VU Research Portal

Interplay between work, retirement and health in an ageing society

Sewdas, R.A.

2020

document version
Publisher's PDF, also known as Version of record

citation for published version (APA)
Sewdas, R. A. (2020). *Interplay between work, retirement and health in an ageing society*.

Chapter 4

Determinants of voluntary early retirement for older workers with and without chronic diseases: a Danish prospective study

Ranu Sewdas
Sannie Vester Thorsen
Cécile RL Boot
Jakob Bue Bjorner
Allard J van der Beek

Abstract

Objectives: This study explored differences in determinants (i.e., health-related, work-related and social factors) of voluntary early retirement between older workers with and without chronic diseases in Denmark.

Methods: Workers aged 56-64 years who were members of a voluntary early retirement scheme were selected from the Danish National Working Environment Survey (2008-2009) and were followed in a public register for four years. Cox regression analyses were performed separately for older workers with and without chronic diseases to identify associations between determinants of voluntary early retirement. To explore differences between groups, an interaction term between the determinant and having a chronic disease was included in the analyses for the total population.

Results: Among 1861 eligible older workers, determinants associated with a higher risk of voluntary early retirement included poorer self-rated health, more depressive symptoms, higher physical workload, lower job satisfaction, and lower influence at work. For older workers with chronic diseases (n=1185) the presence of work-family conflict was also associated with higher risk of voluntary early retirement, whereas for those with no chronic diseases (n=676), a poorer relationship with colleagues was an additional determinant. Higher emotional demands, higher work pace and higher quantitative demands were not significantly associated with voluntary early retirement for either group. None of the interaction terms were found to be statistically significant (p>0.05).

Conclusions: Determinants associated with voluntary early retirement did not significantly differ between older workers with or without chronic diseases in Denmark. We conclude that several health-related, work-related and social factors are important for prolonged labour force participation of older workers (with and without chronic diseases).

Background

To limit the increasing ratio of retired elderly to the active working population, and to minimize the economic burden caused by an ageing population, current European policies encourage older workers to prolong their work participation (1). For example, the Danish government has introduced a gradual increase of the state pension age from 65 years in 2012 to 67 years or older by 2024 (2). In addition, the maximum period for obtaining early retirement benefit from the Danish voluntary early retirement scheme, has been reduced from five to three years before state pension age. Similar policy measures have been taken in several European countries, and as a consequence, it has led to an increasing number of older workers in the labour force in Europe (3). However, the question remains whether the whole population of older workers is able to work longer, or whether there are differences within this population based on their health status, e.g., having chronic diseases. The risk of living with chronic diseases increases with age for both men and women (4), and as a result of the increasing numbers of older workers in the labour market, a large part will have chronic diseases.

Older workers with chronic diseases have a higher risk of an early exit from the labour force (5, 6), and older workers in good health are more likely to prolong their working life (7, 8). An explanation for this might be that health-related problems caused by the presence of a chronic disease lead to functional limitations at work. Following this, older workers with chronic diseases may have specific needs for continued labour force participation that differ from older workers without chronic diseases. Additional knowledge about these differences is a key factor for supporting sustained employment for an older working population in general.

In the present study, we focus on important factors for prolonged labour force participation of older workers (with and without chronic diseases) by investigating factors associated with voluntary early retirement. The role of health-related, work-related and social factors on voluntary early retirement have been acknowledged by several studies (9-16). For example, poor health was shown to be a risk factor for early retirement (9, 13, 16-18). Previous studies have reported that unfavorable working conditions related to physical demands, psychosocial demands or the lack of job control may push individuals towards early retirement (10, 11, 15). A partner or spouse's opinion on early retirement was also found to be associated with early retirement (9). Taken together, several health-related, work-related and social factors influence older workers' labour force participation.

To date, few studies have investigated whether or not the abovementioned factors associated with voluntary early retirement are similar for older workers with or without chronic diseases (5, 6, 19, 20), and these studies have found inconsistent findings. For example, a recent study from the Netherlands showed that having low psychosocial resources at work (i.e., low levels of autonomy, task variation, supervisor support, or co-worker support) was associated with an early exit from the labour force for workers with chronic diseases; however, this was not the case for older workers without chronic diseases (6, 19). In contrast, a study from the United Kingdom showed that favorable working conditions did not significantly reduce the risk of voluntary early retirement for older workers with chronic diseases (5). The available studies on this topic have relied on self-reported early retirement, which we believe is less accurate than objective data retrieved from a register. In addition, most available studies were conducted in the Netherlands or the United Kingdom. Research in other countries may help establish if risk factors are general or country-specific.

Therefore, the aim of the present study was to compare the effects of various determinants (i.e., health-related, work-related and social factors) on voluntary early retirement based on registry data for older workers with and without chronic diseases in Denmark.

Methods

Study design and population

To investigate the determinants of voluntary early retirement among older workers with and without chronic diseases, a prospective study followed participants in the Danish National Working Environment Survey (DANES) for four years (2008-2012) in the National DREAM register (21). DANES was conducted from late 2008 to early 2009 and included 12,559 participants 18 years and older. The DANES 2008-questionnaire survey contains data about work environment, self-perceived health, lifestyle, social factors, and background factors (i.e., age, sex, and level of education). The variables (except for depression and physical workload) from DANES 2008 were based on questions from the Copenhagen Psychosocial Questionnaire (COPSOQ-II), which is a questionnaire on psychosocial work-related factors, and health-related factors (22). The COPSOQ-II has 41 scales and 127 questions. To minimise the response burden, only one or two questions from each scale were included in DANES 2008, and a psychometric analysis was performed to

select the best questions, leaving 54 questions (22). The reliability of the selected questions from each scale was tested by Cohens weighted kappa in a test–retest design and reliability was found to be moderate to very good (Cohens weighted kappa was 0.53–0.81). Further details on the DANES 2008 study design can be found elsewhere (23).

Participants were included if (at baseline) they were: 1) between 56 and 64 years of age (i.e., meaning that they are at risk for voluntary early retirement, which is possible starting from the age of 60 years, within four years); 2) employed and a member of the Danish voluntary early retirement scheme; and 3) had valid data (i.e., response week—the week number in which the participant responded to the questionnaire). Participants who were self-employed at baseline were excluded. In total, 1,861 participants were included in the present study (see Figure 1 for the flow chart). The participants were categorised into two groups based on the presence of a chronic disease, since we were interested in whether or not the presence of any chronic disease influenced the effect of determinants on voluntary early retirement. Having a chronic disease was assessed using the question 'Has a doctor ever told you that you have or had one of the following diseases?'. The answer categories were: asthma, diabetes, cardiovascular disease, back pain, hearing impairment, skin diseases, depression or other mental disorders, or other chronic diseases. Those who answered 'no, never' were placed in the group of older workers without chronic diseases and those who answered 'yes' to one of the answer categories were placed in the group of older workers with chronic diseases.

Dependent variable

The outcome variable was 'age (in weeks) at voluntary early retirement'. Retirement information from 2008-2012 was retrieved from the DREAM register data (linked to the DANES database), which covers all social welfare beneficiaries in Denmark (21). The DREAM register contains data from the Danish Ministry of Employment, Ministry of Social Affairs, Ministry of Education, Ministry of Integration, 241 municipalities, and Statistics Denmark (21). The DREAM register contains information on a weekly basis. In Denmark, an early retirement benefit (Efterløn) could be claimed from the Danish voluntary early retirement scheme at age 60 years or older. However, claiming the retirement benefit after the age of 62 years was encouraged, since it leads to higher benefits for early retirement. Entitlement to the Danish voluntary early retirement scheme (Efterløn) requires membership and contributions to the early retirement scheme for at least 25 years of the last 30 years.
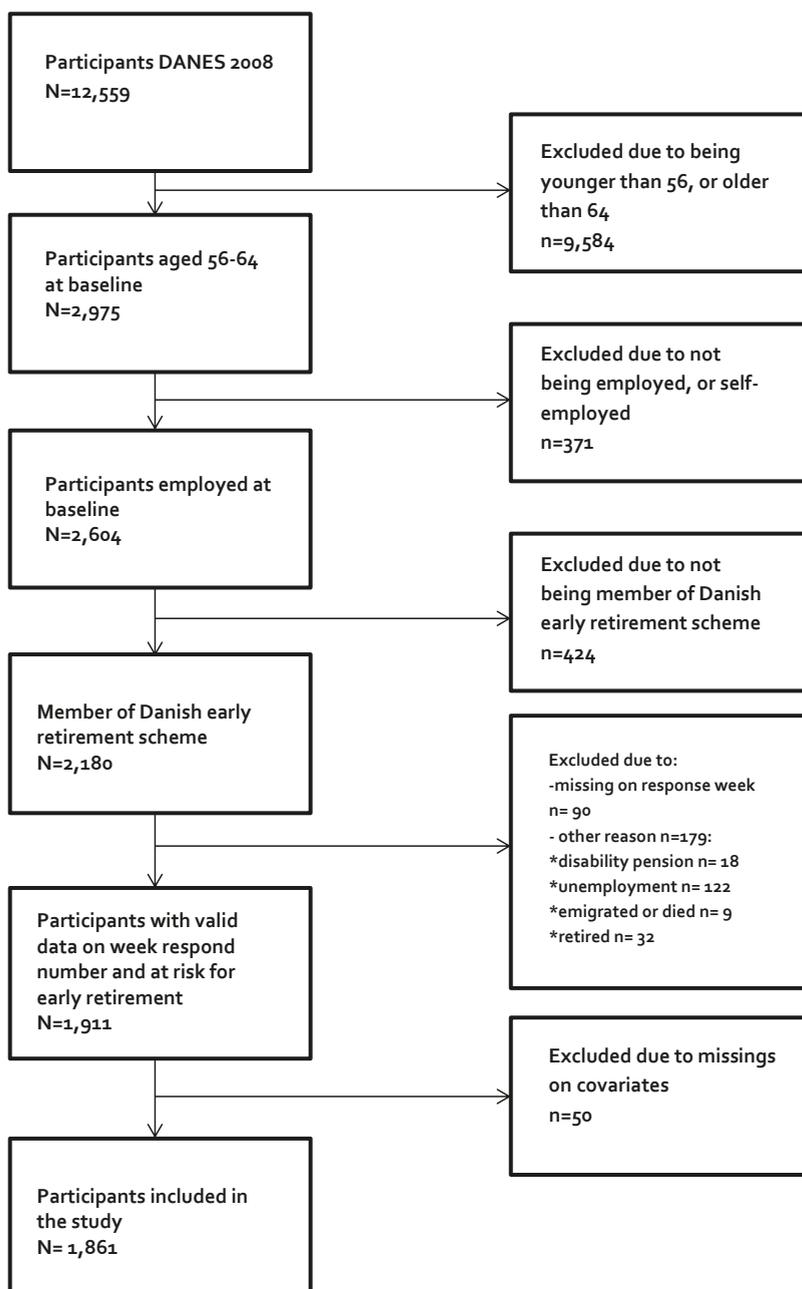
Figure 1. Flowchart of the study population

Independent variables

All information from the independent variables at baseline was obtained from the DANES 2008 questionnaire.

Health-related factors
Self-rated health was measured using the question, 'In general, which of the following would you say best describes your health?: 'excellent', 'very good', 'good', 'fair', or 'poor'?' (24). These scores, ranged between 1 and 5, and were used as descriptive statistics. For the analyses, the answer categories were recoded as 0, 0.25, 0.5, 0.75 and 1.0. Thus, self-rated health ranged from 0 (better self-rated health) to 1 (poorer self-rated health). Self-rated health can be scored as a dichotomous variable, nominal variable or a continuous scale, since a previous study has shown that all three scoring methods for self-rated health are linked to mortality (25). In the present study, self-rated health was analysed as a continuous scale. Depressive symptoms were measured using the Major Depression Inventory Scale (MDI) with 12 items (26). These items were assessed using a six-point scale (i.e., scores between 0 and 5). In this study, we used in total 10 items, since items 8 and 10 each have two sub-items (a and b). Therefore, a total score could vary from 0 to 50 and these scores were used as descriptive statistics. For the analyses, the answer categories were recoded between 0 and 1. Thus, depression score ranged from 0 (less depressive symptoms) to 1 (more depressive symptoms). The MDI can be scored as a continuous scale or dichotomous variables (26). Furthermore, a previous study has shown that the continuous scoring can be used for predicting long-term sickness absence (27).

Work-related factors
Work-related factors from DANES 2008 were largely based on questions from COPSOQ-II (22). Physical workload at one's main job was measured by asking, 'How would you describe your physical activity at your main job?' and answers included: 'mostly sedentary', 'mostly work while standing or walking', 'work while standing or walking with some lifting and carrying' and 'heavy or fast-moving work that is physically strenuous'. Job satisfaction was assessed by asking, 'How pleased are you with your job as a whole, everything taken into consideration?' and answers included: 'very satisfied', 'satisfied', 'unsatisfied' and 'very unsatisfied'.

Emotional demands, work pace, quantitative demands, influence and relationships with colleagues were all assessed using a five-point Likert scale ranging from 'always' to 'never/

4

hardly ever'. Emotional demands were assessed by asking, 'Does your work put you in emotionally disturbing situation?' and 'Do you have to relate to other people's personal problems as part of your work?'. Work pace was assessed by asking, 'Do you have to work very fast?'. Quantitative demands were assessed by asking, 'How often do you not have time to complete all your work tasks?'. Influence at work (i.e. job control) was assessed by: 'Do you have a large degree of influence concerning your work?' and 'Can you influence the amount of work assigned to you?'. Relationships with colleagues was assessed asking, 'Is there a good atmosphere between you and your colleagues?'. For analyses, all answer categories were recoded between 0 and 1 (e.g., a five-point Likert scale was recoded to 0, 0.25, 0.5, 0.75 and 1). Thus, all work-related variables ranged from 0 (better working condition) to 1 (poorer working condition).

Work-family conflict
Work-family conflict was assessed using three questions: 'Do you often feel a conflict between your work and your private life, making you want to be in both places at the same time?', 'Do you feel that your work drains so much of your energy that it has a negative effect on your private life?', and 'Do you feel that your work takes so much of your time that it has a negative effect on your private life?'. These questions had four possible answers ranging from 'no, never/not at all' to 'yes, absolutely/often'. The mean score of these three items was calculated for descriptive statistics ranging between 1 and 4. For analysis, all answer categories were recoded between 0 and 1, and ranged from 0 (lower work-family conflict) to 1 (higher work-family conflict).

Covariates
Sex (male/female), educational level, and mode of data collection were included as confounders. Educational level was categorised as follows: 1=no occupational training, semi-skilled workers education or similar (<12 months), one year of vocational training; 2=completed apprenticeship or vocational training; 3=other occupational training (12 months); 4=higher education < three years; 5=higher education for three to four years; 6= higher education for > four years. Mode of data collection was defined as internet or post versus telephone. Although the two forms of data collection were found to be comparable, we included mode of data collection as a confounder.

Analyses

Descriptive statistics (e.g., means, standard deviations, frequencies and percentages) were used to report baseline characteristics for the groups with and without chronic diseases. From all independent variables, the means of the original scales were reported as descriptive statistics to compare the mean scores of our population with those of the same population in other studies.

As described above, the answer categories in the analyses were standardised to make the variables more comparable; answer categories were recoded between 0 and 1 (e.g., a five-point Likert scale was recoded to 0, 0.25, 0.5, 0.75 and 1.0). In this way, health-related factors, work-related variables, and work-family conflict ranged from 0 (better health/ working condition) to 1 (poorer health/ working condition). All variables were analysed as a continuous scale, since continuous scales were used for the validation of questions from the COPSOQ-II (22), and this method was proven successful in a previous study (15).

Cox regression analyses (SAS 9.3 proc PHreg) were performed separately for the groups of older workers with and without chronic diseases to identify associations between the determinants and age at voluntary early retirement. The participant's calendar age was used as the time axis, and started at 60 years (=0 weeks), since retirement was only possible at 60 years or older. Participants who were older than 60 years when they answered the questionnaire had a start time with a value higher than 0 (delayed entry). For instance, a participant who answered the questionnaire at age 61 years had a start time of +52 weeks on the time axis. Participants who were younger than 60 years when answering the questionnaire had a negative start time on the time axis (e.g., a participant who answered the questionnaire at age 57 years had a start-time of -156 weeks on the time axis). The end-time was calculated for each participant based on the age when they had taken voluntary early retirement (e.g., the end-time for those who retired early at age 62 corresponded to +104 weeks on the time axis; note that as mentioned earlier, no retirement was possible before 60). Participants were followed until December 31, 2012.

Participants were censored if they had accepted a work disability pension, turned 65 years of age, or died. A previous study found differences between fully work-disabled and unemployed persons (including those who retired early). Persons who were fully work-disabled were more often older, experienced more frequent occurrences of symptoms related to their disease and more pain and fatigue, and had more functional disabilities

compared to those who were unemployed (28). Since it is not likely that persons without chronic diseases transition from work to a work disability pension, we censored participants if they went on a work disability pension. Covariates such as sex, educational level and mode of data collection were included in the adjusted model. For each determinant, the confidence interval (CI) of 95% was reported for the hazard ratio (HR).

To test differences between groups with and without chronic diseases, the covariate 'having a chronic disease yes/no' was used to examine possible effect modification (multiplicative interaction) in similar Cox regression analyses among the total population of both groups of workers (29). By studying multiplicative interaction, subgroups of individuals in which the determinant was likely to have the largest effect on the outcome measurement can be identified. Effect modification was considered significant if the interaction term between the covariate 'having a chronic disease yes/no' and the factor had a p-value below 0.05.

Sensitivity analysis

A sensitivity analysis was conducted to test a main effect of having a chronic disease on voluntary early retirement by performing a Cox regression analysis between chronic disease and age at voluntary early retirement.

Results

Table 1 shows the baseline characteristics for the group of older workers (56-64 years old at baseline) with and without chronic diseases in the sample of 1861 persons who met the inclusion criteria mentioned above. From the total eligible sample, 786 (42%) persons retired between 2009 and 2012 and 1185 (64%) persons reported having at least one chronic disease.

Determinants of voluntary early retirement among older workers with chronic diseases

The adjusted analyses showed that among the persons with chronic diseases, an increased risk of voluntary early retirement was found for those having poorer self-rated health (HR: 2.15, 95%CI: 1.37-3.37) and for those having more depressive symptoms (HR: 2.05, 95%CI 1.14-3.71) (Table 2). For work-related factors, a higher risk of voluntary early retirement

was found for higher physical workload (HR: 1.84, 95%CI: 1.37-2.48), lower job satisfaction (HR: 3.08, 95%CI: 2.09-4.55), and lower influence at work (HR: 1.94, 95%CI: 1.36-2.77). And a small increased risk of voluntary early retirement was found for a higher score on work-family conflict (HR: 1.59, 95%CI: 1.11-2.27).

Table 1. Baseline characteristics for the groups of persons with and without chronic diseases (N=1861)

Characteristics	Category, range		Chronic disease (n=1185)	No chronic disease (n= 676)
Retired between 2009-2012	Yes	n (%)	510 (43%)	276 (41%)
Mean follow-up time	Weeks	Mean (SD)	123 (67)	123 (66)
Age	Years	Mean (SD)	58.6 (2.2)	58.5 (2.2)
Sex	Male	n (%)	611 (52%)	308 (46%)
Educational level	1	n (%)	161 (14%)	101 (15%)
	2	n (%)	149 (13%)	118 (17%)
	3	n (%)	214 (18%)	130 (19%)
	4	n (%)	146 (12%)	71 (11%)
	5	n (%)	370 (31%)	200 (30%)
	6	n (%)	145 (12%)	56 (8%)
Mode of data collection	Internet/post vs telephone	n (%)	1058 (89%)	591 (87%)
Health-related factors				
Self-rated health	1-5*	Mean (SD)	2.8 (0.8)	2.3 (0.7)
Depressive symptoms	0-50*	Mean (SD)	7.6 (6.8)	5.1 (5.3)
Work-related factors				
Physical workload	1-4*	Mean (SD)	1.9 (0.9)	2.0 (0.9)
Job satisfaction	1-4*	Mean (SD)	1.8 (0.6)	1.7 (0.6)
Emotional demands	1-5*	Mean (SD)	2.6 (1.0)	2.5 (1.0)
Work pace	1-5*	Mean (SD)	3.4 (0.9)	3.4 (0.9)
Quantitative demands	1-5*	Mean (SD)	2.7 (1.0)	2.5 (1.0)
Influence at work	1-5*	Mean (SD)	2.7 (1.0)	2.7 (1.0)
Relationships with colleagues	1-5*	Mean (SD)	1.7 (0.7)	1.6 (0.7)
Social factor				
Work-family conflict	1-4*	Mean (SD)	1.9 (0.7)	1.8 (0.7)

1=no occupational training, semi-skilled workers education or similar (< 12 months), one year of vocational training; 2=completed apprenticeship or vocational training; 3=other occupational training (≥ 12 months); 4=higher education < three years; 5=higher education for three to four years; 6= higher education for > four years.

*Higher scores indicate a poor health status and worst working conditions

Table 2. Association models between health, work-related and social factors, and age at voluntary early retirement between 2008 and 2012 in Cox regression analyses.

Characteristics	Range	Chronic diseases		No chronic diseases	
		Crude models	Adjusted models*	Crude models	Adjusted models*
		HR (95%CI)	HR (95%CI)	HR (95%CI)	HR (95%CI)
Health-related factors					
Poorer self-rated health	0-1	**2.49 (1.60-3.88)**	**2.15 (1.37-3.37)**	**2.35 (1.18-4.69)**	**2.56 (1.27-5.16)**
More depressive symptoms	0-1	**2.54 (1.41-4.55)**	**2.05 (1.14-3.71)**	**3.85 (1.33-11.11)**	**4.22 (1.47-12.11)**
Work-related factors					
Higher physical workload	0-1	**2.08 (1.57-2.75)**	**1.84 (1.37-2.48)**	**2.19 (1.50-3.19)**	**2.09 (1.39-3.13)**
Lower job satisfaction	0-1	**2.99 (2.02-4.41)**	**3.08 (2.09-4.55)**	**4.84 (2.75-8.51)**	**5.27 (2.96-9.40)**
Higher emotional demands	0-1	0.92 (0.65-1.30)	0.96 (0.67-1.39)	1.19 (0.75-1.92)	1.47 (0.90-2.39)
Higher work pace	0-1	**1.51 (1.00-2.27)**	1.43 (0.95-2.17)	**1.87 (1.04-3.34)**	1.67 (0.94-2.97)
Higher quantitative demands	0-1	0.89 (0.63-1.24)	0.93 (0.66-1.31)	0.92 (0.58-1.48)	1.08 (0.67- 1.74)
Lower influence at work	0-1	**2.36 (1.67-3.35)**	**1.94 (1.36-2.77)**	**2.03 (1.26-3.27)**	**1.69 (1.04-2.75)**
Poorer relation-ships with collea-gues	0-1	1.28 (0.79-2.07)	1.27 (0.79-2.04)	**2.44 (1.23-4.82)**	**2.81 (1.44-5.49)**
Social factor					
Higher work-family conflict	0-1	1.40 (0.99-1.99)	**1.59 (1.11-2.27)**	1.06 (0.62-1.83)	1.32 (0.76-2.29)

* adjusted for sex, educational level and mode of data collection
Bold values significant at 0.05

Determinants of voluntary early retirement among older workers without chronic diseases

Among the older workers without chronic diseases, an increased risk of voluntary early retirement was found for those having poorer self-rated health (HR: 2.56, 95%CI: 1.27-5.16) and for those having more depressive symptoms (HR: 4.22, 95%CI 1.47-12.11) (Table 2). For work-related factors, a higher risk of voluntary early retirement was found for higher physical workload (HR: 2.09, 95%CI: 1.39-3.13), lower job satisfaction (HR: 5.27, 95%CI:

2.96-9.40), lower influence at work (HR: 1.69, 95%CI: 1.04-2.75), and poorer relationship with colleagues (HR: 2.81, 95%CI: 1.44-5.49).

Comparison of determinants

The interaction between having a chronic disease and poorer relationship with colleagues was closest to significance with a p-value of 0.06. However, no interaction had a p-value below 0.05; therefore, the present study did not show a significant difference in the HRs of the determinants between those with or without chronic diseases.

Sensitivity analyses

An increased risk of voluntary early retirement was found for those with chronic diseases compared to those without chronic diseases in the analysis with adjustment for sex, educational level and mode of data collection. The crude analysis showed an HR of 1.20 (95%CI: 0.95-1.28), and for the adjusted analysis an HR of 1.18 (95%CI: 1.02-1.37) was found.

Discussion

The present study showed that poorer self-rated health, more depressive symptoms, higher physical workload, lower job satisfaction, and lower influence at work were determinants of voluntary early retirement among workers with and without chronic diseases. For workers with chronic diseases, a higher score on work-family conflict was associated with a higher risk of voluntary early retirement, whereas a poorer relationship with colleagues was associated with a higher risk of voluntary early retirement among those without chronic diseases. Higher emotional demands, higher work pace and higher quantitative demands were not significantly associated with voluntary early retirement for either group.

In line with previous studies, the present study also found that poorer self-rated health and having more depressive symptoms were strongly associated with voluntary early retirement (9, 13, 16-18, 30). We therefore conclude that better health enables older workers to work longer. The present study also confirms that a higher risk of voluntary early retirement was observed among those with a higher physical workload, lower job satisfaction, and lack of job control (10, 11, 15, 18). Therefore, our results indicate that

employers may support Danish older workers by reducing their physical workload, and providing them with more influence on the number of their tasks, and on how, when and where to perform those tasks. One special finding in the present study was that a poorer relationship with colleagues is an important reason for voluntary early retirement among older workers without chronic diseases. Given this finding, employers may focus on increasing social support, for example, by promoting team-work or team-building activities.

We found no differences between older workers with or without chronic diseases in the factors related to voluntary early retirement. This result corresponds to findings from another recent study with a similar research design (e.g., using retirement as outcome, and controlling for confounding variables) (5). In contrast, another study has shown that the influence of low psychosocial resources at work and high physical demands differed between workers with and without chronic diseases (19). However, that study did not differentiate between exit routes (i.e. unemployment, work disability pension, voluntary early retirement), and did not control for confounding variables. These methodological differences may explain the different findings. Furthermore, the present study adds to these two studies, since we used data (i.e. age at voluntary early retirement) retrieved from a register. An advantage of using an objective measurement for voluntary early retirement instead of self-reported voluntary early retirement is that our data were not affected by recall bias.

According to the International Classification of Functioning, Disability and Health (ICF) model, many personal (i.e., demographic, psychological, health-related factors) and environmental factors (i.e., social and work-related factors) influence work participation among workers with chronic diseases (31). It could be that the present study did not include all determinants important for voluntary early retirement, therefore, we recommend for further research to explore other personal (including financial situation) and environmental factors important for workers with chronic diseases by using a mixed method design. Moreover, there are two other reasons for finding a lack of significant differences. Firstly, it could be that unhealthy workers had already left the labour force via a work disability pension, leaving a selection of workers with and without chronic diseases in good health in the present study population, also called the 'healthy worker effect' (32). Future research is needed to follow participants at younger ages using data with longer follow-up periods to avoid the selection of relative 'healthy' older workers at baseline. Secondly, it could be that the sample sizes were insufficiently large to find statistical significant interactions

between determinants and having a chronic disease. As the data collection was conducted years ago, we were constrained to the sample size available. With the available sample size, it could be possible that we missed relevant interaction terms as they did not reach statistical significance due to low power.

The strengths of the present study are its longitudinal design, the follow-up through public registers, and the high response rate in the baseline survey of 70% (23). However, this study has also several limitations. The determinants in the present study were analysed on a continuous scale. Other scoring methods, such as using nominal or dichotomous variables, might be preferred by some, but consensus is lacking. The advantage of a continuous scale is the sensitivity for change, whereas the advantage of a dichotomous or nominal scale is that it does not assume a linear relation with the effects. However, in the present study for all determinants a linear relation was found between the determinant and outcome variable. Furthermore, since everyone in our study population had the financial opportunity to obtain voluntary early retirement benefits and we excluded those who were not a member of the voluntary early retirement scheme, the results of this study might not be applicable to other countries with different retirement schemes. As our study population was likely homogeneous with regard to the financial possibility to retire early, we cannot clarify on the importance of financial factors related to voluntary early retirement in Denmark. In contrast, this could also be considered a methodological strength, because in many other countries financial pressures may tend to overshadow important health-related, work-related, and social factors. Another limitation was that the group of workers with chronic diseases might be too heterogeneous; various chronic diseases may lead to different limitations at work. Therefore, the heterogeneity of the chronic diseases group may have reduced the possibility for finding significant differences.

The prolonged labour force participation of older workers is a challenge for governments in European countries. The present study and the study by Fleischmann et al. (5) indicate that the factors determining prolonged labour force participation are similar for workers with and without chronic diseases. However, older workers with chronic diseases take more sick leave, have a lower work ability, and we showed that they retire earlier than their colleagues without chronic diseases (5, 6, 33, 34). Therefore, regardless of finding no evidence for the specific needs of older workers with chronic diseases, policy advisors and researchers should acknowledge the vulnerability of older workers in general, and particularly, those with chronic diseases in our ageing labour force. Furthermore, all older workers may benefit from positive working conditions (e.g., more influence on job tasks and lower physical

4

demands), and good self-rated health enables older workers to work longer. Therefore, we recommend that future research focuses on developing and implementing health and work environment promotion programs at the workplace to enable sustained employability of all older workers.

We conclude that in the present study, the influence of health-related, work-related and social determinants of voluntary early retirement did not significantly differ among older workers with or without chronic diseases in Denmark. We also showed higher physical workload, lower job satisfaction, and lower influence at work were associated with a higher risk of voluntary early retirement, and that good self-rated health and fewer depressive symptoms could reduce the risk of voluntary early retirement for older workers (with or without chronic diseases). Optimizing work-related factors may facilitate sustained employment for an older working population in general.

References

1. Sigg R, De-Luigi V. The success of policies aimed at extending working life. Developments and Trends Supporting Dynamic Social Security. 2007:51.

2. Hasselhorn HM, Apt W. Understanding employment participation of older workers: Creating a knowledge base for future labour market challenges. . Research report Berlin: Federal Ministry of Labour and Social Affairs (BMAS) and Federal Institute for Occupational Safety and Health (BAuA). BMAS/BAuA. ; 2015.

3. OECD. Labour force participation rate (indicator): OECD; 2017. [cited 15 June 2019]. Available from: https://data.oecd.org/emp/labour-force-participation-rate.htm.

4. Harbers MM, Achterberg PW. Europeans of retirement age: chronic diseases and economic activity. Bilthoven: RIVM; 2012.

5. Fleischmann M, Carr E, Stansfeld SA, Xue B, Head J. Can favourable psychosocial working conditions in midlife moderate the risk of work exit for chronically ill workers? A 20-year follow-up of the Whitehall II study. Occupational and Environmental Medicine. 2017.

6. Sewdas R, van der Beek AJ, de Wind A, van der Zwaan LGL, Boot CRL. Determinants of working until retirement compared to a transition to early retirement among older workers with and without chronic diseases: Results from a Dutch prospective cohort study. Scand J Public Health. 2018;46(3):400-8.

7. Griffin B, Hesketh B. Post-retirement work: The individual determinants of paid and volunteer work. . Journal of Occupational and Organizational Psychology 2008;81:101-21.

8. Wang M, Zhan Y, Liu S, Shultz KS. Antecedents of bridge employment: A longitudinal investigation Journal of Applied Psychology. 2008;93(4):818-30.

9. de Wind A, Geuskens GA, Ybema JF, Blatter BM, Burdorf A, Bongers PM, et al. Health, job characteristics, skills, and social and financial factors in relation to early retirement--results from a longitudinal study in the Netherlands. Scand J Work Environ Health. 2014;40(2):186-94.

10. Friis K, Ekholm O, Hundrup YA, Obel EB, Gronbaek M. Influence of health, lifestyle, working conditions, and sociodemography on early retirement among nurses: the Danish Nurse Cohort Study. Scand J Public Health. 2007;35(1):23-30.

11. Lund T, Iversen L, Poulsen KB. Work environment factors, health, lifestyle and marital status as predictors of job change and early retirement in physically heavy occupations. American journal of industrial medicine. 2001;40(2):161-9.

12. Lund T, Villadsen E. Who retires early and why? Determinants of early retirement pension among Danish employees 57–62 years. Eur J Ageing. 2005;2:275–80.

13. Reeuwijk KG, van Klaveren D, van Rijn RM, Burdorf A, Robroek SJ. The influence of poor health on competing exit routes from paid employment among older workers in 11 European countries. Scand J Work Environ Health. 2017;43(1):24-33.

14. Robroek SJ, Schuring M, Croezen S, Stattin M, Burdorf A. Poor health, unhealthy behaviors, and unfavorable work characteristics influence pathways of exit from paid employment among older workers in Europe: a four year follow-up study. Scand J Work Environ Health. 2013;39(2):125-33.

15. Thorsen SV, Jensen PH, Bjorner JB. Psychosocial work environment and retirement age: a prospective study of 1876 senior employees. Int Arch Occup Environ Health. 2016;89:891–900.

16. van Rijn RM, Robroek SJ, Brouwer S, Burdorf A. Influence of poor health on exit from paid employment: a systematic review. Occup Environ Med. 2014;71(4):295-301.

17. Schuring M, Robroek SJ, Otten FW, Arts CH, Burdorf A. The effect of ill health and socioeconomic status on labor force exit and re-employment: a prospective study with ten years follow-up in the Netherlands. Scand J Work Environ Health. 2013;39(2):134-43.

18. van den Berg T, Elder L, Burdorf A. Influence of health and work on early retirement. J Occup Environ Med. 2010;52(6):576-83.

19. Boot CRL, Deeg DJ, Abma T, Rijs KJ, van der Pas S, van Tilburg TG, et al. Predictors of having paid work in older workers with and without chronic disease: a 3-year prospective cohort study. J Occup Rehabil. 2014;24(3):563-72.

20. Leijten FR, de Wind A, van den Heuvel SG, Ybema JF, van der Beek AJ, Robroek SJ, et al. The influence of chronic health problems and work-related factors on loss of paid employment among older workers. J Epidemiol Community Health. 2015;69(11):1058-65.

21. Hjollund NH, Larsen FB, Andersen JH. Register-based follow-up of social benefits and other transfer payments: accuracy and degree of completeness in a Danish interdepartmental administrative database compared with a population-based survey. . Scandinavian Journal of Public Health. 2007;35(5):497-502.

22. Pejtersen JH, Kristensen TS, Borg V, Bjorner JB. The second version of the Copenhagen Psychosocial Questionnaire. Scand J Public Health. 2010;38(3 Suppl):8-24.

23. Bjorner JB, Burr H, Feveile H, Løngaard K, Pejtersen J, Roepstorff C, et al. Ændringer i det danske arbejdsmiljø fra 2005 til 2008. Copenhagen: National Research Centre for the Working Environment; 2010.

24. Bjorner JB, Kristensen TS, Orth-Gomér K, Tibblin G, Sullivan M, Westerholm P. Self-rated health: A useful concept in research. prevention and clinical medicine. 1996.

25. Assari S, Lankarani MM, Burgard S. Black-white difference in long-term predictive power of self-rated health on all-cause mortality in United States. Annals of epidemiology. 2016;26(2):106-14.

26. Bech P, Rasmussen NA, Olsen LR, Noerholm V, Abildgaard W. The sensitivity and specificity of the Major Depression Inventory, using the Present State Examination as the index of diagnostic validity. J Affect Disord. 2001;66(2-3):159-64.

27. Thorsen SV, Rugulies R, Hjarsbech PU, Bjorner JB. The predictive value of mental health for long-term sickness absence: the Major Depression Inventory (MDI) and the Mental Health Inventory (MHI-5) compared. BMC medical research methodology. 2013;13(1):115.

28. Baanders AN, Rijken PM, Peters L. Labour participation of the chronically ill. A profile sketch. European journal of public health. 2002;12(2):124-30.

29. Twisk JWR. Inleiding in de toegepaste biostatistiek 2ed. Amsterdam: Reed Business; 2014.

30. Karpansalo M, Kauhanen J, Lakka TA, Manninen P, Kaplan GA, Salonen JT. Depression and early retirement: prospective population based study in middle aged men. Journal of Epidemiology and Community Health. 2005;59(1):70-4.

31. Organization WHO. International classification of functioning, disability and health: ICF. Geneva: WHO; 2001.

32. McMicheal A. Standardized mortality ratios and the 'healthy workers effect': scratcing beneath the surface. Journal of occupational and environmental medicine. 1976;18(3):165-8.

33. Koolhaas W, van der Klink JJ, de Boer MR, Groothoff JW, Brouwer S. Chronic health conditions and work ability in the ageing workforce: the impact of work conditions, psychosocial factors and perceived health. Int Arch Occup Environ Health. 2014;87(4):433-43.

34. Roskes K, Donders NC, van der Gulden JW. Health-related and work-related aspects associated with sick leave: a comparison of chronically ill and non-chronically ill workers. Int Arch Occup Environ Health. 2005;78(4):270-8.

4