	80.3	13.13
Parkinson	354	(83.7)	69	(16.3)	**< 0.001**	0.06	83.2	(6.7)	83.8	6.96
Cataracts	4108	(92.4)	339	(7.6)	**< 0.001**	0.06	83.0	(8.0)	83.3	10.25
Rheumatoid arthritis	4424	(93.8)	293	(6.2)	**< 0.001**	0.04	80.9	(9.7)	82.4	12.58
Hypertension	18976	(95.2)	961	(4.8)	**< 0.001**	0.04	79.3	(9.4)	80.3	12.84
Other emotional dis.	2757	(94.4)	165	(5.6)	**< 0.001**	0.02	79.5	(10.0)	80.3	14.96
Stomach ulcer	1933	(94.5)	112	(5.5)	**< 0.001**	0.02	78.1	(10.3)	79.8	15.90
Other fractures	2865	(94.8)	156	(5.2)	**< 0.001**	0.02	78.2	(10.3)	79.7	13.06
Other diseases	7827	(95.6)	357	(4.4)	**0.047**	0.01	79.3	(10.1)	80.7	15.21
Osteoarthritis	8535	(95.7)	381	(4.3)	0.107	0.01	80.6	(9.7)	82.0	13.00
Cholesterol	11194	(96.1)	452	(3.9)	0.565	0.00	78.5	(9.3)	79.8	13.87
None diseases	10198	(98.8)	124	(1.2)	**< 0.001**	0.07	76.4	(11.1)	77.3	17.99
All cases							79.4	(10.0)	80.7	14.59

Unweighted data. χ^2 = Chi-Square test; SD, Standard deviation; IQR, Interquartile range; V, Effect size for Cramer's (df_1 = small: ≤0.10, medium: 0.11-0.49, large: ≥0.50).

Supplementary Table 4

Population data, deaths and rates crude /standardized for age >50 years. EUROSTAT, 2014

	EUROPEAN UNION (28 countries), EUROSTAT			SHARE (15 countries), EUROSTAT †				SHARE STUDY ‡,§			
Age	Population	Deaths	CR	Population	Deaths	CR	STR	Years at risk	Deaths	CR	STR
50-64	165,170,518	630,409	3.81	63,351,395	335,258	5.29		90,145,436	380,565	4.22	
65-79	67,965,760	1,452,347	21.36	43,816,674	835,550	19.06		68,656,074	1,202,298	17.51	
≥ 80	26,054,664	2,611,167	100.21	17,640,816	1,691,557	95.88		25,020,670	1,802,710	72.04	
Total	259,190,942	4,693,923	18.10	124,808,885	2,862,365	22.93	18.00	184,000,000	3,385,573	18.39	18.47

CR, Crude rate *1000 hab.; STR, Standardized rate*1000 hab.

†The reference for the standardized rate of the 15 SHARE countries is the data from the 28 European Countries, Eurostat (2014)

‡The reference for the standardized rate of the SHARE study is the data from the 15 SHARE countries, Eurostat (2014)

§ Weighted data.