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a nationwide Danish Registry study

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Original Research

Voluntary early retirement and mortality in patients with and without chronic diseases: a nationwide Danish Registry study

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ABSTRACT

Objective: This study explores how the choice of voluntary early retirement (VER) affects mortality in a population where VER is available 5 years before regular retirement age.
Study design: This retrospective cohort study uses a registry-based follow-up design with access to Nationwide Danish Registry Data.
Methods: The study includes all Danish individuals who between 2000 and 2015 were part of an unemployment insurance fund and working at the time of their 60th (P60) or 62nd (P62) birthday. Those alive 1 year from their 60th or 62nd birthday were included in the mortality analysis. Individuals were registered as VER recipients if they chose the benefit within 1 year from P60 or P62. Three-year mortality likelihood following the first year from inclusion was explored for both cohorts separately. Multiple subgroups were explored in the mortality analysis, including individuals with chronic obstructive pulmonary disease (COPD), heart failure, and diabetes.
Results: P60 included 627,278 individuals, and VER was chosen by 22.5%. P62 included 379,196 individuals, and VER was chosen by 33.4%. The likelihood of VER in the P60 was lower in healthy individuals (odds ratio [OR] 0.87, confidence interval [CI] 0.85–0.88) and higher in COPD (OR 1.15, CI 1.07–1.22) and heart failure patients (OR 1.15, CI 1.05–1.25). Three-year mortality was significantly higher in those choosing VER in P60 (OR 1.28, CI 1.22–1.34), which was also found for all health subgroups (healthy, OR 1.18, CI 1.07–1.30; COPD, OR 1.55, CI 1.16–2.07; heart failure, OR 1.42, CI 1.02–1.98; diabetes, OR 1.36, CI 1.12–1.65). The increased mortality risk was not found in the P62 cohort.
Conclusion: The choice of VER is more likely in patients with COPD and heart failure. VER in the P60 cohort is associated with an increased mortality likelihood, which was not found in the P62 cohort, which may be explained by health selection bias.

Introduction

To remain attached to the workforce is, from a societal perspective, highly important to minimize public spending and increase tax revenue. Multiple reasons for not participating in the workforce exists, such as disability pension, unemployment, and early retirement, which to varying degrees are associated with poor self-assessed health, poor mental health, and chronic diseases.[1] In contrast to the previously mentioned benefits voluntary early retirement (VER) recipients actively chooses to leave the workforce. The voluntary part may suggest that the general negative effects associated with unemployment do not apply to this subpopulation.[2] In contrast, the choice in itself may be driven by poor health status due to chronic diseases, such as heart failure, chronic obstructive pulmonary disease (COPD), or diabetes, all known to predispose a poor workforce connection.[3–6]

Various studies have explored the effect of early retirement on mortality with contradicting results, as some studies indicate beneficial effects and others indicate harmful effects, as demonstrated in the metanalysis by Sewdas et al.[7] The explanation may be

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that there are in fact both positive and negative effects on self-reported health status, physical activity, and morbidity in those who retire from the workforce.[8–15]

VER benefit is unique to the Danish social system where similar benefits exist in other countries. It is in Denmark available from age 60 years, and an increase in the benefit is available if VER is postponed till the age of 62 years. VER is available to working individuals who are part of an unemployment insurance fund, paying into the VER scheme, and not receiving sick leave benefit. The availability of VER where the absence of sick leave is required raises the question whether the overall effect of VER is associated with a positive or negative effect on health outcome. We hypothesize that the effect of VER represents an overall negative effect on mortality, making it a prognostic tool for clinicians to identify vulnerable individuals.

Thus, the aim of this study was to explore whether people with comorbidity are more likely to choose VER at both ages 60 and 62 years. We will furthermore explore whether the choice of VER at age 60 and 62 years is associated with an increased mortality.

Methods

Study setting

Danish social security system

During the study period, Denmark had between 5.3 and 5.6 million citizens. In Denmark, health care, education, and retirement benefits are funded through the Danish taxpaying system.

Danish VER

VER is available to people who were members of an unemployment insurance fund and who contributed to the VER benefit fund. In addition, contributions to the VER benefit fund must start before the age of 30 years, and access to VER from the age of 60 years is not available if you are on sick leave or in other ways incapable of working. Furthermore, a minimum salary during a period of 3 years before detachment is required to ensure that the only individuals actively working are eligible. Changes to the VER benefit during the study period did not affect the individuals included.

Study population

The study included all Danish citizens who reached the age of 60 years between January 1, 2000, and December 31, 2015. Two study populations were created, one including people at their 60th (P60) birthday and one consisting of people still part of the workforce at their 62nd (P62) birthday.

Exclusion

Identical exclusion criteria were used for both groups; individuals receiving any type of public support (e.g. unemployed, sick leave, disability pension; see Table S1), as well as individuals not part of an unemployment insurance or with either missing values on educational level or income were excluded.[16] Patients alive 1 year from P60 and P62 were included in the mortality analysis.

Subgroups

Health status subgroups (healthy, heart failure, COPD, diabetes) and demographic subgroups (male, female, income [low/high], and education level [short and medium/long/very long]) and combinations hereof were created for the mortality analysis.

Data sources

A pseudonymized version of the unique Danish Civil Personal Number was used to identify individuals across different registries.[17] Multiple different national Danish registries were accessed for the purpose of this study. The following registries were accessed: The National Patient Registry, which contains information on all hospital contacts with access to diagnosis codes;[18] The Danish National Prescription Registry, with information on prescriptions redeemed from the pharmacy;[19] the Danish Cause of Death registry, with access to time of death;[20] the Statistics Denmark, with access to age, sex, income, and educational level;[17,21] and the Danish Labour Market Registry, with access to workforce connection.[16]

Retrospective registry studies do not require ethical approval or informed consent in Denmark. Access to data was granted by the Capital Region of Denmark (approval nr. P-2019-191).

Outcomes

The outcome VER was defined as individuals choosing it within 1 year from inclusion in the P60 and P62 cohorts. Three-year mortality 1 year from inclusion was furthermore explored for both cohorts.

Variable definitions and covariates

Health subgroups

Citizens were categorized as suffering from a disease if they had a hospital contact within the past 5 years, or, in the case of diabetes, had redeemed a prescription of antidiabetics within the past year. Diagnosis of COPD (International Classification of Diseases, 10th Revision [ICD-10], DJ44), heart failure (ICD-10, DI42 DI43, DI50), and diabetes (ICD-10, DE10-14; ATC, A10) was used for the group analysis. Individuals were defined as healthy if they did not have any diagnosis (as listed in Table S2) and no redeemed prescriptions in the past 6 months.

Comorbidity

Charlson comorbidity index was used in the analysis as a factor to adjust for comorbidity excluding the healthy subpopulation.[22] Diagnosis codes used for Charlson is shown in Table S2.

Demographics

Highest achieved educational level was categorized into four groups, corresponding to the following International Standard Classification of Education levels: short, 0–2 (early childhood education level to lower secondary education level); medium, 3 (upper secondary education level); long, 5–6 (short-cycle tertiary education level to bachelor or equivalent level); very long, 7–8 (masters/doctoral degree or equivalent).[23]

Income was defined as low, medium, and high corresponding to the 0–25%, 25–75%, and 75–100% percentile in the study population.

Statistical analysis

Continuous variables are presented using means and standard deviations when normally distributed and median with 25 and 75 percentiles when not normally distributed.

Cumulative incidence plots were used to visualize the age at which individuals choose VER.

VER as outcome

Choosing VER within 1 year in both cohorts was treated as a dichotomous variable. Logistic regression was used to explore odds

ratios for choosing VER adjusting for sex, education level, and Charlson comorbidity index.

VER as exposure

Logistic regression for each health status subgroup was used to explore 3-year mortality for both P60 and P62. VER was also treated as a dichotomous variable to avoid introducing knowledge on individuals not choosing VER health status (e.g. disability pension, sick leave). Covariates included in the analysis were workforce connection, sex, Charlson comorbidity index, income, and educational level. Subgroup analysis was performed on demographic variables, income (low/high), and education level (short and medium/long/very long) to explore if VER association with mortality is different in relation to demographic characteristics.

Comparison of P60 and P62 characteristics and mortality rates between the groups choosing VER and those not choosing VER made done using Chi-squared test.

SAS (version 9.4, SAS Institute Inc, Cary, NC, USA) and R (version 4.0. 3, R Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.) were used for data management and analysis.

Results

Population

Fig. 1 shows inclusion of individuals for P60 and P62. Table 1 shows baseline data and events in the population at both time points.

Voluntary early retirement

In the P60 cohort, 22.5% (141,271/627,278) had left the workforce due to VER, and 0.2% (1232/627,278) died during the first 12 months. In the P62 cohort, 33.4% (126,782/379,196) had left the workforce due to VER, and 0.2% (886/379,196) died during the first 12 months. The percentages of individuals choosing VER in different subgroups are displayed in Table 2 for both cohorts.

The cumulative incidence from age 60 years is displayed in Fig. 2, revealing two waves of individuals choosing VER at age 60 and 62 years.

The likelihood of choosing VER is displayed in Fig. 3. Males, individuals with higher education level and high income, and people categorized as healthy have a decreased likelihood of choosing VER in both the P60 and P62 cohorts. People with low income have an increased likelihood of choosing VER, and patients with either heart failure or COPD have an increased likelihood of choosing VER in the P60 cohort. Diabetes is, in the P62 cohort, associated with a decreased chance of VER.

Three-year mortality

In the P60 cohort, from age 61 to 64 years, 1.5% (9373/626,046) died and in the P62 cohort, from age 63 to 66 years, 1.7% (6456/378,310) died, accounting for the 3-year mortality analyzed. Estimates of odds ratios of mortality likelihood in people choosing VER compared with people not choosing early voluntary retirement, according to healthy or disease-specific strata, are presented in Fig. 4 for both cohorts. VER was not significantly associated with improved survival in any subgroup in neither the P60 nor in the P62 cohort. On the contrary, the majority of the subgroups in the P60 cohort had a significant higher 3-year mortality likelihood compared with the P62 cohort, in which only one group had significant higher 3-year mortality (COPD subgroup with medium or higher education level). All point estimates are lower for the female subgroups compared with the male subgroups, apart from the diabetes subgroup in the P62 cohort. In most disease subgroups, the point estimated mortality likelihood for the high-income subgroups is higher than that for the low-income subgroups. This trend is less clear in the education subgroups.

The complete models reveal a higher likelihood of dying among males, people with low income and with increasing Charlson comorbidity index, and a lower likelihood with increasing education level and high income in most models.

Comparison of individuals choosing VER in P60 and P62 is displayed in Table 3. Significantly more males, higher educated, and

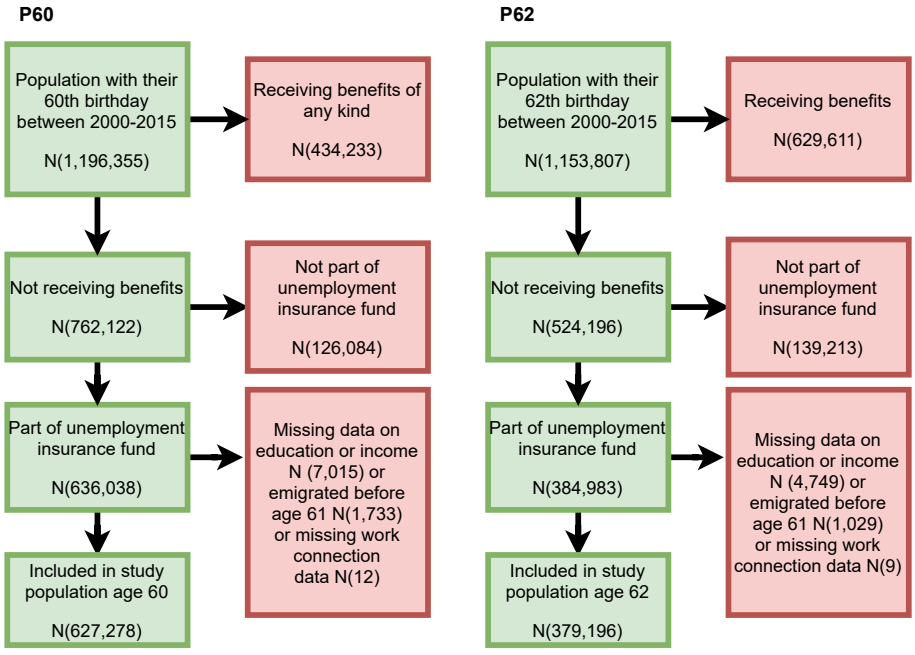

Fig. 1. Flow chart of inclusion for populations age 60 (P60) and age 62 (P62).

Table 1
Population frequency table.

Variable	Level	Age 60 total	Age 62 total
Male		328,591 (52.4)	221,006 (58.3)
Education level			
	Short	156,815 (25.0)	84,513 (22.3)
	Medium	289,670 (46.2)	176,339 (46.5)
	Long	139,860 (22.3)	87,287 (23.0)
	Very long	40,933 (6.5)	31,057 (8.2)
Income			
	25%	154,938 (24.7)	94,799 (25.0)
	25%–75%	317,397 (50.6)	189,598 (50.0)
	75%	154,943 (24.7)	94,799 (25.0)
Status 1 year from inclusion			
	No VER	484,775 (77.3)	251,528 (66.3)
	VER	141,271 (22.5)	126,782 (33.4)
	Died	1232 (0.2)	886 (0.2)
Died during follow-up		10,605 (1.7)	7342 (1.9)
Charlson comorbidity			
	0	547,192 (87.2)	326,381 (86.1)
	1	51,424 (8.2)	33,275 (8.8)
	2	22,202 (3.5)	14,867 (3.9)
	3	3767 (0.6)	2750 (0.7)
	4	915 (0.1)	638 (0.2)
	5	216 (0.0)	173 (0.0)
	6	1308 (0.2)	898 (0.2)
	7 or above	254 (0.0)	214 (0.1)
COPD		4769 (0.8)	3002 (0.8)
Heart failure		3232 (0.5)	2375 (0.6)
Diabetes		21,854 (3.5)	14,734 (3.9)
Healthy		188,131 (30.0)	110,082 (29.0)

VER, voluntary early retirement; COPD, chronic obstructive pulmonary disorder.

people with higher income choose VER at the age of 62 years. Differences in comorbidity distribution are minimal.

Significant differences between the P60 and P62 cohorts were seen when comparing the raw mortality rates in those choosing VER. All significant P-values indicated higher mortality rates in the P60 group. Significant differences between the P60 and P62 cohorts were also seen when comparing the raw mortality rates in those not choosing VER. All significant P-values indicated higher mortality rates in the P62 group (see Tables S3 and S4).

Discussion

This study indicates that individuals with low income, short education, COPD, and heart failure are more likely to choose VER, whereas people who are healthy, have longer education, and have higher income are less likely to choose VER. This indicates that the choice of VER in the total population is influenced by individual's social status and comorbidities. The choice of VER furthermore comes with an increased mortality likelihood in individuals choosing VER at age 60 years and not in patients choosing VER at age 62 years.

It is seen that the likelihood estimates of choosing early voluntary retirement for medium, long, and very long education move toward one when comparing the P60 and P62 groups. The explanation for this tendency may be that the individuals in the lower education group are prone to leaving the workforce at 60 years. As a result of this, a survivorship bias is introduced in the P62 lower education group. This is supported by the demographic data, where the percentages of individuals with a shorter education is higher in P60 than in P62.

The time relation of the self-assessed health to unemployment has been explored by Bockerman, who found that unemployment does not decrease individuals' self-assessed health and that individuals with low self-assessed health are more likely to become unemployed.[24] This may also apply to individuals choosing VER with the choice associated with health status as shown in this study. Multiple studies have shown an increased likelihood of VER in individuals with poor self-perceived health status.[1,25] Individuals within disease subgroups are likely to have a poorer self-rated health compared with healthy due to their chronic diseases.[26] Poor self-rated health has previously been found to be associated with the choice of VER in Denmark in both people with and without chronic diseases.[27] Our finding that patients with COPD and heart failure have a higher likelihood of choosing VER and healthy have a lower likelihood indicates that this is also the case in our population.

The behavior and any possible beneficial and harmful effects associated prospectively with VER are expected to be the same in both P60 and P62 or we at least have no reason to believe that this should change over time. The mortality increases in those choosing voluntary retirement in the age 60 years cohort must therefore likely be explained by something else than the VER status itself. The most obvious explanation for this is that VER at age 60 years is the first option to retire voluntarily with public support for health reasons in people finding it difficult to remain in the workforce. This hypothesis is supported by aforementioned literature on self-perceived health status association with the choice to retire and by the increased mortality risk in people within working age with poor self-perceived health.[28]

Gender differences were seen in terms of a significant association between choosing VER and mortality in females; however, when looking at the health-related subgroups in women, no significant associations were seen. Furthermore, point estimates are lower for females than for males in almost all subgroups. The effect of the difference between men and women may be found in either their motivation for early retirement or their behavior following

Table 2
Voluntary early retirement status one year after inclusion (age 60 [P60] and 62 [P62]).

P60				
Variable	No VER	VER	Dead	Total (n = 627,278)
Health	150,344 (79.9%)	37,518 (19.9%)	269 (0.1%)	188,131 (100%)
COPD	3407 (76.1%)	1327 (27.8%)	35 (0.7%)	4769 (100%)
Heart failure	2458 (76.1%)	746 (23.1%)	28 (0.8%)	3232 (100%)
Diabetes	16,796 (76.9%)	4972 (22.8%)	86 (0.3%)	21,854 (100%)
P62				
Variable	No VER	VER	Dead	Total (n = 379,196)
Healthy	76,060 (69.1%)	33,875 (30.1%)	147 (0.1%)	110,082 (100%)
COPD	1862 (62.0%)	1106 (36.8%)	34 (1.1%)	3002 (100%)
Heart failure	1571 (66.1%)	783 (33.0%)	21 (0.9%)	2375 (100%)
Diabetes	9970 (67.7%)	4688 (31.8%)	76 (0.5%)	14,734 (100%)

VER, voluntary early retirement; COPD, chronic obstructive pulmonary disorder.

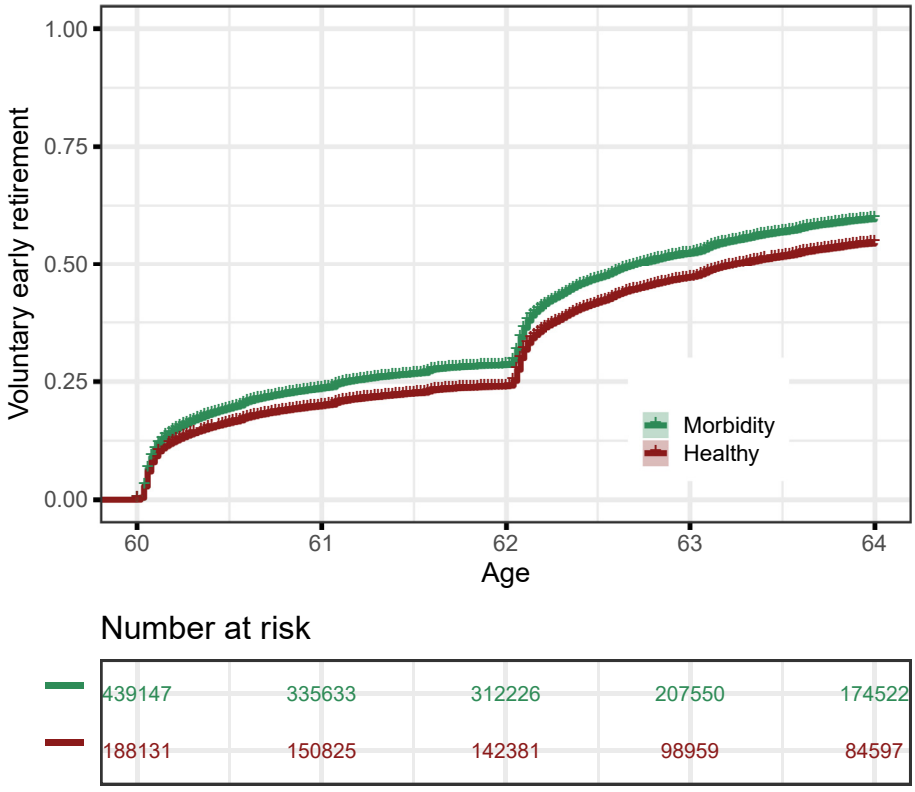

Fig. 2. Cumulative incidence from age 60 till early voluntary retirement in weeks using the P60 cohort.

early retirement. Patients' intentions to retire early have previously revealed gender differences, as men with poor perceived health have a higher likelihood of reporting an intention to retire.[29] Hypothetically, the differences in poor perceived health may explain some of the differences seen in the mortality in the male and female subgroups. The negative effect on physical activity seen in men retiring from strenuous work may furthermore add to these differences.[15]

Patients with COPD and heart failure in the P60 cohort have an increased likelihood of choosing VER. This implies that the choice at

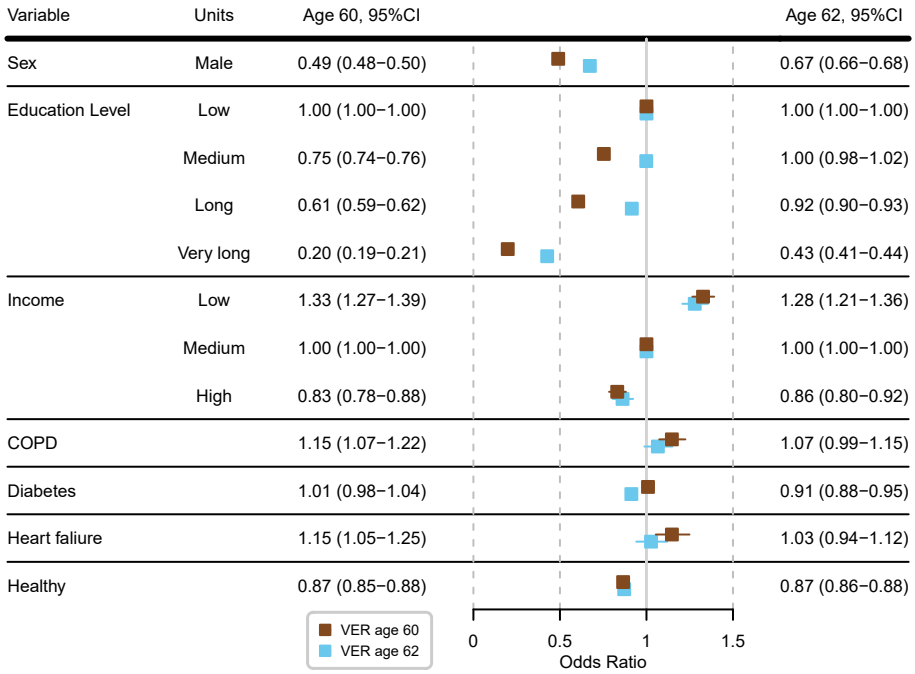

Fig. 3. Logistic regression model of the likelihood of choosing voluntary early retirement (VER) benefit with all variables displayed included in the model. Estimates are odds ratios.

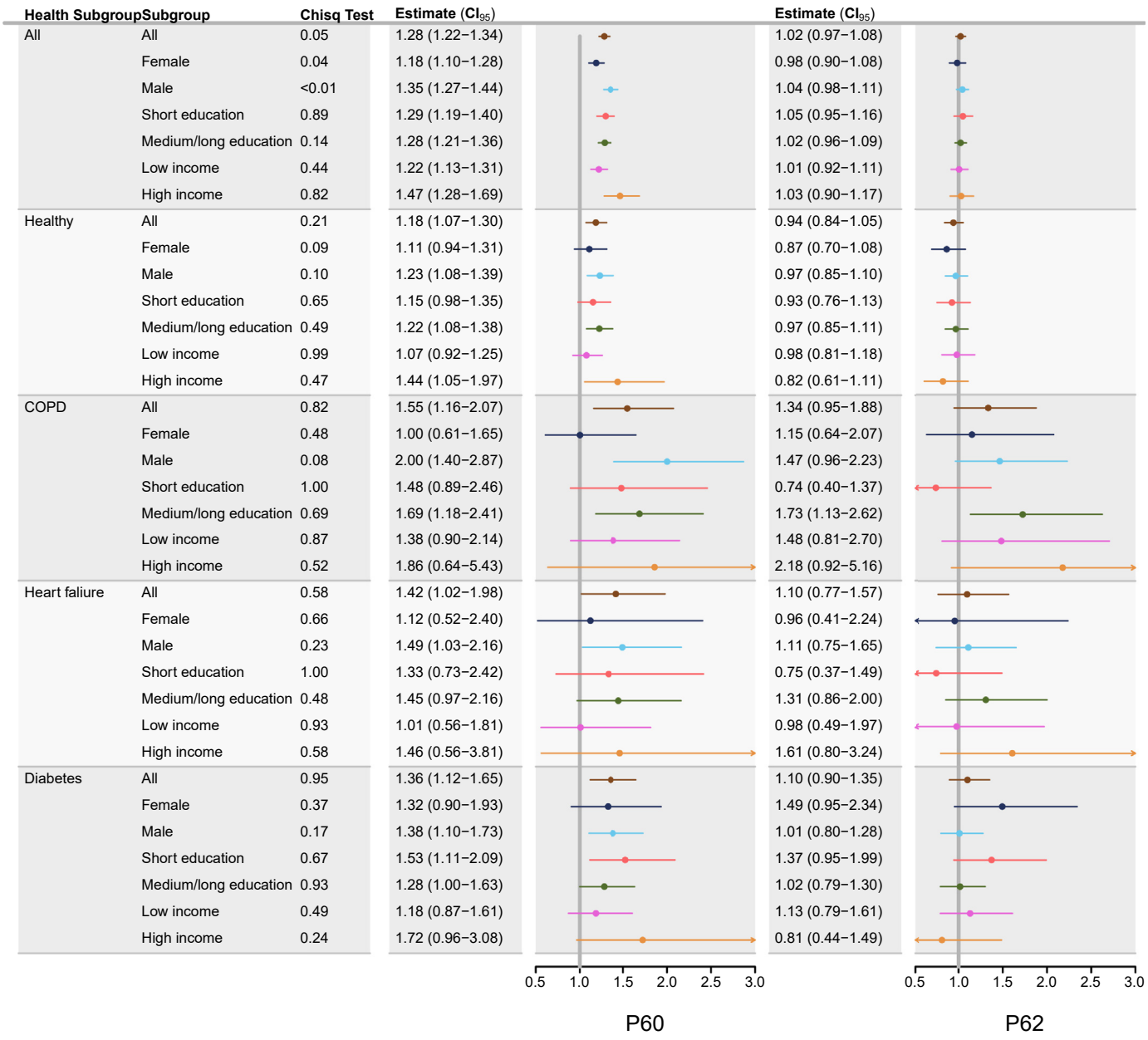

Fig. 4. Logistic regression model of the likelihood of 3-year mortality in the P60 and P62 cohorts stratified according to disease categories and subgroups of male, female, low/medium education level and long/very long education level. All models are adjusted for education level, sex, and Charlson comorbidity index in accordance with subgroup division. Estimates are displayed as odds ratios. Chi-squared test show the *p*-value of the group difference comparing voluntary early retirement rates in the two cohorts and their death rate. All significant *P*-values indicate a favorable outcome for those choosing voluntary early retirement at age 62 years. Subgroup colors; gray = all; pink = female; blue = male; yellow = education level low and medium; green = education level long and very long. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

this time point is to some extent driven by health status. These subgroups remain insignificant for the P62 cohort. This tendency may help explain why a higher mortality is observed with VER in the P60 and not in the P62 cohort. The choice to retire at age 60 years may represent a cumulative poor health as the first time point where it is possible to retire voluntarily, which to some extent is eliminated at age 62 years. This information may increase attention toward patients choosing to leave the workforce to VER when possible.

In Denmark, the access to VER is granted without any healthcare involvement, and therefore, health personnel has the possibility of intervention on any negative health behavior in direct relation to retirement. Different availability of VER between countries may affect the generalizability of our results. However, the identification of individuals choosing to leave the workforce voluntarily as a vulnerable subgroup is expected to translate to populations from other countries.

The association of VER and early retirements (disability pension) with mortality has previously been explored in the Danish registries by Quaade et al.[30] The results from this study suggest that VER compared with all other patients is associated with a lower relative mortality risk. These findings are in contrast with our findings, where no beneficial effects and mainly harmful effects of VER are observed. The study by Quaade et al. also compared VER to employed, which revealed an increased mortality risk for VER in accordance with our study. However, the selection of individuals

Table 3
Voluntary early retirement status at 60 and 62 years.

Variable	Level	VER at age 60 years (n = 141,271)	VER at age 62 years (n = 126,782)	p-value
Sex	Male	53,519 (37.9)	65,200 (51.4)	<1e-04
Education level				
	Short	48,078 (34.0)	30,322 (23.9)	
	Medium	65,150 (46.1)	62,069 (49.0)	
	Long	25,992 (18.4)	29,277 (23.1)	
	Very long	2051 (1.5)	5114 (4.0)	<1e-04
Income				
	25%	50,431 (35.7)	33,662 (26.6)	
	25–75%	72,582 (51.4)	68,960 (54.4)	
	75%	18,258 (12.9)	24,160 (19.1)	<1e-04
Died during follow-up		2578 (1.8)	2183 (1.7)	0.045365
Charlson comorbidity				
	0	121,939 (86.3)	108,742 (85.8)	
	1	12,288 (8.7)	11,296 (8.9)	
	2	5431 (3.8)	5142 (4.1)	
	3	973 (0.7)	987 (0.8)	
	4	241 (0.2)	207 (0.2)	
	5	49 (0.0)	55 (0.0)	
	6	301 (0.2)	278 (0.2)	
	7 or above	49 (0.0)	75 (0.1)	<1e-04
COPD		1327 (0.9)	1106 (0.9)	0.071101
Heart failure		746 (0.5)	783 (0.6)	0.002308
Diabetes		4972 (3.5)	4688 (3.7)	0.013849
Healthy		37,518 (26.6)	33,875 (26.7)	0.346834

VER, voluntary early retirement; COPD, chronic obstructive pulmonary disorder.

compared between studies are different, as disability pension patients are included, and we only include only working patients and do not differentiate on work status after inclusion.

It is important to emphasize that it is not the authors' opinion that VER is harmful because there is no logical way that receiving a voluntary public benefit can have a harmful biological effect. Any harmful effects of VER must be derived from either poor health status before VER as suggested in this study or harmful behavior enforced by VER such as sedentary behavior. The value of the study is therefore that the time of VER is a unique way of identifying individuals at risk of dying at a young age. The access to VER differs between countries, but it is expected that the problem of individuals leaving the workforce for health reasons in no way is unique to the Danish setting.

Strengths and limitations

This study has several strengths. Both cohorts include all individuals at the same time point in their lives, at the age of 60 or 62 years. This for the purpose of analysis eliminates age, which is highly correlated with death, as a confounder. The inclusion of all individuals aged 60 and 62 years over a 15-year period, complete follow-up on all participants, and the use of multiple administrative registries ensures not only large cohorts but also high-quality data with good accuracy.[17–20]

The choice to include and record health status on the birth date at the age of 60 and 62 years is done to ensure comparability in the groups. This does, however, create the possibility that some individuals will have accumulated more diseases at the time where they choose VER. This is not expected to change the results significantly in this relatively young cohort, as the majority of VER recipients choose to activate the benefit in close relation to their birthday.

However, there are also limitations to the study. All individuals included are part of an unemployment insurance fund. The access to VER is limited to members who actively had paid a monthly fee, and the number of contributors has declined during the study period. This may, in our study, force some patients to work, who otherwise would have had a desire to retire and may hereby contribute to the mortality risk in the control groups and limit the effects seen. This may introduce selection bias into the study. However, it does show that in a setting as with the Danish VER, it is still possible to identify those who chose VER at the time it becomes available as vulnerable individuals. The study design also makes the study cohorts very large compared with the existing studies exploring the subject of early retirement.[7]

Fluctuations in the unemployment rates historically may influence the availability and motivation for choosing VER. However, no major fluctuations have occurred in unemployment rates during the study period.

The linear relationship of the time dependency of VER on mortality was not explored. It is possible that the effect of choosing VER on mortality at the age of 60 years wears off more quickly than within the first year of the benefit being available. This may underestimate the effect on mortality for those choosing VER immediately at their 60th birthday who chooses this because of more severe health issues. However, our study contributes with new knowledge regarding how VER is associated with mortality in a social system where VER is a possibility and therefore holds a unique possibility of identifying atrisk patients.

The choice of treating VER as a dichotomous variable and not as all the levels of employment was chosen to avoid introducing health selection bias. People not choosing VER will be registered with sick leave, disability pension, and so on, which are events that may also be warranted for the individuals who have chosen VER. The Danish Labour Market Registry does not record this for patients on voluntary retirement. Therefore, if these patients were excluded, health selection bias would be introduced. The group of patients receiving disability pension at age 61 and 63 years in their respective cohort analysis will to some extent account for patients choosing VER due to health status because the benefit is only available to people not able to work. This choice is hereby expected to limit some of the health bias related to VER; however, it is unlikely to account for it all. Therefore, despite trying to account for the potential health bias selection, the study still clearly indicates residual health bias between the P60 and P62 cohorts. However, the

study still provides important health information on people who voluntarily leave the workforce. Although the access to VER varies between countries, the VER populations around the world remain unexplored, and this study indicates that the health of this population group should be focus for further studies.

The interpretation of the differences seen in the VER mortality estimates between subgroups should be done with caution. With the subgroup divisions creating much smaller groups and events as shown in Tables S3 and S4, the uncertainty of the point estimates of the results are affected. This makes the relatively small changes in the point estimates difficult with overlapping confidence intervals and point estimates in many subgroups. The systematic differences seen in gender, as described previously, do however indicate that some differences between groups exist that are not fully explained by chance. Furthermore, the relatively small changes within the P60 and P62 population subgroups indicate that VER generally represents a negative effect in the P60 cohort and a neutral effect in the P62.

Conclusion

The choice of VER at the age of 60 years is associated with an increased mortality. This effect is most likely explained by an unhealthy selection bias because the association is not found for people choosing to retire at the age of 62 years. Our results indicate that patients leaving the workforce at first given possibility are a vulnerable group regarding mortality. This study hereby adds to the existing knowledge on how VER is associated with health outcomes, revealing a time-dependent association with mortality not previously described to the authors' knowledge.

Author statements

Ethical approval

None sought.

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Competing interests

C.T.P. has received grants for studies from Bayer and Novo Nordisk unrelated to the present study. K.K. has received research grants from The Laerdal Foundation and speaker's honoraria from Novartis, both unrelated to the present work.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2022.07.019.

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