Older workers' work limitations, vitality and retirement preferences

The differential effects of chronic health conditions

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Summary

The retirement landscape in most western countries, including that of the Netherlands, has transformed rapidly in the past few decades. Population ageing has triggered growing concerns about the shrinking of the labour force and sustainability of the welfare state. In order to counter these concerns, most western governments extended working lives by increasing the statutory pension age and suspending early work exit routes. Given that the likelihood of having a chronic health condition increases with age, a substantial number of older workers will be burdened by the needs and limitations of their chronic health conditions as they continue to work until they reach the newly increased retirement age. To ensure the wellbeing and productivity of older workers with chronic health conditions as they work longer than previously expected, it is important to understand how chronic health conditions influence their late-career work and health and how older workers with chronic health conditions can be supported at work.

In this dissertation, I aim to understand how older workers with chronic health conditions experience late-career work and health in the Netherlands. I do so by examining the heterogeneities in the effects of chronic health conditions on older workers' work limitations, vitality and subjective life expectancy, and how these effects drive older workers' retirement preferences. In addition to this, I examine the role of the organization in sustainably supporting older workers with chronic health conditions. Specifically, I focus on identifying the type of organizational climate and organizational policy that carry the most benefits for older workers with chronic health conditions. I use data from the Netherlands Interdisciplinary Demographic Institute's (NIDI) Pension Panel Survey (NPPS), an innovative prospective cohort study that follows a cohort of Dutch older workers born between 1950-1955. The first wave of the NPPS was conducted in the Netherlands in 2015 and it collected data from approximately 6,800 employed older workers aged 60-65 years. The second round of data collection was conducted in 2018. Approximately 5,300 older workers who responded to the questionnaire at wave 1 also responded at wave 2. The NPPS contains detailed information on older workers' retirement processes/intentions, health and work contexts. The multilevel data structure of the NPPS also allows for the differentiation between the effects of

organization-level and individual-level constructs on the health and work of older workers with chronic health conditions.

In Chapter 2, I examine the different pathways through which chronic health conditions influenced older workers' retirement preferences. From the literature, we know that older workers with poor health or who are experiencing chronic health conditions may prefer to retire early. But the reasons behind their preferences are yet unknown. Therefore, in this chapter I disentangle the extent to which vitality, health-related work limitations and subjective life expectancy mediate the relationship between four chronic health conditions (arthritis, cardiovascular diseases, sleep disorders and psychological disorders) and (early) retirement preferences of older workers. The results of this chapter showed that older workers with chronic health conditions were more likely to prefer early retirement. The reason why they preferred early retirement, differed based on the chronic health conditions they experienced. For instance, older workers with arthritis or cardiovascular diseases were more likely to want to retire early because of the health-related work limitations they experienced, while older workers with sleep or psychological disorders were more likely to prefer early retirement due to their diminished vitality. Older workers with cardiovascular diseases were more likely to have lower expectations on how long they will live, which motivated their preferences to retire early. Overall, this chapter provides a better understanding of the mechanisms through which chronic health conditions affects older workers' work, health and retirement preferences, which could provide cues for policy and practice.

In Chapter 3, I investigate the heterogeneities in how chronic health conditions affected older workers' changes in subjective life expectancy using a longitudinal study design. I explore heterogeneity by studying the effects of five types of chronic health conditions - arthritis, cardiovascular disease, sleep disorders, psychological disorders and life-threatening conditions - on subjective life expectancy and by indicating whether the chronic health condition was existing or newly diagnosed. Findings demonstrated that generally older workers' subjective life expectancy did not decrease over time regardless of whether they experienced no, existing or newly diagnosed chronic health conditions. Instead, subjective life expectancy increased less for older workers with newly diagnosed chronic health conditions than for older workers with existing or no chronic health conditions. Interestingly,

the extent of these results differed based on the chronic health condition. For example, older workers newly diagnosed with a life-threatening condition or a psychological disorder, experienced the worst declines in subjective life expectancy. Arthritis and sleep disorders, however, had no effect on how long older workers thought they would live.

According to the literature, older workers confronted with the requirement to work longer are increasingly worried about their capacity to function at work. I hypothesize that this worry will only increase in the presence of a chronic health condition. In Chapter 4, I use a longitudinal study design to examine the differential effects of chronic health conditions on older workers' vitality and worries about physical and mental functioning. The results of this chapter showed that while existing chronic health conditions continued to decrease vitality and increase worries, being newly diagnosed with a chronic health condition intensified these negative effects on older workers with chronic health conditions. Interestingly, newly diagnosed chronic health conditions with more physically disabling symptoms increased worries about physical functional ability, while newly diagnosed chronic health conditions with more mentally disabling symptoms increased worries about mental functional ability.

The results from Chapters 2 to 4 show that chronic health conditions have a substantial negative effect on the vitality, work, subjective life expectancy, psychological wellbeing and retirement preferences of older workers. Importantly, these findings show that these effects differ based on the type of chronic health condition and whether the chronic health condition was newly diagnosed. This raises the question: how can organizations accommodate and support older workers with chronic health conditions? In Chapter 5, I investigate the possible benefits of flexible work arrangements and supportive organizational climates on the health-related work limitations of older workers with arthritis, cardiovascular disease and sleep disorders using a multilevel analysis. The results showed that flexibility in working times and a psychologically safe organizational climate are two job resources that can help counteract the demands older workers may face as they work longer while experiencing chronic health conditions. Flexibility in working times provides older workers with the autonomy to structure their days around their work- and health-related demands. Older workers belonging to an organization with a psychologically safe organizational climate may feel safe enough to disclose

their needs and limitations openly, which might lead to an increased likelihood of receiving workplace accommodations. Moreover, this chapter emphasizes the need to study workplace factors on both the individual- and organization-level to gain a more comprehensive understanding of what, when and how specific policies and practices can support vulnerable groups of older workers.

When considering organizational factors, job type is an important predictor of late-career health and wellbeing. Thus far, research has demonstrated that manual workers experience very different work environments, job demands and job resources compared to non-manual workers. Manual work has also been associated with high physical demands and, consequently, physical health impairments. In Chapter 6, I investigate the impact of retirement (or continued work) on older workers' vitality (and its subcomponents: energy and fatigue) using a longitudinal study design. Furthermore, I study whether these relationships differ between manual and non-manual workers. Older manual workers who continued to work experienced a steep deterioration of their vitality, while older manual workers who retired experienced an improvement in their vitality. Older non-manual workers who retired also experienced an increase in vitality, but their vitality did not change if they continued to work. These results show that retirement benefits the vitality of all older workers and continued work is detrimental to the health of older manual workers. This chapter brings forth two suggestions for policy and practice: 1) if retirement is good for health, retirement should probably not be delayed further and 2) older manual workers may need more support during later career stages.

Taken together, this dissertation demonstrates that chronic health conditions differ widely in how they affect older workers' health, work and retirement preferences. Based on the findings, I am able to draw four main conclusions. First, chronic health conditions affect the vitality, work limitations and retirement preferences of older workers through different pathways. Second, the heterogeneities in the effects of chronic health conditions on older workers' perceptions about their current and future functioning stems from the type and nature of the chronic health condition and whether it was newly diagnosed. Third, organizations can improve the work ability of older workers with chronic health conditions by providing older workers with a psychologically safe workplace climate and flexible working times. Fourth, retirement improves the vitality of older workers, more so for manual workers than non-manual workers.

Overall, this dissertation shows that older workers with chronic health conditions may experience many health- and work-related challenges as they work longer to reach retirement age. Because future generations of workers will work longer, it is vital to install more policy-level and organization-level efforts to protect and promote the health, work and healthy ageing of older workers with chronic health conditions.

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1

Introduction

Demographic changes in the Western world are challenging the sustainability of pension systems. To combat these challenges, governments are increasing retirement ages and suspending early work exit routes. As a result, workers in the latter stages of their careers are working longer than they may have previously expected. Given that the prevalence of chronic health conditions increases with age, a sizable proportion of older workers are being burdened by the needs and difficulties posed by chronic health conditions while they continue to work until the increased retirement age.

With increased awareness of the burdens of older workers, policy makers, organizations and researchers alike are paying more attention to how older workers' ability to work can be maintained. This dissertation aims to augment this cause by studying how the wellbeing and work ability of older workers, especially of older workers with chronic health conditions, can be maintained in the last years of their careers. Existing research demonstrates the negative effects of chronic health conditions on older workers' health, work ability and retirement expectations (Zacher, Wang, & Short, 2022; Kim & Lee, 2019; Boot et al., 2014; Leijten et al., 2014; Sprangers et al., 2000). While these studies provide us with an idea of the direct effects of chronic health conditions, we still lack knowledge on the heterogeneities in the ways through which chronic health conditions affect older workers' wellbeing and work.

In this dissertation, my overarching goal is to gather insights into how chronic health conditions affect older worker's vitality, health-related work limitations and subjective life expectancy, and how these effects drive older workers' preferences to retire early. First, I examine the heterogeneities in how chronic health conditions affect older workers by addressing the distinct effects of different chronic health conditions and by distinguishing the effects of newly diagnosed (vs. existing) chronic health conditions on older workers' vitality, health-related work limitations and subjective life expectancy. By doing so, this dissertation guides the identification of the most vulnerable groups of older workers. Second, I study the role of the organization in sustainably supporting older workers. Specifically, I examine how organizational climate and organizational policies could accommodate the needs of older workers with chronic health conditions and promote their healthy ageing within their workplace.

In this introduction, I begin with a description of the societal context in the Netherlands that has raised the research questions deliberated in this dissertation (Section 1.1). Next, I present a review of previous research on the impact of chronic

health conditions on older workers' vitality, health-related work limitations, subjective life expectancy and retirement preferences, which is followed by the aims of this dissertation (Section 1.2). In Section 1.3, I outline the chapters of this dissertation. Lastly, I describe the data used in this dissertation in Section 1.4.

1.1. Societal context

1.1.1. The consequences of population ageing on the Dutch society

The Dutch population is ageing

The Dutch population is ageing and it will continue to age in the foreseeable future. This demographic transition began in the late 1960s and is motivated by two demographic trends: the increase in longevity and the decrease in fertility rate (OECD, 2013; Van Poppel, Reher, Sanz-Gimeno, Sanchez-Dominguez & Beekink, 2012). As in other high-to-middle-income countries, the Netherlands is seeing a steady increase in its population's life expectancy at birth. A female child born in 1950 was expected to live 72.6 years, while a male child had a life expectancy of 70.3 years (Centraal Bureau voor de Statistiek, 2021c). In 2019, life expectancy increased to 83.6 years for women and 80.5 years for men (Centraal Bureau voor de Statistiek, 2021c). Life expectancy at birth is expected to rise further in the coming decades.

The number of children being born per women, i.e., fertility rate, is decreasing. Younger generations of the Dutch population are postponing childbearing and are having fewer children, causing a drop in the fertility rate in the Netherlands. The average number of children born per women has decreased in the past decades (Centraal Bureau voor de Statistiek, 2021b). In 1950, a women would have an average of 3.1 children, whereas in 2018 this number decreased to 1.6 children (Centraal Bureau voor de Statistiek, 2021b). The Dutch fertility rate is expected to remain approximately the same in the coming decades.

The combined effects of the two demographic trends are changing the composition of the Dutch population. There is now a larger proportion of older adults than younger adults and children. Figure 1.1 illustrates the change in the population structure thus far and how it is expected to change in the future. The proportion of adults over the age of 65 years that was 7.7% in 1950, has more than doubled by 2020 to 19.5% (Centraal Bureau voor de Statistiek, 2021d). This

proportion is projected to increase by another 5% in the next 20 years (Centraal Bureau voor de Statistiek, 2020). At the same time, the percentage of the population under 20 years of age has steadily decreased from 37.3% in 1950 to 21.7% in 2020 (Centraal Bureau voor de Statistiek, 2021d), and is projected to stay around this percentage in the next decades (Centraal Bureau voor de Statistiek, 2020). As a result, the population of the Netherlands is ageing.

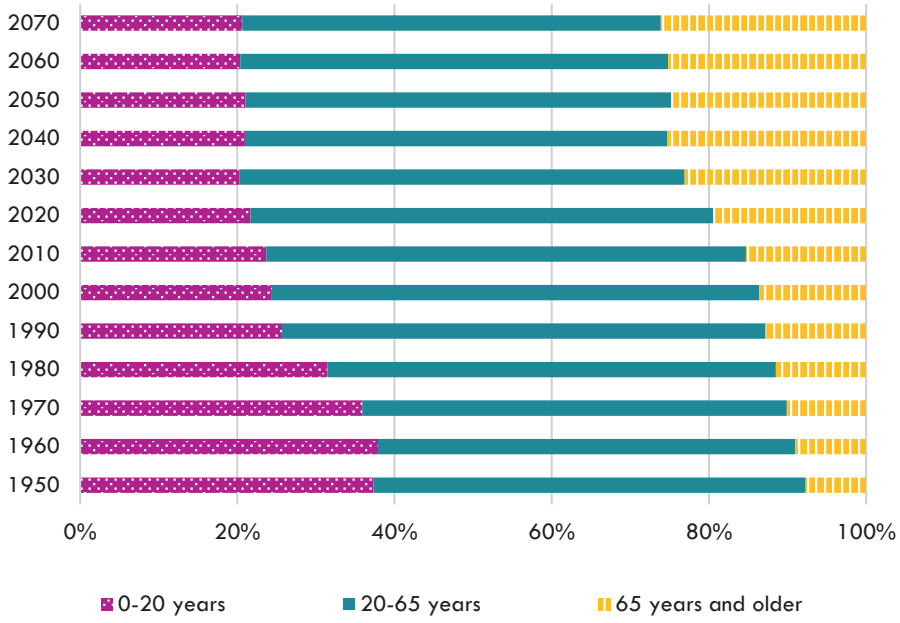

Figure 1.1. The Dutch population per age group from 1950 to 2020 and the forecast of the Dutch population from 2030 to 2070 (Centraal Bureau voor de Statistiek, 2021d, 2020)

Healthy life expectancy and chronic health conditions

While life expectancy soars, healthy life expectancy - i.e., the projected number of years lived in good health without being affected by the everyday consequences and limitations of health issues - is low among the Dutch population compared to other European countries (Centraal Bureau voor de Statistiek, 2019). In 2019, healthy life expectancy at birth was 63.2 years for women and 64.8 years for men (Centraal Bureau voor de Statistiek, 2021c). This means that an individual

in the Netherlands will live at least for 15 years hindered by health-related limitations.

The greatest contributor to ill health in the Dutch population are chronic health conditions. Chronic health conditions are defined as long-lasting, slow-progressing and recurrent health problems (Bernell & Howard, 2016; Shaw et al., 2014). They are not passed from person-to-person, they never completely improve, they have a complex causality and are associated with functional impairments (Bernell & Howard, 2016; Shaw et al., 2014). Interventions are required to prevent chronic health conditions from worsening further and in order to maintain daily functioning and quality of life (Bernell & Howard, 2016; Shaw et al., 2014). The prevalence of chronic health conditions in the Netherlands has increased over the years. In 2015, half of the Dutch population suffered from at least one chronic health condition. Projections show that by 2040, this number will increase to 54% of the Dutch population (Rijksinstituut voor Volksgezondheid en Milieu, 2018). As with prevalence, the disease burden attributable to chronic health conditions has increased steadily and is projected to increase further over the next decades in the Dutch population (Hilderink, Plasmans, Poos, Eysink, & Gijsen, 2020). This means that an increasing proportion of individuals will be diagnosed with and burdened by one or more chronic health conditions in the Netherlands in the future.

Prevalence of chronic health conditions increases with age

The prevalence of chronic health conditions (Stattin, 2005) and the burden of chronic health conditions (Hilderink et al., 2020) increases with age. Ageing is associated with a general decline in physical health (sensory perception, cardiac function, muscle strength, aerobic capacity and bone density), mental fitness (memory, precision and speed of cognitive processes), and homeostasis (McMahan & Sturz, 2006). Ageing also increases susceptibility to injuries, infectious diseases and chronic health conditions (McMahan & Sturz, 2006; Ilmarinen, 2001). Compared to injuries and infectious diseases, chronic health conditions boast the largest contribution to mortality, poor health and total burden of disease among older adults in Europe (Harbers & Achterberg, 2012). The age-associated increase in the prevalence of one or more chronic health conditions are reflected in statistics from the Netherlands: approximately 30% of Dutch adults between 40-49 years are likely to have one or more chronic health condition, while around 50% of Dutch adults over the age of 55 years are likely to have one or more chronic health condition (Centraal Bureau voor de Statistiek. 2021a). This is further demonstrated in Figure

1.2 which illustrates the increase in the prevalence of chronic health conditions with age among the Dutch population. Moreover, healthcare costs in the Netherlands have also been shown to increase with ageing (Bakx, O'Donnell, & van Doorslaer, 2016) and to grow exponentially from 50 years of age, mainly due to chronic health conditions such as mental disorders, dementia and musculoskeletal conditions (Meerding, Bonneux, Polder, Koopmanschap, & van der Maas, 1998).

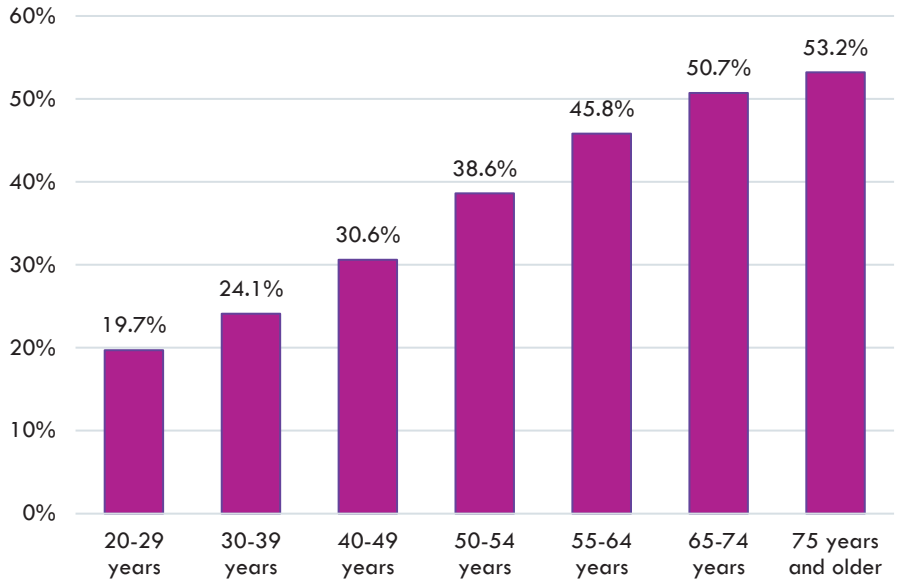

Figure 1.2. The prevalence of one or more chronic health conditions among age groups in the Netherlands in 2020 (Centraal Bureau voor de Statistiek. 2021a)

As with the prevalence of chronic health conditions among the Dutch population, the burden of chronic health conditions, measured via WHO's disability-adjusted life years (DALYs) increase with age (World Health Organization, 2019). According to WHO's statistics on the Netherlands, adults over the age of 60 years have the highest burden of diseases due to chronic health conditions. The age-related increase in DALYs in the Netherlands is presented in detail in Figure 1.3.

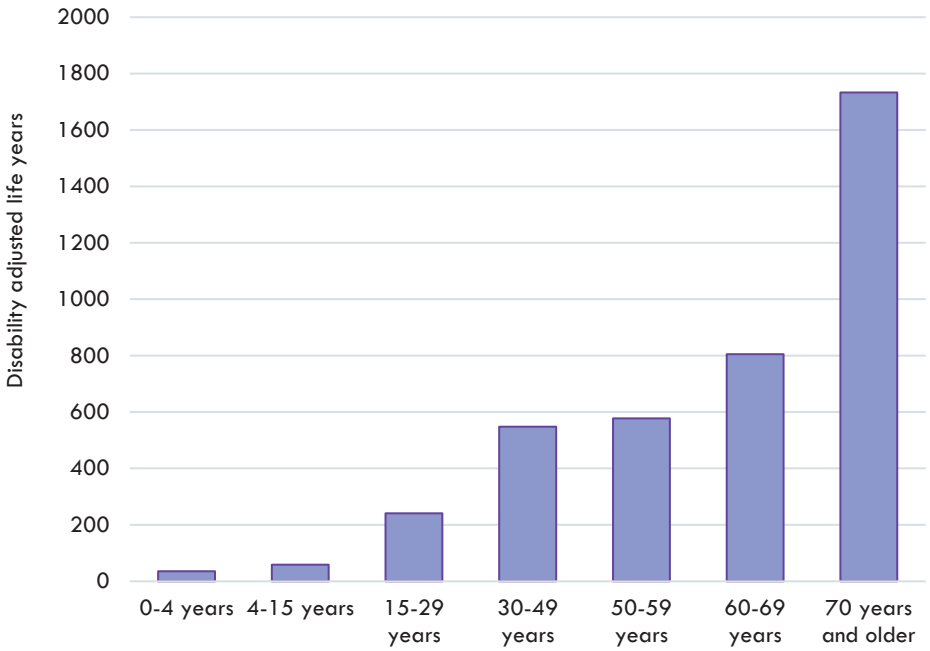

Figure 1.3. Burden of disease due to chronic health conditions increases with age in the Dutch population (World Health Organization, 2019)

1.1.2. Population ageing and the Dutch public pension system

Pension schemes are generally tethered to the age structure of the population. The Dutch pension system is built upon three "pillars". The first pillar of the Dutch pension system is the public pension scheme (Algemeen Ouderdomswet, AOW) was introduced in 1956. The AOW is paid out as a fixed rate to all residents above the statutory retirement age. The AOW benefit is approximately 50% of minimum wage for each member of a couple or 70% of minimum wage for singles. The government's budget for public pension is largely built on a pay-as-you-go system, where the working population pays for the cost of the retired population. Individual contributions to the AOW are capped at a certain limit: when this limit is reached, the government supplements public pension funds using general means. AOW expenditures are highly affected by population ageing. The second pillar of the Dutch pension system are occupational pension schemes. Almost 90% of Dutch workers are attached to an occupational pension scheme through their employer (OECD, 2019). Benefits are financed by a capital to which

workers contribute one-third and their employers contribute two-thirds throughout the workers' career. Together with the AOW, occupational pension schemes make it possible for retirees to gain a sizable percentage of the last salary or of the average life-long salary. The third pillar of the Dutch pension system are private pension savings which are mostly used by workers who get a smaller pension because they are either employed, self-employed or unemployed and do not receive benefits through occupational pension schemes. Private pension savings are a tax-friendly way of enhancing one's pension up to a certain amount.

Population ageing creates an imbalance between the number of workers relative to the number of older dependents, i.e., the old-age dependency ratio. The old-age dependency ratio is defined as the number of individuals over 65 years of age per 100 individuals of working age. In the Netherlands, the old-age dependency ratio grew from 13.9% in 1950 to 30.2% in 2015 (OECD, 2019). Within the next 30 years, the old-age dependency ratio is projected to increase to 53%: which means that 100 workers will be responsible for the upkeep of 53 individuals over the age of 65 years (OECD, 2019). These developments sparked many debates on how the burdens of a high old-age dependency ratio can be combatted. As a result of these concerns, the Dutch public pension system went through two major changes in the last decades that are aimed at extending working lives. On the one hand, the government rolled out a cascade of policy changes which has made it difficult to exit work early. This especially affected the uptake of early retirement and restricted the inflow into disability insurance. On the other hand, policy makers increased the statutory retirement age. Further increases to the statutory retirement age are expected in the future. The next sections describe both of these changes in more detail.

Blocking of early work exit routes, such as early retirement and disability insurance programs

In the 1980s, the Dutch government introduced collectively funded early retirement schemes to combat the rise in unemployment of younger workers. This led to a strong early retirement culture, with older workers retiring as early as 60/61 years by the end of the 1980s (Euwals, van Vuuren, & Wolthoff, 2010). To combat the effects of population ageing, in 2012, the government discontinued all early retirement schemes. This, however, does not mean that early retirement is impossible. It is still possible to exit the workforce through early retirement. But it is financially disadvantageous and is only used by workers who can afford it. As a

result, the uptake of early retirement has been much lower in the 2010s than in the preceding decades.

To decrease the probability of early work exit, the Dutch government also changed other aspects of the pension system. Alternative routes to early work exit, such as disability benefits, were restricted (Euwals, van Vuuren, & Wolthoff, 2010). The Disability Insurance program in the Netherlands, which was introduced in 1967, was provided as a public scheme that was mandatory for all wage workers. Any worker who experienced a loss of income that amounted 35% or more of their monthly wage due to medical impairments could claim disability benefits, which usually equaled to 70% of the lost income. In contrast to disability insurances programs in other high-income countries, the Dutch program covered all medical impairments, regardless of whether they were because of work-related (such as workplace injuries) or non-work-related reasons (comprehensive system). Also, in contrast to other high-income countries, the provision of wage payments for sick workers began as early as their applications for disability benefits were submitted even without a formal assessment of disability. While these features of the Dutch disability insurance program are very generous and attractive to users, some economists believe that it made the Dutch disability insurance program easily exploitable: workers could postpone their return to work as they got paid throughout the whole period of disability (Koning & Lindeboom, 2015). Between the 1960s and 1980s, the share of the workforce claiming disability benefits tripled from a mere 4% to 12% and remained at this very high number until the beginning of the 2000s (Koning & Lindeboom, 2015). The high proportion of workers claiming disability benefits popularized the term "Dutch disease" in circles of economists and policy makers (Koning & Lindeboom, 2015).

To combat the high inflow of disability pension claimants, policy makers started reforming the disability insurance program employing two key strategies from 1990s onwards (Koning & Lindeboom, 2015). First, employers were made more responsible to reduce disability claims by preventing disabilities. If workers did become sick, for a period of two years organizations were to continue paying wages while supporting sick workers and providing them with reintegration activities that could facilitate disabled workers' (especially those partially or temporarily disabled) return to work. Second, disability screening and assessment was made stricter by tightening eligibility criteria for to receive disability benefits. Taken together these policy changes have made it more difficult to claim disability in the Netherlands.

Increasing statutory retirement age

In 2012, along with the discontinuation of early retirement schemes, the government also increased the age of eligibility for public pension. Around this time, policy makers decided to tether the increase in statutory retirement age on a one-to-one basis with the increase in life expectancy. Because this increased retirement age too rapidly, after a decade of debates on how statutory retirement age should be increased, current retirement policies link every projected year of increase in life expectancy with an increase public pension eligibility age by 8 months. According to the public pension law in the Netherlands, the retirement age of each cohort of workers will be conclusively determined five years before they reach statutory retirement age (Oude Mulders, Henkens, & van Dalen, 2021). In line with current life expectancy projections, statutory retirement age for those born in 1970 will be 68 years, while statutory retirement age for those born in 1990 will increase up to 69 years and 6 months (Oude Mulders, Henkens, & van Dalen, 2021). What is also intriguing to note is that the Dutch pension law neglects to consider the possibility of reducing statutory retirement age if the average life expectancy in the Netherlands decreases.

The multitude of measures taken to prolong working lives have increased the net labor participation of older workers between 60-65 years from 21.7% in 2003 to 62.8% in 2020 (Centraal Bureau voor de Statistiek, 2021e). Similar increases were seen for older workers between the ages of 65-70 years, for whom the net labor participation increased from 7.3% in 2003 to 20.1% in 2020 (Centraal Bureau voor de Statistiek, 2021e). This also means that an increasing proportion of the Dutch workforce are experiencing (and will experience) ageing-related declines in their functional capacities which may translate into depleted work productivity, lower work ability, a higher need for recovery from work and an increased need for work accommodations and support at work (van Der Mark-Reeuwijk et al., 2019; Boot et al., 2014). Given that the prevalence and burden of chronic health conditions increases with age, older Dutch workers may also experience more chronic health condition-related needs, difficulties and limitations at the workplace. This population of older workers with chronic health conditions is only projected to increase in size in the future, dredging up questions on how to ensure the productivity, safety and healthy ageing of older workers with chronic health conditions at work (Plomp, de Breij, & Deeg, 2019).

1.2. Chronic health conditions and older workers' wellbeing, work and retirement

Numerous studies have examined the adverse effects of chronic health conditions on work-related outcomes, such as work ability (Thanapop & Thanapop, 2021; Koolhaas et al., 2013), work functioning and work productivity (de Vroome et al., 2015; Leijten, van den Heuvel, Ybema, Robroek, & Burdorf, 2013). Several studies have investigated the effect of chronic health conditions on older workers' retirement preferences and behaviour. While most studies examine the general effect of chronic health conditions on early retirement (Sewdas, Thorsen, Boot, Bjørner, & van der Beek, 2019; Giang & Le, 2018; Trevisan & Zantomio, 2016; Schofield, Shrestha, Passey, Earnest, & Fletcher, 2008; McGarry, 2004), some have dug deeper into the individual effects of having a specific chronic health condition, such as musculoskeletal conditions or depression, on early retirement preferences and behaviour (Jetha et al., 2017; Kang & Kang, 2016; Herquelot, Guéguen, Bonenfant, & Dray-Spira, 2011; Karpansalo et al., 2005; Vijan, Hayward, & Langa, 2004; Yelin, Trupin, & Sebesta, 1999). While these studies have answered the question 'do chronic health conditions - as a collective or individually - affect older workers' preferences to retire early?', they have not investigated the mechanisms through which chronic health conditions affect early retirement preference. This raises an important new question: "*How* do chronic health conditions affect older workers' early retirement preferences?"

The relationship between chronic health conditions and early retirement preferences could be driven by many mediators: especially mediators connected to health and wellbeing. Nevertheless, there is a profound lack of studies that investigate the mediators that link the experience of specific chronic health conditions with early retirement preferences, among workers over the age of 60 years. It can be presumed that some chronic health conditions lead largely to limitations in functioning, which might impede older workers' ability to work and inspire preferences to retire early. Other chronic health conditions might decrease older workers' optimism about their future life expectancy, thereby increasing older workers' preferences to retire early in order to spend time in leisure with family and friends. Given the importance of extending working lives, it is important that we understand *why* older workers with chronic health conditions might prefer early retirement by investigating the pathways through which chronic health conditions affect older workers' retirement preferences. Vitality, health-related work limitations and subjective life expectancy are three health-related variables that could mediate

the pathway between chronic health conditions and early retirement preferences. The following paragraphs defines these mediators and reviews literature that connect each mediator with chronic health conditions and/or early retirement preferences.

1.2.1. Potential mediators in the pathways between chronic health conditions and early retirement preferences

Vitality

Vitality, a concept that is closely related to everyday health, is defined as the feeling of aliveness, both in the physical and mental sense (Hennekam, 2016; Ware & Sherbourne, 1992). In the physical sense, being vital is equivalent to being strong, fit and having energy (Schaufeli & Bakker, 2003). In the mental sense, vitality is characterized by high wellbeing, low fatigue, increased emotional energy, resilience and perseverance (Shirom, 2010; Schaufeli & Bakker, 2003; Ryan & Frederick, 1997). In the fields of work psychology and occupational health, vitality - 'the feeling of being full of energy, fit and indefatigable at work' - is identified as one of the three dimensions of work engagement. Earlier studies have shown that older workers who are more vital are more productive, successful and satisfied at their jobs (Hennekam, 2016; Carmeli, 2009), while low vitality has been shown to be associated with emotional exhaustion and to moderate the relationship between burnout and workers' turnover intentions (Meral, Yildiz, & Karabay, 2018; Basinska, Wiciak, & Dåderman, 2014). With regards to chronic health conditions, numerous studies based on data from patients, the general population and working populations have shown that chronic health conditions have a negative effect on quality of life and everyday vitality (Sprangers et al., 2000). However, the relationship between vitality and early retirement preferences and the mediating role of vitality in the link between chronic health conditions and early retirement preferences is unknown.

Health-related work limitations

Many workers with health issues experience limitations at work that are more likely a result of the medical condition they have: these impediments to work ability are known as health-related work limitations. In comparison to other measures of work ability, health-related work limitations provide a more accurate

quantification of the impact of chronic health conditions on work limitations, as it is by definition a limitation at work that is associated with a medical condition. Thus far, researchers have examined the effects of chronic health conditions on work-related measures such as, productivity, work ability and sickness absence (Boot et al., 2018; Leijten et al., 2014; Leijten et al., 2013; Oude Hengel Blatter, Geuskens, Koppes, & Bongers, 2012; Boot et al., 2011). Past literature has also shown that workers with low work ability tend to retire earlier (Boissonneault & de Beer, 2018; Sell, Bültmann, Rugulies, Villadsen, Faber, & Søgaard, 2009). In some cases, workers with health issues retired earlier because they expected and were afraid of declines in work ability in the future (de Wind et al., 2013). Very few studies, however, have studied the differential effects of chronic health conditions on *health-related work limitations*. Nor, have studies looked at how health-related work limitations might mediate the effect of chronic health conditions on early retirement preferences.

Subjective life expectancy

Subjective life expectancy is the subjective perception of how long an individual expects to live (Bodner & Bergman, 2016). On the one hand, poor health (Bae, Kim, & Lee, 2017) and the experience of chronic health conditions, such as depression (Kim & Lee, 2019) and hypertension (Zacher, Wang, & Short, 2022), have been found to be associated with low subjective life expectancy. One the other hand, subjective life expectancy has been found to be a predictor of health (Hoppmann, Infurna, Ram, & Gerstorf, 2017; Griffin, Loh, & Hesketh, 2013; Kotter-Grühn, Grühn, & Smith, 2010), functioning (Keyes & Westerhof, 2012) and mortality (Kim & Lee, 2019; van Solinge & Henkens, 2018; Siegel, Bradley, & Kasl, 2003). Subjective life expectancy is also a predictor of retirement timing (Fisher, Chaffee, & Sonnega, 2016; van Solinge & Henkens, 2010): because time spent in retirement is determined by age of retirement and age at death (Elder, 2013), subjective life expectancy could guide older workers plan the timing of their retirement and their post-retirement life. However, studies are yet to examine to what extent subjective life expectancy mediates the relationship between chronic health conditions and older workers' retirement preferences.

1.2.2. Heterogeneities in the effects of chronic health conditions

Although past studies have frequently investigated the effects of chronic health conditions on wellbeing and work outcomes, many of them do not pay attention to the heterogeneities in how chronic health conditions impact older workers' wellbeing and work. This dissertation inspects two sources of heterogeneities: the type of chronic health condition and whether chronic health conditions were newly diagnosed or existing.

The effects of chronic health conditions on older workers might differ based on the type of the condition. Chronic health conditions, as a collective, generally lead to reduced work ability (Thanapop & Thanapop, 2021; Koolhaas et al., 2013) and increase the likelihood of early retirement among older workers (Sewdas et al., 2019; Giang & Le, 2018; Trevisan & Zantomio, 2016; Schofield et al., 2008; McGarry, 2004). The negative effects of multimorbidity - i.e., the experience of two or more chronic health conditions - on older workers' work and well-being is also well documented (van Zon et al., 2020; Jason, Carr, Washington, Hilliard, & Mingo, 2017; Ervasti et al., 2016). In recent years, an increasing number of studies are demonstrating the differences in how specific chronic health conditions affect older workers. For example, musculoskeletal conditions have been shown to reduce work ability (Koreshi & Alpass, 2021; Palmer & Goodson, 2015; Leijten et al., 2014), while depression and diabetes has been shown to deplete work functioning (Stynen, Jansen, & Kant, 2015). All three chronic health conditions, however, were associated with an increased likelihood of early retirement among older workers (Jetha et al., 2017; Kang & Kang, 2016; Herquelot et al., 2011; Karpansalo et al., 2005; Vijan, Hayward, & Langa., 2004; Yelin, Trupin, & Sebesta, 1999). These heterogeneities could stem from the varying nature and intensity of symptoms and the differences in access to and effectiveness of treatment and management strategies. To provide a more comprehensive overview on the differential effects of specific chronic health conditions on older workers' work and health, it is important to study the effects of different chronic health conditions on older workers' health and work separately.

Another important contributor to the heterogeneity in how chronic health conditions impact older workers is whether the chronic health condition was newly diagnosed. Chronic health conditions diagnosed earlier in life will impact older workers differently than chronic health conditions that have been diagnosed recently. Studies on patient populations have shown newly diagnosed chronic

health conditions to increase the risk of work disability, functional dependency, sickness absence and early work exit (Mandl, Jørgensen, Skougaard, Olsson, & Kristensen, 2017; Guymer, Littlejohn, Brand, & Kwiatek, 2016; Cohen et al., 2014; Nexo et al., 2014; Westhoff, Buttgereit, Gromnica-Ihle, & Zink, 2008; Wolff, Boult, Boyd, & Anderson, 2005; Barrett, Scott, Wiles, & Symmons, 2000). Among older workers, newly diagnosed arthritis has been shown to increase the perception of work stress and physical demands (Mutambudzi & Henkens, 2021). Older workers newly diagnosed with a chronic health condition could still be struggling with the demands of their chronic health conditions. At the same time, they might still be learning about and adjusting to the volatile nature of their symptoms and the side effects of their newly prescribed medications (Lacaille, White, Backman, & Gignac, 2007). Their self-efficacy in managing their disease might be poor at the beginning and they would need to newly build a system of physical and mental support to manage their chronic health condition (Lacaille et al., 2007). At work, the experience of a newly diagnosed chronic health condition could cause an incongruity between job demands and the ability to perform daily work duties (Gilworth et al., 2003). Because the prevalence of chronic health conditions increases with age and a large number of individuals are diagnosed with a chronic health condition after the age of 60 years (Hilderink et al., 2020), many older workers will get newly diagnosed with a chronic health condition in the last years of their careers. Therefore, it is vital to distinguish between newly diagnosed chronic health conditions and existing chronic health conditions, when studying the effects of chronic health conditions on older workers.

1.2.3. The role of the organization in supporting older workers with chronic health conditions

As a result of increasing retirement ages, it is becoming increasingly important to raise questions on what measures organizations can take to support their general ageing workers and what additional steps they could take to promote the wellbeing and work ability of older workers with chronic health conditions. An increasing number of studies are investigating the role of the organization in supporting their workers with chronic health conditions (Arends, Prinz & Abma, 2017). It is widely known that workers with chronic health conditions leave paid employment because they cannot manage their symptoms at work (van den

Bogaard, Henkens, & Kalmijn, 2016). Studies that examine how organizational factors could support their older workers with chronic health conditions, have mostly measured organizational factors on the individual-level, based on the perceptions of employees (or employers). Rarely, if at all, has past research measured organizational support on the level of the organization using aggregate data. This could have been due to a lack of multilevel data that allows for the use of organization-level measures. For a comprehensive understanding on what it is like to work for an organization, measures of job resources and work environment should be measured on both the individual- and the organization-level.

One such individual-level factor measuring job resources is whether organizations provide employees with access to formal human resources practices, such as flexible work arrangements. Flexible work arrangements are informal or formal policies and practices that allow employees to vary when and where they work (Maxwell, Rankine, Bell, & Macvicar, 2007). Flexible work arrangements are known to provide more comfort, autonomy and control for workers (Dropkin, Moline, Kim, & Gold, 2016). Older workers, especially those whose daily lives our disturbed by the symptoms and the management of their chronic health conditions, could benefit immensely by flexible work arrangements (Dorland et al., 2016; Loretto, Vickerstaff & White, 2005). Many flexible work arrangements are practiced in today's workplaces: some provide flexibility in working time or working place, while others provide phased retirement arrangements. To gain deeper insights into how organizations could help older workers with chronic health conditions, it is important to identify which of the many flexible work arrangements benefit older workers with specific chronic health conditions the most.

In addition to formal human resource policies, it is increasingly important to study organization-level measures of organizational support, such as organizational climate. Organizational climate is "a set of attributes that can be perceived by a particular organization, that may be induced from the way the organization deals with its members and environment" (Schneider, 1973). Organizations differ in how they perceive the employability of older workers and their actions towards them (van Dalen, Henkens, & Wang, 2015). Some organizations may have a more supportive climate that enables older workers with chronic health conditions to flourish despite their health-related limitations, while other organizations may have a more restrictive and demeaning climate where older workers with chronic health conditions feel unsupported and under-appreciated.

Two types of organizational climates - healthy ageing climate and psychological safety climate - are highly relevant to older workers with chronic health conditions. A healthy ageing climate is one that supports the development and maintenance of the functional ability of older workers while enhancing their wellbeing (World Health Organization, 2015). A healthy ageing climate within an organization has been found to prevent health decline while improving the quality of life, job satisfaction and motivation to continue working past retirement age (Zacher & Yang, 2016; Bousquet et al., 2015). A psychologically safe workplace climate is one that encourages and emboldens their workers to take interpersonal risks, by sharing their thoughts and knowledge and disclose their needs and difficulties, without the fear of adverse consequences (Edmondson & Lei, 2014; Liang, Farh, & Farh, 2012; Siemsen, Roth, Balasubramanian, & Anand, 2008). Older workers in a psychologically safe climate may feel safe enough to talk about their difficulties and ask for help, which would promote their sustainable employment. Despite the palpable benefits of a healthy ageing and a psychologically safe organizational climate, studies thus far have barely examined how organizations can foster positive organizational climates to promote the healthy ageing of their older workers with chronic health conditions.

1.2.4. Aims of this dissertation

This dissertation contributes to literature by 1) studying the mechanisms through which chronic health conditions impact early retirement preferences via its effects on vitality, health-related work imitations and subjective life expectancy, 2) addressing the heterogeneities in how different chronic health conditions and a new diagnosis of chronic health conditions (compared to existing chronic health conditions and having no chronic health conditions) affect older workers' vitality, health-related work limitations and subjective life expectancy, and 3) examining the role of the organization in supporting older workers with chronic health conditions on the organization-level.

The aims of this dissertation are:

1. To shed light on the mechanisms through which different chronic health conditions impact older workers' preferences to retire early. I do so by studying how chronic health conditions affect three key health-related variables - vitality, health-related work limitations and subjective life expectancy - and to what extent these effects lead to early retirement preferences.
2. To investigate the heterogeneity in the effects of chronic health conditions on dissertation older workers' vitality, health-related work limitations, subjective life expectancy and early retirement preferences. Two sources of heterogeneity will be examined:
    a. heterogeneity due to different chronic health conditions, and
    b. heterogeneity due to newly diagnosed chronic health conditions, as compared to existing chronic health conditions and having no chronic health conditions.
3. To examine the role of organizations in supporting older workers with chronic health conditions by examining whether and when flexible work arrangements and organization climates can benefit older workers with chronic health conditions.

1.3. Outline

In Chapter 2, the central research question is: *"How do chronic health conditions affect older workers' preference to retire early?"* In this chapter, I disentangle the pathways through which four highly prevalent and burdensome chronic health conditions - arthritis, cardiovascular diseases, sleep disorders and psychological disorders - affect early retirement preferences of older workers. I examine the mediating effects of three health-related variables that are bound to be influenced by the experience of a chronic health condition: vitality, health-related work limitations, and subjective life expectancy. I estimate how much of the effect of each chronic health condition on early retirement preferences is direct, i.e., due to the specific chronic health condition itself, and how much of the effect is indirect, i.e., due to mediators. Figure 1.4 presents an overview of my conceptual framework.

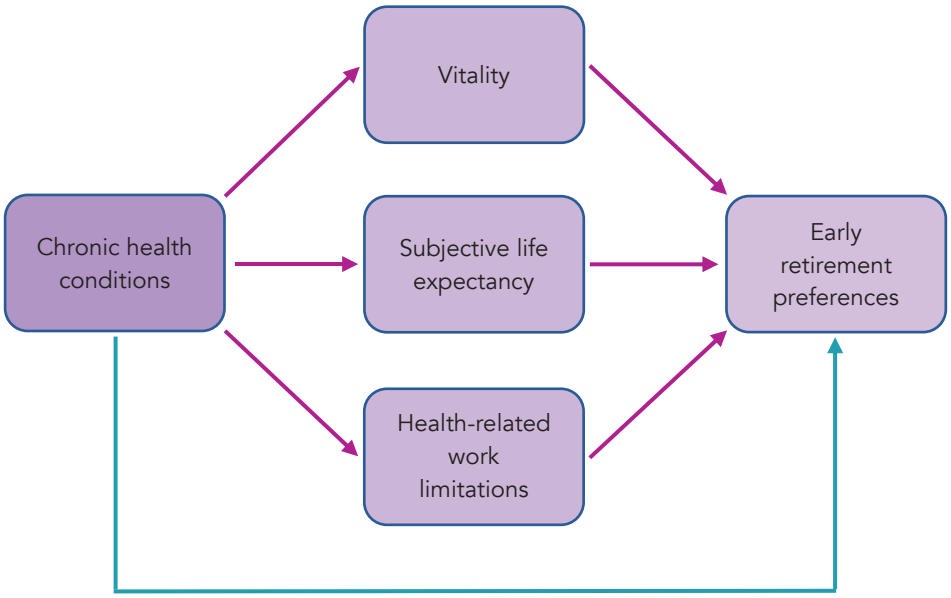

Figure 1.4. Conceptual framework to disentangle pathways through which chronic health conditions affect older workers' preferences to retire early

The comprehension of how chronic health conditions affect older workers' early retirement preferences, could help tailor interventions and policy strategies to better suit and support older workers with different chronic health conditions. These estimations are based on data from 5,696 wage-employed older workers aged between 60-64 years, derived from the first wave of the NIDI Pension Panel Survey (NPPS) which was conducted in the Netherlands in 2015 (see Section 1.4 for a full description of the NPPS and the data).

In Chapter 3, I study the heterogeneities in the effect of chronic health conditions on older workers' subjective life expectancy. The central research question in this chapter is: *"How does the new diagnosis of a* chronic health condition *(as compared to having no chronic health conditions and existing chronic health conditions) influence the change in older workers' subjective life expectancy?"* There is a high probability of being diagnosed with a chronic health condition between the ages of 60-65 years: the years before retirement. Older workers who experience a negative change in their health because they have been newly diagnosed with a chronic health condition may perceive their life expectancy more negatively than those with no chronic health conditions or those who have been managing chronic health conditions for a longer time (existing chronic health conditions). This chapter differentiates the effects of five chronic health conditions: arthritis, cardiovascular disease, sleep disorders, psychological disorders and life-threatening conditions. The analysis is conducted using longitudinal data from the first and second waves of the NPPS, conducted in the Netherlands in 2015 and 2018. I will study how the new diagnosis of each of the five chronic health conditions could affect the change in subjective life expectancy among 4,735 older workers aged between 60-65 years at wave 1.

In Chapter 4, I examine the heterogeneities in the effect of chronic health conditions on older workers' vitality, worries about physical functional ability and worries about mental functional ability. The research question addressed in this chapter is: *"How do newly diagnosed chronic health conditions (as compared to having no chronic health conditions or existing chronic health conditions) change older workers' vitality and worries about physical and mental functioning in the pre-retirement years?* Having a chronic health condition has been found to decrease vitality (Sprangers et al., 2000). Managing the needs and limitations of a newly diagnosed chronic health condition, while continuing to work as well as one did before, might exacerbate worries about physical and mental functional ability. I examine the distinct effects of four chronic health conditions that are highly

prevalent within this age group: arthritis, cardiovascular diseases, sleep disorders and psychological disorders. Data were derived from the two existing waves of the NPPS, collected in the Netherlands in 2015 and 2018. Analysis was conducted on a sample of 1,894 older workers, who were 60-62 years old at wave 1. Similar to Chapter 3, this chapter too guides the identification of vulnerable groups older workers, which might help to develop tailored interventions and work accommodations that could promote their vitality and support them.

In Chapter 5, I investigate the importance of flexible work arrangements and supportive organizational climates in mitigating health-related work limitations experienced by older workers. The research question dealt with in this chapter is: *"Are access to flexible work arrangements (such as flexible working time, flexible workplaces and phased retirement) and supportive organizational climates (i.e., healthy ageing climate and psychological safety climate) associated with fewer health-related work limitations among older workers?"* Theoretically, this chapter is inspired by the Job Demands-Resources model (Schaufeli & Bakker, 2004), which describes that employee wellbeing can be salvaged or maintained by balancing out the demands of the job with resources at work. Resources could include: support from managers or colleagues, more independence at work, flexible work arrangements, workspace accommodations (e.g.: ergonomic furniture) and supportive organizational climates. I used data from the first wave of the NPPS that was conducted in the Netherlands in 2015. The total sample consisted of 5,410 older workers who were employed in 624 organizations. Multilevel analysis was conducted within three subgroups: older workers with arthritis (*N*=2,330), cardiovascular disease (*N*=720) and sleep disorders (*N*=816). Subgroup analysis was conducted to investigate the differences in limitations, needs and accommodation-requirements posed by the three chronic health conditions that vary greatly in the nature of their symptoms. Access to flexible work arrangements is measured on an individual-level, by asking older workers whether they perceive to have access to specific work arrangements. Organizational climate variables, are measured on the level of the organization. This was done by aggregating individual-level measures by organization to create climate variables that represent the environment within the organization. The results of this chapter describe which flexible work arrangements and what sort of organizational climate foster older workers with chronic health conditions. These results may be used to inform policy and practice efforts to retain older workers with chronic health conditions within

workplaces, to accommodate their specific needs and difficulties and to ensure the healthy ageing of older workers with chronic health conditions.

Chapter 6 studies the impact of exiting the workforce on older adults' level of vitality. I assess how retirement may differentially influence the vitality (and its subcomponents: energy and fatigue) of older manual and non-manual workers. The main research questions in this chapter are: *"Does retirement benefit vitality and its subcomponents, energy and fatigue? and does this effect differ between occupational groups, i.e., between manual vs. non-manual workers?"*. Manual workers experience very different work environments, job demands and job resources compared to non-manual workers. This study subtlety examines the effects of these job characteristics on older workers' vitality as they continue to work or after they retire. Data from both waves of the NPPS, collected in the Netherlands in 2015 and 2018, was used for this chapter. Analysis was conducted on 4,156 older workers, of whom 1,934 (47%) retired between the two waves. This chapter contributes to practice by demonstrating how manual workers may experience greater health risks than non-manual workers in the face of the increasing retirement ages. Since opportunities for early retirement are highly restrictive in the Netherlands, it is vital to provide vulnerable groups of older workers, in this case manual workers, with effective job accommodations and interventions that could help maintain or even improve their vitality and the quality and quantity of their healthy working life.

Chapter 7 concludes this dissertation with a discussion of the main findings of this dissertation. In addition, I will discuss the limitations and strengths of this dissertation. This will be followed by practice and policy recommendations and suggestions for future research.

1.4. The data

This dissertation uses data from the NIDI Pension Panel Survey (NPPS, (Henkens, van Solinge, Damman, & Dingemans, 2017). The NPPS was developed under the VICI-project 'Ageing workers in an ageing society: Labor force transitions and work in late life' which was funded by the Dutch Research Council (NWO).

This innovative dataset was especially well-suited to provide insights into the research questions in this dissertation, due to three reasons. First, the NPPS is a prospective cohort study that follows a cohort of Dutch older workers born between 1950-1955. This group of workers were the first cohort for whom all collective early retirement schemes were discontinued. Many of them were already preparing to take up early retirement. The workers had to watch their retirement plans move further away due to increasing retirement ages while adjusting their plans in light of it all. Their adjustment to work longer may have also been made harder by the health complaints they may experience (van Solinge & Henkens, 2017). In 2015, when the data collection was first launched, the participants of the NPPS were aged between 60 and 65 years. The data derived from the NPPS tells the stories of older workers who were affected both by increasing retirement ages and health-related limitations imposed by chronic health conditions: making the NPPS the ideal dataset to answer the research questions raised in this dissertation. Second, the NPPS is a panel study: wave 1 was collected in 2015 and wave 2 was collected in 2018. This dissertation utilizes data from both waves, thus providing me with the opportunity to evaluate the effects of chronic health conditions on the changes in older workers' wellbeing and work ability. Lastly, this dataset has a multilevel data structure, i.e., individual data from older workers are nested within the organizations. Due to the lack of suitable multilevel data, past studies have found it difficult to examine the effects of organization-level concepts and how they influence the ways through which chronic health conditions impact older workers' functioning, productivity and wellbeing. The multilevel nature of the NPPS not only provides the unique opportunity to study the role of the organization (and other organization-level constructs) in the healthy ageing of older workers with chronic health conditions, but also allows the differentiation of individual- and organization-level constructs on the wellbeing and work ability of older workers with chronic health conditions.

The NPPS collected data using a stratified sampling method, among employed older workers enrolled in three of the largest Dutch Pension Funds: ABP,

PfZW and BpfBouw. The three pension funds together represent government and education, health and welfare and construction sectors, which consists of about 49% of the wage employed workers in the Netherlands (De Nederlandsche Bank, 2015). This guaranteed a commensurable variation in job type, job sector, educational level, gender and other socioeconomic variables among participants. During data collection, NIDI researchers selected a sample of organizations from the administrative records of each of the three pension funds, based on and ensuring sufficient variation in organization size and sector. The sample of organizations consisted of 50 large, 200 medium-sized and 300 small organizations. Next, older workers whose age ranged between 60 and 65 years and were employed for at least 12 hours a week by wave 1 in 2015, were randomly sampled from the previously selected organizations. In medium and small organizations, all workers meeting the inclusion criteria were approached, whereas only 50% of eligible workers were sampled in large organizations, with a minimum of 20 workers per organization. Data collection for the first wave of NPPS occurred between May and November, 2015. In total, under the supervision of NIDI researchers, the administrative agencies of the pension funds sent out 15,470 questionnaires (and an introductory letter from NIDI researchers and a recommendation letter from the pension fund's CEO) via post to the selected participants' home addresses. The participants were given the choice to either 1) complete the questionnaire on paper and return it to NIDI researchers in a postage-free envelope or 2) fill out the questionnaire online using a special individualized code. Of them, 6,793 were completed and returned after two reminders, corresponding to a response rate of 44.2% on the individual-level. On the organization-level, the average response rate was 43%. At least one participant in 77% of the organizations responded to the questionnaire.

Data collection for the second wave occurred between May and November of 2018. Attrition occurred between wave 1 and wave 2, leading to a loss of data from 98 participants, whose characteristics do not differ greatly to the characteristics of the original sample and the characteristics of wave 2 participants. The sample was reduced by 86 participants due to mortality and 12 participants due to other reasons. As a result, at wave 2 questionnaires were sent out to 6,695 older workers, who partook in wave 1. Of them, 5,312 older workers responded to the questionnaire. This corresponds to a net response rate of 79.3% (Henkens et al., 2017).

2

Why do older workers with chronic health conditions prefer to retire early?[1]

[1]A slightly different version of this chapter has been published as: Vanajan, A., Bültmann, U., & Henkens, K. (2020). Why do older workers with chronic health conditions prefer to retire early?. Age and ageing, 49(3), 403–410. https://doi.org/10.1093/ageing/afz180

Abstract

Background. Older workers experiencing chronic health conditions (CHCs) are more likely to retire early. The different pathways through which CHCs stimulate retirement preferences, however, remain largely unexplored.

Objective. We present a more comprehensive model in which we test the different pathways through which four specific CHCs—arthritis, cardiovascular disease, sleep disorders and psychological disorders—influence early retirement preferences. We hypothesize that the association between CHCs and early retirement preferences is differentially mediated by subjective life expectancy (SLE), perceived health-related work limitations (HRWL) and vitality.

Methods. We collected data from 5,696 wage-employed older workers (60 to 64 years) in the Netherlands in 2015. Regression models were estimated to examine the associations between CHCs and early retirement preferences. Mediation analysis with the Karlson, Holm and Breen method was used to examine potential mediation pathways.

Results. SLE, HRWL and vitality mediated the association between CHCs and older workers' early retirement preferences. The dominant mediator differed depending on the CHC. Severe HRWL predominantly guided the retirement preferences of older workers with arthritis and cardiovascular disease. Lower vitality mainly mediated retirement preferences of older workers with sleep and psychological disorders. Lower SLE was a significant mediation pathway for older workers with cardiovascular diseases.

Conclusions. HRWL and vitality play a major role in determining retirement preferences of older workers experiencing CHCs. Since both mediators are modifiable, targeted interventions may not only extend older workers' working lives, but also improve the quality of their working lives.

Introduction

The transition from work to retirement is an exceedingly complex process that occurs through various pathways (Szinovacz, 2003). Retirement preferences and decisions are influenced by multiple push and pull factors inside and outside the workplace (Szinovacz, 2003). Poor health is an especially well-known predictor of retirement preferences (Pond, Stephens, & Alpass, 2010) and retirement behaviour (Robroek, Schuring, Croezen, Stattin, & Burdorf, 2013). Moreover, several studies reveal that chronic health conditions (CHCs) are associated with a stronger preference for retirement and a higher likelihood of early retirement (McGarry, 2004), with some studies explicitly demonstrating the effects of depression (Karpansalo et al., 2005), musculoskeletal conditions (Yelin, Trupin, & Sebesta, 1999) and diabetes (Vijan, Hayward, & Langa, 2004) on retirement behaviour.

The different pathways through which CHCs stimulate retirement preference, however, remain largely unexplored. This study aims to explain *why* older workers with CHCs prefer to retire early by analysing the pathways through which this occurs (Figure 2.1). We focus our analysis on four CHCs—arthritis, cardiovascular disease, sleep disorders and psychological disorders—as they are among the most prevalent and burdensome conditions among older workers (WHO, 2018). Based on current policies on state retirement age in the Netherlands (Belastingdienst, n.d.) and the age of the participants in our study, we defined early retirement as retirement before the age of 65 years and 6 months. We hypothesize that: (i) the four CHCs will influence early retirement preferences through separate pathways mediated by three health-related factors—subjective life expectancy (SLE), perceived health-related work limitations (HRWL) and vitality and (ii) the relative contribution of each mediator will differ depending on which of the four CHCs the older worker experiences.

SLE is a concept that assesses individuals' expectations about their time horizon (van Solinge & Henkens, 2010). SLE has been found to predict mortality rates among older workers (van Solinge & Henkens, 2018). Past studies also show a lower SLE among older workers experiencing poor health (van Solinge & Henkens, 2018, 2010). Since time spent in retirement depends on age of retirement and death (Elder, 2013), SLE may guide how older workers plan their retirement and post-retirement life (Griffin, Hesketh, & Loh, 2012). This is confirmed by a handful of studies which found SLE to be an important predictor of intended retirement

age, even after controlling for known predictors of retirement (Griffin, Hesketh, & Loh, 2012; van Solinge & Henkens, 2010).

Vitality is defined as the feeling of aliveness, both in the physical (healthy, capable and energetic) and mental (meaning and purpose) sense (Hennekam, 2016). While CHCs have been shown to decrease the vitality of older adult (Gallegos-Carrillo et al., 2009) and patient populations (Finkelstein et al., 2009), worksite lifestyle and health interventions have been shown to improve the vitality of older workers (Strijk, Proper, van der Beek, & van Mechelen, 2012). Studies have also found increased vitality to predict career success, career satisfaction and job performance among older workers (Hennekam, 2016). While these positive work-related outcomes may encourage older workers to remain at work, we did not find evidence on the association between vitality and retirement preferences.

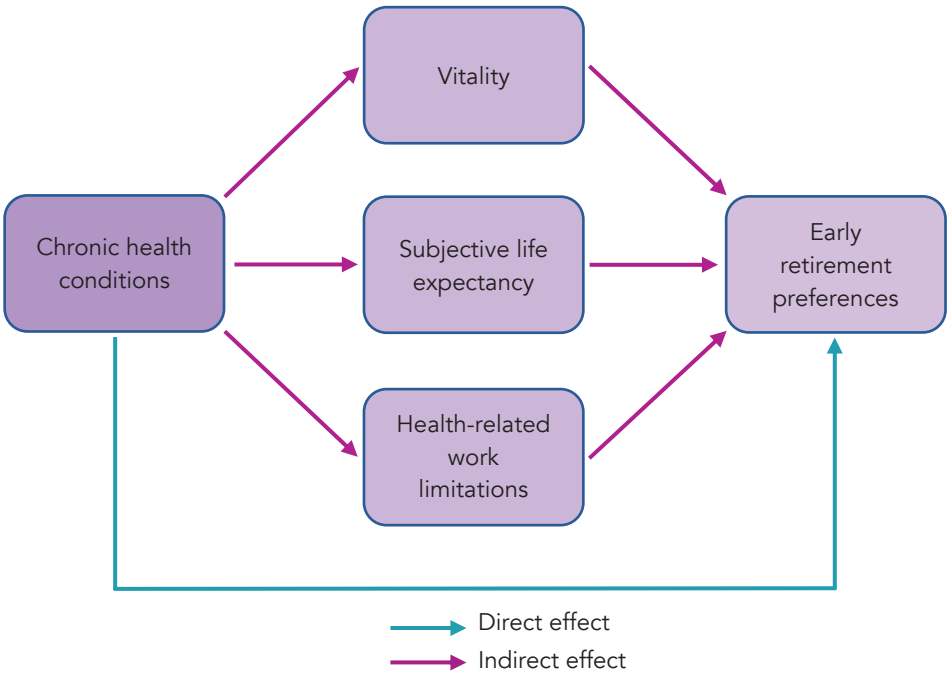

Figure 2.1. Objective and conceptual framework

CHCs are associated with higher levels of perceived work limitations (Vanajan, Bültmann, & Henkens, 2020). The extent of work limitations depends on the type of CHCs experienced (Padkapayeva et al., 2017). For example, Padkapayeva *et al.* (2017) found arthritis to have the strongest effect on increasing work limitations, followed by mood disorders and cardiovascular diseases. Additionally, work limitations have been found to reduce labor force participation (Boot et al., 2014) and increase early retirement preferences (McGarry, 2004). These studies, however, estimate a general measure of work limitations and not work limitations that are explicitly associated with CHCs (Vanajan, Bültmann, & Henkens, 2020).

This study contributes to the literature on the health-retirement nexus in three ways. First, it adds novel and comprehensive information by separating the different pathways through which CHCs of older workers may influence their retirement preferences. Thereby, our study might help answer the fundamental question—why older workers with specific CHCs prefer to retire early. Second, by studying modifiable health-related factors, our study provides cues to extend and improve working lives of older workers experiencing CHCs. For example, employers might consider providing older workers with targeted worksite interventions, work accommodations and health education programs. Third, this study focuses on older workers of pre-retirement age. In public health literature, research on this topic tend to concentrate more on patient populations, workers of all ages, older adults and older workers of a wider age range (de Wind, Scharn, Geuskens, van der Beek, & Boot, 2018; Pond, Stephens, & Alpass, 2010). This study will provide information relevant to older workers who are most affected by CHCs and the need to make decisions about retirement.

Methods

Population

This study used data from the first wave of the NIDI Pension Panel Survey conducted in 2015 (Henkens, Van Solinge, Damman, & Dingemans, 2017). Data were collected among employed older workers enrolled in three of the largest Dutch Pension Funds using a stratified approach. The three pension funds together represent the government and education, health and welfare and construction sectors, which consists of about 49% of the wage employed workers in the

Netherlands (De Nederlandsche Bank, 2015). Though the data are not representative of the total Dutch workforce, it is representative of a large part of the workforce. Initially, a sample of organizations was selected from the files of the pension funds based on organizational size and sector. Thereafter, older workers (aged between 60 and 65 years who worked at least 12 hours a week) were randomly sampled from the selected organizations and asked to complete an anonymous questionnaire. A total of 15,470 questionnaires were sent out, of which 6,793 were completed and returned. This corresponds to an individual-level response rate of 44%. In 77% of the organizations at least one respondent returned the questionnaire. Compared to the base sample, the analytical sample was somewhat younger and comprised more men. Construction and social workers had somewhat lower response rates than workers from other sectors. We found no differences in response rates among workers from small, medium or large organizations. Older workers who received a shorter version of the questionnaire that did not include all relevant variables ($N = 499$), who did not express their retirement preferences ($N = 60$) and who will reach state pension age within the next year ($N = 538$) were excluded from our sample. This resulted in a final study sample of 5,696 older workers between the ages of 60 and 64 years.

Measurements

Outcome variable

Preference to retire early was measured with the question 'What would be your preferred work situation one year from now?' Responses were expressed on a five-point Likert scale (1= strong preference to work, 2 = weak preference to work, 3 = no preference, 4 = weak preference to retire early and 5 = strong preference to retire early).

Primary explanatory variables

The explanatory variables of interest were the CHCs experienced by older workers. Specifically, we measured whether older workers suffered from: (i) arthritis, (ii) cardiovascular disease, (iii) sleep disorders and (iv) psychological disorders. Respondents were asked 'Do you have one or more of the following longstanding diseases (as diagnosed by a doctor)?', which was followed by a list of CHCs (Bajekal, Harries, Breman, & Woodfield, 2004). Older workers answered this question by indicating whether they had the particular CHC. Based on their responses, we

created four dichotomized variables for the four CHCs of interest (1 = I have this CHC and 0 = I do not have this CHC).

Mediator variables

Older workers' SLE was assessed by inquiring 'How likely are you to live beyond the age of 80?', with response categories ranging from highly unlikely (1) to highly likely (5) on a five-point Likert scale (van Solinge & Henkens, 2010). This variable was treated as a continuous measure with higher values indicating higher SLE.

HRWL were measured using the two-part LLSI question (Bajekal et al., 2004). The LLSI has high validity and is a reliable measure of HRWL (Bajekal et al., 2004). The LLSI first asks respondents 'Do you have one or more of the following longstanding diseases (as diagnosed by a doctor)?', followed by 'Do these longstanding diseases limit your performance at work?'. Responses to the second question were made on a three-point Likert scale: 1 = not limited or do not have a CHC, 2 = moderately limited, and 3 = severely limited. We treated this variable as a continuous measure of HRWL. Higher values indicate more severe HRWL.

Vitality was measured using the 4-item question 'How much of the time during the past 30 days did you feel: a. full of energy, b. tired, c. worn out and d. full of pep', which was derived from the 36-item Short Form Health Survey (Ware & Sherbourne, 1992). Respondents answered each item on a six-point scale, ranging from constantly (1) to never (6). This scale showed high reliability (Cronbach's alpha = 0.81). Items a. and d. were reverse coded. Based on the responses, we constructed a single continuous measure of vitality that ranged from 1 to 6. Higher values indicate higher levels of vitality.

Covariates

We controlled for several established demographic covariates. Age, measured in years, was used as continuous variable. Gender (1 = male) and presence of a partner (1 = partner present) were represented by dichotomized variables. Educational attainment was first rated from primary school (1) to university graduate (7). Thereafter, it was recoded in to low (1,2,3), medium (4,5) and high (6,7) educational attainment. Similarly, wealth was initially rated from <5,000 euros (1) to >500,000 euros (7) and subsequently categorized into low (1,2,3), moderate (4,5) and high (6,7) levels of wealth.

Moreover, we controlled for job-related factors: manual work, supervisory position, full-time employment, organizational sector and organizational size. Manual work, supervisory position and full-time employment were dichotomized. Manual work was coded 1 if respondents' jobs were associated with manual work based on the International Standard Classification of Occupation (Ganzeboom, 2010). Supervisory position was coded 1 if respondents said yes to the question 'Do you have a supervisory position?'. Full-time employment was coded 1 if older workers were employed for 36 hours or more per week. Both organizational sector and size were categorical variables with three categories. The three categories of organizational sector are: government and education, construction and health and welfare. Organizations were separated by size into small (<50 employees), medium (50 to 250 employees) and large (>250 employees).

Additionally, we controlled for comorbidity with other CHCs which was coded 1 if respondents experienced one or more CHCs in addition to arthritis, cardiovascular disease, sleep disorders and psychological disorders.

Analysis

Item non-response was under 5% for any single item. This permitted the use of less vigorous missing data imputation methods (Little, Jorgensen, Lang, & Moore, 2014). Therefore, missing data were imputed using single stochastic regression imputation (Enders, 2010). To deal with the multilevel structure of data (older workers were nested within organizations), we used clustered standard errors in all analyses (Stata 14: vce (cluster)).

The sample was described using means, standard deviations and frequencies. We used ordinal least squares (OLS) regression analyses to estimate the impact of CHCs on mediator variables. All mediator variables were standardized. This allowed the interpretation of dichotomized variables as Cohen's *d* effect sizes.

To estimate the association between CHCs and early retirement preferences and mediation by SLE, HRWL and vitality, ordered logistic regression models were used. Model 1 estimates the association between CHCs and early retirement preferences. Models 2 to 4 also include SLE, HRWL or vitality, respectively. Model 5 regressed the associations of all CHCs and all mediators with early retirement preferences. All models were controlled for all covariates.

We used the Karlson, Holm and Breen (KHB) method (Stata 14: khb) to formally test whether SLE, HRWL and vitality mediated the relationship between

CHCs and early retirement preferences. The KHB method provides unbiased decompositions of total effects into direct and indirect effects for both linear and nonlinear models (Breen, Karlson, & Holm, 2013). Within our study, the direct effect examines the association between CHCs and early retirement preferences, while indirect effects explore the mediation by SLE, HRWL and vitality.

Results

Supplementary Table 2.1 describes the characteristics of our sample. The mean age of participants was 61.7 years (SD = 1.4). While 49.2% of participants preferred to keep working, 41.5% of participants preferred to retire early. The most reported CHC was arthritis (43.6%), followed by sleep disorders (14.9%), cardiovascular disease (13.0%) and lastly psychological disorders (4.9%).

Table 2.1 depicts results of the OLS regression analyses on the associations between CHCs and SLE, HRWL or vitality. All CHCs were significantly associated with SLE, HRWL and vitality. These relationships, however, differed depending on the mediator variable. Although all four CHCs were associated with lower SLE, the association is most pronounced for older workers with cardiovascular disease (Cohen's d = - 0.31, CI = -0.39 to -0.23). HRWL were predominantly related to arthritis (Cohen's d = 0.71, CI = 0.66 to 0.76) and psychological disorders (Cohen's d = 0.78, CI = 0.6 to 0.92). Vitality was most related to psychological disorders (Cohen's d = -0.66, CI = -0.77 to - 0.56).

Table 2.2 presents results of the ordered logistic regression analyses on the associations between CHCs and older workers' preference to retire early, while also providing cues about the potential mediation pathways.

Table 2.1.

Associations between Chronic Health Conditions and Subjective Life Expectancy, Health-related Work Limitations, or Vitality (N=5,696)

	Subjective life expectancy		Health-related work limitations		Vitality	
	Coef.	CI	Coef.	CI	Coef.	CI
Primary explanatory variables						
Arthritis	-0.16**	-0.21 – -0.11	0.71**	0.66 – 0.76	-0.24**	-0.27 – -0.20
Cardiovascular disease	-0.31**	-0.39 – -0.23	0.22**	0.14 – 0.29	-0.14**	-0.19 – -0.08
Sleep disorders	-0.21**	-0.29 – -0.13	0.40**	0.33 – 0.48	-0.45**	-0.51 – -0.40
Psychological disorders	-0.16*	-0.29 – -0.02	0.78**	0.63 – 0.92	-0.66**	-0.76 – -0.56
Covariates						
Age	0.05**	0.03 – 0.07	-0.03**	-0.05 – -0.02	0.05**	0.03 – 0.06
Male gender	-0.21**	-0.28 – -0.13	0.05	-0.00 – 0.11	0.01	-0.04 – 0.06
Education attainment	0.14**	0.10 – 0.18	-0.02	-0.05 – 0.02	0.05**	0.02 – 0.08
Wealth	0.09**	0.05 – 0.12	-0.04*	-0.07 – -0.01	0.07**	0.05 – 0.10
Partner present	0.08*	0.01 – 0.15	-0.03	-0.09 – 0.03	0.09*	0.04 – 0.15
Manual work	0.01	-0.07 – 0.10	0.24**	0.16 – 0.31	-0.08*	-0.15 – -0.02
Supervisory position	0.01	-0.06 – 0.07	0.02	-0.03 – 0.07	0.07*	0.03 – 0.12
Full-time employment	0.06	-0.00 – 0.13	-0.14**	-0.19 – -0.09	0.08*	0.03 – 0.13
Org. sector (ref. – Gov. and Edu.)						
Construction	0.01	-0.07 – 0.08	0.05	-0.02 – 0.11	-0.02	-0.07 – 0.04
Health and Welfare	0.01*	-0.06 – 0.09	0.04	-0.02 – 0.11	-0.03	-0.08 – 0.03

Org. size (ref. - <50 employees)						
50-250 employees	-0.05	-0.13 – 0.03	0.03	-0.04 – 0.10	-0.03	-0.09 – 0.03
More than 250 employees	0.09	0.03 – 0.15	-0.04	-0.09 – 0.02	0.07*	0.03 – 0.12
Comorbidity with other CHCs	-0.22**	-0.27 – -0.16	0.49**	0.43 – 0.54	-0.29**	-0.33 – -0.25
Adjusted R^2	0.09**		0.32**		0.22**	

Note. * $p < 0.05$, ** $p < 0.001$. Coef. = Coefficient, CI = 95% confidence interval, ref. = reference category, Gov. and Edu. = Government and Education, Org. = organizational

Table 2.2.

Associations between Chronic Health Conditions, Subjective Life Expectancy, Health-related Work Limitations, and Vitality on Older Workers' Preference to Retire Early (N=5,696)

Variables	Model 1		Model 2		Model 3		Model 4		Model 5	
	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI
Primary explanatory variables										
Arthritis	1.27**	1.16 – 1.40	1.25**	1.14 – 1.37	0.99	0.89 – 1.09	1.14*	1.04 – 1.26	0.97	0.87 – 1.08
Cardiovascular disease	1.18*	1.03 – 1.36	1.13	0.99 – 1.30	1.10	0.96 – 1.26	1.10	0.96 – 1.27	1.05	0.91 – 1.20
Sleep disorders	1.35**	1.19 – 1.54	1.31**	1.15 – 1.50	1.17*	1.03 – 1.33	1.09	0.95 – 1.25	1.02	0.89 – 1.17
Psychological disorders	1.70**	1.37 – 2.10	1.67**	1.35 – 2.06	1.32*	1.07 – 1.63	1.27*	1.02 – 1.57	1.12	0.90 – 1.39
Covariates										
Age	1.43**	1.38 – 1.49	1.44**	1.38 – 1.50	1.45**	1.40 – 1.51	1.47**	1.42 – 1.53	1.49**	1.43 – 1.55
Male gender	1.22*	1.08 – 1.39	1.19*	1.05 – 1.36	1.20*	1.06 – 1.37	1.24*	1.09 – 1.41	1.21*	1.06 – 1.38
Educational attainment	0.91*	0.84 – 0.98	0.92*	0.85 – 0.99	0.91*	0.84 – 0.98	0.92*	0.86 –1.00	0.93	0.86 – 1.00
Wealth	1.07	1.00 – 1.14	1.08*	1.01 – 1.16	1.08*	1.01 – 1.16	1.11*	1.04 – 1.19	1.12*	1.04 – 1.20
Partner present	1.33**	1.16 – 1.51	1.34**	1.17 – 1.53	1.35**	1.18 – 1.53	1.40**	1.23 – 1.60	1.40**	1.23 – 1.60
Manual work	1.35**	1.16 – 1.58	1.36**	1.17 – 1.59	1.25*	1.07 – 1.46	1.30*	1.12 – 1.52	1.24*	1.06 – 1.45
Supervisory position	0.94	0.84 – 1.05	0.94	0.84 – 1.05	0.93	0.83 – 1.04	0.97	0.86 – 1.09	0.96	0.85 – 1.08
Full-time employment	0.77**	0.68 – 0.87	0.78**	0.69 – 0.88	0.81*	0.72 – 0.92	0.80**	0.70 – 0.90	0.82*	0.73 – 0.93
Org. sector (ref. – Gov. and Edu.)										
Construction	1.07	0.91 – 1.26	1.06	0.90 – 1.25	1.06	0.90 – 1.25	1.05	0.89 – 1.24	1.04	0.89 – 1.23
Health and Welfare	0.66**	0.58 – 0.75	0.67**	0.58 – 0.76	0.66**	0.58 – 0.76	0.68**	0.59 – 0.77	0.68**	0.59 – 0.78

Org. size (ref. - <50 employees)										
50-250 employees	1.22*	1.06 – 1.41	1.23*	1.07 – 1.41	1.21*	1.05 – 1.39	1.23*	1.07 – 1.42	1.22*	1.06 – 1.41
>250 employees	1.37**	1.18 – 1.60	1.38**	1.19 – 1.61	1.36**	1.17 – 1.58	1.39**	1.19 – 1.62	1.38**	1.18 – 1.60
Comorbidity with other CHCs	1.18*	1.07 – 1.31	1.15*	1.04 – 1.27	0.99	0.89 – 1.10	1.03	0.93 – 1.14	0.93	0.83 – 1.03
Mediator variables										
Subjective life expectancy			0.87**	0.83 – 0.92					0.95[a]	0.91 – 1.01
Health-related work limitations					1.43**	1.35 – 1.52			1.29**	1.21 – 1.38
Vitality							0.62**	0.57 – 0.66	0.69**	0.63 – 0.74
Pseudo R^2	0.04**		0.04**		0.05**		0.05**		0.05**	

Note. [a] p<0.10, * p < 0.05, ** p < 0.001. Dependent variable is older workers' preference to retire early. OR = Odds ratio, CI = 95% confidence interval, ref. = reference category, Gov. and Edu. = Government and Education, Org. = organizational

Model 1 indicates that experiencing any of the four CHCs were significantly associated with a stronger preference to retire early. Model 2 reveals that high SLE was associated with a weaker preference to retire early (OR = 0.87, CI = 0.83 to 0.92). Model 3 shows that severe HRWL were significantly associated with a stronger preference for retirement (OR = 1.43, CI = 1.35 to 1.52). Model 4 demonstrates that high vitality was associated with a weaker preference to retire early (OR = 0.62, CI = 0.57 to 0.66). Additionally, Models 2 to 4 demonstrate that including any mediator variable in the analysis attenuated the effects of the four CHCs on early retirement preferences, as all odds ratios reduced in size and some lost their significance. Lastly, Model 5 examined the associations between CHCs and preference to retire early, while accounting for all three mediators simultaneously. All mediators were independently associated with early retirement preferences. Severe HRWL were associated with a stronger preference for early retirement (OR = 1.29, CI = 1.21 to 1.38). Contrastingly, high vitality (OR = 0.69, CI = 0.63 to 0.74) and to a lesser extent high SLE (OR = 0.95, CI = 0.91 to 1.01) were associated with a weaker preference for early retirement. The effects of all four CHCs in Model 5 were small and not significant in the full model.

The KHB analyses confirmed that indirect effects accounted for the majority of the total effect of CHCs on retirement preferences (Table 2.3). The indirect effects of CHCs on retirement preferences were significant for older workers with arthritis (OR = 1.32, CI = 1.20 to 1.45), cardiovascular disease (OR = 1.13, CI = 1.04 to 1.23), sleep disorders (OR = 1.33, CI = 1.21 to 1.46) and psychological disorders (OR = 1.58, CI = 1.42 to 1.75), while all direct effects were not significant. These results suggest that the association between CHCs and early retirement preferences mostly ran via the mediators. The results further showed that the association was differentially mediated by SLE, HRWL and vitality, depending on the CHC examined. The indirect effect of CHCs on early retirement preferences ran primarily via HRWL for older workers with arthritis (65.4%) and cardiovascular disease (45.9%). For older workers with sleep disorders (60.3%) and psychological disorders (55.0%), the indirect effect of CHCs on early retirement preferences was predominantly attributable to lower vitality. While SLE explained minor proportions of the indirect effect for most CHCs, it mediated a comparatively larger proportion (11.8%) of the indirect effect for cardiovascular diseases.

Table 2.3.

Indirect Effect of Chronic Health Conditions on Older Workers' Preference to Retire Early via Subjective Life Expectancy, Health-related Work Limitations and Vitality (N=5,696)

Chronic health conditions	Total direct effect		Total indirect effect		Indirect effect via subjective life expectancy	Indirect effect via health-related work limitations	Indirect effect via vitality
	OR	CI	OR	CI	%	%	%
Arthritis	0.97	0.87 – 1.08	1.32**	1.20 – 1.45	2.6	65.4	32.0
Cardiovascular disease	1.05	0.91 – 1.20	1.13*	1.04 – 1.23	11.8	45.9	42.3
Sleep disorders	1.02	0.89 – 1.17	1.33**	1.21 – 1.46	3.4	36.3	60.3
Psychological disorders	1.12	0.90 – 1.39	1.58**	1.42 – 1.75	1.5	43.5	55.0

Note. * $p < 0.05$, ** $p < 0.001$. Dependent variable is older workers' preference to retire early. OR = Odds ratio, CI = 95% confidence interval, % = Attributable percentage

Discussion

This study investigated the different pathways through which CHCs influence retirement preferences using data from 5,696 Dutch older workers in pre-retirement age. The study provides evidence that older workers experiencing arthritis and cardiovascular disease may prefer early retirement due to severe HRWL, while older workers with sleep and psychological disorders may prefer early retirement because of lower vitality. The mediation effect of SLE was minor for all CHCs, except for cardiovascular disease.

Our results clearly show that the nature of CHCs is reflected in the dominance of mediators. For example, sleep disorders may result in fatigue, reduced energy, muted enthusiasm, poor quality of life and consequently, low vitality (Reimer & Flemons, 2003). A common symptom of psychological disorders, such as depression and anxiety, is fatigue, which in turn decreases vitality (American Psychiatric Association, 2013). Our study showed that this lower level of vitality is related to early retirement preferences. Similarly, arthritis and cardiovascular diseases may restrict the full range of activities that the older worker can perform (Vanajan, Bültmann, & Henkens, 2020a). Our results showed that these activity limitations are related to early retirement preferences. We were intrigued by how the mediation effect of SLE for older workers with cardiovascular diseases stood out compared to its mediation effect on the other three CHCs. Cardiovascular diseases are more life-threatening and they can occur suddenly and unexpectedly (Sara, Eleid, Gulati, & Holmes, 2014). This may lead to apprehensions about mortality among patients of cardiovascular diseases. Studies have found that individuals adapt their SLE in response to new information, such as health changes or onset of disease (van Solinge & Henkens, 2018). In line with this, our results show that older workers with cardiovascular diseases take the nature of their disease and resulting worries about their mortality into account when considering retirement preferences.

This study is, however, not without limitations. Given the cross-sectional nature of the data, causal inferences (including reverse causation) are not possible. We also cannot capture the dynamic nature of CHCs. Hence, longitudinal studies are warranted that investigate causal mechanisms and changes over time. Moreover, we lack information on the severity of the CHCs experienced by older workers. Future research may possibly examine the effects of the severity of CHCs. We also do not examine retirement behaviour. The current Dutch retirement system provides older workers with relatively limited opportunities in defining their actual

retirement age by containing career extension through mandatory retirement rules at the state retirement age and by imposing high financial penalties for retiring earlier than the state retirement age. Within this context, a multitude of factors may influence older workers to convert their retirement preferences into retirement behaviours: the study of which is an interesting avenue for future research. Further, we only sample older workers who are enrolled in a pension scheme. These workers may experience a broader choice in retirement than those who are not enrolled in a pension scheme, such as self-employed workers. Older workers experiencing CHCs, who are under the age of 60 years, may exit employment due to different mechanisms than the ones applicable to older workers between the ages of 60 and 65 years. Our study sample limits our ability to examine these mechanisms.

Extending working lives is a key public health and policy challenge in the western world. Our results showed that SLE, HRWL and vitality mediated the association between CHCs and early retirement preferences. We suggest the provision of accommodations and interventions to older workers based on the specific CHC they experience. Employers may provide workplace vitality interventions, such as the empirically supported Vital@Work intervention (Strijk et al., 2012), for older workers with sleep and psychological disorders. Organizations could offer older workers with arthritis and cardiovascular disease flexible work arrangements, such as flexible working hours, that have been found to be associated with lower HRWL (Vanajan, Bültmann, & Henkens, 2020a). Health education programs that assist in correctly appraising SLE can be advantageous for older workers with cardiovascular disease. These accommodations and interventions may act as an impetus for the extension of working lives, the improvement in its quality and the sustainable ageing of older workers.

3

Associations between existing and newly diagnosed chronic health conditions and subjective life expectancy: Results from a panel study[1]

[1]A slightly different version of this chapter has been published as: Vanajan, A., & Gherdan, C. (2022). Associations between existing and newly diagnosed chronic health conditions and change in subjective life expectancy: Results from a panel study. Social Science & Medicine – Population Health. Advance online publication. https://doi.org/10.1016/j.ssmph.2022.101271

Abstract

Background. Subjective life expectancy (SLE) is a vital predictor of mortality, health and retirement. We, however, have sparse knowledge about what drives changes in SLE. Having a chronic health condition (CHC) is likely associated with a change SLE. However, how CHCs are associated with changes in SLE may depend on whether the CHC was newly diagnosed and the type of CHC.

Aim. We hypothesize that newly diagnosed CHCs will be more detrimental to change in SLE than existing CHCs. As CHCs vary in their symptoms and clinical management, we differentiate the effects of five categories of CHCs: arthritis, cardiovascular diseases, sleep disorders, psychological disorders and life-threatening conditions.

Method. Data from two waves of a Dutch pension panel survey, collected 3 years apart, was used. The analytical sample included 4,824 older workers between the ages of 60-65 years at wave 1. Data were analysed longitudinally using a conditional change ordered logistic regression model.

Results. In general, newly diagnosed CHCs were strongly associated with a decrease in SLE. Existing CHCs were also associated with a decrease in SLE, but to a weaker strength. Interestingly, associations between categories of CHCs and the change in SLE differed based on the CHC in question.

Conclusion. Newly diagnosed life-threatening conditions, psychological disorders and cardiovascular diseases are strongly associated with decreases in SLE. Older workers newly diagnosed with these CHCs may benefit the most from health-promotion interventions and workplace accommodations that enhances the effective management of CHCs at work.

Introduction

To combat the labour gaps that may arise from population ageing, workers across the western world are now required to work longer up to a higher age before they could transition into retirement. However, some older workers may choose to retire early due to health-related reasons. While one is more likely to point at health-related work limitations or low vitality as drivers of early retirement preferences, recent research has begun to examine the possibility of subjective life expectancy as a driver of retirement preferences (Vanajan, Bültmann, & Henkens, 2020b). Subjective life expectancy (SLE) is defined as the subjective perception of how long an individual expects to live. Older workers' assessment of how long they will live have been associated with how long they will work, when they will retire and when they will claim their pensions (Khan, Rutledge, & Wu, 2014; Hurd, Smith, & Zissimopoulos, 2004), with studies showing older workers with longer time horizons preferring later retirement (van Solinge & Henkens, 2010). Not only does SLE directly predict retirement behaviour, it also mediates the effect of poor health on older workers' early retirement preferences and their uptake of disability pension (Vanajan, Bültmann, & Henkens, 2020b; Holman, 2019). Despite the negative consequences that low SLE may have on older workers' wellbeing and work, we do not know much about which factors or situations causes SLE to decrease over time Therefore, it is vital that we gather insights into what decreases SLE using longitudinal methods so as to better sustain working lives until retirement age.

Poor health has been associated with low SLE (Bae, Kim, & Lee, 2017; Liu, Tsou, & Hammitt, 2007). This is especially the case for older workers who experience chronic health conditions (CHCs). CHCs, such as depression (Kim & Lee, 2019), hypertension (Zacher, Wang, & Short, 2021) and cardiovascular diseases (Vanajan, Bültmann, & Henkens, 2020b) have been associated with low SLE among older workers. Theoretically, these results are supported by Leventhal's Self-Regulation Theory (Leventhal, Meyer, & Nerenz, 1980). This theory states that an individual's beliefs and expectations about an illness will determine how he/she will evaluate his/her overall health situation. Older workers with CHCs may evaluate their SLE based on their beliefs about their specific CHC - its cause, its effects, its timeline and trajectory, its treatment and prognosis and/or how long the older worker has successfully managed it. Leventhal's theory demonstrates how the many characteristics of a CHC may simultaneously influence older workers' perceptions about their current and future health and life expectancies. This theory emphasizes

the importance of studying the heterogeneities in CHCs, especially in connection to SLE, which has been neglected in literature thus far.

This study examines two sources of heterogeneity in the effects of CHCs: whether the CHC was newly diagnosed and the type of CHC. Individuals who have been living with CHCs for a longer time may experience life differently than those who have been recently diagnosed with CHCs. On the one hand, CHCs can increase in severity with time, reaping negative consequences for SLE. For example, symptoms of arthritis have been shown to worsen with time, thereby causing an increase in activity limitations and in detrimental consequences for work and life (McDonough & Jette, 2010). On the other hand, those who have been diagnosed with a CHC earlier in life might have had the time and space required to accept, learn about and manage the needs and limitations of their condition, which could change SLE for the better. Those recently diagnosed with a CHC could still be learning about their condition, while adjusting to the functional limitations of their CHCs and finding ways to manage their CHCs in daily life (Lacaille, White, Backman, & Gignac, 2007). They could be battling the side effects of their newly prescribed medication and creating a new support system (Lacaile et al., 2007). This has been supported by a study that demonstrated the recent diagnosis arthritis to decrease functioning more than arthritis that has been diagnosed early in life (Mutambudzi & Henkens, 2021; Björk, Thyberg, Haglund, & Skogh, 2006). Despite these conflicting presumptions, to the best of our knowledge, no studies thus far have sought to longitudinally understand how experiencing a CHC over a longer time period or being newly diagnosed with a CHC could be differentially associated with the change in SLE. Therefore, this study aims to investigate how existing (*existing CHCs* - diagnosed over 3 years ago) and newly diagnosed (*newly diagnosed CHCs* - diagnosed within the last 3 years) CHCs are associated with changes in SLE among older workers (60-65 years old at baseline) in the Netherlands using two waves of unique panel data. We hypothesize that being newly diagnosed with a CHC will have a stronger negative association with the change in SLE than existing CHCs: *newly diagnosed CHCs-SLE hypothesis.*

Another source of heterogeneity in the effects of CHCs stems from the type of CHC. CHCs differ in how they present themselves. The symptoms they pose on the human body and the intensity of these symptoms vary depending on the CHC, its severity, when it is diagnosed and how it is managed. Based on these factors, they also evoke a range of different functional limitations and demand the fulfilment of diverse needs. This necessitates the study of the associations of various CHCs

separately and not as a collective group. In order to fully understand the heterogeneities in how CHCs affect SLE among older workers, we aim to examine how five categories of CHCs - arthritis, cardiovascular diseases, sleep disorders, psychological disorders and life-threatening diseases - are associated with changes in SLE among older workers. These specific categories of CHCs were chosen to be studied as they are the most prevalent and most burdensome among older adults (OECD, 2018; WHO, 2018). They were also the most prevalent CHCs among the older workers in our sample, which was important for statistical power.

This study contributes to literature in three ways. First, this study is, to our knowledge, the first to longitudinally analyse the change in SLE using 3-year panel data. Previous studies have mostly examined SLE cross-sectionally at a single time point. The few studies that do evaluate changes in SLE, do so in a population of workers of a wider age category, patient populations or among older community dwelling adults (Chen, Zhu, Hu, & Gao, 2021; Liu, Tsou, & Hammitt, 2007). We study changes in SLE among 4,824 older workers in pre-retirement age (between 60-65 years), who are burdened not only by the requirement to work longer, but also by CHCs, the prevalence of which increases with age. Presumably, this sample of older adults are at a greater risk of low SLE. However, this has not been examined longitudinally. Secondly, we study heterogeneities in how CHCs are associated with changes in older workers' SLE. We examine two sources of heterogeneity: heterogeneity due to the type of CHC and heterogeneity due to whether CHCs were existing or newly diagnosed. This, to our knowledge, has not been previously attempted. Third, by distinguishing the effects of the short- and the long-term presentation of five categories of CHCs, we are able to identify the groups of older workers whose SLE is most affected by their CHC. Currently, literature has provided evidence on the associations between low SLE and functional limitations (Kim & Lee, 2019; Keyes & Westerhof, 2012), poor health (Bodner & Bergman, 2016), high levels of stress (Griffin, Loh, & Hesketh, 2013) and negative health practices (Scott-Sheldon, Carey, Vanable, & Senn, 2010). Based on this evidence, the groups of older workers identified by this study to have low SLE may also suffer from these additional negative effects to health and wellbeing. This information could be used to target workplace accommodations, stress-reduction interventions and other health-promotion interventions to older workers who are most affected by their CHCs.

The retirement context in the Netherlands

Governments throughout the western world are striving to hold on to a sufficient labour supply by extending working lives. This is also the case in the Netherlands. In the last decades, the Dutch government restricted access to early work exit schemes such as early retirement and disability pension. In the late 1900s, the Netherlands actively encouraged early retirement (Euwals, van Vuuren, & Wolthoff, 2010). When the effects of population ageing became more evident, in 2012, the Dutch government discontinued all early retirement schemes. While early retirement is still an available option for Dutch workers, it is financially disadvantageous and only used by older workers who can afford it. In the late 1900s, the Dutch Disability Insurance program was a generous and attractive work exit route as it covered all work- or non-work-related medical impairments and it provided wage payments even before a formal assessment for disability was conducted (Koning & Lindeboom, 2015). Since then, the Dutch disability insurance program has been reformed to include stricter assessments of disability, while also holding employers responsible for the first two years of disability wages and the reintegration of disabled workers (Koning & Lindeboom, 2015). The Dutch government also increased the public pension age. Current retirement policies link every projected year of increase in life expectancy with an increase in public pension eligibility age by 8 months. In line with current life expectancy projections, statutory retirement age for those born in 1970 will be 68 years, while statutory retirement age for those born in 1990 will increase up to 69 years and 6 months (Oude Mulders, Henkens, & van Dalen, 2021).

The many measures taken to retain a sufficient labour force has led to extended working lives for *all* workers (Oude Mulders, 2019). In the Netherlands, the nett labour participation of older workers between 60-65 years rose from 21.7% in 2003 to 62.8% in 2020 (Centraal Bureau voor de Statistiek, 2021e). This extension of working years occurs regardless of the heterogeneities in older workers' capacities to work and despite the health challenges that older workers may experience. Given that the prevalence and burden of CHCs increases with age, older Dutch workers may also experience more CHC-related needs and limitations at work.

Methods

Population

This study used data from the first and second waves of the NIDI Pension Panel Study (NPPS) that was conducted in 2015 and 2018 in the Netherlands. The NPPS is a prospective cohort study that follows a large sample of employed older workers aged between 60-65 years at wave 1 (Henkens, Van Solinge, Damman, & Dingemans, 2017).

Older workers were recruited using a stratified sampling approach. First, a sample of organizations were selected from the files of three of the largest pension funds in the Netherlands (namely, ABP, PfZw and BpBouw) along the dimensions of organization size and sector. Together these pension funds represent 49% of wage employed workers in the Netherlands (De Nederlandsche Bank, 2015). Second, 15,470 older workers aged between 60-65 years who worked at least 12 hours per week were randomly sampled from within the selected organizations. They received the NPPS questionnaire by post. A total of 6,793 older workers responded to this questionnaire at wave 1, corroborating to a net response rate of 44%.

Between the two waves 98 respondents dropped out due to attrition (of them, 86 were deceased). A total of 6,695 questionnaires were sent out by the second wave, of which 5,312 were completed and returned (a net response rate of 79.3%). From this number we excluded 340 respondents who completed a shorter version of the questionnaire that did not include all relevant variables. Additionally, 147 respondents who did not respond to the item on subjective life expectancy at wave 2 and 1 respondent who had a missing value in which organization he/she belonged to were excluded from our sample. We did encounter missing values in the remaining responses. However, these missing values accounted for less than 5% of all observations. This allowed for the use of less vigorous missing data imputation methods (Little et al., 2014). Thus, missing data, except those of the dependant variables, were imputed using single stochastic regression imputation (Enders, 2010). Our final sample consisted of 4,824 older workers (N=4,824) between the ages of 60-65 years at wave 1.

Measurements

Outcome variable

Subjective life expectancy at both waves was assessed using a single item measure which inquired "How likely are you to live beyond the age of 80?" with

response categories originally ranging from *highly likely (1)* to *highly unlikely (5)* on a five-point Likert scale. The responses were reverse coded to range from *highly unlikely (1)* to *highly likely (5),* with higher values representing higher subjective life expectancy. Based on this method, two categorical measures of subjective life expectancy were created at wave 1 (SLE at wave 1, five categories) and wave 2 (SLE at wave 2, five categories).

Primary explanatory variables

The Limiting Longstanding Illness (LLSI) measure (Bajekal, Harries, Breman, & Woodfield, 2004) was used to measure the existence and new diagnosis of five categories of CHCs: arthritis, cardiovascular diseases, sleep disorders, psychological disorders and life-threatening conditions. Respondents were asked "Do you have one or more of the following longstanding diseases (as diagnosed by a doctor)" at both waves. The LLSI was followed by a list of CHCs. Respondents answered by indicating whether they were diagnosed with the particular CHC. Based on the responses to the LLSI at *wave 1*, we created five dichotomized variables that represents existing CHCs (*1=I have this CHC, 0=I do not have this CHC*). Responses to both waves of the LLSI was used to create five dichotomized variables that represents newly diagnosed CHCs. The new diagnosis of a specific CHC was coded 1 if respondents affirmed, they were diagnosed with the CHC at wave 2 in the absence of an affirmative diagnosis of the same CHC at wave 1 (*1=I have been newly diagnosed with this CHC, 0=I have had this CHC for the last 3 or more years or I do not have this CHC*).

Covariates

In order to better estimate the effects of existing and newly diagnosed CHCs on the change in SLE, we controlled for several demographic, health-related, interpersonal and work-related variables. The prevalence of CHCs increases with age and studies have shown sex differences in the prevalence, severity and patterns of CHCs among the older population (de Breij, Huisman, Boot, & Deeg, 2022; Abad-Díez et al., 2014). Moreover, past studies have shown that lower educated older workers are more likely to have health problems than higher educated older workers (de Breij et al., 2020). Socioeconomic differences among older workers have also been shown to strongly predict life expectancy (Lallo & Raitano, 2018). Education level, especially, has strongly been associated with subjective life expectancy (van Solinge & Henkens, 2018). Based on this literature, we controlled

for age, sex and education level at wave 1 within the cluster of demographic variables. Age was treated as a continuous variable, measured in years. Sex was dichotomized, with 1 representing males. In the questionnaire education was originally categorized as elementary school (1), lower vocational education (2), lower general secondary education (3), intermediate vocational education (4), upper general secondary education (5), higher vocational education (6) and university education (7). For this article, we treated education as a categorical measure with 3 categories: low (includes the original categories - elementary school, lower vocational education and lower general secondary education), moderate (includes the original categories - intermediate vocational education and upper general secondary education) and high education (includes the original categories - higher vocational education and university education).

Individuals with higher levels of social support are expected to live longer (Ross & Mirowsky, 2002): this is especially true for individuals who experienced physical health impairments. Social support is also associated with higher quality of life among older adults (Fernández–Ballesteros, 2002). Based on these results, we controlled for social support under the category interpersonal control variables. Social support, derived from wave 1 data, was dichotomized and coded 1 if respondents affirmed that they had plenty of people they could lean on when they had problems.

Older workers with comorbid CHCs were more likely to exit paid employment compared to older workers without comorbidities (Oude Hengel, Robroek, Eekhout, van der Beek, & Burdorf, 2019). Therefore, within the group of health-related controls, we adjusted for multimorbidity at wave 1, a dichotomized measure of health which was coded 1 if respondents confirmed that they were diagnosed with two or more CHCs (1=diagnosed with two or more CHCs).

Moreover, we controlled for two work-related variables: manual work and employment status. Manual work has been associated with lower vitality, higher physical job demands and higher physical health impairments (Mutambudzi & Henkens, 2021; Vanajan, Bultmann, & Henkens, 2021; Schaufeli & Taris, 2014). Past research has also shown differences in healthy life expectancy between older adults in high and low occupational positions (Head et al., 2019). These studies made it necessary to control for job type, i.e., whether older workers were in manual or non-manual work, in our analyses. Manual work was coded 1 if respondents' jobs were associated with manual work according to the international standard classification of occupation at wave 1 (Ganzeboom, 2010). Moreover, having a CHC has been

associated with early retirement preferences among older workers (Vanajan, Bultmann, & Henkens, 2020b). Retirement may provide more time for rest, recovery and leisure without the demands of work. Because employment status can influence older workers' ability to effectively manage their CHC, we controlled for employment status in our analyses. Employment status was coded 1 if respondents indicated that they do work for pay in response to the question "Which situation applied to you?" at wave 2. More details on the wording of survey questions and the coding and psychometric properties of variables are presented in supplementary Table 3.1.

Analyses

We used conditional change ordered logistic regression analysis to longitudinally study the associations between five existing and five newly diagnosed CHCs and the change in SLE. Based on guidelines from Aickin (2009), we regressed the dependent variable at wave 2 (SLE at wave 2) on the dependent variable at wave 1 (SLE at wave 1), independent variables (existing and newly diagnosed CHCs) and control variables (demographic, health-related, interpersonal and work-related controls) (Aickin, 2009). Regressing the dependent variable at wave 2 against its baseline measure and all other covariates is mathematically equivalent to regressing the change of the dependant variable against its baseline measure and all other variables. Because of this mathematical equivalency, the coefficients resulting from the conditional change analysis can be interpreted as change effects from wave 1 to wave 2. Moreover, the inclusion of the dependent variable at wave 1 as a covariate, controls for a possible ceiling effect. The regression equation for the model derived through the conditional change ordered logistic regression analysis is presented in the supplementary material. Because our data is multilevel in structure (older workers were nested within organizations), we used robust standard errors clustered based on the organizational belonging.

Moreover, there is a possibility that mentally-disabling CHCs mediate the associations between physically disabling conditions and the change in SLE. We formerly tested the possibility of this mediation: this is explained in detail in the supplementary material. In order to test for robustness of our primary analysis, we conducted two sensitivity analyses. These analyses are described in the supplementary material.

Results

Descriptive statistics on key variables

The proportion of older workers with existing and newly diagnosed CHCs are demonstrated in Figure 3.1. By the first wave, 43.5% of older workers reported having arthritis, 13.7% reported to have a cardiovascular disease, 14.6% reported experiencing a sleep disorder, 4.7% experienced a psychological disorder and 3.1% reported having a life-threatening condition. Between the two waves, 12.7% of older workers were newly diagnosed with arthritis, while 4.9% were newly diagnosed with a cardiovascular disease, 6.3% reported a newly diagnosed sleep disorder, 2.8% newly experienced a psychological disorder and 2.9% were newly diagnosed with a life-threatening condition.

Older workers also experienced changes to their SLE between the two waves. 54.6% of older workers experienced moderate to low SLE at wave 1. By wave 2, the number of older workers with moderate to low SLE decreased to 47.2%.

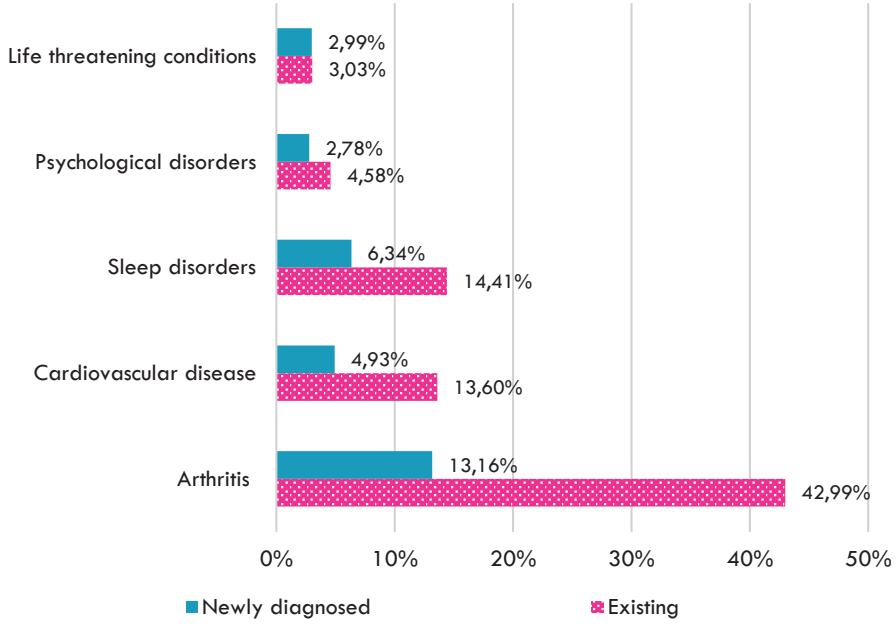

Figure 3.1. Percentage of older workers with existing CHCs and newly diagnosed CHCs

Results of the conditional change ordered logistic regression analysis

Table 3.1 demonstrates the associations between existing and newly diagnosed CHCs and the change in SLE from wave 1 to wave 2.

Existing CHCs

The results revealed existing cardiovascular diseases (b=-0.39, $p<0.001$) and existing sleep disorders (b=-0.19, $p<0.05$) to be moderately associated with a decrease in SLE between wave 1 and wave 2. This effect was not evident for existing arthritis, existing psychological disorders or existing life-threatening conditions.

Newly diagnosed CHCs

Almost all newly diagnosed CHCs were associated with a decrease in SLE; this (partially) confirms our *newly diagnosed CHCs-SLE hypothesis*. Newly diagnosed life-threatening conditions saw the strongest association with declining SLE (b=-1.44, $p<0.001$). Newly diagnosed psychological disorders (b=-0.54, $p<0.05$), cardiovascular diseases (b=-0.48, $p<0.05$) and sleep disorders (b=-0.29, $p<0.05$) were moderately associated with a decrease in SLE. This effect was not evident for older workers who were newly diagnosed with arthritis between the two waves.

The results of the mediation analyses support the results of the regression analysis: these results are presented in detail in the supplementary material. To check the robustness of this analysis, we conducted two sensitivity analyses, results of which are described in supplementary results. In general, results of our primary analysis remain stable after the sensitivity analyses.

Table 3.1.

The effects of existing and newly diagnosed arthritis, cardiovascular disease, sleep disorders, psychological disorders and life-threatening conditions on change in subjective life expectancy from wave 1 to wave 2 (N=4, 824)

Predictors	Change in subjective life expectancy from w1 to w2	
	Coef.	SE
Subjective life expectancy at w1	1.84**	0.05
Existing		
Arthritis	0.10	0.11
Cardiovascular disease	-0.39**	0.09
Sleep disorders	-0.19*	0.09
Psychological disorders	0.03	0.14
Life-threatening conditions	-0.18	0.18
Newly diagnosed		
Arthritis	-0.14	0.09
Cardiovascular disease	-0.48*	0.14
Sleep disorders	-0.29*	0.14
Psychological disorders	-0.54*	0.20
Life-threatening conditions	-1.44**	0.27
Demographic control variables		
Age	0.04*	0.02
Sex (reference=male)	-0.05	0.06
Education	0.10*	0.04
Interpersonal control variables		
Social support (reference=has social support)	0.20	0.18
Health-related control variables		
Multimorbidity (reference=yes, multimorbid)	-0.26*	0.12
Work-related controls		
Employment status (reference=employed)	-0.06	0.06
Manual work (reference=manual worker)	-0.24*	0.09
Wald chi2 (26)	1605.85**	
Log pseudolikelihood	-4553.68	
Pseudo R^2	0.22	

Note. *p<0.05, **p<0.001, Coef. = coefficient; SE = robust (clustered) standard error; w1=wave 1; w2=wave 2

Discussion

This study, to the best of our knowledge, is the first to differentiate the associations between five existing and newly diagnosed CHCs and the change in SLE among older workers in pre-retirement age using panel data. Findings from our longitudinal analysis revealed some existing CHCs to be associated with a decrease in SLE. However, newly diagnosed CHCs were more frequently and strongly associated with decreases in SLE. These effects, however, differed based on the CHC in question. These findings provide partial support to our *newly diagnosed CHCs-SLE hypothesis.*

Heterogeneities due to whether the CHC was existing or newly diagnosed

Existing CHCs

According to our findings existing cardiovascular diseases and sleep disorders were associated with a decrease in SLE. This goes against our assumption that individuals with existing CHCs will adapt to life with their CHC and that this adaptation would protect SLE in the long run (Lacaille et al., 2007). The results for existing cardiovascular diseases and existing sleep disorders, however, support our other assumption: the severity of these conditions could worsen over time, reaping negative consequences for SLE. Cardiovascular diseases and sleep disorders can increase in severity over time or with ageing. This might lead to adverse health events, such as strokes, myocardial infarction or sleep attacks, the fear or expectation of which may in turn influence how older workers evaluate their life expectancy. The effect of these conditions, especially sleep disorders, could be cumulative and delayed: the longer one suffers from sleep disorders, the greater the toll its symptoms will have (Colten & Altevogt, 2006). Based on this, it may take time for the consequences of sleep disorders to add up and change SLE.

Moreover, these results also show that, regardless of how long older workers were managing their CHCs, their SLE was still affected by the mere fact that they had a CHC. Leventhal's Self-Regulation theory (Leventhal, Meyer, & Nerenz, 1980) explains that individuals build their beliefs and expectations about their overall health, wellbeing and by extension their SLE on the severity, prognosis and timeline of their illness and the consequences it has on their lives. Older workers who have been managing their CHCs for a long time, especially those whose CHCs are increasing in severity, may be more negative about their prognosis and a possibility of an illness-free life, which might be reflected in their SLE.

Newly diagnosed CHCs

When it comes to newly diagnosed CHCs, all except newly diagnosed arthritis, were associated with decreases in SLE. These results corroborate with our assumption that individuals will adapt to their CHC with time. Older workers who are newly diagnosed with a CHC might still be adjusting to the idea of being 'sick'. They could still be learning about and adapting to the volatile nature of their symptoms and the side effects of their newly prescribed medications (Lacaille et al., 2007). Their self-efficacy in managing their disease might be poor at the beginning and they would need to newly build a system of physical and mental support to manage their CHC (Lacaille et al., 2007). At work, the experience of a newly diagnosed CHC could cause an incongruity between job demands and the ability to perform daily work duties (Gilworth et al., 2003). In contrast, drawing from the concept of hedonic adaptation (Frederick & Loewenstein, 1999), it is possible that older workers diagnosed with a CHC earlier in life not only adapt to their condition, but also change their reference point of what it is like to be healthy and what they feel like on 'good' days when their symptoms are at a minimum. As a result, they might become more optimistic about their chance of survival the longer they live, regardless of the lack of recovery, thus explaining why existing CHCs have a smaller effect on change in SLE than newly diagnosed CHCs.

Heterogeneity stemming from the type of CHC

CHCs differed in the ways through which they influenced SLE. Arthritis, whether existing or newly diagnosed, was not associated with changes in SLE. This is in line with past studies that show no association between arthritis and SLE (Vanajan, Bultmann, & Henkens, 2020b). While arthritis limits the functional ability of individuals, it is not terminal. Due to its high prevalence, strategies to manage arthritis are widely known and easily practiced. For example, it is relatively easy to provide ergonomic workplace adaptations to individuals with arthritis, compared to interventions for psychological or sleep disorders which need to be personalized.

On the contrary, both existing and newly diagnosed cardiovascular diseases and sleep disorders were associated with decreases in SLE. The negative association between newly diagnosed cardiovascular diseases/sleep disorders and change in SLE was stronger than that between existing cardiovascular diseases/sleep disorders and change in SLE. With regards to cardiovascular diseases, our results strengthen the argument that individuals with cardiovascular diseases continue to fear for their longevity regardless of how long they have lived

with the disease (Albarqouni, von Eisenhart Rothe, Ronel, Meinertz, & Ladwig, 2016; Whitehead, Strike, Perkins-Porras, & Steptoe, 2005). This could be attributed to the unpredictability and sudden morbidity of the disease. This result is supported by previous studies that have shown prevalent cardiovascular diseases to be associated with low SLE (Zacher, Wang, & Short, 2022) and to influence older workers' preference to retire early by reducing SLE (Vanajan, Bultmann, & Henkens, 2020b). Sleep disorders are characterized by fatigue, impaired cognitive performance, anhedonia and an inability to cope with stress. Previous research has associated the experience of a sleep disorder with low vitality, low quality of life (Vanajan, Bultmann, & Henkens, 2020b; Reimer & Flemons, 2003) and diminished work performance (Knebelmann & Prinz, 2016), all if which could reap significant consequences to SLE.

While existing psychological disorders and life-threatening conditions has no association with SLE, newly diagnosed psychological disorders and life-threatening conditions were strongly associated with decreases in SLE, which supported our *newly diagnosed CHCs-SLE hypothesis*. Psychological disorders present a wide range of symptoms, from suicidal ideation, anhedonia and fatigue to a lack of control (American Psychiatric Association, 2013), which can contribute to low SLE (Mirowsky, 1997). Life threatening conditions are terminal by definition. Previous studies have shown associations between being diagnosed with a life-threatening condition, such as cancer, and low SLE (Chen et al., 2021; van Solinge & Henkens, 2018), thus supporting our results.

Limitations

Conceptual limitations

Our study is not without its limitations. When we say our study investigates the effects of five CHCs, we are actually studying the effects of five *categories of* CHCs. Due to the structure of the LLSI measure, we did not have information on the individual conditions in each category of CHC. Some of the CHC categories contain numerous conditions that range in the nature and severity of symptoms. This is especially true for psychological disorders, as different psychological conditions pose varying mortality risks (Walker, McGee, & Druss, 2015). Perhaps, future studies could dig deeper into the categories of CHCs to examine how different conditions within each category influences changes in SLE. Moreover, past studies have shown an association between SLE and partners' health, family longevity, personality and general optimism/pessimism (Zick, Smith, Mayer, &

Taylor, 2014; Griffin, Loh, & Hesketh, 2013; van Solinge & Henkens, 2010; Denollet et al., 1996). We, however, do not have access to these measures in our data, which limits our ability to test or control for these factors within our analysis.

Limitations related to measurements

We use survey data, which comes with limitations such as recall bias and social desirability. Besides, we use a single-item measure of SLE. Future studies might consider using a psychometrically safer multi-item measure. Moreover, some of the measures used have not been validated for our sample. There are better measures for these constructs that could be methodologically safer. For example, multimorbidity can be measured using the psychometrically supported Charlson and Elixhauser comorbidity index (Simard, Sirois, & Candas, 2018), which is unavailable in our survey. Moreover, our data is derived from two waves of a panel study. It would be better to have several time points before and after the diagnosis of CHCs to evaluate how SLE changes with time. Future studies with access to longitudinal data on SLE should consider rerunning this analysis with more waves and with a life course perspective in mind. Due to the nature of our data, we are also not able to precisely quantify how long older workers with existing CHCs have been living with their CHC. Future studies could look at how having CHCs for specific time periods (for instance, 0-3 years, 3-6 years, or more than 6 years) could influence changes in SLE.

Limitations related to the sample

While our total sample size was relatively sizable, the number of cases diagnosed with specific CHCs at the two timepoints was smaller. Moreover, the choice of our study sample brings with it two limitations. First, it limits the generalizability of our results across other age groups (e.g., younger workers with CHCs), countries (with different retirement landscapes), and between other groups of Dutch older workers who are not attached to pension funds (such as self-employed older workers because the NPPS collected data from older workers attached to pension funds). Second, for this analysis we limit our sample to older workers who are working at wave 1, which means that our analysis does not capture older workers with severe complaints/limitations who might have left the workforce before wave 1.

Strengths, practice and policy relevance and conclusion

This study has several noteworthy strengths. To our knowledge, it is the first to examine the heterogeneities in how CHCs are associated with changes in SLE. SLE in itself is a relatively novel and unexplored concept in health-retirement literature which plays an important role in how older workers perceive, feel about and plan their present and future lives. By distinguishing the associations between five categories of existing and newly diagnosed CHCs and changes in SLE, we provide greater insights to literature and practice on the intricate ways CHCs are associated with SLE. Moreover, we study these associations using panel data on a unique sample of older workers, aged between 60-65 years. The recent increase in retirement age and the restriction of early work exit routes has exposed this group of older workers to many challenges at work. Because older workers are more likely to be diagnosed with a CHC at older ages, older workers of pre-retirement age are facing the challenge of managing the needs and limitations of their existing or newly diagnosed CHC while working into old age. Therefore, it is vital that research gains a deeper understanding of the context, causes and consequences of the issues older workers with CHCs face at work. This knowledge can also be used to provide direction for policy and practice initiatives.

Lastly, this study provides cues that may assist policy makers, researchers and employers develop and target interventions effectively. The findings enable us to identify groups of older workers who have very low SLE, perhaps as a result of having a CHC. Having low SLE has also been associated with poor health and well-being and increased functional limitations (Kim & Lee, 2019; Bodner & Bergman, 2016; Keyes & Westerhof, 2012). In order to protect and promote the current and future health, wellbeing and healthy ageing of older workers, employers could provide older workers with interventions targeted to reduce stress and improve vitality and wellbeing (Querstret & Cropley, 2013; Strijk, Proper, van der Beek, & van Mechelen, 2009). Moreover, employers could also accommodate the specific CHC-related needs of older workers by adapting workplaces (through ergonomic furniture, healthy food at work etc.), providing access to flexible work arrangements (such as flexibility in working time) and by creating a psychologically safe organizational climate where older workers feel accepted, appreciated and safe enough to communicate their needs and issues (Vanajan, Bultmann, & Henkens, 2020a). These interventions may improve the overall wellbeing and functioning of older workers with CHCs. The availability of these interventions may also put in place a foundation of support for older workers who have been newly diagnosed

with CHCs to fall back on. All in all, these measures may improve how older workers with CHCs feel about their current wellbeing and functioning, which may lead to a positive evaluation of their SLE.

This study is the first to examine the heterogeneities in how CHCs are associated with changes in SLE. In general, newly diagnosed CHCs have a stronger association with lowered SLE. These associations, however, differed based on the category of CHC, with newly diagnosed life-threatening conditions and psychological disorders being associated with the worst outcomes for older workers' SLE. Low SLE has been shown to drive early retirement (Vanajan, Bültmann, & Henkens, 2020b). By understanding of how CHCs are associated with low SLE, we are able to better target health promotion interventions, flexible work arrangements and workplace adaptations which might improve both the current and future perspectives of older workers and sustain their working lives.

4

How do newly diagnosed chronic health conditions affect older workers' vitality and worries about functional ability?[1]

[1]A slightly different version of this chapter has been published as: Vanajan, A., Bültmann, U., & Henkens, K. (2022). How Do Newly Diagnosed Chronic Health Conditions Affect Older Workers' Vitality and Worries About Functional Ability? Journal of Applied Gerontology, 0(0). https://doi.org/10.1177/07334648221118355

Abstract

Objective. With increasing retirement ages, older workers are working longer while being newly diagnosed with chronic health conditions (CHCs). Our knowledge on how newly diagnosed CHCs influence older workers' vitality and worries is limited. We examine how four newly diagnosed CHCs affect older workers' vitality and worries about physical and mental functional ability.

Methods. We used data from a Dutch pension panel survey. A sample of 1,894 older workers (60-62 years) was analyzed using conditional change OLS regression models.

Results. Having CHCs decreased vitality and increased worries. This effect was worse for older workers newly diagnosed with CHCs. Being newly diagnosed with physically disabling conditions increased worries about physical functioning, while being newly diagnosed with mentally disabling conditions increased worries about mental functioning.

Implications. These findings aid the identification of vulnerable groups of older workers, thereby informing interventions that could improve quality of life, while promoting healthy ageing at work.

Introduction

Retirement ages are increasing throughout the Western world. Consequently, many older workers are working longer while experiencing chronic health conditions (CHCs). To better protect and promote older workers' wellbeing and functional ability in the last years of their careers, stakeholders - including policy makers, employers and researchers - need to better understand the effects of CHCs on workers in their pre-retirement years. It is well established that ageing is associated with an increase in the likelihood of being diagnosed with CHCs (Calvo, Azar, & Shura, 2021; McMahan & Sturz, 2006) and many older workers are diagnosed with a CHC in the years before their retirement (Eurostat, 2021). Till date, not much is known about the effects of these newly diagnosed CHCs on older workers in their pre-retirement years. This study is among the first to look at how newly diagnosed CHCs impact older workers' vitality and psychological health. Using 3-year panel data among older workers aged 60-65 years, this study longitudinally assessed how newly diagnosed CHCs impact changes in older workers' vitality, worries about physical functional ability and worries about mental functional ability. We will study the effects of newly diagnosed arthritis, cardiovascular disease, sleep disorders and psychological disorders and compare these with effects of existing arthritis, cardiovascular disease, sleep disorders and psychological disorders. We chose these conditions as they are among the highest prevailing CHCs in the general population (OECD, 2016). Moreover, according to the World Health Organization, these CHCs are also the largest contributors to the burden of disease (WHO, 2018). Further, it has been shown that these CHCs cause severe work limitations for older workers who are still employed (Vanajan, Bültmann, & Henkens., 2020a).

Vitality is the feeling of aliveness, both in a physical (feeling healthy, capable and energetic) and a mental sense (feeling like one's actions have meaning and purpose). Vitality provides a holistic picture on older workers' perception of their health (Hennekam, 2016). On an individual level, vitality is associated with good health (Kubzansky & Thurston, 2007). In organizations, vital employees are known to be productive, satisfied and successful at their jobs (Carmeli, 2009). On a larger scale, vital individuals benefit the society by contributing to economic growth and social participation (van Steenbergen, van Dongen, Wendel-Vos, Hildebrandt, & Strijk, 2016). Taken together, past research depicts that it is highly beneficial to keep individuals, especially older workers, vital. A past study has shown how

existing arthritis, cardiovascular diseases, sleep disorders and psychological disorders were associated with lower vitality among older workers (Vanajan, Bültmann, & Henkens, 2020b). The effects of newly diagnosed CHCs on vitality were, however, not examined. We hypothesize that newly diagnosed CHCs will decrease vitality more than existing CHCs (*newly diagnosed CHCs-vitality hypothesis*).

Emotions, such as worry, are reactions to events that carry importance to the individual (Lazarus & Lazarus, 1991). Before reacting through emotions, individuals evaluate these events based on their goals, values, and beliefs, taking also their ability to cope with the consequences of the event into account (Lazarus & Lazarus, 1991). This means that individuals will vary in the way they react to events. Past studies have also shown that 'normal' ageing changes the capacity of older individuals to appraise, respond to (both physiologically and psychologically) and adapt to stressors (Hansson, Robson, & Limas, 2001). Reaching a 60th birthday, retirement, policy changes about statutory pension age and being diagnosed of a CHC are examples of events that could cause strong emotional reactions, such as the worry about physical and mental functional ability at work (van Solinge & Henkens, 2017; Hansson et al., 2001). These emotions, in turn, may affect older individuals' well-being and performance at work (Fisher, Ryan, Sonnega, & Naudé, 2016). Although existing studies have shown that many older workers worry about their ability to function and endure in the last years of their careers (van Solinge & Henkens, 2017), not much is known about the health-related precursors of older workers' worries. Being newly diagnosed with a CHC may trigger older workers to worry about their capability to function as they did before their diagnosis. Considering the differences in how the symptoms of physically and mentally disabling CHCs may affect functional ability, we hypothesize that newly diagnosed physically disabling CHCs would increase worries about physical functional ability (*newly diagnosed physical CHC-worries hypothesis*), while newly diagnosed mentally disabling CHCs would increase worries about mental functional ability (*newly diagnosed mental CHC-worries hypothesis*).

This study contributes to the literature and practice in three ways. First, this study is among the first to examine how newly diagnosed CHCs might lead to changes in older workers' vitality and worries about functional ability. We will distinguish the effects of four newly diagnosed CHCs - arthritis, cardiovascular disease, sleep disorders and psychological disorders - on older workers' vitality and

worries. By doing so, we aspire to identify groups of older workers who are most vulnerable.

Second, we study the effects of CHC status on changes in older workers' vitality and worries about physical and mental functioning. While vitality provides a holistic picture on older workers' perceptions of how healthy and alive they feel (Hennekam, 2016), worries about physical and mental functional ability give insight into older workers' perceptions on what they can do. Previous studies have rarely assessed these constructs longitudinally: we aim to fill in this gap. Moreover, these health-related concepts can also be subjected to change, making them targets for health interventions such as the Vital@Work intervention, cognitive behavioral therapy and mindfulness-based interventions (Querstret & Cropley, 2013; Strijk, Proper, van der Beek, & Van Mechelen, 2012). As a result, the outcomes of this study can contribute to practice by informing intervention efforts.

Lastly, the three-year follow up panel data used in our study offers the opportunity to analyze a unique sample of 1,894 older workers between the ages of 60-65 years. This birth cohort of older workers were closest to retirement when increases to retirement age were implemented. This study is carried out in the Netherlands. Due to pension reforms, the Netherlands has witnessed a sharp increase in the net labor participation of older workers between 60-65 years from 21.7% in 2003 to 62.8% in 2020 (Centraal Bureau voor de Statistiek, 2021e). Older workers who were close to retirement age (essentially, those born between the years of 1955 and 1960), were faced with the reality that they would need to change their retirement expectations and prepare to work several years more than they previously imagined. This not only caused uproar from employees, but also from labor unions and employers alike (Oude Mulders, Henkens, & van Dalen, 2020; van Solinge & Henkens, 2017).

Methods

Study design and sample

We used data from the first and second waves of the Netherlands Interdisciplinary Demographic Institute's (NIDI) Pension Panel Survey (NPPS), conducted in 2015 and 2018 in the Netherlands. The NPPS follows a cohort of employed older workers between the ages of 60-65 years (Henkens, Van Solinge, Damman, & Dingemans, 2017), recruited using a stratified approach. Initially, a

sample of organizations was drawn from the files of three pension funds in the Netherlands (ABP, PfZW and BpBouw) along the dimensions of organizational size and sector. These pension funds together represent 49% of wage employed workers in the Netherlands (DNB, 2015). Following this, older workers aged between 60-65 years who worked at least 12 hours a week, were randomly sampled from the selected organizations. Of the 15,470 questionnaires that were sent out to older workers at wave 1, a total of 6,793 older workers responded to the questionnaire (net response rate of 44%). Between the two waves attrition led to the reduction of the sample by 98 respondents. A total of 6,695 questionnaires were sent out by the second wave, to which 5,312 older workers responded (net response rate of 79.3%). Supplementary Table 4.1 describes and contrasts characteristics of older workers who did and did not respond to the second wave. The statutory pension age in the Netherlands currently stands at 66 years and 4 months: this is the mandatory age of retirement. Once workers reach this age, working contracts are usually terminated. To ensure that all respondents in our sample have not reached statutory pension age by wave 2, we included 3,269 workers who were 60-62 years old at wave 1. From those, we excluded 221 responders who received a shorter version of the questionnaire that did not include all relevant variables. Additionally, 292 workers who did not respond to the questions on vitality and worries about physical and mental functional ability at both waves, 1 respondent who had a missing value in which organization he/she belonged to and 861 respondents who retired between wave 1 and wave 2 were excluded from the analyses. Figure 4.1 further illustrates how we derived our study sample from the NPPS. Our final sample consisted of 1,894 older workers between the ages of 60-62 years at wave 1.

Measurements

Outcome variables

Vitality. We measured vitality using the 36-item Short Form Health Survey's (Ware, 1993) 4-item question "How much of the time during the past 30 days did you feel: a. full of energy, b. tired, c. worn out, and d. full of pep?" Each item was answered on a six-point scale, ranging from *constantly (1)* to *never (6).* After reverse coding items a. and d., we summed all items up to construct a single continuous measure of vitality that ranged from 1 to 6. Higher values indicated higher levels of vitality. This measure of vitality demonstrated high reliability at wave 1 (Cronbach's alpha = 0.80) and at wave 2 (Cronbach's alpha=0.84).

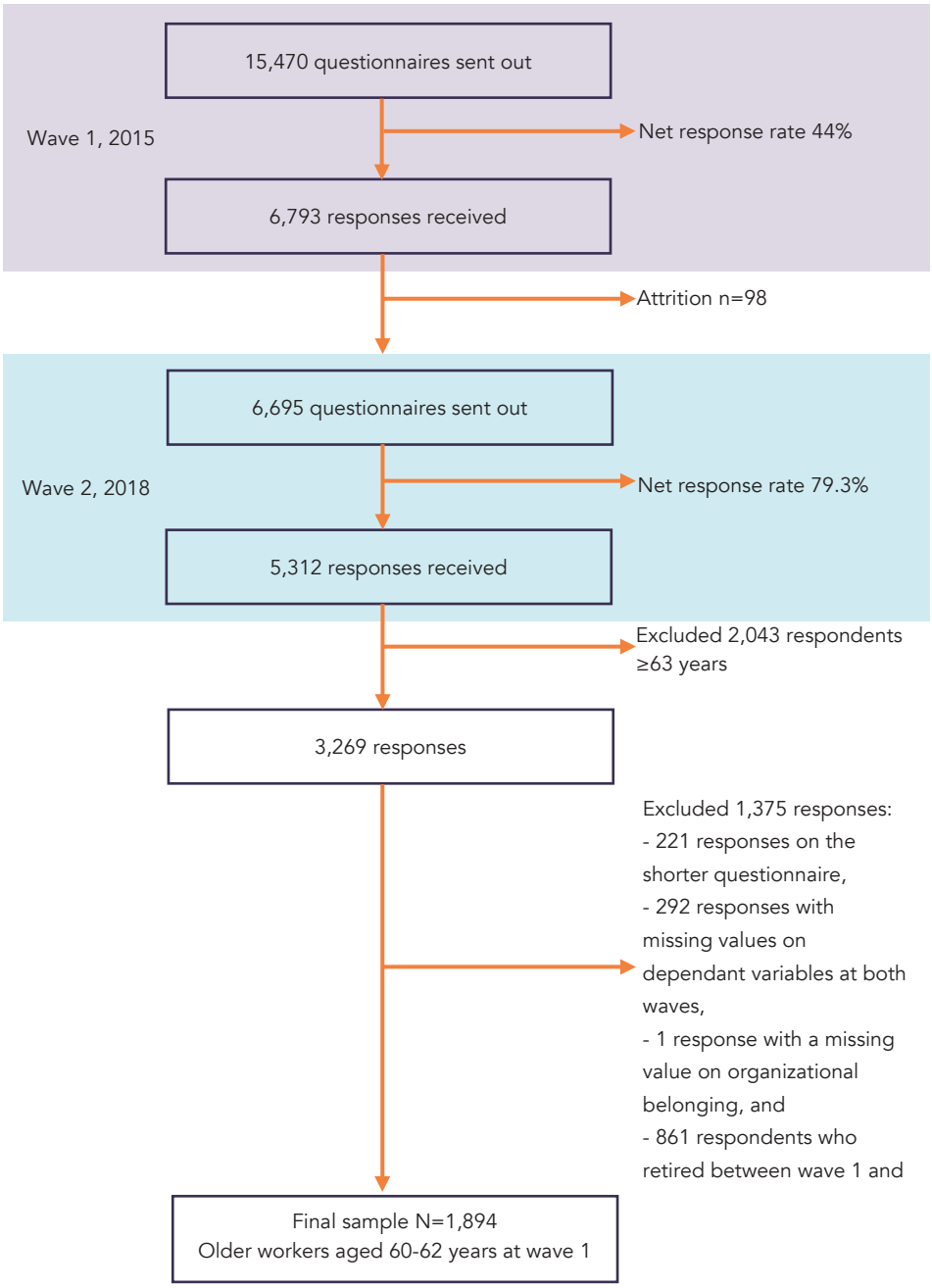

Figure 4.1. Flow chart illustrating the recruitment and retention of older workers in the NPPS and derivation of our study sample

Worries about physical and mental functional ability. Worries about physical functional ability was evaluated using the self-formulated question "To what extent do you experience the following issues because of higher retirement ages: insecurity whether I can physically maintain**?**" Similarly, worries about mental functional ability was evaluated using the question "To what extent do you experience the following issues because of higher retirement ages: insecurity whether I can mentally maintain**?**" Respondents answered by choosing one of five response options which ranged from *not at all (1)* to *very much (5).* We treated both variables as continuous measures, with higher values indicating high levels of worries about physical or mental functional ability.

Primary explanatory variables

We used the first item of the Limiting Long-standing Illnesses (LLSI) measure (Bajekal, Harries, Breman, & Woodfield, 2004) to measure the existence and the new diagnosis of the four specific CHCs: arthritis, cardiovascular diseases, sleep disorders, and psychological disorders. At both waves, respondents were asked "Do you have one or more of the following longstanding doctor-diagnosed diseases?" which was followed by a list of CHCs (Bajekal et al., 2004). Older workers answered this question by indicating whether they had that particular CHC. Based on their responses to this question at *wave 1*, we created four dichotomized variables that represent existing CHCs (*1 = I have this CHC, 0 = I do not have this CHC*). Based on the responses to the LLSI at both waves, we created four dichotomized variables that represent newly diagnosed CHCs. If respondents confirmed the diagnosis of a CHC at wave 2 in the absence of an affirmative diagnosis at wave 1, the variable was coded 1 (*1 = I have been newly diagnosed with this CHC, 0 = I have had this CHC for the last 3 or more years or I do not have this CHC*).

Covariates

We controlled for age (continuous, measured in years), sex (dichotomized, 1=*male*) and presence of partner (dichotomized, 1=*partner present*). Moreover, we controlled for education attainment, which was first categorized as elementary school (1), lower vocation education (2), lower general secondary education (3), intermediate vocational education (4), upper general secondary education (5), higher vocational education (6) and university education (7). Thereafter, educational attainment was recoded into three dichotomized variables: low (1,2,3), moderate

(4,5) and high (6,7) educational attainment. We also controlled for wealth, which was measured as 3 dichotomized variables: low (1= low, less than €50,000), moderate (1= moderate, between €50,000 - €250,000) and high (1= high, more than €250,000). With regards to health, we controlled for the experience of comorbidity at wave 1 which was represented using a dichotomized variable coded 1 if older workers stated that they were diagnosed with more than one CHC in the LLSI measure at wave 1. Additionally, we controlled for manual work, supervisory position, and full-time employment, all of which were dichotomized. If respondents' jobs were associated with manual work based on the international standard classification of occupation (Ganzeboom, 2010), manual work was coded 1. If respondents answered affirmatively to the question "Do you have a supervisory position?", supervisory position as coded 1. If older workers were employed for 36 hours or more per week, full-time employment was coded 1. Moreover, we controlled for organizational sector, a variable with three categories: government and education, construction and health and welfare. Each category was treated as a separate dichotomized variable.

Additional variables for Heckman maximum likelihood selection models. We included two additional variables in the Heckman models that are explained in the analysis section: caregiving responsibilities and work stress. Caregiving responsibilities was a dichotomized variable coded 1 if respondents replied affirmatively to the question "Do you provide help to family members or friends who are ill or in need of help?" Work stress was also a dichotomized variable: respondents who replied affirmatively to the question "is your work stressful?" were coded 1. Descriptive statistics and details on the survey questions and coding as well as relevant psychometric properties of all variables are presented in Supplementary Table 4.2.

Analyses

To study the effects of existing and newly diagnosed CHCs on the change in 1) vitality (model 1), 2) worries about physical functional ability (model 2) and 3) worries about mental functional ability (model 3) from wave 1 to wave 2, three conditional change ordinary least square regression models were run. We regressed the dependent variable at wave 2 on the dependent variable at wave 1, independent variables and controls (Aickin, 2009). The inclusion of the dependent variable at wave 1 as a covariate control for a possible ceiling effect. In our models, the wave 2 measures of vitality, worries about physical functional ability and worries

about mental functional ability were dependent variables. These variables were regressed against their measures at wave 1, existing CHCs and newly diagnosed CHCs. The results of the three models were interpreted as change effects from wave 1 to wave 2.

In these conditional change models, we only observed vitality and worries of older workers who did not exit the workforce through early retirement during the study period. Whether respondents younger than statutory pension age continued to work or retire could be a result of a selective process. To prevent this selection bias, we estimated Heckman maximum likelihood selection models. Initially, selection into the sample (i.e., whether the older worker is working or retired) was estimated based on all explanatory and control variables and two additional variables, namely caregiving responsibility and work stress. These variables are described in the measures section. These two variables were assumed to not only affect vitality and worries but also working/retirement status. Thereafter, the probability of remaining in the panel - converted to Lambda - was calculated using parameter estimates of the first model. This Lambda value was then included in the models predicting the change in vitality and worries. Even though correcting for selection did not lead to any significant changes in our main findings, Table 4.1 (and Supplementary Table 4.3 which presents the full table also with the results of covariates) presents the results of the conditional change models corrected for sample selection.

All dependent variables were standardized prior to regression analysis. This allowed for the interpretation of dichotomized variables, especially the existing and newly diagnosed CHCs, as Cohen's d effect sizes (Cohen, 2013). We used robust standard errors clustered on organizational belonging to account for the multilevel structure of the data (older workers were nested within organizations). Item non-response was less than 5% in all our variables. This permitted the use of a less vigorous missing data imputation method (Little, Jorgensen, Lang, & Moore, 2014). As a result, all missing data (except those of dependent variables) were imputed using single stochastic regression imputation (Enders, 2010).

Results

At wave 1, 39.6% of older workers reported experiencing arthritis, 12.3% reported cardiovascular diseases, 14.2% reported sleep problems and 4.3% reported psychological disorders (Figure 4.2). Between wave 1 and 2, 13.4% of older workers were newly diagnosed with arthritis, 5.0% with cardiovascular disease, 8.1% with sleep problems and 3.5% with psychological disorders (Figure 4.2).

Also, at wave 1, 16.2% older workers reported low levels of vitality, 36.2% of older workers were worried much or very much about their physical functional ability, while 31.5% of older workers were worried much or very much about their mental functional ability until retirement age.

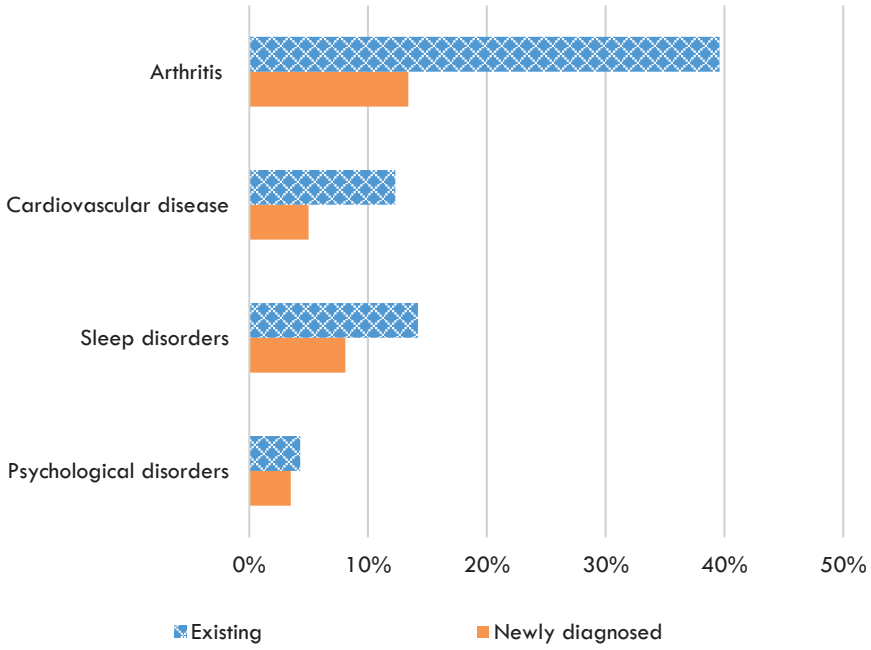

Figure 4.2. Percentage of older workers with existing and newly diagnosed CHCs

The effects of existing and newly diagnosed CHCs on the change in vitality and worries

The results of the conditional change regression analyses are presented in Table 4.1 (and Supplementary Table 4.3). Model 1 examined the effects of existing and newly diagnosed CHCs on the change in vitality. The results show that among existing CHCs, existing arthritis (Cohen's *d*=-0.12, p=0.03) and existing sleep disorders (Cohen's *d*=-0.12, p=0.03) had a small negative effect on the change in vitality from wave 1 to 2. Compared to the effects of existing CHCs, CHCs newly diagnosed between wave 1 and wave 2 had a larger detrimental effect on vitality. Older workers who were newly diagnosed with psychological disorders (Cohen's *d*=-0.69, p=0.000), sleep disorders (Cohen's *d*=-0.38, p=0.000) and arthritis (Cohen's *d*=-0.21, p=0.001) reported declines in vitality between wave 1 and wave 2. Considering the effect sizes, our results support our *newly diagnosed CHCs-vitality hypothesis*.

Model 2 demonstrated that most existing and newly diagnosed CHCs are associated with a general increase in older workers' worries about physical functional ability. Older workers who experienced arthritis, cardiovascular diseases or sleep disorders at wave 1 increasingly worried about their physical functional ability by wave 2. The sizes of these effects, however, were small. Newly diagnosed physically disabling CHCs - arthritis (Cohen's *d*=0.27, p=0.000) and cardiovascular diseases (Cohen's *d*=0.17, p=0.03) - led to increased worries about physical functional ability by wave 2. This effect was not evident for newly diagnosed mentally disabling CHCs. This confirms our *newly diagnosed physical CHC-worries hypothesis*.

Model 3 revealed that worries about mental functional ability is generally affected by the existence or the new diagnosis of mental health conditions. Among existing CHCs, only sleep disorders at wave 1 (Cohen's *d*=0.17, p=0.04) increased worries about mental functional ability between wave 1 and wave 2. Moreover, our findings show that older workers who were newly diagnosed with the two mentally disabling CHCs, sleep disorders (Cohen's *d*=0.37, p=0.01) and psychological disorders (Cohen's *d*=0.47, p=0.000), reported larger increases in their worries about their mental functional ability. This effect was not evident for the newly diagnosed physically disabling CHCs. These results confirm our *newly diagnosed mental CHC-worries hypothesis*.

Table 4.1.

Results of multivariate regression analyses (second stage output of a two-step Heckman model) to explain the effects of existing chronic health conditions at wave 1 and newly diagnosed chronic health conditions between wave 1 and wave 2 on vitality, worries about physical functional ability and worries about mental functional ability at wave 2

Variables	Vitality w2		Worries about physical functional ability w2		Worries about mental functional ability w2	
	Coef.	SE	Coef.	SE	Coef.	SE
Vitality w1	0.55**	0.04				
Worries about physical functional ability w1			0.51**	0.05		
Worries about mental functional ability w1					0.45**	0.06
Arthritis - Existing	-0.12*	0.05	0.14*	0.05	0.05	0.06
Arthritis - Newly diagnosed	-0.21*	0.06	0.27**	0.07	0.08	0.07
Cardiovascular diseases - Existing	-0.10	0.06	0.16*	0.08	0.11	0.08
Cardiovascular diseases - Newly diagnosed	-0.09	0.09	0.17*	0.08	-0.01	0.08
Sleep disorders - Existing	-0.12*	0.06	0.17*	0.05	0.17*	0.08
Sleep disorders - Newly diagnosed	-0.38**	0.10	0.19	0.11	0.37*	0.14
Psychological disorders - Existing	-0.04	0.13	0.11	0.12	0.06	0.13
Psychological disorders - Newly diagnosed	-0.69**	0.14	0.17	0.11	0.47**	0.12
Constant	-2.12	4.10	11.55*	4.46	13.94*	6.39
Lambda	0.10	0.42	0.37	0.53	0.54	0.71
N (censored/uncensored)	861/1894		861/1894		861/1894	
Wald X^2	1613.23**		2842.43**		2180.84**	

Note. ** p<0.001, * p<0.05, Coef. = coefficient, SE = standard error, w1 = wave 1, w2 = wave 2. Analysis was controlled for age, sex, presence of a partner, education, wealth, multimorbidity, full-time work, supervisory position, manual work and organizational sector

Discussion

This study is, to the best of our knowledge, the first to longitudinally distinguish how newly diagnosed CHCs affect older workers' vitality and worries about physical and mental functional ability until retirement. While many older workers report experiencing a CHC (for example, almost half of the sample experience arthritis and cardiovascular diseases), a considerable number of older workers are being newly diagnosed with CHCs (for instance, around 13% of our sample was newly diagnosed with arthritis). In general, existing CHCs at wave 1 (i.e., the experience of CHCs for more than 3 years) were associated with decreased vitality and increased worries about physical and mental functional ability at wave 2. In comparison, newly diagnosed CHCs (i.e., a new diagnosis of a CHC in the 3 years between wave 1 and 2) were associated with larger detrimental effects on vitality and steeper incremental effects on worries. Interestingly, newly diagnosed physically disabling CHCs increased worries about physical functional ability, while newly diagnosed mentally disabling CHCs increased worries about mental functional ability.

We initially assumed that older workers who have had CHCs for a longer time may accept their limitations and adjust to life and work with their CHC, resulting in levels of vitality and worries that is comparable to that of the average population of older workers. However, we observed that existing CHCs continued to have a modest negative impact on vitality and a modest positive impact on worries. These findings may indicate some possibilities. Older workers might experience a worsening of their existing CHCs over time. This worsening could possibly lead to decreased vitality and increased worries about functional ability. Perhaps, older workers might find it increasingly difficult to deal with existing CHCs as they get older. Regardless of how existing CHCs affect older workers, nearing the prospect of retirement should provide older workers, especially those with CHCs, a feeling of relief and a lessening of worries. Our results, however, suggests that levels of worry among older workers with existing CHCs do not decline as they approach the retirement age. This goes to show that older workers who have had long standing CHCs should not be neglected in the provision of care and accommodations just because they seem to be experienced in managing their conditions.

By separating the effects of existing and newly diagnosed CHCs, we provided insights into how and when CHCs influences vitality and worries. Although both existing and newly diagnosed CHCs influence vitality and worries about

functional ability, newly diagnosed CHCs had a stronger detrimental effect on both measures. Older workers who are newly diagnosed with CHCs could still be learning about and adjusting to the symptoms of their illnesses and the ways to manage their CHCs in day-to-day life (Lacaille, White, Backman, & Gignac, 2007). They might still be dealing with the side effects of their newly prescribed medication and building a new support system to help them manage their condition at home and at work (Lacaille et al., 2007). This demonstrates the importance of paying extra attention to assist older workers who are newly diagnosed with CHCs to adjust in their workplaces until they find stable strategies to manage their CHC/s and/or to accommodate their work. Older workers newly diagnosed with CHCs may find it difficult to disclose their conditions to colleagues or supervisors. They might face issues in adapting their work patterns and work environment because of the limitations imposed by CHCs. Previous research has shown that an organizational climate that ensures psychological safety is associated with low health-related work limitations among older workers with CHCs (Vanajan, Bültmann, & Henkens, 2020a). If older workers feel safe and have confidence in their organization, they are more inclined to disclose their difficulties and ask for the work accommodations they need (Vanajan, Bültmann, & Henkens, 2020a; Gignac & Cao, 2009). This calls for organizational-level interventions that focuses on improving psychological safety climate, open communication and collegiality. Conversations built on open communication could lead to older workers with CHCs obtaining flexible work arrangements, such as working time flexibility, which is also associated with low health-related work limitations (Vanajan, Bültmann, & Henkens, 2020a).

Intriguingly, newly diagnosed CHCs with more physically disabling symptoms - arthritis and cardiovascular disease - increased older workers' worries about their physical functional ability at work. Arthritis and cardiovascular disease manifests in symptoms such as chronic pain, restricted movement and exertion which can extensively limit the range of physical activities older workers can perform at the workplace (Vanajan, Bültmann, & Henkens, 2020a). Older workers with work limitations due to arthritis and cardiovascular disease are also known to prefer early retirement (Vanajan, Bültmann, & Henkens, 2020b). This may explain our results: in a public pension system that mandates older workers to work until retirement age despite health-related work limitations, older workers with existing and newly diagnosed arthritis and cardiovascular disease will continue to work while worrying about their physical functional ability at work.

Similarly, older workers who were newly diagnosed with sleep and psychological disorders worried most about their mental functional ability at work. These conditions are characterized by fatigue, muted enthusiasm, depression, inability to cope with stress and impaired cognitive performance. Moreover, sleep and psychological disorders are strongly associated with low vitality, low quality of life (Vanajan, Bültmann, & Henkens, 2020b; Reimer & Flemons, 2003) and diminished work performance (Knebelmann & Prinz, 2016): all of which could lead to increased worries among older workers about their mental functional ability at work.

The core strength of this study lies in its ability to provide novel and comprehensive knowledge to current literature by simultaneously distinguishing the effects of the existence and the new diagnosis of four highly burdensome CHCs on holistic measures of health and functional ability. Moreover, we use data from a large panel dataset on a unique yet representative sample of older workers between the ages of 60-62 years, who are not only burdened by the requirement to work in to old age, but also the need to do so while coping with existing or newly diagnosed CHCs. The panel data also allows us to make longitudinal associations and captures the dynamic nature of the CHCs, vitality and worries.

This study is not without limitations. We do not have information on the severity of CHCs that are experienced by older workers. Severity could play a role in determining the size of the effects of CHCs on vitality and worries. Future research could examine how severity of existing or newly diagnosed CHCs could influence older workers' vitality and worries as they strive to remain in the workforce. Due to the nature of the LLSI measure, we also do not have information on the conditions covered within the umbrella terms of psychological and sleep disorders. The conditions within each umbrella CHC could vary greatly in nature and severity of symptoms. Perhaps, future studies could dig deeper into the conditions covered within umbrella CHCs to examine how different conditions within each umbrella CHC influences change in vitality and worries. Moreover, we measure worries about physical and mental functional ability using a single-item measure of unknown reliability. Future studies could benefit from a multi-item measure of worries. Despite the limited opportunity to retire early, the Netherlands has a well-organized public pension system that provides generous retirement benefits. As a result, the findings of this study may not be generalizable to countries with different pension schemes. Moreover, the results may also not be generalizable to older workers who are not enrolled in a pension scheme, such as self-employed workers. The NIDI

pension panel survey collects data from workers enrolled in a pension scheme. These workers have a broader choice in retirement than workers who are not enrolled in a pension scheme. Future studies could study how older workers from other welfare states or who are not attached to pension schemes experience existing and newly diagnosed CHCs. Future studies could also study how the exact time since diagnosis may influence vitality, functional ability and general well-being of older workers.

By studying the effects of the different CHCs individually and the timing of their diagnosis, this study makes identification of vulnerable groups of older workers possible. This gives organizations and policy makers direction on whom they should target for the provision of suitable interventions. For example, older workers who are newly diagnosed with psychological conditions experience declines in vitality: they could be provided with worksite vitality interventions, such as the Vital@Work intervention (Strijk, Proper, van der Beek, & van Mechelen, 2009). Similarly, older workers who are newly diagnosed with arthritis seem to worry greatly about their physical functional ability. To comfort their worries about their current and future physical functional abilities, organizations could adapt older workers' workspaces to their needs (for instance, by providing ergonomic furniture or a lower floor in the building) or with flexible working hours that give older workers the freedom to choose when they would like to work (Vanajan, Bültmann, & Henkens, 2020a). In general, older workers with high levels of worry could be encouraged to attend mindfulness-based interventions and/or cognitive behavioral therapy (Querstret & Cropley, 2013). The timely identification of vulnerable groups of older workers and the efficient provision of effective interventions will improve both the quality and sustainability of working lives.

5

Health-related work limitations among older workers - the role of flexible work arrangements and organizational climate[1]

[1]A slightly different version of this chapter has been published as: Vanajan, A., Bültmann, U., & Henkens, K. (2020). Health-related Work Limitations Among Older Workers-the Role of Flexible Work Arrangements and Organizational Climate. The Gerontologist, 60(3), 450–459. https://doi.org/10.1093/geront/gnz073

Abstract

Background and Objectives. Given their increasing prevalence with age, chronic health conditions (CHCs) are substantially affecting older workers and organizations. An important question is whether and how flexible work arrangements and organizational climates may help to reduce the work limitations experienced by older workers. Grounded on the Job Demand-Resource model, we hypothesize that access to flexible work arrangements (working-time flexibility, workplace flexibility, phased retirement) and supportive organizational climates (healthy ageing climate, psychological safety climate) are vital job resources that are associated with fewer health-related work limitations among older workers experiencing CHCs.

Research Design and Methods. Multi-level data were collected among 5419 older workers (60 – 65 years) in 624 organizations in the Netherlands. Perceived health-related work limitations of older workers diagnosed with arthritis (N = 2330), cardiovascular disease (N = 720), and sleep disorders (N = 816) were analyzed.

Results. Multilevel ordered logistic regression analyses revealed that perceived access to flexible working hours and a psychologically safe organizational climate was associated with fewer health-related work limitations among older workers with CHCs.

Discussion and Implications. Facilitating longer working lives is a key policy challenge within organizations, in particular if older workers are constraint by CHCs. This study shows that offering flexible working hours and ensuring a psychologically safe climate, where older workers with health issues are inclined to share their work needs and preferences, is likely to contribute to healthy ageing in the workplace.

Introduction

With the increase in retirement age throughout the Western world, more attention is being focused on how older workers' fitness to work can be maintained. Ageing is associated with a general decline in physical health and mental capabilities, and an increased susceptibility to injury, communicable disease, and chronic health conditions (CHCs) (McMahan & Sturz, 2006). Compared with injury and communicable disease, CHCs contribute far more to mortality, ill-health, and the total burden of disease in old age in Europe (Harbers & Achterberg, 2012).

As the prevalence of CHCs increases with age (Stattin, 2005) and the current labor market context requires individuals to work into old age (Henkens et al., 2017a), the prevalence of CHCs in the workplace is increasing and substantially impacting older workers and organizations (Boot et al., 2014). Existing research shows that CHCs in older workers increase the likelihood of an early exit from work and reduce their work productivity, work ability, and work functioning, due to experienced work limitations (Leijten et al., 2014). Despite these negative effects, our understanding of how flexible work arrangements (FWAs) and organizational climates may help reduce or prevent health-related work limitations among older workers with CHCs is limited.

Existing studies that do examine the influence of work conditions on the effect of CHCs on work ability or work limitations of older workers focus solely on work sector, years of paid work, shift work/non-shift work, working hours, decision latitude, psychological and physical job demands, and job strain (Al Dhanhani, Gignac, Beaton, Su, & Fortin, 2014; Koolhaas, van der Klink, de Boer, Groothoff, & Brouwer, 2014). By overlooking the influence of FWAs and organizational climate within the study of work conditions, these studies offer a limited perspective on the work conditions of older workers. This is remarkable given that the development of age-based FWAs and positive organizational climates are deemed crucial to facilitate longer working careers (van Dalen, Henkens, & Wang, 2015). The current study aims to address this gap in knowledge by questioning the extent to which older workers' perceived access to FWAs and the organizations' climate are associated with perceived health-related work limitations among older workers suffering from three highly prevalent CHCs, namely arthritis, cardiovascular diseases, and sleep disorders.

Our study contributes to the literature in three ways. First, we bring together the literature from health and organizational sciences, by highlighting the

health-related work limitations experienced by older workers suffering from three CHCs in pre-retirement years (60–65 years). We focus on arthritis, cardiovascular disease, and sleep disorders, because these are among the most prevalent and burdensome conditions among older workers (WHO, 2018; OECD, 2016; Dregan & Armstrong, 2011). These CHCs have also been found to severely restrict the work functioning of older workers (Chong, Fryer, & Gu, 2013). Moreover, the nature of our dependent variable, health-related work limitations, provides a measure of work limitations that are a direct result of the CHC. Thereby, our study will provide a clearer understanding of the direct impact of arthritis, cardiovascular disease, and sleep disorders on health-related work limitations of older workers.

Second, this study is the first to analyze the impact of the older workers' perceived access to FWAs and organizational climate on health-related work limitations on older workers. FWAs are "any policies and practices, formal or informal, which permit people to vary when and where work is carried out" (Maxwell, Rankine, Bell, & MacVicar, 2007). Organizational climate consists of "a set of attributes that can be perceived about a particular organization, that may be induced from the way the organization deals with its members and environment" (Schneider, 1973). The current study operationalizes organizational climate as an organizational-level variable, thereby providing a full picture of the general atmosphere within each organization. The study of organizational climate, together with perceived access to FWAs, may allow for a more encompassing understanding of the macro- and microlevel impacts of organizational practices and workplace environments on health-related work limitations of older worker with CHCs.

The third contribution of this study is that it uses an innovative dataset with a multilevel data structure. Due to a lack of appropriate multilevel data, previous studies have not examined the effect of organizational climate, an organizational-level concept, on health-related work limitations on older workers with CHCs. This study addresses this gap. We collected multilevel data from 5,419 older workers (aged 60–65 years) working in 624 organizations. These unique multilevel data are necessary to accurately study the role of organizational climate on health-related work limitations. Additionally, it offers a rare opportunity to distinguish between individual- and organizational-level effects on health-related work limitations.

In the Netherlands, the retirement age for people born after 1950 will increase from 65 years to 67 years by 2021. Early exit routes into retirement have been blocked since 2006. These circumstances require older workers to work longer than they previously expected, despite being substantially limited by CHCs

(Harbers & Achterberg, 2012). Since the current study may increase our understanding of the practices through which we could successfully extend working lives in regions with shifting labor market policies, it might potentially benefit older workers, organizations, and even the economy at large.

Theory and Hypotheses

The Job Demand–Resource (JD-R) model states that a balance between job demands and job resources is associated with high level of employee well-being (Schaufeli & Bakker, 2004). Where job demands are defined as "physical, social or organizational aspects of the job that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs," job resources are operationalized as "physical, social or organizational aspects of the job, which may: (a) be functional in achieving work goals; (b) reduce job demands and the associated physiological and psychological costs; and (c) stimulate personal growth and development" (Schaufeli & Bakker, 2004, p. 296). Hockey (1997) argues that, for older workers, job resources are important to accommodate their health-related difficulties. The current study is based on the notion that the circumstances experienced by older workers at their workplaces—their perceived access to FWAs and organizational climate—are likely to shape their health-related work limitations. We elaborate on these factors below.

Perceived Access to FWAs

Because older workers with CHCs are a heterogeneous group, varying in their needs, CHC diagnoses, and personal circumstances, FWAs can accommodate their specific needs and circumstances (Atkinson & Sandiford, 2016). Following Loretto, Vickerstaff, and White's (2007) recommendation to disentangle different aspects of FWAs, we study the impact of three FWAs, namely working-time flexibility, workplace flexibility, and phased retirement, on perceived health-related work limitations. While working-time flexibility allows older workers to choose the times at which they work, workplace flexibility allows them to choose the location. Along the same lines, phased retirement provides older workers with the ability to reduce working hours in a stepwise manner prior to their full retirement.

The need for and use of FWAs increase with age (Kooij, Jansen, Dikkers, & De Lange, 2010). Earlier studies have shown that FWAs prolong employment (Damman & Henkens, 2018), enhance work functioning (Amick et al., 2017), and delay retirement among older workers (Moen, Kojola, & Schaefers, 2016). Older

workers experiencing a CHC may feel helpless and out of control due to the symptoms of their disease and the need to work under strict organizational rules (Gignac, Cott, & Badley, 2000). Recently, Dropkin, Moline, Kim, and Gold (2016) argued that FWAs offered more comfort (e.g., working from home), autonomy (e.g., less face-to-face managerial supervision), and control (e.g., control over work hours), thereby reducing stress, increasing job satisfaction, enhancing work–life balance, and managing CHCs. In line with the JD-R model, perceived access to FWAs is assumed an important job resource for older workers with CHCs. Our *work flexibility hypothesis* presumes that perceived access to working-time flexibility (a), workplace flexibility (b), and phased retirement (c) is associated with fewer health-related work limitations experienced by older workers with CHCs.

Organizational Climate

Organizations differ in their perspectives on the employability of older workers and their actions toward them (van Dalen, Henkens, & Wang, 2015). Organizations that have a supportive organizational climate creates a positive workplace, employee satisfaction, and organizational productivity, while mitigating social, psychological, and work-related problems (Qureshi, Rasli, & Zaman, 2014). We will study the impact of two distinct constructs of organizational climate—healthy ageing climate and psychological safety climate—on health-related work limitations of older workers with CHCs.

Per the World Health Organization (WHO, 2015) definition, a healthy ageing climate is one that supports the development and maintenance of the functional ability of older workers, while enhancing well-being in older age. A healthy ageing climate is a relatively novel yet increasingly popular concept. Bousquet and coworkers (2015) proposed that a healthy ageing climate is assumed to prevent health decline, while developing health and improving quality of life of older workers. Similarly, Zacher and Yang (2016) suggested that a healthy ageing climate may increase older workers' job satisfaction, organizational commitment, and motivation to continue working past retirement age. A healthy ageing climate can be viewed as a resource that enriches the work conditions experienced by older workers. In our *healthy ageing climate hypothesis*, we posit that working in organizations characterized by a climate that supports healthy ageing of their employees is associated with fewer health-related work limitations experienced by older workers with CHCs.

Psychological safety refers to workers' perceptions of the consequences of taking interpersonal risks in their workplaces (Edmondson & Lei, 2014). Studies on psychologically safe workplace climates suggest that they encourage employees to share information and knowledge (Siemsen, Roth, Balasubramanian, & Anand, 2009), and express their ideas (Liang, Farh, & Farh, 2012). Along the same lines, we assume that psychologically safe climates also embolden older workers to express their needs and difficulties, especially those related to CHCs. For example, Gignac and Cao (2009) found workers with arthritis to be more likely to self-disclose their health difficulties in a supportive work environment. A work climate that enhances disclosure—a psychologically safe climate—is a job resource, because it allows open communication, thereby increasing the likelihood of receiving work accommodations, which may lower health-related work limitations. Hence, we propose the *psychological safety climate hypothesis*, which postulates that psychologically safe organizational climates are associated with fewer health-related work limitations experienced by older workers with CHCs.

Methods

Study Design and Sample

This study used data from the first wave of the NIDI Pension Panel Survey conducted in 2015 (Henkens, Van Solinge, Damman, & Dingemans, 2017b). This is a prospective cohort study. The survey is carried out among employed older workers (60–65 years at baseline) enrolled in three of the bigger pension funds in the Netherlands (ABP, PfZW, and BpBouw). A stratified design was used. First, a sample of organizations was drawn from the files of the pension funds. Next, within the selected set of organizations, older workers were randomly sampled in each organization, who worked at least 12 hours per week. The selected older workers received a questionnaire and accompanying letters sent by post from their pension fund to their home address. Respondents were given the choice to complete a paper or an online questionnaire. In total, 15,470 questionnaires were sent to older workers, of which 6,793 were returned after two reminders. This corresponds to a net response rate of 44%.

Following the guidelines of Van Mierlo, Vermunt, and Rutte (2009) on ensuring the reliability of group-level variables, we excluded 578 organizations (out of 1,202) with fewer than three respondents. Item non-response was low (<5%) and

never exceeded 5% for any single item. These circumstances permit less vigorous missing data imputation methods than multiple imputation (Little, Jorgensen, Lang, & Moore, 2014). We therefore dealt with most missing data by single stochastic regression imputation (Enders, 2010, pp. 46–49) and mode imputation. However, few respondents did not provide information on their job, which resulted in 28 cases of missing values among work-related factors, specifically job type and job position. These respondents were excluded from further analysis through listwise deletion. Consequently, the final study population comprised 5,419 older workers employed by 624 organizations.

We conducted our analysis independently for each CHC. These subsamples are: older workers diagnosed with arthritis (N = 2,330 in 567 organizations, 43.0% of total sample), cardiovascular disease (N = 720 in 368 organizations, 13.3% of total sample), and sleep disorders (N = 816 in 396 organizations, 15.1% of total sample).

Measures

Dependent variable

Health-related work limitations were measured using the Limiting Long-Standing Illnesses (LLSI) measure (Bajekal, Harries, Breman, & Woodfield, 2004). The LLSI is a two-part harmonized single-item measure, which captures 1: perceived disabling effects of CHCs, and 2: perceived work limitations due directly to that CHC. The LLSI asks respondents "Do you have one or more of the following longstanding diseases (as diagnosed by a doctor)?," then proceeds with the question "Do these longstanding diseases limit your performance at work?" which has three possible responses: 3 = severely limited, 2 = moderately limited, and 1 = not limited. The LLSI has been widely used in censuses and surveys (Bajekal et al., 2004). The LLSI has high validity and is a stable measure of health-related work limitations (Bajekal et al., 2004).

Independent variables

Perceived access to FWAs. As access to FWAs depend on individual characteristics of older workers, such as occupational status (Danziger & Boots, 2008), it has been operationalized on the individual level as older workers' perceived access to FWAs. Information on perceived access to FWAs was derived from the question "Are the following human resource practices available to you in your organization?" This question was followed by a list of HR practices. Working-

time flexibility was measured by the item "Flexible working hours," while workplace flexibility was measured by the item "Working from home," and phased retirement was measured by the item "Reducing working hours prior to retirement." All items were answered by choosing between 0 = Human resource practice is not available and 1 = Human resource practice is available.

Organizational climate. Healthy ageing climate and psychological safety climate were each measured on a Likert scale using two items each. Healthy ageing climate was measured via the items "In this organization a lot of attention is paid to health and safety at work" and "Health and wellbeing of employees are important in this organization." Healthy ageing is increasingly viewed through the life course perspective, according to which healthy ageing is a lifelong development involving all stages of life (Kuh, Karunananthan, Bergman, & Cooper, 2014). Psychological safety climate was measured via the items "At my work many people are afraid to make mistakes" and "In this organization there is a culture of fear." Participants responded to these items on a 5-point Likert scale, which ranged from 1 = completely agree to 5 = completely disagree. The responses from the two items related to healthy ageing climate were first reverse-coded and then averaged to obtain a mean individual-level score for healthy ageing climate ranging from 1 to 5. The resulting score for healthy ageing climate showed high reliability (Spearman–Brown prophecy reliability estimate = .81). The responses for the two items relating to psychological safety climate were averaged to obtain a mean individual-level score of psychological safety climate ranging from 1 to 5. The resulting score of psychological safety climate showed moderate reliability (Spearman–Brown prophecy reliability estimate = .61).

Next, organizational-level climate variables were developed by aggregating individual-level measures of organizational climate by organization, based on the direct-consensus composition model (a model that averages individual members' responses to operationalize organizational-level scores [Cole, Bedeian, Hirschfeld, & Vogel, 2011]). These scale variables of organizational-level climate ranged from 1 to 5. They were used in multilevel regression analysis. Categorical variables of organizational climate were created for descriptive analysis. These variables comprised of three categories with scores higher than 3 indicating an organizational climate that supports healthy ageing and enhances psychological safety.

Control variables

We control for demographic characteristics, comorbidity with diabetes, psychological disorders, and other CHCs, and work-related factors. Within demographic characteristics, we adjust for age, sex, marital status, and wealth. We explicitly control for diabetes and psychological disorders because they are highly prevalent and comorbid with other CHCs in old age (Barnett et al., 2012).

Work-related factors concern the size of organization, sector, job type (blue-collar vs white-collar jobs), job position (supervisory vs non-supervisory position), proportion of workers over 50 years, proportion of female workers, and proportion of part-time workers. We control for size of organization and sector because the demands and resources of a job may differ based on these factors. In reference to job type, research has found that, in comparison to white-collar jobs, blue-collar jobs are characterized by high physical demands, thus increasing the likelihood of job strain and health impairments (Schaufeli & Taris, 2014). Likewise, job position was controlled for because supervisors benefit from more job control, fewer physical job demands, and easier access to resources, despite the likelihood that their job will be more mentally demanding (Bakker, Demerouti, & Euwema, 2005). Additional information on all variables is provided in Supplementary Table 5.1.

Data Analysis

Descriptive analyses were conducted to examine distribution of the sample and to evaluate the extent of health-related work limitations among older workers experiencing CHCs. Multilevel ordered logistic regression analysis was performed to analyze the impact of perceived access to FWAs, organizational climate, and control variables on health-related work limitations experienced by older workers with CHCs. Additionally, cross-level interactions were analyzed to assess the robustness of our findings. The analysis was carried out for the three CHCs independently.

To support the aggregation of climate variables to organizational-level constructs and to reassure the necessity for multilevel modeling, we estimated one-way analyses of variance (ANOVAs), together with interrater reliability indices (via intraclass correlation coefficients (ICC)). Interrater reliability indices supported the aggregation of individual-level scores of healthy ageing climate (ICC1 = .18, ICC2 = .99) and psychologically safe climate (ICC1 = .08, ICC2 = .99) to the organizational level. In addition, ANOVA results revealed significant and pronounced differences

in health-related work limitations (F (623, 4804) = 1.13, p = .02), healthy ageing climate (F (623, 4824) = 2.92, p < .001), and psychological safety climate (F (623, 4824) = 1.76, p < .001) between organizations. Taken together, this evidence justifies the aggregation of climate variables to organizational-level constructs and the use of multilevel analysis. All analyses were conducted using Stata/SE 14.0 (Stata, College Station, TX).

Results

Characteristics of Participants

Figure 5.1 demonstrates the extent to which arthritis, cardiovascular disease, and sleep disorders limit older workers' performance at work. While about half of the respondents experienced moderate health-related work limitations, 14.0% of respondents with arthritis, 14.7% of respondents with cardiovascular disease, and 19.1% of respondents with sleep disorders experienced severe health-related work limitations. For all three CHCs, approximately a third of respondents reported no work limitations at all.

Regarding access to FWAs, approximately half of the respondents with CHCs reported that they had access to working-time flexibility and workplace flexibility. A larger proportion (71.1%) of respondents had access to phased retirement (Supplementary Table 5.2). Concerning organizational climate, more than half of the respondents worked in organizations that relatively supports healthy ageing and enhances psychological safety. Approximately 1 in 10 respondents worked in organizations with a climate that provides low levels of support for healthy ageing and psychological safety (Supplementary Table 5.2).

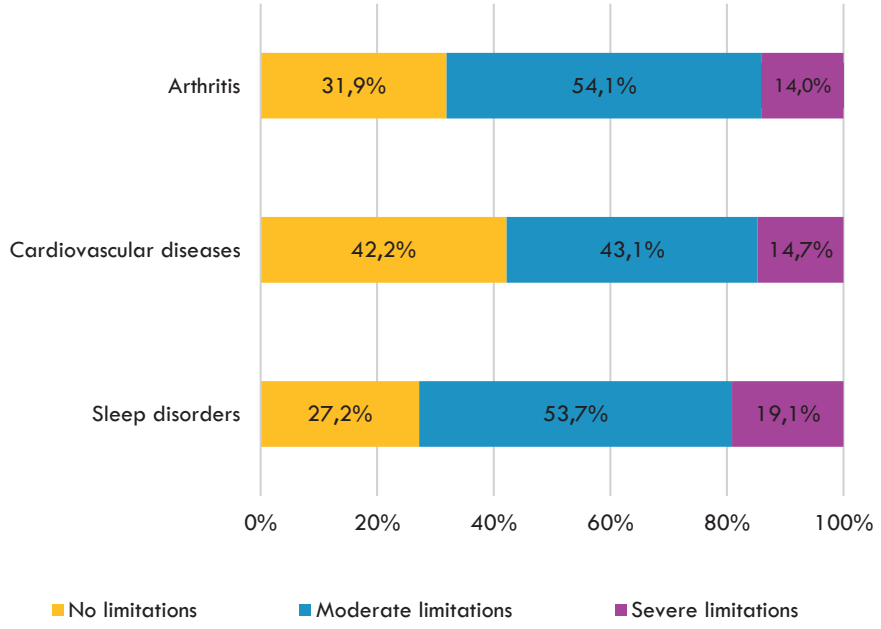

Figure 5.1. Perceived health-related work limitations of older workers with arthritis (N = 2,330), cardiovascular disease (N = 720), and sleep disorders (N = 816)

Influence of Perceived Access to FWAs and Organizational Climate on Health-related Work Limitations

Table 5.1 presents the results of multilevel ordered logistic regression analyses examining the relationships between organizational factors and health-related work limitations. Older workers' perceived access to working-time flexibility was associated with fewer health-related work limitations (Table 5.1). This effect was statistically significant for arthritis ($B = -.42$, $p < .001$) and sleep disorders ($B = -.38$, $p < .05$), and was borderline significant for cardiovascular disease ($B = -.33$, $p = .059$). Hence, the *work flexibility hypothesis - A* was supported. Figure 5.2 illustrates the probability of older workers reporting severe health-related work limitations when they perceived to have access to working-time flexibility and when they perceived to have no access to working-time flexibility. The figure shows that 21.3% of older workers with sleep disorders who perceived they had no access to working-time flexibility experienced severe health-related work limitations (compared to 16.2% for those who perceived to have access to work time flexibility).

This difference was consistent across all CHCs. The *work flexibility hypotheses - B and C* were not supported for other aspects of flexible working—workplace flexibility and phased retirement.

All models revealed that organizations with psychologically safe climates were associated with fewer health-related work limitations among older workers. This effect was significant and consistent among older workers with arthritis ($B = -.32$, $p < .05$), cardiovascular disease ($B = -.45$, $p < .05$), and sleep disorders ($B = -.48$, $p < .05$), supporting our *psychological safety climate hypothesis*. Figure 5.3 visualizes the association between psychologically safe organizational climate and health-related work limitations of older workers experiencing the three CHCs. The figure shows that, approximately 40% of older workers with sleep disorders who work in an organization with a psychologically unsafe climate experienced severe health-related work limitations, while only around 10% of older workers with sleep disorders who work in an organization with a psychologically safe climate experienced severe health-related work limitation. This result was consistent across the three CHCs. The *healthy ageing climate hypothesis* was supported for older workers with sleep disorders ($B = -.45$, $p < .05$). However, the expected association was not found for older workers with arthritis or cardiovascular disease.

Table 5.1

Covariates of perceived health-related work limitations experienced by older workers with arthritis (N = 2,330, number of groups = 567), cardiovascular disease (N = 720, number of groups = 368), and sleep disorders (N = 816, number of groups = 396)

Variables	Model 1: Arthritis		Model 2: Cardiovascular disease		Model 3: Sleep disorders	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Perceived flexible work arrangements						
Working-time flexibility	-0.42**	0.10	-0.33[a]	0.18	-0.38*	0.17
Workplace flexibility	-0.16	0.11	0.02	0.19	-0.15	0.17
Phased retirement	-0.00	0.09	0.11	0.16	0.09	0.15
Organizational climate						
Healthy ageing climate	0.04	0.12	0.17	0.21	-0.45*	0.20
Psychological safety climate	-0.32*	0.13	-0.45*	0.21	-0.48*	0.20
Demographic controls						
Age	-0.06*	0.03	0.02	0.05	0.01	0.04
Sex (reference group – male)	0.08	0.11	0.01	0.20	0.18	0.18
Marital status (reference group – partner present)	-0.14	0.11	-0.04	0.21	0.42*	0.18
Wealth	-0.06*	0.03	-0.07	0.05	-0.07	0.05
Health-related factors						
Diabetes	0.25	0.16	0.49*	0.22	-0.02	0.24
Psychological disorders	1.39**	0.18	1.89**	0.28	1.33**	0.21
Other chronic health conditions	0.80**	0.09	0.82**	0.16	0.74**	0.14

Work-related factors						
Size of organization (reference group - <50 workers)						
50 - 250 employees	0.04	0.17	0.53	0.28	-0.27	0.27
Over 250 employees	0.02	0.18	0.50	0.29	-0.31	0.28
Sector (reference group - government and education)						
Construction	0.25	0.20	0.20	0.29	0.18	0.36
Health and welfare	-0.02	0.14	-0.68*	0.26	0.25	0.22
Job type (reference group - blue-collar workers)	0.72**	0.13	0.59*	0.22	-0.03	0.22
Job position (reference group - supervisory position)	0.02	0.11	0.14	0.18	0.10	0.18
Proportion of part-time workers	0.00	0.00	0.02	0.01	-0.01	0.01
Proportion of workers over 50 years of age	0.00	0.00	0.00	0.01	0.01	0.01
Proportion of female workers	0.00	0.01	-0.01	0.01	0.01	0.01

Note. *p < 0.05, **p < 0.001, [a] p = 0.07. Dependent variable is perceived health-related work limitations experienced by older workers. Arthritis: Model is significant, prob > chi2 = 0.00, log likelihood = -2111.77. Cardiovascular disease: Model is significant, prob > chi2 = 0.00, log likelihood = -662.92. Sleep disorders: Model is significant, prob > chi2 = 0.00, log likelihood = -753.29

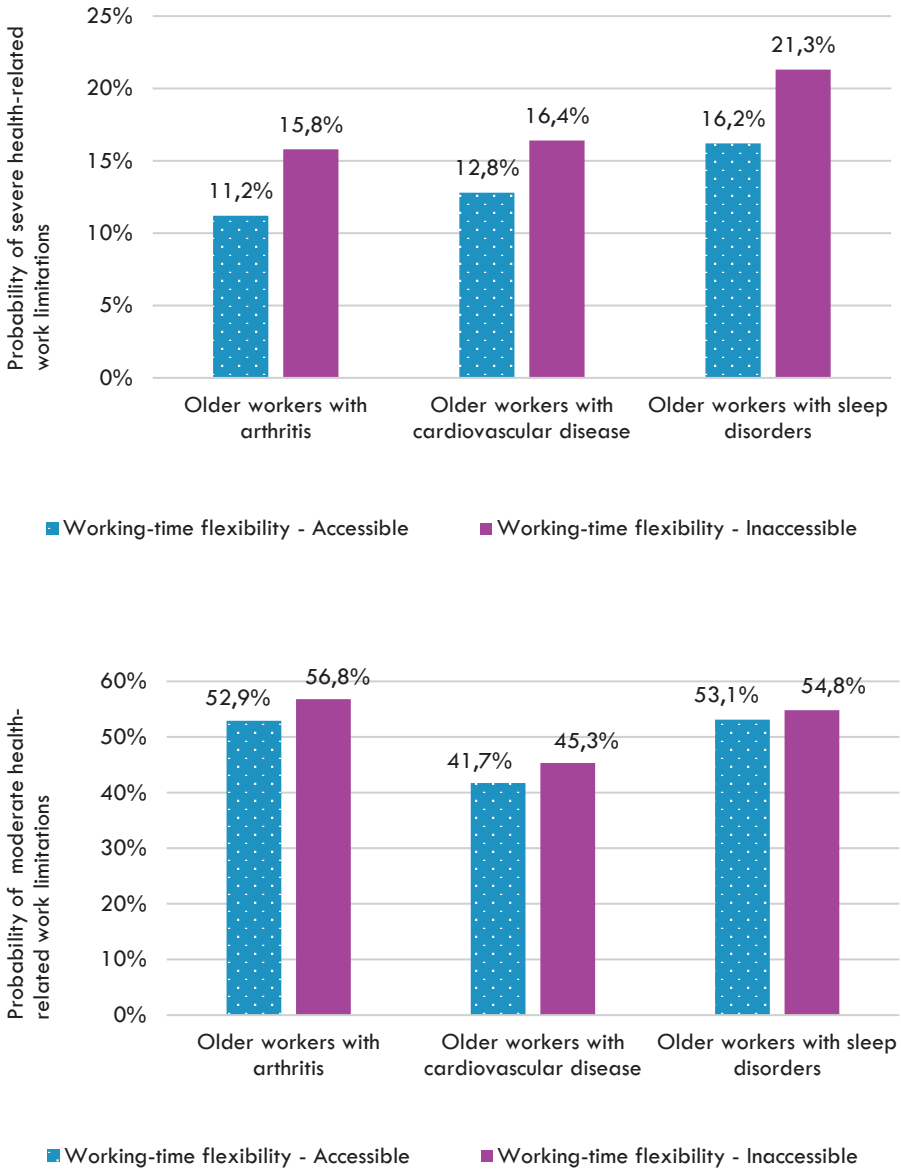

Figure 5.2. Illustration of the effects of perceived access to working-time flexibility on the probability of experiencing moderate and severe health-related work limitations among older workers with arthritis (N = 2,330), cardiovascular disease (N = 720), and sleep disorders (N = 816). Predicted values were calculated based on observable data with all variables at their mean value.

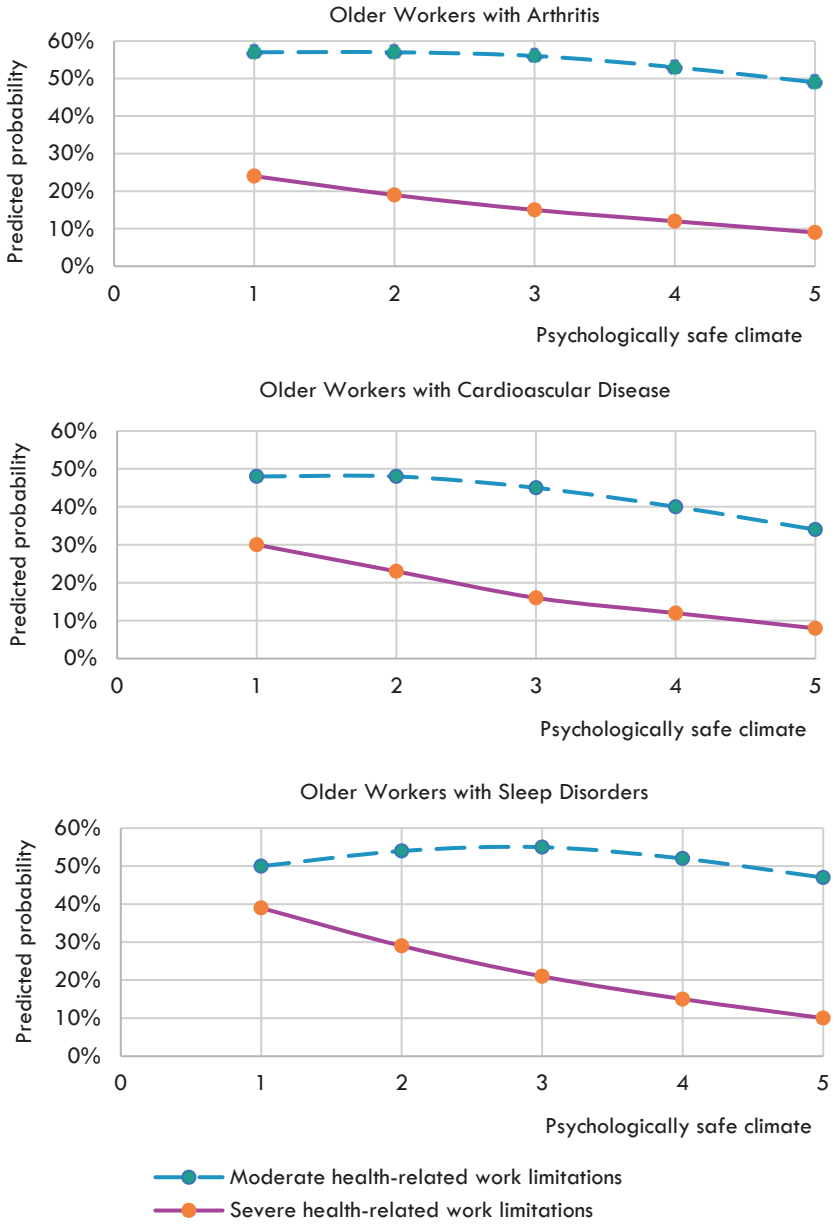

Figure 5.3. Illustration of the effects of a psychologically safe organizational climate on the probability of experiencing moderate and severe health-related work limitations among older workers with arthritis (N = 2,330), cardiovascular disease (N = 720), and sleep disorders (N = 816). Predicted values were calculated based on observable data with all variables at their mean value.

Findings on the influence of control variables showed that comorbid psychological disorders or other CHCs were associated with more health-related work limitations. In addition, employment in a blue-collar job was associated with greater health-related work limitations for older workers with arthritis ($B = .72$, $p < .001$) and cardiovascular disease ($B = .59$, $p < .001$). This association was not statistically significant for older workers with sleep disorders.

Using cross-level interactions, we analyzed several interaction effects. First, we tested whether effects of FWAs differed by the climate within the organization. Second, we tested whether the effects of organizational climate differed based on job type. We also looked for interactions between job type, sex, and size of organization. These analyses revealed no significant effects. Third, we explored whether the effects of FWAs and organizational climate differed by older workers' experience of comorbidity. A significant interaction between comorbidity with other CHCs and healthy ageing climate was evident among older workers suffering from arthritis ($B = -.75$, $p = .03$). This means that a healthy aging climate is associated with fewer health-related work limitations among older workers who simultaneously experienced both arthritis and other CHCs.

Discussion

Many older workers experience CHCs that limit their work. To date, no studies have assessed whether and how FWAs and organizational climates may help to reduce the work limitations experienced by older workers with CHCs. This is surprising, since employers are deemed vital in the process of developing policies and practices that facilitate longer working lives of older workers, especially those who are restricted by CHCs such as arthritis, cardiovascular disease, and sleep disorders. Through this study, we find strong support for our hypotheses that providing older workers experiencing CHCs with access to flexible working hours and a psychologically safe organizational climate is an important avenue in enhancing their employability.

We found older workers' perception of whether they have access to working-time flexibility to be associated with fewer health-related work limitations. Flexible working hours allows older workers to decide *when* they would prefer to work during the working day—that is, flexibility in scheduling within their regular full/part-time job. Older workers with CHCs seem to prefer this time flexibility and

the resulting autonomy to make decisions on how to structure their day around their work, disease symptoms, and health-related limitations and demands (such as doctor's visits) (Atkinson & Sandiford, 2016; Dropkin et al., 2016). Interestingly, these effects were not found for workplace flexibility and phased retirement. Although workplace flexibility allows older workers to work at home or any other place of their choice, there is also an expectation to work during specific working hours. In addition, workplaces provide workers with social contact (Jahoda, 1993, 1981), which positively influences workers' health and well-being (van der Elst, Näswall, Bernhard-Oettel, De Witte, & Sverke, 2016; Paul & Batinic, 2010). Phased retirement provides older workers with the flexibility to reduce their work hours gradually until they retire. However, the reduction of work hours will also lead to lowered earnings over the last years of work, thereby negatively impacting pension benefits, and in turn the desire to use phased retirement (Kantarci & Van Soest, 2008; Chen & Scott, 2003). Moreover, older workers experiencing poor health and CHCs may want to work longer in order to compensate for the financial costs of their health issues (Miah & Wilcox-Gök, 2007).

Next, this study found strong support for the hypothesis that the wider organizational environment has a large impact on how older workers with CHCs deal with their health-related work limitations. We found organizations with psychologically safe climates to be consistently associated with fewer health-related work limitations among older workers with CHCs. This result suggests that the ability to express oneself openly and disclose one's issues in an organization that has a climate in which one feels safe is associated with fewer health-related work limitations (Liang et al., 2012; Gignac & Cao, 2009; Siemsen et al., 2009). Our finding corroborates our theoretical framework, which suggests that psychologically safe organizational climates are a job resource that enhance open communication within organizations. Open communication and disclosure of one's limitations and needs within the organization would in turn increase the likelihood of receiving work accommodations, which may help manage health-related work limitations. This result emphasizes the need for interventions that target the organization as a whole. The occupational health principle "hierarchy of controls" (Halperin, 1996) proposes that interventions addressed at the organizational level or in the work environment produce more sustainable effects on the health of employees, than interventions that target employee characteristics at the individual level. Our study suggests that organizational-level interventions that improve psychological safety climates within organizations can be expected to lower health-related work limitations of older

workers with CHCs and improve their well-being, by increasing their confidence in the organization and encouraging disclosure of difficulties and needs.

There are some noteworthy strengths to our study. The core concept of the study brings innovation to the literature by simultaneously determining the extent to which the individual worker's perception of access to FWAs (on the individual level) and the organization's social climate (on the organizational-level) are associated with health-related work limitations in a true multilevel research design among older workers experiencing CHCs.

This study is, however, not without limitations. The cross-sectional nature of the data limits our ability to test causal effects. In specific cases, the experience of work limitations might even increase the CHC. For example, worries about work limitations may increase sleep disorders. In our design, we are also not able to capture the dynamic nature of CHCs and changes within organizations. This calls for longitudinal studies, which can investigate causal mechanisms and changes over time in the use of FWAs, aspects of organizational climate, and health-related work limitations experienced by older workers with CHCs. Furthermore, the results of this paper might point to a more general effect of "good employership." Employers with a supportive organizational climate, who offer FWAs, might also be employers who stand out positively in other important aspects, such as more social support from the management for older workers with CHCs. In this study, we measured the *perceptions* of work limitations of older workers with CHCs. Furthermore, we lack information on the severity of the CHCs experienced by older workers. Future research might also include objective measures of work limitations and severity of CHCs. Our dependent variable—health-related work limitations—measures work limitations that are direct results of CHCs. Thus, it restricts the study of older workers who do not experience any CHCs. In principle, FWAs and supportive organizational climates may positively influence the working lives of all older workers, not just those suffering from CHCs—this could be an important avenue for future research.

Retirement ages are increasing and are expected to increase further in the coming decades. As a result, organizations with ageing workforces are challenged to accommodate older workers who bring with them their CHCs and CHC-related needs and difficulties. Based on our results, we conclude that providing workers with access to flexible working hours and a psychologically safe organizational climate might act as an impetus to mitigate health-related work limitations and ensure the sustainable ageing of older workers who face the double burden of longer working lives and CHCs. Taken together, these results may ultimately benefit

the healthy longevity of older workers, the growth of organizations, and the development of the economy at large.

6

Do older manual workers benefit in vitality after retirement? Findings from a 3-year follow-up panel study[1]

[1]A slightly different version of this chapter has been published as: Vanajan, A., Bültmann, U., & Henkens, K. (2020). Do older manual workers benefit in vitality after retirement? Findings from a 3-year follow-up panel study. European journal of ageing, 18(3), 369–379. https://doi.org/10.1007/s10433-020-00590-7

Abstract

Objectives. Vitality is the feeling of physical and mental aliveness. Vitality benefits individual, organizational and societal well-being. However, we know much less about the dynamics in the levels of vitality and its' precursors. This study investigates the effects of retirement on vitality and how this effect differs between manual and non-manual workers and by baseline levels of vitality.

Methods. We used two waves of the NIDI Pension Panel Survey, collected in the Netherlands in 2015 and 2018. Data from 4,156 older workers (N=4,156), of whom 1,934 (46.5%) retired between waves, were analysed. Vitality is assessed in three ways, as: 1) a composite measure of vitality, and its subcomponents 2) energy and 3) fatigue.

Results. Conditional Change OLS Regression models demonstrated that retirement is associated with improved vitality and decreased fatigue. Older workers who retire from manual work at wave 1 experienced the largest gains in vitality and highest declines in fatigue at wave 2, compared to those who remained employed. Retirement was more advantageous for older workers who experienced poor vitality and high fatigue at wave 1. No such effects were found for energy.

Conclusion. Older workers in manual work, those experiencing low vitality and high fatigue at wave 1, may benefit most from early retirement. Since opportunities for early retirement are highly restrictive, it is essential to provide these groups of workers with effective work accommodations and interventions that may not only improve their vitality and quality of working life, but also extend their participation in the labour market.

Introduction

Retirement is a major life transition that has substantial effects on health (van Solinge, 2007). Many studies have looked at the effect of retirement on health, with conflicting and inconsistent results (van der Heide, van Rijn, Robroek, Burdorf, & Proper, 2013; Butterworth et al., 2006). These studies have examined the effect of retirement on a broad array of health measures, ranging from general self-rated physical and mental health to specific chronic health conditions. Rarely have these studies sought to understand the effect of retirement on vitality-the feeling of aliveness, both in the physical (healthy, capable and energetic) and mental (meaning and purpose) sense (Hennekam, 2016).

Being vital is beneficial for individuals, organizations and society. A study among Dutch adults found vitality to be positively associated with increased economic, societal and social participation and negatively associated with societal costs (van Steenbergen, van Dongen, Wendel-Vos, Hildebrandt, & Strijk, 2016), revealing the potential benefits of improving vitality on an individual level for societal well-being. Vital employees are described to be full of positive energy and mentally and physically strong (Kark & Carmeli, 2009). They are also productive (Carmeli, 2009) and are satisfied and successful at their jobs (Hennekam, 2016; van Scheppingen et al., 2014). In contrast, low levels of vitality have been associated with burnout symptoms, especially with emotional exhaustion (Basinska, Wiciak, & Dåderman, 2014). Further, low vitality has been shown to moderate the relationship between burnout and turnover intentions at work (Elçi, Yildiz, & Erdilek Karabay, 2018). It has also been shown that older workers experiencing chronic health conditions prefer to retire early due to the poor vitality they experience in their daily lives (Vanajan, Bültmann, & Henkens, 2020b). Currently, the labour market in the western world is experiencing an increase in public pension age and an abolishment of early work exit routes. In this context, it is crucial to better understand how vitality may change from work to retirement in order to sustainably extend working lives. Therefore, this study focuses on understanding the effect of retirement on older workers' and retirees' vitality. Vitality is measured as a combination of the positive state- energy, and the negative state-fatigue (Deng, Guyer, & Ware, 2015). To gain insights into how retirement affects vitality, this study will separately analyse the effect of retirement on vitality, and its subcomponents, energy and fatigue. By separately analysing vitality, energy and fatigue, we aim to distinguish which of

these constructs should be addressed using governmental or workplace interventions and accommodations.

While numerous studies discuss the health consequences of retirement, more recent literature has emphasized the importance of understanding the heterogeneity in the health consequences of retirement (Henning, Lindwall, & Johansson, 2016). Some groups of retirees may find retirement beneficial to health as retirement could relieve them from the daily burden of work and give them more time to focus on their health, family and leisure activities. Others may find retirement detrimental to health as it may signify a loss in social relationships, daily routine and the sense of identity and purpose. These reactions to retirement might greatly depend on situational factors, such as the characteristics of the job one retires from, and personal characteristics, such as one's health before retirement (Henning et al., 2016). This study aims to understand the effect of manual and non-manual work (a characteristic of a job) and vitality at baseline (a personal characteristic), on the change in vitality after retirement or with continued work.

Only a few studies looked at the differential impact of retirement by characteristics of a job. These studies suggest that retirement benefits the health of those who retire from jobs that are stressful, demanding and offer low work-related resources (Eibich, 2015; Pinquart & Schindler, 2007). Although it is important to study employees' perceptions about his/her job's demands and how this affects their health in retirement, for practice implications it is more insightful to differentiate between the types of jobs that are more or less detrimental to health. By this we will be able to identify the types of workers who might experience greater health benefits in retirement. The distinction between manual and non-manual work is deemed to be most relevant. Manual work has been associated with high physical demands and, consequently, physical health impairments (Schaufeli & Taris, 2014) and workers in these jobs may benefit more from retiring than non-manual workers. Currently, the statutory pension age in the Netherlands is 66 years and 4 months. This is the mandatory age of retirement. While older Dutch workers prefer to retire early, this option is seldom practised as it is financially disadvantageous (van Solinge & Henkens, 2017). Thus, a majority of older workers work up to the statutory pension age. As working contracts are usually terminated once the older workers reach the retirement age, there is also no possibility of working after retirement age. These measures restrict older workers' choice in when they can retire. On top of this, similar to the trends in other parts of the Western world, the statutory pension age for *all* workers in the Netherlands is increasing. The statutory pension age,

which was 65 years in 1957, will be increased up to 67 years by 2024, based on the increasing trend in life expectancy (van Solinge & Henkens, 2017). Even though Dutch retirement-related policies are more generous and well-structured compared to other western nations, the increase in statutory pension age could still negatively influence vulnerable groups of older workers. This concern has triggered widespread debate among policy makers on whether statutory pension age should be increased for workers in more demanding jobs, such as manual work. In order to contribute to this debate, we study whether manual workers benefit more in terms of vitality, energy and fatigue by retiring than non-manual workers? Our hypothesis is that older workers in manual work will experience greater improvements in vitality and energy and greater declines in fatigue after retirement, while older workers in non-manual work may not experience such improvements (*manual work hypothesis*).

Several studies revealed that older workers experiencing poor health might benefit more from retirement in terms of their health (van den Bogaard & Henkens, 2018; van den Bogaard, Henkens, & Kalmijn, 2016). For those older workers, retirement may be a relief from daily work-related burdens and give them more time to focus on health promotion and leisure activities (van den Bogaard, Henkens, & Kalmijn, 2016). Older workers in manual work may also report low levels of vitality before retirement due to the demanding nature of their jobs. We hypothesize that older workers with poor vitality at baseline may experience greater improvements in vitality after retirement and that this effect partially meditates the hypothesized positive effect of retirement on vitality among manual workers (*baseline vitality hypothesis*).

This study contributes to current literature in three ways. First, it is to the best of our knowledge the first to longitudinally assess the effect of retirement on vitality and its subcomponents. Vitality is a driver of physical and mental well-being and fostering vitality positively impacts organizational productivity and social participation. By analysing vitality and its two subcomponents, energy and fatigue, we add to the current retirement-related literature and we propose practical suggestions on whether interventions should by geared at enhancing energy or reducing fatigue in the workplace. Second, we study how manual work and vitality at baseline influences the effect of retirement on the change in vitality from wave 1 to wave 2. Thereby, we contribute to literature on the heterogeneity of the health consequences of retirement. Furthermore, we contribute to current policy debates on whether public pension age should be increased for all workers, regardless of

job type and health status. By providing cues into who would benefit more from retirement, we could demonstrate the importance of flexible public pension and tailored interventions based on job type (van der Mark-Reeuwijk et al., 2019). Third, our three-year follow-up panel data offer us the unique opportunity to study the heterogeneity in the effects of retirement on vitality based on a sample of older workers aged 60-65 representative for a large part of the Dutch workforce. Approximately half of the sample transitioned into retirement at follow-up.

Methods

Population

The NIDI Pension Panel Survey is a Dutch prospective cohort study of employed older workers (and retirees) between the ages of 60 and 65 years (Henkens, van Solinge, Damman, & Dingemans, 2017). This study used data from the NIDI Pension Panel Survey, conducted in 2015 and 2018 in the Netherlands. The NIDI Pension Panel Survey has a stratified random design. In the first step, a sample of organizations was drawn from the files of three large pension funds in the Netherlands (ABP, PfZw and BpBouw). The stratified sample of organizations was drawn along the dimensions of organizational size and sector. The pension funds together represent about 49% of the wage employed workers in the Netherlands, thereby guaranteeing sufficient variation in manual and non-manual labor, job category, educational level and gender (De Nederlandsche Bank, 2015). In the second step, older workers aged between 60 and 65 years (birth cohorts 1950-1955), who worked at least 12 hours a week, were randomly sampled from the selected organizations. For the first wave, a total of 15,470 questionnaires was sent out to older workers, of which 6,793 were completed and returned (net response rate of 44%). Attrition occurred between the first and second waves due to mortality (N=86) and other reasons (e.g., duplication of records, retirement by first wave) (N=12). For the second wave, questionnaires were sent out to 6,695 older workers who participated in the first wave. In total 5,326 responded (net response rate of 79.6%). Supplementary Table 6.1 describes and contrasts characteristics of older workers who did and did not respond to the second wave. Older workers who received a shorter version of the questionnaire that did not include all relevant variables (N=513) were excluded from the sample. Missing information on one or more items used to measure vitality led to the exclusion of 326 respondents. A total

of 331 respondents indicated that they retired because of health issues. This group was removed from the sample for reasons of endogeneity: they might bias the results by underestimating the effect of retirement. The final study sample comprised 4,156 older workers, all working at wave 1 (wave 1), of whom 1,934 (46.5%) retired by wave 2 (wave 2), while 2,222 (53.6%) remained in paid employment. Retirement was defined as the complete detachment from workforce, identified by whether the older worker worked any number of hours for pay. Supplementary Table 6.2 describes characteristics of older workers who retired and older workers who continued to work by wave 2.

Measurements

Dependent variables

Level of vitality at wave 1 and wave 2 was measured using Medical Outcome Study's Quality of Life Questionnaire, Short Form-36's (SF-36) vitality scale. This 4-item measure of vitality questions 'How much of the time during the past 30 days did you feel: (i) full of energy, (ii) tired, (iii) worn out and (iv) full of pep' (Ware & Sherbourne, 1992) (Supplementary Table 6.3). Respondents answered all items on a six-point scale, ranging from *constantly (1)* to *never (6).* Items 'full of energy' and 'full of pep' were reverse coded. Thereafter, responses for all four items were added to construct a single continuous measure of vitality at wave 2, which was transformed to range from 0 to 100. Higher values indicate higher levels of vitality at wave 2. This measure of vitality demonstrated high reliability at wave 1 (Cronbach's alpha=0.81) and at wave 2 (Cronbach's alpha=0.82). The minimally important difference (MID) between wave 1 and wave 2 for vitality measured using the SF-36 vitality scale for groups of participants was recommended to be held at 5 points on a 0-100 scale (MID) (Bjorner et al., 2007). This measure will be used to ascertain whether the change in vitality levels is of clinical relevance.

In addition to measuring vitality as a single construct, we also separated it to study the positive and negative states within vitality: energy and fatigue, as has been suggested in the literature (Deng, Guyer, & Ware, 2015; Ware & Sherbourne, 1992). Energy at wave 2 was measured using the two items 'full of energy' and 'full of pep'. A single continuous measure of energy ranging from 0 to 100 was constructed. Higher values indicated higher levels of energy at wave 2. After reverse coding, the two items 'tired' and 'worn out', they were used construct a single continuous measure of fatigue at wave 2 which ranged from 0 to 100. Higher values reflected higher levels of fatigue at wave 2. These 2-item scales of energy (wave 1:

Cronbach's alpha=0.74, wave 2: Cronbach's alpha=0.76) and fatigue (wave 1: Cronbach's alpha=0.82, wave 2: Cronbach's alpha=0.81) demonstrated high reliability.

Independent variables

All respondents were employed at wave 1. Older workers' transition into retirement or their continuance of work between wave 1 and wave 2 was assessed by inquiring 'Which situation applies to you?' at wave 2. Responses were expressed by choosing between *I work for pay* and *I am fully retired*. Based on the responses, we created a dichotomized variable of retirement status at wave 2. We considered anyone who was employed in their career job, bridge employment, part-time work or short-term work as *working (0)* and anyone who was fully retired and engaged in no paid work as *retired (1)*.

Manual work was measured at wave 1 using the item 'In which category could your job or profession be grouped?'. Respondents chose one among nine categories of the International Standard Classification of Occupation (Ganzeboom, 2010). The categories ranged from *higher intellectual or free profession (1)* to *agricultural profession (9)*. Based on these responses, we created a dichotomized variable of manual work, which we coded 1 if respondents' jobs consisted of manual work based on the International Standard Classification of Occupation (Ganzeboom, 2010).

Covariates

We controlled for several demographic, health-related and work-related factors, all measured at wave 1. Age, in years, was treated as continuous variable. Sex (*1=male*) and presence of a partner (*1=partner present*) were represented by dichotomized variables. Educational attainment was measured in seven categories: *primary school (1), lower vocational education (2), lower general secondary education (3), intermediate vocational education (4), upper general secondary education (5), higher vocational education (6)* and *university graduate (7)*. Subsequently, we grouped categories together to create three dichotomized variables: low (1,2,3), moderate (4,5) and high (6,7) educational attainment. Similarly, wealth was measured in seven categories: *< 5000 euros (1)* to *> 500,000 euros (7)*. Thereafter, it was grouped into three dichotomized variables: low (less than 50,000 euros), moderate (between 50.000 and 250,000 euros) and high (more than 500,000 euros) levels of wealth. Caregiving responsibilities were coded 1 if

respondents replied affirmatively to the question 'Do you provide help to family members or friends who are ill or in need of help?'.

Additionally, we adjusted for whether respondents suffered from chronic health condition/s (CHCs). CHC was dichotomized and coded 1 if respondents experienced one or more CHC. Work-related factors included: full-time employment, supervisory position, size of organization and sector. Full-time employment and supervisory position were dichotomized. Respondents who worked for or over 36 hours a week were coded 1 on full-time employment. Supervisory position was coded 1 if respondents said *yes* to the question 'Do you have a supervisory position?'. Organizational size and sector were categorical variables with three categories each. Organizations were separated by size into small (<50 employees), medium (50-250 employees) and large (>250 employees). Organizations belonged to three sectors: government and education, construction and health and welfare. Descriptive statistics and coding and psychometric properties of all variables, before standardization, are presented in Supplementary Table 6.4.

Analyses

To examine the effect of retirement and manual work on the change in vitality, energy and fatigue between wave 1 and wave 2, we conducted conditional change ordinal least square (OLS) regression analyses. In conditional change models, the dependent variable measured at wave 2 is regressed on levels of the dependent variable measured at wave 1, independent variables and control variables (Aickin, 2009). Including wave 1 values of the dependent variable in the regression analysis controls for possible ceiling effects. In our conditional change models, the scores of vitality, energy and fatigue at the second wave were the dependent variables. We regressed these dependent variables against their wave 1 values, retirement status at wave 2 and manual work. The resulting effects could be interpreted as change effects from wave 1 to wave 2.

Model 1, Model 2 and Model 3 examined the effects of retirement, manual work and wave 1 vitality, energy or fatigue on the change in vitality (model 1), energy (model 2) or fatigue (model 3) between wave 1 and wave 2. Model 1a and model 1b predict the change in vitality after retirement. The key difference between models 1a and 1b is that model 1b includes the interaction term between wave 1 vitality and retirement status on the change in vitality after retirement, while model 1a does not.

All dependent variables were standardized before regression analyses. This allowed the interpretation of dichotomized variables (specifically retirement status and manual work) as Cohen's *d* effect sizes (Cohen, 2013). Missing data of all variables, except vitality, fatigue and energy, were imputed using single stochastic regression imputation (Enders, 2010). As item non-response was under 5% for any single item in our data, our use of a less vigorous missing data imputation method was acceptable (Little, Jorgensen, Lang, & Moore, 2014).

Results

Table 6.1 presents the results of the conditional change OLS regression analyses. It examined the effects of retirement, manual work and wave 1 vitality, energy or fatigue on the change in vitality (model 1), energy (model 2) and fatigue (model 3) from wave 1 and wave 2.

Vitality

Model 1a showed that vitality increased after transitioning into retirement (Cohen's d =0.34, $p<0.001$). Model 1a also revealed that being engaged in manual work is associated with a decrease in vitality among all older workers (Cohen's d=-0.22, $p<0.001$). Manual workers who retired experienced a greater increase in vitality than non-manual workers who retired. This is evident from the significant positive interaction between manual work and retirement on the change in vitality between wave 1 and wave 2 in model 1a (b=0.12, $p<0.05$). Figure 6.1 illustrates the differences in the change in vitality between manual and non-manual workers. Manual workers have lower levels of vitality at baseline (wave 1) and showed an increase in vitality between wave 1 and wave 2 for those who retired and a decrease in vitality for those who remained employed. Also, non-manual workers who retired showed improvements in vitality compared to those who remained employed, but to a lesser extent. For both retired and non-retired workers, the MID for vitality exceeded the 5 points, for both manual workers (6.53) and non-manual workers (5.07) affirming these differences in vitality to be clinically relevant. The *manual work hypothesis* was confirmed.

In Model 1b we extended the baseline model (1a) by including the interaction term between wave 1 vitality and retirement status. This model showed that the effect of retirement on changes in vitality between wave 1 and wave 2 is

highly dependent on the baseline level of vitality at wave 1. Older workers with low levels of vitality at wave 1 benefit much more from retirement than workers with high levels of vitality at wave 1 (b=-0.15, p<0.001). This is illustrated in Figure 6.2, which shows that the size of the effect of retirement on the change in vitality was much stronger for older workers experiencing low levels of vitality at wave 1 (b=0.95, p<0.001) than for those experiencing high levels of vitality at wave 1.

Furthermore, the addition of this interaction effect in model 1b leads to the reduction in the size of the interaction effect between manual work and retirement (from b=0.12, p<0.05 in model 1a to b=0.10, p<0.10 in model 1b). This provides evidence that the improvement of vitality upon retirement among manual workers might be traced back to the fact that manual workers have lower baseline levels of vitality. This confirms the *baseline vitality hypothesis.*

Energy

Model 2 showed that retirement is associated with increased energy levels (Cohen's d=0.20, p<0.001). There was no significant difference in the change in energy levels from wave 1 to wave 2 between manual and non-manual workers; the interaction term between manual work and retirement status was not significant (b=0.06, p>0.05). Moreover, the interaction term between retirement status and wave 1 energy level on the change in energy levels from wave 1 to wave 2 was not significant (b=-0.02, p>0.05).

Table 6.1.

Effects of Retirement Status at Wave 2 and Manual Work on Change in Vitality, Energy, or Fatigue between Wave 1 and Wave 2 (N = 4,156)

Variables	Model 1: Vitality at w2				Model 2: Energy at w2		Model 3: Fatigue at w2	
	1a: without vitality at w1 x retirement status at w2		1b: with vitality at w1 x retirement status at w2					
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Retirement Status at w2 (1 = retired)	0.34**	0.03	0.35**	0.03	0.20**	0.03	-0.40**	0.03
Vitality at w1	0.55**	0.01	0.62**	0.02				
Vitality at w1 x Retirement status at w2			-0.15**	0.02				
Energy at w1					0.49**	0.02		
Energy at w1 x Retirement status at w2					-0.02	0.03		
Fatigue at w1							0.61**	0.02
Fatigue at w1 x Retirement status at w2							-0.20**	0.03
Manual work (1 = manual work)	-0.22**	0.05	-0.22**	0.05	-0.19**	0.05	0.21**	0.05
Manual work x Retirement status at w2	0.12*	0.06	0.10[a]	0.06	0.06	0.07	-0.14*	0.06
Demographic controls (w1)								
Age	0.02*	0.01	0.02*	0.01	0.02*	0.01	-0.03*	0.01
Sex (1 = male)	0.02	0.03	-0.02	0.03	-0.01	0.03	-0.05	0.03
Presence of partner (1 = partner present)	0.05[a]	0.03	0.06[a]	0.03	0.11*	0.03	-0.00	0.03
Educational attainment (ref = low)								
Moderate	0.03	0.04	0.02	0.04	0.08[a]	0.04	0.03	0.04

High	0.08*	0.04	0.07*	0.04	0.12*	0.04	-0.04	0.04
Wealth (ref = low)								
Moderate	0.07*	0.03	0.07*	0.03	0.04	0.03	-0.09*	0.03
High	0.10*	0.04	0.10*	0.03	0.09*	0.04	-0.09*	0.04
Caregiving responsibilities (1 = provides care)	0.01	0.02	0.01	0.02	0.02	0.03	0.01	0.02
Health-related controls (w1)								
Having a chronic health condition/s (1 = yes)	-0.11**	0.03	-0.11**	0.03	-0.12**	0.03	0.13**	0.03
Work-related controls (w1)								
Full-time employment (1 = employed full-time)	0.02	0.03	0.03	0.03	0.04	0.03	-0.01	0.03
Supervisory position (1 = supervisory position)	-0.05[a]	0.03	-0.05[a]	0.03	-0.05[a]	0.03	0.03	0.03
Organizational size (ref = small)								
Medium	0.02	0.03	0.02	0.03	-0.02	0.04	-0.05	0.04
Large	0.00	0.04	0.00	0.04	-0.03	0.04	-0.03	0.04
Organizational sector (ref = government and education)								
Construction sector	0.04	0.04	0.04	0.04	0.06	0.04	-0.00	0.04
Health and welfare sectors	0.03	0.03	0.02	0.03	0.03	0.03	-0.02	0.03
Constant	-1.40*	0.57	-1.45*	0.56	-1.43*	0.61	1.68*	0.57
Adjusted R^2	0.38		0.39		0.29		0.36	

Note. ** p<0.001, * p<0.05, [a]p<0.10, Coef. = coefficient, SE = standard error, w1 = wave 1, w2 = wave 2

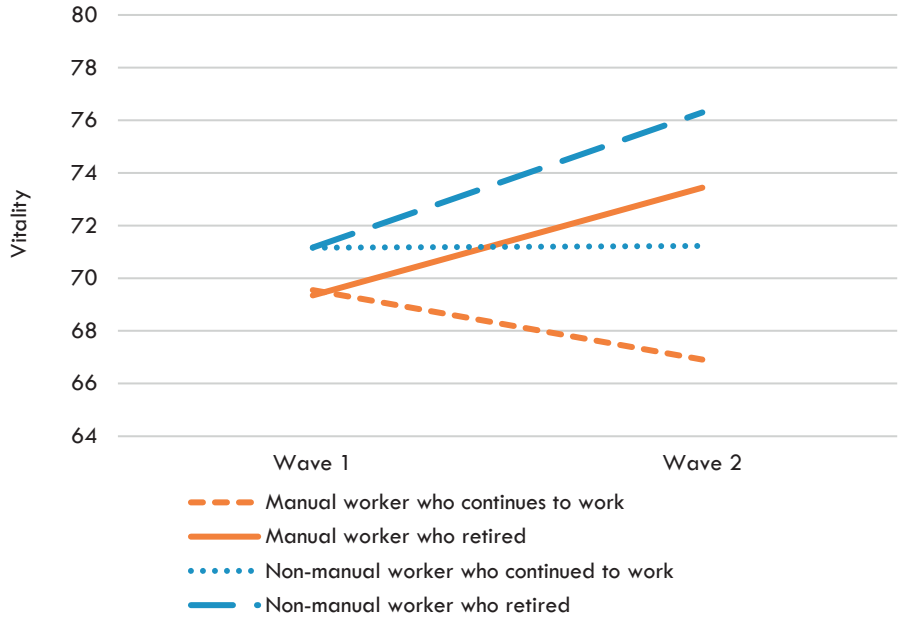

Figure 6.1. Effects of retirement and manual work on vitality from wave 1 to wave 2 among older workers and retirees

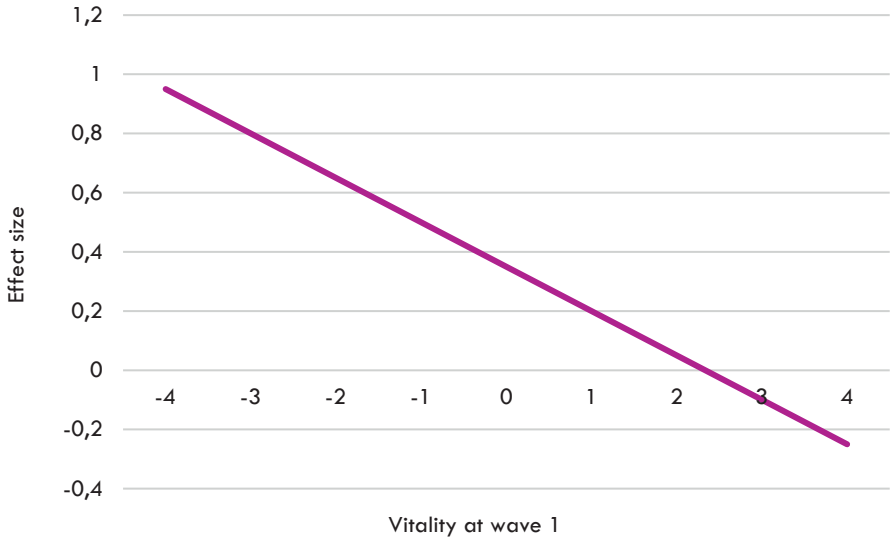

Figure 6.2. Effect of retirement on older workers' vitality at wave 2 by vitality at wave 1

Fatigue

Model 3 reveals that retirement is associated with reduced fatigue levels (Cohen's *d*=-0.40, p<0.001). Manual workers who retired experienced a greater decrease in fatigue than non-manual workers who retired (*b*=-0.14, p<0.05). This confirms the *manual work hypothesis*. Figure 6.3 illustrates this interaction effect. Older manual workers who remained employed experienced increases in fatigue between wave 1 and wave 2, whereas their retired counterparts reported decreases in fatigue between both waves. Older non-manual workers who remained employed reported a slight increase in fatigue at wave 2, whereas those who retired experienced decreases in fatigue at wave 2.

Moreover, our findings showed that the negative effect of retirement on fatigue is much stronger for older workers who report high levels of fatigue at baseline. This is affirmed by the significant negative interaction between retirement status and wave 1 fatigue on the change in fatigue from wave 1 to wave 2 (*b*=-0.20, p<0.001). This confirms the *baseline fatigue hypothesis*.

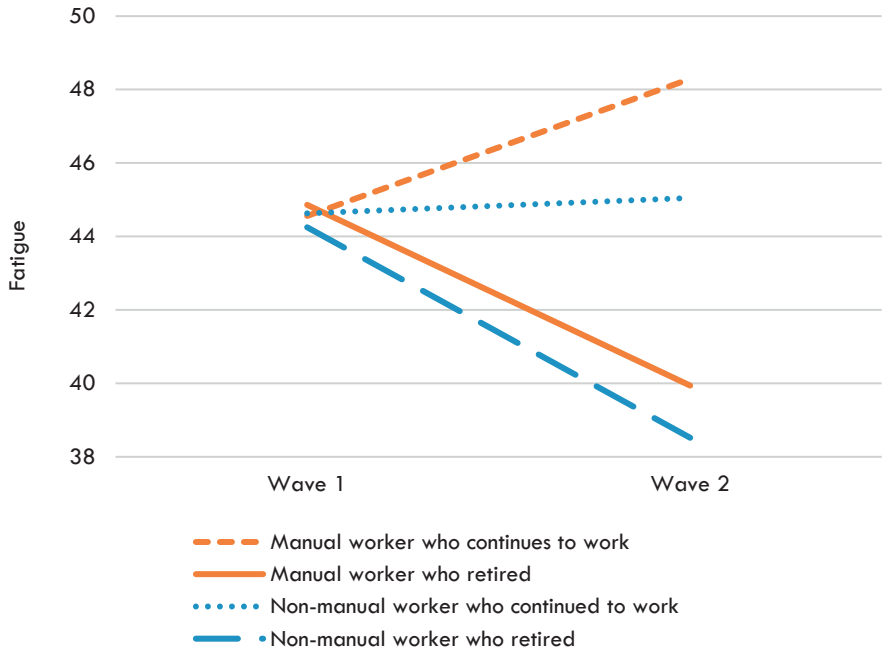

Figure 6.3. Effects of retirement and manual work on the change in fatigue from wave 1 to wave 2 among older workers and retirees

Discussion

Vitality is an important aspect of health. This study is, to the best of our knowledge, one of the first to describe the effect of retirement on vitality and its subcomponents, energy and fatigue. We demonstrate how this effect varies based on wave 1 job type and wave 1 vitality. Our findings reveal that retirement is associated with a clinically relevant increase in vitality. This increase was greatest for older workers in manual work and older workers experiencing low levels of vitality at wave 1. Additionally, we demonstrate that retirement reduces fatigue, more so for older workers who retired from manual work and those who were fatigued before retirement. No such effects were found for energy.

By disentangling the subcomponents of vitality, we demonstrate that fatigue, not energy, is the driver for change in vitality from wave 1 to wave 2. This could be due to the association between fatigue and burnout. Many studies have shown that fatigue and burnout share similar symptoms and consequences (Leone, Wessely, Huibers, Knottnerus, & Kant, 2011), and that fatigue acts as a predictor of burnout (Raftopoulos, Charalambous, & Talias, 2012). Such an association has not been found between energy and burnout. Our findings offer insights into how vitality can be improved in practice: either by promoting a general notion of vitality or, better yet, by targeting the reduction of fatigue. Worksite vitality interventions, such as the Vital@Work intervention, worksite yoga and exercise interventions (de Vries, van Hooff, Guerts, & Kompier, 2017; Strijk, Proper, van der Beek, & van Mechelen, 2012) and mobilization interventions (Mailey, Rosenkranz, Ablah, Swank, & Casey, 2017), have been found to improve vitality among older workers. With regards to fatigue at the workplace, interventions that target the improvement of sleep have been shown to successfully reduce fatigue among workers (Sadeghniiat-Haghighi & Yazdi, 2015). Additionally, workplaces that promote psychosocial safety climates have been associated with better recovery among workers when fatigued (Garrick et al., 2014). Building on these findings, organizations may offer their older workforce with effective (worksite) vitality and fatigue interventions that could sustain and promote the health of older workers, while they are at work.

The effect of retirement on vitality is not uniform across all older workers. Compared to non-manual workers, manual workers who retired experienced greater health benefits (in terms of vitality and fatigue), while manual workers who continued to work experienced greater health declines. Manual work has been associated with a greater physical workload, greater physical job demands and less

control over their work (Raittila, Rahkonen, Lahelma, Alho, & Kouvonen, 2017; Schreuder, Roelen, Koopmans, & Groothoff, 2008). Manual workers are also engaged in repetitive, risky and strenuous movements on a daily basis (Melchior et al., 2006). These unfavourable working conditions have been shown to fuel stress and unhealthy behaviours, leading to health inequalities between manual and non-manual workers (Peretti-Watel, Constance, Seror, & Beck, 2009). Moreover, manual workers were found to have lower work ability than non-manual workers, which in turn was associated with long-term sickness absence from work (Schouten et al., 2015). In addition, it is a challenge to develop worksite vitality interventions that target manual workers. Most interventions that exist today focus on and cater to non-manual workers (de Vries et al., 2017; Mailey et al., 2017; Strijk, Proper, van Mechelen, & van der Beek, 2013; Strijk et al., 2012). Our results are interesting in view of the ongoing debate about increasing retirement ages in ageing countries. This increase may be more challenging for some groups of older workers, such as manual workers, compared to others. A study that questioned employer's perspectives on the increasing retirement age in The Netherlands revealed that employers from construction and industry sectors were highly concerned about the physical capabilities of their older employees to work longer and that they overwhelmingly supported the lowering of the public pension age for manual workers (van Dalen, Henkens, & Oude Mulders, 2019). Instead of sticking to a one size fits all approach, policy makers may consider introducing job type-based and health-based flexible pension options that accommodate the heterogeneities in the health consequences of retirement (*Health and working longer*, 2018; van Dalen, Henkens, & Oude Mulders, 2019). Moreover, organizations may consider reducing the extent of job demand and job burdens on older manual workers by altering their job roles. Likewise, future research could contribute by developing worksite vitality or fatigue reduction interventions that are tailored to the unique difficulties and needs faced by manual workers.

The health effects of retirement also depended on how healthy older workers are before retirement: older workers experiencing poor vitality before retirement experienced greater surges in vitality after retirement. Poor health among older workers is a by-product of ageing (McMahan & Sturz, 2006). A significant proportion of older workers suffer from health-related work limitations (Vanajan, Bültmann, & Henkens, 2020a). Past studies have described ways in which organizations can accommodate older workers with poor health and health-related work limitations. For example, organizations with psychologically safe workplace

climates are associated with fewer health-related work limitations (Vanajan, Bültmann, & Henkens, 2020a). Similarly, the provision of flexible work arrangements is shown to help reduce the negative impact of poor health among older workers (Vanajan, Bültmann, & Henkens, 2020a; Moen, Kojola, & Schaefers, 2016). Moreover, our result calls to view occupational health and safety through the life course perspective (Amick, McLeod, & Bultmann, 2016). Occupational health and safety professionals should consider how earlier (working) life influences later life health outcomes (Amick, McLeod, & Bultmann, 2016). In this case, how vitality earlier in life (together with numerous other labour market, work and health trajectories) could influence vitality at work and after retirement in later life.

The core strength of this study is that it goes beyond existing literature in the health-retirement nexus by simultaneously studying the effect of retirement on vitality and its subcomponents and by examining how this effect may vary based on manual versus non-manual work and baseline vitality of older workers. This is done using an innovative new cohort study with two waves, the second of which was a 3-year follow up. This cohort study includes data on many older workers who made the transition into retirement and who are still working. In addition to this, the findings provide insights into policy and practice implications on an organizational and governmental level.

This study is not without its limitations. This study is conducted in the Netherlands, where retirement benefits are generous and well structured. Our results, therefore, may not be generalizable to nations with dissimilar pension structures. It is also interesting to further elucidate the mechanisms through which retirement increases vitality. The mechanisms might not only relate to the lack of work-related burdens, but also to more rest, more leisure time or to the development of positive health behavior.

The extension of working lives is a key policy and public health priority in the western world. Linking public pension age to an averaged measure of life expectancy is more likely to increase the burden on already disadvantaged groups of older workers (Krekula & Vickerstaff, 2020). Our findings show that older workers in manual work and those experiencing low vitality and high fatigue may suffer from an extension of working lives. Current work-related and retirement-related policies focus on the average worker, without making any distinctions between workers in manual jobs and workers who no not face any physical strain in their work. This study might stimulate policy makers to consider the differences in the ways in which specific groups of older workers react to an increased retirement age, in order to

develop inclusive and sensitive retirement-related policies (Krekula & Vickerstaff, 2020). In any case, it is beneficial to provide older workers with effective interventions aimed at improving vitality and reducing fatigue. Additionally, it is advantageous to accommodate age-related detriments in health and work ability through flexible work arrangements and supportive organizational climates. The timely provision of these interventions, may not only improve the vitality of older workers, but also the vitality of organizations and the society at large.

7

Discussion

Statutory retirement ages are increasing throughout the Western world. As a result, many older workers are working longer while experiencing chronic health conditions. In order to protect and promote older workers' wellbeing and capacity to work in the latter years of their careers, stakeholders - including, policy makers, employers and researchers - need to better understand the effects of chronic health conditions on older workers, while also deliberating on what organizations could do to enhance the healthy ageing of older workers. The main goals of this dissertation are to examine: how chronic health conditions affect older worker's vitality, health-related work limitations and subjective life expectancy, and how these effects drive older workers' preferences to retire early. To address these goals, Chapters 2-6 investigate specific research questions regarding the mechanisms and heterogeneities in how chronic health conditions impact older workers' vitality, health-related work limitations, subjective life expectancy and retirement preferences. I start this chapter by summarizing the findings of Chapters 2-6 in Section 7.1. Thereafter, I interpret the findings and discuss their scientific contributions and implications in Section 7.2. In the next sections, I deliberate on the methodological considerations of this dissertation (Section 7.3) and the policy and practice implications of the findings (Section 7.4). This chapter ends with a few concluding statements that are presented in Section 7.5.

7.1. Summary of findings

In Chapter 2, I examined the different pathways through which chronic health conditions influenced older workers' retirement preferences, by asking the research question: *How do chronic health conditions affect older workers' preference to retire early?* Specifically, I studied the extent to which vitality, health-related work limitations and subjective life expectancy mediated the relationship between four chronic health conditions and (early) retirement preferences of older workers. The four chronic health conditions examined were arthritis, cardiovascular diseases, sleep disorders and psychological disorders. Regression and mediation (via the KHB method) analyses were conducted on 5,696 Dutch workers who were of preretirement age. Having any one of the four chronic health conditions was significantly associated with an increased preference to retire early. These associations were mediated by vitality, health-related work limitations and subjective life expectancy, albeit to varying degrees, depending on the chronic

health condition in question. Older workers with arthritis and cardiovascular diseases experienced more severe health-related work limitations which drove their preference for early retirement. Simultaneously, older workers with sleep or psychological disorders preferred to retire early due to the low vitality they experienced as a result of their conditions. Subjective life expectancy was not a strong mediator in most pathways, except for older workers with cardiovascular diseases, whose retirement preferences were somewhat influenced by lower subjective life expectancy. Taken together this chapter provides a better understanding of the mechanisms through which chronic health conditions affects older workers' work, health and retirement preferences, which could provide cues for policy and practice.

In Chapter 3, I studied the heterogeneities in how chronic health conditions affected older workers' changes in subjective life expectancy based on 3-year longitudinal data from 4,735 older workers aged between 60-65 years at wave 1. The research question investigated in this chapter was: *How does the new diagnosis of a chronic health condition (as compared to having no chronic health conditions and existing chronic health conditions) influence the change in older workers' subjective life expectancy?* Heterogeneity was addressed by studying effects of five types of chronic health conditions - arthritis, cardiovascular disease, sleep disorders, psychological disorders and life-threatening conditions - and by indicating whether the chronic health condition was existing or newly diagnosed. Conditional change ordinary least square regression models were used to answer the research questions. Older workers who experienced a chronic health condition - regardless of whether it was existing or newly diagnosed - experienced a decline in subjective life expectancy. Older workers who were newly diagnosed with chronic health conditions, however, experienced a steeper decline in subjective life expectancy than older workers with no chronic health conditions or older workers with existing chronic health conditions. These results varied based on the chronic health condition in focus. Older workers newly diagnosed with life threatening conditions and psychological disorders experienced the steepest decreases in subjective life expectancy, while older workers with existing and newly diagnosed cardiovascular diseases experienced moderate decreases in subjective life expectancy. In contrast, arthritis and sleep disorders had almost no effect on older workers' change in subjective life expectancy. It may be said that the effects of chronic health conditions on older workers' change in subjective life expectancy are

heterogeneous: the impact of chronic health conditions differed based on the type of condition and on whether the chronic health condition was newly diagnosed.

In Chapter 4, I examined the heterogeneities in the effects of chronic health conditions by answering the research question: *How do newly diagnosed chronic health conditions (as compared to having no chronic health conditions or existing chronic health conditions) affect changes in vitality and worries about physical and mental functioning in the pre-retirement years?* To answer this question, I analyzed longitudinal data from 1,894 older workers who were 60-62 years at baseline using conditional change ordinary least square regression models. Between wave 1 and 2, older workers who were diagnosed with a chronic health condition before wave 1 (existing chronic health conditions), experienced a decrease in vitality and an increase in worries about their ability to function physically and mentally. In the 3-year period between the two waves, a significant proportion of older workers were newly diagnosed with a chronic health condition. These older workers experienced stronger decreases in vitality and steeper increases worries about physical and mental functioning, than their counterpart with no chronic health conditions or existing chronic health conditions. Moreover, newly diagnosed chronic health conditions with more physically disabling symptoms increased worries about physical functional ability, while newly diagnosed chronic health conditions with more mentally disabling symptoms increased worries about mental functional ability. In conclusion, this chapter shows that while existing chronic health conditions continue to decrease vitality and increase worries, being newly diagnosed with a chronic health condition intensifies these effects.

In Chapter 5, I investigated the effects of flexible work arrangements and organizational climate on the health-related work limitations of older workers with arthritis (*N*=2,330), cardiovascular disease (*N*=720) and sleep disorder (*N*=816). The research question addressed in this chapter was: *Are access to flexible work arrangements (such as flexible working time, flexible workplaces and phased retirement) and supportive organizational climates (i.e., healthy ageing climate and psychological safety climate) associated with fewer health-related work limitations among older workers?* Flexible work arrangements are assessed by measuring older worker's perceived access to three work arrangements: working-time flexibility, workplace flexibility and phased retirement. Organizational climate is represented by two organization-level variables: heathy ageing climate and psychological safety climate. Multilevel ordered logistic regression analyses were used to identify which organizational factors were associated with lower health-related work limitations

among older workers with chronic health conditions. Among the three flexible work arrangements, working-time flexibility was associated with fewer health-related work limitations among older workers with arthritis, cardiovascular diseases and sleep disorders. With regards to the organizational climate, organizations with psychologically safe organizational climates were consistently associated with lower health-related work limitations among older workers with chronic health conditions. All in all, these results indicate that working-time flexibility and psychological safety climates are two job resources that can help counteract the demands older workers may face as they work longer while experiencing chronic health conditions. This chapter also emphasizes the need to study workplace factors on both the individual- and organization-level to gain a better and more comprehensive understanding of what, when and how specific policies and practices can assist vulnerable groups of older workers.

In Chapter 6, I investigated whether the impact of retirement on older workers' vitality differed based on their job type. The central research questions examined in chapter 6 were: *Does retirement benefit vitality and its subcomponents, energy and fatigue? and does this effect differ between job types, i.e., between manual vs. non-manual workers?* To study these questions, I conducted conditional change ordinary least square regression models using 3-year longitudinal data from 4,156 older workers, of whom 47% retired between the two waves. Vitality was not only analyzed as composite score, but also as subcomponents - energy and fatigue. Older manual workers who continued to work, were more likely to experience deteriorations in health - in terms of decreased vitality and increased fatigue - compared to older non-manual workers who continued to work. Contrastingly, older manual workers who retired experienced larger improvements in vitality and steeper decreases in fatigue than older non-manual workers who retired. Overall, this chapter demonstrates how the benefits of retirement will be unequally felt among different job types. This provides us with cues on how different jobs may differently affect older workers' health in their late careers.

7.2. Interpretation of findings and scientific contributions and implications

While it is widely known that older workers with chronic health conditions may prefer early retirement (Hess, Naegele, Becker, Mäcken, & De Tavernier, 2021;

Sewdas, Thorsen, Boot, Bjørner, & van der Beek, 2019; Gignac, Smith, Ibrahim, Kristman, Beaton, & Mustard., 2019; Giang & Le, 2018; Trevisan & Zantomio, 2016) the reasons that drive older workers' (with chronic health conditions) preferences to retire early are relatively understudied. This dissertation attempts to fill this gap. According to the findings, early retirement preferences of older workers with chronic health conditions are predominantly driven by how vital they feel, the health-related work limitations they have and their subjective life expectancy. Moreover, I found that the health-related reason behind why older workers with chronic health conditions prefer early retirement differed based on the chronic health condition they experienced. These findings extend current knowledge and enhances our understanding on why chronic health conditions influence older workers' early retirement preferences.

This dissertation does not provide information on why having a chronic health condition might affect early retirement behaviour. Many situational and personal factors - from the working in an age-friendly organization, health, grandparenting preferences and financial stability – may mediate the effects of chronic health conditions on older workers' decisions to retire (Sousa-Ribeiro, Bernhard-Oettel, Sverke, & Westerlund, 2021; De Preter, Van Looy, & Mortelmans., 2013; Miah & Wilcox-Gök, 2007). Future studies may examine the different pathways through which chronic health conditions impact retirement behaviour. Moreover, chapter 2 examined the effects of 4 chronic health conditions - arthritis, cardiovascular diseases, sleep disorders and psychological disorders. These conditions were chosen because they were highly prevalent among older workers. However, there are other potent chronic health conditions that have not been studied within this dissertation due to its low prevalence in the study sample, that have an increasingly large adverse impact on the health of the general Dutch population. For example, visual impairments and diabetes are two such chronic health conditions that have been projected to increase substantially in prevalence and burden of disease in the Netherlands by 2040 (Rijksinstituut voor Volksgezondheid en Milieu, 2018). Perhaps future research could provide more insight on whether and via which pathways chronic health conditions such as diabetes and visual impairments drive older workers' early retirement preferences.

The second aim of this dissertation was to better understand the heterogeneities in how chronic health conditions impacted older workers' health, work and retirement preferences, a question that has remained largely unanswered for the older working population in previous research. Two sources of heterogeneity

were studied: heterogeneity stemming from the type of chronic health condition and heterogeneity stemming from whether the chronic health condition was newly diagnosed or existing. The findings of chapters 2, 3 and 4 demonstrated how different types of chronic health conditions vary in the way they impact older workers' vitality, worries about functioning, subjective life expectancy and early retirement preferences. Chronic health conditions range greatly in their symptoms, prognoses and treatment strategies and in how much they limit functioning at home and at work (Stynen, Jansen, & Kant, 2015; Leijten et al., 2014; Swanson, Arnedt, Rosekind, Belenky, Balkin, & Drake, 2011). For instance, in their study Stynen, Jansen and Kant (2015) found depression to be associated with issues with concentration and an increased need for recovery, while diabetes was associated with decreased physical functioning. These results, together with the findings of this dissertation, emphasizes the importance in distinguishing between types of chronic health conditions when studying the effects of chronic health conditions on older workers' health and work.

Moreover, chapters 3 and 4 demonstrated the relevance in differentiating between newly diagnosed chronic health condition and existing chronic health conditions in our attempts at understanding how chronic health conditions affects older workers. Many older workers are newly diagnosed with a chronic health condition, which they struggle to adapt to physically and psychologically in the last years of their careers (Hilderink, Plasmans, Poos, Eysink, & Gijsen, 2020; Lacaille, White, Backman, & Gignac, 2007). Previous studies have found newly diagnosed chronic health conditions to have a stronger adverse effect on work functioning, work stress and work exit (Mutambudzi & Henkens, 2021; Mandl, Jørgensen, Skougaard, Olsson, & Kristensen, 2017; Guymer, Littlejohn, Brand, & Kwiatek, 2016). Older workers newly diagnosed with a chronic health condition could still be learning about and adapting to the symptoms of their condition, the strategies to manage their condition and the side effects of their newly prescribed medications (Lacaille et al., 2007). They could also still be building a system of physical and mental support to manage their CHC (Lacaille et al., 2007). Newly diagnosed chronic health conditions could cause an incongruity between job demands and the ability to perform daily work duties at work (Gilworth et al., 2003). Together, these literatures support our findings on the stronger negative effect of newly diagnosed chronic health conditions on older workers' health and work.

While this dissertation examines two sources of heterogeneity, other sources of heterogeneity in the effects of chronic health conditions on older workers

do exist. For example, the severity of the chronic health condition experienced may influence older workers' timing to retire. A study by Galloway et al. (2020) found severe rheumatoid arthritis to be associated with increased work impairments and early retirement compared to mild or moderate rheumatoid arthritis. Similarly, Nexo et al. (2015) found severe depressive symptoms to be associated with intentions to retire early. Moreover, multimorbidity - i.e., the experience of two or more chronic health conditions - could affect the wellbeing and work outcomes of older workers. In their study, Oude Hengel, Robroek, Eekhout, van Der Beek and Burdorf (2019) found older workers experiencing two or more CHCs to be more likely to exit paid employment compared to older workers without comorbidities. The study of these sources of heterogeneity and their role in how chronic health conditions drive health, work and retirement preferences of older workers might be an avenue for future research.

Because of increasing retirement ages, it has become increasingly important to develop strategies that can be used by employers to effectively accommodate and promote the wellbeing and work ability of older workers, especially those who are burdened by the limitations imposed by chronic health conditions (Arends, Prinz, & Abma, 2017). The finding of the benefit of flexible working hours is in line with past literature. Flexible working time provides older workers with the space and autonomy to structure their day around their health-related and work-related demands, without losing the social contact, earnings and sense of purpose/identity that comes with other flexible work arrangements such as phased retirement or workplace flexibility (Atkinson & Sandiford, 2016; Dropkin, Moline, Kim, & Gold, 2016; Kantarci & Van Soest, 2008). To a much lesser extent, previous studies have shown the benefits of a psychologically safe organizational climate. Psychologically safe organizational climates support and emboldens older workers by fostering interpersonal support, open communication and disclosure, without the fear of negative consequences (Edmondson & Lei, 2014). This ability to disclose without fear might increase older workers' chances of receiving support, accommodations and interventions (Liang, Farh, & Farh, 2012; Gignac & Cao, 2009; Siemsen, Roth, Balasubramanian, & Anand., 2008).

Overall, this dissertation demonstrates two ways in which organizations/employers can support their older workers with chronic health condition: by providing them with access to working time flexibility and by fostering a psychologically safe organizational climate. This raises two new research questions that might be interesting for future research to pursue. The first is

regarding access and use of flexible working arrangements: Do older workers with chronic health conditions who have access to and need flexible working arrangements actually use these arrangements? Thus far, studies from the Netherlands have shown that workers with chronic health conditions report a need for work adjustments (Boot et al., 2013; Varekamp & van Dijk, 2010). These adjustments were especially regarding working hours and work tasks (Varekamp & van Dijk, 2010). Boot et al. (2013) also showed that having work adjustments reduced the risk of sick leave among workers with chronic health conditions. To date, however, studies have not addressed whether *older workers* with chronic health conditions need work adjustments or flexible work arrangements. We also do not know the factors that encourage or discourage the use of flexible work arrangements by older workers with chronic health conditions who report to need flexible work arrangements. The second research question is regarding psychologically safe organizational climates, which is a relatively understudied concept in literature thus far, especially in connection with older workers and retirement. Future studies may want to examine what makes an organizational climate psychologically safe for older workers? and how can organizations/employers create a psychologically safe organizational climate?

7.3. Methodological considerations

To assess the presence of chronic health conditions, the Limiting Longstanding Illness (LLSI) measure (Bajekal, Harries, Breman, & Woodfield, 2004) was used. The LLSI is a two-part single-item measure, which first asks respondents "Do you have one or more of the following longstanding diseases (as diagnosed by a doctor)?" This question is followed by a list of categories of CHCs. Respondents answered by indicating whether they were diagnosed with a CHC that fits within a category of CHCs listed under the LLSI. Categorizing chronic health conditions in this manner allowed the study of a wide range of chronic health conditions, which is highly valuable when creating a comprehensive overview of how chronic health conditions affect older workers. However, the categorization of chronic health conditions also provides limited information on the individual conditions covered within category. Some CHC categories may contain a wide range of conditions which range in the nature, severity and impact of symptoms. For example, the

category 'psychological disorders' contain various conditions that pose varying morbidity and mortality risks (Walker, McGee, & Druss, 2015).

Moreover, this dissertation centers in on older workers between the ages 60-65 years; therefore, the findings and their implementations are mainly applicable to this age group of workers. This means that I am unable to make statements about how chronic health conditions may affect older workers in other age groups. Presumably, a smaller but significant number of workers over 40 years of age may also experience chronic health condition; however, their needs, difficulties, requirements for accommodation and possible routes of work exit may differ greatly to older workers between the ages of 60-65 years.

Besides, it could be that workers diagnosed earlier in life with more severe or disabling chronic health conditions may have already exited the workforce through (among other ways) disability pension, early retirement or unemployment, before their 60th birthdays. This may give rise to selection bias in our sample.

This dissertation is conducted in the Netherlands using data from Dutch older workers who are navigating the Dutch public pension system. Despite the limited opportunity to retire early, the Netherlands has a well-organized public pension scheme with generous retirement benefits. This system not only differs to the systems in place in low- or middle-income countries, it also differs from welfare systems in other high-income countries such as the United States or the United Kingdom. Consequently, the results of this dissertation are not generalizable to most other countries. Even within the Dutch workforce, not every worker is enrolled in a pension scheme. The NIDI Pension Panel Survey collects data among older workers enrolled in a pension scheme. These older workers have a broader choice in retirement than older workers who are not enrolled in a pension scheme, such as self-employed workers. Workers not enrolled in a pension system have to independently build up their own pension (by saving) during their career, which might strongly affect when they are able to retire. As a result, the results of this dissertation may not be generalizable for Dutch workers who are not enrolled in a pension scheme.

This dissertation uses data collected before the COVID-19 pandemic. Pandemic-induced lockdowns have changed the way we work. For most part of two years, some workers have been working from their homes. At the same time, workers with essential jobs - such as workers in healthcare, retail or law enforcement - have been working under more difficult working conditions. Now that pandemic-induced lockdowns have been lifted or are more lenient, employers are welcoming

their workers back at the workplace, while also allowing workers to create blended work schedules with some days at the office and some days of home office. This has given workers more autonomy and more control over their work life. As a result, the findings of this dissertation may, in some circumstances, need to be amended. It would be interesting to examine how work changes in the future and whether this change would be sustained with time. Moreover, future researchers might consider exploring how change in flexibility and control around work scheduling and blended work schedules might affect older workers with chronic health conditions.

7.4. Implications for policy and practice

The findings of this dissertation contain four overarching messages for employers and policy makers. First, this dissertation brings to surface that *many* older workers are either experiencing a chronic health condition or are being diagnosed with a chronic health condition in their early-sixties. As a result, a sizeable proportion of older workers are dealing with the combined pressures of ageing, working longer and the limitations of their chronic health condition. Because retirement ages are expected to increase in the Netherlands in the future and disability pension is difficult to obtain, the challenges experienced by older workers with chronic health conditions at work will continue to be a cause for concern.

Second, this dissertation demonstrates the strong and varying impact that chronic health conditions have on older workers' health, work and perspectives about their future health, work ability and retirement. For example, the chapters in this dissertation have shown how the experience of chronic health conditions can affect older workers' physical and mental health and functioning and how these translate to preferences to retire. The results of this dissertation, along with many past studies, have described the far-reaching negative consequences of experiencing a chronic health condition. Therefore, it is important for all involved stakeholders to understand that many older workers with chronic health conditions are carrying heavy burdens that affects their daily work lives, especially in the final stages of their careers. Moreover, the findings show that some groups of older workers are more vulnerable to the negative consequences of chronic health conditions than others. Vulnerability varies by type of chronic health condition, by whether the chronic health condition was diagnosed newly and by job type. Employers could consider providing vulnerable groups of older workers, for

example older workers in manual work or older workers with newly diagnosed chronic health conditions, with personalized interventions that may promote their well-being and help them continue to work efficiently. Past studies have described the effectiveness of interventions such as the Vital@Work intervention, worksite yoga, mobilization interventions and health education programs in promoting the wellbeing of older workers (de Vries, van Hooff, Guerts, & Kompier, 2017; Mailey, Rosenkranz, Ablah, Swank, & Casey, 2017; Querstret & Cropley, 2013; Strijk, Proper, van der Beek, & Van Mechelen, 2012). While these studies have not tested the effectiveness of these interventions on older workers with chronic health conditions, it might still be beneficial to provide older workers with chronic health conditions with empirically-supported interventions as opposed to providing no interventions. While there might be challenges in the implementation and perpetuation of these interventions, organizations might consider their use in improving the quality of life and work of older workers with chronic health conditions.

Third, this dissertation emphasizes the need and the urgency for organizations to take an active role in supporting their older workers who are challenged by negative health- and work-related consequences of their chronic health conditions. The findings of this dissertation demonstrate that it is not only important to provide older workers with supportive organizational policies, but it is also vital to foster a positive organizational climate within the workplace. Organizational policies, such as flexible working hours, have been shown to benefit workers' wellbeing, work ability and work-life balance (Chandola, Booker, Kumari, & Benzeval, 2019; Azar, Khan, & Van Eerde, 2018; Possenriede & Plantenga, 2011; Hayman, 2009; Richman, Civian, Shannon, Jeffrey Hill, & Brennan; 2008). As a result, organizational policies are being increasingly incorporated into collective labor agreements in the Netherlands, thus making them more accessible to workers. However, whether an organization possesses a supportive organizational climate is entirely dependent on how employers engage with their workers and how the organization makes workers feel. Organization-level interventions have been shown to have more sustainable positive influences on workers' health and wellbeing (Montano, Hoven, & Siegrist, 2014; Halperin, 1996). While it requires a larger organization-wide effort to foster supportive organizational climates - for example, a psychologically safe organizational climate – the benefits of a supportive organizational climates on older workers' health, well-being and work ability are

significant: this calls for organization-wide changes to foster a supportive and a psychologically safe organizational climate.

The last practical suggestion points towards creating more flexibility in the pension system; especially for vulnerable groups of older workers, such as older workers with manual jobs. In the western world, working lives are being extended, mainly by increasing public pension age. Currently, public pension age is linked to average life expectancy: if life expectancy continues to increase, public pension age will increase further. This approach to increasing retirement age was created with the average worker in mind, but neglects the fact that there is diversity among older workers and puts vulnerable groups of older workers at a disadvantage (Krekula & Vickerstaff, 2020). This dissertation demonstrates how extended working lives unequally impact manual and non-manual workers. Manual workers who continue to work up to higher ages experience stark detriments to their vitality than their counterparts in non-manual work. Similarly, older workers with newly diagnosed chronic health conditions and older workers with specific chronic health conditions (such as, psychological disorders and life-threatening chronic health conditions) are more likely to face more severe consequences to their health and work as they continue to work until a higher public pension age.

In the Netherlands, older workers with poor health and/or in demanding jobs are provided with two options for flexible retirement; phased retirement and the demanding occupations scheme ('de zwaarwerkregeling', Ministerie van Sociale Zaken en Werkgelegenheid, n.d.). Phased retirement allows older workers approaching public pension age to gradually reduce their working hours while supplementing the lost income from their pension fund as they continue to work for the same employer (Hutchens, 2010). This provides older workers with an opportunity to work fewer hours and spend more time in recovery before they retire fully. A study by van Solinge, Vanajan & Henkens (2022) found phased retirement to benefit older workers who have work and family strain by sustaining their vitality and providing them with more relief from balancing work and family life, thus describing the benefits of phased retirement arrangements. Phased retirement arrangements are available for all older workers without many restrictions on eligibility. However, this does require an early withdrawal from the pension pot, which decreased the amount of pension benefits in the years after retirement. The demanding occupations scheme is a sector-specific flexible retirement scheme that acknowledges the heterogeneity in how job type affects older workers' needs for early work exit. Through the demanding occupations scheme, the Dutch

government provides labor unions of most demanding (either physically or psychologically) occupational sectors the opportunity to provide their workers with a pathway into early retirement. This scheme was included within the collective labor agreements of most demanding occupational sectors from 2021 onward. In general, it allows older manual workers who have been employed for 20 years in the same or similar demanding occupational sector, to retire (a maximum of) 3 years earlier than the statutory pension age (Ministerie van Sociale Zaken en Werkgelegenheid, n.d.). By the end of 2021, 1200 applications for the demanding occupations scheme were received just from the construction and infrastructure occupational sectors: the number of applicants for this scheme is only expected to increase in the future (De zwaarwerkregeling: achter de schermen bij APG, 2021).

Overall, the results of this dissertation support the availability and provision of such flexible retirement arrangements which offer vulnerable groups of older workers – i.e., older workers in manual work and older workers at risk for poor health and vitality - more freedom in choosing their retirement timing. Employers and/or HR managers could make their workers more aware of the availability of flexible retirement arrangements and support older workers in their transition into flexible retirement schemes.

7.5. Concluding remarks

In the last decades, governments across the western world have made it a priority to sustain labor forces by increasing retirement ages and restricting access to early work exit routes. As a result, older workers will have to work longer than they previously expected, while combatting health- and work-related challenges posed by chronic health conditions they may experience. To better support older workers with chronic health conditions, researchers, policy makers and employers alike are striving to understand the differential effects of chronic health conditions on older workers and develop effective strategies of intervention and accommodation. This dissertation demonstrates that chronic health conditions differ widely in how they affect older workers' health, work and retirement preferences. While these effects differ by the type of chronic health condition and whether the chronic health condition was newly diagnosed, the experience of a chronic health condition puts older workers at a vulnerable position. This dissertation also provides evidence on what employers can do to support older

workers with chronic health conditions: the findings show that it is not only important to provide older workers with organizational policies such as working time flexibility, but it is also vital to foster supportive organizational climates such as a psychologically safe organizational climate. Overall, this dissertation calls for increased efforts in developing effective and targeted accommodation strategies, interventions and public policies geared to protect and promote the wellbeing, safety and healthy ageing of older workers with chronic health conditions, so as to ensure the quality and sustainability of late-working lives.

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Appendices

Chapter 2

Supplementary Table 2.1.

Characteristics of the sample of Dutch Older Workers (N=5,696)

Variables	Descriptive statistics
Age (mean, standard deviation)	61.7, 1.4
Male gender (%)	54.9
Educational attainment (%)	
Low (1-3)	27.5
Medium (4, 5)	26.6
High (6, 7)	45.9
Wealth (%)	
Low (1-3)	32.9
Medium (4, 5)	46.7
High (6, 7)	20.4
Partner present (%)	82.5
Manual work (%)	20.4
Supervisory position (%)	24.9
Full-time employment (%)	47.1
Organizational Sector (%)	
Government and Education	45.9
Construction	21.6
Health and Welfare	32.5
Organizational Size (%)	
<50 employees	15.9
50-250 employees	44.3
>250 employees	39.8
Prevalence of chronic health conditions (%)	
Arthritis	43.6
Cardiovascular disease	13.0
Sleep disorders	14.9
Psychological disorders	4.9

Supplementary Table 2.1. (Cont.)

Variables	Descriptive statistics
Preference to retire early (%)	
Strong preference to work	34.5
Slight preference to work	14.7
No preference	9.3
Slight preference to retire early	15.7
Strong preference to retire early	25.8
Subjective life expectancy (mean, standard deviation)	3.4, 0.9
Health-related work limitations (mean, standard deviation)	1.5, 0.6
Vitality (mean, standard deviation)	4.1, 0.8

Chapter 3

Supplementary methods

Analysis

Regression equation

The regression equation for the model derived through the conditional change ordered logistic regression analysis:

$$SLE\ at\ wave\ 2 = \beta_0 + \beta_1 SLE\ at\ wave\ 1 + \beta_2 existing\ arthritis + \beta_3 existing\ cardiovascular\ diseases + \beta_4 existing\ sleep\ disorders + \beta_5 existing\ psychological\ disorders + \beta_6 existing\ life-threathening\ conditions + \beta_7 newly\ diagnosed\ arthritis + \beta_8 newly\ diagnosed\ cardiovascular\ diseases + \beta_8 newly\ diagnosed\ sleep\ disorders + \beta_9 newly\ diagnosed\ psychological\ disorders + \beta_{10} newly\ diagnosed\ life-threathening\ conditions + \varepsilon$$

Mediation analysis

Moreover, there is a possibility that mentally-disabling CHCs mediate the associations between physically disabling conditions and the change in SLE. Physically-disabling CHCs, such as arthritis, cardiovascular disorders and life-threatening conditions, are known to be associated with sleeping problems and depleted mental health (Hanssen, Nordrehaug, Eide, Bjelland, & Rokne, 2009; Sateia & Lang, 2008; Dickens, McGowan, Clark-Carter, & Creed., 2002). These negative consequences on mental health and wellbeing may, in turn, be associated with changes in SLE. In order to formerly test how mentally-disabling conditions may mediate the associations between physical illnesses and change in SLE, we conducted two Karlson, Holm and Breen (KHB) mediation analyses (Stata 14: khb): one for existing CHCs and the other for newly diagnosed CHCs. The KHB method provides unbiased decompositions of total effects into direct and indirect effects for both linear and nonlinear models (Breen, Karlson, & Holm, 2013). Within this study, the direct effect examines the association between physically-disabling CHCs and change in SLE, while indirect effects explore mediation by mentally-disabling CHCs.

Sensitivity analyses

We conducted two sensitivity analyses to test for robustness of our primary analysis. Past studies have shown that life expectancy and labour participation may differ between social groups; job type, especially, is an important source of heterogeneity in life expectancy (Head et al., 2019; Lallo & Raitano, 2018). Older workers in lower occupational positions tend hold their healthy life expectancy in poorer regard than older workers in higher occupational positions (Head et al., 2019). To test for this heterogeneity, as a first sensitivity analysis, we conducted a conditional change ordered logistic regression analysis where we tested for the interaction between manual work and existing and newly diagnosed CHCs on change in older workers' SLE.

An increasing number of older workers will suffer from two or more CHCs as they age (Salive, 2013). The experience of multimorbidity has been shown to have detrimental effects on quality of life and many work outcomes from productivity to work exit (Cabral, de Souza, Barbosa, Jerez-Roig, & Souza, 2019). Based on this literature, we conducted a second sensitivity analysis where we examined the association between newly diagnosed CHCs and change in SLE between older workers who did and did not experience comorbidities at wave 1.

Supplementary results

Results of the KHB mediation analysis

The results of the KHB mediation analyses are presented in supplementary Tables 2 and 3. According to the results, almost all physically-disabling CHCs (except existing arthritis) directly affected the change in SLE of older workers at wave 2. However, the effect of existing arthritis on the change in SLE of older workers is mediated to a large extent (around 85%) by the presence of existing sleep disorders. This result corroborates to that of the regression analysis which demonstrates the negative effects of sleep disorders – both existing and newly diagnosed – on the change in SLE of older workers.

Sensitivity analyses

Results of the secondary conditional change ordered logistic regression analysis, which examined interactions between manual work and CHCs on change in SLE of older workers, is presented in Table 4 of the supplementary material.

According to the results, older workers in manual labour who were newly diagnosed with a psychological disorder were more likely to experience declines in SLE (b=-1.36, $p<0.05$). No other interaction effects were significant.

The sensitivity analysis stratified for comorbidities is presented in Table 5 of the supplementary material. While there are some differences between our primary model and this model, most results – specifically those of cardiovascular diseases, psychological disorders and life-threatening conditions – remain similar to that of the primary analysis, thus supporting the robustness of our results.

Supplementary Table 3.1.

Details on the wording of survey questions, coding of variables and psychometric properties of each variable (N=4, 824)

Variables	Wording of survey question	Coding (frequencies or descriptive statistics)
Dependant variables		
Subjective life expectancy at w1 Subjective life expectancy at w2	How likely are you to live beyond the age of 80? (5 answer categories on a Likert scale from 1=highly likely to 5=highly unlikely, which was reverse coded for analysis)	Categorical variable, ranging from 1 to 5 1=Highly unlikely (w1=2.40%, w2=1.78%) 2=Rather unlikely (w1=7.73%, w2=5.29%) 3=Middling (w1=44.47%, w2=40.13%) 4=Rather likely (w1=36.21%, w2=40.94%) 5=Highly likely (w1=9.18%, w2=11.86%)
Independent variables		
Arthritis - Existing	Do you have one or more of the following longstanding diseases, as diagnosed by a doctor? (answer structure: chose between yes or no)	Dichotomized variable: 1=I have this CHC (42.99%) 0=I do not have this CHC (57.01%)
Arthritis - Newly diagnosed		Dichotomized variable: 1=I have been newly diagnosed with this CHC (13.16%) 0=I have had this CHC for the last 3 or more years or I do not have this CHC (86.84%)

Cardiovascular diseases - Existing	Do you have one or more of the following longstanding diseases, as diagnosed by a doctor? (answer structure: chose between yes or no)	Dichotomized variable: 1=I have this CHC (13.60%) 0=I do not have this CHC (86.40%)
Cardiovascular diseases - Newly diagnosed		Dichotomized variable: 1=I have been newly diagnosed with this CHC (4.93%) 0=I have had this CHC for the last 3 or more years or I do not have this CHC (95.07%)
Sleep disorders - Existing	Do you have one or more of the following longstanding diseases, as diagnosed by a doctor? (answer structure: chose between yes or no)	Dichotomized variable: 1=I have this CHC (14.41%) 0=I do not have this CHC (85.59%)
Sleep disorders - Newly diagnosed		Dichotomized variable: 1=I have been newly diagnosed with this CHC (6.34%) 0=I have had this CHC for the last 3 or more years or I do not have this CHC (93.66%)
Psychological disorders - Existing	Do you have one or more of the following longstanding diseases, as diagnosed by a doctor? (answer structure: chose between yes or no)	Dichotomized variable: 1=I have this CHC (4.58%) 0=I do not have this CHC (95.42%)
Psychological disorders - Newly diagnosed		Dichotomized variable: 1=I have been newly diagnosed with this CHC (2.78%) 0=I have had this CHC for the last 3 or more years or I do not have this CHC (97.22%)

Supplementary Table 3.1. (Cont.)

Variables	Wording of survey question	Coding (frequencies or descriptive statistics)
Life-threatening conditions - Existing	Do you have one or more of the following longstanding diseases, as diagnosed by a doctor? (answer structure: chose between yes or no)	Dichotomized variable: 1=I have this CHC (3.03%) 0=I do not have this CHC (96.97%)
Life-threatening conditions – Newly diagnosed		Dichotomized variable: 1=I have been newly diagnosed with this CHC (2.99%) 0=I have had this CHC for the last 3 or more years or I do not have this CHC (97.01%)
Demographic control variables		
Age	In what year were you born? (age in years were calculated)	Continuous variable: ranging from 60 to 65 years (Mean=62.04, *SD*=1.59)
Sex	Are you a man or woman? (2 answer categories: 1=man, 2=women)	Dichotomized variable: 1=Male (54.75%) 0=Female (45.25%)
Education	What is the highest level of education you've completed? (7 answer categories: 1=elementary school, 2=lower vocational education, 3=lower general secondary education, 4=intermediate vocational education, 5=upper general secondary education, 6=higher vocational education, 7=university)	Categorical variable: ranging from 1 to 3 1=Low (26.14%) 2=Moderate (25.77%) 3=High (48.09%)

Interpersonal control variables		
Social support	Could you indicate whether the following statements apply to you: There are plenty of people I can lean on when I have problems? (3 answer categories: 1=yes, 2=more or less, 3=no)	Dichotomized variable: 1=Has social support (96.89%) 0=Does not have social support (3.11%)
Health-related control variable		
Multimorbidity	Do you have one or more of the following longstanding diseases, as diagnosed by a doctor? (answer structure: chose between yes or no)	Dichotomized variable: 1=Yes, has comorbidities (51.60%) 0=No, no comorbidities (48.40%)
Work-related control variables		
Employment status	Which situation applies to you? (2 answer categories: 1=I work for pay, 2=I do not work for pay any longer)	Dichotomized variable: 1=Employed (51.04%) 0=Not employed (48.96%)
Manual work	Based on the International Standard Classification of Occupation, in which category could your job be grouped?	Dichotomized variable: 1=Manual work (18.97%) 0=Non-manual work (81.03%)

Note. *SD*=standard deviation; w1=wave 1; w2=wave 2

Supplementary Table 3.2.

Indirect effect of existing physically-disabling chronic health conditions on older workers' subjective life expectancy (N = 4,824)

Existing physically-disabling chronic health conditions	Total direct effect		Total indirect effect		Indirect effect via existing sleep disorders	Indirect effect via existing psychological disorders
	OR	CI	OR	CI	%	%
Arthritis	1.04	0.84 - 1.29	1.10*	1.04 - 1.17	82.0	18.0
Cardiovascular diseases	0.50**	0.42 - 0.59	1.00	0.97 - 1.04	98.9	1.1
Life-threatening condition	0.45**	0.32 - 0.64	1.03	0.99 - 1.07	86.7	13.3

Note. $*p$ <0.05, $**p$ <0.001. Dependent variable is older workers' subjective life expectancy. OR, odds ratio; CI, 95% confidence interval; %, attributable percentage

Supplementary Table 3.3.

Indirect effect of newly diagnosed physically-disabling chronic health conditions on older workers' subjective life expectancy (N = 4,824)

Newly diagnosed physically-disabling chronic health conditions	Total direct effect		Total indirect effect		Indirect effect via newly diagnosed sleep disorders	Indirect effect via newly diagnosed psychological disorders
	OR	CI	OR	CI	%	%
Arthritis	0.81*	0.68 - 0.96	0.98	0.94 - 1.02	61.5	38.5
Cardiovascular diseases	0.61**	0.46 - 0.79	0.99	0.95 - 1.04	174.0	-74.0
Life-threatening condition	0.27**	0.18 - 0.42	0.99	0.95 - 1.03	14.5	85.5

Note. $*p$ <0.05, $**p$ <0.001. Dependent variable is older workers' subjective life expectancy. OR, odds ratio; CI, 95% confidence interval; %, attributable percentage

Supplementary Table 3.4.

The effects of manual work and existing and newly diagnosed arthritis, cardiovascular disease, sleep disorders, psychological disorders and life-threatening conditions on change in subjective life expectancy from wave 1 to wave 2 (N = 4,824)

Predictors	Change in subjective life expectancy from w1 to w2	
	Coef.	SE
Subjective life expectancy at w1	1.86**	0.05
Existing CHCs * Manual work		
Arthritis * Manual work	0.09	0.13
Cardiovascular diseases * Manual work	-0.29	0.21
Sleep disorders* Manual work	-0.31	0.24
Psychological disorders * Manual work	-0.25	0.41
Life-threatening conditions * Manual work	-0.22	0.47
Newly diagnosed CHCs * Manual work		
Arthritis * Manual work	-0.08	0.21
Cardiovascular diseases * Manual work	-0.20	0.30
Sleep disorders * Manual work	-0.54	0.29
Psychological disorders * Manual work	-1.36*	0.54
Life-threatening conditions * Manual work	-0.59	0.56
Demographic control variables		
Age	0.04*	0.02
Sex (reference=male)	-0.07	0.06
Education	0.12*	0.04
Interpersonal control variables		
Social support (reference=has social support)	0.17	0.18
Health-related control variables		
Multimorbidity (reference=diagnosed with two or more CHCs)	-0.25**	0.06
Work-related controls		
Employment status (reference=employed)	-0.06	0.06
Wald chi2 (26)	1472.05**	
Log pseudolikelihood	-4602.47	
Pseudo R^2	0.21	

Note. *p<0.05, **p<0.001, Coef.=coefficient; SE=robust (clustered) standard error; w1=wave 1; w2=wave 2

Supplementary Table 3.5.

The effects of newly diagnosed arthritis, cardiovascular disease, sleep disorders, psychological disorders and life-threatening conditions on change in subjective life expectancy from wave 1 to wave 2, stratified by multimorbidity

Predictors	Change in subjective life expectancy from w1 to w2			
	Has comorbidities (n=2,489)		No comorbidities (n=2,335)	
	Coef.	SE	Coef.	SE
Subjective life expectancy at w1	1.81**	0.07	1.94**	0.08
Newly diagnosed				
Arthritis	-0.38*	0.19	-0.13	0.10
Cardiovascular disease	-0.43*	0.19	-0.42	0.22
Sleep disorders	-0.30	0.19	-0.14	0.21
Psychological disorders	-0.43	0.24	-0.82*	0.35
Life threatening conditions	-1.12**	0.29	-1.95**	0.48
Demographic control variables				
Age	0.03	0.03	0.05	0.03
Sex (reference=male)	-0.17*	0.08	0.05	0.09
Education	0.12*	0.05	0.06	0.07
Interpersonal control variables				
Social support (reference=has social support)	0.31	0.23	0.08	0.28
Work-related controls				
Employment status (reference=employed)	-0.05	0.09	-0.06	0.09
Manual work (reference=manual worker)	-0.17	0.13	-0.29*	0.14
Wald chi2 (26)	827.75**		785.72**	
Log pseudolikelihood	-2401.48		-2159.90	
Pseudo R^2	0.21		0.21	

Note. *p<0.05,**p<0.001, Coef.=coefficient; SE=robust (clustered) standard error; w1=wave 1; w2=wave 2

Chapter 4

Supplementary Table 4.1.

Characteristics of respondents who dropped out between waves 1 and 2 (N = 1,481) and those who responded to wave 2 (N = 5,312)

Variables	Drop outs from w1 to w2 (N = 1,481)		Respondents at wave 2 (N = 5,312)	
	Mean	*SD*	Mean	*SD*
Demographic controls				
Age (scale, 0-100)	61.97	1.63	62.03	1.60
Sex (dichotomized, 0-1)	0.57	0.50	0.55	0.50
Partner present (dichotomized, 0-1)	0.86	0.34	0.81	0.40
Educational attainment (categorical, 1-3)	2.10	0.85	2.23	0.83
Wealth (categorical, 1-3)	1.86	0.71	1.89	0.72
Health-related control				
Multimorbidity (dichotomized, 0-1)	1.05	0.81	1.01	0.81
Work-related controls				
Full-time employment (dichotomized, 0-1)	0.49	0.50	0.47	0.50
Supervisory position (dichotomized, 0-1)	0.24	0.43	0.25	0.43
Manual work (dichotomized, 0-1)	0.24	043	0.19	0.39
Organizational sector (categorical, 1-3)	1.83	0.87	1.77	0.87

Supplementary Table 4.2.

Descriptive statistics and details on the coding and psychometric properties of all variables (N=1,894)

Variables	Mean	*SD*	Coding and Psychometric properties	Wording of survey question
Vitality at w1 Vitality at w2	4.30 4.16	0.86 0.85	Scale variables, ranging from 1 to 6	How much of the time during the past 30 days did you feel: (i) full of energy (ii) tired (iii) worn out (iv) full of pep (6 answer categories on a Likert scale ranging from 1=constantly to 6=never)
Worries about physical functional ability at w1 Worries about physical functional ability at w2	3.11 2.97	1.23 1.37	Scale variables, ranging from 1 to 5	To what extent do you experience the following issues because of higher retirement ages: insecurity whether I can physically maintain (5 answer categories from 1=not at all to 5=very much)
Worries about mental functional ability at w1 Worries about mental functional ability at w2	2.94 2.88	1.22 1.35	Scale variables, ranging from 1 to 5	To what extent do you experience the following issues because of higher retirement ages: insecurity whether I can mentally maintain (5 answer categories from 1=not at all to 5=very much)

Supplementary Table 4.2. (Cont.)

Variables	Mean	*SD*	Coding and Psychometric properties	Wording of survey question
Arthritis - Existing	0.40	0.49	Dichotomized variable: 1=I have this CHC 0=I do not have this CHC	Do you have one or more of the following longstanding diseases, as diagnosed by a doctor? (answer structure: chose between yes or no)
Arthritis – Newly diagnosed	0.13	0.34	Dichotomized variable: 1=I have been newly diagnosed with this CHC 0=I have had this CHC for the last 3 or more years or I do not have this CHC	
Cardiovascular diseases - Existing	0.12	0.33	Dichotomized variable: 1=I have this CHC 0=I do not have this CHC	Do you have one or more of the following longstanding diseases, as diagnosed by a doctor? (answer structure: chose between yes or no)
Cardiovascular diseases - Newly diagnosed	0.05	0.22	Dichotomized variable: 1=I have been newly diagnosed with this CHC 0=I have had this CHC for the last 3 or more years or I do not have this CHC	
Sleep disorders - Existing	0.14	0.35	Dichotomized variable: 1=I have this CHC 0=I do not have this CHC	Do you have one or more of the following longstanding diseases, as diagnosed by a doctor? (answer structure: chose between yes or no)

Sleep disorders - Newly diagnosed	0.08	0.27	Dichotomized variable: 1=I have been newly diagnosed with this CHC 0=I have had this CHC for the last 3 or more years or I do not have this CHC	
Psychological disorders - Existing	0.04	0.20	Dichotomized variable: 1=I have this CHC 0=I do not have this CHC	Do you have one or more of the following longstanding diseases, as diagnosed by a doctor? (answer structure: chose between yes or no)
Psychological disorders - Newly diagnosed	0.04	0.18	Dichotomized variable: 1=I have been newly diagnosed with this CHC 0=I have had this CHC for the last 3 or more years or I do not have this CHC	
Control variables				
Age	60.86	0.79	Scale variable: ranging from 60 to 65 years	In what year were you born? (age in years were calculated)
Sex	0.54	0.50	Dichotomized variable: 1=Male 0=Female	Are you a man or woman? (2 answer categories: 1=man, 2=women)
Presence of partner	0.80	0.40	Dichotomized variable: 1=Partner present 0=No partner present	Do you have a partner? (4 answer categories: 1=yes, I am married, 2=yes, I cohabit with a partner, 3=yes, I do have a partner, but we do not live together, 4=single)

Supplementary Table 4.2. (Cont.)

Variables	Mean	*SD*	Coding and Psychometric properties	Wording of survey question
Educational attainment			Three dichotomized variables:	What is the highest level of education you've completed? (7 answer categories: 1=elementary school, 2=lower vocational education, 3=lower general secondary education, 4=intermediate vocational education, 5=upper general secondary education, 6=higher vocational education, 7=university)
	0.23	0.42	Low (0,1)	
	0.26	0.44	Moderate (0,1)	
	0.51	0.50	High (0,1)	
Wealth	0.35	0.48	Low (0,1)	How large do you estimate your total wealth (own house, savings, stocks etc. minus debts/mortgages) to be? (7 answer categories: 1= < €5,000, 2= €5000 - €25,000, 3= €25,000 - €50,000, 4= €50,000 - €100,000, 5= €100,000 - €250,000, 6= €250,000 - €500,000, 7= > €500,000)
	0.48	0.50	Moderate (0,1)	
	0.18	0.38	High (0,1)	
Multimorbidity	0.96	0.81	Dichotomized variable: 1=Multimorbidity, two or more CHCs 0=No or one CHC	Do you have one or more of the following longstanding diseases, as diagnosed by a doctor? (answer structure: chose between yes or no)

Full-time employment	0.49	0.50	Dichotomized variable: 1=Employed full-time (>36 hours) 0=Employed part-time (<36 hours)	How many hours per week do you work on average? (answers are given as number of hours)
Supervisory position	0.25	0.43	Dichotomized variable: 1=In supervisory position 0=In non-supervisory position	Do you have a supervisory position? (2 answer categories: 1=no, 2=yes)
Manual work	0.17	0.38	Dichotomized variable: 1=Manual work 0=Non-manual work	Based on the International Standard Classification of Occupation, in which category could your job be grouped?
Organizational sector	0.49	0.50	Three dichotomized variables: Government and education (0,1)	Derived through information from the organization
	0.18	0.39	Construction (0,1)	
	0.33	0.47	Health and welfare (0,1)	
Additional variables for the Heckman analysis				
Caregiving responsibilities	0.63	0.48	Dichotomized variable: 1=Yes, I provide care 0=No, I do not provide care	Do you provide help to family members or friends who are ill or in need of help? (derived through few questions with answer categories corresponding to type of help)
Work stress	0.91	0.28	Dichotomized variable: 1=Yes, work is stressful 0=No, work is not stressful	Is your work stressful? (4 answer categories from 1=very to 4=not at all)

Note. SD = standard deviation, w1 = wave 1, w2 = wave 2

Supplementary Table 4.3.

Results of multivariate regression analyses (second stage output of a two-step Heckman model) to explain the effects of existing chronic health conditions at wave 1 and newly diagnosed chronic health conditions between wave 1 and wave 2 on vitality, worries about physical functional ability and worries about mental functional ability at wave 2

Variables	Vitality w2		Worries about physical functional ability w2		Worries about mental functional ability w2	
	Coef.	SE	Coef.	SE	Coef.	SE
Vitality w1	0.55**	0.04				
Worries about physical functional ability w1			0.51**	0.05		
Worries about mental functional ability w1					0.45**	0.06
Arthritis - Existing	-0.12*	0.05	0.14*	0.05	0.05	0.06
Arthritis - Newly diagnosed	-0.21*	0.06	0.27**	0.07	0.08	0.07
Cardiovascular diseases - Existing	-0.10	0.06	0.16*	0.08	0.11	0.08
Cardiovascular diseases - Newly diagnosed	-0.09	0.09	0.17*	0.08	-0.01	0.08
Sleep disorders - Existing	-0.12*	0.06	0.17*	0.05	0.17*	0.08
Sleep disorders - Newly diagnosed	-0.38**	0.10	0.19	0.11	0.37*	0.14
Psychological disorders - Existing	-0.04	0.13	0.11	0.12	0.06	0.13
Psychological disorders - Newly diagnosed	-0.69**	0.14	0.17	0.11	0.47**	0.12
Age	0.03	0.07	-0.19*	0.08	-0.23*	0.11
Sex (reference = male)	-0.02	0.06	-0.00	0.05	0.03	0.06
Partner present (reference = present)	0.08	0.05	0.01	0.05	-0.04	0.06
Education (reference=low educated)						
Moderately educated	0.01	0.06	0.06	0.06	0.01	0.07
Highly educated	0.06	0.07	-0.04	0.07	-0.10	0.07

Wealth (reference=low wealth)						
Moderate wealth	0.05	0.06	-0.06	0.07	-0.09	0.08
High wealth	0.08	0.09	-0.20	0.13	-0.24	0.13
Multimorbidity (reference = two or more CHCs)	-0.02	0.04	-0.01	0.04	0.00	0.07
Full time work (reference = full-time worker)	0.05	0.08	-0.00	0.09	0.05	0.12
Supervisory position (reference = supervisor)	-0.07	0.06	-0.01	0.07	0.04	0.06
Manual work (reference = manual worker)	-0.18*	0.07	0.23*	0.07	0.01	0.09
Organizational sector (reference = government and education)						
Construction	-0.05	0.08	-0.12	0.10	-0.20	0.14
Welfare and health	0.00	0.05	-0.02	0.05	-0.06	0.06
Constant	-2.12	4.10	11.55*	4.46	13.94*	6.39
Lambda	0.10	0.42	0.37	0.53	0.54	0.71
N (censored/uncensored)	861/1894		861/1894		861/1894	
Wald X^2	1613.23**		2842.43**		2180.84**	

Note. ** p<0.001, * p<0.05, Coef. = coefficient, SE = standard error, w1 = wave 1, w2 = wave 2

Chapter 5

Supplementary Table 5.1.

Means (M), standard deviations (SD), coding and psychometric properties, and wording of survey questions of all variables

Control variables	Arthritis (n = 2,330)		Cardiovascular disease (n = 720)		Sleep disorders (n = 816)		Coding and Psychometric properties	Wording of survey question
	M	SD	M	SD	M	SD		
Dependent Variable								
Health-related work limitations	0.82	0.65	0.73	0.70	0.92	0.68	Categorical variable: 1 = Not limited 2 = Moderately limited 3 = Severely limited	Limiting long-standing illnesses measure: a. Do you have one or more of the following longstanding diseases (diagnosed by doctor)? b. Do these longstanding diseases limit your performance at work? (3 answer categories)
Independent Variables								
Perceived access to flexible work arrangements								
Working-time flexibility	0.48	0.50	0.53	0.50	0.46	0.50	Dummy variable: 1 = yes 0 = no	Are the following HR measures available in your organization? (2 answer categories: 1 = yes, 2 = no)
Workplace flexibility	0.43	0.49	0.47	0.50	0.42	0.49		
Phased retirement	0.69	0.46	0.71	0.45	0.66	0.47		

Organizational climate								
Healthy ageing climate	3.51	0.47	3.56	0.46	3.43	0.45	Scale variable: Individual-level variables are calculated by first reverse-coding and then averaging the two Likert items Individual-level variables were aggregated by organization to create organization level climate variables which range from 1 to 5	To what extent do you agree with the following statements about your organization: 1. In this organization a lot of attention is paid to health and safety at work 2. Health and wellbeing of employees are important in this organization (5 answer categories on a Likert scale ranging from 1 = completely agree, to 5 = completely disagree)
Psychological safety climate	3.41	0.37	3.41	0.37	3.38	0.39	Scale variable: Individual-level variables are calculated by averaging the two Likert items Individual-level variables were aggregated by organization to create organization level climate variables which range from 1 to 5	To what extent do you agree with the following statements about your organization: 1. At my work many people are afraid to make mistakes 2. In this organization, there is a culture of fear (5 answer categories on a Likert scale ranging from 1 = completely agree, to 5 = completely disagree)

Supplementary Table 5.1. (Cont.)

Control variables	Arthritis (n = 2,330)		Cardiovascular disease (n = 720)		Sleep disorders (n = 816)		Coding and Psychometric properties	Wording of survey question
	M	SD	M	SD	M	SD		
Control Variables								
Demographic controls								
Age	62.06	1.59	62.21	1.61	61.91	1.59	Scale variable: ranging from 60 - 65 years	In what year were you born? (age in years were calculated)
Sex	0.50	0.50	0.70	0.46	0.40	0.49	Dummy variable: 1 = male 0 = female	Are you a man or woman? (2 answer categories: 1 = man, 2 = women)
Marital status	0.82	0.39	0.83	0.38	0.78	0.41	Dummy variable: 1 = partner present 0 = no partner present	Do you have a partner? (4 answer categories: 1 = yes, I am married, 2 = yes, I cohabit with a partner, 3 = yes, I do have a partner, but we do not live together, 4 = single)
Wealth	3.93	1.73	3.97	1.71	3.85	1.73	Categorical variable: 1 = > €5,000 2 = €5000 – €25,000 3 = €25,000 – €50,000 4 = €50,000 – €100,000 5 = €100,000 – €250,000 6 = €250,000 - €500,000 7 = > €500,000	How large do you estimate your total wealth (own house, savings, stocks etc. minus debts/mortgages) to be? (7 answer categories)

Health-related factors								
Diabetes	0.07	0.26	0.12	0.33	0.10	0.29	Dummy variable: 1 = yes 0 = no	Do you have one or more of the following longstanding diseases (as diagnosed by a doctor)? (answer structure: chose between yes or no)
Psychological disorders	0.06	0.23	0.08	0.27	0.15	0.35		
Other chronic health conditions	0.38	0.48	0.35	0.48	0.49	0.50		
Work-related factors								
Size of organization	2.38	0.63	2.36	0.64	2.38	0.64	Categorical variable: 1 = less than 50 2 = 50 to 250 3 = more than 250	How many people do approximately work in your work establishment? (3 answer categories)
Sector	1.84	0.88	1.73	0.84	1.89	0.93	Categorical variable: 1 = government and education sectors 2 = construction sector 3 = health and welfare sector	Derived through information from the organization
Job role	0.21	0.41	0.21	0.41	0.16	0.37	Dummy variable: 1 = blue-collar job 0 = white-collar job	Based on the International Standard Classification of Occupation, in which category could your job be grouped?
Job position	0.22	0.42	0.26	0.44	0.19	0.40	Dummy variable: 1 = supervisory position 0 = non-supervisory position	Do you have a supervisory position? (2 answer categories: 1 = no, 2 = yes)

Supplementary Table 5.1. (Cont.)

Control variables	Arthritis (n = 2,330)		Cardiovascular disease (n = 720)		Sleep disorders (n = 816)		Coding and Psychometric properties	Wording of survey question
	M	SD	M	SD	M	SD		
Proportion of workers >50 years	45.60	11.44	46.41	11.90	44.67	11.10	Scale variable: ranging from 0% - 100%	Derived through information from the organization
Proportion of female workers	56.25	31.16	49.97	30.83	61.90	28.51		
Proportion of part-time workers	54.68	31.47	48.08	31.32	60.79	29.36		

Supplementary Table 5.2.

Descriptive statistics of older workers with arthritis (N = 2,330), cardiovascular disease (N = 720), and sleep disorders (N = 816)

Variables	Arthritis (n = 2,330)	Cardiovascular disease (n = 720)	Sleep disorders (n = 816)
Health-related work limitations (%)			
No limitations	31.85	42.22	27.21
Moderate limitations	54.12	43.06	53.68
Severe limitations	14.03	14.72	19.12
Perceived flexible work arrangements (%)			
Working-time flexibility			
Has access to working-time flexibility	47.54	53.12	46.32
No access to working-time flexibility	52.46	46.88	53.68
Workplace flexibility			
Has access to workplace flexibility	42.53	46.88	42.40
No access to workplace flexibility	57.47	53.12	57.60
Phased retirement			
Has access to phased retirement	69.42	71.43	66.30
No access to phased retirement	30.58	28.57	33.70
Organizational climate (%)			
Organization has a healthy ageing climate			
High (score 4 - 5)	62.01	65.88	53.19
Moderate (score 3)	25.52	23.30	29.78
Low (score 1 - 2)	12.46	10.82	17.03
Organization has a psychologically safe climate			
High (score 4 - 5)	56.27	57.14	49.26
Moderate (score 3)	30.66	29.54	34.56
Low (score 1 - 2)	13.06	13.31	16.18
Demographic controls			
Mean age (years)	62.06	62.21	61.92
Sex (%)			
Male	49.98	69.90	40.07
Female	50.02	30.10	59.93
Marital status (%)			
Partner present	81.54	82.94	78.43
Partner not present	18.46	17.06	21.57

Supplementary Table 5.2. (Cont.)

Variables	Arthritis (n = 2,330)	Cardiovascular disease (n = 720)	Sleep disorders (n = 816)
Wealth (%)			
> €5,000	12.8	12.5	12.6
€5000 – €25,000	13.5	12.1	15.9
€25,000 – €50,000	10.1	10.0	10.7
€50,000 – €100,000	17.3	18.9	16.0
€100,000 – €250,000	28.1	28.5	28.1
€250,000 – €500,000	14.0	13.7	13.0
> €500,000	4.2	4.3	3.7
Health-related factors (%)			
Diabetes			
Has diabetes	7.28	12.48	9.56
Does not have diabetes	92.72	87.52	90.44
Psychological disorders			
Has psychological disorders	5.82	7.77	14.58
Does not have psychological disorders	94.18	92.23	85.42
Other CHCs			
Has other CHCs	37.69	35.23	49.14
Does not have other CHCs	62.31	64.77	50.86
Work related factors (%)			
Size of organization			
0 - 50 employees	8.14	9.15	8.46
50 - 250 employees	45.87	45.21	45.34
Over 250 employees	46.00	45.63	46.20
Sector			
Government and education	48.44	52.01	48.90
Construction	19.44	22.75	12.99
Health and welfare	32.12	25.24	38.11
Job type			
Blue-collar workers	20.86	20.97	15.81
White-collar workers	79.14	79.03	84.19
Job position			
Supervisory position	22.18	25.66	19.49
Non-supervisory position	77.82	74.34	80.51
Mean proportion of workers over 50 years	45.60	46.41	44.67
Mean proportion of female workers	56.25	49.97	61.90
Mean proportion of part-time workers	54.68	48.08	60.79

Chapter 6

Supplementary Table 6.1.

Items of the Vitality scale

How much of the time in the last 30 days did you feel:	N	Mean	*SD*
a) Full of energy	4156	4.20	1.00
b) Tired	4156	3.96	0.87
c) Worn out	4156	4.70	1.01
d) Full of pep	4156	4.14	1.11

Supplementary Table 6.2.

Descriptive statistics of (unstandardized) variables in a sample of 4,156 older workers and retirees (N = 4,156)

Variables	Mean	*SD*	Coding and Psychometric properties	Wording of survey question
Vitality at w1 Vitality at w2	70.86 72.94	13.09 13.19	Scale variables, ranging from 0 to 100	How much of the time during the past 30 days did you feel: (v) full of energy (vi) tired (vii) worn out (viii) full of pep (6 answer categories on a Likert scale ranging from 1=constantly to 6=never)
Energy at w1 Energy at w2	69.56 71.66	15.52 15.49	Scale variables, ranging from 0 to 100	How much of the time during the past 30 days did you feel: (i) full of energy (iv) full of pep (6 answer categories on a Likert scale ranging from 1=constantly to 6=never)
Fatigue at w1 Fatigue at w2	44.50 42.44	14.35 14.37	Scale variables, ranging from 0 to 100	How much of the time during the past 30 days did you feel: (ii) tired (iii) worn out (6 answer categories on a Likert scale ranging from 1=constantly to 6=never)

Retirement status at w2	0.49	0.50	Dichotomized variable: 1=Retired 0=Still working	Which situation applies to you? (2 answer categories: 1=I work for pay, 2=I do not work for pay any longer)
Manual work	0.18	0.38	Dichotomized variable: 1=Manually work 0=Non-manual work	Based on the International Standard Classification of Occupation, in which category could your job be grouped?
Demographic controls				
Age	62.03	1.60	Scale variable: ranging from 60 to 65 years	In what year were you born? (age in years were calculated)
Sex	0.55	0.50	Dichotomized variable: 1=Male 0=Female	Are you a man or woman? (2 answer categories: 1=man, 2=women)
Presence of partner	0.81	0.39	Dichotomized variable: 1=Partner present 0=No partner present	Do you have a partner? (4 answer categories: 1=yes, I am married, 2=yes, I cohabit with a partner, 3=yes, I do have a partner, but we do not live together, 4=single)
Educational attainment	2.19	0.84	Categorical variable: 1= low 2= moderate 3= high	What is the highest level of education you've completed? (7 answer categories: 1=elementary school, 2=lower vocational education, 3=lower general secondary education, 4=intermediate vocational education, 5=upper general secondary education, 6=higher vocational education, 7=university)

Supplementary Table 6.2. (Cont.)

Variables	Mean	*SD*	Coding and Psychometric properties	Wording of survey question
Wealth	1.88	0.72	Categorical variable: 1= low 2= moderate 3= high	How large do you estimate your total wealth (own house, savings, stocks etc. minus debts/mortgages) to be? (7 answer categories: 1= < €5,000, 2= €5000 - €25,000, 3= €25,000 - €50,000, 4= €50,000 - €100,000, 5= €100,000 - €250,000, 6= €250,000 - €500,000, 7= > €500,000)
Health-related controls				
Having a chronic health condition	0.66	0.47	Dichotomized variable 1=Has a chronic health condition 0=Does not have a chronic health condition	Do you have one or more of the following longstanding diseases, as diagnosed by a doctor? (answer structure: chose between yes or no)
Work-related controls				
Full-time employment	0.48	0.50	Dichotomized variable: 1=Employed full-time (>36 hours) 0=Employed part-time (<36 hours)	How many hours per week do you work on average? (answers are given as number of hours)
Supervisory position	0.25	0.44	Dichotomized variable: 1=In supervisory position 0=In non-supervisory position	Do you have a supervisory position? (2 answer categories: 1=no, 2=yes)

Organizational size	2.24	0.71	Categorical variable: 1=Small (<50 employees) 2=Medium (50-250 employees) 3=Large (>250 employees)	How many people do approximately work in your work establishment? (3 answer categories: 1=<50 employees, 2=50-250 employees, 3=>250 employees)
Organizational sector	1.81	0.88	Categorical variable: 1=Government and education sectors 2=Construction sector 3=Health and welfare	Derived through information from the organization

Note. *SD* = standard deviation, w1 = wave 1, w2 = wave 2

Supplementary Table 6.3.

Characteristics of respondents who dropped out between waves 1 and 2 (N = 1,308) and those who responded to wave 2 (N = 4,972)

Variables	Drop outs from w1 to w2 (N = 1,308)		Respondents at wave 2 (N = 4,972)	
	Mean	SD	Mean	SD
Demographic controls				
Age (scale, 0-100)	61.97	1.62	62.03	1.59
Male sex (dummy, 0-1)	0.57	0.50	0.55	0.50
Partner present (dummy, 0-1)	0.88	0.33	0.81	0.39
Educational attainment (categorical, 1-3)	2.09	0.85	2.22	0.50
Wealth (categorical, 1-3)	1.86	0.72	1.89	0.72
Health-related controls				
Having a chronic health condition (dummy, 0-1)	0.70	0.46	0.68	0.46
Work-related controls				
Full-time employment (dummy, 0-1)	0.49	0.50	0.47	0.50
Supervisory position (dummy, 0-1)	0.25	0.43	0.25	0.43
Organizational size (categorical, 1-3)	2.23	0.71	2.24	0.71
Organizational sector (categorical, 1-3)	1.93	0.87	1.82	0.87
Manual work (dummy, 0-1)	0.25	043	0.19	0.39

Supplementary Table 6.4.

Characteristics of older workers working at wave 2 (N = 2,222) vs. older workers who retired by wave 2 (N = 1,934)

Variables	Working at wave 2		Retired at wave 2	
	Mean	*SD*	Mean	*SD*
Demographic controls at w1				
Age (scale, 0-100)	61.21	1.18	62.99	1.48
Male sex (dummy, 0-1)	0.54	0.50	0.56	0.50
Partner present (dummy, 0-1)	0.80	0.40	0.82	0.39
Educational attainment (categorical, 1-3)	2.25	0.82	2.26	0.83
Wealth (categorical, 1-3)	1.82	0.71	2.01	0.73
Health-related controls at w1				
Having a chronic health condition (dummy, 0-1)	0.65	0.48	0.69	0.46
Work-related controls at w1				
Full-time employment (dummy, 0-1)	0.50	0.50	0.45	0.50
Supervisory position (dummy, 0-1)	0.25	0.43	0.26	0.44
Organizational size (categorical, 1-3)	2.25	0.71	2.23	0.70
Organizational sector (categorical, 1-3)	1.85	0.89	1.76	0.86
Manual work (dummy, 0-1)	0.18	0.38	0.18	0.38

Nederlandse samenvatting

Het pensioenlandschap is de afgelopen decennia snel veranderd in de meeste westerse landen, onder andere in Nederland. De vergrijzing heeft geleid tot toenemende bezorgdheid over de krimp van de beroepsbevolking en de houdbaarheid van de verzorgingsstaat. Om deze bezorgdheid weg te nemen hebben de meeste westerse regeringen het arbeidsleven verlengd door de wettelijke pensioenleeftijd te verhogen en vervroegde uittreding uit het arbeidsproces te ontmoedigen. De kans op chronische gezondheidsklachten neemt echter sterk toe met de leeftijd. Daardoor zal een aanzienlijk aantal oudere werknemers te maken krijgen met beperkingen door hun chronische aandoeningen terwijl zij blijven werken tot zij de verhoogde pensioenleeftijd bereiken. Om het welzijn en de productiviteit van oudere werknemers met chronische aandoeningen te waarborgen, is het belangrijk te begrijpen hoe chronische aandoeningen het werk en de gezondheid van deze werknemers in hun late carrière beïnvloeden en hoe oudere werknemers met chronische aandoeningen op het werk kunnen worden ondersteund.

In dit proefschrift beoog ik te begrijpen hoe oudere werknemers met chronische aandoeningen werk en gezondheid in hun late carrière ervaren in Nederland. Dit doe ik door de invloed van verschillende chronische aandoeningen op de arbeidsbeperkingen, vitaliteit en subjectieve levensverwachting van oudere werknemers te onderzoeken. Ook onderzoek ik wat de invloed is op de pensioenvoorkeuren van oudere werknemers. Verder onderzoek ik de rol van de organisatie in het duurzaam ondersteunen van oudere werknemers met chronische aandoeningen. In het bijzonder richt ik me op het identificeren van het type organisatieklimaat en organisatiebeleid dat de meeste voordelen biedt voor oudere werknemers met chronische aandoeningen. Ik gebruik gegevens van het Netherlands Interdisciplinary Demographic Institute's (NIDI) Pension Panel Survey (NPPS), een innovatieve prospectieve cohortstudie die een cohort Nederlandse oudere werknemers volgt die geboren zijn tussen 1950-1955. De eerste golf van het NPPS werd in 2015 in Nederland uitgevoerd waarbinnen gegevens van ongeveer 6.800 oudere werknemers in de leeftijd van 60-65 jaar werden verzameld. De tweede ronde van gegevensverzameling werd uitgevoerd in 2018. Ongeveer 5.300 oudere werknemers die in golf 1 de vragenlijst hebben beantwoord hebben

ook in golf 2 gereageerd. De NPPS bevat gedetailleerde informatie over de pensioenprocessen en -intenties, gezondheid en werkcontexten van oudere werknemers. De multilevel datastructuur van de NPPS maakt het ook mogelijk om onderscheid te maken tussen de invloed van eigenschappen van organisaties en van individuen op de gezondheid en het werk van oudere werknemers met chronische aandoeningen.

In hoofdstuk 2 onderzoek ik de verschillende wegen waarlangs chronische gezondheidsproblemen de pensioenvoorkeuren van oudere werknemers beïnvloeden. Uit de literatuur weten we dat oudere werknemers met een slechte gezondheid of met chronische aandoeningen de voorkeur geven aan vervroegd pensioen. Echter, de redenen voor deze voorkeur zijn nog onbekend. Daarom ontleed ik in dit hoofdstuk de mate waarin vitaliteit, gezondheidsgerelateerde werkbeperkingen en subjectieve levensverwachting kunnen verklaren waarom mensen met chronische klachten eerder met pensioen willen. Ik maak daarbij onderscheid tussen de vier chronische aandoeningen artritis, hart- en vaatziekten, slaapstoornissen en psychische aandoeningen. Uit de resultaten van dit hoofdstuk blijkt dat oudere werknemers met chronische aandoeningen vaker de voorkeur geven aan vervroegde pensionering. De reden waarom zij de voorkeur geven aan vervroegde pensionering is mede afhankelijk van de chronische aandoeningen waaraan zij lijden. Zo geven oudere werknemers met artritis of hart- en vaatziekten eerder de voorkeur aan vervroegde uittreding vanwege de gezondheidsgerelateerde arbeidsbeperkingen die zij ondervinden, terwijl oudere werknemers met slaap- of psychische aandoeningen eerder de voorkeur geven aan vervroegde uittreding vanwege hun verminderde vitaliteit. Oudere werknemers met hart- en vaatziekten schatten hun levensduur lager in, wat hun voorkeur voor vervroegde pensionering vergroot. Over het geheel genomen biedt dit hoofdstuk een beter inzicht in de mechanismen waarlangs chronische gezondheidsproblemen de pensioenvoorkeur van oudere werknemers beïnvloeden, hetgeen aanknopingspunten kan bieden voor beleid en praktijk.

In hoofdstuk 3 onderzoek ik hoe chronische aandoeningen veranderingen in de subjectieve levensverwachting van oudere werknemers beïnvloedden over een periode van drie jaar. Ik onderzoek de effecten van vijf soorten chronische aandoeningen - artritis, hart- en vaatziekten, slaapstoornissen, psychische aandoeningen en levensbedreigende aandoeningen - op de subjectieve

levensverwachting. Ik maak tevens een onderscheid tussen bestaande chronische aandoeningen en recent vastgestelde aandoeningen. De bevindingen tonen aan dat de subjectieve levensverwachting van oudere werknemers over het algemeen niet afneemt in de tijd, ongeacht of zij geen, bestaande of nieuw gediagnosticeerde chronische aandoeningen hebben. De subjectieve levensverwachting daalt voor oudere werknemers met nieuw gediagnosticeerde chronische aandoeningen sterk in vergelijking met de groep oudere werknemers met bestaande of geen chronische aandoeningen. Zo daalt de subjectieve levensverwachting van oudere werknemers bij wie onlangs een levensbedreigende aandoening of een psychische stoornis werd vastgesteld, het sterkst. Artritis en slaapstoornissen hebben echter geen effect op hoe lang oudere werknemers dachten te leven.

Volgens de literatuur maken veel oudere werknemers die geconfronteerd worden met een hogere pensioenleeftijd zich zorgen over hun vermogen om op het werk goed te blijven functioneren. Ik veronderstel dat deze bezorgdheid sterk samenhangt met de aanwezigheid van een chronische aandoening. In hoofdstuk 4 gebruik ik een longitudinale studieopzet om de effecten van chronische aandoeningen op de vitaliteit van oudere werknemers en hun zorgen over fysiek en mentaal functioneren te onderzoeken. De resultaten van dit hoofdstuk laten niet alleen zien dat de vitaliteit geleidelijk vermindert en de zorgen toenemen bij reeds bestaande chronische aandoeningen, maar ook dat een nieuwe diagnose van een chronische aandoening sterke negatieve effecten heeft op oudere werknemers. Interessant is dat nieuw gediagnosticeerde chronische aandoeningen met meer lichamelijke invaliderende symptomen de zorgen over lichamelijk functioneren versterken, terwijl nieuw gediagnosticeerde chronische aandoeningen met meer geestelijke invaliderende symptomen de zorgen over geestelijk functioneren versterken.

De resultaten van de hoofdstukken 2 tot en met 4 laten zien dat chronische aandoeningen een aanzienlijk negatief effect hebben op de vitaliteit, het werk, de subjectieve levensverwachting, het psychologisch welzijn en de pensioenvoorkeuren van oudere werknemers. Belangrijk is dat de resultaten laten zien dat deze effecten verschillen tussen de soorten chronische aandoeningen en tussen reeds bestaande en nieuw gediagnosticeerde aandoeningen. Dit roept het volgende vraagstuk op: hoe kunnen organisaties oudere werknemers met chronische aandoeningen tegemoetkomen en ondersteunen? In hoofdstuk 5

onderzoek ik de mogelijke voordelen van flexibele werkafspraken en een ondersteunend organisatieklimaat op de gezondheidsgerelateerde arbeidsbeperkingen van oudere werknemers met artritis, hart- en vaatziekten en slaapstoornissen met behulp van een multilevel analyse. De resultaten laten zien dat flexibiliteit in werktijden en een psychologisch veilig organisatieklimaat kunnen helpen bij het verminderen van problemen waarmee oudere werknemers kunnen worden geconfronteerd als zij langer werken terwijl zij lijden aan chronische aandoeningen. Flexibele werktijden bieden oudere werknemers de autonomie om hun dagen in te delen volgens hun werk- en gezondheidseisen. Oudere werknemers die deel uitmaken van een organisatie met een psychologisch veilig organisatieklimaat kunnen zich veilig genoeg voelen om hun behoeften en beperkingen openlijk bekend te maken, waardoor de kans groter wordt dat zij aanpassingen op de werkplek ontvangen. Bovendien benadrukt dit hoofdstuk de noodzaak om eigenschappen van werkplekken op zowel individueel als organisatieniveau te bestuderen, om meer inzicht te krijgen in wat, wanneer en hoe specifieke beleidsmaatregelen en praktijken kwetsbare groepen oudere werknemers kunnen ondersteunen.

Als we kijken naar werk- en organisatiefactoren, is het type baan een belangrijke voorspeller van gezondheid en welzijn op latere leeftijd. Tot dusver is uit onderzoek gebleken dat werknemers met fysiek zwaar werk een andere werkomgeving en andere functie-eisen ervaren dan werknemers zonder fysiek zwaar werk. Fysiek werk wordt ook in verband gebracht met hoge fysieke eisen en daarmee ook met lichamelijke aandoeningen. In hoofdstuk 6 onderzoek ik het effect van pensionering (of de voortzetting van het werk) op de vitaliteit van oudere werknemers (en op de subcomponenten daarvan: energie en vermoeidheid) met behulp van een longitudinale studieopzet. Verder onderzoek ik of deze relaties verschillen tussen werknemers met en zonder fysiek werk. Bij de oudere werknemers met fysiek werk is een sterke daling van de vitaliteit in de jaren voor pensionering zichtbaar, terwijl bij degenen die met pensioen gaan een verbetering van hun vitaliteit zichtbaar is. Oudere werknemers zonder fysiek werk die met pensioen gaan vertonen ook een toename van hun vitaliteit, maar geen verandering in hun vitaliteit als zij bleven werken. Uit deze resultaten blijkt dat pensionering de vitaliteit van alle oudere werknemers ten goede komt en dat doorwerken belastend is voor de gezondheid van oudere werknemers met fysiek zwaar werk. Dit hoofdstuk bevat twee suggesties voor beleid en praktijk: 1) als pensionering goed is voor de gezondheid, moet

pensionering waarschijnlijk niet verder worden uitgesteld en 2) oudere werknemers met fysiek zwaar werk hebben wellicht meer ondersteuning nodig tijdens latere loopbaanfasen.

Alles bij elkaar toont dit proefschrift aan dat chronische aandoeningen sterk verschillen in de manier waarop zij de gezondheid, het werk en de pensioenvoorkeuren van oudere werknemers beïnvloeden. Op basis van de bevindingen kan ik drie belangrijke conclusies trekken. Ten eerste beïnvloeden chronische aandoeningen de vitaliteit, arbeidsbeperkingen en pensioenvoorkeuren van oudere werknemers op verschillende manieren. Het is daarbij belangrijk onderscheid te maken tussen de aard van de chronische aandoening en of deze nieuw is gediagnosticeerd. Ten tweede kunnen organisaties het werkvermogen van oudere werknemers met chronische aandoeningen verbeteren door de oudere werknemers een psychologisch veilig werkklimaat en flexibele werktijden te bieden. Ten derde verbetert pensionering de vitaliteit van oudere werknemers, meer voor werknemers met fysiek zwaar werk dan voor werknemers zonder fysiek zwaar werk.

Dit proefschrift toont aan dat oudere werknemers met chronische aandoeningen veel gezondheids- en werkgerelateerde uitdagingen kunnen ondervinden naarmate zij langer zullen doorwerken. Aangezien toekomstige generaties werknemers langer zullen werken, is het van vitaal belang om op beleids- en organisatieniveau meer inspanningen te leveren om de gezondheid, het werk en gezond ouder worden van oudere werknemers met chronische aandoeningen te beschermen en te bevorderen.

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About the author

Anushiya Vanajan was born in the suburbs of Colombo, Sri Lanka on a warm October's day in 1991. She grew up in the beach-side streets of central-Colombo. She completed her O Level in Methodist College in 2007 and A Level in Gateway College in 2010.

In 2011, she left Sri Lanka to Kuala Lumpur, Malaysia where she obtained a bachelor's honours degree in Psychology at Lancaster University (in affiliation with Sunway University) by 2014. After graduating, she worked for a year as a Lecturer at a higher education institute in Colombo, Sri Lanka. In this position, she not only conducted lectures in psychology subjects, but was also involved in theses supervision and other research projects.

In Autumn of 2015, Anushiya and her trusty suitcase flew in to Germany, to pursue a Master's degree in Epidemiology at Ludwig Maximilians University, Munich. Here she specialized in environmental and organizational epidemiology, the epidemiology of infectious diseases and the epidemiology of chronic conditions. During her studies, she worked as a research assistant for several epidemiological research projects and for the coordination of a distance learning programme delivered by Harvard T. H. Chan School of Public Health.

In November, 2017, Anushiya moved to the windy yet highly 'gezellig' city - the Hague, to start her PhD candidacy at the Netherlands Interdisciplinary Demographic Institute (NIDI) in affiliation with University Medical Centre Groningen (UMCG). Her project was part of the NWO-funded research programme 'Ageing workers in an Ageing Society: Labour Force Transitions and Work in Later Life'. Her project was co-funded by the UMCG. During the four+ years of her PhD, Anushiya wrote and published five empirical articles in high-ranking journals. She also presented these articles in various international (Annual Meeting of the Gerontological Society of America, Annual Conference of the British Society of Gerontology, Nordic Congress of Gerontology, International Association of Gerontology and Geriatrics European Region Congress, European Population Conference) and national (Dag van de Sociologie, Dutch Demography Day, Netspar International Pension Day) conferences. Additionally, she collaborated with national

and international researchers on book chapters and journal articles. She was also involved in supervising interns and master's theses students.

Besides her work, Anushiya was also an active member at NIDI. She co-created the NIDI Early Career Group through which 'intervisie' programmes and in-company Dutch language courses were initiated. Anushiya also helped develop the new website for NIDI and she enjoyed organizing social events such as NIDI outings.

Currently, Anushiya works for the Generations and Gender Programme, a social science infrastructure for research on population and family dynamics. After the defence of her PhD (and a much-awaited holiday with excited family members, carb-filled pasta and hopefully some snow), Anushiya plans to further her research in social and occupational epidemiology with a focus on the work, retirement and the health of vulnerable populations.

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