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Original Research

The association between voluntary health insurance and health outcomes in older adults in Europe: A survival analysis

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ABSTRACT

Objectives: Voluntary health insurance (VHI) often serves a supplementary role in Europe. The ageing population and adoption of cost-sharing models in response to economic pressures raise concerns that VHI could contribute to health inequalities among older people. This study investigates the association of VHI with health outcomes among older people across 16 European countries and Israel.
Study design: Prospective cohort study.
Methods: Data on participants aged ≥50 years across 16 European countries and Israel were obtained from four waves (2013–2020) of the Survey of Health, Ageing, and Retirement in Europe (SHARE). Gompertz proportional hazards models assessed the association of VHI with mortality and multimorbidity. Hazard ratios (HR) and 95 % confidence intervals (CI) are reported.
Results: VHI prevalence was 38.2 % in 2013 and 34.9 % in 2015, with a higher prevalence among higher-income groups. VHI was associated with a 13 % lower risk of mortality (HR: 0.87, 95% CI: 0.81–0.94) after accounting for demographic, socioeconomic, lifestyle, and health-related factors. VHI was also associated with a lower risk of multimorbidity (HR: 0.92, 95 % CI: 0.87–0.97).
Conclusions: VHI was associated with a reduced risk of mortality and multimorbidity, after adjusting for demographic, socioeconomic, lifestyle, and health-related factors. VHI might facilitate the access to timely and high-quality healthcare services, which may exacerbate health inequalities among older individuals.

Introduction

Voluntary Health Insurance (VHI) is discretionary health insurance which individuals can choose to purchase.[1] In Europe, while healthcare is mainly funded by taxation or social health insurance contributions, VHI typically acts as a supplementary or complementary option for the publicly financed health coverage.[2] Complementary VHI offers coverage for services not fully covered or excluded by the statutory healthcare system and also reimburses co-payments.[2] In France, over 90 % of individuals have complementary VHI to cover co-payments and receive better coverage that is not fully covered by the social health insurance system.[3] Supplementary VHI provides patients with more options and access to a wide range of healthcare services.[2]

The role of VHI becomes particularly relevant when viewed against recent challenges to Universal Health Coverage (UHC).[4] With rising healthcare expenses and budgetary constraints stemming from recent economic crises, many European nations have adopted cost-sharing policies,[5] potentially discouraging essential healthcare utilisation.[6] This issue is especially important for the ageing population in Europe, as many older individuals have increased demands for healthcare services.[7]

In such circumstances, VHI can be a financial cushion, offsetting out-of-pocket payments (OOP). Nevertheless, the benefits of VHI may lead to inequalities in healthcare quality, as wealthier individuals are more likely to have VHI in Europe.[8] Addressing this potential health inequality is essential.

Numerous studies conducted in the United States (US) have shown that health insurance is associated with reduced mortality.[9] In Europe, a

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recent study found higher allocation of total health expenditure to VHI was associated with improved health outcomes across 26 European nations.[10] A second study found that VHI, evaluated in 2004, was associated with a 9 % lower mortality risk across eleven European countries and Israel.[11] In Ireland, a study[12] revealed that adults with only public health insurance faced a 24 % higher all-cause mortality risk compared with those with both public and private insurance. In Russia, while VHI was associated with increased healthcare utilisation, it did not correlate with self-rated health.[13]

Although some evidence suggests an association between VHI and health outcomes in European health systems, previous research has not sufficiently reflected the changing landscape of European health systems in recent years, nor has it analysed multimorbidity as an outcome, despite it being a prevalent health concern among older people.

To address the gap, this study investigates the association between VHI and health outcomes among older people, including mortality and multimorbidity in 16 European Health Systems and Israel between 2013 and 2020. To improve causality, sensitivity analyses were included to control for the socio-demographic and economic factors potentially associated with the propensity of acquiring VHI.[14]

Methods

Study population

This research employs data from multiple waves of the Survey of Health, Ageing and Retirement in Europe (SHARE), a panel survey focusing on the population aged 50 and older in 28 European countries and Israel. SHARE's methodologies have been described elsewhere.[15] This research relies on four waves of SHARE: wave 5 (2013), wave 6 (2015), wave 7 (2017), and wave 8 (2019/2020).[16–19] 17 countries were selected based on their participation in at least one of waves 5 or 6 and data availability of deceased status until wave 8. The selection of waves was based on the most recent data available at the time of analysis. While information on VHI status was only available for waves 1 and 5 to 8, the contents of questions changed between waves 1 and 5. Therefore, to ensure consistency of exposure definition, only data from wave 5 onwards were used.

The SHARE survey from waves 5 to 8 covers various data, including health status, household income, and VHI status. However, during wave 7, approximately 80 % of respondents participated in the SHARELIFE interview,[20] resulting in the absence of measurements for certain variables, including the status of VHI for those participants. The COVID-19 pandemic hindered the data collection in wave 8, leading to the completion of only 70 % of the projected interviews.[21] Additionally, in the Netherlands, online surveys replaced regular SHARE surveys during waves 6 and 7. Therefore, there is no data from regular SHARE for those waves, but data on deceased status was collected until wave 8.

Voluntary health insurance

The exposure variable was the status of VHI. Participants answered yes or no to the following question: "Do you have any supplementary health insurance that pays for services not covered by your basic health insurance/national health system/third party payer?". This question provides information on which participants are covered by additional health insurance beyond their primary coverage (e.g., social health insurance, national health system).

Outcomes

The primary outcome of interest was all-cause mortality. Participant death dates recorded from waves 5 to 8 were used. The information was obtained through an end-of-life interview with a proxy respondent.

The secondary outcome was multimorbidity, which refers to two or more chronic illnesses co-occurring, in line with previous studies focusing on multimorbidity using SHARE data.[22] The chronic disease status was determined by asking participants if a doctor had ever told them they had any of a list of conditions. Only conditions that were consistently collected in all 5 to 8 waves were included in our analysis:[22] heart attack, high blood pressure or hypertension, high blood cholesterol, stroke or cerebral vascular disease, diabetes or high blood sugar, chronic lung disease, cancer, stomach or duodenal ulcer, peptic ulcer, Parkinson's disease, cataracts, hip or femoral fracture, other fractures, Alzheimer's disease, other affective disorders, rheumatoid arthritis, and osteoarthritis. In addition, clinical depression, assessed by the EURO-D scale, was considered. A score of 4 or higher on the scale indicates the presence of such symptoms.[22] We used a simple count of these conditions to measure multimorbidity, as this approach is the most commonly used, particularly when the study design is not predicting outcomes.[23,24] The date of multimorbidity was defined as the date it was first reported in the survey.[25]

Covariates

The demographic covariates considered were age, gender (male, female), and marital status (married or in a registered partnership, other). The socioeconomic indicators comprised total household income (ordered in quartiles within each country for each wave, with Q1 representing the lowest income bracket and Q4 the highest), employment status (employed or self-employed, retired, other), and educational attainment (no education/primary/lower secondary education, upper secondary education, and post-secondary/tertiary).

Participants' health behaviours were assessed based on two factors – smoking habits (current smoker, yes/no) and frequency of engaging in vigorous physical activities (hardly ever or never, once a month or more). In wave 6, about 40 % of respondents had missing values in the smoking variable due to a change in the survey's routing. Because these missing values cannot be considered random, we included it in subsequent sensitivity analyses.

Health status variables incorporated the body mass index (BMI) and the number of chronic diseases. BMI was based on individual weight and height, which were asked in the personal interview. As a measure of healthcare resource utilisation, the number of doctor visits in the past year (12 months) was derived. This variable was not considered in the causal pathway between VHI and the outcomes as it was the status of the past year. Residence countries were also included as covariates.

Statistical analysis

The weighted prevalence of VHI was calculated for each participating country from wave 5 to wave 6, using the calibrated cross-sectional weights provided by the SHARE. This analysis included all the participants who responded in waves 5 or 6. We did not include waves 7 and 8 in this analysis because the status of VHI was unavailable for most participants in wave 7, and only 70 % of the participants completed interviews in wave 8. The chi-squared test assessed the differences between wave 5 and wave 6.

Subsequently, we present baseline data from either wave 5 or 6, using the cross-sectional weights. The baseline data primarily consisted of values from wave 5. However, as the SHARE data has refreshment samples for each wave, if a response was missing in wave 5 due to non-response or lack of participation, values from wave 6 were used. Analysis was restricted to individuals with longitudinal data. Continuous variables were summarised using weighted means with standard deviations, while categorical variables were presented as weighted percentages. Univariate associations of each characteristic with VHI status were assessed by simple linear regression for continuous variables and the chi-squared test for categorical variables. Additionally, the prevalence of VHI by income quartile for each country was presented, with statistical differences assessed by the chi-squared test. We also analysed the difference in the number of chronic diseases at baseline and

percentages of deceased participants over the follow-up periods by income quartile.

We utilised the Gompertz proportional hazards regression model to investigate the associations of VHI with mortality risk and multimorbidity. The Gompertz model was employed over the Cox-proportional hazard model based on statistical assessments using the Akaike Information Criterion (AIC) and Cox-Snell residuals. Additionally, the Gompertz model has been considered a robust model to assess the risk of mortality in older ages.[26] Person years were calculated from the date of attending baseline assessment until the date of events (death or multimorbidity), date lost to follow-up, or end of follow-up, whichever occurred first. The proportional hazard assumption was assessed using Schoenfeld residuals and log-log plots. Potential multicollinearity was assessed using the correlation matrix of coefficients. The survey weights were not used in the regression analyses because some variables used to construct the weights, such as gender and age, were included in the regression model.[27]

The mortality analysis incorporated data from 61,343 participants after excluding participants with missing exposure and covariates information (6.5 %; Supplementary Material Fig. S1). The baseline data were from wave 5 or 6, as defined above, and participants were followed until wave 8. To adjust for potential confounders, the model was adjusted for all the covariates explained above.

Our analysis, focusing on multimorbidity as the outcome measure, was based on a subsample excluding individuals with baseline multimorbidity. After removing participants with missing exposure and covariates information (5.0 %), the final cohort consisted of 28,939 participants (Supplementary Material Fig. S2). The baseline data were from wave 5 or 6, as defined above, and participants were followed until wave 8. The analysis for multimorbidity used the same covariates as the mortality model, excluding the number of chronic diseases. The Netherlands was excluded from this analysis due to insufficient multimorbidity data.

Additionally, subgroup analyses were conducted to examine inequalities in the VHI-mortality relationship across different baseline characteristics and within various health system contexts. Participating countries were stratified by VHI prevalence (above and below 70 %) to assess potential heterogeneity between countries with high and low VHI prevalence. Furthermore, stratified analyses were conducted by multimorbidity status (with and without, for the mortality model only), income quartile, and country of residence. For the individual country analyses, estimates for countries with fewer than ≤50 individuals with the outcome of interest in either VHI group were omitted due to large standard errors.

Three sensitivity analyses were conducted on countries with adequate sample sizes (i.e. no less than 50 individuals with the outcome of interest in each VHI group). First, we estimated the Gompertz proportional hazards model using inverse probability weighting (IPW) to mitigate potential selection bias concerning the possession of VHI.[14] For IPW estimation, we used the logistic regression model and calculated propensity scores of having VHI, adjusted for age, gender, income, job status, education, number of chronic diseases, and residence country. Subsequently, we implemented time-varying exposure models to assess the effects of changes in exposure status throughout the follow-up period. To compensate for the substantial data gaps in wave 7, where approximately 80 % of the data for VHI status, household income, and physical activity was missing, we complemented these missing values using responses from waves 5 and 6. Lastly, we incorporated current smoking status as an additional covariate.

Results are presented as Hazard Ratios (HR) and 95 % confidence intervals (95% CI). Stata software, version 18.0 (Stata Corp), was used for all analyses.

Ethics

The SHARE studies involving human participants were reviewed and approved by the Ethics Council of the Max Planck Society. This research is based on secondary analyses of publicly available and de-identified data.

Results

Prevalence of voluntary health insurance

The overall prevalence of VHI was 38.2 % and 34.9 %, in 2013 and 2015 respectively (Fig. 1). The VHI prevalence across countries ranged from 3.3 % in Estonia to 94.5 % in France in 2015. Countries with high prevalence (>70 %) included Luxembourg (71.7 %–75.6 %), Switzerland (74.0 %–78.7 %), Netherlands (82.4 %), Belgium (82.0 %–81.9 %), Slovenia (79.5 %–83.0 %), Croatia (89.7 %) and France (95.3 %–94.5 %). While most countries' prevalences were generally consistent between 2013 and 2015, only Israel experienced a statistically significant decrease ($p < 0.05$).

Baseline characteristics

The baseline data involved 61,343 participants across 17 countries between 2013 and 2015. Of these participants, 36,521 did not have VHI (59.5 %), while 24,822 did (40.5 %). The baseline characteristics showed that those with VHI had higher income and education levels compared with those without VHI (Table 1). As for the prevalence of VHI by income quartile, while 28 % of the lowest income quartile group had VHI, 45 % of the highest income group had VHI (Fig. 2). The difference in prevalence by income quartile was statistically significant among all the participating countries by the chi-squared test ($P < 0.05$), excluding Croatia, Czechia, and the Netherlands. Additionally, those with VHI reported fewer chronic diseases on average (1.7) than those without VHI (2.0), and a lower percentage of deceased participants over the follow-up periods (8.6 %) compared with those without VHI (12.4 %) (Table 1). These health outcomes differ based on income levels, where individuals with higher income had significantly lower numbers of chronic diseases and percentages of deceased participants(Supplementary Material Fig. S4).

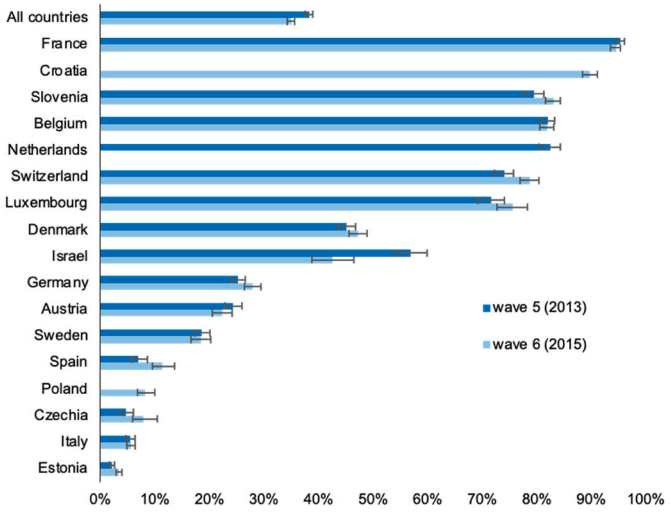

Fig. 1. Prevalence of voluntary health insurance among individuals aged 50 and older in 17 countries in 2013 and 2015: Analysis utilizing cross-sectional weights.
Note: Wave 5 was in 2013 and wave 6 was in 2015. This analysis included all the participants who responded in waves 5 or 6. Data for Croatia and Poland in wave 5 and the Netherlands in wave 6 are unavailable. 95 % confidence intervals are presented for each prevalence.

Table 1
Descriptive statistics by voluntary health insurance status across 17 countries in 2013 and 2015.

	No VHI (N = 36,521)	With VHI (N = 24,822)	Total (N = 61,343)	p-value
Age at interview (in years)	66.2 (10.8)	64.6 (10.6)	65.6 (10.7)	<0.001
Gender				0.318
Male	46.0 %	46.8 %	46.3 %	
Female	54.0 %	53.2 %	53.7 %	
Marital status				0.197
Other	34.6 %	33.6 %	34.3 %	
Married or in a registered partnership	65.4 %	66.4 %	65.7 %	
Household income				<0.001
Q1	32.5 %	22.2 %	28.7 %	
Q2	25.4 %	23.4 %	24.7 %	
Q3	21.8 %	25.0 %	23.0 %	
Q4	20.3 %	29.4 %	23.6 %	
Current job situation				<0.001
Employed or self-employed	27.2 %	37.4 %	30.9 %	
Retired	49.8 %	50.2 %	50.0 %	
Other	22.9 %	12.5 %	19.1 %	
Education				<0.001
Less than upper secondary	48.6 %	30.5 %	42.0 %	
Upper secondary	33.1 %	39.5 %	35.4 %	
Above	18.3 %	30.1 %	22.6 %	
Smoke at present time				0.017
No	80.7 %	82.3 %	81.3 %	
Yes	19.3 %	17.7 %	18.7 %	
Vigorous physical activities				<0.001
Hardly ever, or never	47.8 %	41.4 %	45.5 %	
Once a month or more	52.2 %	58.6 %	54.5 %	
Body mass index (kg/m^2)	27.0 (4.7)	26.4 (4.6)	26.8 (4.7)	<0.001
Number of chronic diseases	2.0 (1.8)	1.7 (1.6)	1.9 (1.7)	<0.001
Number of doctor visits	7.7 (10.5)	6.9 (9.5)	7.4 (10.2)	<0.001
Deceased status over the follow-up period				<0.001
Not deceased	87.6 %	91.4 %	89.0 %	
Deceased	12.4 %	8.6 %	11.0 %	
Wave				<0.001
Wave 5	77.4 %	81.5 %	78.9 %	
Wave 6	22.6 %	18.5 %	21.1 %	

Note: Data are expressed as arithmetic mean (standard deviation) for continuous variables. Data from waves 5 and 6 were merged for this analysis. When available, values from wave 5 were prioritised. In cases where a response was unavailable in wave 5, values from wave 6 were used. Cross-sectional weights were applied to this analysis. Regarding household income, Q1 represents the lowest, and Q4 represents the highest income quartile. P-values were calculated by simple linear regression for continuous variables and chi-squared test for categorical variables. VHI, voluntary health insurance.

Association of voluntary health insurance with mortality and multimorbidity

For the pooled data, participants with VHI had a 13 % reduced risk of all-cause mortality compared with those without (HR: 0.87, 95 % CI: 0.81 to 0.94), adjusted for all the covariates (Fig. 3). Countries with a VHI prevalence of less than 70 % showed an 11 % decreased risk of mortality (HR: 0.89, 95 % CI: 0.81–0.98), whereas in countries with a VHI prevalence of more than 70 %, a 15 % reduction in mortality risk was observed (HR: 0.85, 95 % CI: 0.77–0.95) (Fig. 3). Among those with multimorbidity, VHI status was associated with a 13 % reduced mortality risk (HR: 0.87; 95 % CI: 0.79 to 0.94) (Fig. 3). However, while there was a suggestion of reduced risk (HR: 0.91) for individuals without multimorbidity, the association was not statistically significant (95 % CI: 0.80 to 1.03) (Fig. 3). The associations with mortality did not differ significantly across the income quartiles, as 95 % CI overlapped (Supplementary Material Fig. S5). In individual country analyses, Belgium had a statistically significant 32 % reduction in mortality (HR: 0.68, 95 % CI: 0.57–0.81) (Fig. 3) associated with VHI. However, the 95 % CI overlapped among all the participant countries, and no significant heterogeneity was observed.

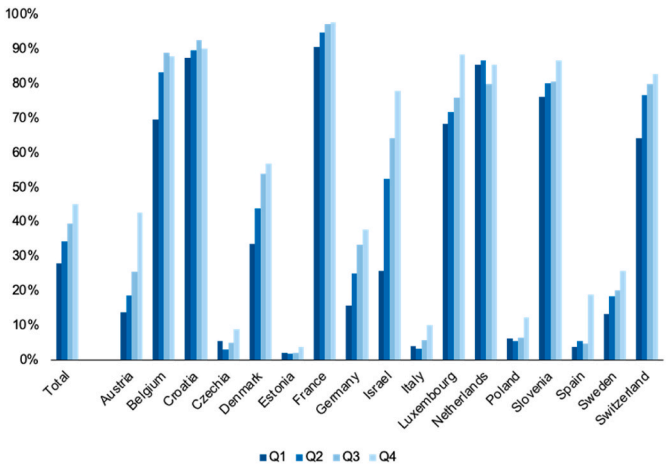

Fig. 2. Prevalence of voluntary health insurance by income quartile across 17 countries.
Note: Q1 represents the lowest income bracket and Q4 is the highest. Data from waves 5 and 6 were merged for this analysis. When available, values from wave 5 were prioritised. In cases where a response was unavailable in wave 5, values from wave 6 were used. Cross-sectional weights were applied. 95 % confidence intervals are presented for each prevalence.

In the pooled analysis across all participating countries, individuals covered by VHI had an 8 % risk reduction in developing multimorbidity (HR: 0.92, 95 % CI: 0.87 to 0.97) with similar estimates for countries with VHI coverage below and above 70 % (Fig. 3). The associations with multimorbidity were consistent across different income levels(Supplementary Material Fig. S5). While the 95 % CI overlapped among the most participant countries, Sweden and Switzerland evidenced statistically significant reductions in multimorbidity risk, with respective reductions of 20 % (HR:0.80, 95 % CI: 0.65–0.98) and 33 % (HR:0.67, 95 % CI: 0.56–0.80), respectively (Fig. 3). In contrast, Italy demonstrated heightened multimorbidity risk with VHI, with a 37 % increase (HR:1.37, 95 % CI: 1.04–1.79).

The sensitivity analyses largely supported our findings. Using the IPW, the results indicated that VHI was associated with a 17 % decreased mortality risk in the pooled data (HR: 0.83, 95 % CI: 0.76 to 0.91) (Supplementary Material Fig. S8).Similarly, the risk of multimorbidity was inversely related to VHI possession (HR:0.93, 95 % CI: 0.87 to 0.99). The associations remained mostly consistent by using IPW. In the time-varying exposure model, these associations persisted. The pooled data showed a 24 % decreased risk of mortality (HR: 0.76, 95 % CI: 0.70 to 0.83), and for multimorbidity, there was an 8 % reduced risk (HR:0.92, 95 % CI: 0.87 to 0.98) (Supplementary Material Fig. S9). When adjusting for smoking status, the association in the pooled data remained significant (Supplementary Material Fig. S10).

Discussion

This study examined the relationship between VHI and health outcomes of older populations across 17 countries. The overall prevalence of VHI in 2013 and 2015 was 38.2 % and 34.9 %, respectively. We found a consistent inverse relationship between VHI status and mortality risk. In the 16 European countries and Israel, older people who had VHI had a 13 % reduced risk of mortality over those without VHI. For individuals

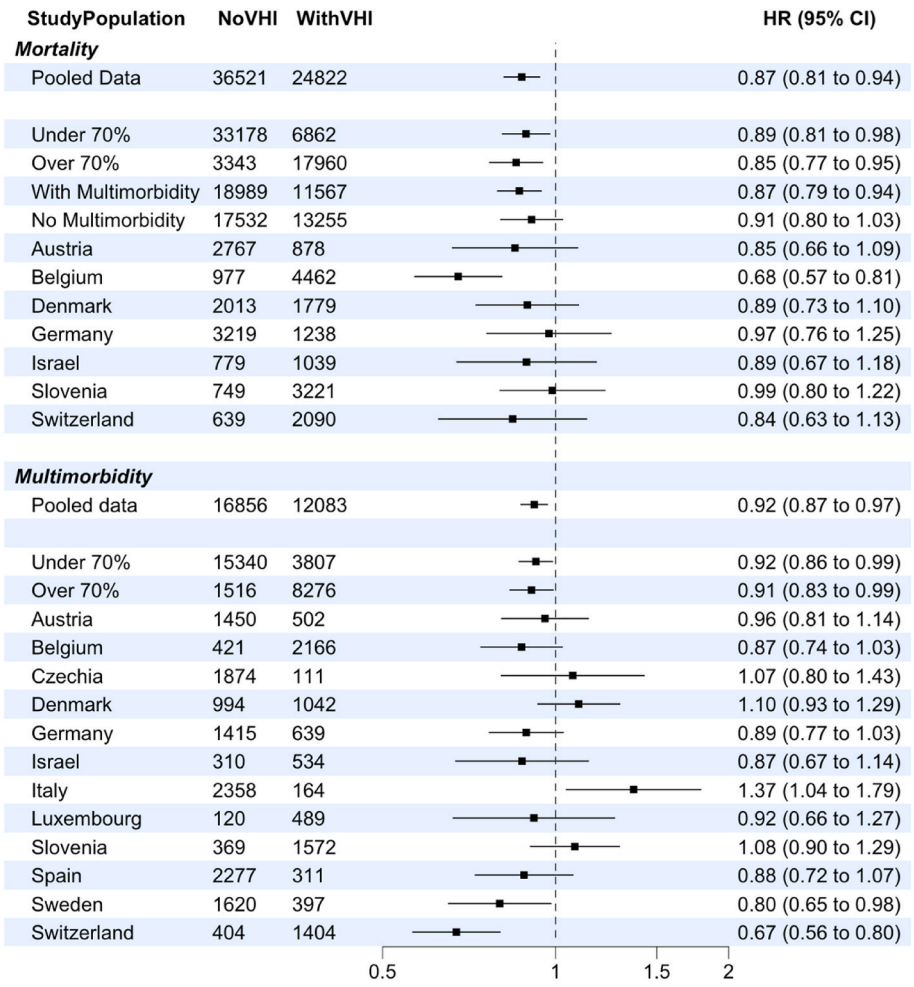

Fig. 3. Hazard ratios for mortality and multimorbidity risk associated with voluntary health insurance.
Note: This figure presents hazard ratios (HRs) with 95 % confidence intervals (CI) for mortality and multimorbidity associated with voluntary health insurance (VHI) using the Gompertz proportional hazards model. The model is adjusted for age, gender, marital status, household income, employment status, education, vigorous physical activities, body mass index, chronic diseases, doctor visits, and country of residence (chronic disease was only adjusted in the mortality model). A stratified analysis was performed by VHI coverage, multimorbidity status, and individual countries. Estimates of countries with fewer than 50 cases of mortality or multimorbidity in either VHI group were not depicted.

who did not have multimorbidity at baseline, VHI was associated with an 8 % lower risk of multimorbidity. Those associations persisted even after utilizing IPW to mitigate selection bias.

The study has confirmed significant variations in the prevalence of VHI across different countries. While no significant differences were found by categorising countries based on their VHI prevalence (above and below 70 %), there were several countries showing uncertainty regarding the association between VHI and health outcomes when country-specific analyses were conducted.

Only a few studies have analysed how VHI affects health outcomes in Europe. Our findings align with and extend previous work by Baggio et al.[11] Compared with Baggio et al., we included additional countries, which led to double the sample size, assessed multimorbidity as an outcome, and controlled for selection bias with IPW. Despite some discrepancies in effect sizes, other related research on the VHI-mortality relationship also aligns with this study's findings. Nolan et al.[12] showed about a 30 % decrease in risk for all-cause mortality in Ireland, and Baek et al.[28] revealed a 47 % decrease in Korea.

Older individuals, especially those with multimorbidity, often require multidisciplinary and integrative healthcare,[29] which may be costly and difficult to access. Those without VHI may face financial constraints and long waiting times. Previous studies in Europe indicate that those with additional coverage exhibit increased healthcare usage.[30,31]

The potential impact of health inequalities from differential access to healthcare in low-income households is important. The prevalence of VHI was higher among wealthier, who also had better health conditions, suggesting VHI may exacerbate health inequalities. The findings underscore the importance of improving statutory healthcare systems to ensure essential healthcare access for all, especially those in lower-income groups.

Several caveats merit discussion. The study's follow-up period is limited. The mean follow-up period for the main mortality model was 4.7 years. This timeframe might not be sufficient for analysing the long-term effects on health outcomes, particularly mortality. Because of this, the time-varying exposure model was only considered in sensitivity analysis.

Reliance on self-reported data introduces potential information bias; for instance, older individuals from lower socio-economic backgrounds may under-report chronic disease.[7] Moreover, the study's assessment of VHI may oversimplify the data and lead to misclassification since VHI plans can vary significantly in benefits and premiums.

This study highlights the inverse association between VHI and health outcomes, including mortality and multimorbidity, among older populations across 16 European countries and Israel. While VHI has potential health advantages, it is important to guarantee equitable access

to essential healthcare for all citizens. To improve our understanding of this complex association, future research should focus on country-specific analyses with larger sample sizes to reflect the diversity of VHI's role and health systems and expand the scope of health outcomes considered.

Author statement

Ethical Approval

The SHARE studies involving human participants were reviewed and approved by the Ethics Council of the Max Planck Society. This research is based on secondary analyses of publicly available and de-identified data.

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Competing interests

The authors declare no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2024.10.031.

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