General discussion
As economic pressure was put on Dutch pension systems due the ageing of the population, efforts have been made to increase workforce participation among older workers. It remains to be seen whether older workers will be capable to postpone their retirement and, therefore, whether the altered retirement policies are feasible. Various potential threats have been identified for employment at high age. The following three factors are considered to be important threats: work demands, poor memory performance, and the effect of retirement age on health. Within these three areas, studies are performed and described in this thesis. The aim of these studies is to improve the comprehension of the relationship of employment and retirement with health to help determine whether the feasibility and success of the retirement policies aimed at increasing workforce participation can be improved.

This thesis has three objectives:

1) To develop and validate a general population job-exposure matrix (GPJEM) including physical work demands, psychosocial work demands, and psychosocial work resources.

2) To examine whether memory complaints reported by 55-64-year-olds are associated with objectively measured memory performance, employment, and with employment characteristics
   a) To examine whether memory complaints are related to objectively measured memory performance and decline in 55-64-year-olds
   b) To examine whether memory complaints are related to employment status and employment characteristics in 55-64-year-olds

3) To examine whether on- and off-time retirement are associated with subjective general and emotional health

This chapter summarises the main findings, discusses methodological strengths and limitations, the relevance of the finding, and recommendations for future research.
7.1 Main findings

The development and validation of a GPJEM including physical demands, psychosocial demands, and psychosocial resources (objective 1)

In chapter 2 the development and validation of a psychosocial and physical GPJEM is presented. The GPJEM described in the present thesis was developed by deriving physical work demands (use of force, work in uncomfortable positions, repetitive movements), psychosocial work demands (task requirements, time pressure, cognitive demands), and psychosocial work resources (autonomy, variation in activities, co-worker job support, supervisory job support) reported by 55-64-year-olds from the Netherlands Working Conditions Survey (NWCS) and linking it to the Netherlands Standard Classification of Occupations 1992 (NSCO92; Statistics Netherlands 2001). A GPJEM with low (≤NWCS-based normative %), moderate (>NWCS-based normative % and ≤50%), and high (>50%) probability of exposure to demands and resources was developed. The GPJEM was applied in the Longitudinal Aging Study Amsterdam (LASA study).

As a primary validation of the GPJEM, associations of physical demands and iso-strain (i.e. high psychosocial demands and low psychosocial resources) with health were examined in respondents of the LASA study who either worked at the time of the interview (current workers) or had worked in the past (former workers). To examine the validity of the physical demands derived from the GPJEM, the following health measures were examined: functional limitations, subjective general health (referred to as self-perceived health in chapter 2), and hip or knee osteoarthritis (OA). Current and former workers who used force during work and worked in uncomfortable positions had more functional limitations and more often had poor subjective general health, but were equally likely to have hip or knee OA compared to those who did not use force during work or work in uncomfortable positions. Former workers who had a job with moderate probability of repetitive movements had more functional limitations compared to former workers who had a job with low probability of repetitive movements. Current and former workers who had a job with high probability of repetitive movements had more functional limitations compared to former workers who had a job with low probability of repetitive movements. Former workers who had a job with high probability of repetitive movements more often had poor subjective general health and hip and knee OA.

To examine the validity of the psychosocial demands and resources derived from the GPJEM, associations between iso-strain and diastolic and systolic blood pressure, hypertension, and cardiovascular diseases (CVD; measured by a combination of self-report, medication use, and general practitioners information) were examined. Workers formerly exposed to iso-strain from work had higher
diastolic blood pressure and more often had hypertension, but were equally likely to have higher systolic blood pressure and CVD. Workers currently exposed to iso-strain were equally likely to have higher diastolic and systolic blood pressure, hypertension, and CVD compared to workers currently not exposed to iso-strain.

In addition to associations with health, occupational classes with high consensus on the level of physical demands, psychosocial demands, and resources (up to 59.5, 71.8, and 83.6%, respectively, and down to 0.0, 0.3, and 7.7%, respectively) were observed, suggesting satisfactory accuracy of the classification.

The results suggest that our GPJEM accurately classifies jobs according to physical demands and, although less clearly, iso-strain.

The association of memory complaints with objectively measured memory functioning, employment, and with employment characteristics in 55-64-year-olds (objective 2)

The studies examining objective 2 were described in chapters 3 (objective 2a) and 4 (objective 2b). Specifically, in chapter 3, it was examined whether prevalent memory complaints (i.e. memory complaints of which it is unknown whether they developed earlier or will persist) in 55-64-year-olds were associated with poor memory performance or memory decline. Adjusted for gender, education, and age, individuals with prevalent memory complaints more often had impaired delayed recall and were at risk of subsequent clinically relevant decline in learning ability at follow-up (i.e. during a period of three years). In addition, it was examined whether incident memory complaints (i.e. memory complaints of which it is known that they were not present three years earlier and unknown whether they will persist) in 55-64-year-olds were associated with memory decline. We observed no evidence for this. As individuals who are still working at this age were observed to ascribe their memory complaints to poor memory but also to stress and multitasking from work (Vestergren & Nilsson 2010), it was additionally examined whether the relationship between memory complaints and memory functioning differed for those still employed compared to those not employed. Only individuals with incident memory complaints at follow-up and a paid job of at least one hour weekly at baseline and follow-up (i.e. continuously employed) were borderline significantly more likely to have clinically relevant decline in learning compared to individuals without memory complaints. No such association was observed in continuously not employed individuals.

In chapter 4 it was examined whether prevalent or incident memory complaints were related to having a paid job (i.e. of at least one hour weekly) or to the following employment characteristics: working hours, job prestige, job
level, psychosocial job demands (i.e. task requirements and cognitive demands, determined by using the GPJEM), and iso-strain (combination of high psychosocial demands and low resources, also determined by using the GPJEM). Adjustments were made for a wide range of known causal or underlying factors of memory complaints, i.e. demographics, memory performance, physical health, mental health, and personality traits. Older workers were shown to be equally likely to experience memory complaints as non-working age peers. Also, working hours, job prestige, job level, task requirements, and iso-strain were not associated with memory complaints. Among workers, individuals with cognitively demanding work were more likely to experience prevalent memory complaints.

It can be concluded that memory complaints reported by 55-64-years-olds are related to objectively measured memory functioning and, independent of memory functioning or other causal or underlying factors, with high cognitive demands.

The association of on- and off-time retirement with subjective general and emotional health (objective 3)

In chapter 5, results are described of a study that examined the effect of retirement and age at retirement on subjective general health (referred to as self-perceived health in chapter 5). After adjustment for relevant individual and contextual characteristics (e.g. baseline self-perceived health, sense of mastery), retirees were equally likely to have excellent, good, or less than good subjective general health compared to age peers who continued employment. Second, the effect of age at retirement was examined by including an interaction term between retirement status and retirement age in the adjusted model. Compared to employed age peers, individuals who retired on-time (59-60 years) were more likely to have excellent or good subjective general health, with less than good subjective general health as the reference category, but only if they did not receive a disability pension. Early (55–58 years) and late (61–64 years) retirees’ subjective general health was unaffected by retirement if they did not receive a disability pension. Early and late retirees who received a disability pension were less likely to have excellent subjective general health after retirement. Higher educated retirees were less likely to have excellent subjective general health after retirement, especially at late retirement age, although health selection might explain this result.

Chapter 6 presents a study examining the effect of age at retirement on subjective emotional health (i.e. depressive symptoms). Interaction terms of retirement age with retirement status, health-related retirement, and retirement voluntariness (i.e. job loss and retirement planning) were tested. After adjustment
for relevant individual and contextual characteristics, retirees and workers were equally likely to have poorer subjective emotional health at any age. Therefore, age at retirement was not associated with subjective emotional health. Health-related retirement and retirement due to job loss did not affect the relationship between age at retirement and subjective emotional health. Poorer subjective emotional health was observed after health-related retirement. However, the association disappeared after additionally adjusting for pre-retirement physical health, suggesting that poorer subjective emotional health was observed because of health selection into retirement. Only late retirees who retired because of job loss had poorer subjective emotional health compared to age peers who continued employment. This effect on subjective emotional health in late retirees was only observed in those who retired due to job loss, not in those who retired for other reasons than job loss. Therefore, this is unlikely to be related to social timing, but is more likely related to job loss.

In conclusion, on- and off-time retirement affected subjective general health (chapter 5) but not subjective emotional health (chapter 6).

### 7.2 Methodological considerations

Some methodological strengths and limitations are discussed in this paragraph which should be considered when interpreting the results described in this thesis.

**Strengths and limitations of the design**

*The LASA and DEAS study* - Both the LASA and the DEAS study are ongoing population based cohort studies, not necessarily focused on older workers. This enhances the ability of our results to be generalized to the Dutch and German population, respectively, as data were not solely collected within for instance certain professions or companies.

Because of their focus on ageing, the majority of the LASA and DEAS participants were aged 65 and over. Therefore, relatively small samples were examined in this thesis when using LASA and DEAS data, possibly explaining unexpected or null results. Specifically, when examining the relationship between work demands as measured by the GPIJM with health using the LASA data, null results were possibly observed because of a lack of statistical power. For instance, all ORs were positive in the relationships between use of force and work in uncomfortable positions with OA, but not statistically significant.

As with all observational studies, it is impossible to determine a causal
relationship because of unobserved variables which potentially bias the results. Moreover, the fact that LASA respondents are followed up approximately every three years and DEAS respondents every six years may affect the extent to which causal relationships can be traced. Between waves, unmeasured changes in for instance health may have occurred. Also, it is unsure whether changes in health preceded or followed retirement, memory complaints, or work exposures when they occurred within one interval between measurements cycles. So whether a causal relationship exists between memory complaints and memory decline, between retirement age and health, or between work exposures and health cannot be determined for sure.

The loss of respondents at follow-up measurement waves (i.e. loss to follow-up) may bias results and is an issue to consider in all cohort studies. In chapters 2, 3, and 4, the potential consequences of loss to follow-up were examined. Due to exclusion of respondents with missing data in chapter 2, the association between physical demands and health measures may have been overestimated in current workers as excluded current workers had fewer functional limitations. The association between physical demands and health measures may have been underestimated in former workers as excluded former workers were older and had more functional limitations. In chapter 3, the association of prevalent and incident memory complaints with memory decline may have been underestimated, as respondents who were lost to follow-up more often showed a lower mean level of memory performance. In chapter 4, no significant differences were found for respondents who were lost to follow-up compared to respondents with data at both waves regarding gender, level of education, baseline age, employment status or memory complaints, so loss to follow-up is unlikely to have biased our results or the generalizability.

A methodological difficulty when examining occupational exposures and health is the ‘healthy-worker effect’ (e.g. Li & Sung 1999): individuals with poor health are thought to less likely be employed. As a consequence, relationships between occupational hazards and health are possibly weakened. In this thesis, a healthy-worker effect may have weakened the relationship between iso-strain and health measures as examined in chapter 2. Individuals with CVD or precursors to CVD (e.g. hypertension) may no longer be employed due to their illness. Measures that are possibly influenced less by a healthy-worker effect may be more appropriate to determine the validity of psychosocial demands and resources in currently employed. For instance, associations have been found with job satisfaction, emotional exhaustion, psychosomatic, and physical health complaints (De Jonge et al 2000).
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The NWCS study- We based our GPIEM largely on aggregated self-reported data from the NWCS study because more objective measurements (e.g. systematic observations) were unavailable in large general population samples similar to the samples used in this thesis. Still, both subjective and objective methods have drawbacks regarding validity and assessment of physical demands (Stock et al 2005) and, especially difficult to measure objectively, psychosocial demands and resources (Burdorf & Van der Beek 1999; Kompier 2005). Also, as self-reported work exposures were aggregated, the influence of individual factors (e.g. mood, past experiences, health) may be reduced.

In order to link work exposures derived from the NWCS to the NSCO92, NWCS job titles were first linked to NSCO92 job classes. For some NWCS job titles, there was no NSCO92 class that perfectly matched. In the NWCS, no data were available on required level of education of the profession, which is needed to properly code the occupations according to the NSCO92. Also, NWCS job titles are less detailed compared with the NSCO92. NSCO92 occupational classes were consequently classified to have a certain level of work exposure based on fewer job titles than are included in the NSCO92 class, which may have led to misclassification.

Although a large NWCS study sample of 55-64-year-olds was examined (n = 18,937), only few respondents (i.e. n < 10) performed jobs belonging to occupational class ‘higher agricultural occupations’ and ‘scientific legal, administrative occupations’. These classes were therefore excluded from further analyses. Also, occupational classes were observed to which few respondents belonged (e.g. n = 31 performed a job that was classified to belong to ‘higher transport occupations’). The small number of respondents from the NWCS study within some NSCO92 occupational classes could have biased the level of consensus and resulted in less precise exposure estimates.

Strengths and limitations of the data

Health-related and involuntary retirement - Both the LASA and the DEAS study have data available on a wide range of variables, enabling us to study and adjust for a wide range of covariates. Importantly, the DEAS study has data on whether retirement was health-related or involuntary at all waves. Information on whether retirement was health-related or involuntary is of importance because they are both observed to be determinants of the health effect of retirement (e.g. Oksanen et al 2011; Romeo Gordo 2006). This information was not available for the respondents of the LASA study that were included in the analyses reported in chapter 5, which may have biased the results. Still, data from all waves of the LASA study were available on whether workers or retirees received disability benefits, which was used as a
proxy for health-related retirement. Also, data from all waves were available on whether workers were planning to retire or whether they were registered at an unemployment office which were used as a proxy for voluntariness of retirement.

Employment history - Several relevant pieces of information on employment histories were lacking from the LASA study which were potentially of importance for the analyses described in chapter 2. First, the proxy for the date at which former workers stopped working was imprecise and, second, the duration of employment, and therefore of occupational exposure, was unknown in both current and former workers. Both pieces of information may explain some unexpected or null results in chapter 2. Third, additionally unknown was whether currently employed 55–64 year olds were preparing to retire. Those preparing to retire may experience less stress from their job, possibly explaining why no associations were observed between iso-strain in currently employed and health in chapter 2.

Questions on use of force and uncomfortable positions in the NWCS study provided insufficiently detailed exposure information to examine associations with OA. Whether use of force and work in an uncomfortable position put demands on knees or hips was unknown. In addition, no information could be derived from the NWCS study, and therefore from the GPIEM, about the (variation in) intensity of exposure. As a result, our findings may underestimate the effect of use of force and work in uncomfortable positions.

Weekly hours of work - In chapters 5 and 6, the transition from employment into retirement was a central determinant. To ensure employment was an important part of the respondents’ life and the transition into retirement was, as a result, sufficiently significant, individuals were only considered to be retired if they worked 8 hours or more weekly before retirement. In addition, the cut-off of 8 hours is chosen because it represents one standard workday. This is an arbitrary cut-off. Another option would have been to examine individuals as being employed if they worked 12 hours or more weekly. This cut-off is used by Statistics Netherlands and is based on a study that showed that individuals who worked at least 12 hours weekly report that their job is their most important activity in their life (Bierings, Imbens & Van Bochove, 1991). Still, adjustments were made for hours of work (i.e. ≥ 8 hours) in chapters 5 and 6 when necessary.

In chapters 2, 3, and 4, respondents were considered to be employed if they worked at least 1 hour weekly. This cut-off has also been used by other researchers (e.g. OECD 2011). To our knowledge, no literature exists that shows the number of hours necessary to determine the level of exposure to physical demands, psychosocial demands, and psychosocial resources (chapter 2) or for employment to be demanding for memory (chapter 3 and 4). The cut-offs are
therefore arbitrary. It is unknown, however, whether the results were consequently under- or overestimated for which additional research is necessary.

**Age at retirement** - It was possible to precisely define the age at retirement by using the date of retirement and of birth in both the LASA and the DEAS studies. An effect of retirement age is not distinguishable from an effect of age when simply comparing younger with older retirees. However, because we were able to include a control group of continuously employed age-peers in the analyses reported in chapters 5 and 6, we were able to determine an effect of retirement age, as opposed to an effect of ageing.

**GPJEM** - The GPJEM developed and validated in chapter 2, was developed using NWCS data and validated using LASA data. Because different studies were used for the development and for the validation, the influence of reporting bias (i.e. the selective revealing of information by respondents) on the relationship between work exposures and health is therefore limited.

A disadvantage of GPJEMs in general is the inability to account for exposure heterogeneity within the job categories (i.e. NSCO92 occupational classes, as described in chapter 4). Heterogeneity within NSCO92 occupational classes exists; certain jobs may be less likely to have exposure to a demand or resource compared with other jobs within one class. The NSCO92 classes were assigned to jobs based on the main domain (e.g. Transport, Technical, Medical) in which the job can be classified and the level of required skills (elementary-scientific). Therefore, work exposures were not used to create NSCO92. For instance, a taxi driver and a sailor possibly experience different levels of physical demands but are categorised by Statistics Netherlands to belong the NSCO92 occupational class ‘lower transport occupations’. This may have resulted in of work exposures.

Although we attempted to use a systematic rationale for the cut-offs used, these are evidently up for debate. As mentioned, heterogeneity exists within occupational classes, which is underlined by the fact that no classes were observed with a 100% consensus (i.e. in which all respondents reported to be exposed to high demands or resources). Therefore, it seems to be a reasonable choice to regard classes in which >50%, a relatively high cut-off, and >NWCS-based total % reported high exposure to demands or resources as high and moderate probability of exposure, respectively. Nevertheless, the chosen cut-offs may have influenced the results and possibly have led to misclassification of work exposures.

**Memory complaints** - In this thesis, memory complaints were investigated by using a single question (i.e. ‘Do you have complaints about your memory?’). Certain types of complaints, such as not finding one’s way around familiar streets, are more strongly related to memory performance compared to other types
(Amariglio et al. 2011). Therefore, the use of a single question as opposed to multiple questions may explain why null results were observed when examining the association between either prevalent or incident memory complaints and memory functioning.

While it is known that incident memory complaints were not present three years earlier, no information was available in the LASA study on whether prevalent memory complaints have been present for a longer period of time. It can be argued that memory complaints that are present for a longer period of time are more strongly related to memory performance. Although we can only speculate, prevalent memory complaints may also include memory complaints that have been present for a longer period of time, which might explain why an association was observed of memory functioning with prevalent memory complaints and only a weak association with incident memory complaints. Knowledge on whether memory complaints were present for a longer period of time may therefore improve the ability of memory complaints to identify individuals with poor memory and is an important future research question. Still, the use of a single question measured at one wave in time may be more feasible to use in future studies, interventions, and prevention programs.

**Memory performance** - To determine relevantly poor memory performance (i.e. subnormal performance and impairment) and relevant memory decline (i.e. above normal decline and clinically relevant decline) in chapter 3, standard deviations (SDs) were used, which is a method that is often utilised in clinical practice. However, no consensus exists on how many SDs are needed to determine relevance. We chose cut-offs (i.e. 1 and 1.5 SDs) which may be viewed as fairly lenient because respondents are sooner categorised as having poor memory or memory decline compared to less lenient cut-offs (e.g. 2 SDs). This may have resulted in an overestimation of individuals with relevantly poor memory or relevant memory decline. An advantage of lenient cut-offs is that it decreases the number of individuals with impaired performance judged as functioning normally (i.e. false-negative judgments) (Hannay & Lezak 2004), thereby limiting the chance of missing individuals that have relevantly poor memory or relevant memory decline.

Subjective general and emotional health - Subjective general health was measured using a single question. Many studies have been performed to examine what this question entails, but these studies show that its meaning is likely to differ between individuals and between age groups (e.g. Galenkamp 2013). Still, as a first exploratory measure to capture an indication of the effect of retirement on health in general, this seems to be a suitable measure. In addition, subjective emotional health was examined, which was measured by depressive symptoms.
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We chose to examine depressive symptoms as a continuous measure as opposed to a dichotomous measure (i.e. to determine a clinically relevant number of depressive symptoms) because it was assumed that the effect of retirement may not be sufficiently large to affect the onset of clinically relevant depression.

7.3 Relevance of the findings

In this section, the relevance of the findings reported for each objective will be interpreted in light of the overall objective, i.e. improving the comprehension of the relationship of employment and retirement with health to help determine whether the feasibility and success of the retirement policies aimed at increasing workforce participation can be improved.

The development and validation of a GPJEM including physical demands, psychosocial demands, and psychosocial resources (objective 1)

The GPJEM developed and validated in this thesis enables researchers to easily determine physical and psychosocial work exposures in existing data sets. First, this GPJEM may be applied in studies with data on the NSCO92. The NSCO92 is a Dutch occupational classification system which has often been used to classify jobs in large Dutch population based studies (‘t Mannetje & Kromhout 2003). Second, this GPJEM may also be applied in Dutch studies with data on an occupational classification system that can be linked to the NSCO92 such as the International Standard Classicisation of Occupations 2008 (ISCO08).

The possibility to easily determine physical and psychosocial work exposures in existing data sets facilitates research on these work exposures among older workers and for instance its relationship with health. Although the development and validation of this GPJEM does not provide direct information on the feasibility of increasing workforce participation among older workers, it opens up possibilities for research within this area. For instance, so far, the increase in workforce participation in the Netherlands has been observed to be mainly attributable to older workers in good health (Deeg & Rijs 2013; Garcia-Gomez, Gaudecker & Lindeboom, 2011). Looking for ways to keep older workers in poor health at work, ideally requires accurate data on health status as well as working conditions. By applying the GPJEM in the LASA study, Boot and colleagues (2013) were able to determine that working in a job with low psychosocial resources from work (i.e. low autonomy, task variation, supervisor support, co-worker support) predicted exit from work in individuals with a chronic disease, but not in individuals
without a chronic disease. More research on this topic may help determine possibilities for increasing workforce participation among individuals in poor health.

Potential sources of misclassification of work exposures were identified that may have decreased the accuracy and validity of our GPJEM; misclassification due to an imperfect linkage between NWCS jobs and NSCO92 jobs, heterogeneity within occupational classes, arbitrary cut-offs, relatively small study samples within NSCO92 occupational classes which may have caused a lack of statistical power, and lacking data on employment histories. Addressing these issues in future studies could provide additional information on the accuracy and validity of our GPJEM. First, to determine whether the work exposures were assigned correctly and, therefore, to further examine the GPJEMs’ accuracy and validity, work demands assessed by our GPJEM could be compared with self-reported work demands from a different data set. For instance, data from the LASA study could be used as, since 2013, self-reported data became available. This would add another criterion of validity for the GPJEM (i.e. the ability to evaluate the exposures in concordance with self-reported data) next to the observed associations with disease. A potential issue with such a comparison is that self-reported data may be subject to circumstantial factors such as mood and health. However, with large samples of self-reported data, one might argue that the influence of circumstantial factors are diluted (Kompier 2005). Second, also to determine whether the work exposures were assigned correctly, a comparison could be made with other GPJEMs, such as the FINJEM. Although the FINJEM is a Finnish GPJEM and not necessarily focused on older workers (Kauppinen, Toikkanen & Pukkala 1998), it also includes psychosocial resources as well as physical and psychosocial demands. Third, investigating the work exposures for individual NSCO92 job titles should ideally be examined, as opposed to work exposures for grouped jobs (i.e. NSCO92 occupational classes). This may ensure a perfect linkage with the NSCO92 and increases its ability to account for exposure heterogeneity within the occupational classes. It is, however, possibly more feasible to examine a selection of jobs which are frequently performed in the Netherlands, as very large study samples are necessary to examine all individual NSCO92 job titles. This provides a selective but a more accurate indication of the accuracy of the linkage with the NSCO92. Finally, for future research on our GPJEM, using data with larger samples and more complete employment histories of individuals (e.g. information on the duration of occupational exposure) is warranted to provide more insight into its association with health measures and therefore its accuracy and validity.
The association of memory complaints with objectively measured memory functioning, employment, and with employment characteristics in 55-64-year-olds (objective 2)

The results described in chapter 3 show that prevalent memory complaints in 55-64-year-olds were associated with impaired memory and with future clinically relevant memory decline. Memory complaints were measured by using a single question measured at one wave, so this is a very practical method to select 55-64-year-olds at risk of impaired memory or at risk of future clinically relevant memory decline. If 55-64-year-olds have prevalent memory complaints, it should be determined whether they indeed have impaired memory functioning, before an intervention is offered. A recent study showed that online tests may be a reliable and valid method of assessing memory performance in individuals aged 40 years and older (Aalbers et al 2013). Memory may be improved by changing life style behaviours such as smoking cessation and increasing physical activity (Engelhardt et al 2010), and by cognitive training (Fillit et al 2002) such as learning strategies for remembering word lists and main ideas and details of stories (Ball et al 2002). In addition, for individuals with prevalent memory complaints it is important to also monitor their memory performance in the future, as they are at risk of developing clinically relevant memory decline, and offer life style interventions, which may prevent or slow down memory decline (Fillit et al 2002).

While memory functioning may decline with age (Ilmarinen 2001; Salthouse 2012; Sluiter 2006), maintaining a good memory functioning may aid older workers’ ability to continue employment at older ages (Ilmarinen 2001; Koolhaas et al 2010; Wickrama et al 2013). Therefore, offering interventions aimed at improving memory of 55-64-year-olds with poor or declining memory may improve the feasibility of increasing workforce participation in this age group. Still, although memory functioning deteriorates when growing older, job performance may not necessarily decrease due to compensatory strategies such as knowledge, learning, and practice (Salthouse 2012), suggesting older individuals are still able to work despite a decline memory functioning. It is worth further exploring whether poor memory functioning leads to exit from the workforce and particularly under which circumstances (e.g. which characteristics of employment).

Results described in chapter 4 show that, independent of memory functioning and other factors, 55-64-year-olds with cognitively demanding work were more likely to experience prevalent memory complaints compared to workers without cognitively demanding work. It has been discussed by other researchers that workers are more likely to notice and subsequently complain about memory decline simply because their job requires good memory capacities (Aarts et al
2010; Mol et al 2009). Particularly cognitive demands, which include intensive thinking, the need to keep focused, and requiring much concentration, may be demanding on memory functioning. The use of their memory in their work consequently directs their attention towards their memory functioning. As a result, individuals with cognitively demanding jobs may simply be more likely to notice their deteriorating but not necessarily failing memory functioning than individuals who do not work in cognitively demanding jobs. The notion that employment may result in noticing ones’ memory functioning might also explain why some evidence was observed in chapter 3 that continuously employed individuals with incident memory complaints were more likely to have clinically relevant memory decline compared to those without memory complaints. No such association was observed in those who were not employed. Still, caution is needed as this association was observed to be borderline significant. Possibly, larger samples are needed to examine whether memory complaints are indeed predictive of poor or declining memory in employed individuals and not in individuals who were not employed.

No research exists on whether specifically those performing cognitively demanding work find their memory complaints burdensome. Still, previous studies show that memory complaints cause some restriction in daily functioning (Ponds, Commissaris & Jolles 1997) and lower life satisfaction between age 55 to 91 and even more so in those aged 55 to 69 years (Mol et al 2009). Also, as Metternich and colleagues (2010) argued, memory complaints may disrupt daily occupational activity, which can become a secondary stress factor. It may therefore be important to decrease memory complaints. Research is needed to determine how memory complaints in those with cognitively demanding jobs could be decreased. It can be argued that the proposed measures of enabling older workers to work part-time instead of full-time (OECD 2014), adjustments of work task (STAR 2011; Skugor & Bekker 2012), and possibly demotion (Josten & Schalck 2010) aimed at keeping older workers in the workforce may also benefit those with cognitively demanding jobs. Working part-time provides more time to recuperate, to increase physical activity, and to engage in social activities. This in turn could improve memory abilities (Engelhardt et al 2010) and therefore result in less memory complaints. In addition, as older workers with cognitive demands were observed to more often have memory complaints in the current thesis, reducing cognitively demanding work tasks may decrease memory complaints. Demotion, i.e. a decline in function type and salary, may also be a solution for some individuals who wish to continue employment, but with less cognitive demands. Particularly, depending on the preferences of older workers and possibilities within the company, individuals could be offered demotion into jobs with less cognitive demands. However, little
is known about the effects of this measure as it is not often applied (Van Dalen & Henkens 2013). For instance, demotion may decrease satisfaction with job content and may cause the employee to experience a loss of status from work, but research is needed that examines whether the reason for demotion (e.g. employees’ health or employers’ policy to match productivity with salary) matters for job content satisfaction or status loss (Josten & Schalck 2010). Whether these individuals actually benefit from working part-time or demotion in the sense that it decreases cognitive demands and they less often report memory complaints has, to our knowledge, never been examined and needs further investigation.

The association of on- and off-time retirement with subjective general and emotional health (objective 3)

Results described in chapter 5 show that individuals who retired on-time (59-60) were more likely to attain excellent or good subjective general health compared to employed age peers, but only if they did not receive a disability pension. These results indicate that social timing of retirement may be a relevant determinant of the health effect of retirement in the Netherlands. In contrast, no evidence for social timing of retirement was observed in chapter 6, in which subjective emotional health was examined. Possibly, social timing might simply affect subjective general health but not subjective emotional health. To determine whether social timing of retirement exists, other outcome measures may also be explored. It was hypothesised in this thesis that off-time retirement might result in psychological stress and, consequently, have a detrimental effect on subjective general and emotional health. Therefore, future studies could investigate whether on- and off-time retirement indeed affects psychological stress levels.

To enhance the success of the retirement policies aimed at increasing the workforce participation of older workers in the Netherlands, it may be important to ensure that the perception of on-time retirement age increases. The examined on-time age in this thesis was set at around the age of 60 for Dutch individuals. This age can be expected to increase with the increasing statutory retirement age. The number of Dutch older workers who think statutory retirement should be at 65 years or higher has increased between 1992 and 2002 (Kappelle & Deeg 2009). Similarly, an increasing number of older workers that are willing to work until the age of 65 has been observed in the Netherlands between 2005 an 2009 (CBS, 2010). This suggests that views about the age appropriateness of retirement may change over time, possibly due to changing retirement policies. However, for norms on retirement age to change, workers may need to be persuaded of the individual and social benefits of retirement, that go beyond financial benefits (Radl
Simply announcing the increase in statutory retirement age via media has shown to increase the age at which older workers expect to retire, but this effect was observed to be less strong in workers with supplement retirement plans with high benefits (De Grip, Fouarge & Montizaan 2013). It was also observed to be less strong in workers employed in jobs with high physical demands and intensive managerial and supervisory tasks and it was not observed in low-educated workers (De Grip, Fouarge & Montizaan 2013). Possibly, the age at which individuals consider retirement is on-time may be stimulated further by ensuring working longer is attractive for them. For instance, a challenging job (Proper, Deeg & Van der Beek 2009; Reeuwijk et al 2013), appreciative leadership style (Van den Berg, Elders & Burdorf 2010), low-stress jobs, and low physical demands (Fraser et al. 2009; Reeuwijk et al 2013) are aspects of work that may discourage retirement before the statutory retirement age.

In chapter 5, worse subjective general health was found after retirement with a disability pension for early and late retirees. Also, the individuals who retired on-time and received a disability pension were equally likely to have excellent or good subjective general health after retirement compared to individuals who continued employment, although this null result is possibly observed because of a lack of statistical power. For these individuals, a health effect of retirement might not be due to retirement (i.e. causal) but due to health selection, as also discussed by other researchers (Jokela et al 2010; Oksanen et al 2011). It can therefore be concluded that increasing the on-time retirement age might not benefit individuals who retired for health reasons and other interventions might be necessary for this group.

In addition to health-related retirement, involuntary retirement may also be an important context factor when investigating an effect of retirement age on (subjective) health. Retirement due to job loss among older working Germans, examined as a proxy for involuntariness, may particularly be detrimental at the age of 62 to 64 years (see chapter 6). An explanation could be that it is especially difficult to become reemployed for individuals nearing statutory retirement age (Gallo et al 2000), underlining that efforts in Germany need to be focused on keeping these individuals employed. In chapter 5 it was shown that involuntary retirement did not affect subjective general health of Dutch retirees, but we were only able to examine retirement planning, which might not suffice as a proxy for involuntary retirement. A previous study showed that involuntary retirement indeed decreased subjective general health in Dutch retirees (Van Solinge 2007).

Although a wide range of contextual factors were examined in this thesis, some additional contextual factors are also worth exploring in future studies. It
can be argued that volunteer work and caring responsibilities in retirement may be relevant to explore. For instance, after retirement that took place because of caring responsibilities or volunteer work, social timing may no longer be felt as relevant as these retired individuals may feel their retirement is justified by their caring obligations. Therefore, whether these contextual factors affect the relationship between social timing of retirement and health may be examined.

On- and off-time retirement has been defined using different cut-offs and research is needed that focuses specifically on which age individuals consider to be on-time, and subsequently, whether health is affected. Retirement before the official early retirement age (Van Solinge & Henkens 2007), retirement before the statutory retirement age (Calvo, Sarkisian & Tamborini 2013) or retirement that was earlier than the individual had anticipated (Wang 2007) have previously been examined as off-time retirement. Consensus on which age is perceived as the on-time retirement age does not exist. In both chapter 5 and 6, retirement age was categorised based on the average retirement age and therefore the age at which most age-peers retired. Earlier or later retirement is defined as ‘off time’ retirement. Subjective health was better after on-time retirement when Dutch data were used, as described in chapter 5, which substantiates the idea that retirement around the age of 60 may be considered to be on-time (Settersten & Hagestad 1996; Van Solinge & Henkens 2007) in the Netherlands. Still, no data were included on the age at which respondents from the LASA or the DEAS study considered retirement to be on-time, so we cannot be sure whether these results prove an effect of social timing of retirement. In addition, research is needed into the existence of late off-time retirement. Both retired individuals and continuously employed individuals within the late off-time age group (will) retire off-time. Also, those considered to be off-time retirees in our study, actually retire closer to the on-time retirement age compared to individuals who continued employment.

7.4 Summary of the recommendations for future research

From our findings, recommendations for future research were made and described in the previous paragraph. These recommendations are summarised below.

Additional information on the GPJEMs’ accuracy and validity can be provided by:

- Comparing the GPJEM with self-reported work exposures or with other GPJEMs, ideally using a selection of frequently performed individual NSCO92 job titles;
- Using occupational exposure data with larger study samples and more complete information on employment histories.
To further improve our knowledge of the ability of memory complaints to detect 55-64-year-olds with poor memory or at risk of memory decline, it may be examined whether:

- Prevalent memory complaints need to be further specified into memory complaints that were present for a longer period of time and memory complaints that were only recently developed;
- Employed compared to not employed 55-64-years with memory complaints are more likely to notice poor memory functioning, for instance by using larger samples.

To determine whether 55-64-years-olds with memory complaints may benefit from an intervention for the purpose of increasing workforce participation, research is needed examining:

- Whether and under which circumstances poor memory functioning leads to workforce exit;
- Whether individuals performing cognitively demanding work find their memory complaints burdensome to the extent that it leads to exit from the workforce;
- Why older workers with high cognitively demanding work more often report memory complaints compared to older workers with low cognitively demanding work and, subsequently, developing suitable interventions for workers with memory complaints resulting from cognitive demands.

To confirm our results on social timing in the Netherlands, additional studies are needed to:

- Examine the relationship of on- and off-time retirement with other outcome measures, such as psychological stress;
- Examine whether caring responsibilities and volunteer work affect the relationship between social timing of retirement and health;
- Determine clear definitions for on- and off-time retirement.

### 7.5 Conclusions

In the context of older workers’ declining health, physical and psychosocial work exposures can be important threats for prolonging working life of older individuals in the Netherlands. The GPJEM developed and validated in this thesis classifies jobs according to physical demands and iso-strain. With this GPJEM, researchers
will be able to better investigate the impact of these work exposures in older workers as well as possible interventions and adjustments that may aid workers to continue employment and to protect older workers’ health. Another potential threat for older workers’ workforce participation is poor memory functioning. As shown in this thesis, the single question about memory complaints may be used as a first step towards identifying specifically 55-64-year-olds who have impaired memory functioning and are at risk of clinically relevant memory decline, which may negatively affect their ability to work. Based on this knowledge, interventions aimed at improving memory can be developed to help older workers to stay in the workforce. High cognitive work demands were observed to also underlie memory complaints in this thesis. Such underlying factors should be taken into account when assessing the significance of memory complaints in older workers to decide on a suitable intervention. Finally, results reported in this thesis show that individuals who retired and received a disability pension were more likely to have poor subjective general health, underlining the importance of health-related retirement in determining the effect of retirement (age) on health. Individuals who retired at an age they perceive as on-time more often had better subjective general health compared to age peers who continued employment, but only if they did not receive a disability pension. By ensuring the age at which retirement is perceived to be on-time increases in those who did not retire for health-reasons, the success of the retirement policies aimed at increasing workforce participation of older workers in the Netherlands could be enhanced. For groups of individuals, such as those who receive a disability benefit, working at a high age may not be feasible. Still, the studies described in this thesis identified possibilities for improvement of the feasibility and success of the retirement policies aimed at increasing older workers’ workforce participation.
References


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