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Chapter 9

General Discussion

Main findings

The overall aim of this thesis was to gain insight into the interplay between the work, retirement and health of older workers. The primary objectives were:

1. to identify determinants of work participation and retirement for older workers with and without chronic diseases, and
2. to gain insight into health-related consequences of work participation and retirement.

Determinants of work participation and retirement

In general, factors related to health, social status, social participation, work, skills and knowledge, and finance were shown to have an influence on work participation and retirement among older workers (**chapter 2**). These factors are generally similar to the factors described in the STREAM research framework, mentioned in the General Introduction, that captures the complexity of determinants that influence work productivity and employment transition (1).

Health-related factors influenced health-related job loss, early retirement, and working beyond retirement. Having a chronic disease, poor self-perceived health status, or depressive symptoms were factors associated with a higher risk of health-related job loss and/or early retirement (**chapter 3**, **chapter 4**, and **chapter 5**). In line with this, our qualitative analysis revealed that good health is an important precondition for working beyond retirement (**chapter 6**). Health is also a motive to work beyond retirement, since participating in work offered the older workers an opportunity to stay fit and healthy.

Work-related factors influenced health-related job loss, early retirement, and working beyond retirement. Quantitative analyses showed that high physical workload was associated with a higher risk of health-related job loss and early retirement (**chapter 3** and **chapter 4**). However, no indication was found that having a physically demanding job moderated the association between poor health and health-related job loss (**chapter 3**). Other work-related factors that increased the risk of early retirement were lower job satisfaction, less autonomy, and poor relationships with colleagues (**chapter 4**). The qualitative analysis showed that flexible work arrangements, i.e., working part-time, fewer obligations and working from home, were important preconditions for working

beyond retirement (**chapter 6**). Furthermore, motives for working beyond retirement were colleague or client appreciation and continued contact with colleagues or clients. Ability to pass on skills and knowledge, learn new skills and increase knowledge were also found to be important motives for working beyond retirement.

For social factors, quantitative analysis revealed that work-family conflict increased the risk of early retirement (**chapter 4**), while the qualitative analysis demonstrated that workers without a working partner were less likely to retire. One reason for this might be that workers beyond retirement age did not want to sit at home alone (**chapter 6**).

For financial factors, the qualitative analysis showed that working beyond retirement was a financial necessity for some (i.e. shortfall in pension income, higher living standards, or mortgage payments), while for others it represented extra income for leisure activities, grandchildren or savings (**chapter 6**).

In addition, the qualitative analysis revealed that a 'purpose in life' was an important domain for working beyond retirement. Purpose in life included factors related to the ability to contribute and participate in society, and maintain daily routines (**chapter 6**).

Differences between older workers with and without chronic diseases

Having a chronic disease increased the risk of early retirement (**chapter 4** and **chapter 5**). Instead of only focusing on the direct association between the health condition or disease and work participation, the ICF model underlines the importance of considering personal and environmental factors when supporting work participation among workers with chronic diseases (2). Several individual, health, work and social factors related to early retirement were studied for workers with and without chronic diseases. The quantitative analysis showed that majority of determinants that influence early retirement (e.g., suffering from depressive symptoms, high physical workload, and low job satisfaction) were similar for workers with and without chronic diseases (**chapter 4** and **chapter 5**). However, autonomy at work and mastery (i.e., having more control over events) were factors that might promote work participation until a higher retirement age, specifically for older workers with chronic diseases (**chapter 5**).

Health-related consequences of work participation and retirement

Self-employed workers differ from employees with regard to working conditions e.g., autonomy and flexibility in working hours (3, 4). A comparison between self-employed workers and employees showed that self-employed workers had better self-rated health and work ability (**chapter 7**). In addition, the longitudinal analysis revealed that being self-employed (compared to being an employee) led to an increase in work ability across three years (**chapter 7**).

Systematic review results for health-related consequences of retirement showed that early retirement was not associated with a higher risk of mortality compared to working until retirement (**chapter 8**). On time retirement, compared to working beyond retirement, was associated with a higher risk of mortality. However, in the subgroup of studies that adjusted for prior health, we did not find an association between on-time retirement and mortality (**chapter 8**). This review also showed that when studying the association between retirement and mortality, it is important to consider the influence of prior health status and demographics to avoid biased conclusions (**chapter 8**).

Reflection on methods

There are several methodological features of this thesis to be considered related to the role of financial factors, measures of health status and the use of longitudinal data.

Financial factors

There are some remarks regarding the role of financial factors in this thesis. First, in the quantitative analyses (**chapter 3 and chapter 5**) all models were controlled for financial factors assessed using the following questions: 'how well do you feel you are managing financially these days?' (**chapter 3**), or 'what is the financial situation of your household?' (**chapter 5**). These financial factors were based on self-reported data, which is less accurate than objective register data (e.g., registered yearly income). However, previous studies have shown that financial factors based on self-reported data (i.e., the participants' opinions on their financial situation) are stronger predictors for (continued) work participation than more objective measurements of financial factors (5, 6).

Second, financial factors were not included in this thesis as a possible determinant of work participation or retirement. However, previous studies have shown that financial factors are associated with (early) retirement (6-8). Previous studies have also suggested that financial factors are only one part of the story, since other factors (e.g., factors related to health, social status, social participation, work, skills and knowledge) also contribute to the decision to retire or continue working (**chapter 1 and chapter 6**) (5, 6, 9, 10). To date, there has been little agreement on whether financial factors, associated with financial incentives embodied in current policy reforms, are more dominant in retirement decisions than these other factors. A previous study in Spain has shown that financial incentives impact the decision to retire, but not for workers in poor health (11). Thus, health status might be more dominant than financial incentives. In contrary, another study in the Netherlands found that workers with chronic diseases prolonged their work participation by about 18 months from the period 1992–1996 to 2012–2016 (12). This finding may be explained by the policy reforms implemented in that period that increased the retirement age and discouraged early exit from work. This indicates that financial incentives may be more dominant than poor health. Furthermore, these factors that contribute to the decision to retire may push or pull in various directions. For example, poor health can be a negative push factor for retirement, while good health can also be a positive pull factor for working beyond retirement (**chapter 6**). At the same time, a financial factor can be a positive pull factor for retirement when early retirement is financially more

attractive than employment (13), whereas a financial factor can also be a negative push factor for working beyond retirement for those who do not have the financial resources to retire (**chapter 6**). To determine which pull or push factor for work participation or retirement is more dominant, it is worth investigating the influence of these factors for all socioeconomic groups, and to study the interactions between these factors.

Measures of health status

In this thesis, various measures of health status were used to examine the determinants of retirement, i.e., having a chronic disease, self-rated health, or depressive symptoms. Information bias may have affected our findings regarding the various measures of health status (14). Self-reported data was used for the measures of health status; i.e., subjective measure as perceived and reported by the participant rather than objectively assessed health status. However, misclassification by these measures of health status seems unlikely, since the questionnaires for self-rated health (i.e., SF-12), and depressive symptoms (i.e., CSD-score or MDI-scale) have been shown to be valid and reliable (15-17). Regarding, the self-reported measure of chronic disease, the participants were asked whether they had one of the listed diseases, or if the doctor had ever told them that they had one of the listed diseases. The participants' answers may have differed from a health professional's judgement, which could be obtained from register data. However, a previous study showed that self-reported data of chronic disease is accurate for certain diseases, and can be used to assess such diseases in a large scale investigation (18). Furthermore, **chapter 4** and **chapter 5** also showed that self-reported chronic disease was a strong predictor for early retirement.

Chronic diseases

The group of workers with chronic diseases in this thesis might have been too heterogeneous, since the nature of each chronic diseases may have led to different limitations at work and decisions to retire early (i.e., disease-specific factors). For example, workers with mental health problems might experience limitations in difficult tasks due to reduced concentration or increased fatigue, whereas workers with physical health problems may struggle to lift heavy objects. A previous study found that having psychological and musculoskeletal health problems were both associated with early retirement, whereas other chronic diseases, such as severe headache or migraines, diabetes mellitus, or circulatory, respiratory and digestive health problems were not associated with early retirement (19). Another study has shown that lung disease, and arthritis were more important in predicting work disability than asthma

and heart disease (20). Due to the small number of participants with chronic disease in this thesis, we were unable to perform separate analyses for each chronic disease in **chapter 4** and **chapter 5**. However, in this thesis, we were only interested in investigating if the presence of a chronic disease influenced work participation and retirement. Other studies have shown that factors associated with work participation among workers with various chronic diseases were generally independent of diagnosis (21-23). This could mean that these factors might be disease-generic (i.e., individual factors and environmental factors) instead of disease-specific (e.g., joint pain with rheumatoid arthritis, or chest pain with cardiovascular disease) (23, 24). Furthermore, since it is becoming more common in older populations to have more than one chronic disease (i.e., multi-morbidity) (25), it might be more relevant to focus on the presence of one or more chronic diseases rather than on a specific disease associated with work participation and retirement.

Longitudinal data

Longitudinal data were used for the quantitative analyses, which allowed us to assess the independent variable at baseline and the dependent variable at follow-up. However, other causal factors could have been missed related to the time of variable measurement. First, in **chapter 3**, **chapter 4**, and **chapter 5**, most determinants (independent variables) were measured at baseline, and the dependent variable (i.e., early retirement or health-related job loss) within a time frame of 2-4 years. We might have missed changes in the health- and work-related factors or social factors within that time frame, which may have influenced the decision to retire early. Second, in **chapter 7**, workers were classified at baseline into either self-employed workers or employees. However, no information was available for the date when the self-employed workers in the study made the transition into self-employment, i.e., the number of years of 'exposure' to self-employment. It is possible that other health-related consequences would have been found when years of exposure to self-employment were taken into account. Third, in this thesis there is no information included on work life history, i.e., earlier work experiences. The role of earlier work experiences can be important for retirement decisions (26-31). A previous study found that working part-time or being self-employed over the work career was associated with the likelihood of working beyond retirement (29). Therefore, to capture a complete picture of the determinants of work participation and retirement, it is recommended to consider information on work life history from registry data, for example. Or following participants for a long follow-up period in a cohort with yearly measurements.

Reflection on findings

A selection of key insights in this thesis are described in the context of two important themes: the healthy worker effect and the ideal pension agreement.

Healthy worker effect

Health has an important impact on employment; we showed that poor health can negatively influence work participation, while the opposite also appears to be true, i.e., good health can facilitate work participation. This is known as the healthy worker effect (32-34). The healthy worker effect relies on two selection mechanisms:

1) *The healthy hire bias or entrance selection* suggests that healthy individuals are more likely than unhealthy individuals to become employed (32). To illustrate this point, in a previous study by Vinni and Hakama (35), healthy hire bias was estimated among a random sample of the Finnish population by comparing the mortality rate of those entering the labour force in 1960 to the mortality rate of the general population. They authors found a standardized mortality ratio (SMR) of 0.7, meaning that those entering the labour force had lower mortality rates compared to the general population (35).

2) *The healthy worker survivor bias or drop-out selection* suggests that healthy individuals are more likely than unhealthy individuals to remain employed (32). For example, Vinni and Hakama (35) also compared the mortality rates of those who retired before the age of 65 years to the mortality rates of those staying within the same occupational category and found higher mortality rates for those who retired (SMR of 1.3) (35). This provides evidence that there is a work drop-out selection of unhealthy individuals.

Thus, the healthy hire bias and healthy workers survivor bias results in a better health status and lower mortality rates among the working population compared to the general population. In occupational health research, a certain occupational group is sometimes compared to the general population to study the effects of harmful occupational exposures on mortality. In this type of study, the healthy worker effect could result in an underestimation of the health effects of harmful occupational exposures (36). The healthy worker effect could also have influenced the results of some studies discussed in this thesis as explained below.

Thesis findings in light of the healthy worker effect

In this thesis, the two selection mechanisms, healthy hire bias and healthy worker survivor bias, could have resulted in a selection of relative healthy participants in our study populations. To illustrate, the population of workers in some studies had a minimum age of 45 years at baseline. In **chapter 4** and **chapter 5** the minimum age at baseline was 57 and 56 years, respectively. It is possible that in our studies, the population of workers at baseline was a selection of healthy older workers for two reasons: (1) participation in paid work requires good health, especially at older ages (i.e., survivor bias), and (2) workers in poor health have the tendency to leave employment (i.e., work drop-out selection). When we compared the differences in determinants of work participation between older workers with and without chronic diseases in **chapter 4** and **chapter 5**, this healthy worker effect might have explained the many similarities we found. It is likely that we started with a selection of relatively healthy older workers, both in those with and without chronic diseases at baseline. This selection also included older workers with chronic diseases, who might have adjusted their working conditions according to their abilities and limitations as a result of their disease(s). Similar explanations can be used for the absence of positive interactions between poor health and physical workload, and poor health and occupational social class in relation to health-related job loss among older workers (**chapter 3**). The workers in this study population were able to work until the age of 50 years or older. Furthermore, in **chapter 7**, we did not find differences in the influence of employment status on self-rated health or work ability among older workers who differed in level of education, financial situation, presence of chronic disease, and work characteristics. It is likely that at baseline, due to the healthy worker effect, older workers with these characteristics did not differ in health status or work ability when comparing self-employed workers and employees. In **chapter 8**, we found that without adjustment for prior health status, on-time retirement appeared to be associated with mortality (HR 1.56, 95% CI: 1.41-1.73), but this effect was attenuated when adjusted for prior health status (HR 1.12, 95% CI: 0.98, 1.28). This finding may reflect a healthy worker effect. To conclude, researchers should consider a possible healthy worker effect, since it may lead to a biased conclusion. Researchers could also control for a possible healthy worker effect by implementing one of the many strategies that exist in the literature (32, 37-39).

Strategies for the reduction of the healthy worker effect

Some strategies for reducing the healthy worker effect proposed in the literature are presented in Table 1. In addition, the advantages and disadvantages of each strategy are

described. One strategy to address the healthy worker effect is to choose a comparable reference group within working populations (32).

Reference group. One strategy to decrease the healthy worker effect is using another occupational group as a reference group instead of using the general population. In this way, it is possible to compare health effects among workers with various occupational exposure levels. For example, Thygesen et al. (40) compared the mortality rates of electricians with three reference groups: workers in the construction industry, carpenters and brick layers, and the general Danish male population. The electricians had mortality rates similar to workers in the construction industry, and carpenters and brick layers, but lower than those in the general population.

Reynolds and Day (41) argue that studies of mortality among astronauts showed lower mortality rates than the general population. Astronauts are more physically fit than the general population, since this is also a requirement for their job. The authors mention their challenge to identify a comparison group to measure the possible increase in mortality rates of astronauts associated with space travel (41). To take this into account, they compared the mortality rates of astronauts to professional athletes, and found similar mortality rates between the two groups. This example illustrates that the difficulty of selecting a comparable occupational group to measure the health effects of certain harmful occupational exposures. In this thesis, we compared in **chapter 2, 3, 4 and 7** workers with 'high exposure' to those with 'low exposure' (i.e., no chronic disease, good health, no physical workload, or employee) instead of using the general population as a reference group.

However, in **chapter 2, 3, 4 and 7**, it is likely that both high and low exposure groups at older ages are relatively healthy because of healthy-worker survivor bias. This could explain why we found no difference between the high and low exposure groups. To address the selection of relatively healthy workers at an older age due to healthy-worker survivor bias, a worker's employment history could be considered. Incident hires, exposure lagging, and the use of G-methods are strategies that also address the influence of employment history.

Incident hires. A proposed strategy to address the healthy worker effect is to study 'incident hires' instead of 'prevalent hires' (42). Prevalent hires refer to participants who are already employed at baseline. Incident hires refer to novice workers who started working after baseline. In this way, all participants have no employment or exposure history. The

mortality rate ratios for prevalent hires and incident hires were calculated in a Norwegian cohort study (42) for the association between silica exposure and lung cancer mortality. This study found a mortality rate ratio of 1.90 (95% CI 1.18 to 3.08) for prevalent hires, and a mortality rate ratio of 2.51 (95% CI 1.14 to 5.55) for incident hires. The finding indicates a stronger relation between silica exposure and lung cancer mortality for incident hires. Following this, using prevalent hires can result in an underestimation of adverse health effects. In this thesis, we used data on prevalent hires, since the exact date of hire for the participants was not known in **chapter 2, 3, 4** and **7**. If this data had been available or if we had included information on employment history, we may have found stronger effects or more differences between workers with and without chronic diseases. A disadvantage of studying incident hires is that all participants should be included at younger ages, and therefore, a cohort with a very long follow-up period is required, particularly when studying retirement.

Exposure lagging. Exposure lagging is similar to an exposure window analysis, where there is a certain latency period of disease (43). By allowing for a latency period of some years, the influence of employment history can be considered in the analyses. Arrighi and Hertz-Picciotto (37) also investigated the use of a latency period of 10-20 years, and showed higher rate ratios for the association between arsenic exposure and mortality due to respiratory cancer in the lagged analysis compared to the analysis without a latency period (37). This shows evidence that without taking an employment history into account, the analysis of the occupational exposure could lead to an underestimation of the adverse health effect. However, it is difficult to establish the duration of the period of latency time for a specific study population, since latency periods vary across individuals, i.e., the previous employment durations vary among individuals. Another point of discussion is whether or not exposure lagging reduces the generalizability of the results, since only 'survivors' (i.e., those who remain employed after a number of years) are included in the analyses, which is actually the healthy worker effect.

G-methods. Another method that considers employment history is the use of more advanced statistical methods, such as G-methods (38, 39, 44, 45). Examples of the G-method are the 'G-estimation' or the 'G-null test' (38, 39). For instance, in the G-null test, cases and non-cases are matched based on employment history. In this way, those with poor health status are compared to those with good health status, if this is the outcome of interest, but they have similar employment histories until a particular point in time. This time point can be used to investigate the difference in a harmful occupational exposure

from the identified time point forward. This strategy is similar to matched case-control studies. Arrighi and Hertz-Picciotto (37) demonstrated that the G-null test also showed an adverse effect between arsenic exposure and mortality due to respiratory cancer. However, this strategy requires matching cases and controls, which can result in a loss of statistical power when the values for the duration of previous employment differ (46). Another disadvantage, applicable to all G-methods, is that data on employment history is needed. This information could be retrieved from registry data, for example.

Thus, the healthy worker effect can lead to an underestimation of the risk estimate for the relation between exposure and health outcome in occupational epidemiology, if this is not adequately addressed. Several strategies exist to control for the healthy worker effect, e.g., focusing on incident hires. More advanced statistical methods, such as G-methods or the use of exposure lagging can also be applied. However, these methods require the availability of studies with long follow-up durations and large sample sizes. If this is not available, choosing a comparable reference group can partly control for the healthy worker effect. Future studies should take a possible healthy worker effect into account to prevent biased conclusions by applying a strategy that suits data availability.

Table 1. Overview of strategies to tackle the healthy worker effect and the advantages and disadvantages of each strategy.

Strategies	Advantages	Disadvantages
Reference group	Compares health effects among workers with various occupational exposure levels	Healthy hire selection for both the high and low exposure groups
Incident hires	Addresses employment history	Studies with a very long follow-up period are needed
Exposure lagging	Addresses employment history	Reduced generalizability of the results, and difficult to establish latency time period
G-methods	Addresses employment history	Availability of data on employment history; matching cases and controls results in loss of power.

The ideal pension agreement

The context in which older workers retire has changed significantly over the past centuries. In 1672, the first known occupational pension scheme for old age was introduced for naval officers in the UK (47, 48). These officers could receive an 'old-age' pension when they became unfit because of age and had worked at least 15 years. However, there was no

fixed eligibility age for this old-age pension. The first state old-age pension with a fixed eligibility age in the world was introduced by Chancellor Otto Von Bismarck of Germany in 1881 and implemented in 1889 (49-51). The eligibility age for old-age pension was 70 years and this pension was paid by the state. However, at that time, the life expectancy at birth in Germany was only 40 years, hence only a few people made it to 70 years. During the First World War, the German government reduced the eligibility age to 65 years (49). A possible reason for this decrease in age was to recruit military officers to join the army; they were promised that if they survived the war, they could retire at 65 years of age. Many years later, this eligibility age for old-age pension was also adopted in other countries.

In the Netherlands, for example, Prime Minister Drees introduced the General Old Age Pension Law (Algemene Ouderdomswet, AOW) in 1957, meaning that a worker could receive old-age pension after reaching the age of 65 years (51). In the 1970s, in the Netherlands, many sectors also introduced early retirement schemes (Vervroegde Uittreding (VUT)). After reaching a certain age (varying by sector), a worker could retire before the statutory retirement age of 65 years (51). From 1997, measures were taken by the Dutch government to make early retirement schemes financially less attractive. In 2006, the qualification criteria for receiving a work disability benefit became stricter. Moreover, since 2010, the eligibility age for old-age pension has been gradually increasing from 65 years in 2012 to 67 years in 2021 (52). Thus, to encourage older workers to prolong their work participation, the policy measures in the Netherlands include raising the statutory retirement age and taking measures to discourage early exit from the labour force. However, as of June 2019, the government, employers and trade unions reached a pension reform agreement that included freezing the retirement age (53). Under the new law, in 2020 and 2021, the age of retirement remains at 66 years and 4 months; however, it then increases in two steps to age 67 in 2024. In 2025, the retirement age will rise based on increases in life expectancy (an increase of two months for every three-month increase in life expectancy).

Rationale for increasing the retirement age

The main reason for increasing the retirement age and reducing incentives to retire early is to minimize the economic burden of an ageing society on a country's social security system (54). To date, a considerable proportion of the European population is aged 65 years and older; people live much longer compared to previous centuries (54). This means that if the retirement age stays the same, people will spend more time in retirement. To illustrate, in 1958, the average duration of retirement was 13 years for men and 17 years for women

in Europe; however, in 2010, this was 19 years for men and 23 years for women (54). This increase in people spending more time in retirement leads to increased costs for pension systems. Therefore, starting in 2010, many governments raised the retirement age and discouraged early exit from the labour force (49).

These state policies and policy reforms still imply that everyone will retire at the same age. However, as a result of these policy reforms, older workers have a longer working life compared to previous decades. This accounts for healthy workers as well as those with chronic diseases or disabilities (12). The most important question is: can everyone work until retirement age in a healthy manner and can everyone enjoy their retirement in good health? To answer this question, I provide insight into why strategies that consider health inequalities in retirement policy are needed.

Health inequalities

First, an increasing life expectancy does not necessarily mean that everyone is able to work until a higher retirement age (55, 56). Living longer does not always correspond to an increase in the number of years living in good health, also known as healthy life expectancy (57). Moreover, life expectancy and healthy life expectancy are not the same in all socioeconomic groups. Previous studies have shown that socioeconomic inequalities in health exist in Europe; the lower a person's socioeconomic position, the poorer their health is (58, 59). Those in a low socioeconomic position have a shorter life expectancy and spend more time in poor health (57, 60). This means that they will have fewer years to enjoy retirement in good health. Furthermore, workers with a lower socioeconomic position have to work for a greater number of years, since they tend to start earlier in their career compared to workers with a higher socioeconomic position. With the same eligibility age for old-age pension, the ratio between the number of years working and the number of years in retirement will differ among socioeconomic groups.

Second, the impact of retirement on health can differ between socioeconomic positions (61). For example, early retirement among low-educated workers perhaps prevents further deterioration of their health due to harmful working conditions, while early retirement among high-educated workers may have an adverse effect on health (62). The impact of early retirement on health can also differ based on whether the retirement is voluntary or involuntary. Positive pull factors, such as more leisure time, can result in voluntary early retirement, while negative push factors, such as being fired, can result in involuntary early retirement. Involuntary retirement can have more negative consequences on health than

voluntary retirement (negative push factor -> involuntary retirement decision -> health decline) (63, 64). Therefore, the effect of prolonging work or retirement on health differs among socioeconomic groups and the actual voluntary nature of retirement.

Strategies to consider health inequalities in retirement policy

Currently, strategies accounting for the differences among socioeconomic groups are planned in the Netherlands. The new Dutch pension reform agreement mentions the possibility of early retirement for workers in arduous and hazardous occupations (53). From 2021 through 2025, employers can allow these workers to retire up to three years before retirement age with an early retirement benefit and without an employer tax penalty. Some European countries (e.g., Belgium, France, Austria) have already instituted a separate retirement policy for workers in arduous and hazardous occupations, e.g., workers can retire early around the age of 60 years if they have worked in an arduous and hazardous occupation for at least 15 years (65, 66). In general, these occupations include harmful working conditions (e.g., working with chemical materials), strenuous physical effort (e.g., mining) or mental activities (e.g., aircraft staff); however, the lists of these occupations vary significantly among these countries (65, 66). In the Dutch pension reform agreement, it is stated that in the upcoming five years, individual sectors will have to determine the occupations eligible for this early retirement option. Further details on how this early retirement option will be implemented in the Netherlands are not yet known and will be specified by the government in the upcoming period.

The possibility of early retirement for workers in arduous and hazardous occupations in the Dutch pension reform agreement is promising for considering health inequalities among socioeconomic groups. However, the Dutch pension reform agreement does not focus on how the government will support workers (in all socioeconomic groups) in prolonging their working lives in a healthy manner, which has been recommended by the Health Council of the Netherlands (67). The Health Council of the Netherlands recommends, for example, that interventions to support workers in prolonging their work participation should be implemented by the employer, since the effects of such interventions have been promising (67). The lessons learned from this thesis together with the recommendations of the Health Council are discussed below.

Recommendations for the pension reform agreement

There is a need for a balance between the financial need for prolonged work participation, and maintaining the health of members of all socioeconomic groups who are working.

To minimize the economic burden of an ageing society on the social security system, I recommend one eligibility age for old-age pension that should be linked to life expectancy. To help older workers in all socioeconomic groups remain active at work in a healthy manner, I have three recommendations to ensure sustained employability and job availability for older workers, while strengthening the possibility of a (partial) retirement option before the retirement age for a subgroup of older workers.¹

The first recommendation focuses on maintaining or improving the sustainable employability of older workers in all occupations. This is important to prevent a health-related exit from work via work disability benefit or unemployment. HR practices could be implemented to help older workers remain active at work in a healthy manner with favorable working conditions (68, 69). This HR practice could include implementing consultations and action plans with various professionals (e.g., occupational physicians, HR staff and supervisors) and the employee to:

- 1) monitor the health of (older) workers to prevent health problems, e.g., frequent health checks (**chapter 3-6**) (70). The health effects of prolonging work participation are still unknown (**chapter 8**), therefore, the Health Council recommends monitoring the health of older workers (67).
- 2) improve working conditions (e.g., reducing heavy physical workload (**chapter 3**), and increasing autonomy at work (**chapter 5**)) and to create a healthy work environment for employees through workplace adjustments (71-75).
- 3) discuss the needs of older workers and how their jobs can be changed, i.e., job crafting to maintain or improve the employee's intrinsic motivation and their ability to work (69, 76).

The second recommendation targets the unemployment rate among older workers—4.5% of the Dutch population aged 55 to 64 years was unemployed in 2018 (77). At an older age, it appears to be very difficult to find a job, since employers have a preference for hiring younger workers (78, 79). For example, it is perceived that older workers are less productive, have less physical and mental capacity, and are more expensive than younger workers (80, 81). To tackle this issue, the government could offer compensation to employers to stimulate hiring older workers. It is unlikely that this would result in a labour market exclusion of younger workers, since a previous study showed that the increased labour

1 These recommendations are mainly focused on employees. However, currently, a transition from salaried employment to self-employment is taking place. Therefore, there is also a need for strategies to help self-employed older workers remain active at work in a healthy manner.

force participation rate of older workers beyond retirement did not lead to a decreased labour force participation rate of younger workers (82).

The third recommendation focusses on the availability of a (partial) early retirement option for a *subgroup* of older workers in all occupations. The government should accommodate an option to partially or fully retire before the retirement age in the first pillar of the Dutch pension system, which is not currently mentioned in the Dutch pension reform agreement². The Health Council has also recommended exploring whether flexible pension schemes could prevent health-related exit from work via unemployment (67). The early retirement option in the first pillar is similar to the Danish pension system, with the exception of the option to partially retire before the retirement age and eligibility criteria to choose this option. Partial retirement has many advantages (66). It could benefit worker health and wellbeing since it can help a person to adjust to retirement and allows for knowledge transfer to another (younger) worker within an organization (66, 83). Furthermore, this strategy would not increase the pension costs as much as full retirement does, and may help facilitate workers remaining at work until retirement age or longer (84). However, a major challenge of this option is that if everyone chose to retire partially before reaching the retirement age, there could be an increase in pension costs in the near future. Another challenge is that this strategy could increase the existing shortage of personnel in some sectors, e.g., the health care sector. A previous study found that replacing full-time retirement with part-time retirement led to a longer working life, but decreased the duration of the total labour force participation of older workers (85).

To take into account the increasing pension costs and the existing shortage of personnel, the option to retire partially or fully before reaching the retirement age should only be available to a *subgroup* of older workers by implementing strict eligibility criteria. Governments could learn from the 17th century about eligibility criteria. For example, eligibility criteria for the option to partially or fully retire before retirement age could be: 1) working for a number of years (e.g., in Germany 45 years (86)), and 2) being physically and/or mentally unfit because of age for a certain period (in case a worker is not eligible to apply for a work disability benefit). The first eligibility criterion depends on when people started their career. However, this creates practical challenges about the exact point when people have started their career (i.e., minimum working hours per week and/or a certain age) and the availability of this administrative data to register the number of years that people have worked. However, one advantage is that this criterion may reduce the inequality in the

2 Partial retirement is only mentioned in the new Dutch pension reform agreement as a possible intervention that employers could use for sustainable employment.

number of years that people work and can enjoy their retirement for all socioeconomic groups. Furthermore, the second criterion takes into account that some people can work until a higher retirement age, whereas those who are not able to work because of health problems can (partially) retire early. There could be a role for occupational physicians to advise workers who have been unfit for a certain period to start working part-time at a certain age or to fully retire before retirement age. In addition, a third eligibility criteria could be applied to specifically target workers with a lower socioeconomic position. These workers could be identified based on information on their educational level, income, and/or occupation.

To conclude, the Dutch pension reform agreement has the potential to sustain a balance between the financial need for prolonged work participation, and maintaining the health of the working population in all socioeconomic groups. However, the current agreement lacks the strategies to help older workers remain active at work in a healthy manner with favorable working conditions. Therefore, it is recommended to implement strategies targeting the sustainable employability of older workers, the availability of jobs at older ages, and a (partial) retirement option before retirement age for a subgroup of workers.

Implications

Several recommendations for research and practice can be derived from this thesis.

Recommendations for research

1. Future research should take a multidisciplinary approach to work participation and retirement studies. **Chapter 2** and **chapter 6** showed that multiple factors, related to various domains (i.e., factors related to health, social status, work, skills and knowledge, and finance), are involved in work participation and retirement. In addition, 'purpose in life' was an important domain for working beyond retirement. Future multidisciplinary research is needed to determine how other factors might interact, since each determinant may push or pull in a specific direction (e.g., financial incentives versus poor health).
2. More insight is needed into the longitudinal relation between the determinants and work participation and retirement, and the health-related consequences of work participation and retirement (both voluntary and involuntary), for all socioeconomic groups. It is recommended that researchers use longer follow-up periods or consider information on work life history to capture a complete picture of the determinants of work participation and retirement (87).
3. Researchers should consider the health inequalities among socioeconomic groups related to work-related factors (**chapter 3**), presence of chronic disease (**chapter 4** and **chapter 5**), and health status (**chapter 3**). In addition, it is of interest to determine whether determinants of work participation among workers with chronic diseases are disease-specific or disease-generic.
4. Future research among the older working population should consider a possible healthy worker effect by applying a strategy that suits data availability. For example, the results from **chapter 8** showed that a consequence of ignoring the healthy worker effect could result in a biased conclusion that working longer results in living longer.

Recommendations for policy and practice

1. Employers should invest in strategies to help older workers remain active at work in a healthy manner while having favorable working conditions. The results from **chapter 2**, **chapter 3** and **chapter 6** demonstrated that all older workers may benefit from favorable working conditions (e.g., shorter working day, options to work from home, more autonomy at work, lower physical demands and the opportunity to learn new skills). Furthermore, the results from **chapter 5** showed that autonomy at work and mastery were factors that may promote work participation until a higher retirement age, specifically for older workers with chronic diseases.
2. Employers should focus more on disease prevention by implementing workplace interventions that include monitoring the health of older workers, since being in good health is an important precondition for work participation (**chapter 6**).
3. In the context of an increasing retirement age, policymakers should improve the availability of a (partial) retirement option before the retirement age for a subgroup of workers. They should acknowledge that vulnerable groups exit from work due to poor working conditions (**chapter 3**), presence of a chronic disease (**chapter 4** and **chapter 5**), and poor health status (**chapter 3**). There should be an option available for these groups to partially or fully retire before the eligibility age of an old-age pension.

Conclusion

This thesis determined that factors related to health, social status, work, skills and knowledge, and finance have an influence on work participation and retirement among older workers with and without chronic diseases. The majority of determinants that influence retirement (i.e., individual, health, work and social factors) are similar for workers with and without chronic diseases. However, autonomy at work and mastery are factors that may promote work participation until a higher retirement age, specifically for older workers with chronic diseases. No evidence was found that having a physically demanding job moderated the association between poor health and health-related job loss. With regard to the health-related consequences of work participation, this thesis showed that self-employed workers have better work ability over time than employees. With regard to the health-related consequences of retirement, we did not find an association between early retirement (compared to continued work participation) and mortality. On time retirement, compared to working beyond retirement, was associated with a higher risk of mortality. However, in the subgroup of studies that adjusted for prior health, we did not find an association between on-time retirement and mortality. Hence, when studying the association between retirement and mortality, it appears relevant to consider demographics as well as prior health status.

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