Relations between health status and labour participation outcomes among older workers over time

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General introduction

Demographic trends: increasing life expectancy

The life expectancy of the general European and Dutch population increased rapidly over the past decades due to amongst others overall better health and healthcare (1-4). Figure 1 presents the substantial increase in life expectancy at birth in the European Union (EU) for males and females, in the period 2002-2020 (1). In 2020, the average life expectancy at birth for European males and females was 77.5 years and 83.2 years (1), and for Dutch males and females respectively 80.8 and 84.1 years (5). Furthermore, it is expected that the life expectancy at birth will keep increasing. The current prognosis estimates that the general life expectancy for males and females will further increase to approximately 86 years in 2040 (2).

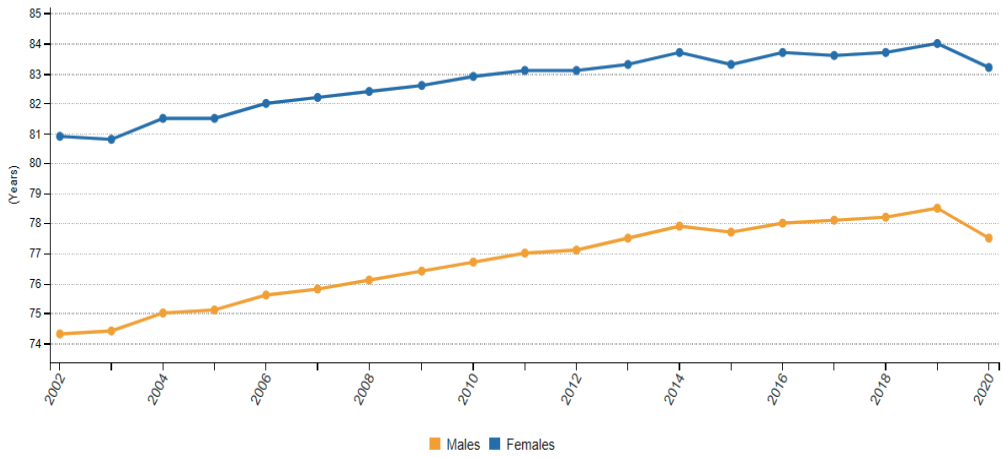

Figure 1: Life expectancy at birth in the EU for males and females, 2002-2020 (1)

These demographic trends may put a strain on the sustainability of social security and pension systems in many Western societies, since the time between statutory retirement age until death has risen substantially (6). As presented in Figure 2, in 1950 Dutch people aged 65 years lived on average another 14.3 years, which increased to 20.1 years in 2019 (6).

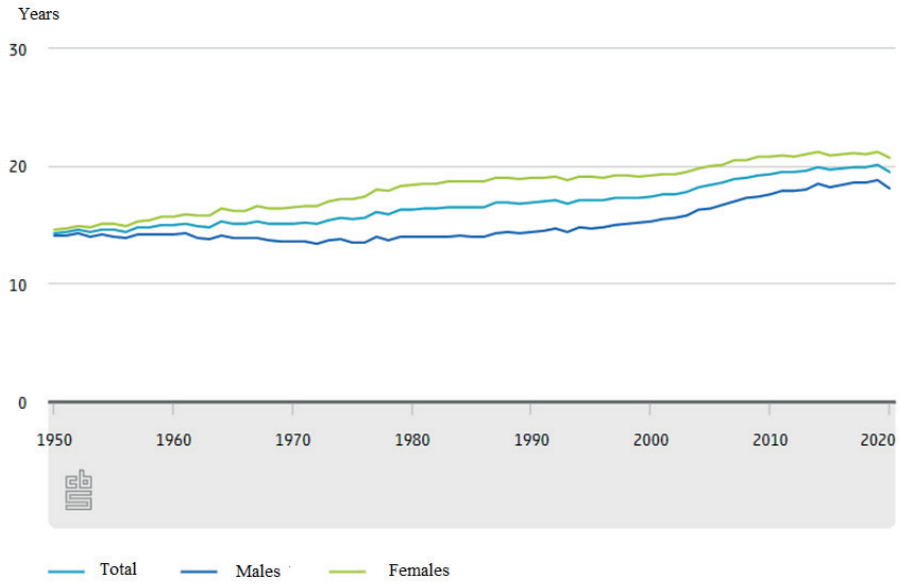

Figure 2: Life expectancy after the age of 65 years in the Netherlands between 1950-2020. Figure adapted from Statistics Netherlands (6).

Due to the substantial increase of the period between statutory retirement age and decease, pensions and socials security benefits have to be paid for a much longer period. This results in much higher costs and threatens he sustainability of social security and pension systems in many Western societies (6). In order to maintain social security and pension systems, Western policies increasingly aim to prolong working lives and to prevent early labour market exit (7, 8). Various policies have already been implemented. For instance, the statutory retirement age - which is linked to life expectancy –is already increased and is expected to further increase (4, 8-10) to 69 years and three months in 2040 (11). Moreover, options for (financially attractive) early retirement or access to other exit routes from paid employment such as the eligibility for disability benefits have been abolished or limited (4, 8, 10).

These policy measures have shown to be effective, since labour participation rates amongst older workers have substantially increased the past years (4) and are expected to continue to increase (4, 6, 7). However, it should be noted that despite the increasing proportion of older workers in the labour market, the proportion of older workers whom are able to work until reaching the statutory retirement age is

still lagging behind (4, 12). Many older workers still leave the labour market before reaching the statutory retirement age (13, 14) through various exit routes such as early retirement, disabilities or unemployment benefits (9, 12). Thus, although the life expectancy increases and the statutory retirement age increases, it does not imply that all older workers are able and willing to prolong working lives (9). It is thus invaluable to investigate what factors may contribute to prolonging working lives among older workers.

Aging, health and functional capacities

With aging, the risk of health problems and the number of people having (a) chronic health condition(s) substantially increases (2, 4, 8, 15-17). In addition, with aging the likelihood of having multiple health problem(s) at the same time further increases (2, 4, 8, 18). As presented in Figure 3, among people aged 55-70 years, the number of chronic health condition(s) present within the same person, increases with increasing age (4, 9).

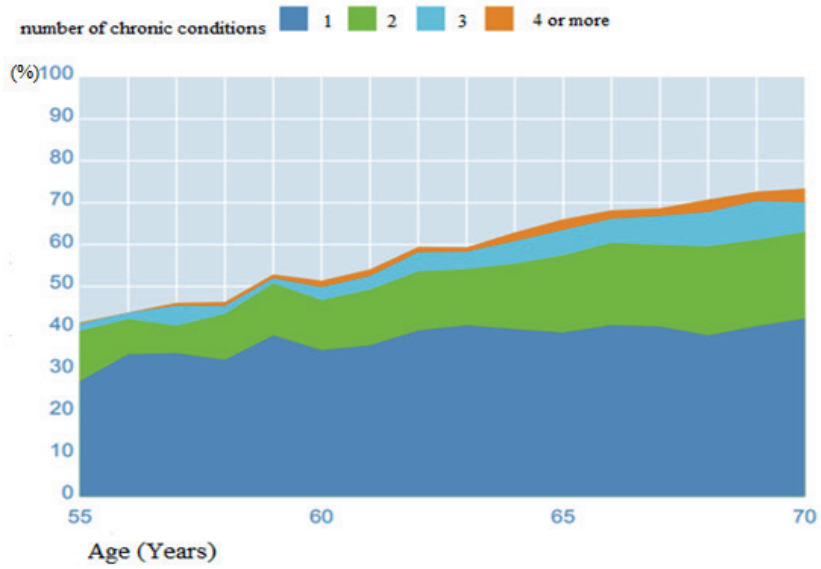

Figure 3: The proportion of people aged 55-70 years with (a) chronic condition(s), divided by number of diseases. Figure adapted from the Dutch Health Council (2018) (4).

Also within the working population, the risk of health problem(s) and the number of people having chronic health condition(s) substantially increases with aging (19). Over the past decade, the proportion of people working whilst having one or more chronic health condition(s) has even increased (19). In 2016, for people aged 55-65 years, 48 per cent were in the labour market whilst having at least one chronic health condition, whereas among people aged 25-55 years, 25 per cent were in the labour market whilst having at least one chronic health condition (19). Although the labour participation rate of older workers in general has strongly increased the past decade in most Western countries (4), still a large proportion of older workers are not able to remain in the labour market. The presence of (a) health problem(s) may hinder labour participation among older workers. In 2022, 61.2 per cent of people aged 55-64 years were employed in the European Union (20). This percentage was however considerably lower among people with (a) health problem(s) or long-standing illness: 39.9 per cent of people aged 55-64 years with (a) health problem(s) or long-standing illness were employed in the European Union (21). These statistics underscore the conclusion of the Dutch Health Council (2018) (4), which states that from a health perspective, prolonging working lives may thus not be self-evident for all older workers (4, 8).

In this light, the definition of older workers should be carefully considered. That is, who is regarded an older worker often greatly differs across studies and reports. Some studies included workers aged 55-65 years (8), or 50-75 years (4), or 50 years onwards (22). In this dissertation, older workers will be defined aged 45 years onwards, in line with the definition of the World Health Organization (WHO) (23). Perhaps, this age limit may be relatively low for some Western countries, however the WHO represents multiple countries of whom the general life expectancy still differentiates substantially.

In addition to increasing age being related to health problems, increasing age is also related to a continuous, general decline in various functional capacities (24, 25), such as for instance a decline in muscle strength (24), processing-intensive tasks (25) and speed progressing of the long-term memory (24, 25). Other functional capacities, such as verbal knowledge, can, however, also increase with aging (25). These general age-related declines in functional capacities are also applicable to older workers. Figure 4 demonstrates a general age-related decline in muscle strength, separately for men and women (24). This figure however also shows more variation/spread in individual muscle power at a higher age.

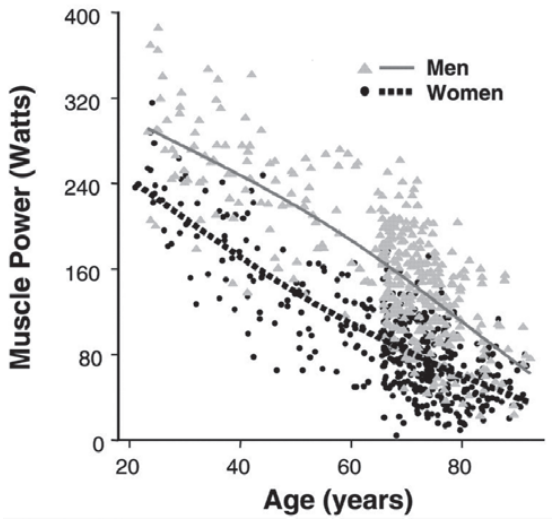

Figure 4: Age-related decline in muscle strength, for men and women separately (24).

This may imply that although in general functional capacities decline with increasing age, the (amount of) decline in functional capacities may still differ substantially per individual. Some older workers may experience a large decline in functional abilities, whereas others may only experience a minor decline in functional capacities with increasing age. While this may imply that prolonging working lives is still possible for a large proportion of older employees, this may at the same time also underscore the conclusion of the Dutch Health Council (2018), which states that from a health perspective, prolonging working lives may not be self-evident for all older workers (4, 8).

Health and labour participation of the older worker

To understand the relation between health and labour participation among older workers, the WHO's International Classification of Functioning, Disability and Health (ICF) conceptual framework (26, 27) is a useful frame of mind (Figure 5).

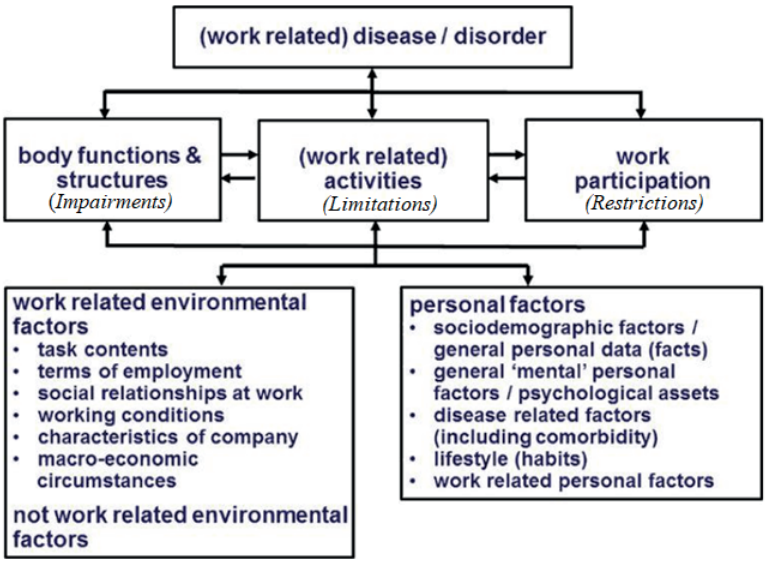

Figure 5: The International Classification of Functioning, Disability and Health (ICF) Framework adapted for work (Source: (27))

The ICF Framework provides a comprehensive understanding of the interactive, complex relationships between health and functioning in all people, including the older worker (28). As mentioned before, with aging the risk of health problems and the number of people having (multiple) chronic health condition(s) substantially increases (2, 4, 8, 15, 16). According to the ICF, potential pathway(s) between health and labour participation can be distinguished. The presence of (a) health problem(s) can generate impairments in body functions and structures, such as tissues, organs and systems. These impairments can lead to functional limitations (18, 29) and a reduced functional capacity (18). Through reduced functional capacities, (a) health problem(s) may also affect an individual's functioning (activities) and can thus generate activities limitations. Subsequently, health problem(s) can generate restrictions in one's labour participation (24, 26). Vice-versa, there can also be an interplay between, for example, labour participation and disease. For instance, labour participation may positively or negatively affect the prognosis, severity, or impact of (a) health problem(s). Also, health problem(s) may directly affect one's labour participation. As mentioned before, even without the presence of (a) health problem(s) a general decline in various functional capacities (24, 25) occurs among older workers. These reduced functional capacities may also affect

older workers' functioning and can generate activity limitations. Subsequently, (a reduced) functioning may affect an older workers' labour participation. Thus, when studying the impact of health on labour participation, it is invaluable to consider the potential pathways linking health, age and labour participation.

In line with the ICF, it is further invaluable to additionally investigate the role of the (work) context when studying the relation between health and labour participation (30, 31). As shown in Figure 5, contextual factors, work-related environmental factors and personal factors, can be coherent and can interact with an individual's health problem(s). Subsequently, this dynamic interaction can positively or negatively affect an older workers' functioning (27) and labour participation (26, 30, 31). Personal factors include amongst others lifestyle (habits), gender, motivation, and engagement (31). Work-related environmental factors (external influence on functioning) include amongst others social relations at work (support of colleagues and/or supervisor), task content (autonomy, decision authority), working time arrangements (working hours), or social relationships at work (support of colleagues) (31). As an example, the functioning of older workers might be negatively affected due to being involved in shift work and physically demanding work. Subsequently, labour participation could be impeded. Potentially, high social support from colleagues/supervisors could (slightly) counteract the impact of physically demanding work and working irregular hours, and positively affect one's functioning and hence labour participation. Moreover, the positive or negative effect of the work context on an individual's functioning may further differ depending on whether someone (already) has (a) health problem(s) (31, 32). When studying the relation between health and labour participation, the role of the work context should therefore be additionally considered since the work context can substantially affect this relation.

Since health appears a very relevant factor in relation to labour participation and prolonging working lives, the impact of health on labour participation of older workers over time forms the central theme of this dissertation.

Thus far, many studies have already demonstrated the substantial role of health on labour participation outcomes among older workers (4, 8-10, 16, 33-42). In general, workers who have health problem(s) often perceive difficulties to remain in the labour force (35, 43). For older workers, health is strongly related to labour participation and the willingness and ability to continue working until the statutory retirement age (4, 8-10, 16, 33-42). Moreover, poor health is considered the primary cause for older employees to leave the labour market (early), that is, before

reaching the mandatory retirement age (4, 10, 16, 36) through disability benefits, unemployment, or via early retirement (36, 40, 44-47). Furthermore, older workers with health condition(s) who left the labour market through these exit routes, are generally less likely to return to paid employment compared to healthy employees (16).

Besides the substantial role of health, the role of psychosocial work-related factors, such as autonomy or support from supervisors and/or colleagues, is substantial and only seems to further increase (48). Previous research already indicated the (direct) impact of various work-related factors from the work context on labour participation (31, 36, 49-52). For instance, a favorable work context consists of e.g. high social support from colleagues (31, 51, 53) and hence can contribute to enhance (sustainable) labour participation over time (47, 54). An unfavorable work context consists for instance of high physically work demands (51) and hence can hinder labour participation. Moreover, these work-related factors may have a mediating role on the relation between health and labour participation over time (47, 54-56). A study of Boot et al. (2013) (55) investigated the impact of work-related factors on having paid work, separately for older workers with and without health problem(s). Findings revealed that the impact of work-related factors on labour participation differed for older workers with and without health problems. For instance, workers with low psychosocial resources at work were less likely to be in the labour force over time, yet solely if they suffered from health problem(s).

Methodological and conceptual considerations regarding health and labour participation of the older worker

While there are many studies on the association between health and labour participation in the literature, some important methodological and conceptual considerations should be noted too. For example, many empirical studies to date have focused on studying the impact of one single indicator of health, such as the presence of health problem(s), or poor/ill health (36, 39, 40, 42, 44, 45, 57, 58) on one specific (dichotomous) outcome of labour participation, such as being in - or out of employment (4, 36, 40, 44, 45), need for recovery (59), retirement intentions (60), or leaving employment (36, 40, 44, 45). Since health is not merely the presence or absence of a health problem (8, 9), yet health is rather diverse (4) and can be differently related to labour participation, it is of added value to consider a broad

spectrum of subjective and objective indicators of health. The same reasoning applies to labour participation. Studying employment status dichotomous in terms of being in – or out of employment, or even specified with regards to exit routes from employment, is highly relevant. However, the outcome measure employment status can be susceptible for changes/fluctuations in the labour market, economy, and policy/institutional factors (61-63) such as labour agreements which may vary per sector and company (64). It is therefore important to study multiple objective and subjective outcomes of labour participation of which some are less susceptible to these fluctuations. Moreover, since multiple actions - such as a reduction in working hours (65, 66) or developing (strong) intentions to retire (earlier) (4, 42, 65, 67) - can precede decisions with regards to leaving employment and (early) retirement, it is invaluable to gain more insight into multiple early indicators of employment status.

Some studies assessing the relation between health and labour participation have been cross-sectional in nature, and consequently (valid) causal conclusions cannot be drawn (68, 69). Of the longitudinal studies already conducted in order to investigate the relation between health and labour participation over time, the follow-up period was often relatively short (4). This makes it difficult to draw valid conclusion(s) over a longer period of time and to consider the presence of (health-related) selection processes over time. This may explain some inconsistent findings obtained from longitudinal studies on the relation between health and labour participation over time. For instance, in some cases, there seems to be a revival in employability and work ability with increasing age (4). These findings are in contrast to other study findings which indicate a general decline in work ability with increasing age (9, 12-14). This may (partially) be explained due to the presence of continuous (health-related) selection processes – or the Healthy Worker Effect (HWE) (70, 71). The HWE may (strongly) bias the relation between health and labour participation over time. The HWE comprises primary and secondary selection processes. Primary selection refers to healthier people being more likely to be hired/ever start working compared to less healthy people (72, 73). Secondary selection refers to (older) workers whom remain in the labour force are generally healthier compared to those who leave the labour force (70, 73-76). Because of (health-related) selection processes, older workers who remain in the labour force tend to be healthier compared to those who leave employment (earlier) (4, 70, 73, 74), which results in the study of relatively healthy older workers and hence may bias study findings. When studying the relation between health and labour

participation a longitudinal approach with a substantial follow-up should be used which ideally also takes into account the selection processes.

The relation between health and labour participation may further be affected by various individual, demographic, and work-related factors (4, 41, 77). For instance, lower educated people generally suffer from more health problems compared to higher educated people. Additionally, lower educated people are more likely to already be involved in physically demanding work from a younger age. It is therefore crucial to consider and adjust for the impact of these factors, since they may also be interrelated and hence can bias the relation between health and labour participation over time.

Moreover, in-depth insight into the role of the work context on this relation, is however still limited. Most research so far investigated the role of the work context by studying the impact of various work-related factors directly on labour participation outcomes among older workers (36, 41, 46, 48, 49, 51, 78, 79), by assessing the relation between work-related factors and labour participations separately for workers with and without health problems (55), or by investigating the mediating role of health when assessing the effect of some work-related factors, such as job demands or job control, on labour participation (80). However, it is of particular interest to explore, besides psychosocial work-related factors, the work context more extensively since it encompasses a multitude of (other) factors such as task content, terms of employment, social relationships at work, working conditions, the characteristics of the employment organization, macro-economic circumstances (31), company labour agreements (64) or the availability of company pension schemes (35, 81, 82). Such studies may give further insights into how the work context can be optimized for older workers with health problem(s).

General objectives

This dissertation aims to gain more insight into the relations between health status and labour participation outcomes among older workers over time. In order to achieve this aim, the following two general objectives will be formulated.

Firstly, we aim to gain more insight into the complex relations between health status and labour participation outcomes among older workers over time, by considering multiple health indicators as well as labour participation outcomes. Hereby, adjustments for potential contextual/confounding factors originating

from personal/private, demographic, and the work domain will be performed and longitudinal findings will be interpreted in the light of (continuous) health-related selection processes.

Secondly, we aim to gain more insight into the potential facilitating and/or hindering impact of work-related factors from the work context on this relation. Hereby, findings may reveal (a) facilitating factor(s) which may aid older workers' labour participation and as such may give insights into how the work context can be optimized for workers with health problem(s).

Hereby, the findings obtained in this dissertation can provide valuable entry points for the development of preventive measures/interventions aiming to enhance sustainable labour participation among older workers and to enable them to prolong working lives. Moreover, the results of this dissertation may be used for tailoring interventions to specific for subgroups of older workers based on their health status, age and work environment.

Approach

To meet to the general objectives formulated in this dissertation and to investigate the complex relations between health status and labour participation outcomes over time, several requirements concerning study design and study population, should be accomplished.

It can be assumed that the impact of health on labour participation outcomes may be different for (older) workers differing in health, age, or profession/sector in which one is employed. This would require a large heterogeneous study population of (older) workers. Moreover, a broad range of data about health factors and labour participation outcomes would be required. Moreover, in line with the ICF, extensive data about a broad range of contextual factors, such as work-related, personal and social factors, would be required. Hereby, adjustments for potential contextual/confounding factors originating from personal/private, demographic, and the work domain could be made when studying relations between health status and labour participation outcomes over time.

Findings obtained from cross-sectional study designs cannot draw valid conclusion(s) about the relations between health status and labour participation over time. Therefore, a large-scale longitudinal (prospective) study design would be required to study cause and effect over time and to draw valid, causal conclusions

over time. Moreover, a longitudinal study design with multiple measurements in-between would be required in order to detect (health-related) adaptations, such as a reduction in working hours, over time. Also, a longitudinal study design with multiple measurements in-between would enable to interpret study findings in the light of continuous (health-related) selection processes over time.

In order to answer to the general objectives proposed in this dissertation, the data infrastructure of the large-scale longitudinal (prospective) Maastricht Cohort Study (MCS) will be used as a sampling frame for the separate studies (83). Depending on the research questions, subsamples of older workers and different follow-up periods will be studied.

The Maastricht Cohort Study

For answering the general objectives, the data infrastructure of the large scale prospective Maastricht Cohort Study (MCS) is highly valuable (83, 84). The MCS assessed a broad range of work-related, domestic, social, individual and health related factors and a wide range of outcomes (such as work status and retirement intentions) on an individual level over time by means of extensive self-administered questionnaires. The majority of the factors were assessed with existing, validated questionnaires. At cohort baseline (1998), a large heterogeneous occupational study population was included: 12,140 employees, involved in different jobs and educational levels, originating from 45 different companies and organizations, completed and returned the baseline questionnaire (83). From cohort baseline (1998) until 2002, respondents received multiple follow-up measurements, with additionally three follow-up questionnaires in 2008, 2012 and 2014 (83). The MCS covers a considerable broad follow-up period of 16 years, offering the opportunity to study cause and effect over time, which is relevant for the development of preventive measures/interventions. In addition, older workers' aged 45 years onwards were already well represented at cohort baseline (33.3 per cent) (83), and additionally the considerable follow-up period enabled us to further study groups of older workers at latter follow-up measurements. Moreover, the wide range of work related and individual factors enable to study the role of the context in the relation between health and labour participation and to correct for important confounders.

Research questions

Taking into account the approach, the general objectives are answered through the following specific research questions using the data-infrastructure of the MCS:

1. What is the impact of chronic health condition(s) and self-perceived health, independently, on various indicators of labour participation and retirement over six-year follow-up period among older employees, and additionally what is the impact of differences between prevalent and incident chronic health condition(s) in this relation?
2. What is the relationship between mental health – more specifically depressive complaints – on different indicators of labour participation among older employees over two-year follow-up period, and additionally what is the potential impact of different work contexts when studying this relation?
3. What is the relation between health – chronic health condition(s), the number of chronic health condition(s), and self-perceived health - and labour participation outcomes over respectively two – and 16-year follow-up period among older employees, and additionally does these associations over time differ within different sectors? Study findings will be interpreted in the light of continuing health-related selection processes, notably the healthy worker effect.
4. What is the impact of differing health status on older dayworkers' considerations towards early retirement at article baseline and does strongly agreeing with these considerations towards early retirement at article baseline predict various labour participation outcomes over two-year follow-up period and does these associations may additionally differ for older employees differing in health status?
5. What is the potential facilitating impact of work engagement on older employees' intentions to respectively prolong working live or to retire earlier, presenteeism behavior, and leaving employment, among older employees over two-year follow-up period, and does these associations differ for older employees differing in health status?

Outline of the dissertation

To address the specific research questions that were formulated in this chapter, we first aimed to gain more insight into the impact of various objective and

subjective health measures, independently, on various indicators of labour participation and retirement over time (Chapter 2). In Chapter 3, the impact of one specific mental chronic health condition, that is depressive complaints, on various labour participation outcomes among older employees over time, is assessed. Additionally, the impact of facilitating and/or hindering work-related factors from the work context on this relation is studied. In Chapter 4, relations between health and labour participation are studied over a considerable follow-up period of 16 years and additionally sector-stratified analyses are performed. In addition, these longitudinal findings covering a follow-up period of 16-years are interpreted in the light of (continuing) health-related selection processes. Chapter 5 states the importance to assess labour participation among older workers already earlier during the employment process, since various steps and/or phases might precede definite choices regarding labour participation and (early) retirement. Besides external (work-related) factors from the work context, in Chapter 6 the impact of internal factors, such as work engagement, is studied in order to investigate whether work engagement could enhance on older workers' labour participation. At last, Chapter 7 provides a general discussion in which an overview of the (main) findings of this dissertation, strengths and limitations, and implications for further research and practical implications for preventive measures/interventions aiming to enhance older workers' labour participation, are presented.

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2

Chronic conditions and self-perceived health among older employees in relation to indicators of labour participation and retirement over time

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Abstract

Background A significant proportion of older employees leave the labour market early, amongst others via unemployment or disability benefits, implying that health might affect possibilities to extend working life.

Objective This study 1) examined associations between chronic conditions (subtypes) and self-perceived health (SPH), independently, and indicators of labour participation and retirement over six-year follow-up among older employees, and 2) explored the impact of differences between prevalent and incident presence of chronic condition(s) in this relation.

Methods Older workers (aged >45 years) included in the Maastricht Cohort Study were studied (n=1,763). The Health and Work Performance Questionnaire assessed chronic conditions and one item from the Short Form health survey-36 assessed SPH. Cox regression analyses assessed associations between chronic conditions and SPH, independently, and retirement intentions, employment status, decreasing working hours, and changes in work over time.

Results Employees with coexistent physical-mental chronic conditions showed higher risks to lose employment and to receive a disability benefit (HR 1.85, 95% CI 1.23-2.78; HR 8.63, 95% CI 2.47-30.11) over time compared to healthy employees. No statistically significant associations were found between SPH and indicators of labour participation and retirement over time. Having chronic condition(s) was cross-sectionally associated with lower SPH scores and larger proportion of part-timers – compared to healthy employees.

Conclusions Chronic condition(s) among older employees were substantially associated with indicators of labour participation and retirement over time. The role of SPH was mainly instantaneous. Findings provide valuable input for preventive measures aiming to prevent an early labour market exit of older employees.

Keywords Objective health – Subjective health – Observational – Ageing workers – Prospective

Introduction

The working population is ageing due to, amongst others, increasing life expectancy. This leads to an increased need for labour participation [1-2]. To minimize the burden on social security and pension systems [3-4] several policy measures (such as increasing legal retirement age) have been implemented [3, 5-6], which have led to a substantial increase in the general net labour participation rate of employees among European countries, such as the Netherlands [5, 7]. Yet, amongst older employees and/or employees suffering from chronic condition(s), the percentage of employees involved in labour participation remains lower [8-9]. As an illustration, the overall labour participation rate in Europe amongst people aged 20-64 years was 72.4 per cent in 2018 [10], whereas for older employees (aged 55-64 years) this was 57.8 per cent [10]. Additionally, the prevalence of chronic conditions is increasing. Currently, more than a quarter of the overall working population in the European Union reports having chronic condition(s) [4, 11-12]. Among older European employees aged 45-65 years, 35.0 per cent works whilst suffering from a long-standing illness in 2018 [11].

There is no uniform definition of chronic conditions [8]. The World Health Organization (WHO) states: 'chronic conditions are health problems requiring ongoing treatment for a period of years or decades', implying that chronic conditions are recurrent, long-lasting and persistent, and cannot be cured [8]. Chronic conditions have a substantial impact on labour market participation both at the macro and micro level [8, 13-14]. At the macro level, chronic conditions contribute to substantial healthcare costs and reduced capacity of the work force since employees with chronic condition(s) leave the labour market earlier [3-4, 11-12, 15-17]. At the micro level, chronic conditions may request adjustments in working life (such as adaptation of working hours) and coping of the individual employee [8].

Previous studies showed that chronic conditions amongst older employees are predominantly considered a decisive factor to determine whether or not to continue working or to retire (earlier) [13, 18-22]. Employees suffering from chronic condition(s) often perceive difficulties to remain involved in employment or to re-enter employment after absence [4, 8 ,12, 23-24]. Poor health is considered a strong predictor for employees to exit the labour market specifically via early retirement benefits, unemployment or disability benefits [8, 14-15, 17, 19-20, 24-26]. Yet, these studies often assessed health as a broad concept in terms of ill or poor health [20,

27-28]. It is of added value to distinguish between mental and physical chronic condition(s) since they affect labour participation differently [3, 16, 22].

Mental chronic condition(s) strongly affect labour participation in terms of higher absenteeism and/or presentism, and higher sickness benefits, disability benefits, and unemployment insurance benefits [3, 15-16]. Physical chronic condition(s) are often associated with limitations in work activities, and strongly influence the retirement decision-making process. Often, physical chronic conditions oblige employees to retire early involuntary [29]. Also the combination of at least one mental and one physical chronic conditions simultaneously is frequently common due to common risk factors [3, 30]. This combination is considered even more disabling, affecting work loss and retirement [17, 30]. In this study, this combination is referred to as 'coexistent physical-mental chronic conditions', irrespectively of order.

In order to provide input for preventive measures aiming to prevent early labour market exit amongst older employees and to gain more insight into the potential impact of health on the possibility to extend working life, it is invaluable to study self-perceived health (SPH) in addition to chronic condition(s). SPH is considered an important predictor affecting the ability and willingness to extend working life amongst older employees [18, 31-32]. Even without any diagnosed illness employees might still perceive their health as poor [32], which underlies the importance to study the impact of SPH, separately, within the same study population. Poor SPH is strongly associated with early labour market exit, more specifically with an increased risk to apply for a disability pension [20, 31-32]. Contrary, good SPH health is considered a strong predictor to work until retirement for both older workers with and without chronic condition(s) [21].

The first goal of this study is therefore to gain more insight into the potential impact of chronic conditions (mental, physical, or coexistent physical-mental chronic conditions) and SPH, independently, on labour participation and retirement outcomes of older employees over time.

When studying this relation, it is important to also consider both willingness (intentions and motivations) and ability of older employees to extend working life. Therefore, both objective as well as subjective outcome measures will be distinguished in order to advance our understanding of labour participation and retirement amongst older employees. Chronic conditions are strongly associated with retirement intentions [19, 32-33]. Since exit from paid employment might be a gradual process [34] and employees might make adjustments in the work situation

in order to accommodate working whilst having chronic condition(s), a decrease in working hours should be assessed and taken into account when studying the relation between health and retirement. SPH is strongly associated with (early) labour market exit amongst older employees [31-32], therefore various labour market exit routes should ideally be explored such as disability or unemployment benefits. This study will thus assess both objective (employment status; potential exit routes; and working hours) and subjective (retirement intentions and whether changes were made in work due to health reasons) outcome measures.

Among employees with a chronic condition, the presence of (a) chronic condition(s) can be prevalent or incident, which might also affect employees' ability to continue working [35]. The second goal of this study is therefore to explore the potential role of differences between prevalent and incident presence of chronic condition(s) on the distribution of SPH and on labour participation and retirement among older employees.

To conclude, this longitudinal study aims to firstly gain more insight into the potential impact of chronic conditions (mental, physical, coexistent physical-mental chronic condition(s)) and SPH, independently, on labour participation and retirement among older employees over a six-year follow-up period. Secondly, this study aims to explore the impact of differences between prevalent and incident presence of chronic condition(s) when studying this relation. Study findings might serve as valuable input for the development of preventive measures aiming to facilitate sustainable employment for older employees with deteriorating health in terms of both chronic condition(s) and SPH.

Methods

Study population

This study is based on data from the ongoing Maastricht Cohort Study (MCS) [36]. At baseline measurement in May 1998, n=12,140 respondents from 45 companies were included [37]. Extensive self-administered questionnaires were used to collect data on multiple follow-up waves. The design of this prospective cohort is described elsewhere [37].

The 2008 wave (n=6,082) was considered article baseline (T0), and two follow-up measurements 2012 (T=48 months) and 2014 (T=72 months) were used in this study, since items and concepts for both health and labour participation were

measured consistently over these waves, resulting in a total follow-up period of six years. At T=48 months, n=5,814 questionnaires were sent out and n=4,783 valid questionnaires were received. At T=72 months, n=3,450 questionnaires were sent out to employees not fully retired at T=72 months and n=2,945 valid questionnaires were received (85.4%). Employees who indicated being fully retired at T=72 months received a separate questionnaire (n=1,284) and were not eligible for inclusion.

At T0, employees aged 45 to 59.17 years and who indicated being in current employment by an employer (n=3,782) were included. Workers aged below 45 years were excluded since these were not considered older employees. Employees aged 59.17 years onwards were excluded, since they could reach the (in that time window applicable) legal retirement age of 65 years and 2 months during the follow-up Moreover, employed employees yet who also indicated being (partly) disabled, being on sabbatical – pregnancy – or parental leave, receiving (partially) disability or unemployment benefits, or being in (partially) retirement, were excluded since some were our main outcomes of interests and our study population should still be actively employed at T0 in order to study incident cases of (early) labour force exit routes over time. Additionally, self-employed employees were excluded, due to potential substantial differences in work content and responsibility, and different entitlement to receive (disability or unemployment) benefits compared to employees employed by an employer. Employees with multiple jobs were excluded since no information available on the content of the second job. Moreover, employees performing night and/or shift work, or working irregular hours, were excluded since these outside regular working hours are divers and each affect employees' well-being and health differently [38]. This resulted in a total study population of n=1,763 older employees at T0. Furthermore, employees who did not complete all items required for respectively calculating chronic conditions (n=64) or SPH (n=8) were excluded, resulting in respectively n=1,699 employees for analyses regarding chronic conditions and n=1,755 employees for analyses regarding SPH.

Health status of employees

The validated Health and Work Performance Questionnaire (HPQ) was used to identify the presence of 34 pre-specified health conditions [39]. The 34 pre-specified conditions of the HPQ were matched with the International Classification of Primary Care-Version 2 (ICPC-2) codes of 28 pre-specified conditions listed by the Dutch National Institute of Public Health and Environment (RIVM) [40-41]. Several health conditions on the HPQ list might be considered determinants or precursors

of disease(s) such as overweight or hypertension, and were therefore not defined as chronic condition(s) according to the RIVM listing [42]. Seventeen chronic mental or physical conditions of the HPQ directly matched with the conditions listed by the RIVM. Some condition(s) Employees could indicate whether or not they have chronic condition(s) and whether they had received or currently received treatment for the(se) condition(s) [39]. Employees were labelled as having one (or more) condition(s) when marking for that condition the answers: 'Yes, I currently have this condition' and; 'I have never received a treatment', 'I have received a treatment in the past', or 'I am currently receiving treatment'. Additionally, employees could list one health condition, which was not previously listed, in an open-ended question.

Healthy employees

Employees indicating 'No, I currently do not have this condition' to all seventeen mental or physical chronic conditions and additionally did not list a mental or physical chronic condition in the open-ended question, were considered the reference group of healthy employees. This resulted in n=978 healthy employees at T0.

Mental chronic condition(s)

Employees indicating having at least one or more of the following mental chronic condition(s): burn-out, anxiety disorder, depression, schizophrenia or other psychotic disorder, and/or bipolar disorder (including mania, hypomania), and not indicating to have (a) physical chronic condition(s), were included in the group of employees having mental chronic condition(s). This resulted in n=62 employees with at least one or more mental chronic condition(s) at T0.

Physical chronic condition(s)

Employees indicating having at least one or more of the following physical chronic condition(s): asthma, chronic obstructive pulmonary disease (COPD), heart disease, consequences of a stroke or cerebral infarction, liver inflammation or cirrhosis of the liver, type I diabetes, type II diabetes, chronic back / neck pain, arthritis or rheumatism, nervous system disease (including epilepsy, MS), migraine, and/or cancer, and not indicating to have (a) mental chronic condition(s), were included in the group of employees having physical chronic condition(s). This resulted in n=551 employees with at least one or more physical chronic condition(s) at T0.

Coexistent physical-mental chronic conditions

Employees indicating having at least one mental chronic condition(s) and at least one physical chronic condition(s) simultaneously, were included in the group of employees having coexistent physical-mental chronic conditions. This resulted in n=108 employees with at least one mental and at least one physical chronic condition at T0.

Differences between prevalent and incident presence of chronic condition(s)

Employees were identified as either having or not having (a) chronic condition(s) at T0. Additionally, employees' health status was assessed at the subsequent follow-up measurement (T=48 months). Again, seventeen chronic mental or physical conditions in the HPQ list matched directly with the conditions listed by the RIVM [41]. As such, three groups of employees were identified at T=48 months: employees indicating neither having (a) chronic condition(s) at T0 nor at follow-up measurement, were classified as healthy employees (n=593); employees indicating not having (a) chronic condition(s) at T0 yet indicating having (a) chronic condition(s) at follow-up measurement, were classified as employees with incident chronic condition(s) (n=180); and employees indicating having (a) chronic condition(s) both at T0 and at follow-up measurement, were classified as employees with prevalent chronic condition(s) (n=409).

Self-perceived health

SPH was measured at T0 by using an item from the Dutch version of the Short Form Health Survey-36 (SF-36 item) [37, 43]. The SF-36 Health Survey is a widely used generic health status measurement [43], originally developed to examine the self-reported health status of patients with a range of chronic conditions [43, 44]. The item asked: 'How do you rate your general health', with five answer possibilities: excellent, very good, good, moderate, or poor. In line with [45], the five answer possibilities were dichotomized into 'good health' (excellent, very good, good) and 'moderate/poor health' (moderate, bad). Employees with good SPH were considered the reference group.

Outcome assessment

Indicators of labour participation and retirement

Retirement intentions

At T0 and T=48 months and T=72 months, employees' retirement intentions were assessed by using a single-item 'Have you considered retiring before reaching your mandatory retirement age?'. Answer possibilities were 'no', 'yes, sometimes', and 'yes, often'. In line with other studies [46, 47], answer possibilities were dichotomized into having weak retirement intentions (no; yes, sometimes) and having strong retirement intentions (yes, often).

Working hours

At T0 and follow-up measurements, one item assessed the number of working hours per week. Response options were: >40, 36-40, 26-35, 16-25, or <16 hours per week, which were recoded into: full-time (>40 or 36-40 h per week), or part-time (26–35, 16–25, < 16 h per week) employment. Employees indicating to transit from full-time employment at T0 to part-time employment at follow-up measurement, were classified as having decreased working hours.

Changes in work due to health reasons

Employees could indicate whether they 'made changes in work due to health reasons in the past year' at T0. Answer possibilities were 'no' or 'yes'.

Employment status

At T0, all employees were in employment by an employer. At T=48 months and T=72 months, employees were again asked to provide an overview of their work status since the previous questionnaire. At T=48 months, employees indicating being 'in employment by an employer' or 'in self-employment (fully or partially)' were classified as being in employment. All other employees were classified as having 'lost employment' at T=48 months, irrespective of the underlying reason(s). At T=72 months, employees indicating being in 'paid work' or 'in self-employment (fully or partially)' were classified as being in employment. All other employees were classified as having 'lost employment' at T=72 months, irrespective of the underlying reason(s).

Labour force exit route
At T0, all employees were employed. At follow-up measurements, employees could have lost employment. To assess the underlying reason(s) of having lost employment, the following labour force exit routes were specified at T=48 months and T=72 months: disability benefits, unemployment benefits, and retirement benefits.

Disability benefits
Employees indicating being '(partially) incapacitated for work at T=48 months', or employees indicating being '(partially) incapacitated for work according to the Dutch work disability act (WAO/WIA)' at T=72 months, were classified as receiving disability benefits.

Unemployment benefits
Employees indicating 'to receive an unemployment benefit' or who 'actively searched for a (paid) job' at T=48 months, or employees indicating being '(partly) involuntarily unemployed (unemployment benefit)' at T=72 months, were classified as receiving unemployment benefits.

Retirement benefits
Employees indicating to be in '(early or part-time) retirement' at T=48 months, or employees indicating 'being (partly) retired' at T=72 months, were classified as receiving retirement benefits.

Confounding and contextual factors
Based on previous research [1, 20, 48], confounding factors from the personal/private, work, and health domain were identified. All confounding factors were measured at T0, except for respondents' educational level which was measured at May 1998.

Personal/private domain
Age, gender, educational level, and whether or not living alone, were assessed. Employees were asked to indicate their highest completed level of education – which was recoded: low (primary school, lower vocational education), medium (lower secondary school, intermediate vocational school, upper secondary school), or high (higher vocational school, university) educational level [6].

Work domain

Decision latitude and psychological job demands were measured by using the validated Dutch version of the Job Content Questionnaire (JCQ) [49]. All subscales from the JCQ had a four-point answer scale ranging from 'strongly disagree' to 'strongly agree'. Decision latitude was measured by the sum of two subscales: skill discretion (six items; e.g. 'My job requires a high level of skill') and decision authority (three items; e.g. 'I have a lot to say about what happens on my job'). Psychological job demands were assessed by the sum of five items (e.g. 'My job requires working very hard'). The total subscale score ranges from 24-96 for decision latitude and 12-48 for psychological job demands. Co-worker social support (four items; e.g. 'People I work with are helpful in getting the job done') and supervisor social support (four items; e.g. 'My supervisor is helpful in getting the job done') were measured with scale ranges from 4-16. Emotional demands were measured by the five questions, of which three questions originate from the Dutch Questionnaire on the Experience and Evaluation of Work (VBBA) [50-51], one question originates from the Dutch questionnaire on Work and Health [49], and one question is self-formulated, resulting in a scale score ranging from 0 to 5. As mentioned above, one item assessed working hours (per week). The five answer options: >40, 36-40, 26-35, 16-25, or <16 h/wk were recoded into full-time (>40 or 36-40 h per week), or part-time (26–35, 16–25, < 16 h per week) employment. Furthermore, one item from the Dutch questionnaire on Work and Health [49] assessed physically demanding work (yes/no).

Health domain

When assessing the longitudinal association between chronic condition(s) and indicators of labour participation and retirement over time, SPH was considered a confounding variable. When assessing the longitudinal association between SPH and indicators of labour participation and retirement over time, the presence of chronic condition(s) was considered a confounding variable.

Statistical analyses

All analyses were undertaken using SPSS Statistics IBM 22.0. P-values below .05 were considered statistically significant. At T0, demographic/private, work, and health factors, and indicators of labour participation and retirement (working hours, retirement intentions, changes in work due to health reasons), were described for employees based on chronic conditions and SPH. Differences at T0

across the groups were examined using one-way ANOVA for continuous measures and χ2-test of independence for dichotomous and categorical variables. For the cross-sectional analyses, no adjustments were made for potential confounding factors. Additionally, at T=48 months, the distribution of SPH was described for employees based on differences between prevalent and incident presence of chronic condition(s) by using one-way ANOVA for continuous measures and χ2-test of independence for dichotomous and categorical variables. For the longitudinal analyses, Cox regression analyses were performed to assess the relation between chronic conditions and SPH, independently, on all indicators of labour participation and retirement: retirement intentions, employment status, labour force exit routes (disability or unemployment benefits, or (early) retirement benefits), and decreasing working hours over time. The reference group consisted of respectively healthy employees and employees with good SPH. For the longitudinal analyses, adjustments were made for potential confounding factors. In the first model, adjustments were made for age, gender, educational level, and whether or not living alone. In the second model, additional adjustments were made for physically demanding work, psychological job demands, decision latitude, emotional demands, co-worker social support, supervisor social support, and working hours. In the third model, additional adjustments were made for respectively SPH and the presence of (a) chronic condition(s). Prevalent cases for the respective indicator of labour participation and retirement at T0 were excluded in order to study solely incident cases at follow-up. Hazard ratios (HRs) and 95% confidence intervals (95% CI) were calculated.

Results

The baseline characteristics for employees based on chronic conditions and SPH are presented in Table 1. Statistically significant differences were observed between healthy employees and employees with respectively physical and coexistent physical-mental chronic conditions regarding demographic factors (gender and educational level). Demographic factors (age, living alone, and financial circumstances) also significantly differed amongst employees with good SPH and employees with moderate/poor SPH. As for health factors, employees with mental, physical, or coexistent physical-mental chronic conditions more often indicated moderate/poor SPH (respectively 11.5; 20.0;

Table 1: Description of demographic/private, work-related, and health factors for healthy employees, employees with mental, physical, or coexistent physical-mental chronic conditions, and employees with good SPH or moderate/poor SPH at article baseline (2008)

	Healthy employees (n=978)	**Employees with mental chronic condition(s)** (n=62)	**Employees with physical chronic condition(s)** (n=551)	**Employees with coexistent physical-mental chronic conditions** (n=108)	*p-value*	**Good SPH** (n = 1,550)	**Moderate/ poor SPH** (n = 205)	*p-value*
Demographic and private factors								
Age Mean, SD *Years*	52.04 (3.97)	52.02 (4.02)	52.33 (4.04)	52.26 (3.93)	.574	52.02 (4.00)	52.99 (3.79)	.001*
N, %								
Gender								
Male	756 (77.5)	46 (76.7)	363 (66.7)	71 (66.4)	<.001*	1,124 (73.1)	146 (71.9)	.716
Educational level								
Low	174 (18.0)	19 (31.1)	134 (24.8)	31 (29.8)	<.001*	322 (21.1)	53 (26.2)	.090
Middle	279 (28.9)	15 (24.6)	181 (33.5)	25 (24.0)		450 (29.5)	65 (32.2)	
High	513 (53.1)	27 (44.3)	225 (41.7)	48 (46.2)		753 (49.4)	84 (41.6)	
Living alone								
Yes	91 (9.3)	3 (5.0)	51 (9.4)	12 (11.3)	.609	135 (8.8)	30 (14.7)	.007*
Partner retired								
Yes	21 (2.4)	1 (1.8)	16 (3.3)	4 (4.5)	.565	36 (2.4)	7 (3.5)	.250
Satisfied with financial circumstances								
Yes	877 (89.9)	49 (80.3)	470 (85.6)	88 (81.5)	.004*	1,374 (88.9)	159 (77.9)	<.001*

Work-related factors N, %								
Physically demanding work *Yes* Mean, SD	113 (11.6)	8 (13.1)	114 (20.7)	28 (26.7)	<.001*	222 (14.4)	52 (25.6)	<.001*
Psychological job demands(a)	31.27 (5.47)	31.45 (6.54)	32.25 (5.60)	33.79 (5.49)	<.001*	31.64 (5.49)	32.56 (6.30)	.028*
Decision latitude (b)	75.03 (9.66)	72.23 (10.44)	73.71 (10.28)	70.95 (11.87)	<.001*	74.52 (10.01)	71.50 (10.41)	<.001*
Emotional demands (c)	.98 (1.11)	1.33 (1.22)	1.40 (1.31)	1.81 (1.53)	<.001*	1.15 (1.22)	1.48 (1.38)	<.001*
Co-worker social support(d)	12.02 (1.35)	11.93 (1.67)	11.96 (1.41)	11.95 (1.79)	.822	12.01 (1.38)	11.92 (1.68)	.398
Supervisor social support(d)	10.69 (2.26)	10.40 (2.80)	10.72 (2.21)	10.02 (2.34)	.021*	10.71 (2.23)	10.12 (2.59)	<.001*
Health factors N, %								
Good SPH	930 (95.2)	54 (88.5)	439 (80.0)	72 (66.7)	<.001*	/	/	/
Moderate/poor SPH	47 (4.8)	7 (11.5)	110 (20.0)	36 (33.3)		/	/	/
SPH (0-100) Mean, SD	59.72 (17.86)	52.87 (16.52)	50.50 (18.34)	42.36 (13.87)	<.001*	/	/	/
Depressive complaints(e) Mean, SD	2.39 (2.77)	4.90 (4.05)	3.05 (3.08)	5.56 (3.61)	<.001*	2.56 (2.85)	5.44 (3.77)	<.001*
Number of conditions								
0	978 (100)	0 (0)	0 (0)	0 (0)	<.001*	930 (64.6)	47 (27.5)	<.001*
1	0 (0)	38 (74.5)	360 (72.4)	0 (0)		342 (23.8)	54 (31.6)	
>=2	0 (0)	13 (25.5)	137 (27.6)	88 (100.0)		167 (11.6)	70 (40.9)	

(a) = scale range = 12-48; (b) = scale range = 24-96; (c) = scale range = 0-5; (d) = scale range = 4-16; (e) = scale range = 0-21 using HADS.

and 33.3%) compared to healthy employees (4.8%). Additionally, amongst employees with moderate/poor SPH, 40.9 per cent indicated having two or more chronic condition(s), which was substantially higher compared to employees with good SPH (11.6 per cent).

Cross-sectional associations between chronic conditions and SPH, independently, and indicators of labour participation and retirement

Retirement intentions

The indicators of labour participation and retirement at T0 for employees, split for chronic conditions and SPH, are presented in Table 2. With regards to chronic conditions, amongst employees indicating mental, physical, or coexistent physical-mental chronic condition(s), respectively 29.0; 18.6; and 28. 7 per cent indicated strong retirement intentions whereas amongst healthy employees 15.5 per cent indicated strong retirement intentions ($p<.001$). With regards to SPH, amongst employees indicating moderate/poor SPH, 34.8 per cent indicated strong retirement intentions whereas among employees indicating good SPH, 15.6 per cent indicated strong retirement intentions ($p<.001$).

Furthermore, cross-sectional associations between SPH and indicators of labour participation and retirement within the four distinguished groups of employees based on chronic conditions, are presented in Table 3. Amongst healthy employees, in the group with strong retirement intentions 90. 1 per cent of the employees perceived good SPH, while this was 96.1 per cent in the group with weak retirement intentions at T0 ($p<.001$). Amongst employees with physical chronic condition(s), in the group with strong retirement intentions 37.3 per cent of the employees perceived moderate/poor SPH, while this was 16.0 per cent in the group with weak retirement intentions ($p<.001$). Amongst employees with mental and coexistent physical-mental chronic condition(s), no statistically significant associations were found between SPH and retirement intentions (respectively $p=.954$ and $p=.229$) (Table 3).

Working hours

With regards to chronic conditions, amongst employees indicating mental, physical or coexistent physical-mental chronic condition(s), respectively 23.0; 26.7; and 33.0 per cent indicated working part-time, whereas amongst healthy employees, 20.9 per

Table 2: Description of indicators of labour participation and retirement for healthy employees, employees with mental, physical, or coexistent physical-mental chronic conditions, at article baseline (2008)

	Healthy employees (n=978)	**Employees with mental chronic condition(s)** (n=62)	**Employees with physical chronic condition(s)** (n=551)	**Employees with coexistent physical-mental chronic conditions** (n=108)	*p-value*	**Good SPH** (n = 1,550)	**Moderate/ poor SPH** (n = 205)	*p-value*
Indicators of labour participation and retirement								
N, %								
Retirement intentions								
Strong	151 (15.5)	18 (29.0)	102 (18.6)	31 (28.7)	<.001*	240 (15.6)	71 (34.8)	<.001*
Weak	823 (84.5)	44 (71.0)	445 (81.4)	77 (71.3)		1,302 (84.4)	133 (65.2)	
Working hours								
Full-time	768 (79.1)	47 (77.0)	401 (73.3)	71 (67.0)	.007*	1,167 (76.0)	156 (76.5)	.877
Part-time	203 (20.9)	14 (23.0)	146 (26.7)	35 (33.0)		369 (24.0)	48 (23.5)	

Table 3: Cross-sectional associations between SPH and indicators of labour participation and retirement for healthy employees, employees with mental or physical chronic condition(s), or coexistent physical-mental chronic conditions at article baseline (2008)

	Retirement intentions			Working hours			Change in work due to health reasons in the past year		
	Strong	Weak		Full-time	Part-time		Yes	No	
	Mean, SD	*Mean, SD*	p-value	*Mean, SD*	*Mean, SD*	*p-value*	*Mean, SD*	*Mean, SD*	*p-value*
Study population (n=1,763)									
SPH									
Good	77.2%	90.7%	<.001*	88.2%	88.5%	.877	70.1%	89.2%	<.001*
Moderate/poor	22.8%	9.3%		11.8%	11.5%		29.9%	10.8%	
Healthy employees (n=978)									
SPH									
Good	90.1%	96.1%	<.001*	94.8%	97.0%	.178	73.1%	95.8%	<.001*
Moderate/poor	9.9%	3.9%		5.2%	3.0%		26.9%	4.2%	
Employees with mental chronic conditions (n=62)									
SPH									
Good	88.9%	88.4%	.954	89.4%	84.6%	.637	75.0%	89.5%	.380
Moderate/poor	11.1%	11.6%		10.6%	15.4%		25.0%	10.5%	
Employees with physical chronic condition(s) (n=551)									
SPH									
Good	62.7%	84.0%	<.001*	80.3%	78.6%	.675	71.1%	80.6%	.159
Moderate/poor	37.3%	16.0%		19.8%	21.4%		28.9%	19.4%	
Employees with coexistent physical-mental chronic conditions (n=108)									
SPH									
Good	58.1%	70.1%	.229	62.0%	74.3%	.208	50.0%	68.8%	.165
Moderate/poor	41.9%	29.9%		38.0%	25.7%		50.0%	31.2%	

cent indicated working part-time (p=.007) at T0. With regards to SPH, no statistically significant association was found between SPH and working hours (Table 2).

Within the four distinguished groups based on chronic conditions, results did not show statistically significant associations between SPH and working hours (Table 3).

Change in work due to health reasons in the past year

Within the four distinguished groups based on chronic conditions, amongst employees with mental, physical, and coexistent physical-mental chronic conditions, no statistically significant association were found between SPH and changes in work due to health reasons (Table 3). Results showed that amongst healthy employees, in the group of employees who made changes in work due to health reasons, 26.9 per cent of the employees perceived poor/moderate SPH, while this was 4.2 per cent in the group of employees who did not make changes in work due to health reasons at T0 (p<.001).

Longitudinal associations between chronic conditions and SPH, independently, and indicators of labour participation and retirement

Retirement intentions

Over six-year follow-up period, no statistical significant associations were found between chronic conditions and retirement intentions (Table 4.1.). Also, no statistical significant associations were found between SPH and retirement intentions over time (Table 4.2.).

Working hours

Employees with coexistent physical-mental chronic conditions had a substantially higher risk for decreasing working hours (HR 2.19, 95% CI 1.18-4.08) over time compared to healthy employees (Table 4.1.). No statistical significant associations were found between SPH and decreasing working hours over time (Table 4.2.).

Employment Status

Employees with coexistent physical-mental chronic conditions had a substantial higher risk to lose employment (HR 1.85, 95% CI 1.23-2.78) over time compared to healthy employees (Table 4.1.). No statistical significant associations were found between SPH and losing employment over time (Table 4.2.).

Labour force exit route

Disability benefits

Employees with physical and coexistent physical-mental chronic condition(s) had significant higher risks to receive disability benefits over time (respectively HR 4.65, 95% CI 1.60-13.50; and HR 8.63, 95% CI 2.47-30.11) compared to healthy employees (Table 4.1.). Fully adjusted models showed no statistical significant associations between SPH and receiving disability benefits over time (Table 4.2.). However, the second model which was solely adjusted for factors from the personal/private and work domain, showed that employees with moderate/poor SPH had a significant higher risk to receive disability benefits over time compared to employees with good SPH (HR 3.58, 95% CI 1.55-8.25).

Unemployment benefits

No statistical significant associations were found between chronic conditions and receiving unemployment benefits over time (Table 4.1.). Additionally, no statistical significant associations were found between SPH and receiving unemployment benefits over time (Table 4.2.).

Retirement benefits

No statistical significant associations were found between chronic conditions receiving and (early) retirement benefits over time (Table 4.1.). Also, no statistical significant associations were found between SPH and receiving unemployment benefits over time (Table 4.2.).

Exploring the role of differences between prevalent and incident presence of chronic condition(s) on SPH and indicators of labour participation and retirement among older employees: cross-sectional associations at T=48 months.

Self-perceived health

Results in Table 5 show that the highest proportion of employees indicating moderate/poor SPH was amongst employees with incident and prevalent chronic condition(s) (respectively 18.4 and 34.8%) at T=48 months. Contrary, amongst healthy employees 4.0 per cent indicated moderate/poor SPH ($p<.001$).

Table 4.1.: Longitudinal associations between mental (n=62), physical (n=551), coexistent physical-mental chronic conditions (n=108) – compared to healthy employees (n=978) - on losing employment, decreasing working hours, receiving disability benefits, receiving unemployment benefits, receiving retirement benefits, and having strong retirement intentions over 6-year follow-up (2008-2014)

							Employment status											
	Strong retirement intentions			Working hours[a]			Losing employment[b]			Disability benefits			Unemployment benefits			Retirement benefits		
	HR[1]	HR[2]	HR[3]	HR[1]	HR[2]	HR[3]	HR[1]	HR[2]	HR[3]	HR[1]	HR[2]	HR[3]	HR[1]	HR[2]	HR[3]	HR[1]	HR[2]	HR[3]
Healthy employees	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Employees with physical chronic condition(s) (n=551)	1.22 (.93-1.60)	1.17 (.89-1.55)	1.17 (.88-1.55)	1.20 (.83-1.73)	1.22 (.84-1.77)	1.24 (.85-1.81)	1.27 (1.00-1.61)*	1.23 (.97-1.56)	1.25 (.97-1.60)	5.11 (1.83-14.29)*	5.19 (1.83-14.71)*	4.65 (1.60-13.50)*	1.09 (.71-1.67)	1.08 (.70-1.67)	1.06 (.68-1.66)	.82 (.56-1.20)	.76 (.52-1.12)	.79 (.53-1.18)
Employees with mental chronic condition(s) (n=62)	.77 (.32-1.89)	.80 (.33-1.95)	.79 (.32-1.95)	1.39 (.60-3.19)	1.34 (.58-3.10)	1.35 (.58-3.13)	1.07 (.55-2.09)	1.06 (.54-2.08)	1.07 (.54-2.11)	N.a.	.N.a.	N.a.	1.32 (.48-3.64)	1.36 (.49-3.76)	1.34 (.48-3.73)	1.56 (.68-3.59)	1.38 (.59-3.22)	1.41 (.60-3.31)
Employees with coexistent physical-mental chronic conditions (n=108)	.95 (.50-1.82)	.88 (.46-1.69)	.88 (.45-1.69)	2.10 (1.16-3.79)*	2.13 (1.17-3.89)*	2.19 (1.18-4.08)*	1.96 (1.33-2.89)*	1.80 (1.22-2.67)*	1.85 (1.23-2.78)*	12.44 (3.90-39.71)*	10.33 (3.10-34.37)*	8.63 (2.47-30.11)*	1.46 (.69-3.06)	1.38 (.65-2.96)	1.35 (.62-2.93)	1.19 (.63-2.24)	1.05 (.54-2.02)	1.12 (.57-2.21)

[a] = transition from full-time to part-time employment, [b] = not participating in employment. 1 = adjusted for factors from the personal/private domain (age, gender, educational level, whether or not living alone), 2 = additionally adjusted for factors from the work domain (physically demanding work, psychological job demands, decision latitude, emotional demands, social support colleagues, social support supervisor, and working hours), 3 = additionally adjusted for SPH. N.a. could not be assessed due to insufficient cases.

Table 4.2.: Longitudinal associations considering the role of SPH on losing employment, decreasing working hours, receiving disability benefits, receiving unemployment benefits, receiving retirement benefits, and having strong retirement intentions over 6-year follow-up (2008-2014) for the whole study population

							Employment status											
	Strong retirement intentions			Working hours[a]			Losing employment[b]			Disability benefits			Unemployment benefits			Retirement benefits		
	HR[1]	HR[2]	HR[3]	HR[1]	HR[2]	HR[3]	HR[1]	HR[2]	HR[3]	HR[1]	HR[2]	HR[3]	HR[1]	HR[2]	HR[3]	HR[1]	HR[2]	HR[3]
Good SPH	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Moderate/poor SPH	1.00 (.64-1.57)	.96 (.61-1.50)	.92 (.58-1.46)	1.33 (.85-2.08)	1.33 (.85-2.10)	1.22 (.76-1.95)	1.23 (.91-1.67)	1.18 (.87-1.60)	1.07 (.78-1.48)	4.44 (1.99-9.90)*	3.58 (1.55-8.25)*	2.29 (.97-5.41)	1.47 (.87-2.48)	1.42 (.84-2.41)	1.38 (.80-2.41)	.94 (.57-1.55)	.91 (.55-1.50)	.97 (.58-1.63)

[a] = transition from full-time to part-time employment, [b] = not participating in employment. 1 = adjusted for factors from the personal/private domain (age, gender, educational level, whether or not living alone), 2 = additionally adjusted for factors from the work domain (physically demanding work, psychological job demands, decision latitude, emotional demands, social support colleagues, social support supervisor, and working hours), 3 = additionally adjusted for factor from the health domain (presence of chronic condition(s) (yes/no)

Labour participation and retirement outcomes

Retirement intentions
No statistical significant associations were found between differences between prevalent and incident presence of chronic condition(s) and retirement intentions (Table 5).

Working hours
Results showed that the highest proportion of employees indicating working part-time was amongst employees with incident and prevalent chronic condition(s) (respectively 32.1 and 38.0%) at T=48 months. Amongst healthy employees, 24.4 per cent indicated working part-time ($p < .001$).

Changes made in work due to health reasons in the past year
Results showed that amongst employees with incident and prevalent chronic condition(s) respectively 5.5 and 8.1 per cent indicated to have made changes in work due to health reasons in the past year. This percentage was substantially lower amongst healthy employees (1.1%) ($p<.001$).

Discussion

This study aimed 1) to examine associations between chronic conditions (mental, physical, or coexistent physical-mental chronic condition(s)) SPH, independently, and labour participation and retirement among older employees over a six-year time period, and 2) to explore the potential role of prevalent and incident presence of chronic condition(s) on SPH and labour participation and retirement among older employees. In sum, study findings showed that coexistent physical-mental chronic conditions were significantly associated with strong retirement intentions and part-time employment compared to healthy employees at T0. Longitudinal analyses showed that employees with coexistent physical-mental chronic conditions had substantial and significant higher risks for decreasing working hours, losing employment, and receiving disability benefits over time compared to healthy employees. SPH was substantially and significantly associated with strong retirement intentions at T0. However, no significant associations were found between SPH and indicators of labour participation and retirement over time,

Table 5: Exploring the role of prevalent and incident presence of chronic condition(s): cross-sectional associations with demographic, health, and indicators of labour participation and retirement at wave 2012

	Healthy employees (n=593)	**Employees who developed chronic condition(s) between time period 2008-2012** (n=180)	**Employees with chronic condition(s) at both time periods (2008-2012)** (n=409)	*p-value*
Demographic factors				
Age (Mean, SD)	55.87 (3.96)	56.43 (3.93)	56.24 (4.00)	.157
Health factors				
Self-perceived health (N, %)				
Good SPH	5.69 (96.0)	146 (81.6)	266 (65.2)	<.001*
Moderate/poor SPH	24 (4.0)	33 (18.4)	142 (34.8)	
Labour participation outcomes				
Retirement intentions				
Strong (N, %)	111 (20.4)	45 (27.1)	88 (23.9)	.151
Working hours (N, %)				
Full-time	410 (75.6)	112 (67.9)	225 (62.0)	<.001*
Part-time	132 (24.4)	53 (32.1)	138 (38.0)	
Changed work due to health reasons in past year? (N,%)				
Yes	6 (1.1)	9 (5.5)	30 (8.1)	<.001*

suggesting a more instantaneous effect of SPH on indicators of labour participation and retirement. As for differences between prevalent and incident presence of chronic condition(s), descriptive findings show that the proportion of employees indicating moderate/poor SPH and working part-time was substantially higher amongst employees with respectively incident and prevalent chronic condition(s) compared to healthy employees.

In line with previous research [18, 32, 52], cross-sectional results showed that the proportion of employees with strong retirement intentions was higher amongst employees with mental and coexistent physical-mental chronic condition(s) compared to healthy employees. Additionally, the proportion of employees working part-time was higher amongst employees with physical and coexistent physical-mental chronic condition(s) compared to healthy employees. With regards to SPH, cross-sectional results showed that the proportion of employees indicating strong retirement intentions was higher amongst employees who indicated moderate/poor SPH compare to those who indicated good SPH. Yet, no significant associations were found between SPH and working hours at T0. When assessing the associations between SPH and indicators of labour participation and retirement within the four distinguished groups based on chronic condition(s) at T0, results showed that amongst healthy employees and employees with physical chronic condition(s) in the groups with strong retirement intentions, the proportion of employees indicating moderate/poor SPH was substantially higher compared to those with weak retirement intentions. Additionally, amongst healthy employees, in the group who made changes in work due to health reasons, the proportion of employees indicating moderate/poor SPH was substantially higher compared to those who did not made changes in work, at T0.

Longitudinal results showed that employees with coexistent physical-mental chronic conditions had substantial and significant higher risks for decreasing working hours, losing employment, and receiving disability benefits over time compared to healthy employees. Additionally, employees with physical chronic condition(s) had a substantial and significant higher risk to receive disability benefits over time compared to healthy employees, which is in line with research showing associations between chronic conditions in general and the risk to exit employment through disability and unemployment benefits [9, 14, 19-20, 24, 26]. Nearly all observed statistical significant associations over time were found amongst the group of employees with coexistent physical-mental chronic conditions. Perhaps the presence of two or more chronic conditions simultaneously within an individual

may substantially increase the risk to exit paid employment [17, 22]. Study findings did not show significant associations between chronic conditions and strong retirement intentions over time. Perhaps selection processes and/or coping skills contributed to these findings. At T0, solely employees who were actively involved in labour participation were included. Perhaps the unhealthiest employees were already excluded (selective participation). Moreover, employees experiencing significant limitations due to chronic condition(s) might have already left the labour market. Employees who remained included in this study were perhaps better able to cope with chronic condition(s) whilst being in employment. With regards to SPH, these study findings did not show statistical significant associations between SPH and indicators of labour participation and retirement over time. This was contrary to our expectations, since previous research [18, 21, 31-32] demonstrated substantial longitudinal associations. Perhaps, the lack of significant associations between SPH and indicators of labour participation and retirements over time can at least partially be explained by the numbers of employees included in the reference group (n=1,550 employees with good SPH) and comparison group (n=205 employees with poor/moderate SPH). Due to the relatively low numbers of workers included in the reference group, and exclusion of prevalent cases of the respective outcomes, the statistical power to test these specific associations could be too low, as only few cases were for these analyses over time. Also, the time period between article baseline and the first follow-up measurement was four years: perhaps this time window was too broad to observe effects over time.

As for differences between prevalent and incident presence of chronic condition(s), descriptive findings showed that the proportion of employees indicating moderate/poor SPH, working part-time and made changes in work due to health reasons, was substantially and statistically significantly higher amongst employees with incident and prevalent chronic condition(s) compared to healthy employees. Yet, these study findings did not solely find differences between employees with incident/prevalent chronic condition(s) compared to healthy employees, also substantial differences between having incident or prevalent chronic condition(s) were found. As for SPH, the proportion of employees indicating poor/moderate SPH was almost twice as big amongst employees with prevalent chronic condition(s) compared to employees with incident chronic condition(s). These findings are supported by previous studies stating that illness duration affects patients' self-rated health: the longer patients were ill, the lower their perceived health score was [33]. Moreover, these study findings showed that the proportion of employees with incident or

prevalent chronic condition(s) were more likely to work part-time, compared to healthy employees. Perhaps employees with (a) chronic condition(s) reduced their working hours in order to remain in involved in (paid) employment [4, 12, 33].

Strengths and limitations

When interpreting the study findings several strengths and limitations of the study should be considered. The multitude of exposure and outcome measures studied is a major advantage. By assessing both SPH and different subtypes of chronic condition(s), independently, in relation to objective and subjective outcome measures of labour participation and retirement, this study provides a more comprehensive insight into (health) factors which might affect indicators of labour participation and retirement of older employees. Within this study we were able to distinguish between mental, physical, and coexistent physical-mental chronic condition(s). For further studies it might be of additional value to take into account comorbidity when having data available of the primary condition of interest and other existing chronic condition(s) amongst employees suffering from comorbidity, in order to understand the impact of health on labour participation and retirement amongst older employees further.

Moreover, this study defined groups of mental, physical, and coexistent physical-mental chronic condition(s) based on valid measurements. However, the severity and impact of a particular type of chronic condition might still differentially affect an employees' ability to work [4, 14]. These study findings are thus readily generalizable to employees with chronic conditions in general, or specified to being mental and/or physical, yet not towards a specific type of chronic condition since the impact on labour participation and retirement might vary. As for SPH, the association between SPH and indicators of labour participation and retirement was studied by using one item with five answer possibilities. In line with previous research [45], these five answer possibilities were dichotomized into good SPH and moderate/poor SPH which created contrast between the two studied categories of good SPH and moderate/poor SPH in this study. For further research, it may be valuable to study SPH on a continuous scale or as a categorical variable, when numbers included within the categories are sufficient in order to assess the transition from one category of SPH to another. This might further advance the understanding of SPH on labour participation and retirement.

Within this study, the effect of chronic condition(s) and SPH, separately, was studied on multiple outcome measures of labour participation and retirement.

Study findings have demonstrated associations firstly, however, it should be acknowledged that these outcome measures were studied parallel, and that we cannot excluded independence of these outcome measures. Therefore, further research should secondly assess the independence of these outcome measures, thus to assess potential coherence between the outcome measures of labour participation and retirement.

Another advantage was the relatively long follow-up period of six years of this prospective cohort study, which enabled us to distinguished cause and effect over time. Yet, it should be noted that within this six-year follow-up period three measurements had taken place: article baseline measurement (T0), and follow-up measurements 2012 and 2014 (T=48 months and T=72 months). Perhaps, the time in-between measurements may sometimes be rather long in order to detect a change in outcome measures. The time in-between measurements, might also affected the observed results for differences between prevalent and incident presence of chronic condition(s) and might led to an underestimation of the observed findings, since the time window used to define incidence and prevalence of chronic condition(s) was four years [53]. Perhaps, employees with incident chronic condition(s) might have already developed (a) chronic condition(s) at the beginning of the four-year time window, making it debatable whether the condition can still be classified as being incident. These employees might already have developed coping skills to cope with this chronic condition whilst being in employment or have already made some work adjustments during this time period [8]. Those who were not able to cope the chronic condition(s) might have already left the labour market before follow-up measurement. The associations found between incident chronic conditions and outcomes of labour participation and retirement and SPH might thus underestimate the strength of the real association.

These study findings provide substantial insights for a preventive approach, since this study approaches health both in terms of chronic condition(s) and SPH, independently, within the same study sample (total study population of n=1,763 at T0). Both chronic condition(s) as SPH should be considered important health-related factors affecting labour participation. Preventive measures can therefore relate to both chronic condition(s) and SPH, providing input to develop and tailor preventive measures specifically for older employees in order to extend working life. Furthermore, chronic condition(s) and SPH were studied consisting of respectively n=1,699 and n=1,755 employees for analyses studying chronic conditions and SPH, enabling us to disentangle cause and effect over time. The number of employees

included within these groups was sufficient, however, the number of employees included in the group of employees with mental chronic condition(s) (n=62) was too low to study incident cases for receiving disability benefits over six-year follow-up period. The relatively low number of employees with mental chronic condition(s), might also be explained by the fact that employees might already have left the labour market earlier, due to the substantial impact of mental chronic condition(s) on (paid) employment, resulting in too low number of employees with mental chronic condition(s) included in this study. Moreover, the low number of employees included in this group moreover made it difficult to compare groups, such as healthy employees vs. employees with mental chronic condition(s), and to draw valid conclusions.

Additionally, for the longitudinal analyses regarding chronic condition(s) in relation to labour participation and retirement, healthy employees were considered the reference group. As for health status, according to this study's definition of having or not having chronic condition(s), employees in the reference group may still suffer from several health conditions, which can be considered as determinants of disease(s) such as overweight, obesity, or hypertension [42]. Thus, since older employees in the reference group could still suffer from various health conditions, no artificial contrast was created which might increase this study's external validity.

No adjustments for potential confounding factors were made for the cross-sectional analyses in this study, since the purpose of these analyses was solely descriptive. In the longitudinal analyses, adjustments were made for important confounding factors based on previous research [1, 20, 48]. As mentioned previously, various work-related factors (such as physically demanding work) could substantially affect health and vice-versa [4, 6]. Moreover, the prevalence of chronic conditions is higher amongst lower educated workers, and may consequently increase the risk to exit paid employment [22]. By adjusting for these confounding factors, potential bias may be avoided. However, we still cannot exclude (potential) residual confounding. Perhaps, various unidentified work-related confounding variables might affect the studied relation. Further research might explore more-in depth other potential undefined confounding factors when studying this relation, such as the severity of a specific type of chronic condition, or other work-related factors. Also, stratification for gender was not possible in this study due to low numbers of women included in the strata. If numbers would be sufficient, further research could also stratify for educational level or gender to assess potential differences in the observed effect over time.

Further, this study assessed a decrease in working hours, by assessing a transition from full-time to part-time employment over time. However, a decrease of working hours may also be a gradual process instead of a full instant transition from fulltime to parttime employment [34]. Therefore, future research could also explore a decrease in working hours as an absolute number of working hours, instead of a transition from full-time to part-time employment. Hereby, a decrease in working hours is then independently from employees' amount of working hours at baseline.

Conclusion

This study indicates substantial and statistical significant cross-sectional associations between chronic conditions and SPH, independently, and indicators of labour participation and retirement such as strong retirement intentions and working hours. As for chronic condition(s), study findings showed that employees with coexistent physical-mental chronic conditions had substantial and significant higher risks for decreasing working hours, losing employment, and receiving disability benefits over time compared to healthy employees. However, despite finding strong cross-sectional associations between SPH and indicators of labour participation and retirement, this study found no significant associations for SPH over time. Study findings suggests a rather instantaneous effect of SPH on labour participation and retirement. As for differences between prevalent and incident presence of chronic condition(s), findings show substantial difference in self-rated SPH, which was rated lowest amongst employees with prevalent chronic condition(s).

These findings include both chronic condition (s) and SPH within the same research sample and indicate that a potential (early) labor market exit as a result of declining health is not only affected by the presence of one or more chronic condition (s). In addition, SPH should also be considered when developing preventive measures to increase the (sustainable) labour participation of older workers to reach the statutory retirement age and to prevent early labour market exit. On the one hand, preventive measures should aim to reduce the emotional need for work of employees with chronic mental illness (s), or physical work demands for employees with chronic physical illness (es). On the other hand, preventive measures should also focus on SPH. However, SPH is strongly related to employees' perception of their ability to extend working life, and therefore requires

a more individual approach and may require approximating other health and social variables to promote the active participation of older workers. Furthermore, future research should aim to additionally assess the role of differences between prevalent and incident presence of chronic condition(s) over time, since these study findings were solely explorative yet still showing strong and substantial cross-sectional associations between SPH and differences between prevalent and incident presence of chronic condition(s).

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Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The Medical Research and Ethics Committee of the Maastricht University Medical Centre approved the protocol for the Maastricht Cohort Study (MEC 08-4-032).

Conflict of interest The authors declare that they have no conflict of interest.

Author contributions Providing accessibility to data and data management were performed by J.J.M. Slangen. The first draft of the manuscript was written by J.G.M. Jennen, and all authors commented on previous versions of the manuscript. All authors read and approved the version to be published. All authors agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Associations between depressive complaints and indicators of labour participation among older Dutch employees: a prospective cohort study

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Abstract

Purpose European policy measures have led to an increased net labour participation of older employees. Yet, via different routes (for instance disability schemes) employees still often leave the labour market early. Mental health may be an important factor hindering labour participation. Aims of this study are twofold: first, to examine the relationship between mental health – particularly depressive complaints - and indicators of labour participation among older employees over a two-year follow-up period and second, to explore the impact of different work contexts when studying this relation.

Methods A subsample of older employees (aged >45 years; n=1,253) from the Maastricht Cohort Study was studied. Depressive complaints were assessed using the Hospital Anxiety and Depression scale. Logistic and Cox regression analyses covered 2 years of follow-up and were also stratified for relevant work-related factors.

Results Employees with mild depressive complaints showed statistically significantly higher risks for poor mental work ability (HR 2.60, 95% CI 1.14-5.92) and high psychological disengagement levels (HR 2.35, 95% CI 1.21-4.57) over time compared to employees without depressive complaints. Within various work contexts, for instance in which employees perform physically demanding work or have high psychological job demands, significantly stronger associations were found between depressive complaints and poor mental work ability over time.

Conclusions This study shows strong longitudinal associations between depressive complaints and indicators of labour participation, also within different work contexts over time. Results provide valuable input for developing preventive measure aiming to enhance sustainable labour participation of older employees.

Keywords Older workers – depressive complaints – labour participation – longitudinal – work context

Introduction

In many developed Western countries there is a need to increase labour market participation due to amongst others longevity and several policies have already been developed and implemented (European Commission 2014). The Europe 2020 strategy targets at increasing the working population's employment rate to at least 75 per cent (European Commission 2014). Besides policies at the EU level, many national policy measures focus on increasing labour participation of older employees. Employees from 45 years onwards are defined as older employees by the WHO (Ilmarinen 2005). For instance, The Netherlands implemented policy measures such as increasing the legal retirement age and abolishing early retirement schemes (Doekhie et al. 2014; Ybema et al. 2009). These policy measures have effectively increased the net labour participation of older Dutch employees over a ten-year time period (2008-2017). A major increase was specifically noticeable for employees aged 55-65 years (Statistics Netherlands 2017a; Statistics Netherlands 2018): the net labour participation of men increased from 61.7 to 77.4 % and for women from 39.6 to 59.2 % in this period (Statistics Netherlands 2018).

Notwithstanding this increased labour participation, it is important to note that older employees still leave the labour market before the actual retirement age. For instance in the Netherlands, this occurs via different routes such as unemployment or disability schemes. There is an increasing proportion of employees receiving work disability benefits according to the Work and Income by Work Capacity Act (Berendsen 2017). This proportion increased from 5.3 to 8.2 per cent over four years (2012-2016) within the 60 plus age group (Berendsen 2017). Furthermore, although the net labour participation of Dutch employees is among the highest in Europe (Statistics Netherlands 2017b) the amount of working hours per week is among the least (Statistics Netherlands 2017b). The proportion of part-time employees in the EU is by far the highest in The Netherlands with nearly 47 per cent (Eurostat 2018). For older male and female employees aged 60-64 the amount of working hours per week is respectively 24.4 and 22.2 hours per week (European Commission 2016). This may suggest that older employees might adjust their work hours in order to be able to continue labour participation (Damman et al. 2013).

With ageing, the risk of having (one or more) chronic condition(s) substantially increases (Doekhie et al. 2014; Sociaal-Economische Raad 2016; Ybema et al. 2009). Additionally, due to declining health, the risk of work incapacity/disability increases (Berendsen 2017). Chronic conditions are considered as an important

factor which could hinder older employees' ability to continue labour participation until their retirement age. This raises the question if and under which conditions older workers with a chronic condition are able to continue to participate in the labour market.

Chronic conditions are not unambiguously to define. In general, mental and somatic chronic conditions are distinguished (Sociaal-Economische Raad 2016). Amongst mental chronic conditions, depressive complaints comprise the majority of mental health complaints. Depressive complaints comprise a depressed mood or relatively mild to moderate symptoms of depression. Moreover, depressive complaints might act as a precursor for (clinical) depression according to DSM criteria (Nuijen et al. 2018; Lexis et al. 2009). Depressive complaints contribute to an increase of societal costs and healthcare use (Kant et al. 2008; Lexis et al. 2009). In the general Dutch population the prevalence rate of depressive complaints is high and is expected to keep increasing. In 2017 respectively 8.3 and 15.1 per cent of men and women had depressive complaints (Nielen et al. 2017; World Health Organization 2018). Depressive complaints are also highly prevalent among the working population (Harvey et al. 2009; Lexis et al. 2012). The first goal of this study is therefore to gain more insight into the impact depressive complaints might have on labour participation of older employees.

When studying the potential association between depressive complaints and labour participation among older employees, it is important to consider that labour participation is a broad concept which entails various outcome measures or indicators. Often studies considered one single indicator to comprise the concept labour participation such as retirement intentions or disability pension (Bültmann et al. 2008; Lahelma et al. 2015). In order to complement the concept labour participation, it is valuable to consider both objective (employment status) and subjective indicators representing labour participation. Therefore, this study will consider both these objective (such as employment status) and subjective indicators (such as retirement intentions, psychological disengagement, and general, mental and physical work ability) to complement the concept labour participation.

In this respect, the concept work ability is relevant since it concerns a (in)balance between work demands and an employees' individual resources to meet these demands (Boschman et al. 2017; Ilmarinen et al. 1997). Good work ability can support employment whereas poor work ability might increase the risk of early retirement (Ilmarinen 2008). Second, retirement intentions can be relevant as these might affect the continuation of labour participation (European Commission 2012).

Additionally, motivation can be conceptualized by psychological (dis)engagement levels since older employees often gradually disengage from work by reducing work investments, activities and motivation a couple of years before the actual retirement age (Damman et al. 2013).

The Conservation of Resources (COR) model is used as theoretical framework (Hobfoll 1989) throughout this study in order to understand and explain the association between depressive complaints and indicators of labour participation. The COR theory offered fundamental insights that have guided research on amongst others coping with chronic illness (Holmgreen, Tirone, Gerhart, Hobfoll, 2017). The main proposition of this theoretical framework is that individuals strive to obtain, foster, and protect resources. Resources are things individuals centrally value such as health, self-esteem, or time (Grandey & Cropanzano 1999; Hobfoll 1989; Hobfoll 2018). Stress is a reaction to an environment in which there is an actual or perceived loss in resources (Grandey & Cropanzano 1999; Hobfoll 1989). With ageing there is an inevitable loss of resources which requests a rearrangement of available resources to compensate for failing ones (Hobfoll 2018). In our study, older employees with depressive complaints (may) have a loss in resources due to impaired health and ageing. This might cause stress and could affect an employees' ability to cope with their (mental) chronic conditions while being involved in labour participation resulting in withdrawal or disengagement (Hobfoll 2018).

Most empirical studies so far have focused on the impact of depressive complaints on one single and particular outcome such as sickness absence or work disability (Andrea et al. 2004; de Graaf et al. 2012; Lexis et al. 2009; Bültmann et al. 2008; Lahelma et al. 2015; Mykletun et al. 2006). Moreover, most studies assessed specific defined occupational groups (Chevalier et al. 1996; Gommans et al. 2017; Lahelma et al. 2015; Stansfeld et al. 2013). Though many studies are prospective cohort studies with significant long follow-up periods (Bonde 2008), these studies were performed in different European countries (Bültmann et al. 2008; Mykletun et al. 2006). Due to differences in social insurance systems generalizations to other countries/settings may be hindered. Furthermore, research specifically into older employees with depressive complaints is lacking. Moreover, longitudinal studies to date often focused on (major) clinical depression (Kaila-Kangas et al. 2014; Knudsen et al. 2010; Mykletun et al. 2006) or common mental disorders (Knudsen et al. 2010; Lahelma et al. 2015) and did not specifically distinguish depressive complaints as exposure of interest. Focusing on depressive complaints instead of clinical depression in the work context is of particular interest, since employees

with a clinical depression might already left the labour market whereas employees with depressive complaints are often still actively involved in the labour market. Furthermore, it is valuable to study depressive complaints both continuously as well as categorically. Studying different categories of severity might explain stagnation or transition to a more severe category of depressive complaints over time (Nuijen et al. 2018). Conceptualizing depressive complaints on a continuum ranging from no/mild depressive complaints at one end of the spectrum to severe complaints at the other end (Cuijpers et al. 2004; Geiselman and Bauer 2000; Hjarsbech et al. 2011) encompasses the total range of complaints preceding the diagnosis of clinical depression (Hjarsbech et al. 2011; Lexis et al. 2009). Moreover, it is valuable to consider the presence of other mental/physical chronic condition(s) since this may lead to a less favorable course of depressive complaints (Nuijen et al. 2018) and consequently also affect labour participation.

The understanding of the association between depressive complaints and indicators of labour participation of older employees may be further advanced by taking into account factors from the work context. It is valuable to study the impact of work-related factors in this relation as this might reveal facilitating and/or hindering factors for labour participation of older employees with depressive complaints and as such give insight how the work context can be optimized for workers with depressive complaints. According to our theoretical framework, other available resources such as employment conditions may counteract individual reactions to stress (Grandey & Cropanzano 1999). This is also supported by previous empirical research. A favorable work context consisting amongst others of low physical work demands, experiencing decision latitude (Stynen et al. 2017), or support from supervisor(s) and co-worker(s) (Ilmarinen 2008) could buffer the adverse impact of depressive complaints. Moreover, employees are less likely to report having early retirement intentions (Stynen et al. 2017) and are more likely to report good work ability (Ilmarinen 2008). Contrary, an unfavorable work context consisting amongst others of high physical work demands and stressful work demands might elevate employees' risk of being out of employment (Gommans et al. 2016; Lund et al. 2001). Moreover, employees are likely to report limited work ability (Ilmarinen 2008). These studies have shown that high psychological job demands, low decision latitude, high emotional demands, number of working hours and overtime work, are related with (an elevated risk of) depressive symptoms (Andrea et al. 2004; Bonde 2008; Driesen et al. 2010; Niedhammer et al. 2004). However, these studies often assessed work-related factors as risk factors for the occurrence of depressive complaints. To

date little is known about the potential facilitating/hindering impact of the work context on the relation between depressive complaints and indicators of labour participation among older employees. The second goal of this study is therefore to acquire more in-depth insight into how older employees with depressive complaints could better facilitated their labour participation. This by assessing potential facilitating and/or hindering impact of factors from the work context such as physically demanding work, working hours, overtime work, decision latitude, psychological job demands, and emotional demands when studying the relation between depressive complaints and indicators of labour participation.

To conclude, our study aims to firstly assess associations between depressive complaints and indicators of labour participation among older employees cross-sectionally and longitudinally over a two-year time period. Secondly, this study aims to assess the potential facilitating and/or hindering impact of factors from the work context in the relation between depressive complaints and indicators of labour participation.

Methods

Maastricht Cohort Study

Data of the ongoing Maastricht Cohort Study (MCS) was used. The MCS is a large-scale prospective cohort study among employees in the Netherlands (Kant et al. 2003). At the baseline of this cohort (1998) 12,140 employees originating from 45 different companies/organizations were surveyed (Kant et al. 2003). Respondents received nine questionnaires in the period 1998 to 2002 with three additional follow-up questionnaires in 2008, 2012, and 2014. Details about the sampling, response rate, study population and measurements were reported elsewhere (Kant et al. 2003). For this study the 2012 wave is considered as article baseline since the concepts depressive complaints and work ability being firstly addressed together in the same questionnaire. Data from the subsequent questionnaire in 2014 is used as two-year follow-up wave for this study.

Study population

At article baseline (2012), 4,783 employees completed and returned the questionnaire. Firstly, employees younger than 45 years (n = 387) and at baseline not working or not implying being solely ‘actively employed’ (indicating being on

(partial) sick leave or pregnancy leave) and not being employed by an employer or not responded to one of these questions (n = 2,010) were excluded. Since the focus of this study is on workers employed by an employer, (partially) self-employed people (n = 60) were excluded. Also employees holding multiple jobs were excluded (n = 90) because of lacking information on the content of the second job. We excluded employees involved in shift work, night work or irregular working hours (n = 437) since particularly shift workers often suffer from disturbance of the circadian rhythm and social disruption, which have been linked to depressive complaints as well (Driesen et al. 2011). Additionally, shift work is associated with other labour participation outcomes (Gommans et al. 2015). Also employees with (pre-) pension arrangement(s) or occupational/sector specific pension arrangement(s) (n = 513) were excluded since our study population should still be actively employed at article baseline in order to assess incident cases of employees who lose (active) employment over time. Also employees on long-term sick leave (> 4 months) at article baseline (n = 19) were excluded. Furthermore, employees who did not complete all items required for calculating the baseline sum score of depressive complaints were excluded (n = 14). After applying these selection criteria, the total study population for the cross-sectional analyses consisted of n = 1,253 employees (373 women and 880 men). For the longitudinal analyses prevalent cases of the respective outcomes were excluded to study incident cases only, resulting in n = 823 (good general work ability), n = 1,171 (good physical work ability), n = 1,095 (good mental work ability), n = 1,002 (weak retirement intentions), n = 1,078 (low psychological disengagement), and n = 1,253 (being in employment) still participating at the follow-up wave in 2014.

Measurements

Depressive complaints

The Depression subscale (HAD-D) of the Hospital Anxiety and Depression (HAD) scale was used to measure the presence and severity of depressive complaints (Zigmond and Snaith 1983). The HAD-D consists of 7 integrated items scored on a four-point Likert scale (0 to 3) resulting in a range of 0 to 21 (Lexis et al. 2009). As mentioned earlier, employees who did not complete all 7 items of the HAD-D scale at article baseline were excluded from the analyses as in this case no total

HAD-D sum score could be calculated. A high value on the HAD-D indicates more severe depressive complaints (Lexis et al. 2009). Additionally, Zigmond & Snaith (1983) defined three categories/ranges of depressive complaints: a score of less than 8 points was defined as a having no depressive complaints; a score of 8 to 10 points was defined as a having mild depressive complaints; and a score of 11 points of more was defined as having moderate/severe depressive complaints (Bjelland et al. 2002; Zigmond and Snaith 1983). In this study, the category 'no depressive complaints' is used as reference group. Although the HAD-D scale was initially developed to identify (possible and probable) caseness of depression among patients in a nonpsychiatric hospital setting (Bjelland et al. 2002), the questionnaire has the same properties when being applied to other populations such as the general population (Bjelland et al. 2002; Lexis et al. 2009). The Cronbach's alpha for internal consistency was .84 for the HAD-D reflecting a good internal consistency (Bjelland et al. 2002).

Indicators of labour participation

Work ability

Work ability was operationalized by different items from the validated Work Ability Index (WAI) (Ilmarinen 2007).

General work ability

General work ability was assessed by one item of the WAI - referred to as the Work Ability Score (WAS). The WAS measures the self-assessed current work ability compared to lifetime best work ability on a ten-point scale varying from 0 (both physically and mentally unable to perform work) to 10 (better than ever able to work) (Ilmarinen 2007; Jääskeläinen et al. 2016). In line with previous studies (Boschman et al. 2017; Jääskeläinen et al. 2016), the WAS score was dichotomized: employees were considered having 'poor to moderate work ability' when scoring 0-7, and having 'good work ability' when scoring 8-10 (Boschman et al. 2017).

Mental and physical work ability

Two separate items of the WAI assessed mental and physical work ability by giving an overall rating on a 5-point scale (1 = 'very bad', 2 = 'bad', 3 = 'moderate', 4 = 'good', and 5 = 'very good'). In line with earlier studies (Boschman et al. 2017; De Raeve et

al. 2007; Ilmarinen 2008), the self-reported mental and physical work ability were dichotomized into 'poor work ability' (very bad, bad, moderate) and 'good work ability' (good, very good).

Retirement intentions

In line with other studies (Härkonmaki et al. 2006; Stynen et al. 2017), a single-item measured whether employees considered retiring before reaching mandatory retirement age: 'have you considered retiring before reaching your mandatory retirement age?' Response options 'no' and 'yes, sometimes' were defined as having weak retirement intentions and 'yes, often' as strong retirement intentions.

Motivation (psychological disengagement)

Psychological disengagement was assessed by six items regarding a variety of work investments, activities, and motivation – as an example 'I think I should assign new responsibilities to younger persons' - which are expected to gradually decrease in older employees' preretirement period (Damman et al. 2013). Answer options ranged from 'completely agree' (score 1) to 'completely disagree' (score 5) with a total score ranging from 5 to 30. A higher mean scale score represents higher psychological disengagement levels (Damman et al. 2013). The mean continuous scale score in this study was 12.69 (SD = 4.17) with an acceptable internal consistency of .71. Previous studies have not yet defined valid cut-off points to classify low and/or high disengagement levels. Within this study, the cut-off value was put on the 'neutral score' on the total scale (that is an average score on all six items being minimal 'neutral' (score 3)). As such, employees with a mean scale score below 18.00 were regarded as having 'low' psychological disengagement levels, whereas employees with a mean scale score of 18.00 or higher were regarded as having 'high' psychological disengagement levels.

Work status

At article baseline, all employees reported being in current (paid) employment by an employer (inclusion criteria). At follow-up measurement, employees were again asked whether or not they were currently involved in paid employment (yes/no) by an employer (yes/no). Those reporting still being in paid employment were considered as 'being in employment'. All other employees were classified as 'not being in employment', regardless of the underlying reason(s).

Contextual and confounding factors

Based on previous research, potential confounding variables from demography/private situation, work context, and health domains, were identified (De Wind et al. 2014; Lee et al. 2017; Scharn et al. 2017). Confounding variables in this present study were measured at article baseline (2012).

Personal and health characteristics

Demographic variables comprised age, gender and educational level. Employees were asked to indicate their highest completed level of education – which was recoded into three categories: low (primary, lower vocational school); medium (lower secondary school, intermediate vocational school, upper secondary school); or high (higher vocational school, university) (Gommans et al. 2017). Household situation was assessed by employees indicating whether or not they were living alone (yes/no).

Work-related factors

This study identified potential confounding/contextual factors from the work context: psychological job demands, decision latitude, co-worker social support, supervisor social support, emotional demands, working hours, and physical demanding work. The validated Dutch version of the Job Content Questionnaire (JCQ) was used to measure psychological job demands and decision latitude (Gründemann 1993). Psychological job demands were assessed by the sum of five items (such as excessive work) whereas decision latitude was measured by the sum of two subscales: skill discretion (such as job variety) and decision authority (such as having freedom to make decisions). The total scores for the subscale psychological job demands ranges from 12 to 48 and for the subscale decision latitude ranges from 24-96. Two scales, each comprising four items, from the JCQ were used to measure co-worker social support and supervisor social support (total score range 4-16). All subscales from the JCQ had answer options on a four-point scale ranging from 'strongly disagree' to 'strongly agree'. Emotional demands were measured by the sum of five items (such as, being often confronted with situation personally affecting employees), originating from the Dutch Questionnaire on the Experience and Evaluation of Work (VBBA) (Van Veldhoven and Broersen 2003; Van Veldhoven and Meijman 1994), the Dutch questionnaire on Work and Health (Gründemann 1993), and self-formulated. The total scale score ranges from 0 to 5. For the stratified analyses, the total subscale scores for psychological job demands, decision

latitude, and emotional demands were calculated and split into tertiles resulting in low, middle and high scores. Based on these tertile scores, psychological job demands and emotional demands were grouped into low/middle and high levels, and decision latitude was grouped into low and middle/high levels. Working hours per week were assessed by one single item with five response options: >40, 36-40, 26-35, 16-25, or <16 h/wk. These were recoded into full-time work (> 40 or 36–40 h per week) and part-time work (26–35, 16–25 or < 16 h per week). Employees were asked whether or not they often performed overtime work (yes/no). Whether or not employees considered their work physically demanding was assessed by one dichotomous item (yes/no) from the Dutch questionnaire on Work and Health (Gründemann 1993).

Presence of other mental/physical chronic condition(s)

The validated Health and Work Performance Questionnaire (HPQ) was used to identify the presence of 34 pre-specified health conditions (Kessler et al. 2003). To define the group of employees with chronic conditions and employees without chronic conditions (reference group), the 34 pre-specified conditions of the HPQ were matched with the ICPC-2 codes of the 28 pre-specified conditions listed by the Dutch National Institute of Public Health and the Environment (RIVM) (O'halloran et al. 2004; Van Oostrom et al. 2017). Several pre-specified health conditions on the HPQ list can be considered as determinants of disease(s) – such as overweight, obesity or hypertension, and were thus not included in the listing of the RIVM as chronic condition (Sociaal-Economische Raad 2016). Seventeen chronic mental or physical conditions in the HPQ matched directly with the RIVM list. Depression was not included in the list of other mental/physical chronic conditions due to being the primary condition of interest within this study. This resulted in a total of 16 chronic mental or physical conditions on the HPQ list. Employees could indicate whether or not they have (a) chronic condition(s) and whether they had received or currently receive treatment for the health condition (Kessler et al. 2003). These answers were dichotomized into 'no I don't have' or 'yes, I have'. Employees were classified as having one or more other mental/physical chronic condition(s) when answering 'yes, I have' to one (or more) of these 16 chronic conditions. Furthermore, the HPQ-list ends with one open-ended question in which employees could list another chronic condition than listed above. The answers to this open-ended question were also matched with the ICPC-2 codes of the 28 chronic condition(s) as specified by the RIVM list. If a condition matched, employees were identified as having a chronic condition.

Statistical analyses

All analyses were undertaken using SPSS Statistics IBM 22.0. P-values below .05 were considered statistically significant. Differences at article baseline across the different categories of depressive complaints were examined by using one-way ANOVA for continuous measures and $\chi 2$ test of independence for categorical variables. For the cross-sectional analyses, logistic regression analyses were performed to examine the associations between depressive complaints both continuous and categorical and for the outcomes: general, mental, and physical work ability, retirement intentions, and psychological disengagement. Odds ratio's (OR) and 95% confidence intervals (95% CI) were calculated. Three models were examined: in the first model adjustments were made for age, gender, educational level and living situation. In the second model, additional adjustments were made for psychological job demands, decision latitude, co-worker social support, supervisor social support, emotional demands, working hours, and physically demanding work. In the third model additional adjustments were made for the presence of other mental/physical chronic condition(s). For the longitudinal analyses, Cox regression analyses were performed for all four outcome measurements. Prevalent cases for the respective indicator of labour participation at baseline were excluded to study only incident cases at follow-up. Hazard ratio's (HR) and 95% CI were calculated. Here, same adjustments were made step-wise as for the cross-sectional analyses. Moreover, stratified analyses were performed for possible facilitating and/or hindering factors from the work context. Depressive complaints were only assessed as a continuum in the stratified analyses. Again, prevalent cases for the respective indicator of labour participation were excluded and same adjustments were made step-wise in line with the cross-sectional and longitudinal analyses.

Results

Descriptive results

The characteristics of the study population (n = 1,253) and separately for the three categories of depressive complaints at 2012 baseline are reported in Table 1. Statistically significant differences were observed between the categories of depressive complaints regarding demographic and private factors (educational level and living alone). As for the work-related factors, statistically significant differences in mean scores for psychological job demands, decision latitude,

Table 1: Description of and mean depressive complaints scores of the study population (n = 1,253) at article baseline (2012) according to demographic – and private, work and health factors (percentage)

	Total study population (n = 1,253)	*No depressive complaints [1] (n = 1,144)*	*Mild depressive complaints [2] (n = 75)*	*Moderate/severe depressive complaints [3] (n = 34)*	*p-value*
Demographic and private factors					
Age (years) Mean (SD)	54.60 (4.95)	54.60 (4.92)	54.28 (5.46)	55.15 (5.01)	.695
Sex					
(%)Male	70.2	70.0	69.3	79.4	.491
(%)Female	29.8	30.0	30.7	20.6	
Educational level					
(%) Low	5.3	4.9	4.1	21.9	.001*
(%)Medium	23.0	23.2	21.6	18.8	
(%) High	71.7	71.9	74.3	59.4	
Living alone					
(% Yes)	10.6	9.8	22.7	9.1	.002*
Health factors					
HAD-D Score (Mean, SD)	2.78 (3.08)	2.08 (2.05)	8.91 (.79)	12.85 (2.22)	< 0.0001*
Presence other chronic condition(s)					
(% Yes)	50.3	48.0	68.1	85.3	< 0.0001*

Work-related factors					
Working hours					
(%)Part-time	29.8	29.8	32.4	24.2	.694
(%) Full-time	70.2	70.2	67.6	75.8	
Physically demanding work					
(% Yes)					
Psychological job demands(a)	13.7	12.8	18.6	32.4	.002*
Mean (SD)					
Decision latitude (b)	31.02 (5.64)	30.85 (5.54)	32.51 (6.29)	33.56 (6.38)	.001*
Mean (SD)	75.00 (10.30)	75.42 (10.19)	71.73 (9.59)	68.00 (12.08)	< 0.0001*
Emotional demands (c)					
Mean (SD)	1.05 (1.24)	.99 (1.20)	1.44 (1.45)	2.06 (1.46)	< 0.0001*
Co-worker social support(d)					
Mean (SD)	12.10 (1.51)	12.15 (1.49)	11.88 (1.53)	10.81 (1.53)	< 0.0001*
Supervisor social support(d)					
Mean (SD)	10.95 (2.19)	11.03 (2.14)	10.27 (2.51)	9.76 (2.56)	< 0.0001*
Indicators of labour participation					
Work ability					
Mean (SD)	7.71 (1.17)	7.83 (1.05)	6.48 (1.63)	6.53 (1.44)	< 0.0001*
General (e)	4.20 (.55)	4.23 (.53)	3.93 (.70)	3.79 (.69)	< 0.0001*
Physical (f))	4.04 (.57)	4.10 (.52)	3.54 (.67)	3.29 (.63)	< 0.0001*
Mental (f)					
Retirement intentions					
(% Strong)	19.8	18.8	30.7	29.4	.02*
Psychological disengagement					
Mean (SD)	12.70 (4.17)	12.43 (4.07)	15.51 (3.98)	15.35 (4.90)	< 0.0001*

[1] no depressive complaints (HAD score= <8); [2] mild depressive complaints (HAD score= 8-10); [3] moderate/severe depressive complaints (HAD score= >11). (a) = scale range = 12-48; (b) = scale range = 24-96; (c) = scale range = 1-5; (d) = scale range = 4-16; (e) = scale range = 0-10; (f) = scale range = 0-5.

co-worker social support, supervisor social support, emotional demands, and physically demanding work were observed between the different categories of depressive complaints. No statistical significant differences were observed for working hours. As for health factors, the percentage of employees having one or more mental/physical chronic condition(s) was significantly higher for employees with moderate/severe depressive complaints compared to employees without depressive complaints (85.3 per cent vs 48.0). As for the indicators of labour participation, all outcome measures showed statistically significant differences in mean scores between the different categories of depressive complaints. At article baseline, a strong cross-sectional association between the severity of depressive complaints and retirement intentions was observed. Over 18 per cent of employees without depressive complaints indicated having strong retirement intentions compared to nearly 30 per cent of employees with moderate/severe depressive complaints.

Cross-sectional and longitudinal associations between depressive complaints and indicators of labour participation

Cross-sectional and longitudinal associations between depressive complaints and indicators of labour participation at article baseline and over a two-year follow-up period are presented in respectively Table 2 and Table 3. Only fully adjusted models are discussed. For the longitudinal analyses prevalent cases for the respective indicator of labour participation at baseline were excluded.

General, mental and physical work ability

At article baseline, a one-point increase in HAD-D score was statistically significantly associated with higher odds for poor general, physical, and mental work ability (respectively OR 1.26, 95% CI 1.20-1.33; OR 1.24, 95% CI 1.15-1.35; and OR 1.40, 95% CI 1.31-1.50) after controlling for confounding factors. Employees with mild and moderate/severe depressive complaints had statistically significantly higher odds for poor general work ability (respectively OR 5.54, 95% CI 3.00-10.23; and OR 3.57, 95% CI 1.47-8.64) and poor physical work ability (respectively OR 4.55, 95% CI 2.07-9.97; and OR 3.82, 95% CI 1.35-10.87) compared to employees without depressive complaints. Furthermore, employees with mild and moderate/severe depressive complaints had statistically significantly higher odds for poor mental work ability (OR 4.57, 95% CI 2.52-8.29; and OR 8.11, 95% CI 3.36-19.56) compared to employees without depressive complaints. At follow-up measurement, a one-

Table 2: Cross-sectional associations between depressive complaints scores/categories and indicators of labour participation

	Poor general work ability			Poor physical work ability			Poor mental work ability			Strong retirement intentions			High psychological disengagement		
	OR[1] (95% CI)	OR[2] (95% CI)	OR3 (95% CI)	OR[1] (95% CI)	OR[2] (95% CI)	OR[3] (95% CI)	OR[1] (95% CI)	OR[2] (95% CI)	OR[3] (95% CI)	OR[1] (95% CI)	OR[2] (95% CI)	OR[3] (95% CI)	OR[1] (95% CI)	OR[2] (95% CI)	OR[3w] (95% CI)
HAD-D continuous (0-21)	1.30 [1.24-1.37] *	1.26 [1.20-1.33] *	1.26 [1.20-1.33] *	1.30 [1.21-1.39] *	1.27 [1.17-1.37] *	1.24 [1.15-1.35] *	1.45 [1.37-1.55] *	1.41 [1.32-1.51] *	1.40 [1.31-1.50] *	1.10 [1.05-1.15] *	1.09 [1.04-1.14] *	1.09 [1.03-1.14] *	1.21 [1.14-1.27] *	1.14 [1.07-1.21] *	1.13 [1.06-1.20] *
Depressive complaints No [a]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mild	6.69 [3.69-12.11]*	5.67 [3.08-10.47]*	5.54 [3.00-10.23]*	5.96 [2.86-12.42]*	5.22 [2.40-11.35]*	4.55 [2.07-9.97]*	6.15 [3.50-10.81]*	4.86 [2.69-8.77]*	4.57 [2.52-8.29]*	2.21 [1.27-3.86]*	2.00 [1.14-3.52]*	1.97 [1.12-3.47] *	2.85 [1.47-5.49]*	2.09 [1.04-4.20]*	1.95 [0.97-3.94]
Moderate/ Severe	5.93 [2.57-13.69]*	3.76 [1.56-9.06]*	3.57 [1.47-8.64]*	7.92 [3.11-20.15]*	4.90 [1.73-13.83]*	3.82 [1.35-10.87]*	17.38 [7.85-38.45]*	9.49 [3.98-22.60]*	8.11 [3.36-19.56]*	1.52 [0.66-3.52]	1.23 [0.51-2.95]	1.19 [0.49-2.87]	4.38 [1.87-10.26]*	2.21 [0.87-5.57]	1.91 [0.76-4.84]

[a] = reference group [1] = adjusted for demographic and private factors (age, gender, educational level, living situation) [2] = additionally adjusted for work-related factors (working hours, psychological job demands, decision latitude, emotional demands, co-worker social support, supervisor social support and physical demands) [3] = additionally adjusted for the presence of other mental/physical chronic condition(s)

Table 3: Longitudinal associations between depressive complaints and indicators of labour participation over 2-year follow-up period

	Poor general work ability			Poor physical work ability			Poor mental work ability			Strong retirement intentions			High psychological disengagement			Not being in employment		
	HR[1] (95% CI)	HR[2] (95% CI)	HR[3] (95% CI)	HR[1] (95% CI)	HR[2] (95% CI)	HR[3] (95% CI)	HR[1] (95% CI)	HR[2] (95% CI)	HR[3] (95% CI)	HR[1] (95% CI)	HR[2] (95% CI)	HR[3] (95% CI)	HR[1] (95% CI)	HR[2] (95% CI)	HR[3] (95% CI)	HR[1] (95% CI)	HR[2] (95% CI)	HR[3] (95% CI)
HAD-D continuous (0-21)	1.09 [1.03-1.16]*	1.08 [1.00-1.15]*	1.07 [1.00-1.15]*	1.09 [1.00-1.19]*	1.08 [0.99-1.19]	1.08 [0.98-1.18]	1.26 [1.18-1.35]*	1.22 [1.13-1.31]*	1.21 [1.12-1.31]*	1.00 [0.94-1.07]	0.96 [0.89-1.03]	0.96 [0.89-1.03]	1.08 [1.02-1.14]*	1.07 [1.01-1.14]*	1.07 [1.01-1.13]*	1.03 [1.00-1.07]	1.03 [0.99-1.06]	1.02 [0.99-1.06]
Depressive complaints																		
No [a]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mild	1.91 [0.78-4.70]	1.67 [0.66-4.23]	1.66 [0.66-4.19]	2.49 [0.87-7.09]	2.26 [0.77-6.61]	2.22 [0.76-6.50]	3.94 [1.84-8.43]*	2.85 [1.28-6.37]*	2.60 [1.14-5.92]*	1.24 [0.54-2.86]	0.97 [0.41-2.28]	0.97 [0.41-2.28]	2.52 [1.32-4.81]*	2.38 [1.22-4.62]*	2.35 [1.21-4.57]*	1.33 [0.87-2.03]	1.28 [0.83-1.96]	1.26 [0.82-1.94]
Moderate/ Severe	2.23 [0.70-7.12]	1.92 [0.56-6.59]	1.79 [0.52-6.20]	2.03 [0.46-8.93]	1.58 [0.34-7.20]	1.53 [0.33-6.98]	8.76 [3.00-25.58]*	4.66 [1.43-15.21]*	4.22 [1.27-14.00]*	0.78 [0.19-3.20]	0.50 [0.12-2.17]	0.50 [0.12-2.16]	1.03 [0.25-4.21]	0.94 [0.22-3.95]	0.91 [0.22-3.86]	1.23 [0.67-2.26]	1.09 [0.58-2.06]	1.07 [0.56-2.03]

[a] = reference group [1] = adjusted for demographic and private factors (age, gender, educational level, living situation) [2] = additionally adjusted for work-related factors (working hours, psychological job demands, decision latitude, emotional demands, co-worker social support, supervisor social support and physical demands) [3] = additionally adjusted for the presence of other mental/physical chronic condition(s)

point increase in HAD-D was borderline statistically significantly associated with a higher risk for poor general work ability (HR 1.07, 95% CI 1.00-1.15], after controlling for confounding factors. Moreover, a one-point increase in HAD-D was substantially and statistically significantly associated with a higher risk for poor mental work ability (HR 1.21, 95% CI 1.12-1.31). Employees with mild and moderate/severe depressive complaints had substantial and statistical significant higher risks for poor mental work ability (respectively HR 2.60, 95% CI 1.14-5.92; and HR 4.22, 95% CI 1.27-14.00) over time compared to employees without depressive complaints. No statistically significantly associations were found for poor physical work ability.

Retirement intentions

At article baseline, a one-point increase in HAD-D score was statistically significantly associated with higher odds for strong retirement intentions (OR 1.09, 95% CI 1.03-1.14). Employees with mild depressive complaints had higher odds for strong retirement intentions (OR 1.97, 95% CI 1.12-3.47) compared to employees without depressive complaints. At follow-up measurement, a one-point increase in HAD-D was not statistically significantly associated with a higher risk for strong retirement intentions. Either, employees with mild and moderate/severe depressive complaints had no statistical significant higher risk for strong retirement intentions over time, compared to employees without depressive complaints.

Psychological disengagement

At article baseline, a one-point increase in HAD-D was statistically significantly associated with higher odds for high psychological disengagement levels (OR 1.13, 95% CI 1.06-1.20).

At follow-up measurement, a one-point increase in HAD-D was statistically significantly associated with a higher risk for high psychological disengagement levels (HR 1.07, 95% CI 1.01-1.13). Employees with mild depressive complaints had a substantial and statistical significant higher risk for high psychological disengagement levels (HR 2.35, 95% CI 1.21-4.57) over time compared to employees without depressive complaints. However, no statistical significant associations were found for employees with moderate/severe depressive complaints.

Employment status

No cross-sectional associations were assessed since all employees were in (paid) employment at article baseline.

When assessing the risk of not being in employment at follow-up measurement, fully adjusted models showed no statistical significant higher risk, while the first model (solely adjusted for demographic and private factors) showed that a one-point increase in HAD-D was borderline statistically significantly associated with a higher risk of not being in employment (HR 1.03, 95% CI 1.00-1.07) over time. No statistical significant associations were found for employees with mild and moderate/severe depressive complaints.

Association between depressive complaints and indicators of labour participation over-time: stratification for potentially hindering and/or facilitating work-related factors

To explore the potential facilitating and/or hindering impact of work-related factors on the strength of the association between depressive complaints and indicators of labour participation over time, stratified analyses were performed for the following six factors: physically demanding work, working hours, overtime work, decision latitude, psychological job demands, and emotional demands (Table 4). Depressive complaints were only assessed as a continuum. Prevalent cases for the respective indicator of labour participation at baseline were excluded.

Physically demanding work

Among employees reporting to perform physically demanding work, results showed substantial and statistical significant associations between depressive complaints and poor physical (HR 1.23, 95% CI 1.01-1.50) and mental (HR 1.44, 95% IC 1.05-1.97) work ability over time. No statistical significant associations were found with between depressive complaints and other indicators of labour participation. Among employees reporting not to perform physically demanding work, a substantial and statistical significant association was found between depressive complaints and poor mental work ability (HR 1.21, 95% CI 1.10-1.32) over time, and a borderline significant association was found between depressive complaints and high psychological disengagement levels (HR 1.07, 95% CI 1.00-1.14) over time.

Working hours

Among full-time workers, results showed a borderline statistical significant association between depressive complaints and poor general work ability (HR 1.08, 95% CI 1.00-1.16) over time. Also, among full-time workers, results showed a

Table 4: Associations between depressive complaints and indicators of labour participation over 2-year follow-up period: stratification for potentially facilitating/hindering work-related factors

	Poor general work ability			Poor physical work ability			Poor mental work ability			Strong retirement intentions			High psychological disengagement			Not being in employment		
HAD-D continuous (0-21)	HR[1] (95% CI)	HR[2] (95% CI)	HR[3] (95% CI)	HR[1] (95% CI)	HR[2] (95% CI)	HR[3] (95% CI)	HR[1] (95% CI)	HR[2] (95% CI)	HR[3] (95% CI)	HR[1] (95% CI)	HR[2] (95% CI)	HR[3] (95% CI)	HR[1] (95% CI)	HR[2] (95% CI)	HR[3] (95% CI)	HR[1] (95% CI)	HR[2] (95% CI)	HR[3] (95% CI)
Physically demanding work																		
Yes	1.12 [0.94-1.34]	1.07 [0.87-1.32]	1.09 [0.88-1.35]	1.17 [1.02-1.35]*	1.18 [0.99-1.41]	1.23 [1.01-1.50]*	1.23 [1.05-1.43]*	1.44 [1.06-1.96]*	1.44 [1.05-1.97]*	0.88 [0.73-1.07]	0.82 [0.67-1.00]	0.82 [0.67-1.01]	1.14 [0.99-1.30]*	1.15 [0.98-1.35]	1.14 [0.97-1.34]	1.03 [0.96-1.12]	1.04 [0.96-1.13]	1.04 [0.95-1.13]
No	1.08 [1.01-1.16] *	1.07 [0.99-1.16]	1.06 [0.99-1.15]	1.05 [0.93-1.17]	1.04 [0.92-1.18]	1.05 [0.93-1.19]	1.27 [1.17-1.37]*	1.21 [1.11-1.32]*	1.21 [1.10-1.32]*	1.02 [0.95-1.10]	0.99 [0.92-1.07]	0.99 [0.91-1.07]	1.07 [1.00-1.14]*	1.07 [1.00-1.14]*	1.07 [1.00-1.14]*	1.03 [0.99-1.07]	1.02 [0.98-1.06]	1.02 [0.98-1.06]
Working hours																		
Full-time	1.11 [1.04-1.19]*	1.08 [1.00-1.17]*	1.08 [1.00-1.16]*	1.14 [1.03-1.26]*	1.09 [0.97-1.22]	1.09 [0.97-1.22]	1.29 [1.20-1.39]*	1.22 [1.11-1.33]*	1.20 [1.09-1.32]*	1.00 [0.93-1.08]	0.96 [0.88-1.05]	0.95 [0.88-1.04]	1.06 [0.99-1.14]	1.05 [0.98-1.13]	1.05 [0.98-1.13]	1.02 [0.98-1.07]	1.01 [0.97-1.06]	1.01 [0.97-1.06]
Part-time	1.00 [0.84-1.20]	1.02 [0.85-1.24]	1.02 [0.84-1.23]	0.98 [0.81-1.19]	1.00 [0.82-1.23]	1.00 [0.81-1.22]	1.18 [1.01-1.37]	1.25 [1.04-1.50]*	1.26 [1.04-1.52]*	0.99 [0.87-1.13]	0.94 [0.81-1.09]	0.95 [0.82-1.11]	1.17 [1.04-1.31]*	1.22 [1.06-1.40]*	1.21 [1.06-1.39]*	1.05 [0.99-1.11]	1.05 [0.99-1.12]	1.05 [0.99-1.13]

Overtime work																	
Yes	1.10 [1.00-1.21]*	/	/	1.09 [0.92-1.29]	/	/	1.30 [1.17-1.45]*	/	/	0.99 [0.88-1.11]	/	/	1.10 [0.99-1.22]*	/	/	1.02 [0.95-1.08]	1.01 [0.94-1.08]	1.00 [0.93-1.08]
No	1.08 [1.00-1.18]*	1.07 [0.98-1.18]	1.06 [0.97-1.16]	1.08 [0.98-1.19]	1.09 [0.98-1.21]	1.09 [0.98-1.21]	1.25 [1.15-1.37]*	1.25 [1.13-1.39]*	1.24 [1.11-1.38]*	1.01 [0.93-1.09]	0.99 [0.91-1.08]	0.99 [0.90-1.08]	1.06 [0.99-1.14]	1.06 [0.99-1.14]	1.06 [0.99-1.14]	1.04 [1.00-1.08]*	1.03 [0.99-1.08]	1.04 [0.99-1.08]
Decision latitude																	
Low	1.05 [0.96-1.14]	1.05 [0.95-1.15]	1.04 [0.95-1.14]	1.10 [0.99-1.23]	1.09 [0.96-1.24]	1.09 [0.96-1.24]	1.31 [1.19-1.45]*	1.28 [1.15-1.42]*	1.27 [1.14-1.41]*	0.98 [0.90-1.06]	0.96 [0.88-1.05]	0.96 [0.87-1.05]	1.06 [0.98-1.15]	1.05 [0.97-1.14]	1.05 [0.96-1.14]	1.04 [1.00-1.08]*	1.03 [0.99-1.08]	1.04 [0.99-1.08]
Middle/high	1.13 [1.03-1.23]*	1.13 [1.02-1.25]*	1.13 [1.02-1.25]*	1.12 [0.96-1.31]	1.10 [0.94-1.29]	1.09 [0.93-1.29]	1.20 [1.07-1.34]*	1.16 [1.02-1.32]*	1.17 [1.02-1.34]*	1.01 [0.91-1.13]	0.99 [0.88-1.12]	0.99 [0.88-1.12]	1.10 [1.01-1.20]*	1.14 [1.05-1.25]*	1.15 [1.05-1.25]*	1.04 [1.00-1.08]*	1.03 [0.99-1.08]	1.04 [0.99-1.08]
Psychological job demands																	
High	1.13 [1.02-1.25]*	1.10 [0.99-1.24]	1.10 [0.98-1.24]	1.19 [1.02-1.38]*	1.15 [0.97-1.37]	1.14 [0.95-1.36]	1.24 [1.11-1.38]*	1.16 [1.03-1.33]*	1.15 [1.01-1.32]*	0.97 [0.86-1.08]	0.88 [0.77-1.00]	0.86 [0.75-.99]	1.13 [1.00-1.29]*	1.08 [0.92-1.26]	1.07 [0.91-1.24]	0.98 [0.90-1.06]	0.96 [0.88-1.05]	0.96 [0.87-1.05]
Low/middle	1.06 [0.98-1.16]	1.06 [0.96-1.16]	1.06 [0.96-1.16]	1.03 [0.91-1.17]	1.05 [0.92-1.20]	1.05 [0.92-1.20]	1.25 [1.15-1.37]*	1.28 [1.16-1.42]*	1.29 [1.16-1.44]*	1.01 [0.93-1.10]	0.99 [0.91-1.08]	1.00 [0.91-1.09]	1.07 [1.01-1.14]*	1.06 [1.00-1.14]*	1.06 [1.00-1.14]*	1.05 [1.01-1.08]*	1.03 [0.99-1.07]	1.03 [0.99-1.07]

Emotional demands																		
High	1.08 [1.01-1.17]*	1.08 [0.99-1.17]	1.08 [0.99-1.17]	1.09 [0.99-1.19]	1.10 [0.99-1.22]	1.09 [0.98-1.21]	1.22 [1.13-1.32]*	1.23 [1.13-1.33]*	1.23 [1.13-1.33]*	1.01 [0.94-1.09]	0.99 [0.91-1.08]	1.00 [0.91-1.09]	1.09 [1.02-1.16]*	1.07 [1.00-1.15]*	1.08 [1.00-1.16]*	1.02 [0.98-1.07]	1.02 [0.98-1.07]	1.02 [0.98-1.07]
Low/middle	1.11 [0.98-1.26]	1.06 [0.93-1.21]	1.06 [0.92-1.21]	1.07 [0.86-1.34]	1.08 [0.85-1.36]	1.07 [0.85-1.36]	1.31 [1.11-1.56]*	/	/	0.96 [0.84-1.11]	.91 [0.79-1.06]	0.91 [0.78-1.05]	1.06 [0.95-1.19]	1.05 [0.94-1.18]	1.05 [0.94-1.18]	1.03 [0.97-1.09]	1.02 [0.96-1.08]	1.02 [0.96-1.08]

[1] = adjusted for demographic and private factors (age, gender, educational level, living situation) [2] = additionally adjusted for work-related factors (working hours, psychological job demands, decision latitude, emotional demands, and physical demands) [3] = additionally adjusted for the presence of other mental/physical chronic condition(s)

substantial and significant association between depressive complaints and mental work ability (HR 1.20, 95% CI 1.09-1.32) over time. Among part-time workers, results showed a statistical significant association between depressive complaints and poor mental work ability (HR 1.26, 95% CI 1.04-1.52) and a substantial and statistical significant association between depressive complaints and high psychological disengagement levels (HR 1.21, 95% CI 1.06-1.39) over time.

Overtime work
Among employees reporting to work overtime, no statistical significant results were obtained. Among employees reporting not to work overtime, results showed a significant association between depressive complaints and poor mental work ability (HR 1.24, 1.11-1.38) over time.

Decision latitude
Among employees reporting low decision latitude, results showed a substantial and statistical significant association between depressive complaints and poor mental work ability (HR 1.27, 95% CI 1.14-1.41) over time. No statistical significant associations between depressive complaints and other indicators of labour participation were observed. Among employees reporting middle/high decision latitude, results showed a statistical significant association between depressive complaints and poor general work ability (HR 1.13, 95% CI 1.02-1.25) and high disengagement levels (HR 1.15, 95% CI 1.05-1.25) over time.

Psychological job demands
Among employees reporting high psychological job demands, results showed a borderline statistical significant association between depressive complaints and poor mental work ability (HR 1.15, 95% CI 1.01-1.32) over time. No statistical significant associations were found between depressive complaints and poor general and physical work ability. Among employees reporting low/middle psychological job demands, results showed a substantial and statistical significant high risk for poor mental work ability (HR 1.29, 95% CI 1.16-1.44) over time.

Emotional demands
Among employees reporting high emotional demands, results showed a borderline statistical significant association between depressive complaints and high psychological disengagement levels (HR 1.08, 95% CI 1.00-1.16) over time. Also,

among employees reporting high emotional demands, results showed a substantial association between depressive complaints and poor mental work ability (HR 1.23, 95% CI 1.13-1.33) over time. No statistical significant associations between depressive complaints and other indicators of labour participation were observed. Among employees reporting low/middle emotional demands, results showed no statistical significant associations between depressive complaints and indicators of labour participation over time.

Discussion

The aim of this prospective study was to examine associations between depressive complaints and indicators of labour participation among older employees and to explore the possible facilitating and/or hindering impact of several work-related factors from the work context on this relation.

Cross-sectional results show that depressive complaints as a continuum were significantly associated with elevated odds of poor general, physical, mental work ability, strong retirement intentions, and high psychological disengagement levels among older employees even after controlling for confounding factors. Employees with mild and moderate/severe depressive complaints had substantial and significant higher odds for poor general, physical, and mental work ability compared to employees without depressive complaints. In addition, employees with mild depressive complaints had significant higher odds for strong retirement intentions compared to employees without depressive complaints.

Longitudinal results show that depressive complaints as a continuum were associated with a higher risk of reporting poor general and mental work ability as well as higher psychological disengagement levels over time. Employees with mild and moderate/severe depressive complaints had a substantial statistical significant higher risk for poor mental work ability over time compared to employees without depressive complaints. The observed results are in line with the COR theory. Employees with mild and moderate/severe depressive complaints might have or perceive a loss of resources in terms of health. This loss of resources affects employees rapidly and thus might lead to negative outcomes such as withdrawal or disengagement from work activities (Hobfoll 2018) affecting labour participation. Additionally, the COR theory explains that ageing is accompanied with an inevitable loss of resources. This may explain the strong associations observed in this study

since our study population consists of older employees. Previous studies also support the strong associations observed between depressive complaints and high psychological disengagement levels. Declining health might accelerate the work disengagement process (Damman et al. 2013; Ilmarinen 2008). Additionally, results indicate substantial associations between depressive complaints and poor mental work ability over time. This might be explained by depressive complaints being considered a potential precursor for depression. Previous research already showed the negative affect of clinical depression on labour participation outcomes such as a decreased work ability and productivity loss (Ilmarinen 2008; Lagerveld et al. 2010). Despite being a precursor for depression, depressive complaints thus also appear to substantially negatively affect labour participation outcomes. No statistical significant associations were found between depressive complaints and strong retirement intentions and not being in employment over time.

Analyses furthermore explored the potential facilitating and/or hindering role of factors from the work context on the relation between depressive complaints and indicators of labour participation. The observed results show that the work context plays an important role in (the strength of) the adverse association between depressive complaints and indicators of labour participation over time among employees reporting to perform physically demanding work or having high psychological job demands. Results show that older employees reporting to perform physically demanding work, having high psychological job demands, having low decision latitude, or having high emotional demands, were at higher risk to report having poor mental work ability over time. These findings are supported by previous studies which also state that diseases in general have a detrimental effect on work ability. These detrimental effects are most apparent among workers performing physically demanding work (Ilmarinen 2008). Previous research also show that high job demands negatively affect employees' physical and mental health (Karasek 1979; Stansfeld et al. 2013). Furthermore, the observed results show that employees reporting having high emotional demands were at higher risk to report high psychological disengagement levels over time. According to the COR theory ageing is accompanied with an inevitable loss of resources such as impaired health (Hobfoll 2018). However, various (individual) resources might minimize these losses due to variations in self-esteem or skills (Grandey & Cropanzano 1999). Perhaps employees with high emotional demands in our study do at the same time have sufficient job resources such as more skills or a higher self-esteem. Consequently, these employees are thus not that affected by the loss of resources such as health.

These employees might be able to cope with depressive complaints in their working life. Among part-time workers, a substantial high risk was found between depressive complaints and high psychological disengagement levels over time. The strength of this association was lower and not significant among full-time workers. Perhaps employees previously involved in full-time employment yet experiencing (mild) depressive complaints reduced their working hours to part-time employment before article baseline in order to remain (actively) involved in paid employment. We cannot rule out a potential healthy-worker effect due to various selection processes. The impact of these (potential) selection processes on the interpretation of our study results will be explained more in-depth in the internal validity paragraph.

Internal validity

The internal validity of this study is strengthened amongst others due to the use of the validated HAD-D scale (Zigmond and Snaith 1983). Although the HAD-D was initially designed to detect depressive complaints in a nonpsychiatric hospital setting, the validity of the HAD-D scale is also warranted in other settings such as primary care patients, in the general population (Bjelland et al. 2002) and among employees (Andrea et al. 2004). The validity of the HAD-D among employees is additionally substantiated by the distribution of employees indicating to be currently under treatment by doctor/caregiver for depressive complaints at article baseline, which increases with increasing severity of depressive complaints (specific data not presented). The HAD-D scale allowed to measure depressive complaints both as a continuum and categorical. This provided more in-depth insights within different categories of severity of depressive complaints. Also, the continuous HAD-D score could indicate a transition and/or increase in indicators per one-point increase in HAD-D. Another major advantage of this study is the prospective and large cohort design. This prospective design enables to us to assess cause and effect and to study longitudinal associations between depressive complaints and indicators of labour participation over time while taking into account confounding factors. Despite this longitudinal design, various selection processes and healthy worker effects (Neophhytou et al. 2014) cannot be ruled out. At article baseline, a potential healthy worker effect might have occurred due to selective participation. Perhaps employees experiencing (more severe) depressive complaints might have already left the labour force or have adjusted their work situation by reducing the amount of working hours and/or (perhaps) enrolled in part-time work due to their health problems already earlier. This might also explain the relatively small proportion

of employees with moderate/severe depressive complaints (n=34). Unfortunately, information about the duration of (a) depressive (episode) complaints is lacking at article baseline. We should interpret these results carefully since this might be a selected population of employees being still actively employed despite having severe depressive complaints. Results are thus likely to be an underestimation of the true impact of depressive complaints on these indicators of labour participation. Moreover, mean HAD-D score at article baseline was statistically significantly higher for the non-responders (n=174) compared to the responders (n=1,079) at follow-up measurement (specific data not shown). This selective loss to follow-up over time may have attenuated the results regarding the impact of depressive complaints on indicators of labour participation over time. Moreover, in both the cross-sectional and longitudinal analyses, several adjustments were made for important demographic, work-related, and health factors. These confounding variables could potentially bias or modify the relation between depressive complaints and indicators of labour participation. In general, ORs and HRs moderately decreased after an additional adjustment was made. After additionally controlling for the presence of other mental/physical chronic condition(s) HRs showed a small decrease. The presence of one or more other chronic condition(s) was highly prevalent among the study population and especially among employees with moderate/severe depressive complaints (85.3 per cent). Perhaps controlling for the presence of other chronic condition(s) led to an underestimation of the true strength of the associations. In the longitudinal analyses, the strength of the association substantially decreased after additionally controlling for work-related factors. This illustrated a potential impact from the work context when studying this relation. Moreover, the observed differences between cross-sectional and longitudinal findings might be (partially) attributable to the duration and frequency of the follow-up period.

External validity

Within our study we aimed to complement the concept labour participation by assessing both objective and subjective outcome measures. The generalizability in our study is strongly affected by the chosen outcome measure. For instance, the generalizability of the observed results in terms of employment status and retirement intentions may be restricted to employees in the Netherlands since these outcomes are also determined by external factors such as social security systems. However, (general, physical, and mental) work ability and psychological (dis)engagement are universal outcome measures which are not country-specific. These observed

results are thus readily generalizable to other European countries. In contrast, having (strong) retirement intentions is highly affected and influenced by the social insurance systems within a specific country. This makes the observed results with regards to strong retirement intentions less generalizable to other settings.

Recommendations further research

Employees without depressive complaints were classified as reference group in which results showed substantial and significant differences compared to respectively employees with mild depressive complaints and employees with moderate/severe depressive complaints. For further research it might be interesting to test differences between employees with mild depressive complaints and moderate/severe depressive complaints. By exploring a (potential) difference in severity of depressive complaints, preventive measures might be tailored specifically for the severity of depressive complaints.

Furthermore, within this study various objective and subjective indicators were used in order to complement the concept labour participation. This is specifically valuable when studying older employees since (declining) health status not only affects work ability but might also affect retirement intentions. A more comprehensive understanding is obtained which might contribute to developing tailored preventive measures and thus optimize labour participation of older employees. However, it should be acknowledged that this study was not intended to be exhaustive in examining all (possible) indicators of labour participation. Further research might for instance explore indicators of labour participation in further detail by assessing the underlying reasons for not being in employment. The exit route from paid employment through for instance disability schemes or unemployment benefits could be explored. While this study explored the potential role of six work-related factors from the work context when studying the relation between depressive complaints and indicators of labour participation, it should be noted that the stratified analyses were based on single work-related factors from the work context and thus not exhaustive. Further research should aim to gain more in-depth insight into the role of other work-related factor(s) from the work context, such as task variety or competencies when studying this relation.

Despite the longitudinal study design being a major prerequisite to assess a causal association over time between depressive complaints and indicators of labour participation, no measurements have taken place in the meantime. Further research should consider more frequent measurements during follow-up in order

to detect more cases of (mild) depressive complaints.

Our goal was to assess whether there is an association between depressive complaints and indicators of labour participation among older employees over time. In order to increase this study internal validity a more homogenous group of older employees was assembled. Results show substantial results amongst these employees involved in daywork. However, it is also valuable to assess this association in other settings. Therefore, further research should investigate this association in other groups of older employees working for instance irregular working hours or being involved in night and/or shift work.

Concluding remarks

Overall, this study indicates strong, adverse associations between increasing depressive complaints and indicators of labour participation over time. Moreover, different work contexts revealed various negative associations between depressive complaints and indicators of labour participation. However, these results were not unambiguous since we found differential effects indicating the important role of the work context when studying this relation.

To prevent the transition from depressive complaints to clinical depression, work organizations/employers should aim to monitor depressive complaints among employees. Uniform preventive measures and/or interventions for all older employees are difficult since a one-size fits-all measure is probably ineffective considering the impact of different work contexts. In line with the COR theory, preventive measures or interventions might focus on enhancing resources in order to compensate for the losses in other resources such as health (Hobfoll 2018). Work organizations/employers should focus on balancing job demands and job resources (such as more autonomy) since this could have a beneficial impact on labour participation indicators among older employees. In addition, it is valuable to consider the role of the work context since the strength of these associations substantially differs within various work contexts. In practice, these study findings may serve as valuable input when considering the development of preventive measures and/or interventions aiming to prolong older employees' working life.

In sum, further research on the relation between depressive complaints and indicators of labour participation should further explore the underlying reason(s) of (early) labour market exit. Also, more in-depth insights into other factors from the work context is necessary when studying this relation, in order to optimize labour participation of older employees in a sustainable way.

Notes

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Informed consent Informed consent was obtained from all individual participants included in the study.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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4

Associations between chronic condition(s), self-perceived health, and labour participation over time: a 16-year follow-up study

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Under review

Abstract

Objective To study longitudinal associations between chronic conditions and self-perceived health (SPH) and labour participation. Additionally, to study associations between the number of chronic conditions and labour participation. Findings will be interpreted in the light of continuing health-related selection processes, notably the healthy worker effect.

Methods Data from the Maastricht Cohort Study was used. Cox regression analyses were performed to study the effects of chronic condition(s) and SPH on labour participation outcomes at two – and 16-years of follow-up, including n=2,070 women and n=5,415 men at baseline. Additionally, sector-stratified analyses were performed. Descriptive statistics explored loss to follow-up from this study.

Results Employees with chronic condition(s) (HR 1.52, 95% CI 1.36-1.71) and employees with moderate/poor SPH (HR 1.62, 95% CI 1.41-1.86) had substantial higher risks to leave employment at 16-year follow-up compared to healthy employees and employees with good SPH. Employees with chronic condition(s) (HR 1.22, 95% CI 1.05-1.43) had a higher risk to reduce working hours at two-year follow-up compared to healthy employees. Sector-stratified analyses showed strongest associations within the sector 'industry'. Selective drop-out of the study was explored: dropouts over time were more likely to report moderate/poor SPH at baseline compared to participants.

Conclusion Health status substantially affected labour participation outcomes over time. Due to selection processes, a population of healthier employees was studied over time which may have strongly attenuated study findings. Preventive measures aiming to reinforce labour participation among employees with health condition(s) should be adopted earlier during the work career to prevent early drop-out from employment.

Keywords Healthy worker effect; occupational cohort; prospective; secondary selection processes; selective drop-out.

Introduction

The workforce is ageing and employees need to work longer (1). Health affects older employees' ability and willingness to extend working life (2-4). With increasing age, work ability and productivity reduces, and consequently the risk to leave employment (earlier) via disability or unemployment benefits, substantially increases (3, 5-7). Other studies imply however, that work ability might even increase amongst older employees aged 60 years onwards (8). An explanation for these inconsistent findings may be found in health-related selection processes that may occur over time (9, 10). Due to ill-health, older workers may have adapted their work (e.g. working less hours) or have even left employment. Consequently, health-related selection processes may result in the study of relatively healthy older workers. This form of health-related selection bias is often referred to as the Healthy Worker Effect (HWE) (8, 9).

HWE bias may occur in occupational studies and originates due to healthier individuals being more likely to become and remain employed (8, 9, 11). The HWE comprises primary and secondary selection processes. People with already better health might be more likely to be hired, whereas the general population might include less healthy people whom consequently might be less likely to ever start working (12, 13) - a process which refers to primary selection. Primary selection is uncontrollable (14) and is difficult to study among the working population (13, 15) since it requires a cohort of young people who have yet to enter the labor market. Furthermore, employees with poorer health status might be less able to cope with work and make adjustments in work (e.g. working fewer hours) or need move out of employment earlier (1, 11, 13, 14). Consequently, (older) employees who remain in employment tend to be relatively healthier compared to those who exit employment (8, 11, 13, 16, 17) – a continuing process which refers to secondary selection.

When studying the relation between health and labour participation over time, findings might be biased because of such health-related selection processes, and may result in an overestimation of possibilities for extended working careers for older workers. It is therefore invaluable to explore indications of selection processes during a broader time period earlier throughout working life and interpret the relations between health and labour participation over time in the light of these selection processes.

When studying the relation between health and labour participation over time,

both chronic condition(s) and self-perceived health (SPH) should be considered. Chronic condition(s) increase the risk to retire early and to exit employment (1, 6, 7, 18), and self-perceived health (SPH) is a strong health predictor for employees' perceptions to extend working life (18). Moreover, SPH is considered a better predictor for disability retirement (6, 18-20) compared to diagnosed disease. Also, mental; physical; and/or coexisting physical-mental chronic condition(s) should be distinguished since these conditions may differentially affect labour participation outcomes (5, 7, 21-23) and are often interrelated (22, 24). Additionally, with increasing age the prevalence of employees having multiple chronic conditions simultaneously increases (3, 25, 26). Having multiple chronic condition(s) strongly affects the risk to lose employment (5, 26, 27) – therefore employees with single versus multiple chronic condition(s) should be distinguished as well.

Over a short time period, employees with poor health might tend to reduce working hours as a means to adapt their work to their health (28, 29). Employees who do not sufficiently benefit from such reduction, might even leave employment (10, 14, 30). In line with the selection hypothesis – which assumes that health predicts various (health-related) adaptations in the employment process (31) – in this study two outcome measures will be studied over time: a reduction in working hours and the risk to leave employment. These health-related adaptations can be viewed as secondary selection processes. Moreover, the possibility to reduce working hours might be sector-dependent, therefore the relation between health and labour participation outcomes will be studied within different sectors.

In sum, this study first aims to investigate the effect of chronic condition(s) (mental; physical; and/or coexisting physical-mental) and SPH on reducing working hours and leaving employment at two – and 16-year follow-up. Additionally, this study aims to investigate the impact of having single or multiple chronic condition(s) on reducing working hours and leaving employment at two – and 16-year follow-up. Moreover, sector-stratified analyses were performed. Second, these study findings will be interpreted in the light of possible (health-related) selection effects over time, such as the healthy worker effect. Also, potential selective drop-out of this study will be explored since selective drop-out could additionally lead to selection bias (32).

Methods

Maastricht Cohort Study

The MCS included a heterogeneous working population (N=12,140 employees originating from 45 different companies). From 1998, employees were followed by means of self-administered questionnaires. More detailed information about the MCS has been reported elsewhere (33, 34). The Medical Research and Ethics Committee of the Maastricht University Medical Centre approved the protocol for the Maastricht Cohort Study (MEC 08-4-032).

Study population

For the present study, cohort baseline questionnaire (1998) is considered article baseline (T0). At T0, employees with multiple jobs were excluded since no information was available about working hours in the other job(s). Also, employees absent due to illness for four weeks or longer, were excluded. Employees performing shift work were also excluded, since shift work is associated with several health outcomes (35). Employees who work regular hours between 7 and 19 hours were included. At T0, the final study population consisted of n=7,492 employees.

Chronic condition(s)

At T0, employees self-indicated whether or not they have a long-term condition (yes/no); and self-indicated whether or not they have one of the listed 19 pre-specified condition(s) (yes/no). Since several of the 19 pre-listed conditions can be considered as determinants of disease(s) (e.g. skin diseases such as eczema), these 19 listed condition(s) were matched with 28 chronic condition(s) listed by the Dutch National Institute of Public Health and the Environment (RIVM) (36). Eleven condition(s) matched directly with the RIVM list. Hereby, employees with and without chronic condition(s) were defined. Additionally, in one open-ended question, employees could list a not previously mentioned health condition which was also matched with the 28 chronic condition(s) listed by the RIVM. Employees were classified as having one (or more) chronic condition(s) when answering 'yes' to one of these eleven chronic condition(s) or additionally listing another chronic condition(s) in the open-ended question, which resulted in n=1,548 employees with chronic condition(s) at T0. Employees indicating 'no' to all eleven condition(s) and additionally did not list another chronic condition(s) in the open-ended question, were considered the reference group of healthy employees at T0 (n=5,943).

Employees with mental, physical, and/or coexisting physical-mental chronic conditions

Employees indicating having psychological problems (such as anxiety, depression, burnout) and who did not suffer simultaneously from (one or more) physical chronic condition(s), were considered as employees with mental chronic condition(s) at T0 (n=120).

Employees indicating having one (or more) of the following physical chronic condition(s): asthma, bronchitis or Chronic Non-Specific Respiratory Disorder; heart disease, myocardial infarction, or high blood pressure; (consequences of) stroke; liver inflammation or liver cirrhosis; diabetes; long-term back pain, hernia, sciatica, 'worn' back; rheumatism, joint infections of the hands or feet, joint wear of the hips, knees or hands; diseases of the nervous system (epilepsy, multiple sclerosis, dizziness with falls); migraines or severe headaches; malignancies or cancer; and who did not suffer simultaneously from a mental chronic condition(s), were considered as employees with physical chronic condition(s) at T0 (n=1,314).

Employees indicating having (a) mental and physical chronic condition(s) simultaneously, were considered as employees with coexisting physical-mental chronic condition(s) at T0 (n=114).

Self-perceived health

Self-perceived health was measured by one item adapted from the Dutch version of the Short Form Health Survey-36 (SF-36) (37). The item has a five-point response scale (excellent, very good, good, moderate, or poor) which was dichotomized into 'good SPH' (excellent, very good, good) and 'moderate/poor SPH' (moderate, bad) (38). Employees with good SPH were considered the reference group at T0 (n=6,532).

Single versus multiple chronic condition(s)

Based on the sum of the number of chronic condition(s) present for each employee, employees were classified as employees having a single chronic condition or as employees having multiple chronic conditions.

Labour participation outcomes

Leaving employment
At T0, all employees were employed. From T0 until 2002, n=9 follow-up measurements with different time-windows in-between assessed whether employees have left employment. The items formulating work status were however not synchronous over the entire follow-up measurements. Therefore, at 2008; 2012; and 2014; n=3 subsequent follow-up measurements assessed whether employees have left employment. Employees neither indicating 'having paid work'/'being in employment by an employer' nor 'being (partially) self-employed', were considered as having left employment.

Working hours
At T0, the average number of working hours per week was assessed by one item, response options were: >40, 36-40, 26-35, 16-25, or <16 hours p/wk, which was categorized into full-time employment (≥36 h) or part-time employment (<36 h).

Reducing working hours
A reduction in working hours was assessed by one item 'have you started working fewer hours per week in the past year (yes/no)?'.

Time-windows and response rate

The risk to leave employment was assessed from T0 until last follow-up measurement (2014), comprising n=12 follow-up measurements over 16 years. At follow-up measurement 2014, the response rate was 24 per cent (n=2,945) since T0. A reduction in working hours was assessed from T0 until two-year follow-up (2000), comprising n=6 follow-up measurements over two years. At follow-up measurement 2000, the response rate was 66 per cent (n=8,070) since T0. Selective drop-out of this study was explored between T0 and follow-up measurement (May) 2000.

Sectors

Sectors were classified according to the Netherlands Standard Classification of Occupations 1992 (33). In this study, four sectors were represented: 'government, education, public facilities' (referred to as 'government'), 'health care' (referred to as 'care'), 'industry-construction' (referred to as 'industry'); and 'transport, services, catering', (referred to as 'transport').

Confounding factors

Data on age, gender, educational level, and working hours were obtained through self-report at T0. Educational level was recoded into three categories: high, medium, and low. Working hours p/wk was assessed by one item.

Statistical analysis

Data was analyzed using IBM SPSS 26.0. Independent samples t-tests and $\chi 2$-tests for continuous and dichotomous variables were used to examine differences for personal, work-related, and health-related factors for the groups of employees differing in chronic condition(s) at T0. Items were not (always) fully completed by the total study population, therefore the proportion of employees answering to a specific item may differ from the total study population. Cox regression analyses were performed to study the effect of chronic condition(s) and SPH at T0 on reducing working hours and leaving employment at respectively two – and 16-year follow-up. Hazard ratios and 95% confidence intervals were calculated. To assess the effect of chronic condition(s) and SPH on the risk to leave employment, the time from being employed at T0 to leaving employment at 16-year follow-up, was modeled. This analysis was performed for all employees irrespective of baseline working hours. Both crude and adjusted models for age and gender, and educational level at T0, were calculated. Furthermore, the effect of single versus multiple physical morbidity on the risk to leave employment or reduce working hours over time, was assessed. To assess the risk to leave employment over time, both crude and adjusted models for age and gender, and educational level at T0, were calculated. To assess the risk to reduce working hours over time, analyses were additionally adjusted for working hours and SPH at T0. Healthy employees were considered reference group. To explore selective drop-out of this study, $\chi 2$ tests for independence assessed differences for health-related factors at T0 among participants and dropouts, identified at two-year follow-up period (follow-up measurement n=6).

Results

Descriptives

Table 1 shows that gender, age and educational level statistically significantly differed between the groups of healthy employees and employees with chronic condition(s) at T0. Employees with chronic condition(s) were older compared to healthy employees (respectively 44.85 and 41.50 years). Also, large differences in educational level were found: among healthy employees 19.6 per cent indicated having completed lower educational level, compared to 47.7 per cent among employees with coexisting physical mental chronic conditions. The proportion of employees working part-time was higher amongst employees with coexisting physical-mental chronic conditions (29.2 per cent) compared to employees with physical or mental chronic condition(s) (respectively 23.2 and 27.7 per cent). Furthermore, the mean scale scores for decision latitude and co-worker social support were higher for healthy employees compared to employees having chronic condition(s). Among employees having respectively physical, mental, and/or coexisting physical-mental chronic condition(s), 21.5; 22.7; 32.7 per cent indicated to perform physically demanding work, compared to 11.7 per cent amongst healthy employees.

Among healthy employees, 6.7 per cent indicated having poor/moderate SPH compared to 33.7 per cent amongst employees with chronic condition(s). The proportion of employees indicating poor/moderate SPH was the highest among employees having coexisting physical-mental chronic conditions (65.5 per cent) compared to employees having physical or mental chronic condition(s) (respectively 29.8 and 47.5 per cent).

Regarding sectors, among employees having coexisting physical-mental chronic conditions, 50.9 per cent indicated working in the 'government' sector and 28.1 per cent indicated working in the 'industry' sector. Contrary, among healthy employees, 33.1 per cent indicated working in the 'government' sector and 43.1 per cent indicated working in the 'industry' sector.

Chronic condition(s), self-perceived health, and the risk to leave employment at 16-year follow-up

Table 2 shows that the risk to leave employment at 16-year follow-up was substantially and statistically significantly higher for employees with chronic condition(s) (HR 1.52, 95% CI 1.36-1.71) and employees with moderate/poor SPH (HR

Table 1: Descriptive characteristics for demographic, work-related, and health factors at T0 among the groups of healthy employees, employees with chronic condition(s), and employees having physical, mental, and/or coexisting physical-mental chronic condition(s)

	Total study population (N=7,492)	Healthy employees (N=5,943)	Employees with chronic condition(s) (N=1,548)	P-value (A)	Employees with physical chronic condition(s) (N=1,314)	Employees with mental chronic condition(s) (N=120)	Employees with coexisting physical-mental chronic condition(s) (N=114)	P-value (B)
Gender								
Female	2,070 (27.7)	1,603 (27.0)	467 (30.2)	.01*	394 (30.0)	46 (38.3)	27 (23.7)	.01*
Male	5,415 (72.3)	4,335 (73.0)	1,080 (69.8)		918 (70.0)	74 (61.7)	87 (76.3)	
Age (Mean, SD)	42.19 (8.73)	41.50 (8.70)	44.85 (8.32)	<.001*	44.90 (8.45)	42.95 (7.70)	46.16 (7.07)	<.001*
Education	1,636 (22.3)	1,141 (19.6)	495 (33.1)	<.001*	404 (31.8)	38 (32.8)	53 (47.7)	<.001*
Low	2,210 (30.2)	1,729 (29.7)	481 (32.1)		420 (33.1)	30 (25.9)	30 (27.0)	
Middle	3,477 (47.5)	2,956 (50.7)	521 (34.8)		445 (35.1)	48 (41.4)	28 (25.2)	
High								
Working hours								
Full-time	5,982 (80.4)	4,817 (81.5)	1,165 (76.0)	<.001*	998 (76.8)	86 (72.3)	80 (70.8)	<.001*
Part-time	1,458 (19.6)	1,091 (18.5)	367 (24.0)		301 (23.2)	33 (27.7)	33 (29.2)	
Physically demanding work								
(% Yes)	1,034 (13.9)	689 (11.7)	345 (22.4)	<.001*	281 (21.5)	27 (22.7)	37 (32.7)	<.001*
Psychological job demands(a)								
Mean (SD)	33.24 (5.61)	33.19 (5.57)	33.42 (5.76)	.17	33.31 (5.72)	34.33 (6.08)	33.63 (5.92)	.13
Decision latitude(b)								
Mean (SD)	73.94 (10.45)	74.57 (10.18)	71.53 (11.10)	<.001*	72.24 (10.75)	67.63 (11.68)	67.46 (12.72)	<.001*

Emotional demands(c)								
Mean (SD)	.96 (1.16)	.88 (1.11)	1.24 (1.30)	<.001*	1.17 (1.24)	1.54 (1.59)	1.73 (1.42)	<.001*
Co-worker social support(d)								
Mean (SD)	11.88 (1.52)	11.92 (1.50)	11.74 (1.61)	<.001*	11.84 (1.55)	11.12 (1.93)	11.28 (1.73)	<.001*
Supervisor social support(d)								
Mean (SD)	10.60 (2.21)	10.67 (2.18)	10.35 (2.32)	<.001*	10.44 (2.27)	9.65 (2.73)	10.08 (2.33)	<.001*
Sectors								
Government	2,546 (34.0)	1,969 (33.1)	577 (37.2)	.002*	473 (36.0)	46 (38.3)	58 (50.9)	<.001*
Care	939 (12.5)	727 (12.2)	212 (13.7)		192 (14.6)	12 (10.0)	8 (7.0)	
Industry	3,158 (42.2)	2,561 (43.1)	597 (38.5)		516 (39.3)	48 (40.0)	32 (28.1)	
Transport	849 (11.3)	686 (11.5)	163 (10.5)		133 (10.1)	14 (11.7)	16 (14.0)	
Self-perceived health								
Good	6,532 (87.7)	5,512 (93.3)	1,020 (66.3)	<.001*	918 (70.2)	62 (52.5)	39 (34.5)	<.001*
Moderate/poor	915 (12.3)	396 (6.7)	519 (33.7)		389 (29.8)	56 (47.5)	74 (65.5)	

P-value (A): Between group employees without chronic condition(s) and group employees with chronic condition(s). P-value (B): Between four distinguished groups of employees based on type of chronic condition(s). (a) = scale range = 12-48; (b) = scale range = 24-96; (c) = scale range = 1-5; (d) = scale range = 4-16;

Table 2: Chronic condition(s), self-perceived health, and the risk to leave employment at 16-year follow-up

	Leave employment		
	HR[1]	HR[2]	HR[3]
Healthy employees	1	1	1
Employees with (a) chronic condition(s)	1.70 (1.52-1.91)*	1.56 (1.39-1.75)*	1.52 (1.36-1.71)*
Employees with physical chronic condition(s)	1.61 (1.43-1.82)*	1.48 (1.31-1.68)*	1.45 (1.28-1.64)*
Employees with mental chronic condition(s)	2.06 (1.50-2.84)*	1.75 (1.27-2.42)*	1.73 (1.26-2.39)*
Employees with mental-physical chronic condition(s)	2.57 (1.87-3.55)*	2.52 (1.83-3.47)*	2.40 (1.74-3.32)*
Stratification per sector			
Healthy employees	1	1	1
Employees with chronic condition(s)			
Government *(N=2,546)*	1.65 (1.27-2.00)*	1.56 (1.29-1.88)*	1.53 (1.26-1.85)*
Care *(N=939)*	1.29 (.97-1.71)	1.34 (1.01-1.78)*	1.32 (.99-1.76)
Industry *(N=3,158)*	1.95 (1.61-2.36)*	1.77 (1.46-2.15)*	1.71 (1.41-2.08)*
Transport *(N=849)*	1.64 (1.17-2.30)*	1.41 (1.00-2.01)*	1.40 (.98-2.00)
Employees with good self-perceived health	1	1	1
Employees with poor/moderate self-perceived health	1.72 (1.50-1.97)*	1.65 (1.44-1.90)*	1.62 (1.41-1.86)*
Stratification per sector			
Healthy employees	1	1	1
Employees with poor/moderate SPH			
Government *(N=2,546)*	1.82 (1.47-2.25)*	1.76 (1.42-2.18)*	1.74 (1.40-2.16)*
Care *(N=939)*	1.30 (.89-1.89)	1.30 (.89-1.90)	1.28 (.88-1.88)
Industry *(N=3,158)*	1.94 (1.53-2.45)*	1.88 (1.49-2.39)*	1.80 (1.42-2.29)*
Transport *(N=849)*	1.37 (.90-2.07)	1.36 (.90-2.06)	1.38 (.91-2.09)

(1) crude; (2) adjusted for gender and age at cohort baseline (1998); (3) additionally adjusted for educational level at cohort baseline (1998)

1.62, 95% CI 1.41-1.86) compared to healthy employees and employees with good SPH, after adjusting for confounding factors. For employees having respectively physical; mental; and/or coexisting physical-mental chronic conditions the risks to leave employment over time was statistically significantly and considerably higher (HR 1.45, 95% CI 1.28-1.64; HR 1.73, 95% CI 1.26-2.39; and HR 2.40, 95% CI 1.74-3.32 respectively) compared to healthy employees.

Within the sectors 'government' and 'industry', employees with chronic condition(s) had statistically significantly higher risks to leave employment over time (HR 1.53, 95% CI 1.26-1.85; and HR 1.71, 95% CI 1.41-2.08) compared to healthy employees. Within the sectors 'government' and 'industry', employees with moderate/poor SPH had statistically significantly higher risks to leave employment over time (HR 1.74, 95% CI 1.40-2.16; and HR 1.80, 95% CI 1.42-2.29) compared to employees with good SPH. No statistical significant associations were found within the sectors 'care' and 'transport' after adjusting for all demographic factors.

Chronic condition(s), self-perceived health, and the risk to reduce working hours at two-year follow-up

Table 3 shows that the risk to reduce working hours at two-year follow-up was substantially and statistically significantly higher for employees with chronic condition(s) (HR 1.22, 95% CI 1.05-1.43) compared to healthy employees, and (borderline) statistically significantly higher for employees with poor/moderate SPH (HR 1.19, 95% CI 1.00-1.42) compared to employees with good SPH, after adjusting for confounding factors. Solely for employees having physical chronic condition(s) the risk to reduce working hours over time was statistically significantly higher (HR 1.20, 95% CI 1.02-1.41) compared to healthy employees.

Within the sectors 'industry' and 'transport', employees with chronic condition(s) had statistically significantly and substantially higher risks to reduce working hours over time (respectively, HR 1.44, 95% CI 1.08-1.90; and HR 1.61, 95% CI 1.00-2.58) compared to healthy employees. Fully adjusted models did not show statistical significant associations between SPH and the risk to reduce working hours over time within all four sectors. After solely adjusting for gender, age, educational level, and working hours at T0, within the sector 'industry', employees with poor/moderate SPH had statistically significantly and substantially higher risk (HR 1.40, 95% CI 1.03-1.90) to reduce working hours over time compared to employees with good SPH.

Table 3: Chronic condition(s), self-perceived health, and the risk to reduce working hours at two-year follow-up

	Reducing working hours				
	HR[1]	HR[2]	HR[3]	HR[4]	HR[5]
Healthy employees	1	1	1	1	1
Employees with (a) chronic condition(s)	1.30 (1.13-1.50)*	1.26 (1.10-1.46)*	1.30 (1.13-1.50)*	1.28 (1.11-1.48)*	1.22 (1.05-1.43)*
Employees with physical chronic condition(s)	1.26 (1.08-1.47)*	1.23 (1.05-1.43)*	1.26 (1.08-1.48)*	1.24 (1.06-1.46)*	1.20 (1.02-1.41)*
Employees with mental chronic condition(s)	1.42 (.95-2.11)	1.38 (.92-2.05)	1.39 (.93-2.07)	1.47 (.99-2.19)	1.38 (.92-2.08)
Employees with mental-physical chronic condition(s)	1.59 (1.08-2.35)*	1.53 (1.04-2.27)*	1.62 (1.09-2.41)*	1.46 (.98-2.17)	1.33 (.89-2.01)
Stratification per sector					
Healthy employees	1	1	1	1	1
Employees with chronic condition(s)					
Government *(N=2,546)*	1.07 (.85-1.35)	1.07 (.84-1.35)	1.12 (.88-1.42)	1.12 (.88-1.42)	1.07 (.83-1.38)
Care *(N=939)*	1.06 (.78-1.44)	1.12 (.82-1.52)	1.10 (.80-1.50)	1.08 (.79-1.47)	1.04 (.74-1.44)
Industry *(N=3,158)*	1.61 (1.24-2.07)*	1.50 (1.16-1.94)*	1.53 (1.18-1.99)*	1.52 (1.16-1.98)*	1.44 (1.08-1.90)*
Transport *(N=849)*	1.88 (1.24-2.85)*	1.82 (1.17-2.82)*	1.81 (1.16-2.83)*	1.66 (1.05-2.63)*	1.61 (1.00-2.58)*
Employees with good self-perceived health	1	1	1	1	1
Employees with poor/moderate self-perceived health	1.29 (1.09-1.52)*	1.30 (1.10-1.53)*	1.32 (1.12-1.57)*	1.28 (1.09-1.52)*	1.19 (1.00-1.42)*
Stratification per sector					
Healthy employees	1	1	1	1	1
Employees with poor/moderate SPH					
Government *(N=2,546)*	1.15 (.89-1.48)	1.17 (.91-1.52)	1.22 (.95-1.58)	1.19 (.92-1.54)	1.16 (.88-1.52)
Care *(N=939)*	1.15 (.76-1.73)	1.20 (.79-1.82)	1.18 (.78-1.80)	1.19 (.78-1.81)	1.17 (.75-1.83)
Industry *(N=3,158)*	1.58 (1.17-2.13)*	1.50 (1.11-2.03)*	1.51 (1.12-2.05)*	1.40 (1.03-1.90)*	1.21 (.87-1.69)
Transport *(N=849)*	1.60 (.94-2.72)	1.55 (.91-2.65)	1.49 (.87-2.56)	1.34 (.78-2.30)	1.18 (.68-2.06)

(1) crude; (2) adjusted for gender and age at cohort baseline (1998); (3) additionally adjusted for educational level at cohort baseline (1998); (4) additionally adjusted for working hours at cohort baseline (1998); (5) additionally adjusted for respectively self-perceived health or presence of (one or more) chronic condition(s)

Employees with single versus multiple physical morbidity and the risk to leave employment and reduce working hours over time

Table 4 shows that the risk to leave employment at 16-year follow-up was substantially and statistically significantly higher for employees with single physical morbidity (HR 1.38, 95% CI 1.20-1.58) and employees with multiple physical morbidity (HR 1.31, 95% CI 1.17-1.46) compared to healthy employees. The risk to reduce working hours at two-year follow-up was higher for employees with single physical morbidity (HR = 1.21, 95% CI 1.01-1.44) compared to healthy employees. No statistical significant associations were found for employees with multiple physical morbidity and the risk to reduce working hours over time. Due to low numbers in other groups, these associations were solely assessed amongst employees having physical chronic condition(s).

Exploring selective drop-out of this study

Table 5 shows that dropouts were more likely to report poor/moderate SPH at T0 compared to participants (16.9 vs. 13.7 per cent, p<.001). No statistical significant differences were found for the presence of chronic condition(s) and the number of chronic condition(s).

Table 4: Employees with single versus multiple physical morbidity and the risk to reduce working hours and leave employment at two – and 16-year follow-up

	Leave employment		Reduce working hours			
	HR1	**HR2**	**HR1**	**HR2**	**HR3**	**HR4**
Healthy employees	1	1	1	1	1	1
Employees with single physical morbidity (N=1,023)	1.40 (1.22-1.61)*	1.38 (1.20-1.58)*	1.22 (1.03-1.45)*	1.26 (1.06-1.49)*	1.25 (1.05-1.48)*	1.21 (1.01-1.44)*
Employees with multiple physical morbidity (N=291)	1.33 (1.19-1.48)*	1.31 (1.17-1.46)*	1.13 (.97-1.31)	1.16 (.99-1.35)	1.14 (.98-1.33)	1.11 (.95-1.30)

(1) adjusted for gender and age at cohort baseline (1998); (2) additionally adjusted for educational level at cohort baseline (1998); (3) additionally adjusted for working hours at cohort baseline (1998); (4) additionally adjusted for respectively self-perceived health (1998).

Table 5: Descriptive characteristics for health-related factors at T0 among participants and dropouts identified over time: exploring selective drop-out of this study

Variable (%)	Study participants (N = 8,069)	Dropouts (N = 4,071)	p-value
Chronic condition(s)			
Present	22.8	23.9	.16
Not present	77.2	76.1	
Number chronic condition(s)			
1 condition	72.1	70.9	.48
2 or more condition(s)	27.9	29.1	
SPH			
Good	86.3	83.1	<.001*
Moderate/poor	13.7	16.9	

*Statistically significant group differences were tested with respectively the Chi-square test for independence

Discussion

This study aimed to investigate the effect of chronic condition(s) and SPH on reducing working hours and leaving employment at respectively two – and 16-year follow-up, and additionally to investigate the impact of having single or multiple chronic condition(s) on these outcome measures. Also, sector-stratified analyses were performed.

The risk to reduce working hours at two-year follow-up was statistically significantly higher for employees with chronic condition(s) compared to healthy employees, and for employees with poor/moderate SPH compared to employees with good SPH. The risk to leave employment over time was considerably and statistically significantly higher for employees having respectively physical; mental; and/or coexisting physical-mental chronic conditions compared to healthy employees. This is in line with earlier studies (1, 6, 21, 23, 27, 39, 40). Regarding single or multiple chronic condition(s), the risk to reduce working hours over time did not statistically differ between employees with multiple physical morbidity compared to healthy employees. Perhaps, reducing working hours is not sufficiently in order to cope with two or more physical chronic conditions whilst being in employment (21, 22). This is also supported by our study showing that employees with multiple physical morbidity had substantial higher risks to leave employment over time. Sector-stratified analyses observed the strongest associations were observed within the sector 'industry'. Perhaps due to most employees within 'industry' perform physically demanding work which is related to leaving employment earlier (1, 40). Within the sector 'care', no statistically associations were found over time. Perhaps, the impact of gender might partially explain these study findings. The sector 'care' is mostly a female-dominated sector. In general, females are more likely to be involved in part-time work compared to men (41-43). Descriptive findings also suggest this: the proportion of employees already working part-time within the sector 'care' was substantially higher (64.8 per cent) compared to other sectors (21.3; 6.6; and 13.5 per cent in 'government', 'industry'; and 'transport') at T0 [specific data not shown].

It is important to interpret these findings in the light of possible (health-related) selection effects over time, such as the healthy worker effect. Potential primary selection bias before article baseline cannot be ruled out since (most) participants in the MCS were already employed before entering the MCS. Descriptive results also suggest that a reduction in working hours may have already occurred before T0 due to ill-health: at T0, the proportion of employees working part-time was already substantially higher for employees with chronic condition(s) compared to healthy

employees. Also, the proportion of employees already working part-time work at T0 was substantially higher for employees with single or multiple physical chronic conditions (respectively 22.4 and 28.3 per cent) compared to healthy employees (18.5 per cent) [specific data not shown]. However, excluding potential selection bias before T0 is difficult (1, 11, 13). Moreover, secondary selection processes could have occurred during the participants' careers and may have strongly attenuated the study findings. Due to selection processes, employees who remain in employment tend to be healthier compared to those who left employment (8, 11, 13, 16, 17). This may result in the study of relatively healthy older workers. Furthermore, selective drop-out of this study due to health status at T0, may have also led to selection bias (15, 32, 44). In line with Jennen (2021) (39), this study demonstrated selective drop-out due to health differences at article baseline: dropouts were more likely to have indicated moderate/poor SPH at T0 compared to participants [specific data not shown].

This study did not aim to quantify the effect of these selection processes, yet to interpret the study findings in the light of continuing selection processes. Due to these selection processes, the observed associations between health and labour participation outcomes may have been strongly attenuated.

Strengths and limitations

When interpreting these findings, various conceptual and methodological aspects should be considered.

The operationalization of health by both chronic condition(s) (and different subtypes) and SPH is invaluable since chronic condition(s) and SPH differently affected labour participation. Moreover, the two outcome measures reducing working hours and leaving employment were considered as health-related adaptations in the employment process (31). It can however be argued whether these adaptations were voluntary (self-regulated adaptations) or involuntary (e.g. forced by organizational changes (14)). The outcome measure leaving employment was defined by employees neither indicating being employed by an employer nor in self-employment, irrespective of the underlying reason(s). Other exit routes – e.g. receiving disability benefits – were not explored. Moreover, having left employment does not directly refer to an exit from paid employment: after an initial exit employees can (always) return to work which can eventually lead to education, self-employment, or a more favorable work situation (45). An avenue for further research would be to disentangle whether a reduction in working hours and leaving employment is (in)voluntary.

A major advantage of this study is the sector-stratified analyses, which enabled to study associations between health and labour participation within different work environment(s). Hereby, also the impact of potential unidentified confounding factors from the work environment and/or institutional factors such as statutory policies and social norms affecting the choice to reduce working hours (43), can be diminished. However, even within the same sector, job tasks and content might differ.

Moreover, selective drop-out of this study due to health differences at T0 was explored at two-year follow-up. This time window is relatively short yet was used to reduce any form of selection bias since employees identified as dropouts can be considered a true representation of selective dropouts and not dropouts due to an administrative selection. At the two-year follow-up measurement, all employees participating since cohort baseline received a questionnaire regardless of whether they participated in the measurements in-between T0 and the two-year follow-up measurement. Latter follow-up measurements were solely performed for employees who participated to all previous questionnaires.

Conclusion

This prospective study demonstrated strong associations between chronic condition(s) and SPH on reducing working hours and leaving employment at two - and, 16-year follow-up. Moreover, having multiple physical morbidity substantially increases the risks to leave employment over time. Sector-stratified analyses demonstrated the strongest associations between health and labour participation outcomes within the sector 'industry'. These findings underline the substantial role of health on labour participation outcomes over time, and provide valuable input for preventive measures aiming to optimize labour participation.

Preferably, preventive measures should intervene earlier during the employment process. Hereby, employees might be (better) able to cope with health condition(s) whilst being in employment and early exit from employment can be prevented.

This study also states the importance to interpret these findings in the light of continuing health-related selection processes, since these selection processes may have strongly attenuated the observed associations. In order to provide accurate input for preventive measures, further research should carefully consider the potential impact of these selection processes when studying the relation between health and labour participation by considering the study population of which study findings are obtained.

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Examining considerations towards early retirement across employees differing in health status and their implications for labour participation outcomes over time: a prospective study among older dayworkers

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Abstract

Research objective Health and age can affect the extent to which older employees are involved in the retirement decision-making process. So far, limited research is available investing the impact of retirement intentions on subsequent behavior for employees differing in health status. This study aims to (i) assess whether considerations towards early retirement differ for older dayworkers with differing health status and age and (ii) whether considerations towards early retirement affect labour participation outcomes over time.

Methods Questionnaire data from the prospective Maastricht Cohort Study were used. Twelve items assessed considerations towards early retirement among n=737 dayworkers aged 45-55 years, and n=605 dayworkers aged 55-61.5 years at article baseline (T0). To study whether strongly agreeing with considerations affect various labour participation outcomes over two-year follow-up, cox regression analyses were performed for the total population n=1,342 older dayworkers aged 45-61.5 years.

Results Consideration(s) towards early retirement differed substantially between older dayworkers with differing health status and increasing age at T0. Employees strongly agreeing with the consideration 'wanting to take early retirement due to a reorganization' had a substantially and statistically higher risk for receiving unemployment benefits (HR 11.82, 95% CI 3.12-44.86) over time compared to employees slightly/fully disagreeing with this consideration.

Conclusions This study shows the substantial role of health on retirement considerations and already provides valuable input for policy measures. Few statistical significant longitudinal associations were observed. If associations are demonstrated over time, study findings can provide input for tailored preventive measures aiming to enhance labour participation among older employees.

Keywords Longitudinal - Work environment – Health – Considerations – Retirement – Older employees

Introduction

The 'baby boom generation' moves into retirement. Consequently, the costs of this growing number of people in retirement have to be defrayed by fewer people in the workforce (Nilsson 2020; Eurofound 2021). To maintain social welfare systems in an ageing society, the legal retirement age has been rising substantially in the past decade (Eurofound 2021). In the European Union (EU), the proportion of older employees working until legal retirement age has already substantially increased from 2009 to 2020 (Eurostat 2021). In the EU, 59.8 per cent of the employees aged 55-64 years were employed in 2020 (Eurostat 2021). In the Netherlands, this percentage was among the highest - 71.0 per cent of employees aged 55-64 years were employed in 2020 (Eurostat 2021). This relatively high percentage in the Netherlands can however, at least partly, be explained by the substantial proportion of employees being in part-time employment. Despite increasing labour participation rates among older employees, retiring before reaching the legal retirement age – remains common (Browne et al. 2019). All these factors together make it invaluable to gain in-depth insight into the retirement (decision-making) process among older workers.

Decisions about when retire (early) can be influenced by multiple factors such as health, job characteristics, and social and (personal) finances (Browne et al. 2019; De Wind et al. 2015). Of these factors, health has been reported to have a considerable effect on the decision to retire (Browne et al. 2019; Damman et al. 2013; Oksanen et al. 2012; Nivalainen 2020): due to health problems, work capacities might be restrained. In order to deal with declining health, older employees with ill-health may leave employment earlier via retirement compared to employees with good health (Damman et al. 2013; Oksanen et al. 2012; Solem et al. 2016). Moreover, health affects an individual's ability and willingness to continue working (Statistics Netherlands 2017). Older employees (aged 45-65 years) with poor/moderate (self-perceived) health believed they were able to continue their work until an average age of 62.5 years (Statistics Netherlands 2017). This was considerably lower compared to employees with good (self-perceived) health (65.0 years) (Statistics Netherlands 2017). Regarding willingness, older employees with poor/moderate (self-perceived) health were willing to continue working until 64 years whereas older employees with good (self-perceived) health were willing to work six months longer (Statistics Netherlands 2017). When interpreting these findings the time window in which these findings were obtained should be considered – that is, in

2015 the legal retirement age in the Netherlands was still 65.3 years (Statistics Netherlands 2017).

Health can be considered as an important factor in the explanation of retirement timing (Nivalainen 2020). Retirement can be viewed as a decision-making process leading from retirement thoughts to retirement plans and from retirement plans to actual retirement (Damman et al. 2013; Oksanen et al. 2012; Nivalainen 2020). The retirement decision-making process encompasses three phases: thinking about the possibility of retirement (retirement thoughts), making plans about retirement (retirement intentions) and making the transition to retirement (actual retirement) (Nivalainen 2020). In this study, the time period before reaching the actual retirement age is central. This study firstly aims to assess whether intentions (referred to as 'considerations') towards early retirement differ among older employees differing in health status. Following the broad definition of health by the World Health Organization (WHO), in which health is not solely determined by the presence or absence of disease, it is invaluable to assess different health dimensions. In addition to chronic conditions, self-perceived health (SPH) is considered an important factor affecting older employees' retirement planning (Sewdas et al. 2018). In order to provide a more comprehensive insight into health factors which might affect the retirement decision-making process, this study therefore distinguishes both chronic condition(s) and SPH. Besides health, age also affects the extent to which older employees are involved in the retirement decision-making process. Previous studies (Eurostat 2021; De Wind et al. 2015; Nivalainen 2020; Grødem et al. 2021) mostly studied groups of employees aged 55 years onwards, since these employees are closer to the retirement age compared to their younger counterparts and as such may be already more involved in the retirement decision-making process. Therefore, in this study considerations towards early retirement will be assessed among two age categories of older employees: those not yet approaching the (early) retirement age and those closer to approaching the (early) retirement age.

So far, there is limited empirical research available that assesses the extent to which retirement intentions actually affect subsequent behavior (Nivalainen 2020; Solem et al. 2016). This insight is of crucial importance to better understand the retirement decision-making process. Therefore, this study secondly aims to assess whether strongly agreeing with considerations towards early retirement is associated with actual early retirement over time, and whether this association differs by differing health status.

Previous research has already indicated that factors from the work environment strongly affect health and retirement intentions and consequently retirement decisions (Nivalainen 2020; Saurama et al. 2004; Edge et al. 2017; Virtanen et al. 2014; Van Solinge et al. 2014; Andersen et al. 2020). Retirement intentions can be shaped by the type of occupation (4; Van Zon et al. 2017) and social norms towards early retirement. Social norms might vary per sector (Nivalainen 2020; Pihlajamäki et al. 2020). It is therefore invaluable to examine the relation between consideration(s) towards early retirement and labour participation outcomes within a homogenous study population. Hereby, potential bias from the work environment can be minimized. Due to job content differing between day – and shift workers (Gommans et al. 2015), only older dayworkers will be included. Moreover, physically demanding work strongly affects the retirement decision-making process (Nilsson 2020; Solem et al. 2016; Health Council 2018; Andersen et al. 2021). Therefore, solely dayworkers performing none to low physically demanding work will be studied over time.

It should be noted that early retirement might not be a feasible option for all older employees. Early retirement may be considered a voluntarily exit from paid employment. However, due to ill-health older employees often exit paid employment involuntarily through disability and unemployment benefits (Leijten et al. 2013; Leijten et al. 2015). Perhaps some employees make adaptions in their work by e.g. decreasing the working hours per week in order to maintain in paid employment whilst having (a) health condition(s) (Nivalainen 2020; Statistics Netherlands 2017). Therefore, in addition to early retirement – other outcome measures such as reducing working hours, and losing employment (through disability pension, unemployment benefits, early retirement), will be studied in order to gain a comprehensive overview of the employment status of older employees.

Methods

Data from the prospective Maastricht Cohort Study (MCS) was used in this study (Kant et al. 2003). The study was approved by the Medical and Ethical Committee of the AZM/Maastricht University (MEC08-4-032.4) and conducted in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. The MCS included at cohort baseline (1998) 12,140 participants from 45 companies, who were employed in different occupations and sectors. Follow-up

data was collected by means of self-administered questionnaires. More in-depth information about the MCS were reported elsewhere (Kant et al. 2003).

Study population

For this study, the 2012 measurement was defined as article baseline (N= 4,783) (T0) and the subsequent 2014 measurement is defined as follow-up measurement (T1). Employees aged 45-61.5 were included. The lower age limit is in line with the WHO definition of older workers: from 45 years onwards (National Research Council 2004). The upper age limit was set at 61.5 years since this study aims to (still) detect considerations towards early retirement and not the already (early) planned actions/decisions towards retirement. At T0, the legal retirement age was 65 years, but older employees on average retired at 63.5 years (Statistics Netherlands 2016). The upper age limit is therefore 61.5 years which is at two-years before the average retirement age at T0. Some older employees are closer to the retirement age compared to their younger counterparts which may affect the retirement decision-making process. Therefore, analyses will be performed separately for the two age strata: employees aged 45-55 years; and 55-61.5 years. Full – or part-time retirees at T0 were excluded due to being the outcome of interest. Moreover, self-employed employees and employees involved in multiple jobs were excluded. Furthermore, pregnant women or with pregnancy leave, employees with parental; sabbatical; or on partially or fully sick leave, were excluded. To include a homogeneous study population of older employees performing none to low physically demanding work, solely employees involved in day work (0700-1900 hours) were included. Moreover, The Baecke work index quantifies the amount of physical activity performed in the occupational domain and comprises eight items (Baecke et al. 1982). First, data about the type of occupation and tasks performed in this occupation was gathered. Then, by using the Ainsworth physical activity compendium (Ainsworth et al. 2011), employees' occupations were converted into three categories of energy expenditure: light, moderate, or vigorous. Employees performing light physical work were included (referred to as 'dayworkers'). This resulted in N=737 older dayworkers aged 45-55 years and N=605 older dayworkers aged 55-61.5 years at T0.

Measures

Health status

Chronic condition(s)
Employees' health status at T0 was coded according to employees reporting none or one/multiple chronic condition(s). The presence of 34 pre-specified health conditions was identified based on self-reported closed ended questions using the validated Health and Work Performance Questionnaire (HPQ) (Kessler et al. 2003). The 34 pre-specified health condition(s) of the HPQ were matched with the ICPC-2 codes of the 28 pre-specified conditions listed by the Dutch National Institute of Public Health and the Environment (RIVM) (Van Oostrom et al. 2017; O'halloran et al. 2004). Seventeen chronic condition(s) of the HPQ matched directly with the RIVM list. Employees could indicate whether or not they have the specific chronic condition, and additionally whether they had received or currently receive treatment for the specific chronic condition (Kessler et al. 2003). These response options were dichotomized into 'no I don't have' or 'yes, I have'. Employees indicating 'yes, I have' to one of these seventeen chronic condition(s), were classified as having chronic condition(s). Additionally, in an open-ended question, employees could list another (not previously listed) chronic condition(s). These open-ended questions were also matched with the ICPC-2 codes specified by the RIVM list. If a health condition matched, employees were classified as having chronic condition(s). Employees without chronic condition(s) were considered the reference group.

Self-perceived health
One item from the Dutch version of the Short Form Healthy Survey-36 (SF-36 item) (Aaronson et al. 1998) stated: 'How do you rate your general health'. Response options dichotomized into 'good self-perceived health' ('excellent'; 'very good'; 'good') and 'moderate/poor health' ('moderate'; 'poor') (Dalstra et al. 2002). Employees with good self-perceived health were considered the reference group.

Considerations towards early retirement
At T0, employees were asked: 'Can you indicate to what extent these reasons contribute to your consideration of taking early retirement? I want to retire early …'. Twelve items were listed, such as 'If it is financially feasible' or 'Because of my

health' (Instute for Policy Research and Advice 2006). Response options were: 'to a great extent'; 'reasonable extent'; 'minor extent'; 'not'; 'n.a.' (Instute for Policy Research and Advice 2006). The answer options were recoded into '(strongly) agree' (first two response options) and '(slightly/fully) disagree' (third and fourth response option). The answer option 'n.a.' was defined as missing value and not included in the analyses.

Labour participation outcomes

Employment status
At T0, all employees were employed. At T1, one item asked: 'what is your current work status'. Employees indicating being 'in paid employment by an employer (yes)', or 'being self-employed (fully/partially) (yes)', were considered as being 'in employment' at T1. Employees classifying otherwise, were considered 'not being in employment' regardless of the underlying reason(s). At T1, employees could have lost employment and exit routes were specified: early retirement, disability benefits, and unemployment benefits.

Early retirement
Employees indicating 'retired (fully/partially)' on the item 'what is your current work status' at T1, were classified as employees being with early retirement.

Reducing working hours
Employees indicating 'yes' on the item 'did you start working fewer hours in the past year' at T1, were classified as employees who reduced their working hours.

Disability benefits
Employees indicating 'receiving disability benefits (fully/partially)' on the item 'what is your current work status' at T1, were considered as employees receiving disability benefits.

Unemployment benefits
Employees indicating 'involuntarily unemployed (fully/partially)' on the item 'what is your current work status' at T1, were classified as employees receiving unemployment benefits.

Contextual/confounding factors

Potential confounding factors from the personal/private, work-related and health domains were considered (Browne et al. 2019; Edge et al. 2017; Van Solinge et al. 2014; Carr et al. 2016; Kubicek et al. 2010) for the longitudinal analyses studying associations between considerations towards early retirement at T0 and labour participation outcomes at T1. All confounding factors were measured at T0.

From the personal/private domain, age, gender, educational level, partner retired, and living alone, were considered confounding factors.

From the work-related domain, one item originating from the Dutch questionnaire on Work and Health (Gründemann et al. 1993) assessed whether employees considered their work as physically demanding (yes/no). One item assessed the number of working hours per week (h/week): five answer options were recoded into full-time work (>40 or 36-40 h/week) and part-time work (26-35, 16-25, or < 16 h/week). Psychological job demands and decision latitude was measured by using the validated Dutch version of the job content questionnaire (JCQ) (Gründemann et al. 1993). The total scores for the subscale psychological job demands ranges from 12 to 48 and for the subscale decision latitude the total scores ranges from 24 to 96. Moreover, co-worker social support and supervisor social support were measured using the JCQ. The total scores for these scales ranges from 4 to 16. Emotional demands was measured by using the sum of five items originating from the Dutch Questionnaire on the Experience and Evaluation of Work (VVBA) (Van Veldhoven et al. 2003; Van Veldhoven et al. 1994), the Dutch questionnaire on Work and Health (Gründemann et al. 1993), and one self-formulated item. This scale ranges from 0 to 5.

From the health domain, self-perceived health and the presence of chronic condition(s) were considered confounding factors.

Furthermore, employees were asked to indicate 'whether within the company at which you are currently employed, schemes exist which facilitate labour force exit before reaching the mandatory retirement age'. The percentage of employees indicating 'yes' were presented in Table 1 for descriptive purposes.

Statistical analysis

Data was analyzed using IBM SPSS 26.0. P-values below .05 were considered statistically significant.

Descriptive statistics of personal/private, work-related, and health factors at T0 were described for older dayworkers in strata, based on health status and age,

using one-way ANOVA for continuous measures and χ2 test of independence for categorical variables. Considerations towards (early) retirement at T0 were described for older dayworkers in strata, based on health status and age at T0, using the χ2 test of independence for categorical variables. Unfortunately, due to few incident cases for the respective outcomes over time, stratification for health status and age was not possible. Multivariate survival analyses using Cox regression analyses were performed for the total study population of older dayworkers (aged 45-61.5 years). The impact of (strongly) agreeing with considerations towards (early) retirement on labour participation outcomes (losing employment; receiving disability; receiving unemployment; retiring early; reducing working hours) was explored over two-year follow-up period. The reference group consisted of older dayworkers (slightly/fully) disagreeing with consideration(s) towards (early) retirement at T0. Hazard ratio's and 95% confidence intervals were calculated. Crude and additionally adjusted models for respectively factors from the private/personal, work-related, and health domain were calculated. The association between the consideration '(strongly) agreeing wanting to take early retirement because the work is physically demanding' and labour participation outcomes over time, was not adjusted for whether employees considered their work as physically demanding.

Results

Descriptives

Table 1 shows baseline characteristics for older dayworkers in strata based on health status and age, for personal, work-related, and health-related factors.

Regarding chronic condition(s), for personal factors results showed that the percentage male employees were higher among healthy employees (71.5 per cent) compared to employees with chronic condition(s) (57.0 per cent) within the age stratum 45-55 years. On average, employees with chronic conditions(s) had a slightly higher age compared to healthy employees in both age strata (respectively within the age strata 45-55 years: 50.93 years versus 50.49 years of age; and within the age stratum 55-61.5 years: 58.22 years versus 58.02 years of age). Educational level statistically significantly differed between healthy employees and employees with chronic condition(s) within the age stratum 55-61.5 years. For work-related factors, the proportion of employees indicating to perceive their work as physically demanding was higher among employees with chronic condition(s) compared to

Table 1: Descriptive statistics of personal, work-related, health, and labour participation factors among older dayworkers at article baseline, stratified for health status and age

	Chronic condition(s)						Self-perceived health					
	45-55 years (N=672)			55-61.5 years (N = 558)			45-55 years (N = 734)			55-61.5 years (N = 603)		
	Healthy employees N = 365	Employees with CC N = 307	p-value	Healthy employees N = 263	Employees with CC N = 295	p-value	Good SPH N = 641	Moderate/ Poor SPH N = 93	p-value	Good SPH N = 508	Moderate/ Poor SPH N = 95	p-value
Gender (N, %)												
Male	261 (71.5)	175 (57.0)	<.001*	212 (80.6)	219 (74.2)	.07	426 (66.5)	49 (52.7)	.01*	390 (76.8)	72 (75.8)	.84
Age (Mean, SD)	50.49 (2.73)	50.93 (2.70)	.04*	58.02 (1.80)	58.22 (1.85)	.19	50.74 (2.72)	51.03 (2.66)	.34	58.09 (1.78)	58.50 (1.88)	.04*
Educational level (N,%)												
Low	47 (16.3)	54 (21.1)	.09	49 (23.0)	86 (34.5)	.01*	92 (17.7)	19 (23.5)	.31	118 (27.9)	27 (33.8)	.53
Middle	66 (22.8)	70 (27.3)		47 (22.1)	33 (13.3)		127 (24.5)	22 (27.2)		73 (17.3)	14 (17.5)	
High	176 (60.9)	132 (51.6)		117 (54.9)	130 (52.2)		300 (57.8)	40 (49.4)		232 (54.8)	39 (48.8)	
Partner retired (N,%)												
Yes	6 (1.9)	9 (3.4)	.52	16 (7.2)	21 (8.6)	.82	12 (2.2)	4 (5.0)	.15	33 (7.7)	7 (10.0)	.77
Working hours (N, %)												
Full-time	280 (76.9)	208 (68.2)	.01*	203 (77.2)	191 (65.0)	.00*	471 (73.8)	60 (64.5)	.06	371 (73.2)	59 (62.1)	.03*
Part-time	84 (23.1)	97 (31.8)		60 (22.8)	103 (35.0)		167 (26.2)	33 (35.5)		136 (26.8)	36 (37.9)	
Physically demanding work (N,%)												
Yes	28 (7.8)	37 (12.8)	.04*	21 (8.3)	39 (14.0)	.04*	53 (8.6)	19 (21.3)	<.001*	45 (9.4)	18 (19.4)	.01*
(Mean, SD)												
Psychological job demands (12-48)	31.29 (5.36)	31.94 (5.56)	.13	31.44 (5.50)	31.71 (6.15)	.59	31.49 (5.47)	31.79 (5.73)	.63	31.25 (5.61)	32.49 (6.91)	.06
Decision latitude (24-96)	77.22 (8.78)	75.74 (10.40)	.05	77.12 (9.30)	74.22 (10.65)	.01*	76.75 (9.46)	73.07 (11.05)	.00*	76.39 (9.78)	71.29 (10.95)	<.001*
Supervisor social support (4-16)	11.25 (2.21)	10.66 (2.39)	<.001*	10.97 (2.13)	10.63 (2.20)	.07	11.09 (2.25)	10.32 (2.39)	.00*	10.87 (2.13)	10.39 (2.49)	.06

Co-worker social support (4-16)	12.28 (1.44)	12.20 (1.73)	.48	12.04 (1.42)	11.94 (1.46)	.42	12.26 (1.53)	12.01 (1.69)	.15	12.07 (1.47)	11.72 (1.26)	.03*
Emotional demands (0-5)	.92 (1.17)	1.28 (1.30)	<.001*	.88 (1.25)	1.23 (1.25)	.00*	1.03 (1.23)	1.40 (1.33)	.01*	.96 (1.21)	1.55 (1.38)	<.001*
SPH (N, %)												
Good	355 (97.5)	225 (73.8)	<.001*	252 (96.2)	215 (73.1)	<.001*	641 (100.0)	93 (100.0)		508 (100.0)		
Poor/moderate	9 (2.5)	80 (26.2)		10 (3.8)	79 (26.9)						95 (100.0)	
Chronic condition(s) (N, %)												
Present		307 (100.0)					225 (38.8)	80 (89.9)	<.001*	215 (46.0)	79 (88.8)	<.001*
Not present	365 (100.0)			263 (100.0)	295 (100.0)		355 (61.2)	9 (10.1)		252 (54.0)	10 (11.2)	
Retirement intentions (N, %)												
Strong	67 (18.4)	50 (16.4)	.50	52 (19.8)	78 (26.7)	.06	115 (18.0)	15 (16.3)	.69	110 (21.8)	30 (31.6)	.04*
Access to early retirement schemes (N,%)												
Yes	82 (35.0)	69 (36.1)	.82	89 (44.5)	102 (46.8)	.64	146 (35.9)	23 (38.3)	.71	173 (45.3)	35 (50.0)	.47

healthy employees within both age strata (45-55 years: 12.8 vs. 7.8 per cent; and 55-61.5 years: 14.0 vs. 8.3 per cent). Furthermore, results showed that the percentage of employees working part-time was substantially higher for older employees with chronic condition(s) compared to healthy employees in both age strata, however the percentage of employees working part-time was the highest among older employees within the age stratum 55-61.5 years (35.0 per cent). The mean scale scores for decision latitude and emotional demands were respectively lower and higher for older employees with chronic condition(s) compared to healthy employees, within both age strata. The percentage of employees indicating to have access to early retirement schemes in the company in which they are employed, did not statistically significantly differ for employees based on health status. However, with increasing age the percentage employees indicating to have access to these early retirement schemes increased. For health-related factors, results showed that the proportion of older employees reporting poor/moderate self-perceived health was substantially higher among employees with chronic condition(s) compared to healthy employees within both age strata (45-55 years: 26.2 vs. 2.5 per cent; and 55-61.5 years: 26.9 vs. 3.8 per cent).

Regarding self-perceived health, for personal factors results showed that the percentage male employees was higher among employees with good self-perceived health (66.5 per cent) compared to employees with moderate/poor self-perceived health (52.7 per cent) within the age stratum 45-55 years. For work-related factors, the proportion of employees working part-time was higher among employees with poor/moderate SPH compared to employees with good SPH within the age stratum 55-61.5 years. The proportion of older employees indicating to perceive their work as physically demanding was higher among employees with moderate/poor SPH compared to employees with good SPH within both age strata (45-55 years: 21.3 vs. 8.6 per cent; and 55-61.5 years: 19.4 vs. 9.4 per cent). The mean scale scores for decision latitude and emotional demands were respectively lower and higher for employees with moderate/poor SPH compared to employees with good SPH within both age strata. Moreover, the proportion of employees reporting strong retirement intentions was higher among employees with moderate/poor SPH compared to employees with good SPH (31.6 vs. 21.8 per cent) within the age stratum 55-61.5 years. The percentage of employees indicating to have access to early retirement schemes in the company in which they are employed, did not statistically significantly differ for employees based on health status.

Considerations towards (early) retirement among older dayworkers, stratified for health status and age at T0.

In table 2, the extent to which older dayworkers indicate to consider early retirement at T0, are presented in strata based on health status and age.

The proportion of older employees (strongly) agreeing with 'wanting to retire early due to health' was substantially and statistically higher for employees with chronic condition(s) compared to healthy employees for both age strata (45-55 years: 51.2 vs. 30.2 per cent; and 55-61.6 years: 53.0 vs. 24.0 per cent); and higher for employees with poor/moderate SPH compared to employees with good SPH for both age strata (45-55 years: 63.3 vs. 36.6 per cent; and 55-61.5 years: 75.0 vs. 31.7 per cent). Moreover, the proportion of older employees (strongly) agreeing with 'wanting to retire early because the work is physically demanding' was higher for employees with chronic condition(s) compared to healthy employees in the age strata 45-55 years (13.8 vs. 5.9 per cent) and higher for employees with poor/moderate SPH compared to employees with good SPH in both age strata (45-55 years: 18.5 vs. 8.8 per cent; and 55-61.5 years: 16.9 vs. 9.1 per cent). Furthermore, statistically significantly differences were observed among the proportion of employees (strongly) agreeing with 'wanting to retire early because the work is mentally though' for the groups stratified for differing health status and age. The proportion of employees (strongly) agreeing with 'wanting to retire early due to an organization' and 'wanting to retire early due to limited development opportunities', was statistically significantly higher among employees with poor/moderate SPH compared to employees with good SPH among older employees aged 55-61.5 years. The proportion of employees (strongly) agreeing with 'wanting to retire early because it is difficult for me to keep up with professional content' differed statistically significantly among employees with chronic condition(s) compared to healthy employees; and among employees with poor/moderate SPH compared to employees with good SPH within the age strata 55-61.5 years. Moreover, statistically differences were observed between the different health status and age groups with regards to (strongly) agreeing with 'wanting to retire early because I have difficulty with changes at work'. Except for employees with chronic condition(s) aged 45-55 years, for which no statistical significant differences were observed.

Table 2: Description of the extent to which older dayworkers consider early retirement at T0, stratified for health status and age.

	Chronic condition(s)						Self-perceived health					
"I want to take early retirement ..." (%)	**45-55 years**			**55-61.5 years**			**45-55 years**			**55-61.5 years**		
	Healthy (N=365)	CC (N=307)	p-value	Healthy (N=263)	CC (N=295)	p-value	Good SPH (N=641)	Poor/moderate SPH (N=93)	p-value	Good SPH (N=508)	Poor/moderate SPH	p-value
If it is financially feasible	9.9	10.4	.82	14.2	14.3	.97	10.6	9.9	.83	14.9	(N=95)	.44
(Slightly/fully) disagree	90.1	89.6		85.8	85.7		89.4	90.1		85.1		
(Strongly) agree												
Because I need more free time												
(Slightly/fully) disagree	24.5	22.2	.49	28.9	28.2	.87	23.1	26.4	.49	27.9	11.8	.37
(Strongly) agree	75.5	77.8		71.1	71.8		76.9	73.6		72.1	88.2	
Because of my health												
(Slightly/fully) disagree	69.8	48.8	< .001*	76.0	47.0	<.001*	63.4	36.7	<.001*	68.3	32.6	<.001*
(Strongly) agree	30.2	51.2		24.0	53.0		36.6	63.3		31.7	67.4	
Because my partner is also retired												
(Slightly/fully) disagree	64.9	59.7	.22	77.7	69.6	.07	62.3	61.8	.93	73.4	25.0	.87
(Strongly) agree	35.1	40.3		22.3	30.4		37.7	38.2		26.6	75.0	
Because the work is physically demanding												
(Slightly/fully) disagree	94.1	86.2	.00*	92.2	87.5	.09	91.2	81.5	.01*	90.9	72.5	.04*
(Strongly) agree	5.9	13.8		7.8	12.5		8.8	18.5		9.1	27.5	
Because the work is mentally tough												
(Slightly/fully) disagree	64.6	56.7	.04*	61.2	50.4	.02*	61.7	54.1	.18	58.4	83.1	.00*
(Strongly) agree	35.4	43.3		38.8	49.6		38.3	45.9		41.6	16.9	

Due to a reorganization I am leaving											
(Slightly/fully) disagree	83.4	78.7	.22	81.4	78.5	.50	81.8	82.7	.87	82.1	40.4	.01*
(Strongly) agree	16.6	21.3		18.6	21.5		18.2	17.3		17.9	59.6	
Because I don't have enough variety in my work											
(Slightly/fully) disagree	94.7	96.3	.36	96.7	93.4	.10	95.6	91.3	.10	95.6	67.8	.12
(Strongly) agree	5.3	3.7		3.3	6.6		4.4	8.8		4.4	32.2	
Because the employer stimulates this											
(Slightly/fully) disagree	93.6	94.8	.55	94.3	93.8	.85	93.8	94.3	.87	93.6	91.5	.46
(Strongly) agree	6.4	5.2		5.7	6.2		6.2	5.7		6.4	8.5	
Because my development opportunities are limited											
(Slightly/fully) disagree	90.3	91.1	.73	91.6	86.7	.09	90.8	85.5	.14	90.3	95.9	.02*
(Strongly) agree	9.7	8.9		8.4	13.3		9.2	14.5		9.7	4.1	
Because it is difficult for me to keep up with professional content											
(Slightly/fully) disagree	89.6	88.1	.57	91.2	84.2	.02*	90.2	81.9	.02	90.6	81.5	<.001*
(Strongly) agree	10.4	11.9		8.8	15.8		9.8	18.1		9.4	18.5	
Because I have difficulty with changes at work											
(Slightly/fully) disagree	94.2	91.3	.17	88.4	83.2	.10	94.4	81.7	<.001*	88.0	72.1	.00*
(Strongly) agree	5.8	8.7		11.6	16.8		5.6	18.3		12.0	27.9	

Longitudinal associations between attitudes towards early retirement at T0 and labour participation outcomes at T1, for the population of older dayworkers aged 45-61.5 years

In Table 3, the findings regarding impact of (strongly) agreeing with considerations towards early retirement at T0 on various labour participation outcomes over time among older employees aged 45-61.5 years, is shown. Regarding losing employment, (fully adjusted) models showed no statistical significant risks. Solely the second model (adjusted for private/personal and work-related factors) showed that employees (strongly) agreeing with 'wanting to take early retirement due to a reorganization' at T0, had an increased risk of losing employment over the two-year follow-up (HR 1.97, 95% CI 1.08-3.59) compared to employees (slightly/fully) disagreeing with this consideration. Regarding receiving disability benefits, (fully adjusted) models showed no statistical significant risks. Solely the crude model showed that employees (strongly) agreeing with 'wanting to take early retirement because it is difficult for me to keep up with professional content' at T0, had an increased risk to receive disability benefits over the two-year follow-up (HR 5.93, 95% CI 1.20-29.37) compared to employees (slightly/fully) disagreeing with this consideration. Regarding receiving unemployment benefits, fully adjusted models showed that older employees (strongly) agreeing with 'wanting to take early retirement due to a reorganization' at T0 had substantially and statistically significantly higher risks for receiving unemployment benefits (HR 11.82, 95% CI 3.12-44.86) over two-year follow-up compared to employees (slightly/fully) disagreeing with the consideration. Regarding early retirement and reducing working hours, (fully adjusted) models showed no statistical significant risks over time.

Table 3: Longitudinal associations between considerations towards early retirement at T0 and labour participation outcomes at T1, for the population of older dayworkers aged 45-61.5 years

N = 1,342 older employees aged 45-61.5	Early retirement				Reducing weekly working hours				Losing employment				Receiving disability benefits				Receiving unemployment benefits			
Items assessing considerations towards early retirement at T0	HR	HR[1]	HR[2]	HR[3]	HR	HR[1]	HR[2]	HR[3]	HR	HR[1]	HR[2]	HR[3]	HR	HR[1]	HR[2]	HR[3]	HR	HR[1]	HR[2]	HR[3]
Strongly agreeing with wanting to take early retirement if it is financially feasible	1.65 (.39-6.99)	1.49 (.34-6.57)	1.94 (.35-10.85)	2.04 (.36-11.48)	23.26 (.17-3148.56)	/	/	/	1.34 (.62-2.91)	1.58 (.72-3.46)	1.59 (.71-3.54)	1.62 (.73-3.61)	.78 (.09-6.66)	1.13 (.09-13.63)	/	/	2.67 (.36-19.87)	2.89 (.38-21.92)	2.85 (.35-23.12)	2.97 (.36-24.48)
Strongly agreeing with wanting to take early retirement because I need more free time	1.64 (.62-4.34)	1.64 (.56-4.75)	1.80 (.58-5.60)	2.08 (.62-6.93)	1.46 (.64-3.31)	1.30 (.57-2.97)	1.30 (.56-3.00)	1.31 (.57-3.05)	1.27 (.75-2.14)	1.24 (.74-2.10)	1.18 (.69-2.04)	1.21 (.69-2.10)	.44 (.09-2.20)	.56 (.11-2.89)	/	/	2.21 (.65-7.49)	2.34 (.68-7.98)	2.17 (.59-7.96)	2.23 (.60-8.27)
Strongly agreeing with wanting to take early retirement because of my health[a]	.93 (.79-1.09)	.93 (.79-1.09)	.92 (.78-1.09)	.92 (.77-1.10)	.60 (.31-1.19)	.66 (.33-1.31)	.61 (.30-1.22)	.56 (.26-1.20)	.81 (.51-1.27)	.77 (.49-1.22)	.77 (.48-1.23)	.76 (.46-1.26)	53.04 (.07-40104.52)	/	/	/	.70 (.28-1.74)	.67 (.27-1.67)	.72 (.27-1.93)	.69 (.23-2.04)
Strongly agreeing with wanting to take early retirement because my partner is also retired	.48 (.16-1.40)	.54 (.17-1.75)	.43 (.12-1.63)	.43 (.11-1.66)	1.60 (.78-3.27)	1.16 (.51-2.65)	1.15 (.50-2.65)	1.14 (.49-2.64)	1.02 (.63-1.66)	.98 (.57-1.67)	.99 (.57-1.72)	.98 (.56-1.70)	.52 (.06-4.63)	.56 (.05-5.71)	/	/	.49 (.14-1.69)	.55 (.13-2.25)	.57 (.13-2.41)	.55 (.13-2.38)

Strongly agreeing with wanting to take early retirement because the work is physically demanding[a] (*)	1.01 (.78-1.32)	1.02 (.78-1.33)	1.03 (.78-1.34)	1.03 (.79-1.35)	1.81 (.75-4.33)	2.07 (.82-5.23)	2.14 (.81-5.67)	2.21 (.83-5.91)	.90 (.39-2.06)	.96 (.41-2.22)	.81 (.34-1.94)	.82 (.34-1.97)	1.63 (.20-13.54)	1.20 (.11-13.00)	/	/	.59 (.08-4.41)	.63 (.08-4.97)	.43 (.04-4.45)	.42 (.04-4.33)
Strongly agreeing with wanting to take early retirement because the work is mentally though[a]	1.01 (.87-1.18)	1.01 (.86-1.18)	1.01 (.85-1.20)	1.01 (.85-1.20)	2.07 (1.07-4.00)	1.80 (.90-3.61)	1.90 (.91-3.99)	1.91 (.91-4.01)	1.07 (.69-1.65)	.99 (.63-1.56)	.88 (.54-1.46)	.89 (.54-1.48)	2.83 (.52-15.45)	1.43 (.22-9.32)	/	/	1.01 (.41-2.46)	.95 (.36-2.49)	.72 (.25-2.10)	.74 (.26-2.13)
Strongly agreeing with wanting to take early retirement due to a reorganization I am leaving[a]	1.07 (.85-1.35)	1.07 (.85-1.35)	1.08 (.85-1.37)	1.08 (.85-1.37)	.34 (.08-1.45)	.38 (.09-1.66)	.44 (.10-1.98)	.41 (.09-1.88)	2.09 (1.23-3.56)*	1.72 (.99-3.00)	1.97 (1.08-3.59)*	1.98 (1.08-3.60)*	.04 (.00-84054.51)	/	/	/	5.50 (2.13-14.19)*	5.03 (1.88-13.45)*	10.65 (2.89-39.16)*	11.82 (3.12-44.86)*
Strongly agreeing with wanting to take early retirement because I don't have enough variety in my work	.46 (.06-3.37)	.64 (.08-5.23)	.63 (.07-5.90)	.55 (.06-5.46)	.04 (.00-13.39)	/	/	/	.67 (.24-1.83)	.86 (.30-2.46)	.93 (.31-2.79)	.96 (.32-2.90)	.04 (.00-18139.90)	/	/	/	1.55 (.45-5.35)	1.92 (.50-7.32)	3.59 (.68-18.93)	4.39 (.74-25.90)
Strongly agreeing with wanting to take early retirement because the employer stimulates this	1.40 (.42-4.69)	1.08 (.30-3.80)	1.01 (.27-3.86)	1.12 (.27-4.59)	.04 (.00-14.34)	/	/	/	.91 (.37-2.26)	.74 (.29-1.88)	.72 (.28-1.86)	.72 (.28-1.87)	.04 (.00-55423.37)	/	/	/	.66 (.09-4.97)	.76 (.09-6.41)	.56 (.05-5.98)	.59 (.05-6.54)

Strongly agreeing with wanting to take early retirement because my development opportunities are limited[a]	1.00 (.86-1.31)	1.01 (.77-1.33)	1.05 (.79-1.40)	1.06 (.79-1.41)	.28 (.04-2.01)	.32 (.04-2.32)	.32 (.04-2.46)	.32 (.04-2.48)	1.06 (.51-2.20)	1.09 (.52-2.28)	1.12 (.50-2.50)	1.14 (.51-2.55)	.04 (.00-7952.13)	/	/	/	1.99 (.66-6.00)	2.31 (.74-7.21)	2.45 (.63-9.52)	2.57 (.65-10.13)
Strongly agreeing with wanting to take early retirement because it is difficult for me to keep up with professional content[a]	1.01 (.80-1.28)	1.01 (.80-1.28)	1.02 (.81-1.30)	1.03 (.81-1.31)	.99 (.39-2.55)	.95 (.36-2.48)	.89 (.33-2.39)	.90 (.33-2.42)	1.03 (.53-2.00)	1.10 (.56-2.19)	1.01 (.49-2.08)	1.06 (.51-2.21)	5.93 (1.20-29.37)*	4.78 (.84-27.19)	/	/	1.22 (.36-4.17)	1.47 (.41-5.34)	1.37 (.34-5.60)	1.48 (.33-6.70)
Strongly agreeing with wanting to take early retirement because I have difficulty with changes at work[a]	1.00 (.78-1.29)	1.01 (.78-1.30)	1.03 (.79-1.34)	1.04 (.80-1.36)	.94 (.37-2.40)	.93 (.35-2.50)	.96 (.33-2.76)	.95 (.33-2.73)	1.05 (.52-2.09)	1.02 (.50-2.07)	.86 (.40-1.87)	.90 (.41-2.00)	3.58 (.66-19.56)	3.71 (.62-22.44)	/	/	1.34 (.39-4.59)	1.17 (.32-4.27)	1.01 (.23-4.37)	1.09 (.23-5.22)

a = reference group (slightly/fully disagree with consideration); 1= analyses additionally adjusted for demographic/private factors (age, gender, educational level, partner retired, living alone); 2 = analyses additionally adjusted for work-related factors (performing physically demanding work, working hours per week, psychological job demands, decision latitude, supervisor social support, co-worker social support, emotional demands); 3= analyses additionally adjusted for SPH and presence of chronic condition(s); *=for specific item analyses not adjusted for item ‘performing physically demanding work at T0’

Discussion

This study shows that the extent to which employees indicate to consider early retirement, substantially varies for older dayworkers differing in health status and age. Over time, study findings did indicate many associations between (strongly) agreeing with various considerations towards early retirement at T0 and labour participation outcomes over time, but few of these associations were statistical significant. For example, the risk to retire early over time differed between employees (strongly) agreeing with the consideration 'wanting to take early retirement if it is financially feasible' compared to employees (slightly/fully) disagreeing with this consideration, however the association was not statistically significantly.

Cross-sectional findings showed that the proportion of employees (strongly) agreeing with the consideration 'Wanting to retire early due to health' was substantially and statistically higher for employees with chronic condition(s) compared to healthy employees and for employees with poor/moderate SPH compared to the proportion of employees with good SPH at T0. The proportion of employees (strongly) agreeing with 'Wanting to retire early due to a reorganization' and 'Wanting to retire early due to limited development opportunities' was statistically significantly higher among employees with poor/moderate SPH compared to employees with good SPH, aged 55-61.5 years at T0. Our cross-sectional findings suggest that a differing health status already substantially affects the retirement decision-making process rather early by (strongly) agreeing with these considerations to retire early (8). A cross-sectional study by Nilsson (2016) supports our findings and states that SPH is highly associated with older employees' (55-64 years) retirement planning. However, at T0 no statistical significant associations were found for the 'Wanting to retire early if it is financially feasible' statement. A study by Von Bonsdorff (2009) also reports that the financial situation does not predict early retirement intentions.

Longitudinal findings did indicate many associations between various considerations towards early retirement at T0 and labour participation outcomes over time, but few of these associations were statistical significant. Fully adjusted models showed that older employees (strongly) agreeing with 'Wanting to take early retirement due to a reorganization' had substantially and statistically significantly higher risks for losing employment and receiving unemployment benefits over time compared to employees (slightly/fully) disagreeing with the consideration. Perhaps, a reorganization within an organization is necessarily in

order to save costs. It is presumable that many employees do not immediately find another job, and consequently apply for unemployment benefit (Institute for Employee Insurance 2022). Although previous research demonstrated strong associations over time between actual actions towards early retirement due to financial possibilities (De Wind et al. 2014), our study findings showed that the risk to retire early over time did not statistically significantly differ between employees (strongly) agreeing with the consideration 'Wanting to take early retirement if it is financially feasible' compared to employees (slightly/fully) disagreeing with this consideration at T0. Furthermore, our none adjusted model showed that older employees (strongly) agreeing with 'Wanting to take early retirement because it is difficult for me to keep up with professional content' had increased risks to receive disability benefits over time compared to employees (slightly/fully) disagreeing with this consideration. Perhaps, those older employees (strongly) agreeing with this consideration, perceive a skill mismatch and consequently leave employment via different exit routes (Gommans et al. 2017).

No statistical significant associations over time were between considerations towards early retirement and early retirement.

Various important methodological and conceptual considerations should be taken into account when interpreting the findings of this study.

The description of the exposure items might, at least partially, explain the few statistical significant associations over time. The exposure items described the extent to which older employees indicate to consider early retirement and were thus more likely to be related to the outcome measure early retirement over time. Consequently, the exposure items might not be considered a proxy for other labour participation outcomes such as receiving disability benefits. However, various labour participation outcomes over time were studied since a voluntarily exit from paid employment (e.g. early retirement) might not be feasible for older employees suffering from ill-health and some have to involuntarily exit paid employment through other exit routes (e.g. disability benefits).

Due to a low number of older employees (strongly) agreeing with considerations towards early retirement at T0 and few incident cases for the respective outcome measures at T1, this study's statistical power was relatively low. It was therefore necessary to perform the longitudinal analyses for the broader age range of older employees (aged 45-61.5 years). However, within this age range, many of these employees were not yet approaching the (early) retirement age which may also explain observing few statistical significant associations over time for outcome

measures such as early retirement. If statistical power is sufficient, further research should aim to study these associations over time among older employees stratified for health status and age.

Since this study's cross-sectional analyses were intended to be mainly descriptive and therefore performed for important substrata of older dayworkers differing in health status and age, no adjustments for potential confounding factors were made at T0. Perhaps, gender could have affected the cross-sectional findings (Von Bonsdorff et al. 2009). If numbers allow, further research can assess the potential role of gender within these substrata. In the longitudinal analyses, adjustments were made for important confounding factors from the private/personal, work-related and health domains.

In order to minimize potential bias from the work environment, a homogeneous study population of older dayworkers performing light physical work load was included. However, still some older dayworkers perceived their work as physically demanding at T0. Potential bias from subjective physical work demands thus cannot be ruled out.

Also the study's two-year follow-up period may have been too short to detect changes in labour participation outcomes over time. However, assessing this relation in a broader time window would be difficult since the oldest dayworkers could reach the (legal) retirement age in that time window. Consequently, the outcome measure early retirement could then no longer be studied. Furthermore, potential selection processes cannot be ruled out. Perhaps employees might have already left employment before T0 due to ill-health or older age and consequently the healthier employees remain in employment, reducing the observed associations.

When generalizing these study findings, one should carefully consider various potential contextual factors such as subjective norms towards early retirement and institutional factors (Von Bonsdorff et al. 2009; Van Dam et al. 2009).

According to the Theory of Reasoned Action (TRA) (Montano et al. 2015), behavior is determined by the intention to perform the behavior. Older employees may develop an intention to retire early, particularly when having a positive attitude towards early retirement (Van Dam et al. 2009). Intentions are determined by subjective norms and the attitude towards the behavior (Montano et al. 2015). Subjective norms are perceived pressures from the work and social environment such as the partner and/or relatives (Van Dam et al. 2009). The TRA argues that the more positive the subjective norm and the stronger the attitude, the more likely a behavior will occur. Perhaps, older dayworkers in this study perceived none/low

social support to retire early (Van Dam et al. 2009), which could have attenuated the actual behavior to retire early. However, individual data regarding subjective norms was not available and cannot be estimated. However, the TRA is widely used to predict health behaviors, not labour force participation. Furthermore, institutional factors such as labour agreements and/or the availability of early retirement schemes can affect or shape older employees' retirement intentions. These institutional factors can vary per sector and per company (Von Bonsdorff et al. 2009). In our study, descriptive results showed that with increasing age, the percentage employees with access to early retirement schemes, increased. Older employees closer to approaching the (early) retirement age might have become more aware of the accessibility/availability of early retirement schemes compared to employees not yet approaching the (early) retirement age.

Conclusion(s)/implication(s)

The extent to which older dayworkers indicated considering early retirement varies substantially between older dayworkers, depending on their health status and age. These findings already provide valuable input for policy measures aiming to increase labour force participation rates among older employees. Due to low numbers available for the longitudinal analyses, these analyses could only be performed for the whole study population. Few statistical significant associations between considerations towards early retirement at article baseline and labour participation outcomes at follow-up were observed. For further research it is strongly recommended to study the impact of considerations towards early retirement on labour participation outcomes in larger samples which might enable stratified analysis for health status and age. Moreover, further research studying the relation between considerations towards early retirement and labour participation outcomes should distinguish between specific companies or sectors. Hereby, the potential role of contextual (e.g. sector-specific) factors and arrangements - such as the availability/accessibility to early retirement schemes – can be taken into account in order to facilitate the development of tailored preventive measures.

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6

The role of work engagement and chronic health conditions on different labour participation outcomes over time among older employees

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Submitted

Abstract

Objective To investigate the role of work engagement (WE) and chronic health conditions on different labour participation outcomes over time among older employees

Methods Longitudinal data were used (N=2,023). WE was measured using nine items of the Utrecht Work Engagement Scale. Presenteeism frequency, (retirement) intentions, and leaving employment were each measured by one single item consisting of multiple answer options.

Results Higher WE levels were cross-sectionally associated with lower odds for frequent presenteeism behavior (OR .84, 95% CI .75-.94) and strongly agreeing with the intention to retire before the mandatory retirement age (OR .79, 95% CI .72-.87).

Conclusions Strong cross-sectional associations were observed, however the direction differed depending on amongst others health status. For employees with chronic health condition(s), increased WE levels were related to lower presenteeism, however not for employees without chronic health conditions.

Keywords Work engagement – Presenteeism – Aging workforce – Prolongation of working lives – Prospective

Introduction

In Northern America and Europe, longevity of citizens increases compared to a few decades ago and consequently the proportion of elderly people in the population is predicted to continue to increase (1). Also, the proportion of elderly workers is substantially increasing (1, 2). In order to sustain current pension systems more emphasis is put on prolongation of older employees' working lives (2, 3). Various polices have already been successfully implemented in order to postpone retirement (1), such as increasing the statutory retirement age (2). However, many older employees (still) exit paid employment before reaching the statutory retirement age, among others via e.g. work disability pensions, unemployment or (early) retirement (3, 4). In order to resist the socioeconomic negative consequences of an aging workforce in Northern America and Europe and to prevent early labour market exit, it is important to gain more insight into factors contributing to prolong working lives in order to increase or facilitate older employees' labour participation.

Many studies already showed that external factors can act as important barriers or facilitators for remaining in work until or working beyond the statutory retirement age (2, 3, 5-7). Work-related factors such as performing physically demanding work (8, 9) or having low job control/authority (6) can hinder workers to work until the statutory retirement age. Contrary, other factors such as for example economic incentives, having more senior days, performing less physically demanding work (1), the availability of training/lifelong learning and flexible workhours (2, 10) may stimulate postponement of retirement among older employees.

Besides the impact of external (such as work-related) factors on labour participation among older employees (7, 8, 11), it is invaluable to also consider the potential role of intrinsic factors that may stimulate to continue working. Older workers might be more prone to value intrinsic factors, such as motivation (12). Motivation has already shown to have a mediating role on health behaviors, such as sickness presenteeism and absence (11). Perhaps similar to the relation of motivation and health behaviors (11), a relation between work engagement and different labour participation outcomes may be observed as well.

Work engagement (WE) refers to an internal positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption in a job (13, 14). Engaged employees feel energetic and have an effective connection with their work activities. Engaged employees consider themselves to be able to deal with their job demands (15), like to learn and develop themselves, take personal

initiative, and are innovative and make few mistakes (16). Also, the core of work with meaningful, stimulating and self-fulfilling tasks and activities can contribute to the aim to prolong working life (17, 18). WE has a moderately positive relation with age (14, 19-22): older employees have higher WE scores (2, 14) compared to their younger counterparts. This may be explained by older employees having increased personal competencies gained and more experience in both work and life (21, 23, 24). Having high WE can be valuable for employees, employers, and organizations (20, 25). More engaged employees often experience more positive work to home enrichment and less work to family conflicts (25). Additionally, WE is positively related to work performance (26) and to positive attitudes towards work and the organization (job satisfaction, organizational commitment and low turnover) (27) and a lower risk of sickness absence (25, 28).

Previous studies investigated the potential mediating role of WE in the relation between e.g. work-related factors and labour participation outcomes (40), the impact of various work-related factors such as job demands and/or resources on WE (41, 42), or the impact of WE (42, 43) on (organizational) outcomes such as job performance or turnover intention (43-45). For instance, higher WE levels were related to higher organizational commitment and job satisfaction levels, and reduced turnover intention (15, 22, 46). However, longitudinal evidence about the effect potential impact of WE on different labour participation outcomes among employees is still limited (20).

Apart from WE being associated with sickness absence behavior, it may be hypothesized that WE may further be related to other health behavior outcomes, such as presenteeism, but also retirement intentions and labour participation outcomes over time.

Presenteeism behavior is defined as attending work in spite of having health complaints and/or feeling sick (29, 30). On the shorter-term, presenteeism behavior can suggest as a sign of dedication to the job. However, on the longer-term, presenteeism behavior may have negative implications for employees and organizations. Employees who frequently exhibit presenteeism behavior may not recover sufficiently from the strain caused by the presence of (a) physical and/or mental health problem(s). The strain may accumulate over time which can affect older employees' functioning and organizational productivity (31-36), and consequently can lead to (long-term) sickness absenteeism (31, 37, 38). It is important to investigate the potential impact of WE on presenteeism behavior over a relatively short and long time period. By gaining more insight into this relation,

results may contribute to provide valuable input for preventive measures aiming to prolong older workers working lives by intervening already rather early when older employees show presenteeism behavior.

Besides presenteeism behavior, another outcome associated with WE might be retirement intentions. As stated by Andersen (2020) (1), a substantial proportion of older employees still has not yet decided about their definite retirement age. Retirement decisions encompass a complex decision-making process leading from retirement thoughts to plan and to actual retirement (39, 40). There is a high concordance between planned retirement and actual retirement (40, 41). It is therefore invaluable, not only to actual retirement actions, but to assess retirement intentions, since these intentions may affect actual retirement actions (40). And as such, might potentially be an important mediating factor in this pathway. Gaining more understanding about the potential impact of WE on retirement intentions provides opportunities to support prolongation of working lives and enables to tailor and target policy actions.

In addition to presenteeism behavior and retirement intentions, also labour participation in terms of remaining in or leaving the labour force might be affected by the WE of employees. However, still limited empirical research exists on how amongst others retirement intentions relate to subsequent behavior (40). It is thus invaluable to assess whether WE may also be an accurate predictor for actual labour participation, and hereby perhaps a facilitating factor for older workers labour participation.

The goal of this study is to assess associations between WE and different labour participation outcomes among older employees both in a cross-sectional and longitudinal design.

The understanding of these associations over time may be further advanced by distinguishing various subgroups of older employees, such as older employees differing in health status. Health is a central factor in older employees' decision about work and retirement planning (1, 6, 40, 42). Also, older employees often perceive difficulties to cope with deteriorating health status whilst being in employment (2). Due to health problems many employees still leave the labour market early via unemployment, disability pension, or early retirement (1, 17, 43, 44). Perhaps, WE may have a buffering effect and hence may facilitate older workers' labour participation, even whilst having health problems.

Therefore, this study additionally aims to acquire more in-depth insight into the associations between WE and labour participation outcomes over time by

performing stratified analyses for older employees differing in health status. Hereby, study results might potentially be tailored towards various subgroups of older employees and provide valuable input for opportunities to prolong older employees' working lives.

Methods

Study population

Data from the prospective Maastricht Cohort Study (MCS) was used. The study was approved by the Medical and Ethical Committee of the AZM/Maastricht University (MEC08-4-032.4) and conducted in accordance with the ethical standards laid down in the 1964 World Medical Association Declaration of Helsinki and its later amendments. At cohort baseline (1998), N=12,140 participants originating from 45 different companies were included (45). From 1998-2002 respondents received nine questionnaires, with additionally three follow-up questionnaires in 2008, 2012, and 2014. Due to the measurement and conceptualization of WE and presenteeism behavior only at the latter two waves, the 2012 measurement is considered article baseline and the subsequent measurement at 2014 is considered as two-year follow-up wave for this study.

At article baseline, various in – and exclusion criteria were defined. Firstly, eligible employees should be (actively) employed by an employer due to the primary determinant in our study being WE. Employees additionally indicating being e.g. on pregnancy leave or (partially) incapacitated for work, or (partly) retired at baseline, were excluded. Also, employees on long-term sick leave (>4 months) were excluded. Moreover, solely older employees aged 45 years onwards were included due to a moderately positive relation between age and WE (14, 16-19). We excluded employees without a permanent contract, since employees with no permanent contract may lack job control and social support, which can affect WE and labour participation outcomes (25, 46). Also, employees in self-employment were excluded due to being self-employed was positively related to higher levels of WE compared to salaried employees (25). Finally, employees with multiple jobs were excluded due to lacking information on the content of the second job. This resulted in a study population of N=2,023 older employees at article baseline. For the longitudinal analyses, prevalent cases for the respective outcome measure were excluded to study incident cases only.

Health status

Health status at article baseline was assessed by using the validated Health and Performance Questionnaire (HPQ) which listed 34 pre-specified health conditions (47). Due to some conditions listed by the HPQ list are considered precursors of condition(s) (e.g. overweight) and not chronic condition(s) as defined by the Dutch National Institute of Public Health and the Environment (DNIPH), the 34 conditions listed by the HPQ were combined with the International Classification of Primary Care-Version 2 (ICPC-2) codes of 28 pre-specified conditions listed by the DNIPH (48, 49). Seventeen chronic condition(s) in the HPQ matched directly with the DNIPH list. Moreover, employees could additionally list a not previously mentioned condition in an open-ended question. The answer to this open-ended question was also matched with the ICPC-2 codes of the DNIPH list. If a not previously listed condition matched, employees were classified as having a chronic health condition(s). Employees could indicate to the original answer options whether or not they have (a) chronic condition(s); and if they (currently) have the condition, whether they had received or currently receive treatment for the specific health condition(s) (47). Answer options were dichotomized into 'no I don't have a chronic condition(s)' or 'yes, I have a chronic condition(s)'. Employees indicating 'yes, I have a chronic condition(s)' to one (or more) of these seventeen condition(s), were classified as employees with chronic health condition(s).

Work engagement

The Utrecht Work Engagement Scale (UWES-9) was used to measure WE (14). The UWES consists of nine items, such as 'I feel happy when I am working intensely'. Responses were scored on a 7-point scale (1=Never, 7=Always (14, 50, 51). The internal validity and reliability of the UWES-9 has been studied and reported earlier and was high (Cronbach's alpha total scale was .904) (22). In this study, the internal consistency of the total scale was .924.

In this study, WE was studied both as a continuous and a categorical variable. A sum score was used to measure WE with the total score of the UWES-9 (52, 53). A high score on the UWES-9 meant that the participant was engaged in his or her job (50). However, previously established cut-off points to categorize WE levels were obtained from a heterogeneous study population with substantially lower WE levels (27) and therefore not applicable to our homogenous study population of older workers. Therefore, the study populations' 25th, 50th, and 75th quartile scores on the total WE scale at T0 were used to categorize various WE levels. The

quartile scores were 5.22, 6.00, and 6.56 respectively. The first group – referred to as 'low WE' - contains the smallest value up to 5.21. The second group – referred to as 'relatively low WE' included the values 5.22 until 5.99. The third group – referred to as 'medium WE' included the values 6.00 until 6.55. The fourth group – referred to as 'high WE' - consisted 6.56 until the highest point of the set (7.00). In this study, the category 'low WE' was used as a reference group.

Labour participation outcomes

Presenteeism behavior

Presenteeism behavior was assessed with one item: 'Has it happened over the previous 12 months that you have gone to work despite feeling that you really should have taken sick leave because of your state of health?''. Answer options were: 'not once'; 'once'; 'twice'; '3 or 4 times'; and '5 times or more'. In line with earlier studies (54, 55), self-reported presenteeism is dichotomized into 'No frequent presenteeism' (including answer options 'not once' and 'once') and 'Frequent presenteeism' (including answer options 'twice', '3 or 4 times', and '5 times or more').

Intention to retire before the mandatory retirement age

The intention to retire early was assessed by one item: 'It is my intention to exit employment before reaching the for me applicable mandatory retirement age' (56). The item was scored on a five-point Likert scale and was, in line with Stynen et al. (2019) (4), recoded into two categories: '(strongly) agree' (including answer options 'agree' and 'fully agree') and 'neutral-(strongly) disagree' (including answer options 'totally disagree', 'disagree', and 'neutral').

Intention to work beyond the mandatory retirement age

The intention to work beyond the mandatory retirement aged was assessed by one item: 'It is my intention to prolong working life beyond the for me applicable mandatory retirement age' (57). The item was scored on a five-point Likert scale and was, in line with Stynen et al. (2019) (4), recoded into two categories: '(strongly) agree' (including answer options 'agree' and 'fully agree') and 'neutral-(strongly) disagree' (including answer options 'totally disagree', 'disagree', and 'neutral').

Leaving employment

At article baseline, all employees were (actively) employed by an employer and employees in self-employment were excluded. At follow-up measurement, employees who did not indicate to be involved in 'paid work' (fully or partially) or employees who indicated to be 'self-employed' (fully or partially) at follow-up, were classified as having left employment, irrespective of the underlying reason(s).

Confounding and contextual factors

Potential confounders from the personal, work-related and health-related domain (25, 29, 58) in this presented study were measured at T0.

Consistent with other WE studies (59), adjustments were made for demographic factors such as age (14, 19-22), gender (14, 25), educational level (25), and whether employees were living alone or not.

Moreover, additionally adjustments were made for various work-related factors, since factors such as job demands, resources, type of occupation(s), working hours, and support, may (strongly) affect WE levels (15, 22, 25, 33, 46, 58), presenteeism (29), and/or the intention to retire (1, 60). The validated Dutch version of the Job Content Questionnaire was used to measure psychological job demands (PJD) and decision latitude (DL) with answer options on a four-point scale ranging from 'strongly disagree' to 'strongly agree' (61). PJD were calculated by the sum of two subscales: decision authority and skill discretion. The total scale scores for the subscales PJD and DL ranges respectively from 12-48 and from 24 to 96. Four items measured each co-worker social support and supervisor social support with scale scores ranging from 4-16. Moreover, emotional demands were measured by the sum of five items originating from the Dutch Questionnaire on the Experience and Evaluation of Work (62), the Dutch questionnaire on Work and Health (61), and one self-formulated item. The total scale score ranges from 0-5. Whether or not employees considered their work as physically demanding (yes/no) was assessed by one item from the Dutch questionnaire on Work and Health (61). Working hours per week were assessed by one item with five response options: >40, 36-40, 26-35, 16-25, or <16 h/week. These were recoded into full-time work (>40 or 36-40 h/week) and part-time work (26-35, 16-25 or <16 h/week).

Furthermore, one item assessed employees' self-perceived health (63). The item asked: 'How do you rate your general health', with five answer possibilities: excellent, very good, good, moderate, or poor. In line with (64), the five answer possibilities were dichotomized into 'good health' (excellent, very good, good) and

'moderate/poor health' (moderate, bad). The proportion of employees indicating their self-perceived health as 'good' or 'poor/moderate' were presented in Table 1 for descriptive purposes.

Statistical analyses

First, personal/private, work-related, health factors, and labour participation outcomes at article baseline were described for the total study population and per stratum of older employees differing in health status. Differences between the two strata of older employees differing in health status were examined using one-way ANOVA for continuous measures and $\chi 2$ test of independence for categorical variables.

Second, logistic regression analyses were performed to examine cross-sectional associations between WE (both continuous and categorical) and the outcomes presenteeism; intention to retire before the mandatory retirement age; and intention to work beyond the mandatory retirement age. Odds ratios and 95% confidence intervals (95% CI) were calculated. Three models were presented: the first model was crude, the second model made adjustments for: age, gender, educational level, and living situation, and the third model made additional adjustments for: working hours, PJD, DL, emotional demands, co-worker social support, supervisor social support, and physical demands.

Third, Cox regression analyses were performed to examine longitudinal associations between WE and all previously listed labour participation outcomes and additionally the risk of leaving work over time. Hazard ratios and 95% CI were calculated. Here, identical step-wise adjustments as for the cross-sectional analyses were made. To study incident cases only over time, prevalent cases for the respective outcome measure at article baseline were excluded. P-values below 0.05 were considered statistically significant.

Results

Descriptives

Table 1 presents the baseline characteristics for the total study population (N=2,023) and for two strata of older employees differing in health status (employees with chronic health condition(s) and employees without chronic health condition(s)).

Age, gender, and educational level differed statistically significantly per stratum:

Table 1: Descriptive characteristics for the study population (N=2,023) and stratified for health status at article baseline (2012)

	Total study population (N = 2,023)	Employees with chronic health condition(s) (N = 941)	Employees without chronic health condition(s) (N = 903)	p-value
Demographic and private factors				
Age (years) (Mean, SD)	54.61 (4.81)	55.19 (4.77)	53.98 (4.82)	<0.001*
Gender (N, %)				
Male	1,443 (71.3)	640 (68.0)	676 (74.9)	<0.001*
Female	580 (28.7)	301 (32.0)	227 (25.1)	
Educational level (N, %)				
Low	142 (7.2)	84 (9.1)	46 (5.2)	<0.001*
Middle	571 (28.9)	298 (32.3)	220 (25.0)	
High	1,265 (64.0)	540 (58.6)	614 (69.8)	
Living alone (N, %)				
Yes	208 (10.4)	102 (11.0)	85 (9.6)	.305
Health factors				
Self-perceived health (N, %)				
Good	1,735 (86.1)	709 (75.7)	865 (96.2)	<0.001*
Poor/moderate	279 (13.9)	228 (24.3)	34 (3.8)	
Work-related factors				
Work engagement (1-7) (Mean, SD)	5.68 (1.14)	5.56 (1.23)	5.76 (1.07)	<0.001*
Work engagement (categorical) (N, %)				
Low	477 (29.7)	253 (33.2)	190 (26.8)	.019*
Relatively low	240 (14.9)	111 (14.5)	106 (14.9)	

Medium	493 (30.7)	234 (30.7)	220 (31.0)	
High	398 (24.8)	165 (21.6)	194 (27.3)	
Working hours (N, %)				
Full-time	1,347 (67.8)	594 (64.4)	629 (70.6)	.005*
Part-time	641 (32.2)	328 (35.6)	262 (29.4)	
Physically demanding work (N, %)				
Yes	407 (21.0)	215 (24.1)	154 (17.7)	<0.001*
PJD (12-48) (Mean, SD)	31.29 (5.76)	31.36 (5.97)	31.24 (5.56)	.654
DL (24-96)	74.47 (10.45)	73.66 (10.92)	75.44 (9.94)	<0.001*
Emotional demands (1-5)	1.16 (1.29)	1.30 (1.30)	1.01 (1.25)	<0.001*
Co-worker social support (4-16)	12.11 (1.55)	12.08 (1.65)	12.13 (1.46)	.574
Supervisor social support (4-16)	10.80 (2.27)	10.60 (2.33)	10.98 (2.21)	<.001*
Labour participation outcomes				
Presenteeism (N, %)				
Frequent presenteeism	393 (19.5)	269 (28.7)	100 (11.1)	<0.001*
No frequent presenteeism	1,619 (80.5)	667 (71.3)	798 (88.9)	
Intention to work beyond mandatory retirement age (N, %)				
(strongly) agree	237 (11.8)	106 (11.3)	103 (11.5)	.922
neutral–(strongly) disagree	1,777 (88.2)	831 (88.7)	796 (88.5)	
Intention to retire before the mandatory retirement age (N, %)				
(strongly) agree	768 (38.2)	366 (39.2)	338 (37.6)	.473
neutral–(strongly) disagree	1,244 (61.8)	568 (60.8)	562 (62.4)	

(*) P-value <0.05 statistically significant differences between the two strata of older employees differing in health status using one-way ANOVA for continuous measures and $\chi 2$ test of independence for categorical variables

employees without chronic health condition(s) were respectively younger, included a higher proportion of male employees, and included a higher proportion of highly educated employees, compared to employees with chronic health condition(s).

Moreover, the proportion of employees indicating poor/moderate SPH was substantially and statistically significantly higher for employees with chronic health condition(s) (24.3 per cent) compared to employees without chronic health condition(s) (3.8 per cent).

Furthermore, working hours, physically demanding work, decision latitude, emotional demands, and supervisor social support differed statistically significant employees with different health status. As regards WE, the mean score was statistically significantly higher for employees without chronic health condition(s) (5.76) compared to employees with chronic health condition(s) (5.56) ($p<.001$).

As regards the labour participation outcomes, employees with chronic health condition(s) reported substantially and statistically significantly more presenteeism behavior compared to employees without chronic health condition(s) (28.7 per cent vs 11.1 per cent) ($p<.001$). The proportion of employees (strongly) agreeing with respectively the intention to work beyond the mandatory retirement age and the intention to retire before the mandatory retirement age, did not statistically significantly differ between the two strata.

Cross-sectional associations between WE and labour participation outcomes

Table 2.1 presents the cross-sectional associations between WE (continuous and categorical) and labour participation outcomes at article baseline.

Frequent presenteeism behavior

For the total study population, a one-point increase in UWES-9 score was statistically significantly associated with lower odds for frequent presenteeism behavior (OR .84, 95% CI .75-.94) at T0. Moreover, employees reporting a 'high WE' had a substantial lower likelihood to report frequent presenteeism behavior compared to employees reporting a 'low WE' at T0.

For employees with chronic health condition(s), a one-point increase in UWES-9 score was statistically significantly associated with a lower likelihood to report frequent presenteeism behavior at T0. Moreover, employees reporting 'relatively low WE' and 'high WE' had statistically significant lower odds to report frequent presenteeism behavior compared to employees reporting 'low WE'.

For employees without chronic health condition(s), a one-point increase in

Table 2.1: Cross-sectional associations between work engagement (continuous and categorical) and different labour participation outcomes: intention to work beyond mandatory retirement age; intention to retire before the mandatory retirement age; and presenteeism

Total study population (N= 2,023)	Presenteeism behavior (frequent presenteeism)			Intentions to work beyond mandatory retirement age (strongly) agree			Intention to retire before the mandatory retirement age (strongly) agree		
Work engagement	OR [95% CI]	OR1 [95% CI]	OR2 [95% CI]	OR [95% CI]	OR1 [95% CI]	OR2 [95% CI]	OR [95% CI]	OR1 [95% CI]	OR2 [95% CI]
Continuous (1-7)	.80 (.73-.88)*	.80 (.73-.89)*	.84 (.75-.94)*	1.13 (.98-1.29)	1.16 (1.01-1.33)*	1.10 (.95-1.27)	.80 (.73-.87)*	.80 (.73-.87)*	.79 (.72-.87)*
Low (1.00-5.22) [a]	1	1	1	1	1	1	1	1	1
Relatively low (5.23-6.00)	.63 (.42-.95)*	.64 (.42-.97)*	.69 (.45-1.07)	.72 (.40-1.29)	.75 (.42-1.36)	.71 (.39-1.28)	.74 (.53-1.03)	.74 (.53-1.03)*	.76 (.54-1.07)
Medium (6.01-6.56)	.75 (.55-1.04)	.78 (.56-1.07)	.84 (.59-1.20)	1.22 (.80-1.86)	1.33 (.87-2.03)	1.14 (.73-1.79)	.72 (.55-.94)*	.71 (.54-.94)*	.74 (.55-.98)*
High (6.57-7.00)	.51 (.36-.74)*	.50 (.34-.73)*	.56 (.37-85)*	1.54 (1.00-2.35)*	1.60 (1.04-2.47)*	1.30 (.81-2.09)	.45 (.33-.61)*	.45 (.33-.62)*	.47 (.34-.65)*
Employees with chronic health condition(s) (N=941)									
Work engagement	OR [95% CI]	OR1 [95% CI]	OR2 [95% CI]	OR [95% CI]	OR1 [95% CI]	OR2 [95% CI]	OR [95% CI]	OR1 [95% CI]	OR2 [95% CI]
Continuous (1-7)	.80 (.71-.91)*	.80 (.71-.90)*	.84 (.73-.97)*	1.03 (.86-1.23)	1.07 (.89-1.28)	1.04 (.85-1.26)	.80 (.71-.90)*	.81 (.72-.91)*	.79 (.70.91)*
Low (1.00-5.22) [a]	1	1	1	1	1	1	1	1	1
Relatively low (5.23-6.00)	.54 (.32-.92)*	.51 (.30-.88)*	.50 (.28-.89)*	.76 (.34-1.68)	.75 (.33-1.69)	.70 (.31-1.59)	.69 (.42-1.11)	.71 (.43-1.16)	.71 (.43-1.18)
Medium (6.01-6.56)	.73 (.49-1.10)	.73 (.49-1.10)	.81 (.52-1.27)	.98 (.54-1.78)	1.06 (.58-1.95)	.91 (.48-1.73)	.83 (.56-1.21)	.83 (.56-1.22)	.89 (.59-1.35)
High (6.57-7.00)	.49 (.30-.79)*	.47 (.29-.76)*	.54 (.32-.93)*	1.44 (.78-2.66)	1.60 (.85-2.99)	1.33 (.6-2.64)	.31 (.19-.51)*	.32 (.20-.53)*	.33 (.19-.56)*
Employees without chronic health condition(s) (N=903)									
Work engagement	OR [95% CI]	OR1 [95% CI]	OR2 [95% CI]	OR [95% CI]	OR1 [95% CI]	OR2 [95% CI]	OR [95% CI]	OR1 [95% CI]	OR2 [95% CI]
Continuous (1-7)	.92 (.75-1.13)	.94 (.77-1.15)	.98 (.78-1.24)	1.41 (1.09-1.81)*	1.39 (1.08-1.78)*	1.24 (.95-1.63)	.76 (.67-.87)*	.76 (.66-.87)*	.76 (.65-.89)*
Low (1.00-5.22) [a]	1	1	1	1	1	1	1	1	1
Relatively low (5.23-6.00)	1.06 (.48-2.33)	1.03 (.47-2.29)	1.30 (.56-3.01)	.63 (.22-1.80)	.67 (.23-1.94)	.59 (.20-1.72)	.70 (.43-1.16)	.67 (.41-1.12)	.68 (.41-1.14)
Medium (6.01-6.56)	.96 (.49-1.86)	.97 (.50-1.91)	.97 (.46-2.08)	1.80 (.91-3.57)	1.85 (.92-3.70)	1.47 (.71-3.05)	.55 (.36-.83)*	.53 (.35-.81)*	.55 (.35-.87)*
High (6.57-7.00)	.86 (.43-1.74)	.87 (.43-1.77)	.93 (.41-2.11)	2.09 (1.05-4.15)*	1.97 (.98-3.96)	1.42 (.66-3.05)	.48 (.31-.74)*	.47 (.30-.74)*	.50 (.31-.81)*

[a] low category of WE (1.00-5.22) is reference group [] crude model; [1] adjusted for demographic and private factors (age, gender, educational level, living situation); [2] = additionally adjusted for work-related factors (working hours, PJD, DL, emotional demands, co-worker social support, supervisor social support and physical demands. *p-value <0.05

UWES-9 score was related to lower odds to report frequent presenteeism behavior (OR 0.98, 95% CI .78-1.24) at T0.

Intention to retire before the mandatory retirement age

For the total study population, a one-point increase in UWES-9 score was statistically significantly associated with lower odds for (strongly) agreeing with the intention to retire before the mandatory retirement age at T0. Moreover reporting a 'medium WE' and 'high WE' had lower odds to (strongly) agree with the intention to retire before the mandatory retirement age compared to employees reporting a 'low WE'.

For employees with chronic health condition(s), a one-point increase in UWES-9 score was associated with lower odds for (strongly) agreeing with the intention to retire before the mandatory retirement age. Moreover, employees reporting a 'high WE' had a substantially and statistically significantly lower odds to (strongly) agreeing with the intention to retire before the mandatory retirement age (OR 0.33, 95% CI .19-.56) compared to employees reporting a 'low WE' at T0.

For employees without chronic health condition(s), a one-point increase in UWES-9 score was statistically significantly associated with lower odds for (strongly) agreeing with the intention to retire before the mandatory retirement age. Moreover, employees reporting a 'medium WE' and 'high WE' had statistically significantly lower odds to (strongly) agreeing with the intention to retire before the mandatory retirement age at T0 compared to employees reporting a 'low WE'.

Intention to work beyond the mandatory retirement age

For the total study population, a one-point increase in UWES-9 score was associated with a higher likelihood to (strongly) agreeing with the intention to work beyond the mandatory retirement age (OR 1.10, 95% CI .95-1.27).

For employees with chronic health condition(s), a one-point increase in UWES-9 score was associated with higher odds for (strongly) agreeing with the intention to work beyond the mandatory retirement age at T0.

For employees without chronic health condition(s), a one-point increase in UWES-9 score was associated with substantially higher odds for (strongly) agreeing with the intention to work beyond the mandatory retirement age (OR 1.24, 95% CI .95-1.63).

Longitudinal associations between WE and labour participation outcomes

Table 3.1 presents the longitudinal associations between WE (continuous and categorical) and labour participation outcomes over two-year follow-up. For the longitudinal analyses, prevalent cases for the respective outcomes at T0 were excluded to study incident cases only.

Frequent presenteeism behavior

For the total study population, a one-point increase in UWES-9 score was associated with a higher risk to report frequent presenteeism behavior over time, however fully adjusted models showed no statistical significant association (HR 1.04, 95% CI .88-1.23).

For employees with chronic health condition(s), a one-point increase in UWES-9 score was associated with an increased risk for frequent presenteeism over time (HR 1.02, 95% CI .83-1.24). Employees reporting a 'relatively low WE', 'medium WE', and 'high WE' had lower risks to report frequent presenteeism behavior over time compared to employees reporting a 'low WE'.

For employees without chronic health condition(s), a one-point increase in UWES-9 score was associated with a higher risk to report frequent presenteeism behavior over time (HR 1.12, 95% CI .79-1.58). Moreover, employees reporting a 'relatively low WE', 'medium WE', and 'high WE' scores had substantial higher risks to report frequent presenteeism behavior over time compared to employees reporting a 'low WE'.

Intention to retire before the mandatory retirement age

For the total study population, a one-point increase in UWES-9 score was associated with a higher risk for (strongly) agreeing with the intention to retire before the mandatory retirement age over time.

For employees with chronic health condition(s), a one-point increase in UWES-9 score was associated with a higher risk for (strongly) agreeing with the intention to retire before the mandatory retirement age over time.

For employees without chronic health condition(s), a one-point increase in UWES-9 score was associated with a lower risk for (strongly) agreeing with the intention to retire before the mandatory retirement age over time. Fully adjusted models showed that employees reporting a 'relatively low WE' had a statistically significantly lower risk to (strongly) agree with the intention to retire before the mandatory retirement age over time (HR .33, 95% CI .11-.99) compared to employees reporting a 'low WE'.

Table 3.1: Longitudinal associations between work engagement and different labour participation outcomes over two-year follow-up period

Total study population (N= 2,023)	Frequent presenteeism behavior			(strongly) agree with the intention to work beyond mandatory retirement age			(strongly) agree with the intention to retire before the mandatory retirement age			Leaving employment		
Work engagement	HR [95% CI]	HR[1] [95% CI]	HR2 [95% CI]	HR [95% CI]	HR[1] [95% CI]	HR[2] [95% CI]	HR [95% CI]	HR[1] [95% CI]	HR[2] [95% CI]	HR [95% CI]	HR[1] [95% CI]	HR[2] [95% CI]
Continuous (1-7)	1.16 (1.00-1.34)*	1.08 (.93-1.26)	1.04 (.88-1.23)	1.33 (1.09-1.61)*	1.30 (1.06-1.59)*	1.14 (.92-1.41)	1.05 (.94-1.19)	1.02 (.90-1.15)	1.01 (.89-1.16)	.99 (.91-1.08)	.99 (.91-1.09)	.98 (.88-1.08)
Low [b]	1	1	1	1	1	1	1	1	1	1	1	1
Relatively low	.97 (.54-1.76)	.89 (.49-1.61)	.95 (.52-1.75)	2.06 (.98-4.33)	1.98 (.94-4.18)	1.71 (.80-3.66)	1.00 (.62-1.60)	1.00 (.63-1.61)	.98 (.61-1.58)	1.03 (.70-1.53)	1.03 (.70-1.54)	.98 (.66-1.46)
Medium	1.32 (.84-2.08)	1.17 (.74-1.84)	1.01 (.62-1.65)	2.54 (1.34-4.81)*	2.26 (1.19-4.30)*	1.61 (.81-3.19)	1.07 (.74-1.55)	.99 (.68-1.44)	.94 (.64-1.38)	.95 (.68-1.32)	.94 (.67-1.31)	.92 (.64-1.31)
High	1.18 (.72-1.94)	.89 (.53-1.49)	.79 (.45-1.38)	2.65 (1.37-5.13)*	2.54 (1.29-4.98)*	1.74 (.83-3.62)	.87 (.57-1.33)	.78 (.51-1.21)	.72 (.46-1.14)	.89 (.62-1.29)	.89 (.61-1.30)	.83 (.54-1.25)
Employees with chronic health condition(s) (N=941)												
Work engagement	HR [95% CI]	HR[1] [95% CI]	HR2 [95% CI]	HR [95% CI]	HR[1] [95% CI]	HR[2] [95% CI]	HR [95% CI]	HR[1] [95% CI]	HR[2] [95% CI]	HR [95% CI]	HR[1] [95% CI]	HR[2] [95% CI]
Continuous (1-7)	1.11 (.93-1.32)	1.04 (.87-1.25)	1.02 (.83-1.24)	1.23 (.96-1.57)	1.17 (.90-1.51)	1.07 (.81-1.42)	1.07 (.91-1.25)	1.03 (.88-1.21)	1.05 (.88-1.25)	1.03 (.92-1.15)	1.03 (.92-1.16)	1.02 (.89-1.17)
Low [b]	1	1	1	1	1	1	1	1	1	1	1	1
Relatively low	.85 (.39-1.81)	.93 (.43-2.04)	.90 (.40-2.02)	2.01 (.73-5.55)	2.12 (.76-5.92)	1.87 (.63-5.55)	1.26 (.69-2.31)	1.35 (.73-2.49)	1.30 (.67-2.51)	1.06 (.60-1.86)	.94 (.53-1.66)	.91 (.51-1.62)
Medium	1.08 (61-1.90)	1.00 (.57-1.76)	.83 (.46-1.52)	1.81 (.70-4.68)	1.41 (.53-3.73)	1.18 (.42-3.36)	1.27 (.77-2.09)	1.16 (.70-1.92)	1.13 (.66-1.92)	1.12 (.72-1.73)	1.13 (.73-1.76)	1.13 (.70-1.80)
High	.98 (.52-1.83)	.79 (.41-1.50)	.74 (.38-1.46)	2.33 (.92-5.91)	2.00 (.76-5.28)	1.62 (.57-4.56)	.72 (.36-143)	.66 (.33-1.32)	.65 (.32-1.32)	.89 (.53-1.48)	.86 (.51-1.47)	.81 (.45-1.44)
Employees without chronic health condition(s) (N=903)												

Work engagement	HR [95% CI]	HR[1] [95% CI]	HR2 [95% CI]	HR [95% CI]	HR[1] [95% CI]	HR[2] [95% CI]	HR [95% CI]	HR[1] [95% CI]	HR[2] [95% CI]	HR [95% CI]	HR[1] [95% CI]	HR[2] [95% CI]
Continuous (1-7)	1.31 (.98-1.73)	1.22 (.91-1.63)	1.12 (.79-1.58)	1.40 (1.03-1.90)*	1.40 (1.02-1.92)*	1.19 (.83-1.72)	1.07 (.87-1.30)	1.02 (.84-1.27)	.98 (.78-1.23)	.93 (.80-1.08)	.92 (.79-1.07)	.88 (.73-1.05)
Low [b]	1	1	1	1	1	1	1	1	1	1	1	1
Relatively low	1.38 (.44-4.33)	1.12 (.35-3.59)	1.36 (.40-4.62)	2.09 (.70-6.23)	1.85 (.61-5.67)	1.33 (.43.4.15)	.37 (.13-1.08)	.35 (.12-1.03)	.33 (.11-.99)*	.88 (.47-1.64)	.92 (.48-1.76)	.84 (.43-1.65)
Medium	2.24 (.92-5.45)	1.87 (.76-4.62)	2.15 (.75-6.17)	2.94 (1.17-7.42)	2.98 (1.17-7.56)	2.01 (.73-5.56)	.86 (.48-1.54)	.81 (.45-1.46)	.83 (.45-1.55)	.73 (.42-1.29)	.78 (.44-1.38)	.71 (.37-1.36)
High	1.95 (.75-5.02)	1.32 (.49-3.58)	1.27 (.37-4.33)	2.60 (.98-6.93)	2.51 (.92-6.80)	1.55 (.49-4.89)	.92 (.51-1.66)	.85 (.46-1.57)	.76 (.38-1.49)	.83 (.47-1.45)	.85 (.47-1.54)	.74 (.37-1.48)

[b] low WE = reference group. [] crude model; [1] adjusted for demographic and private factors (age, gender, educational level, living situation); [2] = additionally adjusted for work-related factors (working hours, PJD, DL, emotional demands, co-worker social support, supervisor social support and physical demands. *p-value <0.05.

Intention to work beyond the mandatory retirement age

For the total study population, a one-point increase in UWES-9 score was associated with a higher risk for (strongly) agreeing with the intention to work beyond the mandatory retirement age over time (HR 1.30, 95% CI 1.06-1.59), after solely adjusting for demographic and private factors. Moreover, crude models show that employees reporting 'medium WE' and 'high WE' had substantially and statistically significantly higher risks to (strongly) agree with the intention to work beyond the mandatory retirement age over time (respectively HR 2.54, 95% CI 1.34-4.81; and HR 2.65, 95% CI 1.37-5.13) compared to employees reporting a 'low WE'.

For employees with chronic health condition(s), a one-point increase in UWES-9 score was associated with higher risks for (strongly) agreeing with the intention to work beyond the mandatory retirement age over time.

For employees without chronic health condition(s), a one-point increase in UWES-9 score was substantially and statistically significantly associated with higher risks for (strongly) agreeing with the intention to work beyond the mandatory retirement age over time (HR 1.40, 95% CI 1.02-1.92) after solely adjusting for demographic and private factors.

Leaving employment

For the total study population, a one-point increase in UWES-9 score was associated with a lower risk to leave employment over time.

For employees with chronic health condition(s), a one-point increase in UWES-9 score was associated with a higher risk to leave employment over time.

For employees without chronic health condition(s), a one-point increase in UWES-9 score was associated with a lower risk to leave employment over time (HR .88, 95% CI .73-1.05).

Discussion

This study provides evidence for cross-sectional associations between WE and various outcomes of labour participation. The strength of these associations however differed depending on the studied outcome of labour participation and for employees differing in health status. Over time, findings show that WE at article baseline was related to higher risks for (strongly) agreeing with the intention to work beyond the mandatory retirement age at follow-up. Fully adjusted longitudinal

models however demonstrate few statistically significant findings. This might be explained by little contrast in WE levels at article baseline, or perhaps the effect of WE on labour participation may have already occurred before article baseline since older workers are generally involved already long in the employment process.

Whether WE was a facilitating or hindering factor for older workers labour participation, highly depended on the outcome measure of labour participation being studied. For instance, we initially hypothesized that more engaged employees would be more likely to report presenteeism behavior. However, our cross-sectional findings showed that WE was associated with lower odds to report frequent presenteeism behavior at T0. Possibly, this might be explained by reverse causation (65): WE might also be a consequence instead of a cause of frequent presenteeism. In line with previous research (66), WE was statistically significantly associated with lower odds for strongly agreeing with the intention to retire before the mandatory retirement age. Also, although not statistically significantly, WE was associated with strongly agreeing with the intention to work beyond the mandatory retirement age at T0 as previously hypothesized.

Furthermore, stratified analyses for older workers differing in health status were performed. These findings show that the strength and direction of these associations at baseline seems to differ for older workers differing in health status. Despite previous studies stating that health condition(s) are a (strong) determinant for presenteeism (30, 55), our findings show that among workers with chronic health condition(s), WE was related to lower odds to report (frequent) presenteeism at baseline. Perhaps, in our study older workers with chronic health condition(s) do not perceive their health a crucial factor to perform presenteeism behavior (30) due to perhaps (already) coping with this chronic health condition(s) for a considerable time period. Moreover, our cross-sectional findings show that among employees without chronic health condition(s), WE was associated with substantially higher odds for (strongly) agreeing with the intention to work beyond the mandatory retirement age. These findings are supported by previous research stating that health is a central factor in older employees' decisions about work and retirement planning (1, 6, 40, 42) and can contribute to the prolongation of working lives.

Longitudinal study findings showed that among the total study population increasing WE levels were associated with increased risks to report frequent presenteeism behavior over time, which is supported by an earlier study (31). Moreover, increasing WE levels were associated with increased risk to (strongly) agree with the intention to work beyond the mandatory retirement age over time.

Furthermore, stratified analyses might reveal that the strength of the longitudinal associations seems to differ for the two strata of employees differing in health status. For both strata of older workers with and without chronic health condition(s), the risk to report presenteeism behavior over time increased, although not statistically significantly. The strength of this association might be higher for workers without health problems (HR 1.12, 95% CI .79-1.58) in contrast to older workers with chronic health condition(s) (HR 1.02, 95% CI .83-1.24). Our findings were contrary to previous research indicating that health condition(s) are a (strong) determinant for presenteeism behavior (36, 58). Moreover, in line with previous studies (1, 17, 43, 44), our findings show that the association between WE and (strongly) agreeing with the intention to work beyond the mandatory retirement age over time was substantially higher among employees without chronic health condition(s).

It should be noted however that few fully adjusted longitudinal models demonstrated statistical significant associations. This will be further discussed in the next paragraph regarding 'methodological and conceptual considerations'.

Various conceptual and methodological considerations should be taken into account when interpreting these study results.

This prospective study enabled us to disentangle cause and effect over time, however two-year time window was relatively short. This was however the only follow-up period available due to the concepts of WE and presenteeism being solely assessed at waves 2012 and 2014. For further research, it might be suggested to study these associations in a broader time window. Hereby, further research can also assess whether presenteeism may precede actually leaving the labour force over time.

Moreover, despite the prospective design enable us to study cause and effect over time, it should be noted that our article baseline does not correspond to cohort baseline. Thus, the study population of older workers generally have been in the labour market already for quite some years and perhaps over time not much dynamics can be (further) expected. Possibly, the effect of WE on labour participation may have already occurred before article baseline. Furthermore, the healthy worker effect cannot be ruled out (19) and may have already taken place before article baseline. It can be hypothesized that less engaged workers might have already left the organization (25) or labour force prior to our article baseline, and that the most engaged older workers are more likely to remain in employment (21, 23). Consequently, a selected population of older workers with relatively high WE levels may have been included and studied, which may have affected our study

findings. In addition, the same reasoning applies to chronic health condition(s): older workers with chronic health condition(s) who were unable to cope with their health condition(s) whilst being in employment, may have already left the labour force prior to our article baseline. Consequently, at article baseline a healthier selected population of older workers who are able to cope with their chronic health conditions whilst being in employment may have been included and attenuated our findings.

Furthermore, observing few statistical significant associations over time might also be explained by the cut-off values used for WE in this study. The UWES (instruction) manual (27) calculated norm scores for the UWES-15 based on data from a large heterogeneous study sample (N=9,679 employees). However, the UWES norms scores were obtained from a heterogenous study population and had substantially lower WE levels. Consequently, these UWES norms scores were not applicable to our population of older employees as it would classify many older employees as having low(er) WE levels (14, 19-22, 24). Therefore, this study classified WE levels according to the total study population's quartile scores. It should however be noted that our study populations' WE scores were already relatively high (mean score 5.68, SD 1.14) due to exclusively including older workers at article baseline. According to the norm scores of the UWES-15, our study population scored 'high' to 'very high' in WE values (27). Consequently, there was little contrast between the categories of WE in this study population, which may have attenuated the true impact of WE on labour participation outcomes over time.

Regarding confounding factors, adjustments were made for potential confounding factors originating from the demographic/private and work-related domains. However, it can be argued whether additional adjustments for work-related factors may be an overcorrection. Work-related factors may be a part of the mechanism affecting respectively WE and outcomes of labour participation. Potential overcorrection may result in an underestimation of the observed findings, which can explain observing few statistical significant associations over time in the fully adjusted models.

Furthermore, this study firstly aimed to demonstrate (potential) associations between WE and various labour participation outcomes among older employees, by studying these outcomes parallel. However, dependence between these outcomes cannot be excluded. For further research it is recommended to secondly investigate a potential coherence between these outcomes.

As regards the external validity of these study results, it should be noted that our

results are generalizable to the total population of older workers involved in paid employment by an employer. However, results should be interpreted within the Dutch work context since WE levels may differ between countries due to economic and governance indicators (14, 25, 26) and choices regarding prolongation of working lives can be affected by contextual factors on a national (e.g. social security system) and organizational level (e.g. availability of early retirement schemes) (4).

Conclusion(s) implication(s)

This study shows substantial and strong cross-sectional associations between WE and different outcomes of labour participation among older employees. However, the direction and strength of these cross-sectional associations differed depending on the studied outcome of labour participation and differences in health status. Fully adjusted longitudinal findings demonstrated few statistical significant associations between WE and different outcomes of labour participation. This might be explained by little contrast in WE levels at article baseline; the effect of WE on labour participation may have already occurred before article baseline; the impact of the healthy worker effect; and a potential overcorrection due to adjusting for work-related factors. Consequently, this may have attenuated our study findings over time.

This study already provides valuable insights into the impact of WE on different outcomes of labour participation at article baseline. Moreover, this study also suggest potential longitudinal associations over time, however, further longitudinal research, investigating these associations in a broader time window, and also preferably among a study population with more contrast in WE levels, is needed to confirm this. Such further research is firstly required before study findings can be used as input for preventive measures aiming to facilitate workers' labour participation.

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7

General discussion

General discussion

Due to demographic trends, Western policies aim to prolong older workers' working lives in order to maintain social security and pension systems (1). Despite increasing labour participation rates among older workers, still many older workers are not able to work until reaching the statutory retirement age and thus leave the labour market (earlier) through various exit routes (1, 2). It is therefore crucial to gain more insight into the multitude of factors affecting older workers' labour participation, such as individual, demographic, work-related, and health factors. Of these factors, health is known to be a strong predictor for older workers' labour participation and the decision to continue working until the statutory retirement age (3). Therefore, the relation between health and labour participation of older workers forms the central theme of this dissertation.

While there are many studies on the association between health and labour participation in the literature, also important methodological and conceptual considerations remain. Earlier research so far mostly studied one single indicator of health, such as poor/ill health (3-10), and/or one specific (dichotomous) outcome of labour participation, such as being in - or out of employment (3, 7, 9-11). In addition, some studies revealed inconsistencies in study findings when studying relations between health and labour participation over time, which may be attributable to methodological and conceptual weaknesses and/or the presence of selection processes. It is therefore crucial for research to investigate the complex relation between health and labour participation in-depth.

The general objectives of this dissertation aim to gain more in-depth insight into the complex relations between health status and labour participation outcomes among older workers over time, whilst taking into account the potential impact of the (work) context as well as selection processes on this relation. Furthermore, the potential facilitating and/or hindering impact of work-related factors (from the work context) on labour participation outcomes among older workers' with health problem(s) will be investigated. Hereby, results can provide valuable entry points for the development of preventive measures/interventions aiming to facilitate (sustainable) labour participation among older workers.

In this dissertation, the general objectives were met by answering the specific research questions as formulated in Chapter 1, using the data infrastructure of the large-scale longitudinal (prospective) Maastricht Cohort Study (MCS) as a sampling

frame for the separate studies. At cohort baseline, 12,140 employees originating from more than 45 different organizations/companies were included (12). By means of extensive self-administered questionnaires, multiple follow-up measurements were performed over a 16-year follow-up period.

In this general discussion, the main results of the dissertation are discussed, and methodological and conceptual considerations are addressed. Moreover, this chapter reflects upon the generalizability of the results, followed by the overall conclusion and practical implications of the results.

Main findings

The importance to study multiple indicators of health in order to grasp the broad concept health in relation to several participation outcomes was already delineated in Chapter 1. In Chapter 2, we distinguished various objective and subjective indicators of health and outcomes of labour participation and retirement. Results revealed that different types of mental and/or physical chronic health condition(s), and self-perceived health, independently, were substantially related to outcomes of labour participation and retirement. The strength of the observed results over time however differed depending on the type of chronic health condition(s) studied. For instance, employees with physical chronic health condition(s) had a substantial and significant higher risk to receive disability benefits over time compared to healthy employees. Employees with mental and physical chronic health conditions simultaneously, had higher risks for decreasing working hours, losing employment, and receiving disability benefits over time, compared to healthy employees. Moreover, results potentially suggest a more instantaneous effect of self-perceived health (SPH) since solely statistical significant cross-sectional associations were observed between SPH and strong retirement intentions. In addition, the potential impact of disease duration was explored, and results revealed that the longer employees were ill (prevalent chronic health condition(s)), the lower their self-perceived health score was. These results show the importance to consider both objective and subjective indicators of health when aiming to study the relation between health and labour participation among older workers. While in Chapter 2 an important distinction was already made with regards to different types of chronic health condition(s) (mental and/or physical), it was also crucial to investigate the impact of one specific condition, that is depressive complaints, on different outcomes of labour participation. Depressive complaints are highly prevalent among the working population and expected to keep increasing (13, 14) (Chapter 3). As hypothesized,

results showed substantial associations between increasing depressive complaints and different outcomes of labour participation over time, such as poor general, physical, mental work ability, and high psychological disengagement levels. In addition, results revealed the impact of depressive complaints on outcomes of labour participation varied within different work contexts. For instance, among full-time workers, depressive complaints were associated with poor general work ability over time. Among part-time workers, depressive complaints were associated with poor mental work ability and high psychological disengagement levels over time. Results presented in Chapter 4 revealed that employees with different types of chronic health condition(s) and SPH, independently, had substantial higher risks to leave employment over 16-year follow-up. When interpreting these associations over time, the potential impact of the work context as well as selection processes, was carefully considered. By performing sector-stratified analyses, we revealed that the strength of the relation between health status and outcomes of labour participation differed between sectors, with the strongest associations observed within the sector industry. Moreover, continuous (health-related) selection processes were demonstrated over time, for instance, by (health-related) adaptations already earlier in employment process. This suggests that over time, employees with poor(er) health may have already adjusted their work situation to their (chronic) health condition(s) or may have already left employment. Consequently, a highly selected group of healthier older workers was studied over time. This has substantial implications for the observed research results in Chapters 2-4, which may be considered an underestimation of the true impact of health status on outcomes of labour participation. If the potential presence of such (health-related) selection processes is ignored, the ability of older workers to prolong working lives might be overestimated when using such study results as entry points for the development of (practical) preventive measures/interventions aiming to extend older workers' working lives. In Chapters 2-4, we investigated the impact of objective and subjective health indicators on outcomes of labour participation and retirement over time, and additionally considered the presence of (health-related) selection processes. Since decisions regarding labour participation and retirement are gradual processes, the retirement decision-making processes was further investigated in Chapter 5. The retirement decision-making processes encompasses various phases, the first phase encompassing (the development of) retirement intentions. Since attitudes towards (early) retirement can act as an important precursor for actual retirement behavior and labour participation over time, it was crucial to further investigate the impact

of health status on attitudes towards (early) retirement. Our results demonstrated that the extent to which older workers indicated considering early retirement varies depending substantially on older workers' health status – chronic health conditions and SPH - and age at article baseline. Furthermore, many longitudinal associations between considerations towards (early) retirement and labour participation outcomes were observed, however only few associations were statistically significant. As such, conclusions regarding causality of relations between attitudes towards (early) retirement and actual retirement behavior cannot be drawn yet and further research is warranted. In Chapters 2-5, the impact of (external) work-related factors from the work context in the relation between health and labour participation among older workers over time was thoroughly investigated. It was however also invaluable to investigate the role of an intrinsic factor on older workers' labour participation, since older workers may be more prone to value intrinsic factors compared to extrinsic factors (15, 16). Therefore, in Chapter 6, the relation between work engagement and labour participation outcomes was studied. Our results revealed strong cross-sectional associations between work engagement and different outcomes of labour participation. However, the effect size of these cross-sectional associations varied substantially depending on the labour participation outcome studied, and on health status. Our results were not in line with what we previously hypothesized. For instance, our results showed that among older workers with chronic health condition(s), increasing levels of work engagement were related to lower odds to report (frequent) presenteeism behavior at article baseline. Over time, results demonstrated that increasing work engagement levels were associated with increased risks to report frequent presenteeism behavior and (strongly) agreeing with the intention to work beyond the mandatory retirement age. However, few of these longitudinal associations reached statistical significance. These study results demonstrated that further research is warranted before study results regards to work engagement can be used as entry points for practical recommendations for preventive measures/interventions aiming to facilitate older workers' labour participation.

Methodological and conceptual considerations

In order to adequately interpret the main results, in the paragraph below a number of methodological and conceptual considerations related to the studies described in this dissertation are discussed, alongside with their (potential) influence on the results.

Data-infrastructure and study population

The data-infrastructure of the Maastricht Cohort Study (MCS) was highly valuable to meet the general objectives and to answer to the research questions as formulated in Chapter 1. At cohort baseline, a large heterogeneous study population consisting of 12,140 employees aged between 18 and 65 years with different levels of education, originating from 45 Dutch companies/institutions and representing (nearly) all sectors, were included (12, 17). By means of extensive self-administered questionnaires, a broad range of work-related, domestic, social, individual and health related factors, as well as a wide range of labour participation outcomes were assessed over a considerable 16-year follow-up period.

In our studies, older workers were defined aged 45 years onwards which is in line with the definition of the WHO (18). In general, an age of 45 years marks the onset of physical and cognitive changes associated with aging (19, 20). Moreover, previous studies concerning labour market participation also used this age limit, since in many countries this age range features a decline in labour participation rates (21). However, it should be noted that, even when using the WHO definition, still a heterogeneous study population in terms of age was studied. Due to the large proportion of older workers already included at cohort baseline cohort baseline of the MCS (37 per cent) (12), the relations between health and labour participation over time could be studied separately for older workers not yet close to approaching the (early) retirement age and older workers closer to approaching the (early) retirement age (Chapter 5). Results indeed underscored that it was of crucial importance to study different age groups and indicated that, for instance, the extent to which older dayworkers indicated to consider early retirement varied substantially between older dayworkers depending on their age. Moreover, we carefully considered the upper age limit was depending on the time period in which the relations were studied. This substantially increased the power and precision of the conducted studies in this dissertation. Most policies aiming to prolong working lives until higher age are developed based on biological age (20, 22), which is in line with the age conceptualization in this dissertation. Although other age conceptualizations were not available in the MCS, an avenue for further research may be to study, besides biological age, also other age conceptualizations such as subjective age (21, 23).

The large heterogeneous study population and the broad range of work-related, domestic, social, individual and health related factors assessed in the MCS, enabled to make adjustments for various confounding/contextual factors when studying

relations between health and labour participation over time, and furthermore enabled to study various important subgroups of older workers, for instance, based on gender, educational level, or for workers employed within (a) specific sector (12, 17). This was of crucial importance, since hereby results revealed facilitating/hindering factors, from for instance the work context, in the relation between health and labour participation among older workers.

Although the 16-year follow-up period of the MCS was highly valuable to demonstrate causal associations over time, the potential presence of cohort effects over this follow-up period cannot be ruled out (24, 25). Cohort effects refer to variations over time, in one or more characteristics, among groups of individuals defined by some shared (social) changes/fluctuations (26). From 1998-2014, various changes/fluctuations in the labour market, economy, and policy measures, occurred which could have affected the studied labour participation outcomes at that specific time point during follow-up period (27). For instance, in 2008, the prevalence of unemployed people could have been higher compared to other time points during the follow-up period due to a large economic recession at that specific time point. Also, in 2005, the Disability Insurance Act (WAO) was replaced by the Work and Income according to Capacity for Work Act (WIA) (28). The WIA puts more emphasis on participation: one must work according to one's ability (28). The introduction of the WIA was accompanied by a more gradually lower influx of people with disabilities compared to the WAO. Cohort effects could thus have potentially affected exposures as well as outcomes of labour participation at specific time points during the follow-up period, for instance, the prevalence rate of the number of unemployed people could have been considerably higher at a specific time point. However, it is less likely that cohort effects have affected the observed associations between exposures and outcomes over time. Due to the frequency of the measurements in-between and the broad spectrum of labour participation outcomes investigated using the MCS, potential cohort effects could be limited. In addition, due to the broad spectrum of labour participation outcomes studied over time, outcomes which are generally less dependent on (social) changes/fluctuations in a certain time period, for instance retirement intentions, could be studied and hence potential cohort effects could be limited.

Time window, frequency of measurements and selection processes

The 16-year follow-up period (1998-2014) of the MCS appeared more than sufficient to study all proposed relations between health status and labour participation

outcomes over time, as proposed in the general objectives and research questions. For most of the conducted studies, a two-year time window was chosen. For instance, when aiming to study a change in working hours, a two-year time window was already sufficient to detect transitions over time. The total follow-up period of 16-years was however of crucial importance to detect (health-related) changes in the employment process and to interpret results between health and labour participation in the light of continuous (health-related) selection processes over time (Chapter 4).

From 1998 to 2002 respectively nine subsequent follow-up measurements were performed (12) with three additional subsequent follow-up measurements in 2008, 2012, and 2014 (17). This sampling frequency of the measurements in-between was essential to investigate the impact of health on labour participation and additionally to gain further insight into the time course between changes in health and labour participation over time. It should however be noted that in between the consecutive follow-up waves, changes in health status or labour participation may occur. For instance, the follow-up period in between the consecutive follow-up waves in 2002, 2008, and 2012, was relatively long and the potential impact of recall bias on the study results could not be ruled out (29). Moreover, it can be difficult to define disease during using a using a four-year time period. In Chapter 2, workers with respectively prevalent and incident chronic health condition(s) were defined. It can be that workers defined as having incident chronic health condition(s), might have already suffered from the chronic health condition(s) relatively long, for instance, since the beginning of the four-year time window. However, especially when studying chronic health condition(s), it can be that the effect of health on labour participation outcome cannot be detected directly, and some time between in-between measurements is required. For future studies investigating the relation between health and labour participation, frequent sampling will also be requested. If possible, further research could aim to follow employees from the onset of a disease, or, to more specifically assess the disease duration in a questionnaire.

The presence of selection processes - including the Healthy Worker Effect (HWE) (30, 31) - cannot be ruled out when studying relations between health and labour participation over time (32). Primary selection processes are difficult to control for and may have already taken place before cohort baseline (1998) since (most) participants in the MCS were already employed before entering the MCS (33-37). This is also demonstrated by the average age of 41 years among the respondents at cohort baseline (12), which suggests that most employees were (already) in the

middle of their careers. Moreover, as demonstrated in Chapter 4, the proportion of employees working part-time was already substantially higher for employees with chronic health condition(s) compared to healthy employees at cohort baseline. This could imply that employees with health problem(s) already choose to work fewer hours when joining the labour force in order to remain in paid employment whilst having (a) health problem(s), indicating selective participation before baseline (12). Moreover, it was likely that due to poor health, various (health-related) adaptations were made throughout the employment process, such as a reduction in working hours. Results implied that due to the presence of these secondary selection processes, healthier individuals were more likely to remain employed over time (30, 31, 36). Consequently, the observed results may be an underestimation of the true impact of health on labour participation. It should be noted that our aim was to interpret the relation between health and labour participation in the light of continuing health-related selection processes, and not to quantify these selection processes. Both primary and secondary selection processes may have resulted in the study of a (highly) selected, healthier population of older workers over time. Consequently, these selection processes could have strongly attenuated the results obtained when studying health and labour participation in this dissertation. Besides primary and secondary selection processes, the impact of selective dropout from the study could not be ruled out. Unfortunately, selective drop out from the study was inevitable. Descriptive statistics also demonstrated that selective dropout from the study resulted amongst others due to differences in health at article baseline. For instance in Chapter 3 (38) dropouts were more likely to have indicated moderate/poor SPH at article baseline compared to participants (specific data not shown). Consequently, due to selective dropout from the study, results between health and labour participation over time could have been further attenuated. It is therefore highly recommended for future research to also consider the presence of these selection processes, and to take into account the implications of the impact of these selection processes on the observed study results.

Health

It appeared highly valuable to investigate, besides the presence and/or absence of health problems, also other indicators of health such as self-perceived health (39). This was also underscored by the Dutch Health Council (11, 40). Our results (clearly) demonstrated that different indicators of health were differently related to labour participation outcomes over time. For instance, the impact of physical

and/or mental chronic health condition(s) on labour participation outcomes differed substantially depending on the type of chronic health condition(s) studied (Chapter 2). Also, study results emphasized the substantial effect of self-perceived health on labour participation and retirement planning, and additionally often suggested a (more) instantaneous effect of self-perceived health (Chapter 2 and 5). Besides chronic health condition(s) and self-perceived health, the data-infrastructure of the MCS also enabled to further investigate a specific and highly prevalent mental chronic health condition among the working population, that is, depressive complaint(s). Depressive complaints were assessed both continuous as well as categorical (Chapter 3). Results revealed that depressive complaints as a continuum were associated with a higher risk of reporting poor general and mental work ability as well as higher psychological disengagement levels over time. Moreover, employees with mild and moderate/severe depressive complaints had a substantial statistical significant higher risk for poor mental work ability over time compared to employees without depressive complaints.

It should be acknowledged that, in our studies, the health status of workers was defined based on self-rated responses to the questionnaires (12). No diagnosis was made/performed by a doctor or other (medical) professional. Hence, information bias due to these self-rated responses cannot be excluded (41). However, due to amongst others repeated measurements during follow-up as well as the availability for workers to indicate in the questionnaires whether or not they have (a) chronic health condition(s) and whether they had received or currently receive treatment for the health condition by a (medical) professional (42), the potential impact of information bias on the results was minimized. Moreover, our study results (38) underscored the reliability of the self-reported data used, for instance by demonstrating that with increasing severity of depressive complaints the proportion of employees indicating to be currently under treatment by a doctor/caregiver for depressive complaints at article baseline, also increased (Chapter 3). In addition, a conformation study by Szerencsi et al (2013) (43) also demonstrated a high agreement between self-reported data from the MCS and data obtained from medical records from the hospital, further underscoring that self-reported data is reliable. Besides the substantial validity of the self-reported data, validated questionnaires were used to determine the presence/absence of chronic health condition(s), self-perceived health, and depressive complaints (17, 42, 44-46).

The presence/absence of chronic health condition(s) was determined using the validated Health and Performance Questionnaire (HPQ). The HPQ listed 34 pre-

specified health conditions (42). Some health conditions listed by the HPQ list, such as overweight, can however be considered precursors of health condition(s) and not as chronic health condition(s) as defined by the Dutch National Institute of Public Health and the Environment (DNIPH). Therefore, the 34 conditions listed by the HPQ were combined with the 28 pre-specified conditions listed by the DNIPH (47, 48). Seventeen chronic health condition(s) matched directly. In our studies, an individual was defined as having (a) chronic health condition(s) when indicating having one (or more) of these seventeen condition(s). Employees not indicating having one of these seventeen condition(s) were considered the reference group. When using this definition of health status, workers included in the reference group could however still suffer from several (other) health condition(s) which can be considered determinants of disease such as overweight or hypertension (49). This was highly valuable since hereby no artificial contrast was created between workers with chronic health condition(s) and workers included in the reference group. Furthermore, the definition of health status enabled to identify multiple mental and/or physical chronic health condition(s) simultaneously within one individual (42), which was of additive value since having two or more condition(s) simultaneously substantially increases among older workers (50, 51).

The results obtained in this dissertation strongly emphasize the importance to consider different health indicators, such as (different types of mental and/or physical) chronic health condition(s), disease duration, the number of chronic health condition(s) present within an individual, and self-perceived health which reflects an individual's health experience. Additionally, the exemplary case of a specific mental chronic health condition, that is, depressive complaints was investigated. This was of additive value since besides a dichotomous approach to health, depressive complaints were assessed both categorical as well as continuous. This provided more in-depth insights within different categories of severity of depressive complaints. Assessing depressive complaints continuously could indicate a transition and/or increase in indicators per one-point increase in HAD-D. However, it should be acknowledged that the study results specifically for depressive complaints, for instance, are not (directly) applicable to other mental chronic health condition(s). For further research it is therefore suggested to study other, highly prevalent mental and/or physical chronic health condition(s) specifically, since the impact of these condition(s) can be differently related to labour participation outcomes.

Labour participation

A broad spectrum of labour participation outcomes was studied using the MCS. Hereby, more understanding of older workers' ability and willingness to prolong working lives (11) was gained.

In addition to studying older workers' employment status and additionally specified exit routes from paid employment (52, 53), it was also important to investigate older workers' functional abilities needed in order to meet the requirements of work and to prolong working lives, in terms of general, physical, and mental work ability. Moreover, since various intentions, behaviors and (psychological) motivations with regards to prolonging working lives may already develop in the years prior to reaching retirement age and may affect decisions regarding employment or retirement later, it was invaluable to additionally investigate these perceived subjective labour participation outcomes. This was also supported by the ICF framework, which states that labour participation is not only dependent on an individual's functioning, but also affected by contextual factors such as personal factors. Personal factors encompass amongst others an individual's intentions and motivations (54). Our results indicated that, for instance intentions, could affect the ability and/or willingness to prolong working lives and actual decisions to retire (early) or leave the labour force. Hereby, our study results emphasize the importance to not solely consider employment dichotomous in terms of whether an older worker is employed or not, yet that it is invaluable to gain more in-depth insights into the preceding steps which occur gradually over time before (actual) decisions regarding to prolonging working lives or (early) retirement were made. Moreover, as mentioned earlier, the broad spectrum of labour participation outcomes was highly valuable since it enabled to limit the potential impact of cohort effects. Hereby, labour participation outcomes, such as retirement intentions, which were less dependent on, for instance, the economic situation during that time period (27), could be investigated.

Although in our studies labour participation outcomes were assessed using self-reported data, it can be assumed that self-reported data is reliable (in line with the reasoning in the health paragraph). Moreover, valid instruments such as the as work ability index to investigate work ability were used (55, 56).

It should be noted that in our studies, labour participation outcomes were studied parallel. In our view it was an important first step to be taken to investigate the impact of health status on different labour participation outcomes separately. Of course, a potential dependence between (some of) these outcomes cannot be

ruled out, where e.g. one outcome may precede the other over time. For instance, employees with (a) health problem(s) could first make adjustments in work by e.g. working fewer hours, preceding definite decisions regarding labour participation e.g. leaving the labour force. Given the availability of the measured concepts at different follow-up periods, it was not possible to investigate potential dependence of outcomes in detail over time using the data infrastructure of the MCS. This would however be an interesting avenue for further research.

Furthermore, in order to diminish bias due to other (work-related) factors, in our studies mostly groups of older workers in employment by an employer, were studied. However, previous literature indicated that (many) older workers can leave employment and transit to self-employment (57, 58). It is therefore valuable for further research, to study in addition to specified exit routes from paid employment, potential transitions to self-employment.

Studying the role of the work environment and context in the relation between health and labour participation

As indicated by the ICF, the impact of contextual factors on the relation between health and labour participation is substantial (59-61). Using the data-infrastructure of the MCS, a broad range of contextual factors, originating from the personal/individual, demographic and work domains (3, 20, 62-70), were obtained.

In our studies, various in – and exclusion criteria in order to encompass a homogeneous subpopulation of older workers with regards to type/content of work (71-73) were formulated in order to minimize potential bias from work-related factors when investigating relations between health and labour participation over time. Moreover, various step-wise adjustments for these contextual/confounding factors were performed in order to minimize bias when studying relations between health and labour participation over time.

Furthermore, it was of crucial importance to investigate the potential facilitating/hindering role of these contextual factors on relations between health and labour participation. In Chapter 5, the impact of personal factors was investigated by composing two age groups of older workers. Results indeed underscored that the extent to which older dayworkers indicated to consider early retirement varied substantially between older dayworkers depending on their age. Moreover, the role of facilitating/hindering work-related factors affecting relations between health and labour participation were investigated (Chapter 3). Results demonstrated that relations between health and labour participation differed depending on the

studied work-related factor. Since the work context may encompass a broad range of factors, such as institutional factors (availability of early retirement schemes/ labour agreements, social norms) (74, 75), it was further invaluable to perform sector-stratified analyses.

It should however be noted that, although the literature (73, 76, 77) supports the crucial facilitating/hindering role of various work-related factors (Chapter 3), the stratified analyses were (still) based on a single work-related factor and hence not exhaustive. For further research it is therefore suggested to additionally investigate the role of other work-related factor(s) from the work context, such as task variety or competencies. Furthermore, in our studies adjustments were made for contextual/confounding factors identified at article baseline. However, it can be hypothesized that contextual/confounding factors do not remain stable over time and hence potential changes in contextual/confounding factors may have occurred during the follow-up period. In Chapter 4, a potential change in contextual/confounding factors over 16-year follow-up period can thus not be excluded. Although most studies in this dissertation had a follow-up period of two-years, for further research it would be suggested to take into account potential transitions/changes in both work-related as well as private confounding/ contextual factors over time.

Overall, due to the extensive data-infrastructure of the MCS and the usage of validated questionnaires and instruments to assess a broad range of work-related, domestic, social, individual and health related factors and a wide range of labour participation outcomes over a considerable 16-year follow-up period, the internal validity of the conducted studies in this dissertation was considerably high.

Generalizability

As regards the generalizability, or external validity, of the study results, it should be noted that our results are generalizable to the population of older workers involved in paid employment by an employer, as opposed to self-employed people for example. Moreover, due to studying different indicators of health, results are generalizable to employees with chronic health conditions in general, to employees with mental and/or physical chronic health condition(s), or specified to older workers with depressive complaints,. It should however be noted that our study results may not be generalizable to other specific types of chronic health condition(s), since the impact on labour participation and retirement might vary. Moreover, study results are generalizable to specific subpopulations

of older workers in (paid) employment within a specific work context/sector. In addition, results also transcended sectors and hence were generalizable to all employees involved in the same job content, such as in light physical occupational expenditure jobs (Chapter 5).

Although some of the studied labour participation outcomes, such as work ability, can be considered more or less universal and hence generalizable to other settings, our results should however also be interpreted within the Dutch context. That is, outcomes such as unemployment status, are more country-specific due to differences across countries in economic and governance indicators (78-80) such as social security and pension systems (2, 81, 82).

Practical implications

By meeting the general objectives and answering to the research questions as formulated in Chapter 1, the study results obtained in this dissertation demonstrated the crucial role of health in relation to prolonging working lives. Study results hereby provide valuable entry points for the development of effective preventive measures/interventions aiming to prolong working lives among older workers.

When developing preventive measures/interventions, it is recommended to regularly monitor workers' health throughout the career since health problem(s) are often not, or only partially, modifiable mainly with regards to chronic health condition(s) which are persistent and long-lasting (83). Furthermore, it is important to assess different indicators of health besides the presence/absence of health problem(s) (11), such as self-perceived health, when monitoring an individual's health. Furthermore, it is invaluable to consider the timing of preventive measures/interventions. It is important to monitor health preferably already rather early during the career since hereby employees might be (better) able to cope with health condition(s) whilst being in employment and (early) exit from employment can be prevented. Moreover, considering the impact of selection processes, results further underline the importance to consider the timing of preventive measures when developing preventive measures/interventions aiming to enhance employability. If selection processes are ignored, the ability of older workers to prolong working lives might be overestimated and hence (preventive) measures may not be effective. Preferably, interventions should be offered already earlier during the work career, when workers are not yet close to approaching the statutory retirement age. In addition, it is invaluable to consider the substantial role of the work context when developing preventive measures/interventions. For instance, interventions can

be targeted more specifically towards the specific work contexts. Hereby, the effectiveness can further increases which is not solely valuable for employees, yet also for employers. Even if older workers may switch from job/company, it remains highly likely that one remains involved in another job within the same sector and hence all employees and employers can ultimately benefit from effective policies (84-87).

It should be noted that, of course, the study results obtained cannot be applied directly into practical (preventive) interventions/measures. However, this was beyond the scope of this dissertation. In order to meet our general objectives, relations between health and labour participation were thoroughly investigated and hereby study results could provide valuable entry points for the development of preventive measures aiming to enhance older workers' employability. This was highly valuable since the need for developing effective preventive measures/interventions remains substantial. Many studies which assessed the effectiveness of interventions aiming to increase older workers' employability, demonstrated a relatively small positive effect (1, 11). Therefore, the study results obtained in this dissertation are thus highly valuable to provide entry points to further optimize the development of effective preventive measures/interventions.

Conclusion

This study results obtained in this dissertation demonstrated the crucial role of health on prolonging working lives. The presence of selection processes may have even (strongly) attenuated the observed results between health and labour participation over time. Moreover, using the ICF (59) as frame of mind, the substantial impact of contextual factors, that is work-related and personal factors, was demonstrated. Our study results demonstrate that from a health perspective, it is not self-evident for all older workers to prolong their working lives, which is also underscored by the Dutch Health Council (11). Beside, our results already provide valuable entry points for the development of preventive measures aiming to prolong working lives among older workers. Of course, the study results obtained cannot be applied directly into practical (preventive) interventions/measures. However, this was also beyond the scope of this dissertation.

When developing preventive measures/interventions, it is suggested to monitor different indicators of health already early during the work career in order to prevent (early) labour market exit due to health problem(s). Moreover, for policy developers, when using these study results as entry points for the development of

(practical) preventive measures/interventions or policies aiming to prolong work careers of older workers, the presence of selection processes should be considered. If selection processes are ignored, the ability of older workers to prolong working lives might be overestimated and hence (preventive) measures may not be effective.

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8

Impact

Impact

This paragraph highlights the (additive) societal, economic and scientific relevance of this dissertation and its potential societal, economic and scientific impact.

Societal and economic value

Due to demographic changes, one of the key objectives of the Dutch and European politics is to increase general labour participation rates, amongst others by prolonging older workers' working lives (1-3). Several policy measures have already been developed and implemented and have been proven successful in order to increase older workers' labour participation rates, such as increasing the statutory retirement age (3, 4). However, still a substantial proportion of older workers leaves the labour market early – that means before reaching the statutory retirement age (4, 5). Most of these older workers leave the labour market through disability benefits, unemployment, or via early retirement (2-4, 6-10).

Leaving the labour market (earlier), can have major societal and economic implications for various stakeholders. For older workers themselves, leaving employment (early) can have a negative effect on their mental health (4, 11) and may also have negative financial implications (one may not have sufficient pension) (12). Early labour market exit imposes also high costs for employers. These costs comprise costs for sick leave and (contribution to) disability pensions. It may lead to loss of specific expertise and in difficulties in finding sufficiently (qualified) employees (12). Early labour market exit is also associated with high costs for society due to societal contribution to unemployment benefits and costs for sick leave and disability pensions (13). Because the number of older workers increases in size and people in older age categories are at higher risk of having (one or more) health problem(s), the number of (older) people receiving disability benefits increases (14). This increase in disability benefits is mainly attributable to an increase in WIA benefits (Work and Income According to Work Capacity Act) (14, 15). As such, the sustainability of (Dutch) social security and pension systems may be threatened (3, 16).

In 2019, in total 818,378 people in the Netherlands received disability benefits, of which 69 per cent was through the WAO or the WIA (15). For people aged 55-64 years, the number of people receiving disability benefits (WAO/WIA) was respectively 134.073 for males and 136.803 for females (15). For people aged 65

years onwards, the number of people receiving disability benefits (WAO/WIA) was respectively 23,937 for males and 20,130 for females (15). Due to the increase in the number of benefits and indexation, the benefit costs for disability are estimated to rise from 13.6 billion euros in 2021, to 14.3 billion euros in 2022 (17). It should be noted that these numbers are not exhaustive and do not reflect the overall costs for the society. However, these numbers do already provide an indication of the enormous costs related to early labour market exit.

When addressing the societal and economic impact of this dissertation it is important to address that the findings obtained in this dissertation cannot be converted directly into practical (preventive) interventions/measures focused on prolonging older workers' working lives. However, our findings provide valuable entry points for the development and timing of preventive measures/interventions aiming to sustain/facilitate older workers' labour participation. If over time, these preventive measures/interventions are shown to be effective – even for a small fraction – and the influx into the WIA is reduced slightly - the societal and economic impact in terms of costs savings, will be substantial. Moreover, when using these study findings as entry points for the development of (practical) preventive measures/interventions or policies aiming to prolong work careers of older workers, the presence of selection processes should be considered. If selection processes are ignored, the ability of older workers to prolong working lives might be overestimated and hence (preventive) measures may not be effective. This also underlines the importance to consider the timing of preventive measures. The need for preventive interventions/measures may already be earlier throughout the career.

Scientific value

Apart from their societal and economic impact, the findings obtained in this dissertation and the applied methodology, also have a high scientific value.

Investigating the relation between health and labour participation is rather complex. However, the prospective longitudinal design of the Maastricht Cohort Study (MCS) enabled us to study a broad range of objective and subjective health-related factors and outcomes of labour participation on an individual level over time by means of extensive self-administered questionnaires, whilst also taking in account potential other (confounding/contextual) factors as well as selection processes. Consequently, the internal validity of the studies conducted in this dissertation was high. However, it should be noted that the potential impact of

(health-related) selection processes cannot be excluded, especially when aiming to study a subpopulation of older workers. (Health-related) selection processes might have already taken place before (study/article) baseline measurement and hence cannot be excluded. Moreover, during the working career (study period) workers may have also made various adaptations in their employment process in order to maintain involved in paid employment, perhaps due to declining health. Additionally, those (older) who were unable to continue to perform paid work due to health reasons – might also left the labour market early Also, in longitudinal data, selective loss to follow-up over time is likely to occur. This was demonstrated in Chapter 3: employees with more severe depressive complaints at article baseline were more likely to not be included at follow-up compared to employees with moderate/mild depressive complaints at article baseline. Consequently, due to the presence of these selection processes, inconsistent study findings can be observed over time (18) which has substantial implications. As suggested in Chapter 4 and also by the Dutch Health Council (2018) (18), it is thus of substantial importance for researchers to consider the presence and impact of (health-related) selection processes, and that the observed findings may be an underestimation of the 'true' impact of health on labour participation. For further research, it is suggested to explore indications of selection processes during a broader time period earlier throughout working life in order to consider selection processes already earlier, in order to draw valid conclusion(s) over time.

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Summary

Summary

This dissertation aims to gain more insight into the role of health on older workers' labour participation, whilst taking into account the potential impact of the (work) context as well as selection processes in this relation.

Due to demographic changes, people become older and the time between retirement age until death has also risen substantially over the past decades (1). These demographic changes have implications for the sustainability of social security and pension systems in many Western societies (1). In order to maintain social security and pension systems, Western policies aim to increase labour participation rates, amongst others by prolonging working lives of older workers (2-4). In recent years, the proportion of older people involved in the labour market already substantially increased, mainly among older workers aged 55-64 years (5). Yet, still many older workers are not able to work until reaching the statutory retirement age and leave the labour market early – thus before reaching the statutory retirement age – through various exit routes such as early retirement, disabilities or unemployment benefits (5-9). It is of crucial importance to consider factors underlying older people's prolongation of working lives.

It is known that health has substantial implications for labour participation (10) and strongly affects older workers' employability (2, 5, 6, 11-18) and decisions regarding whether or not to work longer or retire (early) (19, 20). However, with aging, the risk of having health problems substantially increases (2, 5, 21, 22). Also, the risk of multimorbidity – that is having one or more health problem(s) simultaneously – increases (5).

Health problems or illness are in many cases a given and to a certain extent one cannot prevent the onset of health problems at some point in life. Moreover, health problems or illness (21) are often not, or only partially, modifiable mainly with regards to chronic health condition(s) which are persistent and long-lasting (10). Thus, health status can affect one's ability and willingness to prolong working lives among older workers (5). Consequently, not all older people with poor health may be able to work until reaching the statutory retirement age (5).

The general objective of this dissertation was to gain more in-depth insight into relations between health status and labour participation outcomes among older workers over time, whilst taking into account the potential impact of the (work) context as well as selection processes in this relation. Furthermore, since

health problems or illness are often not, or only partially, modifiable, mainly with regards to chronic health condition(s), the potential facilitating and/or hindering impact of work-related factors (from the work context) on labour participation outcomes among older workers' with health problem(s), was explored. Hereby, findings can provide points of entry to the development of preventive measures/interventions aiming to facilitate/sustain labour participation of older workers. The data infrastructure of the prospective Maastricht Cohort Study (MCS) enabled us to investigate this relation thoroughly. The MCS encompassed extensive data about a broad range of objective and subjective health related factors and outcomes of labour participation, as well as a broad range of confounding/contextual factors. Moreover, a large heterogeneous occupational study population was included. At cohort baseline (1998), 12,140 workers involved in different jobs and educational levels, originating from 45 different companies and organizations, completed and returned the baseline questionnaire (23). Additionally, the longitudinal observational research design with multiple measurements over a considerable follow-up period enabled us to disentangle cause and effect over time and to consider the potential presence of (health-related) selection processes.

Since health does not solely refer to the presence/absence of health problems or illness and labour participation does not solely reflect to being in – or out of employment, multiple objective and subjective health related factors and labour participation outcomes were studied in this dissertation. When studying the relation between health and labour participation over time, adjustments for various contextual/confounding factors from the private/personal, work-related, and health domains (5, 14, 24) were made in all Chapters. In most studies, groups of older workers aged 45 years onwards were included (except for **Chapter 4**). It should however be noted that perhaps closer to retirement age people may be more actively involved in decision(s) regarding retirement as for those yet further aged from retirement. Therefore, age-stratified analyses were also performed (**Chapter 5**).

In **Chapter 1**, the introduction, background information about the relation between health and labour participation and gaps in research so far are provided. Finally, the general aim and objectives for this dissertation are described. In **Chapter 2,** the impact of both objective and subjective indicators of health, independently, on different labour participation outcomes and retirement over time, were studied. Findings revealed substantial cross-sectional associations between different types of chronic health condition(s) and indicators of labour participation and

retirement (such as retirement intentions and working hours). The strength of the relations over time however differed due to differences in the type of chronic health condition(s). For instance, employees with mental and physical chronic health conditions simultaneously, had higher risks for decreasing working hours, losing employment, and receiving disability benefits over time, compared to healthy employees. No statistical significant associations over time were observed between chronic health condition(s) and strong retirement intentions. Whereas self-perceived health (SPH) was associated with strong retirement intentions at baseline, no longitudinal associations between self-perceived health and indicators of labour participation and retirement were observed however, suggesting a potentially more instantaneous effect of SPH. Furthermore, findings showed that SPH scores substantially differed due to disease duration: the longer employees were ill (prevalent chronic health condition(s)), the lower their self-perceived health score was. In **Chapter 3**, we focused on the impact of a specific mental chronic health condition, that is, depressive complaints, on different outcomes of labour participation. As hypothesized, results showed adverse associations between increasing depressive complaints and indicators of labour participation over time, such as poor general, physical, and/or mental work ability, and high psychological disengagement levels. No statistical significant associations were observed between depressive complaints and strong retirement intentions and leaving employment over time. In **Chapter 4**, we assessed the relation between health and labour participation over a considerable follow-up period of 16-years, and additionally interpreted the findings in the light of continuing (health-related) selection processes. As hypothesized, findings revealed that employees with mental, physical, and mental-physical chronic health condition(s) had substantial higher risks to leave employment over 16-year follow-up compared to healthy employees. Moreover, employees with poor/moderate SPH had an increased risk to reduce working hours over two-year follow-up compared to employees with good SPH. It was crucial to interpret the findings in the light of continuing (health-related) selection processes, due to studying a subpopulation of older workers throughout time. It could be that those workers who were not able to remain in (paid) employment whilst having health problem(s), already left the labour market and/or our study. For instance, the risk to reduce working hours over time did not statistically differ between employees with multiple physical chronic health conditions compared to healthy employees. Perhaps, employees with two or more physical chronic health condition(s) already left the labour market earlier. It was thus likely that a (highly)

selected group of healthier older workers was studied at over time. Consequently, the observed findings may be an underestimation of the actual impact of health on labour participation over time. The same reasoning applies to the observed study findings in **Chapter 2** and **Chapter 3**. Also here, longitudinal observations may be an underestimation of the actual impact of health on labour participation outcomes. Since decisions regarding labour market participation and retirement can be considered a gradual process, we advanced our understanding by focusing on the retirement decision-making process among older workers in **Chapter 5**. The retirement decision-making processes encompasses various phases, with the first phase encompassing (the development of) retirement intention(s). It was invaluable to investigate whether retirement intention(s) were related to actual retirement behavior over time, and hence provide valuable insight in older workers' decision regarding labour participation and retirement. Findings revealed that the extent to which older workers consider early retirement substantially varies depending on older workers' health status and age at article baseline. Also SPH was highly related to older workers' retirement decision-making process. Furthermore, we aimed to assess whether considerations towards (early) retirement predict actual retirement behavior over time. Over time, many associations between considerations towards (early) retirement and labour participation outcomes were observed, however few associations were statistically significant. In **Chapters 2-5**, the impact of (external) work-related factors from the work context in the relation between health and labour participation, was extensively investigated. However, since older workers may be more prone to value intrinsic factors compared to extrinsic factors (25), we also investigated the potential role of an intrinsic factor (work engagement) that may affect older workers' labour participation (**Chapter 6**). Findings revealed that work engagement was strongly cross-sectional related to different outcomes of labour participation. However, the strength and direction of these cross-sectional associations varied substantially depending on the studied outcome of labour participation, and on health status. For instance, contrary to previous research studying work engagement, our findings showed that among older workers with chronic health condition(s), increasing levels of work engagement were related to lower odds to report (frequent) presenteeism behavior at article baseline. Over time, study findings showed potential longitudinal associations over time, however few of these longitudinal associations reached statistical significance. These study findings demonstrated that further research is warranted before providing points of entry for preventive measures/interventions aiming to increase older workers

work engagement and hence facilitate older workers' labour participation.

Besides investigating the relation between health and labour participation in-depth, whilst taking into account the impact of the work context and selection processes, it was also highly invaluable to explore the potential facilitating and/or hindering impact of work-related factors (from the work context) on labour participation outcomes among older workers' with health problem(s). In **Chapter 3**, stratified analyses for various work-related factors were performed. Findings revealed that the strength of associations between depressive complaints and labour participation outcomes over time strongly differed within various work contexts. For instance, the strength of the association differed among older workers reporting to perform physically demanding work, having high psychological job demands, low decision latitude, or high emotional demands. In **Chapter 4**, sector-stratified analyses revealed the strongest associations within the sector industry. Furthermore, in all studies, in – and exclusion criteria were also carefully defined in order to comprise a more homogeneous study population based on the type or content of the work. For instance, based on the amount of physical activity performed in the occupational domain (**Chapter 5**).

In the general discussion (**Chapter 7)**, the main findings are presented and internal validity of the conducted studies are discussed, as well as generalizability (external validity) of the results. Moreover, recommendations/input for further research are presented. We conclude that the impact of different health related factors on various labour participation outcomes among older workers was substantial, and additionally demonstrated the facilitating and hindering impact of various work-related factors on labour participation outcomes for older workers with health problem(s). It should however be noted that the presence of selection processes may have strongly attenuated our findings over time.

Of course, the findings obtained cannot be applied directly into practical (preventive) interventions/measures. This step was also beyond the scope of this dissertation. Despite that many interventions aiming to increase older workers' employability have already been developed and implemented, the effectiveness of these interventions appeared to be relatively small (2). A strong need for developing more effective preventive interventions/measures hence remains. Hereby, our findings already provided highly valuable entry points for the development of preventive measures aiming to enhance labour participation of older workers. Our findings already revealed the facilitating impact of various work-related factors in the relation between health and labour participation, which provides

valuable entry points for the development of preventive measures/interventions. Moreover, findings revealed that various health-related decisions regarding labour participation might already occur earlier during the work career. This also underlines the importance to carefully consider the timing of preventive measures, which are offered preferably already earlier during the work career. It is expected that if these measures/interventions subsequently prove to be effective, even for a small fraction, the societal and economic impact is substantial. If (more) older workers are able to prolong working lives and less leave the labour market (early), the (Dutch) governmental costs related to early labour market exit of older workers, substantially decreases. Besides the societal and economic impact, the individual impact for older workers themselves may also be substantial, not only financially in terms of providing more pension (26), but also from a health point of view since work has been found to be beneficial e.g. for older workers' mental health (2, 27).

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Nederlandstalige samenvatting

De studies beschreven in dit proefschrift beogen meer inzicht te geven in de relatie tussen gezondheidsstatus en arbeidsparticipatie van oudere werknemers, rekening houdend met de mogelijke impact van de (werk)context en selectieprocessen in deze relatie.

De afgelopen decennia werd de arbeidsmarkt geconfronteerd met verschillende (demografische) ontwikkelingen, zoals vergrijzing en ontgroening van de beroepsbevolking. Doordat mensen ouder worden, neemt de ook de tijd tussen de pensioengerechtigde leeftijd en het overlijden fors toe (1). Deze (demografische) ontwikkelingen zetten sociale zekerheidsstelsels en pensioenvoorzieningen in veel westerse samenlevingen onder druk (1). Om de sociale zekerheidsstelsels en pensioenvoorzieningen in stand te kunnen houden, is het beleid in westerse landen gericht op het onder andere bevorderen van de arbeidsparticipatie van oudere werknemers door deze langer te laten doorwerken. De afgelopen jaren nam de netto-arbeidsparticipatie van ouderen toe, vooral onder ouderen in de leeftijdsgroep van 55 tot en met 64 jaar (2). Hoewel de arbeidsparticipatie in het algemeen toeneemt, zijn echter nog steeds veel oudere werknemers niet in staat te werken tot aan het bereiken van de wettelijke pensioenleeftijd. Nog steeds verlaat een aanzienlijk deel van de oudere werknemers de arbeidsmarkt voortijdig – dus voordat ze de wettelijke pensioenleeftijd hebben bereikt – via verschillende uittreedroutes zoals vervroegd pensioen, arbeidsongeschiktheid - of werkloosheidsuitkeringen. Het is daarom van cruciaal belang rekening te houden met de factoren die de verlenging van het beroepsleven van ouderen in de weg kunnen staan of juist kunnen faciliteren.

Het is bekend dat gezondheidsstatus een substantiële rol speelt bij het bevorderen van de arbeidsparticipatie en inzetbaarheid van oudere werknemers, als ook op beslissingen omtrent langer doorwerken of (vervroegd) pensioen. Met toenemende leeftijd neemt het risico op gezondheidsproblemen echter aanzienlijk toe. Ook neemt het risico op multimorbiditeit – dat wil zeggen het gelijktijdig hebben van één of meer gezondheidsklachten – toe.

Gezondheidsproblemen of ziekten zijn in veel gevallen een gegeven en tot op zekere hoogte kan men het ontstaan van gezondheidsproblemen op een bepaald moment in het leven niet voorkomen. Bovendien zijn gezondheidsproblemen of ziekten vaak niet of slechts gedeeltelijk veranderbaar, vooral wat betreft chroni-

sche gezondheidsproblemen die persistent en langdurig zijn. Een gezondheidsprobleem kan van invloed zijn op iemands mentale en/of fysieke vermogen en/of bereidheid om het arbeidsleven te verlengen. Bijgevolg kunnen mogelijk niet alle ouderen met gezondheidsproblemen blijven werken tot ze de wettelijke pensioengerechtigde leeftijd hebben bereikt.

De algemene doelstelling van dit proefschrift was om meer inzicht te krijgen in de relaties tussen gezondheidsstatus en arbeidsparticipatie in de loop van de tijd van oudere werknemers, rekening houdend met de potentiële impact van de (werk) context en selectieprocessen in deze relatie. Aangezien gezondheidsproblemen of ziekten vaak niet of slechts gedeeltelijk veranderbaar zijn, met name bij chronische aandoening(en), is bovendien de mogelijk faciliterende en/of belemmerende invloed van werk-gerelateerde factoren (uit de werkcontext) op de arbeidsparticipatie van oudere werknemers met gezondheidsproble(e)m(en) onderzocht. Hierdoor kunnen bevindingen aanknopingspunten bieden voor de ontwikkeling van preventieve maatregelen/interventies die erop gericht zijn de arbeidsparticipatie van oudere werknemers te bevorderen. De data-infrastructuur van de Maastrichtse Cohort Studie (MCS) stelde ons in staat om deze relatie grondig te onderzoeken. Middels vragenlijsten die de deelnemers zelf invulden werd een breed scala aan objectieve en subjectieve gezondheidsgerelateerde factoren, de psychosociale werkomgeving, als ook een breed palet van uitkomsten van arbeidsparticipatie in kaart gebracht. In de periode van 1998 tot 2002 werd 10 maal een vragenlijst uitgestuurd. In 2008 werd retrospectief gevraagd naar onder andere de arbeidshistorie, arbeidsomvang, en werktijdenregime in de periode van 2002 tot 2008. Vervolgens vonden twee follow-up metingen plaats in 2012 en 2014. Het longitudinale observationele onderzoeksdesign met meerdere metingen over een aanzienlijke follow-up, stelde ons in staat oorzaak en gevolg in de tijd te ontwarren en de mogelijke aanwezigheid van (gezondheidsgerelateerde) selectieprocessen te overwegen. Bij cohort-baseline (1998) werd een grote heterogene populatie van werkenden geïncludeerd. Bij cohort-baseline vulden 12.140 werknemers met verschillende beroepen en opleidingsniveaus, afkomstig uit 45 verschillende bedrijven en organisaties, de vragenlijst in.

Aangezien gezondheidsstatus niet alleen betrekking heeft op de aanwezigheid/afwezigheid van gezondheidsproblemen of ziekten, en arbeidsparticipatie niet alleen verwijst naar het al dan niet hebben van een baan, werden in dit proefschrift meerdere objectieve en subjectieve gezondheidsgerelateerde factoren en uitkomsten van arbeidsparticipatie bestudeerd. Bij het bestuderen van de rela-

tie tussen gezondheidsstatus en arbeidsparticipatie in de tijd, werd in alle hoofdstukken gecorrigeerd voor verschillende contextuele/verstorende factoren uit het privé/persoonlijke, werk-gerelateerde en gezondheidsdomein. In de meeste studies zijn groepen oudere werknemers van 45 jaar en ouder geïncludeerd (behalve in **hoofdstuk 4**). Er moet echter worden opgemerkt dat mensen die dichter bij de pensioengerechtigde leeftijd komen wellicht actiever bezig zijn met keuzes en/of beslissing(en) over pensionering in vergelijking met mensen die zich verder van de pensioengerechtigde leeftijd bevinden. Daarom werden, waar mogelijk, ook gestratificeerde analyses voor leeftijd uitgevoerd (**Hoofdstuk 5**).

In **Hoofdstuk 1**, de inleiding, wordt achtergrondinformatie gegeven over de relatie tussen gezondheidsstatus en arbeidsparticipatie en hiaten in onderzoek tot nu toe. Ook worden in hoofdstuk 1 het algemene doel en de doelstellingen voor dit proefschrift beschreven. In **Hoofdstuk 2** werd de invloed van zowel objectieve als subjectieve gezondheidsindicatoren onafhankelijk van elkaar bestudeerd, op verschillende uitkomsten van arbeidsparticipatie en pensionering in de loop van de tijd. Uit de resultaten kwam naar voren dat er aanzienlijke cross-sectionele verbanden bestaan tussen verschillende soorten chronische gezondheidstoestand(en) en indicatoren van arbeidsparticipatie en pensionering (zoals pensioenintenties en werktijden). De sterkte van de relaties in de tijd verschilde echter door verschillen in het type chronische aandoening(en). Zo liepen werknemers met zowel mentale en fysieke chronische gezondheidsproblemen, grotere risico's op het verliezen van hun baan en het ontvangen van arbeidsongeschiktheidsuitkeringen in de loop van de tijd, in vergelijking met gezonde werknemers. Ook was het hebben van mentale en fysieke chronische gezondheidsproblemen geassocieerd met een vermindering van arbeidsduur in de tijd. Er werden in de loop van de tijd geen statistisch significante associaties waargenomen tussen chronische gezondheidstoestand(en) en sterke intenties om met pensioen te gaan. Terwijl zelf ervaren gezondheid in de cross-sectionele analyses geassocieerd was met sterke pensioneringsintenties, werden er echter geen longitudinale verbanden waargenomen tussen zelf ervaren gezondheid en indicatoren van arbeidsparticipatie en pensionering. Dit duidt wellicht op een meer 'onmiddellijk' effect van zelf ervaren gezondheid. Bovendien toonden bevindingen aan dat zelf ervaren gezondheid scores sterk samenhangen met ziekteduur: hoe langer werknemers ziek waren (veel voorkomende chronische gezondheidsaandoening(en)), hoe lager hun zelf ervaren gezondheidsscore was. In **Hoofdstuk 3** werd de impact van een specifieke psychische chronische aandoening, namelijk depressieve klachten, op verschillende uitkomsten van arbeidspar-

ticipatie bestudeerd. De bevindingen lieten negatieve verbanden zien tussen toenemende depressieve klachten en indicatoren van arbeidsparticipatie in de loop van de tijd, zoals een slecht algemeen, fysiek en/of mentaal werkvermogen en een hoge mate van zogenaamde psychologische 'disengagement'. Psychologische 'disengagement' refereert naar verschillende houdingen en gedragingen waarvan - met name bij oudere werknemers - kan worden verwacht dat ze veranderen in de periode vóór pensionering, zoals bijvoorbeeld de bereidheid om deel te nemen aan nieuwe cursussen. Er werden geen statistisch significante associaties waargenomen tussen depressieve klachten en sterke pensioenintenties en het verlaten van het werk na verloop van tijd. In **Hoofdstuk 4** werd de relatie tussen gezondheidsstatus en arbeidsparticipatie onderzocht over een aanzienlijke follow-up periode van 16 jaar. De bevindingen werden daarbij ook geïnterpreteerd in het licht van continue (gezondheidsgerelateerde) selectieprocessen. De bevindingen toonden aan dat werknemers met (een) mentale, fysieke, en zowel mentaal en fysieke chronische gezondheidsprobleme(e)m(en) substantieel hogere risico's hadden om het werk te verlaten gedurende een follow-up van 16 jaar in vergelijking met gezonde werknemers. Bovendien was het hebben van een slechte/matige zelf ervaren gezondheid, geassocieerd met een vermindering van arbeidsduur in de tijd. Bij het bestuderen van een subpopulatie van oudere werknemers door de tijd heen was het van cruciaal belang om de bevindingen te interpreteren in het licht van continue (gezondheidsgerelateerde) selectieprocessen. Het kan zijn dat juist werknemers met gezondheidsproblemen stopten met (betaald) werk, en daardoor de arbeidsmarkt en/of onze studie al eerder hebben verlaten. Een vermindering van de arbeidsduur in de tijd verschilde bijvoorbeeld niet statistisch significant tussen werknemers met meerdere fysieke chronische gezondheidsproblemen in vergelijking met gezonde werknemers. Wellicht hebben werknemers die problemen ervaarden ten gevolge van het hebben van meerdere fysieke chronische gezondheidsproblemen, de arbeidsmarkt/de studie al verlaten. Daarentegen, werknemers met meerdere fysieke chronische gezondheidsproblemen die wel in staat waren om met/ondanks hun fysieke chronische gezondheidsproblemen te blijven (door) werken, zijn nog (steeds) actief op de arbeidsmarkt/geïncludeerd in de studie. Dit kan mogelijk verklaren waarom er geen verschil in reductie van arbeidsduur werd geobserveerd bij werknemers met meerdere fysieke chronische gezondheidsproblemen ten opzichte van gezonde werknemers. Het was dus waarschijnlijk dat er in de loop van de tijd een (zeer) geselecteerde groep van gezondere oudere werknemers werd bestudeerd. De bevindingen in deze studies zijn dan ook mogelijk een

onderschatting van de daadwerkelijke impact van gezondheidsstatus op arbeidsparticipatie in de tijd. Dezelfde redenering geldt voor de onderzoeksbevindingen in **Hoofdstuk 2** en **Hoofdstuk 3**. Ook hier kunnen longitudinale observaties een onderschatting zijn van de daadwerkelijke impact van gezondheidsstatus op uitkomsten van arbeidsparticipatie. Aangezien individuele keuzes en beslissingen omtrent arbeidsparticipatie en pensionering als een geleidelijk proces kunnen worden beschouwd, hebben we ons begrip vergroot door ons in **Hoofdstuk 5** te concentreren op het besluitvormingsproces over pensionering onder oudere werknemers. Het besluitvormingsproces over pensionering omvat verschillende fasen, waarbij de eerste fase (de ontwikkeling van) pensioenvoornemen(s) betreft. Het was van groot belang om te onderzoeken of intentie(s) om met pensioen te gaan verband hielden met het daadwerkelijke pensioengedrag in de loop van de tijd, om zodanig meer inzicht te verkrijgen in beslissingen van oudere werknemers met betrekking tot arbeidsparticipatie en pensionering. Uit de bevindingen bleek dat de mate waarin oudere werknemers vroeg pensioen overwegen, varieert. Het overwegen van vroeg pensioen wordt onder andere beïnvloed door de gezondheidsstatus van oudere werknemers als ook door de leeftijd van oudere werknemers op het moment dat pensioen intenties worden gemeten. Ook zelf ervaren gezondheid was sterk gerelateerd aan het besluitvormingsproces van oudere werknemers over pensionering. Verder wilden we nagaan of overwegingen om (vervroegd) met pensioen te gaan, het daadwerkelijke pensioengedrag in de loop van de tijd voorspellen. Bevindingen lieten verbanden tussen overwegingen ten aanzien van (vervroegde) pensionering en arbeidsparticipatieresultaten zien, echter waren slechts weinig verbanden statistisch significant. In de **Hoofdstukken 2-5** werd de invloed van (externe) werk-gerelateerde factoren uit de werkcontext op de relatie tussen gezondheidsstatus en arbeidsparticipatie uitgebreid onderzocht. Omdat oudere werknemers echter meer geneigd zijn om intrinsieke factoren te waarderen dan extrinsieke factoren, werd ook de mogelijke rol van een intrinsieke factor (bevlogenheid) die de arbeidsparticipatie van oudere werknemers kan beïnvloeden, onderzocht (**Hoofdstuk 6**). Uit de bevindingen bleek dat er aanzienlijke cross-sectionele verbanden waren tussen bevlogenheid en verschillende uitkomsten van arbeidsparticipatie. De sterkte en richting van deze cross-sectionele verbanden varieerde echter aanzienlijk, afhankelijk van de onderzochte uitkomst van arbeidsparticipatie en de gezondheidstoestand. Onze cross-sectionele bevindingen tonen bijvoorbeeld aan dat onder oudere werknemers met chronische gezondheidsproblemen, een toenemende mate van werkbevlogenheid verband hield met een lagere kans om (frequent) presenteïsme

gedrag te rapporteren. Presenteïsme wordt doorgaans gedefinieerd als het gedrag van een werknemer die ondanks fysieke of psychische gezondheidsproblemen blijft werken, terwijl hij of zij vanwege deze gezondheidsproblemen eigenlijk thuis zou moeten blijven. De onderzoeksresultaten toonden potentiële verbanden in de loop van de tijd, maar weinig van deze longitudinale verbanden waren statistisch significant. Deze resultaten toonden aan dat verder onderzoek nodig is voordat er aanknopingspunten kunnen worden geboden voor preventieve maatregelen/interventies die erop gericht zijn de arbeidsbetrokkenheid van oudere werknemers te vergroten.

Naast het onderzoeken van de relatie tussen gezondheidsstatus en arbeidsparticipatie, rekening houdend met de impact van de werkcontext en selectieprocessen, was het ook van groot belang om de potentiële faciliterende en/of belemmerende impact van werk-gerelateerde factoren (uit de werkcontext) op arbeidsparticipatie van oudere werknemers met gezondheidsproblemen te onderzoeken. In **Hoofdstuk 3** zijn gestratificeerde analyses voor verschillende werk-gerelateerde factoren uitgevoerd. Bevindingen lieten sterke longitudinale verbanden tussen depressieve klachten en uitkomsten van arbeidsparticipatie zien, echter de sterkte van deze verbanden verschilde binnen verschillende werkcontexten. De sterkte van het verband was bijvoorbeeld verschillend voor oudere werknemers die aangaven fysiek veeleisend werk te doen of hoge psychologische werkeisen binnen het werk te hebben, in tegenstelling tot oudere werknemers die aangaven weinig fysiek veeleisend werk te doen of lage psychologische werkeisen binnen het werk te hebben. In **Hoofdstuk 4** laten sector gestratificeerde analyses zien dat binnen de sector industrie de sterkste verbanden tussen gezondheidsstatus en arbeidsparticipatie worden gevonden. Verder werden in alle studies de in- en exclusiecriteria zorgvuldig gedefinieerd om zo een meer homogene onderzoekspopulatie te vormen op basis van het type of de inhoud van het werk. Bijvoorbeeld, werknemers werden geïncludeerd op basis van de hoeveelheid fysieke activiteit die verricht wordt in het beroepsdomein (**Hoofdstuk 5**).

In de algemene discussie (**Hoofdstuk 7**) worden de belangrijkste bevindingen gepresenteerd en wordt de interne validiteit van de uitgevoerde onderzoeken besproken, evenals de generaliseerbaarheid van de bevindingen. Bovendien worden aanbevelingen/input voor verder onderzoek gepresenteerd. We concluderen dat de impact van verschillende gezondheidsgerelateerde factoren op verschillende uitkomsten van arbeidsparticipatie onder oudere werknemers substantieel was, en toonden bovendien de faciliterende en belemmerende impact van verschillen-

de werk-gerelateerde factoren op arbeidsparticipatie van oudere werknemers met gezondheidsproblemen aan. Er moet echter worden opgemerkt dat de aanwezigheid van selectieprocessen onze bevindingen in de loop van de tijd mogelijk sterk heeft afgezwakt.

Uiteraard kunnen de bevindingen uit de onderzoeken niet direct worden toegepast in praktische (preventieve) interventies/maatregelen. Deze stap viel buiten het bestek van dit proefschrift. Ondanks dat er al veel interventies zijn ontwikkeld en geïmplementeerd om de inzetbaarheid van oudere werknemers te vergroten, blijkt de effectiviteit van deze interventies relatief klein te zijn (3). Er blijft dus een sterke behoefte bestaan aan het ontwikkelen van effectievere preventieve interventies/maatregelen. Onze bevindingen kunnen waardevolle aanknopingspunten opleveren voor de ontwikkeling van preventieve maatregelen gericht op het vergroten van de arbeidsparticipatie van oudere werknemers. Uit onze bevindingen bleek dat verschillende werk-gerelateerde factoren een faciliterende invloed hebben op de relatie tussen gezondheidsstatus en arbeidsparticipatie, hetgeen ook waardevolle aanknopingspunten biedt voor de ontwikkeling van preventieve maatregelen/interventies. Bovendien bleek uit de bevindingen dat verschillende gezondheidsgerelateerde beslissingen over arbeidsparticipatie al eerder in de arbeidsloopbaan kunnen worden genomen. Dit onderstreept het belang om ook goed na te denken over de timing van preventieve maatregelen, die bij voorkeur al eerder in de arbeidsloopbaan moeten worden aangeboden. De verwachting is dat wanneer deze maatregelen/interventies vervolgens effectief blijken te zijn, al was het maar voor een klein deel, de maatschappelijke en economische impact substantieel kan zijn. Als (meer) oudere werknemers in staat zijn om langer door te werken en minder mensen de arbeidsmarkt (vroegtijdig) verlaten, nemen de (Nederlandse) overheidskosten gerelateerd aan het vroegtijdig verlaten van de arbeidsmarkt van oudere werknemers substantieel af. Naast de maatschappelijke en economische impact kan de individuele impact voor oudere werknemers zelf ook aanzienlijk zijn, niet alleen vanuit een financieel perspectief (meer pensioen) maar ook vanuit een gezondheid en welzijn perspectief. Het is gebleken dat werk heilzaam is, bijvoorbeeld voor de geestelijke gezondheid van oudere werknemers (3, 4).

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About the author

Jacqueline Jennen was born on the 30th of September 1994, in Sittard, the Netherlands.

After completing secondary school (VWO), she studied *Health Sciences (Prevention and Health)* at Maastricht University (Maastricht, the Netherlands) and obtained a Bachelor of Science degree in 2016. She acquired a Master of Science degree in *Work, Health, and Career* at Maastricht University (Maastricht, the Netherlands) and graduated in 2017. From November 2017 until September 2022 she worked as a PhD candidate at the Department of Epidemiology at Maastricht University (Care and Public Health Research Institute, CAPHRI), under the supervision of prof. dr. IJmert Kant and dr. Nicole Jansen. Her PhD project aimed to gain more insight into relations between health status and labour participation among older workers, whilst taking into account the potential impact of the (work) context as well as selection processes when studying this relation. The project was financially supported by the Province of Limburg, The Netherlands, through the 4Limburg program (Grant number 2017/50486) and by Care and Public Health Research Institute (CAPHRI), Maastricht University, the Netherlands, and resulted in the present dissertation.