WORKING LONGER IN GOOD HEALTH

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Working Longer in Good Health

Langer doorwerken in goede gezondheid

Fenna Ruby Marie Leijten

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CONTENT

CHAPTER 01

GENERAL INTRODUCTION

BACKGROUND

Work and health

Population demographics are changing and Western countries are being confronted with an ageing society. As a result, strains on social security systems have arisen and government pension funds cannot handle the large group of persons over the statutory retirement age that have the right to collect their pension. In response to these strains, governments are increasing the retirement age and making early exit from the workforce via early retirement more difficult. However, as workers age they may be confronted with health problems at the workplace. In the Netherlands, 48% of persons over the age of 55 have at least one chronic disease [1]. This leads to the general question of how older persons can work productively, for longer, and in good health.

The relationship between work participation and health is bidirectional, and can be described by selection and causation hypotheses. According to the selection hypothesis, the healthiest persons are in employment: persons with poor health are more likely to exit the workforce and, once out of the workforce, persons with poor health are less likely to re-enter the workforce [e.g., 2]. This hypothesis is in line with the observation that the largest part of the workforce consists of persons with good health, termed the 'healthy worker effect' [3].

Research has indeed shown that a consequence of health problems is a reduction in productive employment. For example, workers with health problems have a reduced work ability [e.g., 4,5], reduced productivity at work [e.g., 6], and more sickness absence [e.g., 7]. In the long term, research shows that workers with health problems are more likely to exit the workforce early via disability benefits, but findings on the extent to which health problems predict unemployment and early retirement are not conclusive [8]. Overall, health problems can result in a loss in 'working life expectancy' and 'healthy working years' [9].

The second aspect to the work-health relationship can be described by the causation hypothesis, which postulates that, once unemployed, health [further] deteriorates [10]. Different mechanisms have been identified by which unemployment affects health: via poverty and changes in income, stress due to the life event of becoming unemployed, loss of self-esteem related to unemployment, and increased unhealthy behaviours like smoking or alcohol consumption [10]. Additionally, the causation hypothesis suggests that once back in paid employment, health improves. This has been found in empirical studies [11] and could be due to the provision of daily structure and stimulation of social relationships by employment [12].

This thesis focusses on the influence of work and individual factors on health, and in turn on the selection hypothesis, specifically the impact that health has on productive and

sustained employment. Workers that are productive are defined, in the current thesis, as having a high work ability, i.e., the physical and mental capability to do work [13], a high productivity at work, i.e., quantity and quality of work, and no long-term sickness absence. Sustained employment implies remaining in the workforce as long as possible, and thus not exiting early via disability, unemployment, or early retirement.

Interrelations between health, work-related factors, and individual factors

When unravelling the relation between work and health it is important to question under which circumstances and why the employment of certain workers is affected by health and that of others is not. The type of health problem, working conditions, and individual factors could play a key role.

First, it is important to acknowledge that different health problems may have a different effect on work. Past findings show that especially musculoskeletal and mental health problems are important for work ability [14], that mental health problems have a larger effect on work performance than physical health problems [15], and that the effects of mental and physical health problems on sickness absence are similar [15]. With regard to sustained employment, a meta-analysis showed that both mental and physical health problems were important predictors of disability benefits and that mental health problems were an important predictor of unemployment, and to a lesser extent, of early retirement [8]. An integrated approach in which multiple health problems are simultaneously studied can give further insight into the differential influence of health on work.

Second, although the causation hypothesis postulates that being in employment is good for health, the quality of work must be taken into consideration. Unfavourable work-related factors can be detrimental to health and these factors may in turn also impact productive and sustained employment. When looking at the burden of diseases, it has been shown that occupational risk factors significantly contribute to health impairments, for example ergonomic stressors are responsible for 37% of back pain [16]. Furthermore, the benefits of employment for mental well-being are dependent on the quality of psychosocial work factors [e.g., 17]. Conversely, favourable work-related factors, such as high autonomy and low job demands, have been found to benefit productive and sustained employment [e.g., 18-20]. Van den Berg et al. [2011] also found that workers with low work ability that had high job control had a smaller productivity reduction than workers with low work ability and low job control [21]. It is thus likely that the adverse influence of poor health on productive and sustained employment depends on the conditions that a worker finds him- or herself in at the workplace.

Third, individual factors may impact health directly but may also influence how employees deal with unfavourable work-related factors. For example, the degree to which a worker has a "positive, fulfilling work-related state of mind" [22], i.e., a high work engagement, is related to health. Research shows that more engaged workers have a

better mental health, are more vital, and less frequently absent due to sickness [23-25]. It has also been suggested that high work engagement buffers the adverse effects of unfavourable work-related factors on health [23], i.e., the health of workers with a higher work engagement is less affected by unfavourable work-related factors than that of workers with a lower work engagement.

A worker's ability to deal with health problems [at the workplace], operationalized as his or her coping style, may also influence the extent to which health problems affect employment. For example, workers with rheumatoid arthritis and a passive behavioural coping style were found to have increased sickness absence as compared to those who did not have a passive coping style [26]. It can be postulated that, alongside the direct effect of work-related and individual factors on health, an interaction exists between these factors and health in influencing productive and sustained employment.

Theoretical perspectives on these interrelations

Several theoretical models exist that try to depict the complex interaction between work-related factors, individual factors, health, and employment.

The Job-Demand-Control model (JDC model) takes balance into consideration: having high job control that allows workers to make decisions can counter high job demands, when this is not the case, strain can cause adverse health outcomes [27].

Following the development of this JDC model, other models were created that place more focus on individual factors in combination with work. An example of such a model is the Effort-Reward Imbalance model (ERI model), in which effort, both external (e.g., demands of the job) and internal (e.g., coping) are countered by rewards (e.g., esteem, salary) [28]. An imbalance between efforts and rewards can lead to distress and strain, the extent to which differs between individuals [28].

Also placing more focus on the individual, the authors of the Job Demands-Resource model (JDR model) postulated that a broader range of factors, like job control and social support but also personal motivation, are important positive resources [23]. In the JDR model it is acknowledged that for each person in each job, different factors may play the most prominent role, but that these can be subdivided into demands and resources. Furthermore, resources do more than merely balance out demands, these are also important for personal development. Good health can be seen as an important resource. Thus if workers encounter health problems that result in an imbalance, changing demands and/or resources could potentially help to restore a balance.

In line with this, the Illness Flexibility model proposes that workers with poor health but more flexibility are less likely to have a reduced work ability or prolonged sickness absence [29].

IMPERATIVES

Past findings and the theoretical models described above suggest that there is an interplay between health and work-related and individual factors, but their influence on productive and sustained employment has not been thoroughly researched. In order to address this, large scale studies are needed that allow for different facets of health, work-related and individual factors, and productive and sustained employment to be concurrently studied. This can allow for comparisons to be made and priorities to be identified. Furthermore, considering the societal imperative for older employees to remain in employment and do so productively, it is important to study this specific high risk group. Namely, older workers are at high risk for chronic health problems and exiting the workforce before the statutory retirement age. These employees are also most proximately influenced by the changing statutory retirement ages and financial schemes surrounding early retirement in the Netherlands. Lastly, longitudinal studies are needed in order to move away from purely cross-sectional associative conclusions and towards more causal explanations.

OBJECTIVES OF THIS THESIS

Research has shown that the quality of work is important for health. However, rarely have different types of work-related factors, both psychosocial and physical, and differential effects hereof on mental and physical health been studied. The emerging concept of work engagement both as a direct predictor of health and as a buffer of the adverse effects of poor work quality on health, needs to be further explored. Thus, the first research question of this thesis is:

1. What is the influence of work-related factors and work engagement on health?

As past research has indicated that poor health in turn has consequences for employment, the current thesis aims to add to the literature by zooming in on specific chronic health problems and comparing their effects on employment. Furthermore, consequences of poor health on different facets of employment are studied: work ability, productivity, sickness absence, and loss of paid employment. The second research question of this thesis is:

2. To what extent does health influence productive and sustained employment?

In line with existing theoretical perspectives, the interplay between work and health may be influenced by work-related and individual factors such as coping style. The interaction effects between these factors and health on productive and sustained employment have not often been studied, but can provide important information for workplace interventions. As the prevalence of chronic health problems increases, understanding how workers with health problems can remain in employment productively is crucial. In accordance, the third research question in this thesis is:

3. Do work-related factors and coping style modify the influence of health on productive and sustained employment?

The overarching goal of this thesis is to contribute to the current state of knowledge regarding the imperative question of how to keep older employees working longer, productively, and in good health.

THE STUDY ON TRANSITIONS IN EMPLOYMENT, ABILITY AND MOTIVATION (STREAM)

In order to address the research questions of the current thesis, data from the Study on Transitions in Employment, Ability and Motivation (STREAM) were used. STREAM is a prospective longitudinal study that began in 2010. The study is funded by the Dutch Ministry of Social Affairs and Employment and TNO. The research is a collaboration between TNO, the VUmc Amsterdam, and the Erasmus MC Rotterdam. In STREAM, an Intomart GFK internet panel annually filled out an online questionnaire from 2010-2013 (T1, T2, T3, T4). The panel consists of employed, non-employed and self-employed persons that were aged 45 to 64 years at baseline. The sample was stratified at baseline on the basis of age and work status. 15,118 persons responded to the baseline STREAM questionnaire, representing a response of 71%. Of these respondents, 12,055 were employed. In the following three years (2011, 2012, 2013) this same group was invited to participate again, in 2013 11,237 persons filled out the questionnaire. In total 9,639 persons filled out all four questionnaires.

The STREAM questionnaire covers topics on: health, work-related factors, skills and knowledge, social factors, financial factors, ability, motivation, opportunity, productivity and transitions in employment. Information on age, gender, education, and work status is also collected. The scales and items used within the STREAM study are, where possible, validated and commonly used scales. In the questionnaire respondents indicate whether they may be contacted for further (qualitative) research - 50% of baseline respondents

agreed to this. More extensive information on STREAM can be found in the design article published by Ybema et al. in 2014 [30].

In order to adequately answer the research questions and make a substantial contribution to the current literature, as described above, a longitudinal dataset is crucial. Both determinants and outcomes are repeatedly measured in STREAM. This allows for the influence of determinants at one time point on outcomes at a follow-up time point to be [repeatedly] assessed. By using advanced longitudinal methods we can move towards causal explanations, to the extent that is warranted with observational data.

The STREAM study was reviewed by the VU University Medical Centre Amsterdam medical ethical committee, which declared that the Medical Research Involving Human Subjects Act does not apply. The committee had no objection to the execution of STREAM. Participants were provided with information on the study that made it clear that their privacy would be guaranteed, that all answers would be treated confidentially and that data would be stored in secured computer systems [30].

OUTLINE OF THIS THESIS

After this general introduction, research question 1 will be addressed in chapter 2. The influence of psychosocial and physical work-related factors on mental and physical health will be determined. The direct and interaction effect of work engagement on mental and physical health will also be studied. This study uses data from the first two STREAM waves, T1 and T2.

Research questions 2 and 3 will be addressed in chapters 3-7. In all of these chapters the influence of health problems on various facets of productive and sustained employment is assessed (research question 2). The role of work-related factors and coping style in the health-employment relation is addressed in chapters 3 and 5-7 (research question 3).

In chapter 3 the influence of mental and physical health on work ability is assessed, as well as the role that coping style has in the relation, using STREAM T1 and T2 data. In chapter 4 the influence of different types of chronic health problems on both work ability and productivity at work is determined. The effects of the health problems are compared, and different methodological approaches are taken to move away from purely cross-sectional conclusions. Data from STREAM waves T1, T2, and T3 are used. In chapter 5, a qualitative approach is taken to study, in detail, how health affects productivity at work. In this study the role of different individual and work-related factors is brought to light. Participants in this qualitative sty were selected from STREAM T1 and additionally interviewed.

In chapters 6 and 7 the influence of different types of chronic health problems on, respectively, sickness absence and early exit from the workforce is determined. The

modification of work-related factors on the effects of health on these two outcomes is also studied. Chapter 6 makes use of STREAM T1 and T2 data. Chapter 7 makes use of all four STREAM waves.

In the general discussion, chapter 8, the research questions will be answered. Several matters that need to be considered when interpreting the findings will be explained, followed by a more detailed description of several key insights. Lastly, recommendations for different stakeholders will be provided.

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CHAPTER 02

ASSOCIATIONS OF WORK-RELATED FACTORS AND WORK ENGAGEMENT WITH MENTAL AND PHYSICAL HEALTH: A 1-YEAR FOLLOW-UP STUDY AMONG OLDER WORKERS

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ABSTRACT

Purpose

The goals of this study were to determine whether, among older employees, unfavourable physical and psychosocial work-related factors were associated with poorer mental and physical health and whether high work engagement buffered the associations between unfavourable work-related factors and poorer health.

Methods

A 1-year longitudinal study with employed persons aged 45-64 was conducted within the Study on Transitions in Employment, Ability and Motivation (n=8,837). Using an online questionnaire, work-related factors (physical: physical load; psychosocial: psychological job demands, autonomy, and support) and work engagement were measured at baseline and health at baseline and 1-year follow-up. General linear models were used to assess associations of work-related factors and work engagement with health. Tests of interaction terms assessed whether work engagement buffered the work related factor-health associations.

Results

Unfavourable psychosocial work-related factors at baseline were associated with poorer mental health at follow-up. Higher physical load, higher psychological job demands, and lower autonomy at baseline were associated with poorer physical health at follow-up. Higher work engagement at baseline was related to better physical and especially better mental health during the 1-year follow-up. Work engagement had a small effect on the associations between work-related factors and health.

Conclusions

Among older employees, especially the promotion of a high work engagement and, to a lesser extent, favourable work-related factors can be beneficial for mental health in particular.

INTRODUCTION

The employed population is ageing, calling for more research on how to keep older employees working productively and in good health for longer. Employees with poor health are more likely to become unemployed, disability pensioned, and retire early [1]. It is essential to understand under which circumstances older employees can maintain a good health status, which in turn might benefit productivity, work ability, and prolonged employment [1-3].

Various studies have shown that work-related factors may influence health. High physical work load has a negative effect on health, musculoskeletal disorders in particular [4,5]. Unfavourable psychosocial work-related factors have been found to relate to poor mental health [6-9]. In a study on the predictive power of psychosocial work-related factors, however, the authors conclude that an array of work-related factors should be studied in predicting mental health, including meaning of work [9]. Another recent study has shown that especially the psychosocial work-related factors job demands and autonomy interact with a wide array of commonly occurring health problems to influence sickness absence [10]. Whereas past research has often focused on specific health disorders, such as musculoskeletal disorders, the current study assessed the associations of work-related factors with both general self-perceived mental and physical health.

Recently work engagement has been identified as a potentially important factor for health and well-being [11,12]. Schaufeli et al. [13] define work engagement as "a positive, fulfilling work-related state of mind;" engaged employees have a connection with their work activities and "see themselves as able to deal well with the demands of their jobs". High work commitment and meaning of work, concepts very similar to work engagement, have been related to higher vitality, mental health, and reduced sickness absence, a likely consequence of poor health [9,14]. Past observational studies have shown that, among nurses' aides and surgeons, higher work engagement was related to outcomes closely related to health, namely, less sickness absence and better work ability, respectively [15,16]. Past findings are mixed however, as another study among firefighters found that although work engagement was related to work ability, it was not related to sickness absence [17]. Furthermore, from past findings it is still unclear how work engagement functions in the associations between work-related factors and health: having a high work engagement has been found to partly buffer the adverse effects of job demands on health [11], whereas other studies point to work engagement functioning as a mediator [18,19]. In the current study it was hypothesized that a high work engagement would buffer the adverse association between unfavourable work-related factors and health.

The first research question of the current study was: what is the influence of psychosocial and physical work-related factors on mental and physical health? The specific

work-related factors studied were: physical load (physical) and psychological job demands, autonomy, and support (psychosocial). The second and third research questions were: is high work engagement related to good mental and physical health, and does a high work engagement buffer the influence of work-related factors on health?

METHODS

Study design

The current study is part of the Study on Transitions in Employment, Ability and Motivation (STREAM), an ongoing 1 year longitudinal study among older (aged 45-64) employees in the Netherlands [20]. In STREAM participants annually fill out online questionnaires on topics such as: health, work-related and individual factors, transitions in employment, and productivity. The current 1-year longitudinal study used STREAM data from 2010 (baseline) and 2011 (follow-up). In the STREAM baseline measurement 15,118 individuals participated (response 71%), of which 12,430 individuals also participated in the follow-up (82%).

Since the current study focusses on work-related factors that partly require a contract with an employer, non-employed (n=1,474), self-employed (n=728), and persons that underwent a transition in employment status (i.e.,between employment, non-employment, and self-employment) (n=1,075) were excluded (remaining n=9,153). After further exclusion of persons with incomplete information on work-related factors at baseline (n=69) and health at follow-up (n=247), the total study population consisted of 8,837 participants. For analyses that required baseline health information 236 (2.7%) persons were excluded because of incomplete information.

The Medical Ethical Committee of the VU University Medical Centre (Amsterdam) declared that the Medical Research Involving Human Subjects Act does not apply to the STREAM study and had no objection to the execution of this research. In the information that accompanied the online questionnaire, it was emphasized that privacy would be guaranteed, and that all data would be treated confidentially and stored in secured computer systems.

Measures

Health

Mental and physical health were measured at baseline and follow-up using the Short Form-12 Health Survey (SF-12), which consists of 12 items that were used to calculate both a mental and physical health component score [21]. The SF-12 includes items such as: "In general, would you say your health is … [Excellent(1)-Poor(5)]" and "Are you re-

stricted by your health in the following activities: e.g., walking up a few stairs? [Yes, very restricted (1)-Not, not at all restricted(3)]". Mental and physical health scale scores were standardized using USA 1998 standards, leading to a possible range from 0 to 100, with higher scores representing better health.

Work-related factors and work engagement

Unfavourable work-related factors included in this study were high physical load and the psychosocial factors high psychological job demands, low autonomy, and low support. Physical load items were derived from the Dutch Musculoskeletal Questionnaire [22,23] and the Netherlands Working Conditions Survey [24] and included five items on force exertion, static load, and vibration (Cronbach's alpha=0.86). Psychological job demands were measured with four items from the Job-Content Questionnaire (JCQ) [25] about how fast, much, hard, and hectic an individual's work is (Cronbach's alpha=0.87). Autonomy was measured using five JCQ items [25], about making decisions, deciding the order and speed of conducting tasks, having to find solutions, and being able to take time off (Cronbach's alpha=0.78). Support was defined as whether colleagues and supervisors are willing to help and listen to work-related problems, and was assessed using four items from the Copenhagen Psychosocial Questionnaire (COPSOQ) [26] (Cronbach's alpha=0.81). All work-related factors items were measured on five-point Likert scales (1 "(almost) never" to five "always"). Scales were recoded so that all higher scores related to less favourable work-related factors (i.e., high physical load, high psychological job demands, low support, and low autonomy).

Work engagement was assessed using six items on vigour and dedication from the Utrecht Work Engagement Scale (UWES) [13] related to having energy at work, feeling fit and strong at work, being enthusiastic and inspired by one's job, being motivated to go to work, and being proud of one's work (Cronbach's alpha=0.93). Answer options, on a seven-point Likert scale, ranged from 0 "never" to 6 "always/daily."

Work engagement and these specific work-related factors were included in the current study because, on the basis of past studies, they were presumed to be important for health. In the STREAM questionnaire, for reasons of brevity, subscales and abbreviated versions of the original scales were used. The Cronbach's alphas showed that these subscales were reliable. Furthermore, an exploratory factor analysis of all items also distinguished these same five scale components (i.e., work engagement, physical load, autonomy, psychological job demands, and support) and sufficient factor loadings were found (range 0.47-0.91).

Individual factors

The individual factors gender, age, and educational level were included in this study as possible confounders. Age was categorised into four 5-year groups. The highest level

of education attained was categorised into three groups: low (lower general secondary educational, preparatory secondary vocational education), medium (intermediate vocational training, higher general secondary education, pre-university education), and high (higher vocational education, university education).

Statistical analyses

Loss-to-follow-up was analysed for differences in individual factors and health between sustained participants and those lost to follow-up. Descriptive statistics were used to report on the study population's general characteristics. Spearman rho correlations were calculated to assess the associations between work-related factors and work engagement. Pearson correlations were calculated to assess the associations between mental and physical health at baseline and follow-up. General linear regression models (GLM) were used to assess whether work-related factors and work engagement at baseline were associated with mental and physical health at follow-up. Separate GLM analyses were conducted with mental and physical health as outcome variables.

In Model 1 all work-related factors, work engagement, and individual factors (i.e., age, gender, and education) were incorporated. Hereafter, a full multivariate model (Model 2) was tested whereby interaction terms of the work-related factors and work engagement were also included. Four centred interaction terms were made by: (work engagement—mean work engagement) X (work-related factor—mean work-related factor). The four interaction terms were work engagement and physical load, psychological job demands, autonomy, and support. In order to depict the interactions, figures were made for the significant interactions with three regression lines corresponding to mean (M), high (M + 1 standard deviation (SD)), and low (M -1 SD) work engagement scores. Lastly, in Model 3, Model 2 was expanded upon by also adjusting for health at baseline. Interpretations based on Model 3 thus pertain to the associations of work engagement, work-related factors, and their interactions, with health changes during follow-up.

From the GLM analyses, unstandardized regression coefficients (B), their standard errors (SE), and corresponding p values were reported. Regression coefficients represent the average change in mental and physical health with a one unit change in work-related factor and work engagement. The per cent adjusted explained variance (R^2) of each model was reported.

All analyses were conducted in IBM SPSS 20.

RESULTS

Study population characteristics

Descriptive information on the study population can be found in Table 1. The average age of participants was 54 years, the sample consisted of slightly more males than females.

Loss-to-follow-up was similar among men and women (18%), 20% for the youngest and 17% for the oldest age groups, and 18% for lower and 16% for higher educated persons. Those lost to follow-up did not differ from sustained participants with regard to physical health, but did have a slightly better mental health (mean mental health score difference=0.48, $p<0.05$).

Table 1 Individual factors, work-related factors, work engagement, and health among workers aged 45-64 years (n=8,837)

		n (%)	Mean (SD)	Median (min-max)
Individual factors				
Gender (female)		3,881 (43.9)		
Age			53.92 (5.30)	54 (45-64)
	45-49	2,259 (25.6)		
	50-54	2,339 (26.5)		
	55-59	2,637 (29.8)		
	60-64	1,602 (18.1)		
Education[1]	Low	2,359(26.7)		
	Medium	3,441 (38.9)		
	High	3,037 (34.4)		
Work-related factors				
Physical load			1.79 (0.88)	1.40 (1 (low)-5 (high))
Psychological job demands			3.13 (0.77)	3.00 (1 (low)-5 (high))
Autonomy			2.16 (0.70)	2.00 (1 (high)-5 (low))
Support			2.41 (0.77)	2.50 (1 (high)-5 (low))
Work engagement			4.49 (1.19)	4.83 (1 (low)-6 (high))
Health				
Mental Health:	Baseline	8,837	52.54 (7.91)	55.13 (10.13-69.43)
	Follow-up	8,601	53.07 (7.60)	55.70 (11.27-71.80)
Physical Health:	Baseline	8,837	51.71 (7.70)	54.68 (13.70-67.13)
	Follow-up	8,601	51.18 (7.97)	54.26 (12.40-67.20)

Note: SD=standard deviation. [1] Low: lower general secondary educational, preparatory secondary vocational education, Medium: intermediate vocational training, higher general secondary education, pre-university education, and High: higher vocational education, university education.

Work-related factors and work engagement were correlated (all Spearman's rho correlations<0.18). Mental health at baseline and follow-up was correlated (Pearson correlation=0.52), as was physical health at baseline and follow-up (Pearson correlation = 0.61). Men had a better mental (B=0.73, SE=0.16) and physical (B=1.60, SE=0.17) health at baseline than women. Younger persons had a better physical health (B=1.11, SE=0.26) but a poorer mental health (B=-2.32, SE=0.25) than older persons. Persons with lower educational attainments had a poorer physical health (B=-2.21, SE=0.22) and a slightly better mental health (B=0.64, SE=0.21) than persons with a higher educational attainment.

Association between work-related factors, work engagement, and health

In the first multivariate model (Table 2, Model 1) unfavourable psychosocial work-related factors, i.e., higher psychological job demands (B=-0.93, SE=0.12), lower autonomy (B=-0.25, SE=0.12), and lower support (B=-0.39, SE=0.11) were associated with poorer mental health. A higher physical load was associated with poorer physical health (B=-0.64, SE=0.10). Of the psychosocial work-related factors, higher psychological job demands (B=-0.30, SE=0.11) and lower autonomy (B=-0.27, SE=0.12) were associated with poorer physical health; support was not related to physical health (see Table 2 Model 1). A higher work engagement was associated with both better mental health (B=1.67, SE=0.07) and better physical health (B=0.84, SE=0.07) (see Table 2, Model 1). On the zero to six point scale, a one point increase in work engagement score was thus associated with a 1.67 point increase in mental health score and with a 0.84 point increase in physical health score.

A model with only individual factors explained 1.3% of the total variance in mental health, this increased to 3.9% when work-related factors were added and with the addition of work engagement thereafter the total per cent of explained variance in mental health was 9.9% (Model 1). Thus, the work-related factors contributed an extra 2.6% to the explained variance beyond the individual factors, and work engagement an extra 6.0% beyond the individual factors and work-related factors. Individual factors explained 2.5% of the total variance in physical health, work-related factors added an extra 1.1%, and work engagement added another 1.3% (total of 4.9% explained variance in physical health with Model 1).

In the multivariate models that contained the interaction terms (i.e., Model 2), the associations between work-related factors and work engagement with health remained: unfavourable psychosocial work-related factors were again related to poorer mental health, higher physical load, higher psychological job demands, and lower autonomy were related to poorer physical health, and higher work engagement was related to both better mental and better physical health (see Table 2, Model 2).

Table 2 The associations between work-related factors and work engagement at baseline and mental and physical health at 1-year follow-up among workers aged 45-64 (n=8,837)

		Mental Health		Physical Health	
		B	(SE)	B	(SE)
Model 1:	R^2	9.9%		4.9%	
Work-related factors (range 1-5)					
Higher physical load		0.07	(0.10)	-0.64**	(0.10)
Higher psychological job demands		-0.93**	(0.10)	-0.30**	(0.11)
Lower autonomy		-0.25*	(0.12)	-0.27*	(0.12)
Lower support		-0.39**	(0.11)	-0.06	(0.11)
Higher work engagement (range 0-6)		1.67**	(0.07)	0.84**	(0.07)
Model 2:	R^2	10.0%		5.0%	
Work-related factors (range 1-5)					
Higher physical load		0.07	(0.10)	-0.62**	(0.10)
Higher psychological job demands		-0.96**	(0.10)	-0.30**	(0.11)
Lower autonomy		-0.25*	(0.12)	-0.28*	(0.12)
Lower support		-0.41**	(0.11)	-0.04	(0.11)
Higher work engagement (range 0-6)		1.69**	(0.07)	0.86**	(0.08)
Interactions					
Work engagement & physical load		-0.24**	(0.07)	0.21**	(0.08)
Work engagement & psychological job demands		0.24**	(0.08)	0.08	(0.08)
Work engagement & autonomy		-0.21*	(0.09)	-0.17°	(0.09)
Work engagement & support		0.16°	(0.08)	-0.07	(0.09)
Model 3:	R^2	28.7%		38.0%	
Work-related factors (range 1-5)					
Higher physical load		-0.05	(0.09)	-0.21**	(0.09)
Higher psychological job demands		-0.44**	(0.10)	-0.19*	(0.09)
Lower autonomy		-0.12	(0.10)	-0.08	(0.10)
Lower support		-0.22**	(0.10)	-0.13	(0.09)
Higher work engagement (range 0-6)		0.67**	(0.07)	0.22**	(0.06)
Interactions					
Work engagement & physical load		-0.06	(0.07)	0.12°	(0.06)
Work engagement & psychological job demands		0.00	(0.07)	0.06	(0.07)
Work engagement & autonomy		-0.24**	(0.08)	-0.13	(0.08)
Work engagement & support		0.05	(0.07)	0.04	(0.07)
Baseline health	Mental	0.45**	(0.01)		
	Physical			0.61**	(0.01)

Note: Model 1 adjusted for age, gender, educational level, all work-related factors, and work engagement; Model 2 adjusted for age, gender, educational level, all work-related factors, work engagement, and all interaction terms; Model 3 adjusted for age, gender, educational level, all work-related factors, work engagement, all interaction terms, and baseline health (n=8,601, 236 persons had incomplete baseline health information). B=Unstandardized regression coefficient; R^2=Adjusted per cent explained variance.
*p<0.10; **p<0.05; ***p<0.01.

In Model 3, when baseline health was also included, only lower autonomy was no longer associated with poorer mental or physical health. Higher psychological job demands (B=-0.44, SE=0.10) and lower support (B=-0.22, SE=0.10) were associated with poorer mental health during follow-up, and higher physical load (B=-0.21, SE=0.09) and higher psychological job demands (B=-0.19, SE=0.09) were associated with poorer physical health during follow-up. Higher work engagement was still associated with better mental (B=0.67, SE=0.07) and physical health (B=0.22, SE=0.06) during follow-up. The explained variance in mental health almost tripled from 10 to 28.7% when baseline mental health was added to the model. The explained variance in physical health increased eightfold, from 5 to 38.0%, when baseline physical health was added to the model. Thus the health score at baseline was the strongest predictor of the health score at 1-year follow- up.

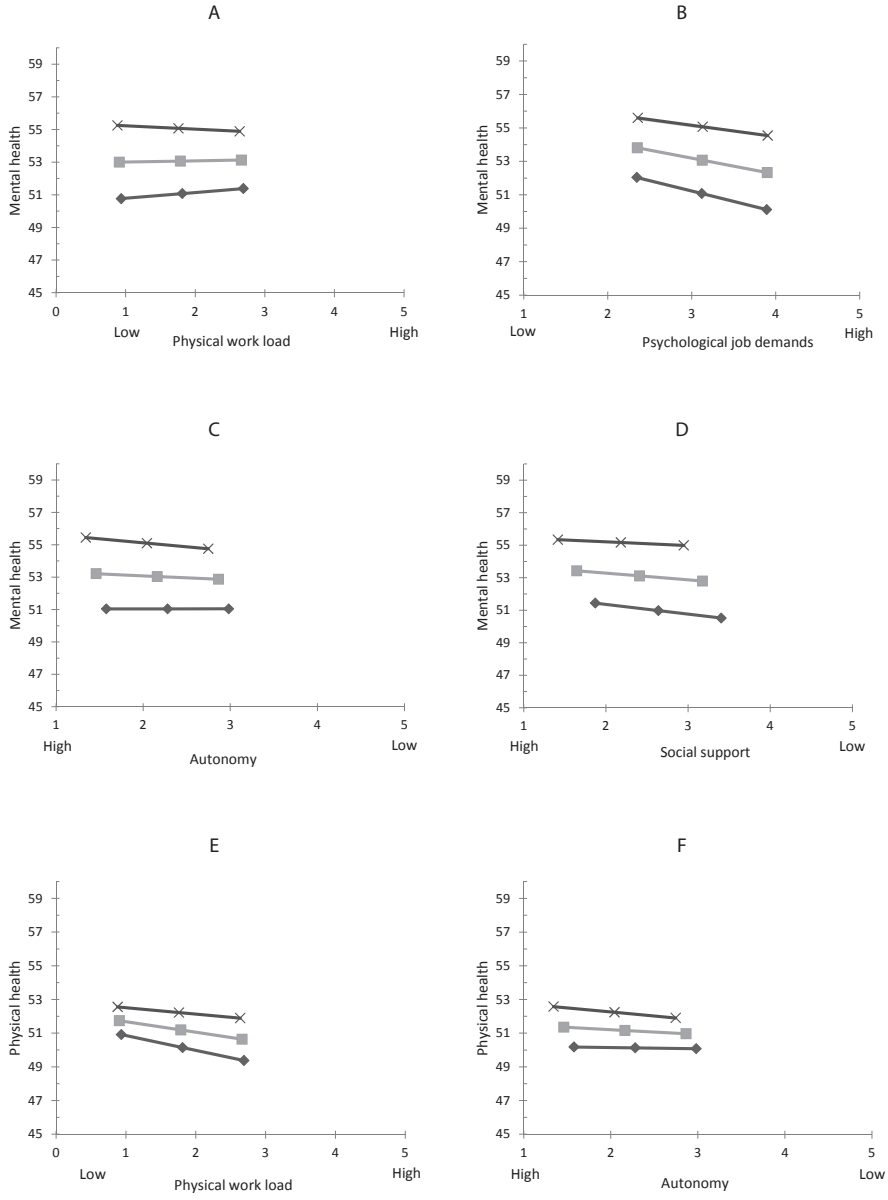
Interaction work engagement and work-related factors

In Model 2, not adjusted for baseline health, work engagement statistically significantly interacted with all work-related factors to associate with mental health (see Table 2, Model 2; and Figure 1). As can be seen in the Figure 1, a higher work engagement strengthened the associations between lower physical load (B=-0.24, SE=0.07) and higher autonomy (B=-0.21, SE=0.09) and better mental health. On the other hand, as can be seen in Figure 1, a higher work engagement buffered the associations between higher psychological job demands (B=0.24, SE=0.08) and lower support (B=0.16, SE=0.08) and poorer mental health. Work engagement and physical load and autonomy interacted to associate with physical health (see Table 2, Model 2; and Figure 1). As can be seen in Figure 1, a higher work engagement buffered the association between higher physical load and poorer physical health (B=0.21, SE=0.08). On the other hand, as can be seen in Figure 1, a higher work engagement strengthened the association between higher autonomy and better physical health (B=-0.17, SE=0.09).

The per cent explained variance in health increased with only 0.1 from Model 1 to Model 2, when interaction terms were added. After also incorporating baseline health, in Model 3, a higher work engagement was found to strengthen the association between higher autonomy and better mental health during follow-up (B=-0.24, SE=0.08). A higher work engagement was also found to buffer the association between higher physical load and poorer physical health during follow-up (B=0.12, SE=0.06).

The per cent explained variance in health increased with only 0.1 from Model 1 to Model 2, when interaction terms were added. After also incorporating baseline health, in Model 3, a higher work engagement was found to strengthen the association between higher autonomy and better mental health during follow-up (B=-0.24, SE=0.08). A higher work engagement was also found to buffer the association between higher physical load and poorer physical health during follow-up (B=0.12, SE=0.06).

Figure 1 Interaction work engagement and work-related factors with health among older (aged 45-64) employees (n=8,837) (corresponds to Model 2)



Note: Lines represent work engagement:

- Mean + 1 standard deviation
- Mean
- Mean - 1 standard deviation

DISCUSSION

Unfavourable psychosocial work-related factors, i.e., higher psychological job demands, lower autonomy, and lower support, were associated with poorer mental health. Higher physical load, higher psychological job demands, and lower autonomy were associated with poorer physical health. Higher work engagement was associated with better physical and especially better mental health. Work engagement had a small effect on the associations between work-related factors and health.

Work-related factors and health

The finding that psychosocial work-related factors were associated with mental health concurs with studies that have linked psychosocial factors at work to mental health [7-9] and that have shown that the mental health benefits of employment depended on the psychosocial quality of the job [6]. A recent Danish study also found an association between high quantitative demands and low social support and antidepressant use, which is considered a good proxy of mental health [27]. However, in the current study, two of the three unfavourable psychosocial work-related factors assessed, namely higher psychological job demands and lower autonomy, were also related to poorer physical health. Physical load, which in past studies has been especially linked to musculoskeletal disorders, was not found to relate to mental health in the current study, but only to physical health. Work-related factors together explained more variance in mental health than individual factors and for physical health individual factors explained slightly more variance than work-related factors.

Work engagement and health

In the current study higher work engagement had an association with better health. This is in line with findings that work engagement is related to work ability [15, 16] and that workers with a higher work engagement may have more psychological hardiness [28], and thus also better health [29]. However, findings on the association between high work engagement and a decreased likelihood of sickness absence, also a proxy of health, are inconclusive [15, 17]. Different findings in past studies could be due to different operationalizations of health, as in a study among fire-fighters [17] the health-related measures were based on the quantity of sickness absence days and the number of self-reported diseases diagnosed by a physician. Furthermore, past studies have focused on specific occupational groups, i.e., nurses' aides, surgeons, and fire-fighters, that are different from one-another [15-17].

The relation between work engagement and mental health was stronger than that of work engagement and physical health in the current study. Past studies have also found that high work engagement is related to mental health dimensions, such as less

anxiety, less depression, high life satisfaction, and good mental well-being [12, 30]. The strong association between work engagement and mental health may be partially related to a common source bias; the construct work engagement is more similar to the construct mental health than to the construct physical health.

Interaction work-related factors and work engagement

Small interaction effects were found between work engagement and work-related factors with health and the interaction terms contributed little to the explained variance (0.1%) for both mental and physical health. After correction for baseline all interaction effects were no longer statistically significant, except between work engagement and autonomy. Thus it appears that particularly the association between high autonomy and better mental health was somewhat strengthened by work engagement.

Findings from past research on the role of work engagement in the association between work-related factors and health are inconclusive. Having a high work engagement has been found to partly buffer the adverse effects of job demands on health [11], whereas another study has shown that work engagement mediated the relation between job resources and turnover intention and that burnout, which had a strong negative relation to work engagement, mediated the relation between job demands and health outcomes [18].

Implications of findings

In order to interpret our findings we should take into consideration that many associations, even small ones, were statistically significant in the current study due to the large study population. In order to determine the practical relevance of the statistically significant main associations we considered how much change in the work-related factors and work engagement is needed in order to achieve a minimal important difference (MID) in health. Half a SD has been identified as a universally applicable MID for health-related quality of life measures among specific patient populations (at follow-up, mental health MID=3.80, physical health MID=3.99) [31]. These MIDs are especially relevant at individual level in treatment regimes of patients, whereas on population level smaller changes may be considered substantial. The current study population is a community-based sample and, thus, small effects can be substantial in a public health context.

In order to achieve an MID improvement in mental health the reported associations between work engagement and the three related psychosocial work-related factors (regression coefficients in model 1 from Table 2) imply that these four determinants must improve by at least 1.25 SD in order to achieve an MID in mental health. For physical health the MID requires an improvement of more than two SD in work engagement and the work-related factors physical load, psychological job demands, and autonomy.

Separately, work engagement would need to improve with two and four SD in order to achieve an MID in mental and physical health, respectively.

A main finding from the current study is thus that in order to realize improvements in mental health, especially the promotion of a high work engagement and, to a lesser extent, improvement in work-related factors could be beneficial. Much greater changes in work engagement and work-related factors would need to be realized in order to achieve changes in physical health. These conclusions are also reflected in the proportion of variance in mental and physical health that can be explained by work-related factors and work engagement.

Several randomised control trials have been conducted in which interventions, for example based on mindfulness trainings, were aimed at improving employees' work engagement. The effectiveness of such trainings and interventions to date is at best modest [32-34]. Work engagement may also be related to other personal factors, such as motivation, self-efficacy, coping, and psychological hardiness, which, according to the International Classification of Functioning and functional capacity schemes, are important for health and functioning [35]. Although the effects of work-related factors on health were smaller than those of work engagement, altering working conditions will still have health benefits. Alongside more individual-based interventions, it is also important to consider the role of organizational-level factors in health protection and promotion as well as in the stimulation of work engagement. Further research is needed to develop successful interventions that are beneficial for health and functioning.

Potential limitations

Some limitations of this study should be mentioned. The standardised weighing system of the SF-12 creates orthogonalized mental and physical health scores which means that, when assessing health with the SF-12, the naturally occurring covariance in which persons with good physical health also tend to have good mental health is largely eliminated, and physical health and mental health are forced to be uncorrelated (Pearson correlation=0.01).

To check the assumptions of linearity and normality, we examined the univariate associations between quadratic and logarithmic transformed work-related factors and work engagement scales with mental and physical health. Findings were the same for logarithmic and original scales. Only for the relationships between autonomy and mental health and between psychological job demands and physical health did quadratic terms contribute to the regression in addition to the original scales. Quadratic terms of the other work-related factors and work engagement did not contribute to the regression. When further exploring the relation between autonomy and psychological job demands with mental and physical health, respectively, it appeared that the relations were especially present for high autonomy and high psychological job demands. The

findings presented use the original scales and assume normal distributions and a linear association between the predictors and health.

From the findings of this study reversed causality cannot be fully excluded, namely it could also be that health influences work-related factors and work engagement. In Model 3 an adjustment for health at baseline was included, thus this model depicts the associations between work-related factors and work engagement with health reductions or improvements. Mental and physical health at baseline were associated with mental and physical health, respectively, at 1-year follow-up. Because work engagement and the same work-related factors, excluding autonomy, were still found to relate to health after the adjustment for baseline health we presume that work-related factors and work engagement lead to [changes in] health. This interpretation is further supported by recent studies in which normal causal relations between work engagement and anxiety [27], depression [27,28], and life satisfaction [36] were found to be stronger than the reversed causal relations. Consequently, it was concluded that work engagement was antecedent to these types of mental health factors.

Effect modification was assessed through interaction terms of work-related factors and work engagement. Based on previous studies [7,11], the hypothesis of this study was that work engagement moderated the associations of work-related factors and health, a complementary hypothesis that cannot be ruled out is that work-related factors moderate the associations of work engagement and health.

Findings from our longitudinal study, with such a large and heterogeneous sample, expand upon findings from past studies that often had cross-sectional designs with a focus on one occupational group or health disorder. Especially the main associations between work-related factors and work engagement with health have practical implications. The findings from this study indicate that promoting work engagement and, to a lesser extent, favourable work-related factors can be beneficial for mental health in particular.

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CHAPTER 03

DIFFERENTIAL EFFECTS OF MENTAL AND PHYSICAL HEALTH AND COPING STYLE ON WORK ABILITY: A ONE-YEAR FOLLOW-UP STUDY AMONG AGING WORKERS

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ABSTRACT

Objective

This study examines whether mental and physical health relate differently to work ability and whether these associations vary with coping style.

Methods

A 1-year longitudinal study was conducted among 8842 employees aged 45 to 64 years from the Study on Transitions in Employment, Ability and Motivation. On-line questionnaires measured self-perceived mental and physical health at baseline and coping and work ability at follow-up. The data were analysed using hierarchical regression analysis.

Results

Active coping and good mental and especially physical health predicted high work ability at follow-up. Avoidant coping was negatively related to work ability. Seeking support was unrelated to work ability. Interaction effects of coping and health on work ability were weak.

Conclusion

Successful coping styles and good health predict high work ability, and thus, promoting such factors can help improve sustainable employability.

INTRODUCTION

Because of ageing populations, many Western countries must currently maintain and even increase the work participation of older employees. Losing the valuable experience and knowledge of these employees is undesirable for organizations [1,2]. Unfortunately, the likelihood of health problems (such as musculoskeletal problems and cardiovascular and respiratory diseases) in this population is relatively high [3], which could endanger the degree to which they are able to continue working. Moreover, mental illness has been identified as a major cause of inability to work across all age groups [4,5]. It is therefore vital to examine the consequences of mental and physical health problems for the work ability of older employees.

High work ability is associated with self-perceived high quality of work and enjoyment of staying in one's job [6], whereas poor work ability is related to productivity loss [6,7]. Poor work ability also increases the risk of early retirement, long-term sickness absence, and work disability [8-10]. Work ability is related not only to employment outcomes but also to health. For example, Pohjonen [11] found that individuals who perceived their health status as poor had a higher likelihood of reporting poor work ability. On the basis of the relation between work ability and health as well as past findings in this area, this study assumed that good general (i.e., mental as well as physical) health would predict high work ability [12]. Nevertheless, because the magnitude of the relations between various types of diseases and work ability differs [13,14], it is plausible that the effects of mental and physical health on work ability are not similar. On the basis of the study by Ilmarinen et al [15], we expected that work ability would depend on both health problems and work demands. Therefore, we examined the effects of health problems on work ability, taking into account the type of work an individual does (i.e., predominantly physically or mentally demanding). To further add to the existing literature, we examined whether mental and physical health differ in their effect on work ability, to better understand how different health problems may reduce work ability differently and to target interventions for individuals with a high probability of reduced work ability.

According to Alavinia et al [0], the (im)balance between health conditions and related function limitations and work demands must be considered when determining work ability. Employees who use appropriate coping styles often find a new balance in their work situation.16 The ability to cope successfully with physical and mental work requirements is therefore considered an important skill when suffering from health problems, but to date, the role of coping in the health-work ability association has not explicitly been researched. Alavinia and his colleagues recommend to study workers' coping capacities, working conditions, and health jointly, rather than independently [10]. It has been suggested that differences among persons in the way they adapt to

and cope with mental and physical problems could explain varying work outcomes for mental and physical conditions [17,18]. Folkman and Lazarus [19] defined coping as "the cognitive and behavioural efforts made to master, tolerate, or reduce external and internal demands and conflicts among them" (p. 223). Coping is often considered as a relatively stable trait, that is, individuals are assumed to use similar coping strategies across different situations and throughout their lifetime. The effects of coping on outcomes may vary with the type of coping strategy that is used; therefore, we examined how different coping styles are related to work ability. Generally, active, problem-solving coping is known to have positive effects on well-being and overall health outcomes, whereas avoidance strategies are related to psychological distress and physical symptoms [20,21]. Because these health outcomes are associated with work ability, we expected that coping would directly relate to work ability. Moreover, we hypothesized that the work ability of persons with relatively poor health would benefit more from applying effective coping styles than the work ability of persons with a relatively good health [22].

We expected an interaction between active coping and both types of health [20,23], because similar outcomes of coping were found for both mental and physical disorders [24-29]. In summary, for both mental and physical health, we hypothesized that negative effects of physical and mental health problems on work ability would be strongest for persons using an avoidant coping style and weakest for those using an active coping style and those seeking social support. This study was designed to address the following research questions:

1. Do mental and physical health problems influence work ability differently (Q1)?
2. Does an individual's type of coping style influence his or her work ability (Q2)?
3. Do coping styles moderate the effects of mental and physical health on work ability (Q3)?

METHODS

Study design and population

This study had a 1-year follow-up design. In 2010 and 2011, an existing Dutch Internet panel was used for data collection of the Study on Transitions in Employment, Ability and Motivation. Topics of the annual Study on Transitions in Employment, Ability and Motivation questionnaire are health, job and personal characteristics, work ability, productivity, and transitions in employment. The baseline sample, stratified by age and work status, consisted of 15,118 persons (71% response). The 1-year follow-up had a response of 82%, corresponding with 12,430 participants. The focus in this study was on persons employed at both baseline and follow-up (n = 9153), thus excluding self-

employed and currently nonworking persons. The latter group was excluded because our focus was on work ability at the time of the questionnaire and we wanted to avoid any recall bias. After list-wise deletion of missing data, the final sample included 8824 employees.

The medical ethical committee of the VU University Medical Centre, Amsterdam, declared that the Medical Research Involving Human Subjects Act did not apply to the Study on Transitions in Employment, Ability and Motivation and raised no objections to the execution of this research. The information accompanying the on-line questionnaire emphasized that the privacy of participants was guaranteed, that all answers to the questions were anonymous and treated confidentially, and that all data were stored on secured computer systems.

Measures

Work ability

Work ability at baseline and follow-up was measured using the question "If you would rate your work ability in the best time of your life at 10 points, at how many points would you rate your work ability at this moment?" [30] This item from the Work Ability Index measures a person's current work ability relative to his or her lifetime best, on a scale from 0 to 10 [31], and in other studies, has been related to the entire Work Ability Index and health [32-35].

Functional health status

Functional health status at baseline was measured using the 12-Item Short-Form Health Survey (Cronbach's alpha=0.89) [33]. The 12 items provide two weighted summary scores assessing physical function and mental well-being. The 12-Item Short-Form Health Survey scores were weighted using 1998 US standards (mean=50; SD=10; in the 1998 general US population) [36]. Scores can theoretically range from 0 to 100, with higher scores indicating better perceived health.

Coping

Coping was measured at follow-up by using nine items derived from the Utrecht Coping List [37], assessing to what extent participants deal with difficult situations through avoidant behaviour (i.e., avoidance behaviour; three items, Cronbach's alpha=0.74), an active response to the problems (i.e., active coping; three items, Cronbach's alpha=0.76), and by seeking social support (three items, Cronbach's alpha=0.67). The nine items were measured using four-point Likert scales (1 = rarely/never; 4 = very often). Participants' mean scores on the respective three items per three coping constructs (i.e., avoidance, active, and support) were calculated.

Covariates

Gender, age, and type of work were included in the analyses as covariates. Individuals answered one question concerning what type of work they conducted: "What kind of tasks do you mainly perform in your job?" ("mainly physically demanding," "mainly mentally demanding," or "both physically and mentally demanding"). This item is part of the Work Ability Index [31].

Statistical analyses

Descriptive analyses as well as Pearson product-moment correlations (r) were used to examine how the variables were related to one another. Hierarchical linear regression analyses were performed to assess the relation of mental and physical health with work ability (Q1) and the relation of coping with work ability (Q2). Interaction terms of coping and health variables were included as a means of assessing effect modification (Q3). Centred variables were computed for the interaction analyses.

The covariates as well as baseline work ability were entered in the first block of this stepwise regression analysis. The correction for baseline work ability allows for conclusions to be drawn about the influence of the baseline determinants on changes in work ability during the follow-up year. Hereafter, the main effects of physical and mental health (block 2) and the three coping styles (active, avoidant, and social support; block 3) on work ability were added to the model. Interaction terms of mental and physical health and the three coping styles (six interaction terms) were entered in the fourth block. Finally, the difference of the regression coefficients of mental and physical health was tested using a t test. For all statistical analyses, Statistical Package for the Social Sciences 20 (Statistical Products and Service Solutions, Inc, Chicago, IL) was used.

RESULTS

Study population and descriptives

A loss-to-follow-up analysis showed no significant selective loss to follow-up due to low work ability (r=-0.09; not significant) or poor physical health (r=-0.01; not significant). Younger participants (r=-0.02; $p<0.05$) and participants with a poor mental health (r=-0.02; $p<0.05$) were slightly less likely to participate in the follow-up than others.

Table 1 presents the means, standard deviations, and range for the study variables, showing that more than half of the sample were men (56.2%). The mean age of the sample was 54 years (SD=5.3). The mean score on work ability was 7.92 (SD=1.54) and 7.88 (SD=1.56) at follow-up. Active coping was the most frequently used coping style (M=2.90), while avoidant coping was used the least (M=1.73).

Table 1 Means (M), standard deviations (SD), and ranges of the study variables (n=8,824)

	%	M	SD	Minimum to Maximum
Gender				
Male	56.24			
Female	43.76			
Type of work				
Mental	61.51			
Physical	12.60			
Both mental and physical	25.88			
Age		53.90	5.30	45 - 64
Work ability (Baseline)		7.92	1.54	0 - 10
Work ability (Follow-up)		7.88	1.56	0 - 10
Physical health		51.72	7.70	13.70 - 67.13
Mental health		52.56	7.92	10.13 - 68.34
Coping				
Avoidant		1.73	0.49	1 - 4
Seeking social support		2.19	0.54	1 - 4
Active		2.90	0.54	1 - 4

Table 2 Pearson correlations among the study variables

		1.	2.	3a.	3b.	3c.	4.	5.	6.	7.	8.
1.	Work ability T1	1.00									
2.	Work ability T2	0.44	1.00								
3a.	Mental work	-0.09	-0.09	1.00							
3b.	Physical work	0.07	0.01		1.00						
3c.	Both mental and physical work	0.05	0.04			1.00					
4.	Coping: avoidant	-0.13	-0.06	-0.01#	-0.02*	0.03*	1.00				
5.	Coping: social support	-0.00	0.00	-0.02*	0.06	-0.02#	-0.02#	1.00			
6.	Coping: active	0.12	0.14	-0.14	0.16	0.03	-0.23	0.25	1.00		
7.	Physical health	0.44	0.35	-0.08	0.05	0.06	-0.07	0.02#	0.04	1.00	
8.	Mental health	0.37	0.24	0.04	-0.02#	-0.03	-0.23	-0.05	0.12	0.01#	1.00

Note: n=8,824. All correlations significant at $p<0.01$, except *$p<0.05$ and #$p>0.05$.

Most participants (61.5%) considered their work as primarily mentally demanding, whereas a quarter (25.9%) indicated their work as both mentally and physically demanding. The remainder (12.6%) conducted primarily physically demanding work.

Table 2 presents the Pearson correlations among the variables. Work ability at baseline and follow-up were moderately correlated ($r=0.44$; $p<0.01$).

Table 3 Summary of hierarchical regression analysis for variables predicting work ability (T2)

	Model 1		Model 2		Model 3		Model 4	
Variable	B	SE B	B	SE B	B	SE B	B	SE B
Model 1								
Gender	-0.06	0.03	0.01	0.03	0.03	0.03	0.03	0.03
Age	-0.01*	0.00	-0.01**	0.00	-0.01**	0.00	-0.01**	0.00
Physical work	0.23**	0.05	0.24**	0.05	0.19**	0.05	0.19**	0.05
Both mental and physical work	0.12**	0.04	0.12**	0.03	0.11*	0.03	0.11*	0.03
Work ability T1	0.44**	0.01	0.30**	0.01	0.29**	0.01	0.29**	0.01
Model 2								
Physical health			0.04**	0.00	0.04**	0.00	0.04**	0.00
Mental health			0.03**	0.00	0.02**	0.00	0.02**	0.00
Model 3								
Coping: avoidant					-0.22**	0.03	-0.21**	0.03
Coping: social support					-0.05	0.03	-0.05	0.03
Coping: active					0.18**	0.03	0.19**	0.03
Model 4								
Physical health × Coping: active							0.01	0.00
Physical health × Coping: avoidant							0.00	0.00
Physical health × Coping: social support							-0.01*	0.00
Mental health × Coping: active							0.01*	0.00
Mental health × Coping: avoidant							0.01*	0.00
Mental health × Coping: social support							0.00	0.00
R^2		0.20		0.24		0.25		0.25
F for change in R^2		439.62**		400.38**		294.82**		185.43*

Note: B=Unstandardized regression coefficient, SE B=standard error B. Reference category for gender: male, reference category for type of work: mental work. *p<0.05 **p<0.01. n=8,824.

Both physical and mental health were correlated to work ability at the two measurement points. The association between work ability and physical health at follow-up was stronger (r = 0.35; p<0.01) than that between work ability and mental health (r = 0.24; p<0.01).

Effects of mental and physical health on work ability (Q1)

The covariates (i.e., age, gender, type of work, and work ability at baseline) explained 20% of the variance in work ability at follow-up (Table 3, model 1). Work ability decreased slightly with increasing age. Participants having a primarily physically demanding job or a job that combined physically and mentally demanding work reported higher work ability than participants conducting solely mentally demanding work.

Mental and physical health at baseline explained an additional 4% of the variance in work ability at follow-up (model 2) (R^2=0.24). Both poor physical and mental health were negatively related to work ability. Physical health had a slightly stronger relation with work ability (B=0.04; p<0.01) than mental health (B=0.03; p<0.01). The difference between the associations of physical and mental health with work ability (as obtained in the same analysis) was statistically significant; ΔB(0.026-0.042) = -0.016; t(9,150) = -6.23; p<0.001.

Effects of coping style on work ability (Q2)

Table 3 shows that addition of the three coping styles to the model (model 3) explained 1% extra variance as compared with model 2 (including only the covariates and mental and physical health). Avoidant coping was negatively related to work ability (B=-0.22; p<0.01), active coping predicted work ability positively (B=0.18; p<0.01), and seeking support was unrelated to work ability (B=-0.05; p>0.05).

Effect modification of coping on the health-work ability relation (Q3)

The model in which interaction terms between coping and health were entered into the regression (model 4) accounted for a small but significant increase of the explained variance in work ability (ΔR^2=0 .001; p<0.05). We found small interactions between mental health and active coping (B=0.01; p<0.05), and mental health and avoidant coping (B=0.01; p<0.05). Figure 1 shows that the contribution of mental health to higher work ability was stronger for employees with active coping. The association between mental health and work ability was stronger for persons with avoidant coping (Figure 2).

Finally, a small negative interaction effect was found between physical health and support seeking (B=-0.01; p<0.05) (Figure 3). The positive association between physical health and work ability was weaker for persons who often (labelled "most" in the Figures) seek social support.

Figure 1 Moderating effect of active coping on the relationship between mental health and work ability

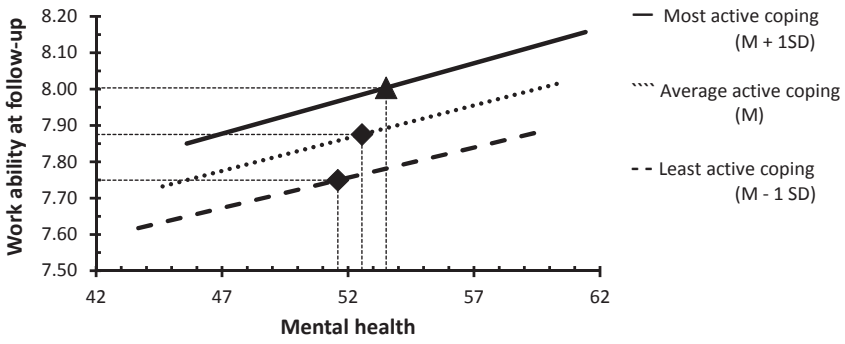


Figure 2 Moderating effect of avoidant coping on the relationship between mental health and work ability

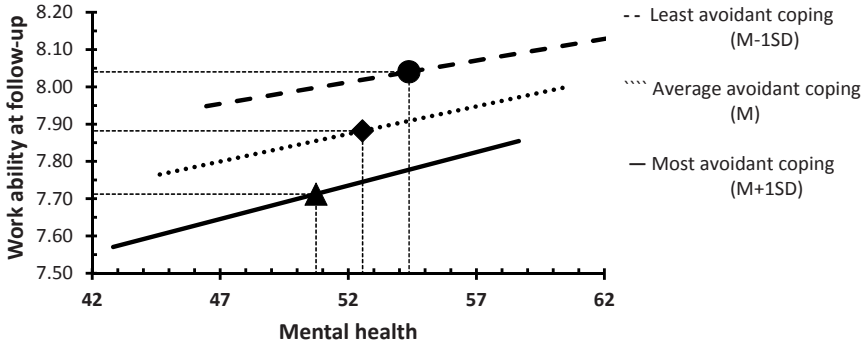
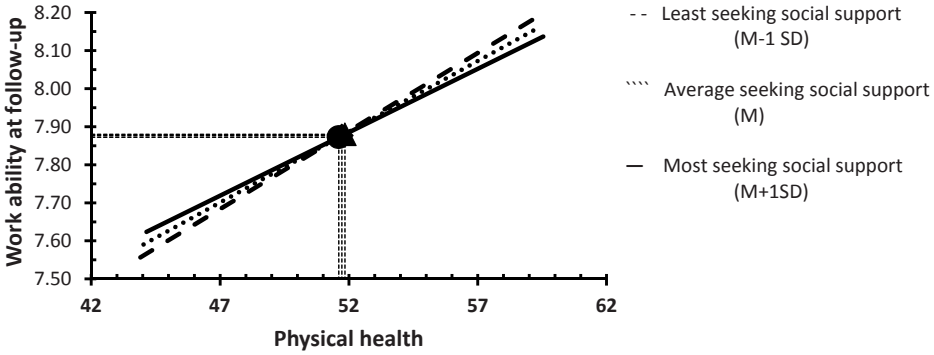


Figure 3 Moderating effect of seeking social support on the relationship between physical health and work ability



Accordingly, the association between poor physical health and poor work ability was stronger for those persons who do not seek social support often (labelled "least" in the Figures).

DISCUSSION

This study contributes to knowledge on the sustainable employability of older workers by determining the relative impact of mental and physical health on the work ability of these workers as a function of individual factors (i.e., coping). Drawing on a prospective data set containing data from 8,824 employees aged between 45 and 64 years, a series of regression analyses showed that both physical and mental health were related to work ability, and that this relation was strongest for physical health (Q1). With regard to the effects of coping on work ability (Q2 and Q3), active coping was associated with higher

work ability and slightly more so for persons with good mental health than for persons with poor mental health. Conversely, avoidant coping was associated with lower work ability and particularly so for persons with poor mental health. Finally, although there was no main effect of seeking support on work ability, a weak joint effect with physical health showed that seeking social support was related to an increase of work ability for persons with poor health but with a decrease of work ability for persons with good health.

The three most interesting findings of this study were the following. First, our findings showed that incorporating physical and mental health in our model improved the prediction of work ability at follow-up with 4%. As in previous research [22,38], the influence of physical health on work ability was stronger than that of mental health. It is possible that persons associate their work ability mainly with physical functioning, perhaps because physical limitations are more visible and apparent. Alternatively, physical health problems may simply be more restrictive for one's work ability than mental health problems.

Second, coping styles accounted for a small (1%) but significant additional proportion of the variance in work ability at follow-up, beyond what was already accounted for by the covariates and mental and physical health. Thus, this study has shown that coping style is potentially a relevant factor in the maintenance of high work ability among older employees. As expected, active coping influenced work ability positively and can therefore be regarded as an effective coping style in maintaining work ability, in contrast to avoidant coping that reduced work ability. Although we had expected to see a positive effect of seeking support on work ability, no main effect was found. Van Rhenen et al. [21] argued that seeking support could affect work outcomes in two ways; (1) traditionally, it is assumed that social support reduces sickness absence, and (2) social support, on the contrary, could also promote absence-related behaviour and encourage a person to stay at home when ill. As both processes could operate simultaneously, any effect of seeking social support on work ability could remain undetected [21].

Finally, we found three small but statistically significant interaction effects between health and coping. The general idea of avoidant coping being a negative manner of dealing with situations [20,21] was confirmed in this study for persons with both poor and good mental health. The negative effect of avoidant coping on work ability was strongest for persons with poor mental health, which supported the expectations. Similarly, we expected that the positive effect of active coping would be strongest for persons with poor mental and physical health. Nevertheless, whereas active coping exerted the expected positive influence on work ability, this effect was strongest for persons with good mental health. This might have been due to a process of work-related flow, which arises when healthy persons experience self-efficacy through a high level of controllability (e.g., active coping), thereby being even better able to work [39]. Seeking

support, the third coping strategy, moderated the relation between physical health and work ability. Seeking support was expected to have the strongest positive effect on work ability for persons with poor mental and physical health. Whereas this reasoning was supported for persons with poor physical health, seeking social support was associated with a lower work ability for persons with good physical health. In a meta-analytic review, seeking social support was also negatively related to health outcomes for acute stressors (but positively related to chronic stressors) [40]. Apparently, seeking social support does not always reap the anticipated positive returns.

The main strengths of this study include its large and diverse sample (in terms of professional background and health status) and a 1-year follow-up design. Nevertheless, the large sample size raises the issue of statistical significance versus practical relevance of the results. We found some evidence that coping moderated the effects of health on work ability, but the magnitude of these effects was low compared with that of the other factors predicting work ability. Therefore, we consider the main effects of mental and physical health, the differential magnitude of these, and to a lesser extent, the main effect of coping on work ability as the primary outcomes of this study. A second limitation derives from the fact that coping styles were assessed at follow-up only; thus, this aspect of our design is of a cross-sectional nature. This inhibits us from drawing conclusions on the causal direction of effects of coping on work ability. Note that it is often assumed that coping is a stable characteristic (i.e., a trait), implying that it is largely irrelevant as to when coping styles are assessed in a prospective design. Nevertheless, coping may also be examined from a more contextually oriented viewpoint whereby it is possible that a person copes differently across different situations [41]. Finally, this study focused on older persons still at work. This implies that a "healthy worker effect" cannot be excluded, because severely ill persons who were not employed anymore were not studied. If present, such an effect will have resulted in an overly positive estimate of the participants' average work ability as well as conservative effect estimates because of restriction of range effects.

Conclusion

Both mental and physical health predicted later work ability. From a practical point of view, these findings suggest that organizational interventions that create awareness of the importance of health among employees, promote physical fitness, or reduce stress symptoms can help maintain and promote good work ability of older workers. Furthermore, our findings indicated that workers will benefit from using active rather than avoidant coping styles. We believe that coping styles are more or less stable traits, which may only be modified in cognitive or behavioural therapy. Nevertheless, the employer may discourage avoidant behaviour and stimulate proactive behaviour. Additional supportive efforts may be needed to promote the work ability of employees with avoidant

coping styles, as compared with those with an active coping style, both when in poor health and in good health. Furthermore, avoidant coping style can be viewed as an identifiable and potentially modifiable risk factor for low work ability.

Note that, in this study, work ability was examined as a function of employee health and coping and that our findings suggested that work ability is rather stable across the relatively short 1-year follow-up time, as evidenced by a strong effect of work ability at baseline on work ability at follow-up. Nevertheless, after correction for baseline work ability, the associations between health and work ability remained significant, meaning that physical and mental health influenced subsequent changes in work ability. This suggests that it may be useful to look at a different way of improving work ability, namely, to focus on practical adjustments at work. These may be customized to the employee and his or her health issues and could thus improve work ability. In a qualitative article on maintaining productivity of older workers [42], it was concluded that the type of adjustment is particularly important. These researchers argue that there are no general adjustments that ensure that productivity is maintained. Rather, adjustments must be specifically tailored to the individual worker. For example, an adjustable desk might be appropriate for an employee with back problems, whereas an employee with depressive symptoms might benefit from social support of his colleagues.

All in all, this study contributed to current knowledge on work ability by showing that active coping and better mental and especially physical health are associated with later high work ability. Conversely, avoidant coping was negatively related to work ability. Although interaction effects of coping and health on work ability were found, the main effects of these factors are considerably more relevant from a practical point of view. Therefore, interventions should focus on promoting health and an active coping style among older employees.

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CHAPTER 04

THE INFLUENCE OF CHRONIC HEALTH PROBLEMS ON WORK ABILITY AND PRODUCTIVITY: A LONGITUDINAL STUDY AMONG OLDER EMPLOYEES

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ABSTRACT

Objectives

This study aimed to assess the influence of chronic health problems on work ability and productivity at work among older employees using different methodological approaches in the analysis of longitudinal studies.

Methods

Data from employees, aged 45-64, of the longitudinal Study on Transitions in Employment, Ability and Motivation was used (n=8,411). Using three annual online questionnaires, we assessed the presence of seven chronic health problems, work ability (scale 0-10), and productivity at work (scale 0-10). Three linear regression generalized estimating equations were used. The time-lag model analysed the relation of health problems with work ability and productivity at work after one year; the autoregressive model adjusted for work ability and productivity in the preceding year; and the third model assessed the relation of incidence and recovery with changes in work ability and productivity at work within the same year.

Results

Workers with health problems had lower work ability at one-year follow-up than workers without these health problems, varying from a 2.0% reduction with diabetes mellitus to a 9.5% reduction with psychological health problems relative to the overall mean (time-lag). Work ability of persons with health problems decreased slightly more during one-year follow-up than that of persons without these health problems, ranging from 1.4% with circulatory to 5.9% with psychological health problems (autoregressive). Incidence related to larger decreases in work ability, from 0.6% with diabetes mellitus to 19.0% with psychological health problems, than recovery related to changes in work ability, from a 1.8% decrease with circulatory to an 8.5% increase with psychological health problems (incidence-recovery). Only workers with musculoskeletal and psychological health problems had lower productivity at work at one-year follow-up than workers without those health problems (1.2% and 5.6%, respectively, time-lag).

Conclusions

All methodological approaches indicated that chronic health problems were associated with decreased work ability and, to a much lesser extent, lower productivity at work. The choice for a particular methodological approach considerably influenced the strength of the associations, with the incidence of health problems resulting in the largest decreases in work ability and productivity at work.

INTRODUCTION

The population is ageing, and the proportion aged over 50 years is expected to continue to grow rapidly [1]. In parallel, the workforce is ageing, leading to potential strains on social security systems. In order to deal with this, many Western countries have increased the statutory retirement age. In an ageing workforce, health problems will become more prevalent. Employees with health problems could be faced with decreased work ability [2], quantitative productivity loss at work [3,4], sickness absence [5], and even exit the labour force [6]. Work ability can be defined as the balance between an individual's resources (e.g., health, functional abilities, competencies) and work demands (e.g., work environment, contents, demands) [7].

Several studies have shown that health problems are related to unfavourable work outcomes. Psychological health problems are associated with sickness absence and reduced work productivity [8,9]. Other studies have shown that different musculoskeletal pain complaints are also associated with productivity loss at work [10]. Most findings on relations of health with work outcomes come from studies with a cross-sectional design. A few longitudinal studies have, however, shown that psychological health problems are related to an increased risk of sickness absence in the following year [5] and that especially general physical health is related to reduced work ability at one-year follow-up [2]. These studies have used different definitions of health problems and work outcomes, which makes the comparison of the influence of different chronic health problems on work outcomes difficult. Thus, longitudinal studies that incorporate multiple health problems are needed [11,12].

Comparison between studies is further hampered by the different methodological approaches used, which require nuanced interpretations. A critical issue in establishing causality is the temporality of the observed association, i.e., that the cause precedes the effect in time. In longitudinal studies, a determinant is thus often related to an outcome that is measured at a later point in time by using a time-lag [e.g., 13].

In the present longitudinal study, we assess the relation of self-reported chronic health problems with self-reported work ability and productivity at work one year later (time-lag model). Although in this design the determinant, i.e., the health problem, was present prior to the assessment of work ability and productivity at work, it may still be difficult to rule out reverse causality [14]. It is possible that the outcome has influenced the determinant prior to the study period, especially since both measures are based on self-reports and their correlation could remain stable throughout the study period. In order to deal with this, an autoregressive technique is often used whereby the outcome of interest is adjusted for its baseline value [15,16]. Hence, such an analysis relates the determinant to a change in the outcome during the follow-up period. We apply this

autoregressive approach to analyse whether the presence of a health problem predicts a decrease in work ability and productivity at work during one-year follow-up.

Since longitudinal studies cover a limited period of the lives of older employees, it is not unreasonable to ask what the appropriate timeframe would be for common health problems to cause a decrease in work ability and productivity at work. For example, does the influence become noticeable within one year or only as a gradual process over time? It is possible that persons with health problems have lower work ability and productivity at work than persons without health problems, but that the mere presence of such problems does not cause a decrease in work ability and productivity within one year. In a recent study, changes in self-perceived economic difficulties were associated with a decline in mental and physical functioning during a 4-7 year follow-up period [17]. In the third model, we apply a similar approach and specifically relate changes in health (i.e., incidence and recovery) during a particular year to direct changes in work ability and productivity at work during that same year.

This longitudinal study is novel in that both work ability and productivity at work are included as outcomes, it comprises several common health problems, and uses three common approaches of assessing longitudinal relations between health and these outcomes.

METHODS

Study design

The Study on Transitions in Employment, Ability, and Motivation (STREAM) is a four-year (2010-2013) longitudinal prospective cohort study among a stratified sample of older persons (aged 45-64 years) in the Netherlands [18]. STREAM participants annually complete an online questionnaire on topics such as work characteristics, health, employment status and transitions, work ability, and work productivity.

The current study used data from three STREAM waves, whereby respondents in 2010 (T1) were also approached for participation in 2011 (T2) and in 2012 (T3). At baseline (T1, 2010) 15,118 persons participated in STREAM, 71% of all invited persons. In 2011 (T2) 82.2% of the baseline sample responded (n=12,430). In 2012 (T3), a total of 12,057 persons responded, of which 1105 persons had only participated at T1 and not at T2, and 10,952 had also participated at T2. Thus 10,952 persons participated in all three waves, representing 72.4% of the original sample.

Persons were included in the current study if they participated in all three waves (n=10,952) or in T1 and T2 (an additional 1,478 persons). Participants who were self- or non-employed (n=3,959) or missing information on work ability or productivity at work

(n=60) were excluded. This resulted in a final sample of 8,411 persons, of whom 7,322 participated in all three waves.

The Medical Ethical Committee of the VU University Medical Centre (Amsterdam) declared that the Medical Research Involving Human Subjects Act does not apply to the STREAM study and had no objection to the execution of this research. In the information that accompanied the online questionnaire, it was emphasized that privacy would be guaranteed and that all data would be treated confidentially and stored in secured computer systems.

Measures

Outcomes

Work ability was assessed using the first dimension of the Work Ability Index (WAI), in which a worker assesses his/her current work ability as compared to their lifetime best [7]. Answers ranged from 0="not able to work" to 10="work ability at lifetime best." It has been shown that this first WAI item is strongly associated with the overall WAI [19,20].

Productivity at work was assessed with the following item: "How much work have you done in the last 4 weeks compared to normal?" Answer scores ranged from 0="much less than normal" to 5="the same as normal" and 10="much more than normal".

Health problems

The presence of health problems was assessed with the question: "Do you (currently) have one or more of the following chronic diseases, disorders, or handicaps?" [21]. The following seven health problems were referenced: musculoskeletal, severe headache or migraines, circulatory, respiratory, digestive, diabetes mellitus, and psychological. Health problems were not mutually exclusive. Incidence, recovery, and recurrence of health problems were defined over consecutive one-year follow-up periods. Incidence was defined as not having the health problem at one wave and having it the following wave. Recovery was defined as having the health problem at one wave and not having it the following wave. Recurrence was defined as having the health problem at one wave and also the following wave.

Covariates

The following individual factors were included as potential confounders included in the analyses: age, gender, and highest attained educational level. Age was categorized into four 5-year groups. Educational level was categorized into three groups: low (lower general secondary educational, preparatory secondary vocational education), medium (intermediate vocational training, higher general secondary education, pre-university education), and high (higher vocational education, university education).

Four work-related factors were also included in the analyses as potential confounders: (i) physical load was measured with four items (Cronbach's alpha=0.85) [21-23], (ii) psychological job demands were measured with four items (Cronbach's alpha=0.87) [24], (iii) autonomy was measured with four items (Cronbach's alpha=0.77) [24], and support from colleagues/supervisor was measured with five items (Cronbach's alpha=0.80) [25]. Each item had a 5-point continuous answer scale. Mean scores across all items within each work-related factor were calculated for each participant. For more details on these work-related factors please see Ybema et al [18] on the design of the STREAM cohort.

Statistical analyses

Descriptive statistics were used to provide information on participants' age, gender, educational level, work ability, and productivity at work. A non-response analysis was conducted by comparing work ability and productivity scores at baseline of sustained and lost-to-follow up participants. To determine and compare the within- and between-subject variance in work ability and productivity at work, an analyses of variance was conducted. The within-subject variance from this analysis represents how much individuals' work ability and productivity at work scores, on average, varied throughout the three waves. The between-subject variance represents how much variation there was between different individuals. The Pearson-r correlation between work ability and productivity scores at each wave was also calculated.

Generalized estimating equations (GEE) with linear regression analyses were used since GEE takes into account the correlation between the different waves during the study. Three different specifications of the statistical model were used (see Table 1) [14]. The relation between health problems and work ability and productivity at work after one year was first analysed in a time-lag model. In this model, regression coefficients represent the mean differences in work ability and productivity after one year between persons with and without the health problems. Next, an autoregressive model was used that adjusted for work ability and productivity at work the preceding year. The regression coefficients in this case represent the mean differences in one-year change in work ability and productivity at work between persons with and without the health problem. In the third model, the relation between changes in health, i.e., incidence and recovery, with changes in work ability and productivity at work was assessed. The regression coefficients in this model represent the mean differences in one-year change in work ability and productivity at work

between persons with changes in health status and those with stable health status. In these analyses, two separate comparisons were made, namely between incident cases and persons who did not have the health problem at both waves, and between persons with recovery from health problems and those with recurrent or persistent health problems at both waves.

Table 1 Three specifications of a Generalized Estimating Equations (GEE) model in the analysis of the influence of health problems on work ability and productivity at work in a longitudinal study with three annual waves (T1, T2, and T3)

Outcome (Y)	Predictors (X)	Covariates
Model 1: Time-lag $Y_{(t)} = \beta_0 + \beta_1 X_{(t-1)}$		
Work ability (T2)	Health problem (T1)	Other health problems (T1) Work-related factors (T1) Individual factors (T1)
Work ability (T3)	Health problem (T2)	Other health problems (T2) Work-related factors (T2) Individual factors (T1)
Model 2: Autoregressive $Y_{(t)} = \beta_0 + \beta_1 X_{(t-1)} + \beta_2 Y_{(t-1)}$		
Work ability (T2)	Health problem (T1)	Other health problems (T1) Individual factors (T1) Work ability (T1)
Work ability (T3)	Health problem (T2)	Other health problems (T2) Work-related factors (T2) Individual factors (T1) Work ability (T2)
Model 3: Analyses of change $Y_{(t)} = \beta_0 + \beta_1 (X_t - X_{t-1}) + \beta_2 Y_{(t-1)}$		
Work ability (T2)	Incident health problem (T1-T2) Recovered health problem(T1-T2)	Other health problems (T1) Work-related factors (T1) Individual factors (T1) Work ability (T1)
Work ability (T3)	Incident health problem (T2-T3) Recovered health problem(T2-T3)	Other health problems (T2) Work-related factors (T2) Individual factors (T1) Work ability (T2)

Note: The same analyses were done with productivity at work as the outcome.

In the time-lag model, an exchangeable working correlation structure was used, in which correlations between measurements are assumed to be equal regardless of the time interval between them (i.e., one or two waves) [14]. For the other models, independent working correlation structures were used, in which the correlation between measurements is assumed to be zero because in these models the correlation between measurements has already been accounted for by adjusting for work ability and productivity at work the preceding year [14]. All presented results are from multivariate analyses that include each time (i.e., wave), all health problems, and individual and work-related factors. For the incidence recovery model, analyses were stratified on the basis of preva-

lence at the preceding year. Thus separate comparisons were made between those with incidence of health problems relative to those free from these complaints and between those who recovered from health problems relative to those with continued presence of health problems. Unstandardized regression coefficients (B) and their 95% confidence intervals (95% CI) based on the Wald-statistic were reported. In order to better interpret the regression coefficients with regard to the work ability and productivity at work, these were also expressed in percent of difference (time-lag model) and change (other models) relative to the overall mean work ability and productivity at work in the study population. All analyses were done with SPSS version 20.0 (IBM Corp, Armonk, NY, USA).

RESULTS

Sample characteristics and time trends

Slightly more men than women were included in this study, mainly in the age groups <60 years, and the majority had a medium or high educational background (see Table 2). Employees lost to follow-up after T1 did not statistically significantly differ in work ability (mean difference 0.02, 95% CI -0.06-0.10) or productivity at work (mean difference -0.05, 95% CI -0.14-0.04) from those employees not lost to follow-up.

At all three waves, musculoskeletal problems were the most prevalent and psychological health problems the least (see Table 3). The proportion of recurrent cases with regard to prevalent cases the preceding year ranged from 48.3% for psychological health problems to 95% for diabetes mellitus. Recovery ranged from 5% for diabetes mellitus to 51.7% for psychological health problems. The highest incidence was seen for musculoskeletal problems (14.7%). The proportion of prevalent, incident, recovered, and recurrent cases of chronic health problems was stable throughout the waves.

At baseline, the three most prevalent combinations of health problems were musculoskeletal health problems with severe headache or migraines (n=335, 4.0% of the total sample), musculoskeletal and respiratory health problems (n=269, 3.2% of the total sample), and musculoskeletal and digestive health problems (n=262, 3.1% of the total sample).

The average work ability and productivity at work remained very stable throughout the study period (see Table 4). Individual variation was greater in productivity at work than work ability during the study period. Work ability scores throughout the three waves had a stronger correlation (Pearson's r range 0.37-0.44) than productivity at work scores (Pearson's r range: 0.21-0.27). Work ability and productivity at work were positively correlated (Pearson's $r=0.23$, $p<0.01$).

Table 2 Individual characteristics, work-related factors, work ability, and productivity at work among older Dutch employees at baseline in the longitudinal study with two years follow-up (n=8,411)

		T1 (2010)						
						Percentiles		
		%	n	Mean	SD	25th	50th	75th
Gender (Female)		44.0	3,703					
Age				53.57	5.17			
	45-49	26.7	2,249					
	50-54	27.9	2,345					
	55-59	30.2	2,536					
	60-64	15.2	1,281					
Education	Low	26.3	2,214					
	Medium	39.4	3,313					
	High	34.3	2,884					
Work Ability (range 0-10)				7.96	1.50	7	8	9
Productivity (range 0-10)				5.77	1.80	5	5	7
Work-related factors (range 1-5)								
Physical load				1.79	0.88	1.00	1.40	2.40
Psychological job demands				3.14	0.77	2.75	3.25	3.75
Autonomy				3.84	0.70	3.40	4.00	4.20
Support				3.59	0.76	3.00	3.75	4.00

Note: For the work-related factors the following sample sizes are reported on due to missing baseline information: physical load (n=8,391), psychological job demands (n=8,380), autonomy (n=8,400), and support (n=8,409). SD=standard deviation.

Table 3 Prevalence, recovery, incidence, and recurrence of self-reported health problems among older Dutch employees in a longitudinal study with a two-year follow-up period with complete information at each annual wave (n=7,322)

	Musculoskeletal		Severe headache or migraine		Circulatory		Respiratory		Digestive		Diabetes mellitus		Psychological	
	%	n	%	n	%	n	%	n	%	n	%	n	%	n
T1 (2010)														
Prevalence	31.5	2,309	8.3	605	9.2	675	7.3	532	6.0	438	6.4	466	3.6	265
T2 (2011)														
Recovery	28.5	659	37.2	225	32.3	218	22.9	122	44.5	195	9.3	43	49.1	130
Incidence	14.7	738	2.6	172	3.5	230	1.7	115	2.6	178	0.9	59	1.9	134
Recurrence	71.4	1,650	58.5	380	67.7	457	77.1	410	55.5	243	90.8	423	50.9	135
Prevalence	32.6	2,388	7.5	552	9.4	687	7.2	525	5.7	421	6.6	482	3.7	269
T3 (2012)														
Recovery	26.5	631	34.4	190	26.7	184	21.7	114	41.8	176	5.0	24	51.7	139
Incidence	14.2	701	2.7	187	3.2	210	1.9	129	3.3	227	1.2	83	1.7	119
Recurrence	73.6	1,757	65.6	362	73.2	503	78.3	411	58.2	245	95.0	458	48.3	130
Prevalence	33.6	2,458	7.5	549	9.7	713	7.4	540	6.4	472	7.4	541	3.4	249

Table 4 The three-year mean and variance of work ability and productivity at work of older employees (n=8,411)

	T1 (2010)		T2 (2011)		T3 (2012)		Variance	
	Mean	SD	Mean	SD	Mean	SD	Within-subject	Between-subject
Work ability	7.96	1.50	7.92	1.49	7.86	1.59	37.3%	61.7%
Productivity at work	5.77	1.80	5.74	1.79	5.67	1.82	49.4%	50.6%

Note: Sample includes respondents at T1, T2, and T3 (n=7,322) and T1 and T2 (n=1,089). SD=standard deviation.

At baseline, younger persons and those with a higher education had a higher work ability and productivity at work than older persons and those with a lower education, respectively. No differences were found between baseline work ability and productivity at work for men and women. Concerning the work-related factors, lower physical load, higher autonomy, and higher social support were related to higher work ability scores. Higher psychological job demands and higher autonomy were related to higher productivity at work (Appendix, Table A).

Health and work ability

All health problems were related to lower work ability at one-year follow-up (Table 5). Workers with psychological health problems had a 0.75 (95% CI 0.57-0.92) point lower work ability than workers without psychological health problems, reflecting a difference of 9.5% in mean work ability. For the other health problems, work ability was 0.16-0.35 points lower, reflecting a difference of 2.0-4.4% in mean work ability. When health problems were present, work ability decreased more during the one-year follow-up than when health problems were not present. For example, work ability decreased from 0.10 points among workers with circulatory problems to 0.44 points among workers with psychological health problems (i.e., 1.2-5.1%). The effect estimates in the autoregressive model were consistently smaller than in the time-lag model, varying from a reduction in effect estimates of 18% with diabetes mellitus to 52% with circulatory health problems. For incidence of health problems, one-year decreases in work ability differed from 0.08 points for diabetes mellitus (1.0%) to 1.48 points for psychological health problems (18.7%) compared to persons remaining without those health problems. For recovery from health problems, the changes in work ability ranged from a 0.14 point decrease for severe headache or migraines (1.8%) to a 0.66 point increase for psychological health problems (8.2%) compared to persons with those health problems two years in a row. In general, the relation of incidence with decreases in work ability was much stronger than that of recovery with increases in work ability.

Table 5 Longitudinal analyses using linear regression generalized estimating equations (GEE) of the relation between health problems with work ability and productivity in a sample of older employees (n=8,401)

			Work ability		Productivity at work	
			B	95% CI	B	95% CI
Health problem		Model				
Musculoskeletal	1	Time-lag	-0.33	-0.38 - -0.27**	-0.07	-0.14 - -0.01*
	2	Autoregressive	-0.24	-0.29 - -0.19**	-0.06	-0.13 - 0.00*
	3	Incidence	-0.28	-0.36 - -0.20**	-0.07	-0.17 - 0.03
		Recovery	0.09	-0.01 - 0.19	-0.11	-0.23 - 0.00
Severe headache or migraines	1	Time-lag	-0.22	-0.33 - -0.12**	-0.10	-0.22 - 0.02
	2	Autoregressive	-0.13	-0.22 - -0.05**	-0.09	-0.20 - 0.02
	3	Incidence	-0.26	-0.43 - -0.09**	-0.02	-0.21 - 0.17
		Recovery	-0.14	-0.33 - 0.05	-0.11	-0.35 - 0.14
Circulatory	1	Time-lag	-0.21	-0.30 - -0.12**	-0.06	-0.16 - 0.04
	2	Autoregressive	-0.10	-0.18 - -0.02*	-0.04	-0.13 - 0.06
	3	Incidence	-0.30	-0.44 - -0.15**	-0.21	-0.39 - -0.02*
		Recovery	0.03	-0.15 - 0.20	-0.25	-0.45 - -0.05*
Respiratory	1	Time-lag	-0.30	-0.42 - -0.18**	-0.07	-0.20 - 0.06
	2	Autoregressive	-0.20	-0.30 - -0.10**	-0.07	-0.19 - 0.05
	3	Incidence	-0.21	-0.37 - -0.05*	-0.09	-0.34 - 0.15
		Recovery	0.03	-0.21 - 0.27	0.02	-0.26 - 0.29
Digestive	1	Time-lag	-0.30	-0.43 - -0.18**	-0.03	-0.17 - 0.11
	2	Autoregressive	-0.24	-0.35 - -0.12**	-0.03	-0.16 - 0.11
	3	Incidence	-0.41	-0.59 - -0.24**	-0.17	-0.36 - 0.02
		Recovery	-0.01	-0.23 - 0.21	0.16	-0.11 - 0.42
Diabetes mellitus	1	Time-lag	-0.16	-0.28 - -0.04*	-0.05	-0.17 - 0.08
	2	Autoregressive	-0.13	-0.22 - -0.03*	-0.05	-0.16 - 0.06
	3	Incidence	-0.08	-0.38 - 0.22	-0.07	-0.37 - 0.24
		Recovery	0.21	-0.20 - 0.61	-0.02	-0.41 - 0.37
Psychological	1	Time-lag	-0.75	-0.92 - -0.57**	-0.33	-0.51 - -0.14**
	2	Autoregressive	-0.44	-0.61 - -0.30**	-0.24	-0.41 - -0.06**
	3	Incidence	-1.48	-1.78 - -1.18**	-0.92	-1.22 - -0.62**
		Recovery	0.65	0.37 - 0.93**	-0.07	-0.42 - 0.28

Note: Multivariate analyses including: all health problems, wave, age, gender, education, and work-related factors (i.e., physical load, psychological job demands, autonomy, support). Sample includes respondents at T1, T2, and T3 (n=7,322), respondents at T1 and T2 (n=1,089) and excludes persons with missing information on work-related factors (n=10). B=Unstandardized regression coefficient. **p<0.01; *p<0.05.

Health and productivity at work

Some chronic health problems were related to lower productivity at work at one-year follow-up, with the largest difference of 0.33 points (5.7%) for psychological health problems (Table 5). Only slight differences in one-year decreases in productivity at work were found between persons with and without health problems. Effect estimates were much smaller in the autoregressive model than in the time-lag model, as was seen for work ability.

For incidence of health problems, one-year decreases in productivity at work ranged from 0.02 points with severe headache or migraines (0.3%) to 0.92 points with psychological health problems (16.1%). For recovery from health problems, the changes in productivity at work ranged from a 0.25 point decrease with circulatory (4.4%) to 0.16 increase with digestive (2.8%) health problems. As with work ability, incidence was more strongly related than recovery to productivity at work.

DISCUSSION

Workers with chronic health problems had lower work ability at one-year follow-up. The greatest differences in work ability were found between persons with and without psychological health problems (9.4%) and musculoskeletal problems (4.2%) and the smallest differences between persons with and without circulatory health problems (2.7%) and diabetes mellitus (2.0%). The largest effects were observed for the influence of incident psychological health problems on work ability with an 18.7% decrease during one-year follow-up. The smallest observed effects were of the presence of a health problem on changes in work ability during one-year follow-up, with a maximum difference of decrease in work ability of 5.6% between persons with and without psychological health problems. For productivity at work, associations were much smaller and only workers with musculoskeletal problems (1.2%) and psychological health problems (5.8%) had statistically significantly lower productivity at work at one-year follow-up compared to persons without these health problems. The magnitude of the influence of health problems on both work ability and productivity at work was comparable to a 15 year increase in age (i.e., from the 45-49 age group to the 60-64 year age group), but substantially greater than that of gender and the incorporated work-related factors.

In accordance with the findings from the current study, a recent study found that psychological health problems influenced work performance more than other chronic health problems [26]. Another study that compared and examined similar health problems showed that psychological health problems had the strongest effects on work productivity and sickness absence as compared to other health problems [8]. The strong effects of psychological health problems on work ability and productivity at work could

potentially be explained by clear presence of symptoms and complaints, whereas, for example, circulatory health problems may be diagnosed by a physician but be unaccompanied by perceivable symptoms. It would be interesting in future research to have more extensive health information in order to compare multiple self-report measures as well as general practitioner, hospital, and pharmacy registry data.

Co- or multi-morbidity may be present among participants, the highest comorbidity in the current study was seen for persons with musculoskeletal health problems. All health problems were included simultaneously for the multivariate results. The findings from univariate analyses, in which only one health problem was incorporated, were very similar to the multivariate analyses (results not shown). In extra analyses, the potentially synergistic effects of mental and physical health problems were explored by assessing the joint effects of psychological problems with other health problems (i.e., musculoskeletal, severe headache or migraines, circulatory, respiratory, digestive, and diabetes) on work ability and productivity at work in the time-lag model. We found no indications for such synergistic effects.

In this study, health problems were more strongly related to work ability than productivity at work. It is possible that health is more inherent to work ability because work ability takes an individual's work demands and resources into account - good health is in itself a resource [7]. Past studies have shown that poor health is a strong predictor of reduced work ability [2], but also that health problems relate to productivity loss at work [8,27]. Our findings differ from these latter studies in that only two of the seven health problems were related to productivity at work. This could be because the productivity at work measure used in this study was not specifically health-related productivity loss, i.e., presenteeism. Productivity is an output that can be influenced both by the individual him- or herself as well as by tangible devices (e.g., computers) or social factors (e.g., cooperative and productive colleagues) that are necessary for an individual to conduct his/her work productively [27]. This supports the notion to study similarities and differences between general productivity loss at work and presenteeism.

The extent of comparability between the work ability and productivity at work scales should also be considered. Less variance was observed in work ability than productivity at work, as was reflected in the standard deviation. Work ability fluctuated less over the three waves than productivity at work, as could be seen in the lower percentage of within- versus between-subject variance. The differences in variation and fluctuation could be related to the recall period (i.e., four weeks for productivity at work and now for work ability) and end- and mid-points of the work ability and productivity at work scales. It is likely that the effects of health on productivity found were smaller because the changes in productivity could be both better or worse than normal, whereas work ability could only be as good as the lifetime best or worse. Furthermore, the subjective perceived reference point of normal may have already shifted in light of health prob-

lems, whereas lifetime best may be a more set reference point. Finally, it might also be that random measurement error is higher for productivity at work than work ability. It is thus important to consider the construction of the productivity at work and work ability scales.

The observed findings differed between the three methodological approaches in this study. Effect estimates were almost halved between the time-lag and autoregressive models. Effect estimates in the autoregressive model reflect differences in changes in mean scores between groups with and without a chronic health problem, whereas effect estimates in the time-lag model represent absolute differences in mean scores between these groups. Thus the time-lag model pertains to between-subject differences and the autoregressive model in essence pertains to within-subject differences. The results from the current study indicate that the presence of a health problem does not relate as strongly to changes in work ability and productivity at work, but rather lower work ability and productivity at work. It is thus possible that the health problem initially caused a decrease in work ability and productivity at work, but that the workers have learned to cope with their problems and only experience small changes during the follow-up period.

In the incidence-recovery model, we observed that changes in health problems coincided with one-year changes in work ability in the same year. This may suggest that the influence of a chronic health problem on work ability is a short-term effect rather than a gradual process. However, the negative effects of incident health problems were consistently larger than positive effects of recovery of these health problems, which also points towards long-term effects of chronic health problems. For some health (i.e., circulatory) problems, recovery in a given year was even associated with a further decrease in work ability. This has also been found in two recent studies. Namely, Lallukka and colleagues assessed the influence of economic difficulties on self-rated health and found that a reduction in economic difficulties still related to poorer physical health during the 4-7 years of follow-up [17]. Furthermore, De Raeve and colleagues assessed the relation between one-year changes in work schedules, working hours, and working overtime with one-year changes in self-reported health outcomes such as fatigue and psychological distress, and found that the presumed positive changes in working conditions were occasionally also related to worsening health [28]. It is possible that it takes longer than one year to reverse the effects of a health problem. It is also possible that having ever had the chronic health problem has long-term effects on work ability and productivity at work.

The preferred choice between methodological approaches in a longitudinal study should depend on the hypothesized nature of the association between the determinant and outcome. When the outcome under study is an irreversible first event, e.g., stroke, heart attack, or death, reversed causality is not a concern. In the current study,

however, we cannot be sure that the change in work ability and productivity at work occurred after the change in health during the follow-up period, nor can we be sure how much time elapsed between the two changes. In a sensitivity analysis, incidence of health problems was also related to changes in work ability one-year later, essentially introducing a time-lag of one year. The statistically significant ($p<0.01$) effect estimates in this adjusted incidence-recovery model were smaller (range 10-39%) than those in the original model. This suggests that the effects of changes in health problems on work ability are most likely to occur in a shorter period of time, i.e., within the same year, where after it is possible that adjustments are made. This is supported by findings from a qualitative study in a comparable study population, which showed that many adjustments were made in order to allow employees to cope with their health problems at work and restore a balance in their demands and resources [27].

Strengths of this study include its longitudinal design, relatively low drop-out, large sample size and high power, which allowed for various methodological approaches to be compared. GEE analyses were used in the current study, which provide population-averaged regression coefficients and take the correlation between repeated waves into account [14]. Furthermore, such GEE analyses seem to be robust against the wrong choice of a working correlation structure [14]. In addition to an exchangeable correlation structure, we also tested the time-lag model with an unstructured correlation structure and found no differences in observed effect estimates. The model with the exchangeable correlation structure was chosen because in this model less parameters need to be estimated. A potential limitation of GEE analyses versus individual-based repeated measurement analyses, such as random coefficients or multilevel analyses, is the assumption that values are missing completely at random. It is, however, unlikely that this was problematic in the current study because of the large sample size and because the outcome variables were on continuous scales [29].

Continuous scales of the work ability and productivity at work measures were used in the current study. We chose not to dichotomize the outcome variables because there are no standard cut-off values available for these scales, and thus categorization on a certain level may be arbitrary and can lead to a loss of information. However, in order to ensure the robustness of our findings, we ran exploratory logistic regression GEE analyses in which we compared participants with the lowest tertiles to those in the higher two tertiles of the outcomes (Appendix, Table B). The results from these analyses confirm our conclusions that (i) stronger effects were seen for health problems relating to work ability than productivity at work, (ii) incidence of health problems predicted the greatest loss of work ability and productivity during follow-up, and (iii) psychological health problems showed the largest effects.

The annual questionnaire provided only point prevalence information on common chronic health problems. Thus, the episodic character of some of the health problems

within the follow-up year could not be assessed. In order to explore the influence of long- and short-term changes in health problems on work-related outcomes, it is advisable to gather repeated information over timeframes shorter than one year. Furthermore, in this study different specific health problems were clustered due to the nature of the online questionnaire and in order to focus on main groups, for example for musculoskeletal complaints the body region affected was not distinguished.

In conclusion, this study provides novel insights into the relations between chronic health problems and work ability and productivity at work. The strength of the associations found between health and work ability and productivity at work differed substantially per methodological approach for analysing longitudinal studies. The strongest associations were observed when changes in chronic health problems were related to changes in work ability and productivity at work during the same year of observation. The results support several past findings that especially psychological health problems have adverse effects on work ability and productivity at work and thus should be seen as an important risk factor for inhibiting sustainable employability and, hence, a key focus of (workplace) health interventions.

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APPENDIX

Table A Longitudinal analyses using linear regression Generalized Estimating Equations (GEE) of the relation between individual and work-related factors with work ability and productivity in a sample of older employees (n=8,401)

		Model		Work ability		Productivity at work	
				B	95% CI	B	95% CI
Individual factors							
Age	45-49	1	Time-lag	0.20	0.11 - 0.29**	0.25	0.15 - 0.35**
	50-54			0.06	-0.03 - 0.15	0.18	0.08 - 0.28**
	55-59			0.03	-0.06 - 0.12	0.05	-0.05 - 0.14
Gender (male)		1	Time-lag	0.01	-0.05 - 0.07	-0.01	-0.07 - 0.05
Ed.	Low	1	Time-lag	-0.14	-0.22 - -0.07**	-0.19	-0.28 - 0.10**
	Mid			-0.01	-0.07 - 0.05	-0.05	-0.12 - 0.02
Work-related factors							
Physical load		1	Time-lag	-0.09	-0.12 - -0.05**	-0.04	-0.07 - 0.00
Job demands		1	Time-lag	0.00	-0.04 - 0.03	0.37	0.32 - 0.41**
Autonomy		1	Time-lag	0.14	0.10 - 0.18**	0.11	0.07 - 0.15**
Support		1	Time-lag	0.11	0.08 - 0.15**	-0.03	-0.07 - 0.01

Note: Multivariate analyses including: health problems, wave, age, gender, education, and work-related factors (i.e., physical load, psychological job demands, autonomy, support). Sample includes respondents at T1, T2, and T3 (n=7,322), respondents at T1 and T2 (n=1,089) and excludes persons with missing information on work-related factors (n=10). B=Unstandardized regression coefficient; Ed.=Educational level.
**p<0.01; *p<0.05.

Table B Longitudinal analyses using logistic regression Generalized Estimating Equations (GEE) of the relation between health problems with work ability and productivity in a sample of older employees (n=8,401)

				Work ability <8 (33%) vs. ≥8 (66%)		Productivity at work <5 (33%) vs. ≥5 (66%)	
			Model	OR	95% CI	OR	95% CI
Individual factors							
Age	45-49	1	Time-lag	0.80	0.69 - 0.91**	0.93	0.76 - 1.13
	50-54			0.94	0.83 - 1.07	0.93	0.77 - 1.13
	55-59			1.02	0.89 - 1.15	0.86	0.71 - 1.05
Gender (male)		1	Time-lag	0.99	0.91 - 1.08	0.98	0.86 - 1.11
Ed.	Low	1	Time-lag	1.20	1.08 - 1.34**	1.05	0.89 - 1.24
	Mid			1.01	0.91 - 1.12	0.90	0.78 - 1.05
Health problem							
Musculoskeletal		1	Time-lag	1.59	1.47 - 1.73**	1.44	1.27 - 1.63**
		2	Autoregressive	1.49	1.37 - 1.61**	1.43	1.26 - 1.61**
		3	Incidence	1.53	1.43 - 1.75**	1.64	1.35 - 1.98**
			Recovery	0.77	0.66 - 0.89**	1.17	0.96 - 1.44
Severe headache or migraines		1	Time-lag	1.29	1.13 - 1.48**	1.17	0.96 - 1.43
		2	Autoregressive	1.21	1.06 - 1.38**	1.17	0.97 - 1.43
		3	Incidence	1.55	1.22 - 1.97**	1.15	0.82 - 1.62
			Recovery	1.08	0.82 - 1.43	1.32	0.90 - 1.94
Circulatory		1	Time-lag	1.38	1.22 - 1.57**	1.18	0.97 - 1.44
		2	Autoregressive	1.26	1.12 - 1.43**	1.15	0.95 - 1.39
		3	Incidence	1.53	1.23 - 1.90**	1.72	1.30 - 2.28**
			Recovery	0.82	0.63 - 1.07	1.27	0.85 - 1.89
Respiratory		1	Time-lag	1.35	1.17 - 1.56**	1.47	1.20 - 1.81**
		2	Autoregressive	1.25	1.09 - 1.44**	1.41	1.16 - 1.72**
		3	Incidence	1.54	1.16 - 2.04**	1.44	0.98 - 2.11
			Recovery	0.89	0.64 - 1.22	1.08	0.70 - 1.68
Digestive		1	Time-lag	1.44	1.23 - 1.68**	1.44	1.16 - 1.79**
		2	Autoregressive	1.38	1.19 - 1.61**	1.40	1.13 - 1.73**
		3	Incidence	1.81	1.44 - 2.27**	1.49	1.12 - 2.00**
			Recovery	0.94	0.69 - 1.28	1.09	0.71 - 1.67
Diabetes mellitus		1	Time-lag	1.16	0.99 - 1.36	1.03	0.81 - 1.31
		2	Autoregressive	1.14	0.98 - 1.32	1.04	0.83 - 1.30**
		3	Incidence	0.93	0.63 - 1.40	1.29	0.77 - 2.15
			Recovery	0.81	0.47 - 1.42	0.64	0.21 - 1.91
Psychological		1	Time-lag	2.70	2.25 - 3.24**	2.10	1.64 - 2.68**
		2	Autoregressive	2.23	1.85 - 2.68**	1.90	1.51 - 2.40**
		3	Incidence	4.30	3.21 - 5.75**	3.79	2.82 - 5.08**
			Recovery	0.49	0.35 - 0.70**	0.96	0.60 - 1.55

Table B Longitudinal analyses using logistic regression Generalized Estimating Equations (GEE) of the relation between health problems with work ability and productivity in a sample of older employees (n=8,401) (continued)

			Work ability <8 (33%) vs. ≥8 (66%)		Productivity at work <5 (33%) vs. ≥5 (66%)	
		Model	OR	95% CI	OR	95% CI
Work-related factors						
Physical load	1	Time-lag	1.14	1.09 - 1.20**	0.98	0.91 - 1.06
Job demands	1	Time-lag	0.98	0.93 - 1.03	0.90	0.83 - 0.97**
Autonomy	1	Time-lag	0.79	0.75 - 0.84**	0.99	0.91 - 1.08
Support	1	Time-lag	0.84	0.80 - 0.88**	0.87	0.81 - 0.94**

Note: Multivariate analyses including: health problems, wave, age, gender, education, and work-related factors (i.e., physical load, psychological job demands, autonomy, support). Sample includes respondents at T1, T2, and T3 (n=7,322), respondents at T1 and T2 (n=1,089) and excludes persons with missing information on work-related factors (n=10). Correlation structures: Model 1=exchangeable, Models 2 & 3=independent. OR=odds ratio; Ed.=Educational level. **p<0.01; *p<0.05.

CHAPTER 05

HOW DO OLDER EMPLOYEES WITH HEALTH PROBLEMS REMAIN PRODUCTIVE AT WORK?: A QUALITATIVE STUDY

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ABSTRACT

Purpose

The goal of this qualitative study was to gain insight into how older employees remain productive at work in spite of health problems.

Methods

Twenty-six semi-structured telephone interviews were conducted with older employees, 46-63 years of age, who reported a poor health in the Study on Transitions in Employment, Ability, and Motivation. Demographic, health, and work information was gathered, followed by information on adjustments made in response to health problems. Inductive and deductive analyses were done independently by two researchers.

Results

Four pathways through which poor health could influence productivity were identified: (1) poor health did not influence productivity; (2) poor health created a temporary imbalance in demands and external and internal resources after which adjustments were made and productivity was maintained; (3) adjustments were made in response to an imbalance, but productivity remained reduced; and (4) no adjustments were made and productivity was reduced. Whether and which adjustments occurred was influenced by factors in various domains, such as: visibility of the problem (health), autonomy (work-related), support (relational), and the ability to ask for help (personal). Sustainable productivity was influenced by internal factors that enhanced or hindered the creation of a balance, and by whether appropriate adjustments were made.

Conclusions

The influence that health can have on productivity depends on the individuals' unique imbalance and personal disposition. Helpful a priori work place characteristics and personal well-being should be promoted so that a balance between demands and resources can be found in times of poor health.

INTRODUCTION

In a society confronted with an ageing population and a debate on increasing retirement ages due to financial and economic necessity, research into labour force participation is imperative [1]. Poor health has been identified as a major determinant of exit from the workforce [2,3]. Because periods of poor health are likely among older employees an important question arises: how can a successful and productive work life be maintained in spite of periods of poor health?

Previous findings demonstrate that poor health does not only influence exit from paid employment, but also productivity loss—which in turn can impact exit decisions [4,5]. Emotional well-being, coping and acceptance of the illness are internal factors that can stimulate the maintenance of productivity [4,6]. External factors of influence on productivity include autonomy, flexibility, and support from colleagues [4,7,8]. These internal and external factors have also been found to influence work ability [9], job performance [10], and staying at work [11].

It is anticipated that adjustments in response to health problems can maintain work productivity, through balancing an individual's internal and external resources with their demands. The Job Demands-Resource Model (JDR Model) suggests that resources such as autonomy and social support in combination with demands influence performance outcomes, such as productivity [12]. Past research has found that personal adjustments as well as adjustment latitude at work (e.g., autonomy and flexibility) are important for staying at work [11] and work ability and productivity [8]. According to the JDR model, such adjustments could be made to ensure that resources and demands are in balance. Further, Social Cognitive Theory, a well-known health behaviour model that relates cognitive personal factors, environment at work and at home, and individual behaviour in a triangular reciprocal relationship to organizational outcomes, expands upon the JDR Model and can be applied here [13]. Based on findings from past research, the JDR Model, and SCT, adjustments that could influence an individual's demands and resources and thus productivity, can be grouped into work-related, personal, and relational domains.

Adjustments to health problems do not arise at random; instead they form a process between and within people and circumstances and might depend on the individual's characteristics, the nature of his or her work, and relationships with others. Whereas most past research has approached the topic as a static matter by merely identifying influential factors for a reduced work performance [4,14], we wanted to shed light on the dynamic process by which such factors interact with each other and with work performance and thus used qualitative methods. The aims of the current study were to (1) gain insight into the process by which health influences productivity, (2) identify work-

related, relational, and personal adjustments made in response to health problems, and (3) to understand how adjustments are triggered.

METHODS

A qualitative study with semi-structured telephone interviews was conducted. The consolidated criteria for reporting qualitative research checklist (COREQ) was used as a guideline [15]. The Free University of Amsterdam Medical Ethics Committee declared that the Medical Research Involving Human Subjects Acts does not apply to the Study on Transitions in Employment, Ability, and Motivation (STREAM). The Medical Ethical Committee has no objection to the execution of the STREAM research. The current study falls within the STREAM study, participants volunteered to be contacted for a future interview study and provided their name and telephone numbers. Informed consent for the use of the interviews for the writing of publications was granted at the start of each interview and recorded. This was in accordance with the requirement for non-identifiable data collection in the Dutch Code of Conduct for Observational Research (www.federa.org).

Participant selection

Interview participants were collected from STREAM, which is a 4 year (2010-2013) longitudinal study among Dutch citizens aged 45-64 with the goal of identifying under which circumstances work life can be prolonged in good health and in good productivity [16]. Participants were eligible for the interview study if they had given permission to be contacted in the STREAM 2011 questionnaire, were employed at the time of the interview, and had poor perceived health. This selection ensured that individuals who had experienced health problems that could potentially have influenced their work were sampled. Perceived health was operationalized using the first item of the Short-Form Health Survey (SF-12): "In general, would you say your health is…," with answer options ranging from poor (1) to excellent (5)—those with scores of poor (1) or moderate (2) in both the STREAM 2010 and 2011 assessments were eligible to participate [17].

Two strongly contrasting groups of interviewees were created by purposefully sampling on sex and both productivity and work ability within the group that met the initial selection criteria. Productivity was operationalized with the following item: "How much work have you done in the last 4 weeks compared to normal?," rated on a scale ranging from less than normal (1) to more than normal (11) (low = 1-5, high = 7-11). Work ability was measured using the first item from the Work Ability Index, asking individuals to compare their current work ability to their lifetime best with a possible answer of completely unable to work (0) to work ability at life time best (10) (low = 0-5, high 8-10); this

item has been found to represent overall work ability well [18,19]. Sixteen individuals, 8 males and 8 females, with a high productivity and good work ability and 10 individuals, 5 males and 5 females, with a low productivity and low work ability in the STREAM 2011 measurement were interviewed.

Interview procedure

Interviewing and recruitment was done via telephone by the first author (FL), a female PhD student, from January to March of 2012. The interviewer conducted three pilot interviews to practice and make adjustments to the protocol. She knew none of the participants personally.

During interviews, a recording device was used so that transcription could occur later and extra notes were made during the interviews. The interviews consisted of: introduction, demographics, work, health, the influence of health on work, adjustments, and conclusion sections. The interviewer introduced herself and the goal of the research and asked demographic-related questions. Most of this information was already known on the basis of the STREAM 2011 questionnaire, but was asked again in order to establish rapport. Information about the individual's work life was gathered so that work-related demands and resources, and any changes herein, could be understood. The JDR model was used when creating these questions. In the health section, the open question "Have you experienced any (periods of) poor health within the last few years?" was posed, followed by questions based on the WHO International Classification of Functioning, Disability, and Health (ICF) [20]. Through these questions an understanding of the scope, severity, and influence of the health problem(s) on the individual's life could be understood and relevant questions about possible adjustments were asked.

The interviewer asked whether and what influence health had on work productivity, explained to the participants as being the quality and quantity of work conducted, as opposed to prior to the existence of the health problem. Questions about possible adjustments that had occurred in response to health problems were divided into work-related, personal, and relational domains for the convenience of ordering the interview and based on the hypothesized adjustments that could have occurred (based on the JDR and SCT models and past findings such as by Alavinia et al. 2009 and Staw et al. 1994) [4,6]. Through follow-up questions insight was gained into when, why, and by whom adjustments had been made and if productivity had been influenced by these. See example interview questions in Table 1.

Table 1 Example interview questions

Domain	Construct	Theory
Work-Related		SCT: External Environment
"What kind of work do you do? Is your job stressful?"	Tasks, Stress	JDR: Job Demands, Strain
"Do you have freedom at work to go your own way?"	Autonomy	JDR: Job Resources
"Did any concrete changes (e.g., work times, tasks, and flexibility) take place at work in response to health problems?"	Tasks, Flexibility	JDR: Job Demands, Job Resources
Personal		SCT: Personal & Cognitive
"How important is your work to you?"		JDR: Motivation
"Did you ever consider reducing how much you work in light of the health problems?"		
Relational (private & work)		SCT: External Environment
"Who played an important role, in your private or work life, in this process?"	Support	JDR: Job Resources

Note: SCT= Social Cognitive Theory, JDR= Job Demands-Resource Model.

Analyses

To control for the quality of the information gathered, a step-method was used. Primarily five, then ten, and then eleven interviews were conducted (phases=3, n=26). Analyses were done using a mixture of deductive and inductive techniques and occurred in the same phase of research as interviewing. This process allowed us to use a method of data saturation: after the first two phases of interviewing, the researchers decided that conducting one more round would provide sufficient information for the remaining analyses.

After each phase, recordings were transcribed by either the first author (n=22) or an intern (n=4). Hereafter each interview was open coded by both analysts independently (n=26). In open coding, statements that seemed relevant for the research questions were given a code name. Codes could be novel or could stem from the JDR or SCT theories (e.g., autonomy, relationships). A list of the codes made after the first phase (n=5) was used when analysing the remaining interviews—additions were made where necessary. After coding, a "profile" was made for each participant with demographic, work, health information, and codes including their descriptions, quotes, context, and relevance (n=26). Health problems were categorized using the WHO 2010 International Classification of Diseases (ICD) [21] and occupation was categorized using the International Standard Classification of Occupations (ISCO) [22].

Alongside profiles, short summaries were written for all participants (n=26). Based on this information, timelines were made for the first twenty interviews, which explained how health had (not) influenced productivity. In analyses, productivity was defined on the basis of whether a balance in demands and resources was found and by how an

individual's productivity was during the hours at work. The summaries and timelines were discussed by analysts (FL, interns). This led to the creation of initial results in the form of a pathway model on the influence of health on productivity (FL, SR). For the remaining six interviews, timelines were made and compared to the pathway model, which was adjusted accordingly by two analysts (FL, SR).

RESULTS

Participant information

In total, eighty individuals were called, of which 39 could not be reached. Of the 41 individuals spoken to, 26 participated and 15 did not participate. Non-participation was due to: being on long-term sick leave (n=10), being too busy (n=2), unavailable at the scheduled appointment time (n=2), and uninterested (n=1). Interviews had a mean duration of 37 minutes (min=20, max=49). Thirteen females and 13 males participated, with a mean age of 53 (min=46, max=63).

The five most reported health conditions, according to the ICD, were: diseases of the musculoskeletal system and connective tissue (n=15), endocrine, nutritional and metabolic disorders (n=9), diseases of the respiratory system (n=6), diseases of the circulatory system (n = 6), mental and behavioural disorders (n=5), and other (n=9) [21]. Sixteen individuals had multiple health problems.

Based on information from the questionnaire we found that fourteen participants conducted solely mentally demanding work, two solely physically demanding work, and nine both physically and mentally demanding work. Participant occupation, according to the ISCO, was as follows: Manager (n=1), Professionals (n=6), Technician and Associate Professionals (n=2), Clerical Support Workers (n=9), Craft and Related Trade Workers (n=4), Service and Sales Workers (n=3), and Plant and Machine Operator, Assembler (n=1) [22].

Process: (How) does health influence productivity

A pathway model of how health influences work productivity was created. In Figure 1 the pathways are schematically shown. The process begins with poor health, after which an imbalance may or may not occur (yes/no). Hereafter the pathways are distinguished by whether an adjustment occurs (yes/no), and whether a balance is then found (yes/no). Figure 2 provides specific examples of adjustments (box b), influential factors for adjustments (box a), and barriers and facilitators of productivity maintenance (box c). The moment in the process when these different factors (boxes a-c) play a role is also shown in Figure 1.

Figure 1 Theoretical pathway model: how poor health influences productivity

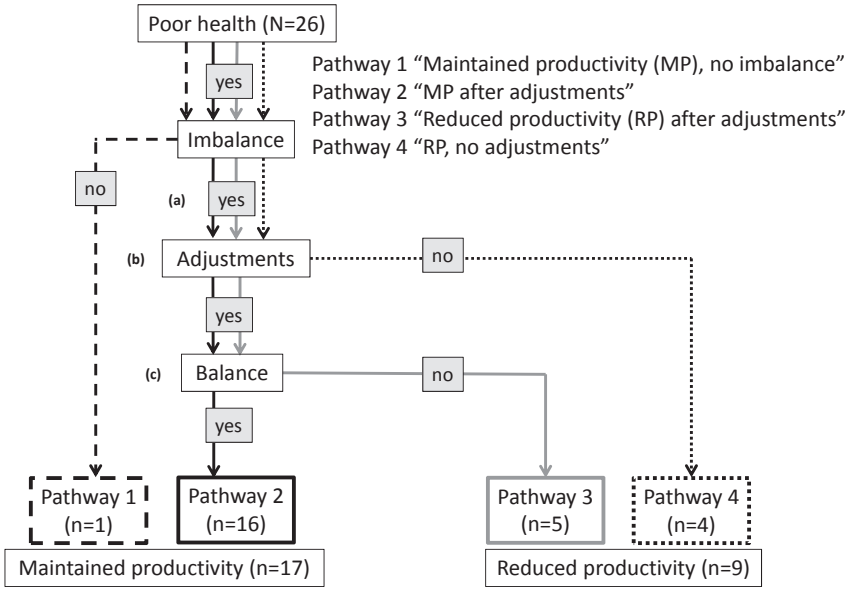
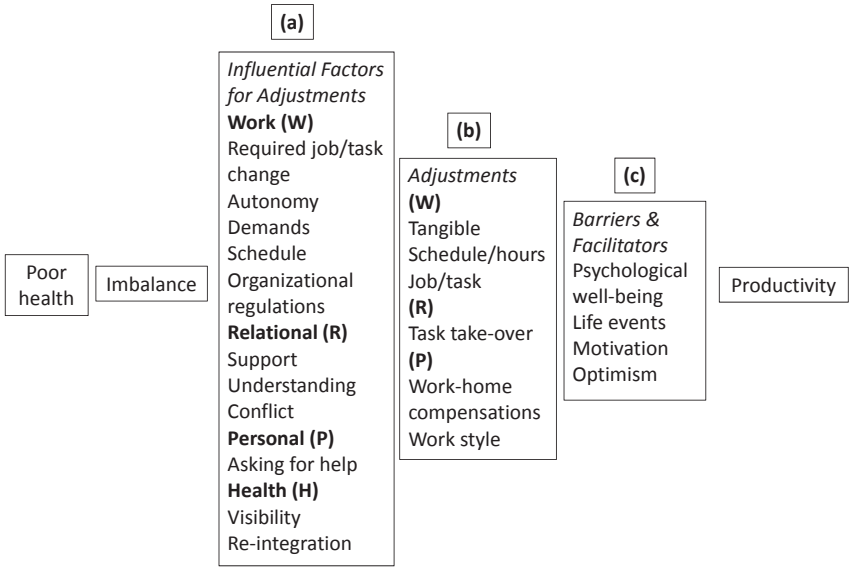


Figure 2 Identifying influential factors for adjustments, adjustments, and barriers and facilitators for productivity

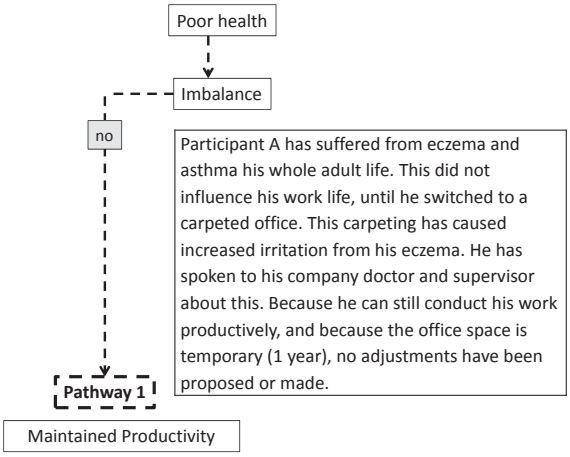


In the process (Figure 1), four pathways were distinguished. In Pathway 1, titled "Maintained productivity, no Imbalance," health had no influence on productivity. Participants in Pathway 2, "Maintained productivity after adjustments," experienced imbalances, followed by adjustments, and a maintained productivity. Participants in Pathway 3, "Reduced productivity after adjustments," also experienced adjustments in response to imbalances, but productivity was still reduced. In pathway 4, "Reduced productivity, no adjustments," no adjustments occurred after an imbalance and productivity was reduced. Classification into pathways through which health influenced productivity depended on whether an imbalance occurred between work demands, external resource, and internal resources, whether adjustments were made, and how productivity was influenced. The results below use Figures 1 and 2 and extra case examples to explain how health influences productivity.

Imbalances

An imbalance occurred when work-related demands, such as night or shift work, or high physical demands or pressure, were felt to be incongruent with an individual's external or internal resources. Important external resources reported were factors such as autonomy or understanding. The health problem itself reduced internal resources by influencing an individual's work ability through psychological exhaustion, stress, pain, or concentration complaints. For twenty-five participants, an imbalance was experienced due to diminished internal resources as a consequence of health problems. For the participant in pathway 1: MP, no imbalance, health had no influence on productivity because the nature of the health problem was such that it did not influence internal resources and did not cause an imbalance (see Figure 3).

Figure 3 Case example pathway 1: maintained productivity, no imbalance



Identifying adjustments

In response to potential imbalances, adjustments occurred in the work, personal, and relational domains. An overview of these adjustments can be seen in Figure 2.We now identify the various adjustments made (Figure 2 (Box b)) and describe how these were triggered by influential factors (Figure 2 (Box a)). Thereafter we describe why productivity was (not) maintained due to barriers or facilitators (Figure 2 (Box c)).

Work-related adjustments (Figure 2 Box b.W)

In the work domain, tangible (n=3), scheduling (n=8), and content (n=11) adjustments were made. Tangible work changes, such as a new desk or chair, occurred for several participants. These adjustments reduced discomfort or inconvenience, but were not reported as restoring a balance. Work adjustments pertaining to schedules included different work times, reduced working hours, reduced shift work, working from home, and increased break possibilities. Work content changes, such as in job or tasks, occurred for many participants. Both schedule and content changes were aimed at reducing physical and/or psychosocial strain and altering the type of demands.

Relational adjustments (Figure 2 Box b.R)

Relational adjustments could pertain to both private and work relationships. The most important adjustment in this domain was task take-over as a form of relational support. This adjustment is similar to task changes, but pertains to the relational aspect through which work tasks that had prior to the health problem been conducted by the individual, were taken over by others. Task take-over was most often initiated by colleagues or supervisors, and was conducted by colleagues or in one case an individual's husband. For Participant N, who works at a day care, colleagues voluntarily assisted: "then they'd say, hey why don't you give the bottle to that baby, and I'll dress the kids," because the latter was difficult for her to do with her hand pains.

Task take-over was deemed as a very important adjustment because it distinguished participants with a maintained productivity from those without for all but one participant. However, this woman, Participant V, is also distinguished by the fact that the stakeholder in this adjustment was her husband, who came to her work with her to help her conduct tasks that were too physically demanding.

Personal adjustments (Figure 2 Box b.P)

In the private sphere, participants often (n=14) described the personal adjustment work-home compensations: resting after work or limiting weekend activities in order to save energy and refrain from activities that could worsen health complaints. Further, personal adjustments in the work sphere, namely in work style (n=10), were reported to restore a balance because they were directly aimed at resolving causes of imbal-

ance (e.g., stress and demands). Examples of work style adjustments included slowing down general work pace to reduce stress, switching task focus in order to increase job satisfaction and/or decrease specific demands, and avoiding certain bodily positions/movements to decrease physical demands. Such adjustments were made by Participant L, for example: "I was so busy that I had to run to catch the train to get to appointments on time, and yeah then when I was at home [sick] I realized I didn't want to do that anymore, so I'm going to plan things better."

Influential factors for adjustments (Figure 2 Box a)

Several factors in the work, relational, personal, and health domains influenced whether and which adjustments occurred (see Figure 2). Factors could impact adjustments both through their presence or absence and could have a positive or negative influence on whether adjustments occurred.

Work-related influential factors (Figure 2 Box a.W)

In the work domain, required job or task changes directly influenced changes in jobs or tasks. Job or task changes were required because work was not being conducted well or because of organizational situations and regulations. The stakeholder in this situation was often the supervisor who initiated such an adjustment after an imbalance. Autonomy also influenced adjustments. For example, in Participant B's situation, her bursitis in her shoulder caused pain during desk work, which led to the implementation of a software program that would remind her to take breaks from typing. Due to the lack of autonomy in her function, however, she would never take these breaks because then co-dependent colleagues would have to wait for her. A job change was influenced by a required job change initiated by her supervisor. Thus for participant B two influential factors, the lack of autonomy and a required job change, acted together to stimulate a successful adjustment—a work content change that brought about a balance. High physical demands or shift work also influenced the type of adjustment that occurred, namely schedule or hour changes and task changes. Further, organizational regulations especially influenced whether the adjustment working at home could take place.

Relational influential factors (Figure 2 Box a.R)

Mentioned influential factors in the relational domain were on a spectrum: support and understanding on one end, and conflicts on the other. Support and understanding was a prerequisite of voluntary task take-over and assisted in the rapid attainment of tangible adjustments. When a conflict was present, support was not experienced once the health problem developed. Consequently, effective adjustments were hindered: Participant R had a major conflict with her superior and several colleagues—it took her 5 years to get a new chair that she needed for her back complaints.

Personal influential factors (Figure 2 Box a.P)

An influential personal factor was the ability to ask for help. Asking for help, an aspect of active coping, stimulated adjustments when present and prevented them when absent. Participant D, who suffers from severe sight impairment, did not want to be seen like a "whiner" by requesting the tangible adjustments he needs, namely a larger computer screen and better lighting—thus refraining from asking for help prevents this adjustment. On the other hand, asking for help allows for adjustments needed for a balance for Participant I, who has hand pain complaints from osteoarthritis—she straightforwardly asks her colleagues to pick up heavy things for her when she feels that she cannot do so.

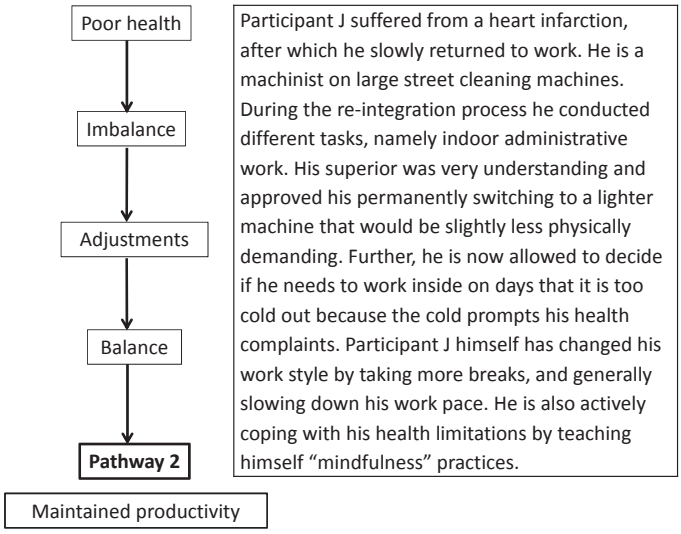
Health-related influential factors (Figure 2 Box a.H)

Several participants (n=6) mentioned that no one could see that they had health problems, and felt that this influenced how others acted towards them. They perceived this lack of "visibility" as a lack of understanding and support: "the annoying thing… is that people can't see it, I still have my feet, I still have all my toes—there must be nothing wrong with me. So when I leave work around two, people would say, 'oh I'd like a schedule like that too,' and they just didn't understand" (Participant H). Participants that had a sudden onset of illness that led to a period of sickness absence and thereafter a re-integration or work build up period, on the other hand, had a high illness visibility (n=6). These participants went from having a (fairly) good health that had no influence on their balance, to suddenly not being able to work at all. The re-integration process and "visibility" led to acknowledgement of the health problem, support, and adjustments that were perceived as effectively maintaining productivity. The re-integration process stimulated adjustments that directly addressed the imbalances caused by the health problems.

Restoring a balance

An adjustment helped to maintain productivity when it tackled the individual's unique imbalance. Participant J in pathway 2: MP after adjustments, for example, changed tasks and his work style, which allowed for a restoration of balance and sustainable productivity in spite of his health problem (see Figure 4). Participants in pathway 3: RP after adjustments, like those in pathway 2: MP after adjustments, experienced adjustments in response to imbalances, yet their productivity was not maintained. This was because the adjustments made were not sufficient or applicable to their specific health problems. Participant U was the only individual interviewed who underwent a re-integration process, but continued to have a reduced productivity. In this case, the adjustments made, including job change and no more shift work, were not substantial enough to restore her balance because she still conducts highly physically demanding tasks that are incongruent with her health problems.

Figure 4 Case example pathway 2: maintained productivity after adjustments



Barriers and facilitators (Figure 2 Box c)

An additional explanation for why adjustments did not restore a balance for participants in pathway 3: RP after adjustments was that strong barriers were present. Barriers are internal well-being factors that inhibited productivity maintenance regardless of adjustments: psychological disorders or complaints, having experienced negative life events, low job motivation, and job dissatisfaction. Life events included personal or partner's having life threatening illnesses, or partners passing away. Participants with a reduced productivity (pathway 3: RP after adjustments and pathway 4: RP, no adjustments) more often reported suffering from internal barriers (n=5), than those with a maintained productivity (n=1). Participant S, for example, experienced many adjustments, but due to the psychological aftermath of multiple negative life events and a very low job satisfaction, his productivity remained low (see Figure 5).

On the other hand, internal facilitators to do with coping and optimism were beneficial in productivity maintenance: Participant O (pathway 2: MP after adjustments), who suffers from chronic pain complaints, states that "[it] doesn't have to, I don't think, rule your life… I don't feel sorry for myself." Similarly, participants with a maintained productivity more often made personal adjustments, such as effective changes in work style. Participants in pathway 4: RP, no adjustments did not experience any adjustments due to a lack of stimulating influential factors and, like those in pathway 3: RP after Adjustments, had strong internal barriers (see Figure 6).

Figure 5 Case example pathway 3: reduced productivity after adjustments

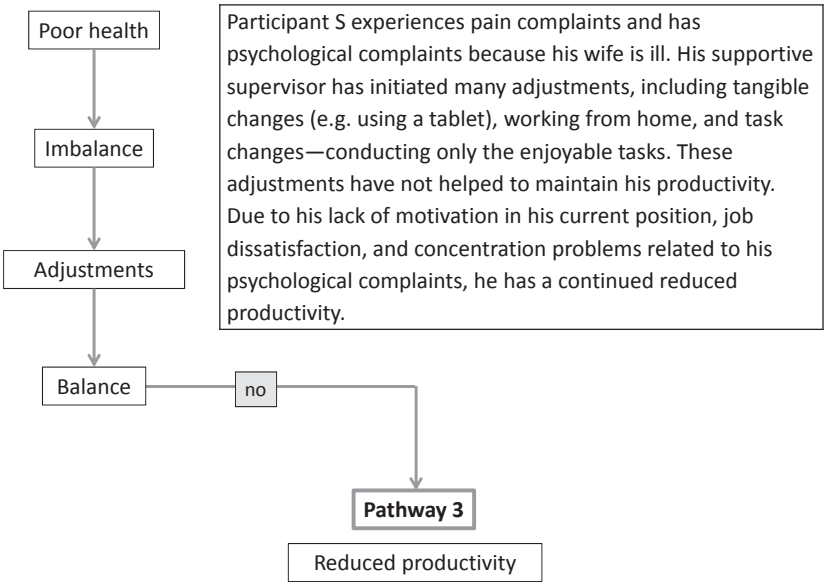
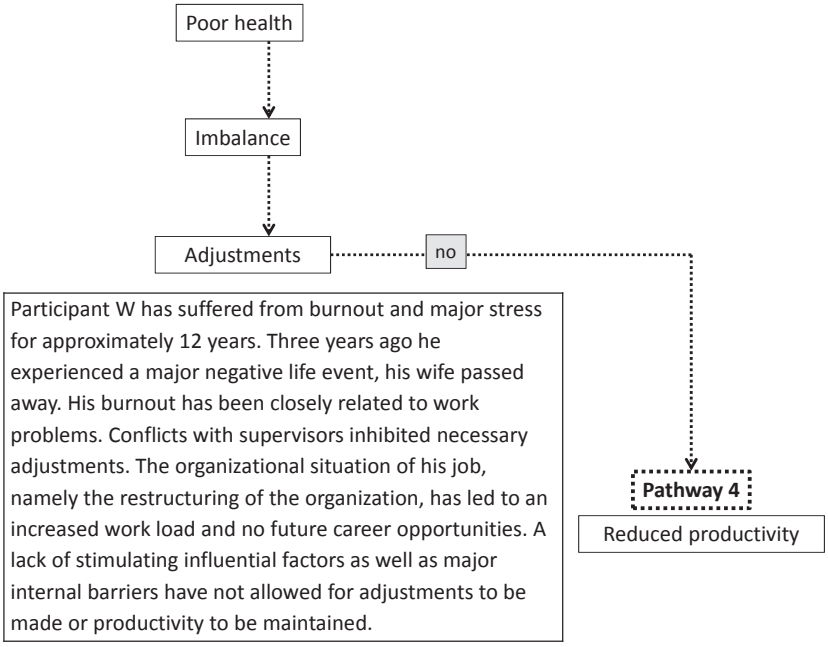


Figure 6 Case example pathway 4: reduced productivity, no adjustments



DISCUSSION

The process through which health influenced productivity can be described via four pathways, health: (1) had no influence on productivity, (2) caused an imbalance, adjustments were made, and productivity was maintained, (3) caused an imbalance, adjustments were made, yet productivity was not maintained, and (4) caused an imbalance which directly led to reduced productivity. For participants in pathway 1: MP, no imbalance, poor health did not influence productivity because the nature and severity of the health problem did not cause an imbalance in demands and resources. Participants in pathway 2: MP after adjustments and 3: RP after adjustments are distinguished from one-another by whether the adjustment that occurred matched the specific imbalance present and thus resolved it, and by whether strong barriers or facilitators were present. No adjustments were made for participants in pathway 4: RP, no adjustments because of the absence of influential factors needed for adjustments, and because strong barriers were present. Whereas past research has often identified particular adjustments, this study has gone further by exploring what proceeds adjustments and what follows in terms of actual productivity sustainability. Merely the occurrence of adjustments did not lead to productivity maintenance or restoration, instead the type of adjustment in relation to the unique imbalance at hand and the presence or absence of internal barriers and facilitators determined whether productivity was maintained.

The role of the (im)balance between demands and external resources and internal resources in productivity maintenance was partially expected on the basis of the JDR model. The particular influence of the health-related factors of visibility and re-integration are linked to the necessity of understanding and support for adjustments. Past research has found that support from supervisors in particular is important for staying at work [11] and job performance [23]. The role that the type of health problem (mental or physical), also related to emotional well-being, had on the process is in line with findings that depict the differing influences of various health problems on work performance. Specifically, a recent study found that mental health problems influenced productivity at work more negatively than physical health problems, whereas physical health problems led to more sickness absence than mental health problems [24]. Personal influential factors and facilitators related to psychological well-being have also been identified in past research: self-management skills, motivation, low emotional distress and making personal adjustments have been found to be important for staying at work in individuals with musculoskeletal complaints [11,25,26]. Staying at work is a precondition of productivity maintenance, and we similarly found that such personal factors were important for productivity maintenance. Further, positive emotions and job satisfaction have also been found to lead to favourable work outcomes and job performance [6,10]. For participants who suffered from psychological problems, making personal adjust-

ments appeared to be more difficult because these psychological problems interfered with the motivation to restore productivity. The work-related influential factors found in our study are also in line with findings in the literature that suggest that autonomy, job control, and adjustment latitude influence staying at work [11], work ability, and productivity [8].

Potential limitations

This study had several potential limitations that should be mentioned. Potential downsides of conducting interviews via telephone as opposed to face-to-face include lack of non-verbal communication and depersonalization between speakers [27,28]. Telephone interviews were, however, conducted for two main reasons: practicality and anonymity. We suspected that employed participants would be more inclined to participate if interviews were conducted by telephone because the appointment could made around their working schedule—interviews were often conducted in the evening. Increased feelings of anonymity and a reduction of the interviewer's immediate subjective interpretation are also possible upsides of conducting telephone interviews [27,28]. After the first phase of interviewing it was decided that the remaining interviews would also be conducted via telephone because the experience had been positive: the necessary information was being collected and participants seemed willing and at ease.

Defining and judging productivity was difficult for participants and analysts. Because we sampled purposefully on the basis of work ability and productivity scores in the STREAM 2011 questionnaire, the similarity between these scores and the pathway outcomes could be checked. Discrepancies occurred because a reduction in working hours was not necessarily considered to be a decrease in productivity. Instead, these reductions allowed participants to restore a balance, and maintain a high productivity during their working hours. Participants, on the other hand, reported this as a reduced productivity in terms of quantity of work conducted compared to prior to the existence of the health problems. When judging whether an individual maintained his or her productivity, we assumed that a balance between demands and resources and high work ability was necessary for sustainable productivity.

Purposeful sampling resulted in equal amounts of male and female interviewees, this allowed us to see that our findings were not different for men and women. Purposeful sampling on work ability and productivity did not result in equal groups: more participants in the high productivity and work ability group were interviewed than those in the low productivity and work ability group, because of difficulties in reaching participants, and because more individuals in the latter group were on long-term sick leave.

General conclusions

As a result of health problems, unique imbalances occurred that required tailored adjustments. Adjustments did not arise at random, instead they were determined by influential factors that often preceded the occurrence of the health problem. A priori work place characteristics such as support and autonomy should be promoted, which will facilitate the implementation of necessary adjustments in case of health problems and imbalances. Further, psychological factors were found to be an important underlying facilitator and barrier for creating a balance in demands and resources and ultimately productivity outcomes. The psychological well-being of older employees thus needs to be stimulated, for example through the use of self-management training. Understanding how sustainable productivity can be maintained is essential in the context of the societal debate on increasing retirement ages and prolonging successful work life, and calls for continued quantitative and qualitative research exploring how this can be achieved.

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CHAPTER 06

DO WORK FACTORS MODIFY THE ASSOCIATION BETWEEN CHRONIC HEALTH PROBLEMS AND SICKNESS ABSENCE AMONG OLDER EMPLOYEES?

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ABSTRACT

Objectives

The aim of this study was to (i) assess how common chronic health problems and work-related factors predict sickness absence and (ii) explore whether work-related factors modify the effects of health problems on sickness absence.

Methods

A one-year longitudinal study was conducted among employed persons aged 45-64 years from the Study on Transitions in Employment, Ability and Motivation (n=8,984). The presence of common chronic health problems and work-related factors was determined at baseline and self-reported sickness absence at one-year follow-up by questionnaire. Multinomial multivariate logistic regression analyses were conducted to assess associations between health, work factors, and sickness absence, and relative excess risk due to interaction (RERI) techniques were used to test effect modification.

Results

Common health problems were related to follow-up sickness absence, most strongly to high cumulative sickness absence (>9 days per year). Baseline psychological health problems were strongly related to high sickness absence at follow-up [odds ratio (OR) 3.67, 95% confidence interval (95% CI) 2.80-4.82]. Higher job demands at baseline increased the likelihood of high sickness absence at follow-up among workers with severe headache [RERI 1.35 (95% CI 0.45-2.25)] and psychological health problems [RERI 3.51 (95% CI 0.67-6.34)] at baseline. Lower autonomy at baseline increased the likelihood of high sickness absence at follow-up among those with musculoskeletal [RERI 0.57 (95% CI 0.05-1.08)], circulatory [RERI 0.82 (95% CI 0.00-1.63)], and psychological health problems [RERI 2.94 (95% CI 0.17-5.70)] at baseline.

Conclusions

Lower autonomy and higher job demands increased the association of an array of common chronic health problems with sickness absence, and thus focus should be placed on altering these factors in order to reduce sickness absence and essentially promote sustainable employability.

INTRODUCTION

Due to the ageing workforce and decreasing birth rates, it has become crucial to ensure older employees work productively and in good health for longer. Alongside ageing, health problems occur more often and in turn work ability can decrease [1]. Poor health can lead to reduced productivity in terms of productivity loss at work, increased sickness absence, or exit from the workforce [2-4]. The influence that poor health has on sickness absence differs for various types of health problems [3-5]. Work-related factors, such as autonomy, social support, and work pressure also influence productivity loss at work and sickness absence [6-9]. Past findings indicate that work-related factors, such as autonomy, job satisfaction, physical load, and social support, interact with health problems in their influence on productivity outcomes [10-14].

In accordance with past findings, we hypothesize that favorable factors at work such as high support, high autonomy, low job and emotional demands, and low physical load can help employees with health problems to remain productive at work and avoid or reduce sickness absence. Findings from past qualitative research [15, 16] support the idea that work-related factors modify the effect of health on sickness absence, but quantification of this occurrence is still lacking in the literature. Understanding the effect of work on the influence of poor health on sickness absence has important practical implications because health problems may not always be solved, but work-related factors are amendable.

Since past studies have shown that different health problems affect sickness absence to a different extent [3,5], it is possible that effect modification of work-related factors also differs per health condition. We hypothesize that health problems will cause sickness absence if unfavorable work factors are present that trigger or aggravate the health problems or that interfere with functioning. For example, psychosocial work factors such as emotional demands and lack of support could especially modify the effects of psychological health problems on sickness absence, whereas workers with musculoskeletal disorders in physically demanding jobs may experience more limitations at work and, thus, are more likely to call in sick. Gaining such problem-specific insight is essential for the development of tailored interventions for sustainable employability, defined as maintaining a high work productivity in good health. The goals of this study were to (i) assess how health problems and work-related factors predict sickness absence and (ii) investigate whether and to what extent work-related factors modify the effects of common health problems on sickness absence.

METHODS

Study design

A prospective study with a one-year follow-up was conducted within the longitudinal Study on Transition in Employment, Ability, and Motivation (STREAM) [17]. In STREAM, a stratified sample of Dutch citizens aged 45-64 years complete annual online questionnaires on health, job and personal characteristics, work ability, productivity, and transitions in employment. The current study used STREAM data from 2010 (baseline) and 2011 (follow-up). In 2010, 15 118 individuals participated (response 71%), with comparable participation in the four age groups sampled: 45-49, 50-54, 55-59, and 60-64 years. In 2011, 12,430 individuals participated again in STREAM (82%). As our research questions pertained to work-related factors that are specific to workplace settings, we excluded participants if they underwent a transition in work status (employed, self-employed, not employed) between baseline and follow-up (n=1,075), were self-employed both years (n=728), or not employed both years (n=1,474). Of the remaining participants, 169 persons were excluded because of incomplete data, resulting in a total inclusion of 8984 participants in this study.

The Medical Ethical Committee of the Free University of Amsterdam Medical Center declared that the Medical Research Involving Human Subjects Act does not apply to the STREAM study. The Medical Ethical Committee had no objection to the execution of this research. In the information that accompanied the online questionnaire, it was emphasized that (i) the privacy of participants was guaranteed, (ii) all answers to the questions were anonymous and would be treated confidentially, and (iii) all data were stored in secured computer systems.

Sickness absence

Sickness absence was assessed at baseline and at follow-up with the open question: "How many work days have you, during the past twelve months, been absent due to sickness?" Three categories of cumulative sickness absence were made: none (0 days), low (1-9 days), and high (>9 days).

Health problems

The occurrence of various health problems at baseline was assessed with the question: "Do you [currently] have one or more of the following chronic diseases, disorders, or handicaps?" [18]. Of the 13 answer options, the following 7 categories were made: musculoskeletal disorders (MSD), severe headache or migraines, circulatory diseases, respiratory diseases, digestive problems, diabetes, and psychological complaints. These health categories were not mutually exclusive. Multimorbidity was defined as the presence of ≥2 health problems.

Work-related factors

Studied work-related factors included: autonomy, support, job demands, emotional demands at work, and physical workload. Autonomy was measured with five items derived from the Job Content Questionnaire (JCQ) about: making decisions, deciding the order of and speed of conducting tasks, having to find solutions, and being able to take time off (Cronbach's alpha=0.78) [19]. Job demands, measured with four JCQ items, consisted of how fast, much, hard, and hectic an individual's work is (Cronbach's alpha=0.87) [19]. Support was measured with four items from the Copenhagen Psychosocial Questionnaire (COPSOQ) concerning whether colleagues and supervisors are willing to help and listen to work-related problems (Cronbach's alpha=0.81) [20, 21]. Emotional demands at work were also assessed with three items derived from the COPSOQ about emotionally difficult situations, emotional demands, and emotional involvement at work (Cronbach's alpha=0.85) [20, 21]. Physical workload was assessed with five items from the Dutch Musculoskeletal Questionnaire on force exertion, static load (standing, posture, kneeling), and vibration (using tools or machines that cause vibration) (Cronbach's alpha=0.86) [22]. All work-related factor items had 5-point answer scales ranging from 1=(almost) never to 5=always. These scales were dichotomized based on the sample distribution (median values). Categories suspected of having the lowest risk for sickness absence were used as reference categories [23].

Covariates

Age, gender, and educational level were incorporated in this study as covariates. The highest level of education attained was categorized into three groups: low (lower general secondary educational, preparatory secondary vocational education), medium (intermediate vocational training, higher general secondary education, pre-university education), and high (higher vocational education, university education).

Statistical analyses

Descriptive statistics were used to report on general characteristics of the study population. Multinomial logistic regression analyses were conducted to study associations between health problems and work-related factors as independent variables at baseline with the occurrence of cumulative sickness absence during 12-month follow-up, distinguishing none (0 days) (reference), low (1-9 days), and high (>9 days) cumulative sickness absence. Odds ratios (OR) and their corresponding 95% confidence intervals (95% CI) were calculated. First, in model 1, analyses were conducted for each independent variable separately, adjusting for age, gender, and education, since these individual characteristics were significantly related to sickness absence. Thereafter, a multivariate analysis (model 2) using an enter method was conducted, incorporating the work-related factors, health problems, and covariates that had a significant association with either

low or high cumulative sickness absence in model 1. This procedure allows for a direct comparison between determinants of low and high sickness absence. Lastly, in model 3, baseline sickness absence was also added to the multivariate model, categorized the same way as follow-up sickness absence. This model focuses on incidence rather than occurrence of sickness absence as the dependent variable. As multimorbidity was defined on the basis of separate health problems, this variable was not included in either models 2 or 3 in order to avoid over adjustment.

To study whether and to what extent work-related factors modified the effect of health problems on sickness absence, interaction effects were analysed by calculating relative excess risk due to interaction (RERI) terms and their 95% CI, using the delta method in Excel (Microsoft Corp, Redmond, WA, USA) [23-25]. RERI are calculated with OR as estimates of relative risks (RR), RERI= OR (*health problem + unfavorable work factor*) - OR (*health problem + favorable work factor*) - OR (*no health problem + unfavorable work factor*) + 1 [23, 24]. When RERI is not equal to zero, an additive interaction is present; RERI can range from negative infinity (negative interaction, less than additivity) to positive infinity (positive interaction, more than additivity) [23]. Through this analysis the per cent increase in likelihood of sickness absence for persons with a health problem and unfavorable work-related factors as opposed to those with the health problem and favorable work-related factors was also calculated [((OR (*health problem + unfavorable work factor*) – OR (*health problem + favorable work factor*)) / OR (*health problem + favorable work factor*)) × 100]. Variables that were significantly related ($p<0.05$) to sickness absence in the multivariate analysis (model 2) were incorporated in the effect modification analyses. Analyses were done using SPSS, version 20, (SPSS Institute, Chicago, IL, USA) and Excel.

RESULTS

Descriptive information

The study population characteristics can be found in Table 1. Loss-to-follow-up was 18% for both men and women, 20% and 17% for the youngest and the oldest age groups, respectively, and 18% and 16% for low and high educated persons, respectively. Persons with high baseline cumulative sickness absence had a loss-to-follow-up of 18%, this was 17% for those with a low sickness absence.

Additional analyses showed that, at baseline, men were less likely than women to have cumulative sickness absence of 1-9 days [OR 0.87 (95% CI 0.79-0.96)] and of >9 days [OR 0.90 (95%CI 0.80-1.01)]. The oldest age group had less sickness absence of 1-9 days [OR 0.58 (95% CI 0.50-0.67)] but similar sickness absence of >9 days [OR 0.94 (95% CI 0.79-1.13)] when compared to the youngest age group.

Table 1 Demographic, health, work, and sickness absence descriptive information among n=8,984 employed older (aged 45-64) individuals

Variable	Per cent (%)	n (n=8,984)
Age (mean=54, min=45, max=64)		
45-49	25.4	2,285
50-54	26.6	2,387
55-59	29.8	2,681
60-64	18.2	1,631
Gender: female	43.9	3,941
Educational level		
Low	26.6	2,393
Medium	39.0	3,507
High	34.3	3,084
Health problems		
Musculoskeletal	32.1	2,880
Circulatory	9.6	861
Severe headache or migraines	8.3	742
Respiratory	7.3	659
Diabetes	6.6	592
Digestive	5.9	529
Psychological	3.9	354
Multimorbidity	11.9	1,067
No health problem	42.2	3,793
Work-related factors (median)		
Lower autonomy (4.00)	47.7	4,282
Lower support (3.71)	35.4	3,176
Higher job demands (3.00)	49.5	4,446
Higher emotional demands (2.67)	36.8	3,303
Higher physical work load (1.40)	47.6	4,278
Baseline cumulative sickness absence		
None (0 days)	53.0	4,762
Low (1-9 days)	28.7	2,585
High (>9 days)	18.2	1,637
Follow-up cumulative sickness absence		
None (0 days)	55.2	4,960
Low (1-9 days)	27.3	2,450
High (>9 days)	17.5	1,574

Lower educated persons were more likely to have high [OR 1.43 (95% CI 1.24-1.65)] and less likely to have low [OR 0.76 (95% CI 0.67-0.86)] cumulative sickness absence. All covariates were included in the remaining analyses.

More than fifty per cent of the participants were not absent during the one-year follow-up, about 27% had a short cumulative sickness absence (1-9 days) and about 17% had high cumulative sickness absence (>9 days) within the past year. The prevalence of sickness absence at baseline was 47% and 45% at follow-up. For both low and high sickness absence, the recurrence was approximately 46% and the incidence approximately 17%.

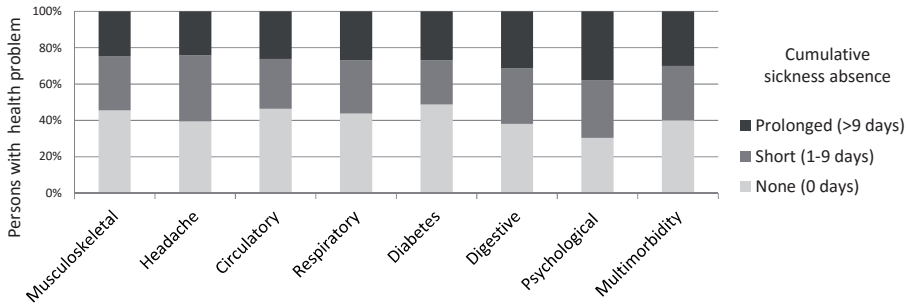
By far the most frequently present health problem at baseline was a MSD (32.1%), followed by circulatory diseases (9.6%), and severe headache (8.3%). The same pattern was seen in the frequency of health problems at follow-up, the maximum change in prevalence between the two assessments was 0.8%. Multiple health problems were present in 11.9% of the study population at baseline, often combinations of MSD with: migraines (4.0%), heart disease (3.4%), and respiratory problems (3.2%).

All work-related factors at baseline were marginally interrelated (Spearman's rho correlations<0.27). Work-related factors were relatively stable at baseline and follow-up and the proportion of persons with recurrent (un)favorable work factors ranged from 69% (emotional demands) to 87% (physical work load).

Health problems and sickness absence

Figure 1 depicts the distribution of sickness absence among persons with common health problems. High sickness absence was most common among persons with psychological complaints (38%). Table 2 shows that the presence of a health problem at baseline was related to an increased likelihood of sickness absence during follow-up (models 1 and 2). The relationship between health problems and sickness absence was stronger with high than low cumulative sickness absence.

Figure 1 Occurrence of self-reported sickness absence over the past 12 months amongst older (aged 45-64) employees with common health problems (n=8,984)



Note: Headache=severe headache or migraines.

Table 2 Associations between health, work-related factors, and cumulative self-reported sickness absence in a sample of older (aged 45-64) employees (n=8,984)

	Model 1				Model 2				Model 3			
	Low (1-9 days)		High (>9 days)		Low (1-9 days)		High (>9 days)		Low (1-9 days)		High (>9 days)	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Work-related factors												
Low autonomy	1.09	0.99-1.20	1.43	1.27-1.60	1.11	1.00-1.23	1.30	1.15-1.47	1.05	0.94-1.17	1.18	1.04-1.35
Low support	0.88	0.80-0.98	1.05	0.93-1.18	0.85	0.76-0.94	0.94	0.84-1.07	0.87	0.78-0.97	0.99	0.87-1.13
High job demands	1.11	1.00-1.22	1.32	1.17-1.48	1.09	0.98-1.21	1.20	1.06-1.36	1.06	0.95-1.18	1.13	0.99-1.29
High emotional demands	1.12	1.01-1.24	1.32	1.17-1.49	1.07	0.96-1.19	1.08	0.95-1.23	1.06	0.95-1.19	1.07	0.93-1.23
High physical load	0.87	0.79-0.96	1.24	1.10-1.39	0.80	0.72-0.89	1.06	0.93-1.20	0.80	0.72-0.90	1.04	0.91-1.19
Health problems												
MSD	1.55	1.40-1.73	2.26	2.00-2.54	1.48	1.33-1.65	1.98	1.75-2.24	1.32	1.18-1.48	1.63	1.43-1.86
Severe headache	1.84	1.54-2.19	2.02	1.66-2.46	1.68	1.41-2.01	1.59	1.29-1.95	1.47	1.22-1.76	1.31	1.05-1.64
Circulatory	1.34	1.13-1.60	1.96	1.64-2.34	1.32	1.11-1.57	1.79	1.49-2.16	1.14	0.95-1.36	1.37	1.12-1.68
Respiratory	1.38	1.14-1.67	2.07	1.69-2.52	1.28	1.06-1.56	1.75	1.42-2.15	1.11	0.91-1.36	1.39	1.11-1.74
Digestive	1.68	1.36-2.08	2.76	2.23-3.43	1.45	1.17-1.80	2.07	1.66-2.59	1.22	0.97-1.54	1.62	1.27-2.07
Diabetes	1.09	0.88-1.34	1.77	1.44-2.17	1.03	0.83-1.27	1.55	1.25-1.93	0.94	0.75-1.17	1.36	1.07-1.71
Psychological	2.16	1.64-2.83	4.34	3.34-5.65	1.98	1.51-2.61	3.67	2.80-4.82	1.45	1.09-1.94	2.28	1.70-3.07
Multimorbidity	1.53	1.31-1.79	2.70	2.30-3.16								

Note: MSD=musculoskeletal disorders; OR=odds ratio; 95% CI=95% confidence interval. Model 1: analyses adjusted for covariates (i.e., age, gender, education). Model 2: analysis adjusted for covariates, work-related factors, and all health problems except multimorbidity. Model 3: analysis adjusted for covariates, work-related factors, all health problems except multimorbidity, and baseline sickness absence.

After adjustment for baseline sickness absence (model 3), all health problems remain statistically significantly associated with high sickness absence. Overall, the associations between health problems and sickness absence were marginally reduced after adjustment for baseline sickness absence (maximum OR reduction 26%).

Work-related factors and sickness absence

All work-related factors were related to follow-up cumulative sickness absence (Table 2). After adjusting for age, gender, educational level, and health problems, lower autonomy [OR 1.30 (95% CI 1.15-1.47)] and higher job demands [OR 1.20 (95% CI 1.06-1.36)] were related to high cumulative sickness absence (model 2). Adjustment for baseline sickness absence decreased these associations (OR) by <10% (model 3).

Interaction work-related factors and health

Figure 2 shows that lower autonomy and higher job demands were important work-related factors that interacted with common health problems. Interaction effects were not observed for low cumulative sickness absence (for numerical details see Table A in the Appendix).

Figure 2 Relative excess risk due to interaction (RERI) of health and work-related factors on high (>9 days) cumulative sickness absence during one-year follow-up, after adjustment for age, gender, and education

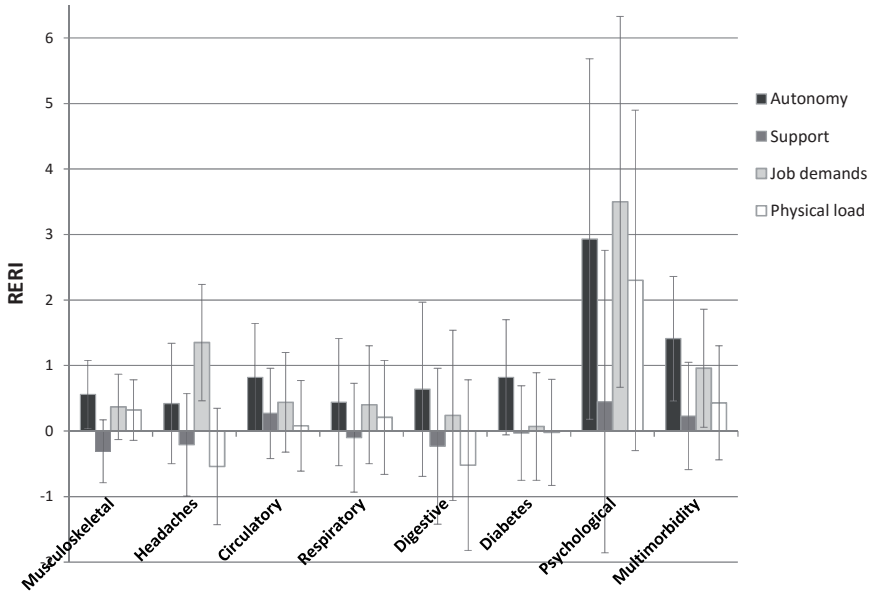


Table 3 Interaction effects of work-related factors and health on high cumulative sickness absence, after adjustment for age, gender, and education (n=6,534)

Health problem		Work-related factor	n	OR	95% CI	RERI	95% CI
Musculoskeletal disorders							
		Autonomy				0.57	0.05-1.08
	Not present	Higher	2,446	1.00			
	Not present	Lower	2,069	1.37	1.18-1.59		
	Present	Higher	979	2.19	1.84-2.60		
	Present	Lower	1,040	3.12	2.65-3.69		
Severe headache or migraines							
		Job demands				1.35	0.45-2.25
	Not present	Lower	3,121	1.00			
	Not present	Higher	2,942	1.25	1.11-1.41		
	Present	Lower	222	1.52	1.12-2.06		
	Present	Higher	249	3.12	2.39-4.07		
Circulatory							
		Autonomy				0.82	0.00-1.63
	Not present	Higher	3,102	1.00			
	Not present	Lower	2,806	1.39	1.23-1.57		
	Present	Higher	323	1.76	1.36-2.28		
	Present	Lower	303	2.97	2.32-3.79		
Psychological							
		Autonomy				2.94	0.17-5.70
	Not present	Higher	3,320	1.00			
	Not present	Lower	2,973	1.38	1.23-1.55		
	Present	Higher	105	3.53	2.38-5.24		
	Present	Lower	136	6.85	4.78-9.82		
		Job demands				3.51	0.67-6.34
	Not present	Lower	3,232	1.00			
	Not present	Higher	3,061	1.27	1.13-1.43		
	Present	Lower	111	3.27	2.22-4.80		
	Present	Higher	130	7.04	4.86-10.21		
Multimorbidity							
		Autonomy				1.43	0.48-2.38
	Not present	Higher	3,070	1.00			
	Not present	Lower	2,707	1.34	1.18-1.52		
	Present	Higher	353	2.28	1.80-2.89		
	Present	Lower	404	4.05	3.26-5.03		
		Job demands				1.01	0.11-1.91
	Not present	Lower	2,994	1.00			
	Not present	Higher	2,785	1.26	1.11-1.44		
	Present	Lower	349	2.43	1.92-3.08		
	Present	Higher	406	3.70	2.98-4.60		

Note: MSD=musculoskeletal disorders; OR=odds ratio; 95% CI=95% confidence interval; RERI=Relative excess risk due to interaction. Excluding persons with low cumulative sickness absence (n=2,450).

Within persons with musculoskeletal [RERI 0.57 (95% CI 0.05-1.08)], circulatory [RERI 0.82 (95% CI 0.00-1.63)], psychological [RERI 2.94 (95% CI 0.17- 5.70)], and a multimorbidity of health problems [RERI 1.43 (95% CI 0.48-2.38)], lower autonomy increased the likelihood of high cumulative sickness absence (Figure 2 and Table 3).Within persons with a multimorbidity of health problems, lower autonomy increased the likelihood of high cumulative sickness absence by 78%. For those individuals with psychological health complaints, this increase in likelihood of high cumulative sickness absence was even higher, at 94% (see Table 3).

Higher job demands also strengthened the association of severe headache, psychological, and a multimorbidity of health problems with high cumulative sickness absence. For persons with psychological complaints, higher as opposed to lower job demands were associated with a relative excess risk of high sickness absence of 3.51 (95% CI 0.67-6.34), the presence of higher job demands increased the likelihood of high cumulative sickness absence by 115% (see Table 3).

DISCUSSION

The presence of common health problems at baseline was associated with sickness absence at one-year follow-up, especially of >9 days. Lower autonomy and higher job demands solely related to the likelihood of high cumulative sickness absence and interacted with various health problems. Among persons with psychological complaints, MSD, severe headache, circulatory problems, and a multimorbidity of health problems at baseline, lower autonomy and higher job demands increased the likelihood of high cumulative sickness absence at follow-up.

In this study the modifying effects of autonomy and job demands on the relation between commonly occurring chronic health problems and sickness absence have been explicitly quantified through interaction effect analyses. The proportion of the combined effects of the work factors and health problems on sickness absence that was due to the interaction [attributable proportion (AP)=RERI / OR(*health problem* + *unfavorable work factor*)] ranged from 0.18 (MSD × autonomy) to 0.50 (psychological × job demands) (possible AP range= -1-1) [23]. The risk of lower autonomy and higher job demands for sickness absence has been found in other, mostly cross-sectional, studies [9,11,12].

Results from past findings also suggest that work-related factors play a role in the health-productivity loss association, but have looked solely at physical health problems instead of at a wide array of common health problems as the current study does [10,13]. Because autonomy and job demands are such important effect modifiers, it is an imperative that employers focus on these work-related factors in promoting sustainable employability.

Of all health problems, psychological health complaints had the strongest association with sickness absence after adjustment for baseline sickness absence (OR 2.28). This result is in line with findings that suggest that specifically bipolar, major depressive, and panic disorders are strongly associated with sickness absence on the population level [5]. A recent study has also found that an increase in psychological health problems amongst older employees leads to disability retirement [3].

Psychological, physical, and a multimorbidity of health problems all interacted with job demands and autonomy in their associations with sickness absence. Work-related factors can modify the effect of health problems on sickness absence by supporting active and successful coping and adaptations, that will enable an individual to keep working productively as was found in a recent interview study also carried out within STREAM [16]. It may be hypothesized that psychosocial work-related factors are important because they allow an individual to exert control over how his or her work is conducted and inherently how adjustments therein can be made. Aspects of the Illness Flexibility model, and findings from the aforementioned interview study, are in line with this [12]. The results also point to the relevance of internal motivation as a potential prerequisite of making such alterations [12,16]. Future research should thus corroborate whether favorable work factors are sufficient in reducing sickness absence or whether motivational factors further moderate this relationship.

Because physical workload was not associated with high sickness absence, some extra explorative analyses were conducted. Separate analyses for each item of physical load showed comparable results, hence, the scale construction cannot explain the lack of an association. Further, because the multivariate analyses corrected for educational level it is possible that overcorrection occurred, but when the analyses were repeated without the inclusion of educational level, the same non-significant effects were found. Past findings on the role of physical load in productivity loss have also been inconclusive [4]. Because the participants in STREAM are ≥45 years of age, it is possible that persons who worked in jobs that required a higher physical load - but could not handle this due to poor health - had already switched careers at a younger age, and thus the healthy worker effect might explain our findings.

There are limitations in this study to be mentioned. Because sickness absence was measured at both baseline and follow-up, we assessed the association of health and work-related factors with both incidence (model 3) and occurrence (models 1 and 2, interaction analyses) of sickness absence. Since sickness absence in both models 2 and 3 had similar determinants, the interaction effect analyses were limited to the occurrence of sickness absence because the current study had less discriminatory power to also investigate interaction for incident cases.

Effect modification was assessed with RERI interaction effect analyses. Based on our hypotheses, we presumed that work-related factors modified the effects of health on

sickness absence. A reversed scenario, in which health moderates the effects of work factors on sickness absence, cannot be excluded on the basis of interaction effect analyses. However, our primary hypothesis was that health problems precede sickness absence, as presented in the introduction.

As many variables were included in the analyses, there is a possibility of finding effects per chance. We, however, chose to analyze the effects of many different common health problems and work-related factors on sickness absence in order to assess consistent patterns and effects; autonomy and job demands were important effect modifiers for a variety of health problems.

Work-related factors were dichotomized as higher or lower on the basis of median values because scales were ordinal and some scores were much more frequent than others, for example low physical workload. Making different groups for each of the 5-point answers would have led to a large reduction of power. Dichotomization had the potential downside that participants were categorized as higher or lower, which may not have reflected their scores on the scale labels. For example, the median cut-off point for higher physical load was 1.40, which is according to the labels everything but "(almost) never"; thus "rarely", "sometimes", "often", and "(almost) always" were clustered together. To control the accuracy of findings, analyses were done comparing participants with the lowest and highest tertile work-related factor scale scores. Because these analyses resulted in very similar findings to the median value analyses, we chose to keep the median as a cut-off point.

The self-reported health problem item may be flawed in that the health problems were a combination of disorders and complaints, and the question did not specify whether the problem was diagnosed by a physician. Nonetheless, the health problems were clear predictors for sickness absence. Self-reporting of sickness absence over a 12-month period has been found to concur with registered sickness absence. As sickness absence days increase, however, the accuracy of self-reporting decreases [27,28]. Since high sickness absence was defined by any number of days >9 in our study, we assume that such inaccuracies did not influence our findings.

Based on findings from the current study, we conclude that autonomy and job demands have a moderating effect on the association between common chronic health problems and sickness absence. Encouraging lower job demands and higher autonomy can help to reduce sickness absence in spite of the presence of health problems. Therefore, work-related factors are deemed to be essential in the promotion of sustainable employment and relevant for interventions for older employees with health problems.

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APPENDIX

Table A Effect modification, expressed as relative excess risk due to interaction (RERI), of work-related factors on the influence of health on cumulative sickness absence in older (aged 45-64) employees (n=8,984)

		Autonomy		Support		Job demands		Physical load	
		RERI	95% CI	RERI	95% CI	RERI	95% CI	RERI	95% CI
Health problem									
Musculoskeletal									
S.A.	Low	0.24	-0.06-0.53	-0.02	-0.31-0.27	-0.13	-0.45-0.19	0.23	-0.02-0.47
	High	0.57	0.05-1.08	-0.30	-0.79-0.19	0.37	-0.12-0.87	0.33	-0.13-0.80
Severe headache or migraines									
S.A.	Low	-0.23	-0.88-0.43	0.24	-0.36-0.85	0.48	-0.20-1.15	-0.18	-0.78-0.42
	High	0.42	-0.51-1.35	-0.21	-0.98-0.57	1.35	0.45-2.25	-0.53	-1.43-0.36
Circulatory									
S.A.	Low	0.14	-0.34-0.62	-0.10	-0.54-0.34	0.21	-0.27-0.69	-0.16	-0.59-0.27
	High	0.82	0.00-1.63	0.28	-0.42-0.97	0.44	-0.32-1.21	0.08	-0.66-0.83
Respiratory									
S.A.	Low	0.51	-0.05-1.06	-0.20	-0.69-0.29	0.16	-0.38-0.71	0.26	-0.22-0.74
	High	0.46	-0.51-1.44	-0.12	-0.93-0.69	0.43	-0.47-1.33	0.19	-0.69-1.06
Digestive									
S.A.	Low	-0.75	-1.52-0.03	-0.12	-0.80-0.56	-0.09	-0.84-0.67	-0.20	-0.87-0.47
	High	0.64	-0.69-1.98	-0.23	-1.42-0.96	0.24	-1.07-1.55	-0.52	-1.82-0.78
Diabetes									
S.A.	Low	0.16	-0.32-0.65	-0.10	-0.53-0.34	0.31	-0.17-0.80	0.08	-0.35-0.50
	High	0.82	-0.06-1.70	-0.08	-0.80-0.63	0.07	-0.76-0.89	-0.01	-0.82-0.79
Psychological									
S.A.	Low	1.09	-0.15-2.32	-0.02	-1.13-1.09	0.31	-0.95-1.56	0.55	-0.56-1.66
	High	2.94	0.17-5.70	0.46	-1.85-2.76	3.51	0.67-6.34	2.30	-0.30-4.90
Multimorbidity									
S.A.	Low	0.34	-0.14-0.82	-0.03	-0.47-0.42	0.17	-0.34-0.68	0.15	-0.29-0.58
	High	1.43	0.48-2.38	0.21	-0.60-1.02	1.01	0.11-1.91	0.41	-0.46-1.29

Note: Adjusted for age, gender, and educational level. S.A.=cumulative sickness absence days (high: >9 days; low: 1-9 days); RERI=Relative excess risk due to interaction.

CHAPTER 07

THE INFLUENCE OF CHRONIC HEALTH PROBLEMS AND WORK-RELATED FACTORS ON LOSS OF PAID EMPLOYMENT AMONG OLDER WORKERS

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ABSTRACT

Background

With an ageing society and increasing retirement ages, it is important to understand how employability can be promoted in older workers with health problems. The current study aimed to determine whether (1) different chronic health problems predict transitions from paid employment to disability benefits, unemployment and early retirement, and (2) how work-related factors modify these associations.

Methods

Self-report questionnaire data was used from the Dutch longitudinal Study on Transitions in Employment, Ability and Motivation with 3 years of follow-up (2010-2013), among employees aged 45-64 years (n=8,149). The influence of baseline chronic health problems and work-related factors on transitions from paid employment to disability benefits, unemployment and early retirement during follow-up was estimated in a competing risks proportional hazards model. Relative excess risk of transitions due to the interaction between chronic health problems and work-related factors was assessed.

Results

Severe headache, diabetes mellitus and musculoskeletal, respiratory, digestive and psychological health problems predicted an increased risk of disability benefits (HR range 1.78-2.79). Circulatory (HR=1.35) and psychological health problems (HR=2.58) predicted unemployment, and musculoskeletal (HR=1.23) and psychological health problems (HR=1.57) predicted early retirement. Work-related factors did not modify the influence of health problems on unemployment or early retirement. Psychosocial work-related factors, especially autonomy, modified the influence of health problems on disability benefits. Specifically, among workers with health problems, higher autonomy, higher support and lower psychological job demands reduced the risk of disability benefits by 82%, 49%, and 11%, respectively.

Conclusions

All health problems affected disability benefits to a similar extent, but psychological health problems especially predicted unemployment and early retirement. For older workers with health problems, promoting an optimal work environment has the potential to contribute to sustainable employment.

INTRODUCTION

Western society is being confronted with an ageing population. The resulting strain on social security systems has made it increasingly important that older workers remain in employment for a longer time period. As a consequence of living more years with chronic health problems, older workers are now also more likely to experience health-driven labour force exit, while (re-)employment has in fact been found to be good for health [1,2].

A recent systematic literature review on longitudinal studies showed that self-perceived general health, mental health and various chronic diseases were associated with exit from the workforce through unemployment and work disability [3]. A benefit for work disability can be granted temporarily, but return to paid employment is often relatively low [4]. Studies on the role of health in early retirement present an inconclusive picture. In the aforementioned review, general health was related to early retirement, but chronic diseases only showed a marginal relation and in a qualitative study both good and poor health were found to be important for early retirement [3,5]. Comparing the influence of different health problems on multiple exit routes is difficult because only few original articles [6] have focused on more than one specific exit route and/or health problem.

When comparing the influence of health on different transitions out of paid employment, it should be acknowledged that these transitions are related events. The probability of one exit route, that is, early retirement, disability pension or unemployment, may depend on the probability of other exit routes. For example, workers with health problems have a higher risk of transitioning to disability benefits, leaving healthier employees viable for other transitions at a later point in time, in essence the healthy worker effect [7]. Furthermore, disability and unemployment are to some extent communicating vessels that depend on eligibility criteria in the social security system; empirical evidence has shown that restrictions in disability enrolment had spill-over effects on transitions to unemployment [8]. When studying determinants of early exit from paid employment, the interdependency and time-dependency of different routes needs to be considered, which requires an analytical approach that incorporates such so-called 'competing risks'.

Work-related factors may also play a role in whether and when workers exit from the workforce. Several studies have reported that work-related factors may directly influence exit from the workforce [9-12]. Recent findings show that among workers with chronic health problems, favourable psychosocial resources relate to remaining in employment and reducing sickness absence [13,14]. In the current study, we will determine whether work-related factors modify the influence of health on early exit from the workforce via disability benefits, unemployment and early retirement. Such knowledge can contrib-

ute to the development of workplace interventions aimed at keeping employees (with health problems) in employment for a longer time period.

In summary, the objectives of the current study were to add to the existing literature by determining among older workers whether (1) the presence of *different* chronic health problems predict a future transition from paid employment to disability benefits, unemployment or early retirement, and (2) work-related factors modify the influence of chronic health problems on these transitions.

METHODS

Study design

In the current study, data from the Study on Transitions in Employment, Ability and Motivation (STREAM) were used. STREAM is a longitudinal Dutch cohort study with 3 years of follow-up (2010-2013). The STREAM sample was drawn from an online panel and was stratified according to 5-year age groups and work status (i.e., employed, self-employed, non-employed). Participants between the ages of 45 and 64 annually filled in an online questionnaire on a variety of topics, including employment status, work characteristics and health. More detailed information on the STREAM study design can be found elsewhere [15]. The current study builds on prior STREAM publications that have focused on facets of sustainable employability of employees still working, for example, sickness absence, work ability and productivity [14,16].

In total, 15,118 respondents participated in the first wave of STREAM (2010). Only baseline employed respondents were included in the current study (n=10,464), with complete baseline information on work-related factors (n=10,383). Self-employed workers were excluded because these workers may experience different working circumstances than employees, for example, with regard to social support from colleagues or supervisors, or the level of autonomy in conducting work tasks. Furthermore, only employees who participated in more than one wave were included in the current study (n=9,501) because we were interested in transitions that could occur during the follow-up period. Lastly, a selection was made of respondents that remained employed or made a transition to disability pension, unemployment or early retirement during follow-up. Thus, workers who made other transitions, for example, to self-employment, statutory retirement or to becoming a housewife/houseman were excluded as well as persons with a mixed participation status, for example, simultaneously in paid employment and early retirement (overall excluding a further 1,352 persons). This resulted in a total study population of 8,149.

The VU University Medical Centre Amsterdam medical ethical committee declared that the Medical Research Involving Human Subjects Act does not apply to STREAM.

The medical ethical committee had no objection to the execution of this study. In the information provided to STREAM participants, it was made clear that their privacy would be guaranteed, that all answers would be treated confidentially and that data would be stored in secured computer systems [15].

Loss of paid employment

The outcome of interest in the current study was loss of paid employment. Employment status was operationalised with the question "In which situation are you currently?" (one or more paid jobs as an employee, work disabled, unemployed, (early) retired) and a question on whether persons received different types of government financial benefits. Based on this, four mutually exclusive employment status were defined at each follow-up wave: disability benefits, unemployment, early retirement and employment. Subsequently, three transitions groups were defined from baseline employment to disability benefits, unemployment and early retirement during follow-up, as well as a group with sustained employment.

The work status disability benefits was defined on the basis of whether participants stated they were currently receiving work disability benefits. In the Netherlands, disability benefits are calculated on the basis of a disability percentage, determined by the difference between what an individual can theoretically earn with his or her maintained functional abilities and what he or she earned prior to the disability or what a comparable person without any disability earns. Only if there is a reduction of (potential) income greater than 35%, disability benefits will be granted (http://www.government.nl). From the moment of initial sickness absence, it generally takes 2 years before one can apply for disability benefits. Thus, the transition from employment to disability benefits was defined over a 2-year period in the current study.

Unemployment was defined on the basis of whether persons indicated they were unemployed. If respondents indicated that they were early retired or retired and under the age of 65 at the time of the questionnaire, then this was defined as the work status 'early retirement'. The transition from employment to unemployment and early retirement could occur over a 1-year period.

Employment was defined as having one or more paid job(s) as an employee. Employment was also defined as having less than 100 sickness absence days (≈6 months) in the past 12 months in order to ensure that the predictors (health and work-related factors) were measured prior to the transitions, as long-term sickness absence is an inherent predecessor of disability benefits.

Chronic health problems

The presence of a chronic health problem was assessed at baseline using the following question, "Do you (currently) have one or more of the following chronic diseases,

disorders or handicaps?" [17]. Thirteen answer options (i.e., chronic diseases, disorders or handicaps) were provided for which participants could indicate whether these were present. Seven categories of health problems were created for the current study: severe headache or migraines, diabetes mellitus and musculoskeletal, circulatory, respiratory, digestive and psychological health problems. Different musculoskeletal disorders were classified together into one category. Specific answer options were not studied, namely, rare health problems with a prevalence typically below 1% (e.g., epilepsy). We also classified participants into two groups based on whether any of the seven categories of health problems were present or whether none of these categories were present.

Work-related factors

Physical work load and three psychosocial work-related factors (i.e., psychological job demands, autonomy and support) were assessed at baseline. Physical load was assessed using five items on force exertion, static load and vibration (Cronbach's alpha=0.86) [18,19] Psychological job demands was assessed using four items on how fast, how much, how hard and how hectic an individual's work is (Cronbach's alpha=0.86) [20]. Autonomy was assessed using five items on making decisions, deciding the order and speed of conducting tasks, having to find solutions, and being able to take time off (Cronbach's alpha =0.77) [21]. Support at work was assessed using four items on whether colleagues and/or supervisors are willing to help and listen to work-related problems (Cronbach's alpha=0.80).20 Items on the four work-related factor scales were all measured on five-point Likert scales ranging from 1 '(almost) never' to 5 'always', and were all dichotomised at the median value.

Individual factors

The factors age, gender and educational level were included as potential confounders. Three categories of educational level were used: low (lower general secondary educational, preparatory secondary vocational education), medium (intermediate vocational training, higher general secondary education, pre-university education) and high (higher vocational education, university education).

Statistical analyses

Descriptive statistics were used to report on the baseline characteristics (i.e., work-related, health, demographic and occupation factors) of the study population and the frequencies of transitions between the annual waves.

The influence of baseline chronic health problems and work-related factors on transitions from paid employment to disability benefits, unemployment, and early retirement during follow-up was assessed in a competing risks proportional hazards model [22]. This model takes into account that these outcome routes are related events;

that is, the risk of one event depends on whether the other event has occurred. This is of particular importance for labour force exit routes, since disability will most often occur at a younger age than early retirement and eligibility criteria and financial consequences also play a role.

Sub-HR and their 95% CIs are presented from multivariable models that included all health problems simultaneously in order to take multimorbidity into consideration, as well as work-related and individual factors. The influence of having any of the health problems as compared to having none of these on loss of paid employment was analysed in a multivariable model including work-related and individual factors. An HR greater than one for a particular determinant indicates an increased risk of a specific transition occurring during the follow-up, considering the competing risks of the other transition routes.

In order to determine whether taking competing risks into account indeed influenced our findings, sensitivity analyses with standard Cox proportional hazards models were also conducted. The findings from the two models were compared by looking at the percent change in (sub)HR. In order to determine whether work-related factors modify the influence of health problems on transitions from paid employment, relative excess risk due to interaction (RERI) terms were calculated. Multiple testing and chance findings would have been a problem had the interaction effect of each specific health problem with each work-related factor on the three forms of loss of paid employment been analysed (i.e., 7×4×3=84 statistical tests). The dichotomous classification of any of the specific health problems being present as compared to none of these health problems was used for the effect modification analyses. In sensitivity analyses, the specific interaction of musculoskeletal and psychological health problems with work-related factors on transitions were also assessed. RERI terms were calculated using HRs as estimates of relative risk; RERI=(HR (*health problem and unfavourable work factor*)) - (HR (*health problem and favourable work factor*)) - (HR (*no health problem and unfavourable work factor*)) + 1 [23,24]. The HR terms used to calculate the RERI term, the RERI term itself and its 95% CI, as calculated with the delta method, are reported [23,25]. To determine the role of work-related factors in loss of paid employment specifically among workers with health problems, the risk of loss of paid employment between workers with health problems and favourable versus unfavourable work-related factors was also compared in terms of percent change in HR. All RERI analyses were adjusted for age, gender and educational level. Analyses were conducted in SPSS V.20 and STATA V.13.1.

RESULTS

Study population

Baseline characteristics of the study population are presented in Table 1. Participants were on average 53 years old, and slightly more males than females participated in the current study. Most participants had a medium or high educational level. At baseline, workers were predominantly employed in the following types of companies: health and well-being, public administration, education and industry (according to EU NACE classification of economic activities of organisations).

Table 1 Baseline characteristics of the sample: individual factors, work-related factors and chronic health problems in older employees (n=8,149)

Individual factors			
Age		Mean (SD)	53.4 (5.07)
Gender	Male	n (%)	4,611 (56.6)
Education	Low	n (%)	2,144 (26.3)
	Medium	n (%)	3,202 (39.3)
	High	n (%)	2,803 (34.4)
Work-related factors			
Physical load		Mean (SD)	1.79 (0.88)
	Higher (>1.40)	n (%)	3,878 (47.6)
	Lower (≤1.40)	n (%)	4,271 (52.4)
Psychological job demands		Mean (SD)	3.16 (0.76)
	Higher (>3.25)	n (%)	3,059 (37.5)
	Lower (≤3.25)	n (%)	5,090 (62.5)
Autonomy		Mean (SD)	3.85 (0.69)
	Lower (<4.00)	n (%)	3,846 (47.2)
	Higher (≥4.00)	n (%)	4,303 (52.8)
Support		Mean (SD)	3.60 (0.76)
	Lower (<3.75)	n (%)	4,023 (49.4)
	Higher (≥3.75)	n (%)	4,126 (50.6)
Health problem			
Any health problem		n (%)	3,998 (49.1)
Musculoskeletal		n (%)	2,412 (29.6)
Severe headache or migraines		n (%)	658 (8.1)
Circulatory		n (%)	737 (9.0)
Respiratory		n (%)	564 (6.9)
Digestive		n (%)	445 (5.5)
Diabetes mellitus		n (%)	506 (6.2)
Psychological		n (%)	234 (2.9)

Note: SD=standard deviation.

Musculoskeletal health problems were most prevalent (29.6%), followed by circulatory health problems and severe headache. Psychological health problems were the least prevalent (2.9%); 49.1% of the study sample had one or more health problem.

During the 3 year follow-up, 14.1% of the sample (n=1,147) lost their paid employment; 7% of the workers retired early (n=570; 27.9 per 1,000 person-years), 5.8% became unemployed (n=474; 23.2 per 1,000 person-years) and 1.3% started receiving disability benefits (n=103; 5.0 per 1,000 person-years).

Determinants of loss of paid employment

Chronic health problems

With the exception of circulatory health problems, the presence of all health problems at baseline were related to an increased risk of disability benefits, ranging from 1.78 (95% CI 1.06 to 2.99) for severe headache to 2.79 (95% CI 1.45 to 5.39) for psychological health problems. Employees with circulatory (HR 1.35; 95% CI 1.03 to 1.77) and psychological (HR 2.58; 95% CI 1.83 to 3.62) health problems at baseline were at an increased risk of unemployment. Employees with musculoskeletal (HR 1.23; 95% CI 1.06 to 1.42) and psychological (HR 1.57; 95% CI 1.05 to 2.34) health problems were at an increased risk of early retirement.

The sensitivity analyses showed that HRs estimated by the standard Cox proportional hazards model (see Appendix Table A) for chronic health problems on the transition to disability benefits were larger than in the competing risks model, up to 20% for psychological health problems. For unemployment and early retirement, estimates were approximately the same (maximum change 1.1%) (Table 2).

Work-related factors

In the multivariable analyses, adjusted for individual factors and health, work-related factors were not statistically significant independent risk factors of disability benefits. Lower physical load was a risk factor of unemployment. Lower support was a risk factor of both unemployment and early retirement (Table 2).

Table 2 Multivariable analyses of the relations between the presence of a chronic health problem and loss of paid employment using competing risks proportional hazards models (n=8,149)

		Disability benefit n = 103/8,149	Unemployment n = 474/8,149	Early retirement n = 570/8,149
		HR (95% CI)	HR (95% CI)	HR (95% CI)
Any of the health problems		3.48 (2.18-5.56)	1.32 (1.10-1.58)	1.11 (0.96-1.28)
Specific health problem				
Musculoskeletal		2.19 (1.49-3.22)	1.05 (0.87-1.28)	1.23 (1.06-1.42)
Severe headache or migraines		1.78 (1.06-2.99)	0.95 (0.68-1.33)	1.18 (0.86-1.63)
Circulatory		1.49 (0.88-2.54)	1.35 (1.03-1.77)	1.01 (0.81-1.26)
Respiratory		2.02 (1.18-3.44)	0.96 (0.68-1.35)	0.69 (0.50-0.93)
Digestive		1.97 (1.17-3.33)	0.89 (0.60-1.33)	0.86 (0.64-1.14)
Diabetes mellitus		2.43 (1.44-4.09)	1.14 (0.82-1.60)	1.15 (0.92-1.44)
Psychological		2.79 (1.45-5.39)	2.58 (1.83-3.62)	1.57 (1.05-2.34)
Individual factors				
Age (years)		1.05 (1.01-1.10)	1.01 (0.99-1.03)	1.66 (1.60-1.71)
Gender (male)		0.77 (0.51-1.15)	0.88 (0.74-1.06)	1.40 (1.19-1.64)
Education	Low	1.56 (0.92-2.63)	1.50 (1.20-1.88)	0.83 (0.69-1.00)
	Medium	1.44 (0.87-2.36)	1.17 (0.94-1.45)	0.85 (0.72-1.02)
	High	Reference	Reference	Reference
Work-related factors				
Higher physical load		1.08 (0.71-1.63)	0.82 (0.68-0.99)	1.16 (1.00-1.36)
Higher psychological job demands		0.88 (0.60-1.28)	0.87 (0.72-1.06)	0.98 (0.84-1.14)
Lower autonomy		1.22 (0.82-1.83)	1.14 (0.95-1.38)	1.08 (0.93-1.25)
Lower support		1.33 (0.90-1.98)	1.46 (1.22-1.75)	1.16 (1.00-1.35)

Note: HR=Sub hazard ratio. HRs for the specific health problems, individual and work-related factors are presented from the same multivariable analyses. HRs presented for the category any of the health problems are from multivariable analyses including individual and work-related factors.

Effect modification of work-related factors on health-employment transitions

The only statistically significant RERI was for health problems and autonomy for disability benefits (RERI 2.09; 95% CI 0.77 to 3.41). Specifically, workers with health problems and lower autonomy had an 82% greater risk of disability benefits than those with health problems and higher autonomy (see HRs in Table 3). Although other RERIs were not statistically significant, we observed some indications that, among workers with a health problem, those with unfavourable psychosocial work-related factors had a greater risk of disability benefits compared to those with favourable psychosocial work-related factors. Namely, workers with lower social support and higher psychological job demands showed 49% and 11%, respectively, greater risk of disability benefits than workers with health problems and higher social support and lower psychological job demands (see HRs in Table 3).

Table 3 Modification of work-related factors on the relation between chronic health problems and loss of paid employment using relative excess risk due to interaction

			Disability benefit n = 103/8,149		Unemployment n = 474/8,149		Early retirement n = 570/8,149	
		n	RERI (95% CI)	HR (95%CI)	RERI (95% CI)	HR (95%CI)	RERI (95% CI)	HR (95%CI
Health problem	physical load		-0.20 (-2.39-1.99)		0.00 (-0.38-0.37)		0.17 (-0.14-0.48)	
Not present	Lower	3,071		Reference		Reference		Reference
Not present	Higher	1,080		1.45 (0.62-3.36)		0.81 (0.62-1.06)		1.11 (0.89-1.40)
Present	Lower	1,928		4.16 (2.08-8.33)		1.31 (1.03-1.67)		1.05 (0.86-1.29)
Present	Higher	2,070		4.41 (2.19-8.86)		1.12 (0.88-1.43)		1.33 (1.10-1.61)
Health problem	psychological job demands		0.80 (-0.66-2.17)		-0.33 (-0.78-0.12)		0.15 (-0.17-0.46)	
Not present	Lower	2,668		Reference		Reference		Reference
Not present	Higher	1,483		0.56 (0.21-1.51)		1.04 (0.78-1.38)		0.95 (0.74-1.20)
Present	Lower	2,422		2.90 (1.68-5.03)		1.46 (1.17-1.82)		1.08 (0.91-1.29)
Present	Higher	1,576		3.22 (1.82-5.70)		1.16 (0.89-1.51)		1.17 (0.95-1.44)
Health problem	autonomy		2.09 (0.77-3.41)		-0.27 (-0.77-0.22)		0.16 (-0.15-0.47)	
Not present	Higher	2,295		Reference		Reference		Reference
Not present	Lower	1,856		0.43 (0.17-1.11)		1.30 (0.99-1.70)		1.05 (0.84-1.32)
Present	Higher	2,008		1.87 (1.02-3.45)		1.49 (1.15-1.93)		1.06 (0.87-1.30)
Present	Lower	1,990		3.40 (1.94-5.96)		1.52 (1.17-1.96)		1.28 (1.05-1.56)
Health problem	social support		1.35 (-0.44-3.14)		-0.05 (-0.58-0.47)		-0.20 (-0.58-0.18)	
Not present	Higher	2,200		Reference		Reference		Reference
Not present	Lower	1,951		1.13 (0.49-2.61)		1.58 (1.20-2.08)		1.31 (1.04-1.64)
Present	Higher	1,926		3.02 (1.52-5.99)		1.41 (1.06-1.86)		1.25 (0.99-1.59)
Present	Lower	2,072		4.50 (2.33-8.71)		1.94 (1.50-2.51)		1.36 (1.09-1.69)

Note: Analyses are adjusted for age, gender and educational level. HR=Sub hazard ratio; RERI=Relative excess risk due to interaction.

Likewise, although the overall RERI was not statistically significant, we found an indication that workers with health problems and higher physical load had a 27% greater risk of early retirement than workers with health problems and lower physical load (see HRs in Table 3). There was no indication of modification by work-related factors for the effects of health problems on unemployment (see Table 3).

Similar to the overall health problem analyses, in the sensitivity analyses too we found that persons with musculoskeletal and psychological health problems and unfavourable psychosocial work-related factors were at a greater risk of disability benefits (see Appendix Tables B and C). This increased risk ranged from 28% to 45% for musculoskeletal health problems, and from 108% to 185% for psychological health problems.

DISCUSSION

Workers with chronic health problems had an increased risk of starting to receive disability benefits during the 3 year follow-up, ranging from 1.78 with severe headache to 2.79 with psychological health problems. Alongside psychological health problems, only circulatory and musculoskeletal health problems were related to transitions to unemployment and early retirement, respectively. Within the group of workers with health problems, those with favourable psychosocial work-related factors had a lower risk of disability benefits; this risk reduction was up to 82% with higher autonomy.

As poor health is a pre-requisite of receiving disability benefits, it is not surprising that workers with health problems were at an increased risk. The effects of the seven health problems on disability benefits were relatively comparable in the current study. Similarly, in the review by van Rijn et al [3], the risk of disability pension ranged from 1.80 with poor mental health to 2.35 with respiratory health problems. In the prospective French GAZEL cohort study, greater differences were found between health problems with psychiatric diagnosis being the strongest predictor of disability pension (HR 7.56 for men, HR 4.14 for women) and respiratory diagnosis the weakest (HR 3.92 for men, HR 2.62 for women) [26]. There may be diverse reasons for mixed findings, such as the registry method of health via self- versus physician-reports, the severity of the health problems and different definitions of disability across different systems.

When compared to other health problems, psychological health problems had the strongest relation with unemployment and early retirement in the current study. Past studies using STREAM data on the effects of chronic health problems on sickness absence, productivity and work ability, have also shown especially large effects of psychological health problems [14,16]. In line with this, the recent Organisation for Economic Co-operation and Development (OECD) report on mental health and work in the Netherlands states that more needs to be achieved for workers with moderate

and mild mental health problems [27]. Workplace adjustments and accommodations may be needed because health problems can cause an imbalance in demands and resources [16]. Workers with psychological health problems, however, are less likely to disclose their health problems to their managers, and disclosure is a prerequisite for obtaining necessary accommodations [28,29]. In the current study, the prevalence of psychological health problems was 2.9%; this group possibly contains persons with moderate to severe mental health problems, as in 2011 the prevalence of mild mental health problems in the Netherlands was found to be 9.6%, moderate 2.5% and severe 1.6% [30]. This could in part explain the strong effects of psychological health problems on loss of paid employment.

For early retirement it should be acknowledged that this is a complex transition: not only poor health is a predictor, but good health can also play a role in that workers want to enjoy their retirement while still in good health [5]. Financial arrangements and opportunities at both the national and organizational level must also be considered in early retirement transitions [31]. Macro level determinants should be considered in future research on loss of paid employment, such as the economic situation in an occupational sector or an organisation, as this may also lead to socioeconomic differences.

Among workers with any of the seven categories of chronic health problems, higher autonomy had the strongest modifying effect on the risk of disability benefits, followed by higher social support and lower psychological job demands. In order to restore the balance between demands and resources for those workers with health problems, autonomy can play a crucial role as it allows a worker to make necessary adjustments (e.g., deciding how and in which order to conduct work tasks, being able to think of solutions for how to approach things and decide when to take time off from work) [32]. Furthermore, colleague and supervisor support can emotionally help a worker, but also makes it easier for him or her to attain accommodations in the workplace [32]. In line with this, the greater the perceived adjustment latitude a worker with health problems has, that is, the extent to which his or her work effort can be adjusted, the lower the sickness absence [33]. If interventions can successfully ensure that favourable work-related factors are present, our findings suggest that the risk of loss of paid employment would decrease. Future research should also explore the modifying role of other work-related factors that have been found to have a direct association with continued employment, such as challenging work and organisational commitment [31,34].

Strengths and limitations

A strength of the current study is that different health problems, work-related factors and forms of early loss of paid employment were incorporated in one study; this made it possible to compare effects. This allowed for competing risk analyses to be used, which take into account multiple competing events and help to compare these findings to that

of a traditional Cox model. In the current study we found that the influence of health on disability benefits reduced with up to 20% for psychological health problems in the competing risks model. Such an attenuation may be expected, and has been shown in a simulation study [35], because a portion of the workers with, especially psychological, health problems also show transition to unemployment and early retirement and thus less workers with (such) health problems are viable to transition to disability benefits.

A limitation in this study is that work status was based on self-reported data and we did not have information on the exact percentage of work disability benefits that workers actually received. Furthermore, we did not consider whether and when workers returned to paid employment or to other employment status. For workers who started to receive disability benefits or retired early, re-entering to paid employment was relatively rare, 9% and 0.1%, respectively. Unemployment, however, was a more temporary transition, namely, 25% returned to paid employment within the next year. In future research it would be beneficial to use objective work status information, for example, based on tax registry information alongside self-reported data to study the main source of income, different routes out of employment and combined work status (e.g., being early retired and working part-time) that can allow for different approaches to be used, such as multistate and working life expectancies models [36,37]. Related to this, a limitation of the current study is that the time of an event was studied on a 1-year basis, that is, between questionnaire waves. This, however, is somewhat crude and again using objective information could allow for the exact time of a transition.

When assessing effect modification we did not look at separate health problems, because otherwise too many interaction terms would be tested and statistical power was low due to too few events during follow-up in some subgroups. In sensitivity analyses of effect modification of musculoskeletal and psychological health problems, findings from the overall analyses were confirmed. All of the effect modification terms had large CIs. For this reason we also determined the role of work-related factors in loss of paid employment, specifically in workers with health problems based on the clinically relevant differences in HRs.

Conclusions

The presence of almost all chronic health problems predicted, to a similar extent, that workers started to receive disability benefits, whereas predominantly psychological health problems predicted unemployment and, to a lesser extent, early retirement. Favourable psychosocial work-related factors reduced the risk of receiving disability benefits for persons with health problems. Alongside good health, our study suggests that promoting favourable psychosocial work-related factors among ageing workers can contribute to sustainable employment.

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APPENDIX

Table A Sensitivity analyses of the multivariate relations between the presence of a chronic health problem and loss of paid employment in a standard Cox proportional hazards model

		Disability benefit n = 103/8,149	Unemployment n = 474/8,149	Early retirement n = 570/8,149
		HR (95% CI)	HR (95% CI)	HR (95% CI)
Any of the health problems		3.61 (2.25-5.80)	1.32 (1.10-1.59)	1.11 (0.94-1.31)
Specific health problem				
Musculoskeletal		2.21 (1.48-3.31)	1.06 (0.87-1.29)	1.23 (1.03-1.46)
Severe headache or migraines		1.74 (1.01-3.00)	0.96 (0.68-1.34)	1.18 (0.84-1.65)
Circulatory		1.62 (0.93-2.80)	1.35 (1.02-1.78)	1.01 (0.80-1.29)
Respiratory		2.03 (1.20-3.44)	0.96 (0.67-1.37)	0.69 (0.48-0.97)
Digestive		1.91 (1.09-3.35)	0.89 (0.59-1.33)	0.86 (0.61-1.22)
Diabetes mellitus		2.55 (1.47-4.41)	1.15 (0.82-1.63)	1.16 (0.89-1.51)
Psychological		3.35 (1.72-6.55)	2.59 (1.82-3.69)	1.58 (0.99-2.52)
Individual factors				
Age		1.09 (1.04-1.14)	1.02 (0.99-1.03)	1.66 (1.60-1.72)
Gender (Male)		0.76 (0.51-1.13)	0.89 (0.74-1.07)	1.40 (1.17-1.67)
Education	Low	1.54 (0.91-2.61)	1.50 (1.18-3.70)	0.83 (0.70-1.04)
	Medium	1.35 (0.82-2.24)	1.16 (0.93-1.46)	0.85 (0.70-1.04)
	High	Reference	Reference	Reference
Work-related factors				
Higher physical load		1.14 (0.76-1.71)	0.82 (0.68-1.00)	1.16 (0.98-1.39)
Higher psychological job demands		0.90 (0.59-1.35)	0.87 (0.72-1.06)	0.98 (0.82-1.17)
Lower autonomy		1.23 (0.82-1.84)	1.14 (0.95-1.38)	1.08 (0.91-1.28)
Lower support		1.38 (0.93-2.06)	1.46 (1.21-1.76)	1.16 (0.98-1.38)

Note: HR=Hazard ratio; HRs for the specific health problems, individual and work-related factors are presented from the same multivariable analyses. HRs presented for any health problem are from multivariable analyses including with individual and work-related factors.

Table B Modification of work-related factors on the effect of musculoskeletal health problem on loss of paid employment

			Disability benefit n = 103/8,149		Unemployment n = 474/8,149		Early retirement n = 570/8,149	
		n	RERI (95% CI)	HR (95%CI)	RERI (95% CI)	HR (95%CI)	RERI (95% CI)	HR (95%CI)
Musculoskeletal	physical load		0.84 (-0.54-2.22)		0.06 (-0.30-0.43)		0.28 (-0.06-0.63)	
Not present	Lower	3,190		Reference		Reference		Reference
Not present	Higher	2,547		0.91 (0.50-1.64)		0.83 (0.66-1.03)		1.10 (0.91-1.33)
Present	Lower	1,081		2.14 (1.21-3.80)		1.05 (0.80-1.37)		1.11 (0.88-1.39)
Present	Higher	1,331		2.89 (1.72-4.87)		0.93 (0.72-1.21)		1.49 (1.23-1.79)
Musculoskeletal	psychological job demands		1.34 (0.18-2.49)		-0.15 (-0.55-0.25)		0.10 (-0.26-0.45)	
Not present	Lower	3,661		Reference		Reference		Reference
Not present	Higher	2,067		0.51 (0.26-1.04)		0.95 (0.75-1.19)		0.98 (0.80-1.20)
Present	Lower	1,429		1.89 (1.17-3.05)		1.13 (0.90-1.44)		1.22 (1.02-1.47)
Present	Higher	992		2.74 (1.69-4.45)		0.93 (0.69-1.24)		1.30 (1.04-1.62)
Musculoskeletal	autonomy		0.93 (-0.64-2.50)		0.14 (-0.27-0.55)		-0.15 (-0.52-0.23)	
Not present	Higher	3,149		Reference		Reference		Reference
Not present	Lower	2,588		1.17 (0.66-2.08)		1.10 (0.89-1.36)		1.19 (0.99-1.43)
Present	Higher	1,154		2.32 (1.30-4.13)		1.00 (0.75-1.32)		1.33 (1.08-1.63)
Present	Lower	1,258		3.41 (2.01-5.81)		1.23 (0.95-1.59)		1.37 (1.11-1.68)
Musculoskeletal	social support		0.21 (-1.72-2.15)		-0.17 (-0.68-0.34)		-0.21 (-0.62-0.20)	
Not present	Higher	2,970		Reference		Reference		Reference
Not present	Lower	2,767		1.66 (0.91-3.01)		1.55 (1.25-1.93)		1.26 (1.04-1.53)
Present	Higher	1,156		3.07 (1.68-5.64)		1.16 (0.86-1.56)		1.40 (1.11-1.78)
Present	Lower	1,256		3.94 (2.21-7.02)		1.54 (1.18-2.01)		1.46 (1.18-1.80)

Note: RERI=Relative excess risk due to interaction; HR=Sub hazard ratio.; Musculoskeletal=Musculoskeletal health problem. Analyses are adjusted for age, gender and educational level.

Table C Modification of work-related factors on the effect of psychological health problem on loss of paid employment

			Disability benefit n = 103/8,149		Unemployment n = 474/8,149		Early retirement n = 570/8,149	
		n	RERI (95% CI)	HR (95%CI)	RERI (95% CI)	HR (95%CI)	RERI (95% CI)	HR (95%CI)
Psychological	physical load		-0.93 (-6.36-4.51)		0.09 (-1.48-1.67)		0.39 (-1.04-1.82)	
Not present	Lower	4,383		Reference		Reference		Reference
Not present	Higher	3,756		1.26 (0.82-1.94)		0.84 (0.70-1.01)		1.20 (1.04-1.39)
Present	Lower	112		4.79 (1.91-11.95)		2.49 (1.55-4.01)		1.50 (0.80-2.80)
Present	Higher	122		4.12 (1.67-10.16)		2.42 (1.53-3.82)		2.09 (1.24-3.54)
Psychological	psychological job demands		2.90 (-2.08-7.87)		-0.16 (-1.81-1.50)		0.18 (-1.13-1.50)	
Not present	Lower	4,951		Reference		Reference		Reference
Not present	Higher	2,964		0.93 (0.61-1.41)		0.90 (0.74-1.09)		1.01 (0.87-1.19)
Present	Lower	139		2.63 (0.98-7.09)		2.67 (1.76-4.06)		1.57 (0.90-2.73)
Present	Higher	95		5.46 (2.42-12.34)		2.42 (1.43-4.09)		1.77 (1.00-3.12)
Psychological	autonomy		3.61 (-1.58-8.80)		-1.40 (-3.38-0.57)		0.31 (-1.06-1.68)	
Not present	Higher	4,211		Reference		Reference		Reference
Not present	Lower	3,704		1.27 (0.84-1.91)		1.16 (0.97-1.40)		1.13 (0.98-1.31)
Present	Higher	92		2.16 (0.54-8.71)		3.62 (2.28-5.76)		1.52 (0.80-2.88)
Present	Lower	142		6.04 (2.86-12.78)		2.39 (1.49-3.82)		1.96 (1.19-3.24)
Psychological	social support		3.73 (-1.57-9.02)		0.36 (-1.72-2.44)		0.45 (-0.95-1.85)	
Not present	Higher	4,032		Reference		Reference		Reference
Not present	Lower	3,883		1.37 (0.90-2.07)		1.47 (1.22-1.77)		1.17 (1.01-1.36)
Present	Higher	94		2.22 (0.54-9.14)		2.79 (1.60-4.87)		1.43 (0.70-2.92)
Present	Lower	140		6.32 (3.04-13.16)		3.62 (2.39-5.50)		2.05 (1.26-3.33)

Note: RERI=Relative excess risk due to interaction; HR=Sub hazard ratio; Psychological=Psychological health problem. Analyses are adjusted for age, gender and educational level.

CHAPTER 08

GENERAL DISCUSSION

MAIN FINDINGS

The three research questions addressed in this thesis will be answered in the sections below, combining findings from all chapters.

What is the influence of work-related factors and work engagement on health?

Favourable psychosocial work-related factors play a positive role for mental health, and both physical and psychosocial work-related factors do so for physical health. The positive influence of higher work engagement on health, however, is more pronounced.

In chapter 2, the relation between baseline work-related factors and work engagement with health at one-year follow-up was analysed. Favourable psychosocial work-related factors, i.e., lower psychosocial job demands, higher autonomy, and higher social support, positively influence mental health. Several of these factors, i.e., lower psychosocial job demands and higher autonomy, also positively influence physical health. Lower physical work load has a positive effect on physical health but is unrelated to mental health. Higher work engagement has a strong positive influence on physical health and even more so on mental health. Only weak effect modification of work engagement on the relation between work-related factors and health was found in chapter 2.

To what extent does health influence productive and sustained employment?

Poor health adversely affects productive and sustained employment. Across different facets of employment the largest influence is seen for psychological health problems. Overall, it appears that poor health has the most substantial and consistent consequences for work ability, sickness absence, and early exit from the workforce via disability benefits. A smaller influence of health was found on productivity at work and exit via unemployment and early retirement.

Productive employment

Work ability, productivity at work, and sickness absence were facets of productive employment studied in this thesis.

In chapter 3 the relation of mental and physical health with work ability at one-year follow-up was studied. Poor mental and especially physical health at baseline are associated with a decrease in work ability during one-year follow-up. In chapter 4, three waves of STREAM data were used to test the association of health problems with work ability and productivity at work applying different statistical approaches. Seven different chronic health problems were studied: severe headache or migraines, diabetes mellitus, and musculoskeletal, circulatory, respiratory, digestive, and psychological health problems. A worker with any of these seven health problems has a lower work ability

at one-year follow-up than a worker without this health problem. Smaller and fewer relations were found for productivity at work: only workers with musculoskeletal and psychological health problems have a lower productivity at work at one-year follow-up as compared to workers without these health problems.

Especially a change in health status within one year is related to a change in work ability and productivity at work during that same year; the relation between the stable presence or absence of a health problem with a one-year change in these outcomes is weaker. The largest influence is of incident psychological health problems: these workers have, on average, a 1.48 point decrease in work ability and 0.92 point decrease in productivity at work (both measured on scales from 0-10) during one-year follow-up. Hereafter, the largest influence is of incident digestive (0.41 point decrease) and circulatory (0.30 point decrease) health problems on work ability, and of incident circulatory health problems (0.21 point decrease) on productivity at work.

In a qualitative study on the relation between health and productivity at work, described in chapter 5, the extent to which a health problem affects productivity was found to depend on whether: an imbalance is created in a worker's demands and resources, necessary adjustments are made in response to this, and barriers and facilitators are present. In line with findings from chapter 4, an important facilitator for remained productivity was found to be psychological well-being.

The same seven health problems that were related to work ability and productivity in chapter 4 were studied in relation to sickness absence in chapter 6. The presence of a health problem at baseline is related to an increased risk of high sickness absence during one-year follow-up, defined as more than 9 cumulative days over the past 12 months. Workers with psychological health problems, as compared to those without psychological health problems, again have the greatest increased likelihood of high sickness absence at follow-up (odds ratio (OR)=3.67), followed by digestive (OR=2.07) and musculoskeletal (OR=1.98) health problems.

Sustained employment

In chapter 7 the seven chronic health problems also studied in chapters 4 and 6 were studied in relation to sustained employment, using STREAM data from all four waves. Workers with any of these health problems at baseline, excluding circulatory, were found to have an increased risk of exiting the workforce via disability benefits during three-year follow-up. In accordance with the studies on productive employment, the greatest risk exists for workers with psychological health problems (hazard ratio (HR)=2.79), followed by diabetes mellitus (HR=2.19) and musculoskeletal health problems (HR=2.43). Only workers with psychological (HR=2.58) and circulatory (HR=1.35) health problems have an increased risk of exiting early via unemployment, and only those with psychological

(HR=1.57) and musculoskeletal (HR=1.23) health problems have an increased risk of exiting via early retirement.

Do work-related factors and coping style modify the influence of health on productive and sustained employment?

Findings from this thesis support the notion that favourable work-related factors can modify the adverse influence of poor health specifically on productivity at work, sickness absence, and disability benefits. This was found for psychosocial work-related factors, but not for physical work-related factors. Coping style is predominantly of direct importance for employment.

Work-related factors

In the qualitative study presented in chapter 5 it was shown that alongside factors in the relational, personal, and health domains, work-related factors also influence whether poor health results in reduced productivity. In almost all cases poor health led to an imbalance in resources and demands among interviewees. However, whether necessary adjustments were made depended in part on work-related factors. For example, in some cases workers were required to change job or specific tasks in light of the new imbalance, whereas other workers had a high level of autonomy at work that allowed them to make necessary adjustments- such as having colleagues take over tasks for them. The type of adjustments that were made could also be in the work domain, e.g., tangible alterations to workplaces or amended work schedules.

In chapters 6 and 7 the moderating role of work-related factors in the health-employment relation was quantified. Specifically, this was researched for seven chronic health problems and sickness absence with a one-year follow-up design (chapter 6), and early exit from the workforce with a three-year follow-up design (chapter 7). The findings from these two studies were similar: low psychosocial job demands, high autonomy, and high social support came forth as psychosocial work-related factors that buffer the influence of an array of different health problems on sickness absence and early exit via disability benefits. In terms of risk, for example, for workers with psychological health problems and high psychological job demands the risk of high sickness absence (>9 cumulative days in 12 months) is 7.04 (OR), whereas for those with low psychological job demands this is 3.27 (OR). Similarly, for disability benefits, this risk is 5.46 (HR) as compared to 2.63 (HR). A slight increased risk of early exit via unemployment and early retirement with unfavourable work-related factors was observed, but no strong evidence of effect modification of health problems by these factors was found.

Coping style

The modifying role of coping style in the health-work ability association was found to be quite marginal (chapter 3). The small statistically significant interaction effects that were found, were overshadowed by the main effects that health and coping style have on work ability. Specifically, workers, regardless of their health status, with an avoidant coping style have a lower work ability and those with an active coping style have a higher work ability.

Findings from the qualitative study described in chapter 5 corroborate the conclusion that coping style is important for productive employment. Namely, an influential factor for obtaining necessary adjustments is the ability to ask colleagues or supervisors for help, reflecting a non-avoidant but active coping style.

CONSIDERATIONS

Several considerations need to be taken into account when interpreting the findings from this thesis. Namely, a selection of determinants of productive and sustained employment were studied, the importance of effects may depend on the level of interpretation, and an observational design was used which limits causal conclusions from being drawn.

Selection of determinants

The determinants studied in relation to productive and sustained employment were those measured in the STREAM questionnaire. These concepts were included on the basis of literature and theoretical review, as well as expert opinion [1]. In the STREAM study design it was a goal to keep the questionnaire as similar as possible at each wave, and thus measuring a fixed set of concepts at each wave. However, with the set of determinants studied much variance in productive and sustained employment was left unexplained. For instance, only 38% of the variance in physical health was explained by demographic factors, work-related factors, work engagement, and physical health in the prior year (chapter 2). Similarly, demographic factors, type of work, mental and physical health, and work ability in the prior year only explained 25% of the variance in work ability (chapter 3).

Therefore, other factors that were not studied also explain variance in productive and sustained employment. The definition of health that places the ability of an individual to adapt and self-manage central, proposed by Huber and colleagues, has received increasing attention in the past few years [2]. Linked to this, the capability approach, which proposes that achieving valuable outcomes requires capabilities and real opportunities, can be applied in the field of occupational health [3-4]. Capabilities and

the ability to adapt are concepts that may be of particular interest for an older working population trying to achieve functional and employment outcomes. Consequently, although it is a strength of the STREAM study design that the included concepts were repeatedly assessed because this allowed for longitudinal and repeated analyses, a limitation is that the role of such novel concepts could not be explored.

Importance of effects

The analyses presented in this thesis pertain to average individual effects. These can be interpreted as the average increase in productive and sustained employment that is expected for an individual if the risk factor were to be reduced by one unit. Depending on the extent to which a risk factor is present in the population, e.g., the extent to which older Dutch workers have specific health problems or unfavourable work-related factors, a one unit change herein can be equated to substantial improvements in productive and sustained employment on the population level [5].

The STREAM sample was purposefully selected and is not a representative sample. This means that the presence of health problems or exposure to unfavourable work-related factors could be an over- or underrepresentation of the true prevalence hereof in the Dutch population of workers between 45 and 64 years. Accordingly, this thesis did not intend to generalise to the population level, and instead focused on the strength of relations [6]. This information can be used to determine population level implications if combined with prevalence data. It is expected that the strength of the relations will be the same across different study populations. It is, however, possible that specifically with regard to the influence of health on employment transitions variation exists across different welfare systems [e.g., 7-8].

For one particular workerwho is at low risk of the studied determinants, the expected improvements in productive and sustained employment found in our studies may not appear meaningful. In order to consider to what extent a determinant would need to change in order to achieve a relevant change in the outcome for an individual, a 'minimal important difference' (MID) can be calculated. In the field of health sciences an MID has been defined as half a standard deviation [9]. Applying this, the three studied psychosocial work-related factors and work engagement each would need to improve by 1.25 standard deviations in order to achieve an MID in mental health, whereas improving only work engagement by two standard deviations is also related to an MID in mental health (chapter 2). Furthermore, if all other determinants studied remained constant, an improvement in physical health by 2.42 standard deviations is related to an MID in work ability (chapter 3). In order to ensure uptake of workplace interventions among individual workers it can be beneficial to extrapolate findings in such a way. Namely, a relatively substantial change in the determinant is needed in order for

an individual worker to perceive the change in the employment outcome as relevant, which may motivate their active participation in an intervention.

Observational design and causal inference

It should be recognised that findings from this thesis are based on observational studies and thus that causality cannot be proven. The incidence of a health problem can be related to a subsequent or parallel reduction in productive employment, for example, but it cannot be ascertained that the change in health status was the [only] cause of the reduction in productive employment. Considering the complexity of the real world, it is likely that a cyclical process occurs by which, for example, the development of a psychological health problem is followed by a loss in productivity at work, which leads to further exacerbation of the psychological health problem. Intervention studies can shed light on whether changing one factor will lead to a change in another factor. For example, randomised controlled trials of workplace interventions can be used to test whether changing work-related factors will actually be followed by a change in productive and sustained employment. Alternative designs that do not require traditional randomisation can also be applied when studying workplace interventions [10]. The findings from this thesis are thus important to consider when designing workplace interventions, and indicate that a focus should be placed on psychological health problems and psychosocial work-related factors, as will be further described below.

INTERPRETING KEY FINDINGS

A selection of key insights from this thesis is more thoroughly described below. First, methodological insights on analysing longitudinal observational data are presented. Next, the prominent influence of psychological health problems on productive and sustained employment is discussed. Lastly, methodological choices and implications of the effect modification of psychosocial work-related factors are explained.

Analysis of change and relevant time frame

Although causal conclusions cannot be drawn, in order to move past purely cross-sectional conclusions when using observational data, different longitudinal analyses can be used. In various studies in this thesis the element of 'change' was explicitly taken into account, with the hope that such information could also be useful for the design of workplace interventions in the future. Often in observational studies the baseline value of the outcome of interest is adjusted for, to in part rule out reversed causality [e.g., 11,12]. In doing so the relation between a determinant and the *change* in an outcome is assessed [13]. The question should be postulated as to whether a determinant at one

point in time will be related to a change in the outcome during the follow-up, or whether a change in the determinant is more likely to precede a change in the outcome.

In STREAM, a relatively short window of older workers' lives in employment is captured. It is thus important to decide whether changes in productive and sustained employment can be expected within the follow-up. Much weaker associations were observed between health and one-year changes in the outcomes (seen in chapter 3-4), than between simultaneous changes in health and in the outcomes (seen in chapter 4). These findings suggest that a decrease in productive and sustained employment occurs rather directly after, or parallel to, the onset of a health problem. As the qualitative study in chapter 5 also showed, workers make adjustments in response to health problems, and thus likely do not experience great decreases anymore in the long-term. Following workers for a longer period of time with a higher repetition of data collection may allow for the initial onset of chronic health problems to be captured, and therefore their initial effects on productive and sustained employment. Decisions on whether to analyse change, and over which time-period, should be made on a case-by-case basis depending on the research question at hand and the relevance of 'change' in each context and time frame.

Prominent influence of psychological health problems

In various chapters psychological health problems had the largest influence on productive and sustained employment as compared to the other studied health problems. For unemployment and functioning at work, comparable to our assessment of work ability and productivity at work, this is in line with past findings [14,15]. When comparing the influence of different types of health problems, it is a main strength in this thesis that the same question was used to assess the presence of each type of health problem and that the findings pertain to the same study population. It is possible, however, that in the STREAM questionnaire the more severe mental health problems are being brought to light. Namely, the low prevalence (circa 3%) is more comparable to that of severe, and not mild, mental health problems in the Netherlands [16]; this could in part explain the strong relations found.

Nevertheless, the consistent findings in all of our studies support the notion that all, but in particular psychological, health problems form a serious risk for the productive and sustained employment of older workers. Even when considering the lower prevalence of psychological health problems than for example pain in Western populations, other studies have also recognised the strong effects of mental disorders on reduced productivity [14,17]. In line with this, an OECD report on mental health and work in the Netherlands also points out that there is too little attention for workers with mental health problems [18].

That psychological health problems have a greater influence on employment than other health problems could be due to the fact that these problems are less [well] treated. In the STREAM questionnaire, the presence of the health problem was assessed, not whether workers were seeking help for these or taking medication. A recent study showed that if workers with psychological health problems were to overcome barriers in seeking help, productivity loss could be greatly reduced [19]. Barriers to seeking help can be divided into structural barriers, e.g., recognising the need and arranging financial cover for treatment, and attitudinal barriers [20]. Related to attitudinal barriers, stigma that still surrounds mental health problems may also hamper disclosure [21,22]. Disclosure and open communication are in turn important for realising necessary accommodations. As was seen in chapter 5, for workers with health problems that are not visible to the naked eye, colleague and supervisor support seems to be more troublesome, for example a worker states how others may perceive him: 'I still have my feet, I still have all of my toes - there must be nothing wrong with me'. The importance of effective communication and problem-solving between workers and the workplace has also been empirically shown [e.g., 23]. In conclusion, consequences of health problems in the workplace may be more prominent among workers with psychological health problems due to issues around treatment, stigma, disclosure, and communication.

Effect modification of psychosocial work-related factors

In various chapters effect modification was studied. This can be tested by determining whether the synergistic effect of two risk factors is greater than their sum or their product. When an interaction term is incorporated in a linear regression analysis, departure from additivity is tested. In logistic regression analyses, in standard statistical packages, creating an interaction term often results in the calculation of departure from multiplicity. 'Relative excess risk due to interaction' (RERI) terms can be calculated in order to determine departure from additivity in logistic regression analyses [24]. Alongside the easy interpretation of the RERI and thus the interaction effects, in public health studies and in the field of occupational epidemiology it has been advised to focus on departure from additivity [25-27]. In this thesis it was shown that the adverse effects of unfavourable psychosocial work-related factors and health problems for productive and sustained employment *together* is greater than the sum of their individual effects.

Although differences between health problems were seen in their influence on employment, the modifying role of psychosocial work-related factors was seen for all types of health problems. Similarly, in a recent mixed-methods study, autonomy was found to be important for work participation among workers with cardiovascular disease, osteoarthritis, and depression [28]. The overall importance of psychosocial work-related factors for health and work ability is also supported by past findings [e.g., 29,30]. Interestingly, physical work load, in the various studies in this thesis, was not found to be an

important effect modifier. This could potentially be related to the healthy worker effect, whereby only those [healthiest] workers that can deal with high physical work load are the ones still occupied in such jobs [31]. Because the STREAM sample consists of persons aged 45 and over, it is certainly possible that those workers who could not handle a high physical work load already switched jobs at an earlier point in their career.

The moderating role of psychosocial work-related factors is especially interesting when considering the fact that as workers have to remain in the workforce for longer, they will also be confronted with chronic diseases. In this thesis it was shown that workers with health problems do indeed have a reduced productive and sustained employment, yet, among those with favourable psychosocial work-related factors this reduction was much lower. Thus workplace interventions could focus on promoting favourable psychosocial factors for all workers, or specifically for workers with chronic health problems.

RECOMMENDATIONS

Recommendations for researchers

Integrating methods and units of analysis

Using multiple methods, i.e., qualitative and quantitative, and focusing on different units of analysis, i.e., micro, meso, and macro, to answer research questions pertaining to complex phenomena should become the norm. Conducting a qualitative study within this thesis was of great added value: this allowed for new concepts to be explored and provided input for later quantitative studies. For example, this brought us to study whether work-related factors were quantifiable effect modifiers in the health-employment relation. The use of quantitative analyses can also be further expanded upon by combining self-report questionnaire data to tax registries, which can provide more detailed work status information.

Productive and sustained employment can also be studied by analysing different units: micro (e.g., individual), meso (e.g., social network, organisational), and macro (e.g., culture, country). For example, case study techniques can be used that integrate data gathered from an individual's perspective with data collected from his or her surroundings. Alongside the collection of self-report quantitative and qualitative data, a worker's colleagues and supervisors can be interviewed, and workplace policies and welfare system regulations can be studied. By integrating different units of analysis the 'how' and 'why' questions surrounding a process, e.g., of becoming unemployed, can be better understood.

Evidence from interventions

With the knowledge that work-related factors, work engagement, and coping style are important for the productive and sustained employment of older workers [with health problems], more evidence is needed on how to successfully change these factors. The findings from this thesis bring forth questions surrounding the underlying reasons for which some workers are highly engaged and have a favourable coping style, whereas others do not. The same can be asked for work-related factors: do these systematically differ across workplaces, or do workers in similar positions experience these differently? By tackling these issues, interventions at the workplace level or at the worker level can be introduced that try to change these factors. Evidence is then needed as to which workplace interventions are successful in modifying these factors in a real-world setting, and whether this results in the expected changes in productive and sustained employment. Evidence in the form of effect evaluations should be accompanied by process evaluations that can further aid the successful implementation of interventions in different workplaces.

Recommendations for employers and employees

Promoting favourable psychosocial quality of work

It is important that a favourable psychosocial work environment is promoted, as this contributes to productive and sustained employment. Several psychosocial work-related factors were found to be of direct importance, as well as to buffer the adverse effects of health, for productive and sustained employment. Employers can help promote favourable psychosocial working conditions, for example, high autonomy can allow for necessary adjustments to be more easily made in case an imbalance arises as a result of health problems. Furthermore, both employers and employees are responsible for creating good relationships, social support, and open communication in the workplace, as these factors can facilitate asking for help, obtaining needed adjustments, and could reduce the risk of stigma.

Tailored approach

It is essential that each worker's unique imbalance is considered and that employers refrain from generalising. Although on average workers with psychological health problems are more likely to have a reduction in productive and sustained employment, individual variation has to be considered. A tailored approach is necessary, especially as stigma still exists and hampers disclosure. As was shown in the qualitative study, generic accommodations that are often provided for in the workplace do not adequately address a workers' needs. Again, open communication between the employer and employee

may play a key role in finding appropriate adjustments that can make productive and sustained employment possible.

Recommendations for policy

In order to encourage workers [with health problems] to remain in employment, in a productive and engaged manner, putting in place a certain degree of flexibility may be necessary at a higher policy level, as this can trickle down to allow employees and their employers to take a tailored approach. For example, part time work may be a promising way to keep older workers from exiting the workforce early: many of the workers in the qualitative study presented in this thesis stated that working fewer hours per week was quite beneficial for remaining productive within their working hours. This was corroborated by the finding that autonomy buffered the adverse influence of health problems on productive and sustained employment.

Policy should address the fact that as older workers are being stimulated to remain in the labour force for longer, the number of workers facing chronic health problems will also increase. As this thesis showed that workers with health problems are more likely to have a reduced productivity and sustainability in the workforce, policies should be implemented that support employers in promoting a high psychosocial quality of work and tailoring provisions to workers' needs.

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SUMMARY
SAMENVATTING

SUMMARY

With an ageing population, increasing retirement ages, and a high prevalence of chronic health problems among older persons, it is important to understand how older workers [with health problems] can remain in productive and sustained employment. Accordingly, the following research questions were addressed in this thesis:

1. What is the influence of work-related factors and work engagement on health?
2. To what extent does health influence productive and sustained employment?
3. Do work-related factors and coping style modify the influence of health on productive and sustained employment?

Data from older (45-64 years) employees that participated in the Study on Transitions in Employment, Ability and Motivation (STREAM) were used to answer these research questions. STREAM is an observational longitudinal questionnaire study.

What is the influence of work-related factors and work engagement on health?

In chapter 2, using data from two STREAM waves, the relation between baseline work-related factors and work engagement with health at one-year follow-up among older employees was analysed. Favourable psychosocial work-related factors, i.e., lower psychosocial job demands, higher autonomy, and higher social support, positively influence mental health. Several of these factors, i.e., lower psychosocial job demands and higher autonomy, also positively influence physical health. Lower physical work load has a positive effect on physical health but is unrelated to mental health. Higher work engagement has a strong positive influence on physical health and even more so on mental health. Only weak effect modification of work engagement on the association between work-related factors and health was found in chapter 2.

To what extent does health influence productive and sustained employment?

Productive employment encompassed work ability, productivity at work, and sickness absence in this thesis. In chapter 3 data from two STREAM waves were used to determine the association of mental and physical health with work ability of older employees. This study showed that poor mental and especially physical health are associated with lower work ability one year later.

In chapter 4, three waves of STREAM data were used and different statistical methods were applied to test the association of health problems with work ability and productivity at work at one-year follow-up. Seven different chronic health problems were studied: severe headache or migraines, diabetes mellitus, and musculoskeletal, circulatory, respiratory, digestive, and psychological health problems. A worker with any of these health problems was found to have a lower work ability at one-year follow-up than a worker without these health problems. Smaller and fewer relations were found

for productivity at work: only workers with musculoskeletal and psychological health problems have a lower productivity at work at one-year follow-up as compared to workers without these health problems.

Especially a change in health status within one year is related to a change in work ability and productivity at work during that same year; the relation between the stable presence or absence of a health problem with a one-year change in these outcomes is weaker. The largest influence is of incident psychological health problems: these workers have, on average, a 1.48 point decrease in work ability and 0.92 point decrease in productivity (both measured on scales from 0-10) during one-year follow-up.

A qualitative study on the relation between health and productivity is described in chapter 5. In this study health was found to negatively affect productivity when an imbalance is created in a worker's demands and resources, necessary adjustments are not made in response to this, and barriers are present. In line with findings from chapter 4, an important barrier to maintained productivity was a lack of psychological well-being.

In chapter 6, the relation of the seven aforementioned chronic health problems at baseline with sickness absence at follow-up was assessed. The presence of a health problem is related to an increased likelihood of high sickness absence, defined as more than 9 cumulative days over the past 12 months. Workers with psychological health problems, as compared to those without psychological health problems, again have the greatest increased likelihood of high sickness absence at follow-up (odds ratio (OR)=3.67), followed by workers with digestive (OR=2.07) and musculoskeletal (OR=1.98) health problems.

In chapter 7 the influence of the seven chronic health problems on early exit from the workforce during three-year follow-up was studied. Employees with health problems, excluding circulatory, were found to have an increased risk of exiting the workforce via disability benefits. In accordance with the studies on productive employment, the greatest risk exists for workers with psychological health problems (hazard ratio (HR)=2.79), followed by diabetes mellitus (HR=2.19) and musculoskeletal health problems (HR=2.43). Only workers with psychological (HR=2.58) and circulatory (HR=1.35) health problems have an increased risk of unemployment, and only those with psychological (HR=1.57) and musculoskeletal (HR=1.23) health problems have an increased risk early retirement.

Do work-related factors and coping style modify the influence of health on productive and sustained employment?

In chapter 3 the modifying role of coping style in the health-work ability association was also studied. This modifying role was found to be quite marginal and was overshadowed by the main effects that health and coping style had on work ability. Specifically, workers, regardless of their health status, with an avoidant coping style have a lower work ability and those with an active coping style have a higher work ability.

Findings from the qualitative study described in chapter 5 corroborate the conclusion that coping style is of direct importance for productive employment. For example, an influential factor for obtaining necessary adjustments is the ability to ask colleagues or supervisors for help, reflecting a non-avoidant but active coping style.

Furthermore, in chapter 5 it was also shown that work-related factors influence whether poor health results in reduced productivity. In almost all cases poor health led to an imbalance in resources and demands among interviewees. However, whether necessary adjustments were then made depended in part on work-related factors. For example, in some cases workers were required to change jobs or specific tasks in light of the new imbalance, whereas other workers had a high level of autonomy at work that allowed them to make necessary adjustments- such as having colleagues take over tasks for them. The type of adjustments that were made could also be in the work domain, e.g., tangible alterations to workplaces, or work schedules could be amended.

Whether work-related factors modified the effects of health on productive and sustained employment was quantified in chapter 6 and chapter 7. The findings from these studies are similar: low psychosocial job demands, high autonomy, and high social support came forth as factors that buffer the influence of an array of different health problems on sickness absence and on early exit via disability benefits. In terms of risk, for example, for workers with psychological health problems and high psychological job demands the risk of high sickness absence (>9 cumulative days in 12 months) is 7.04 (OR), whereas for those with low psychological job demands this is 3.27 (OR). Similarly, for disability benefits, this risk is 5.46 (HR) as compared to 2.63 (HR). A slight increased risk of unemployment and early retirement with unfavourable work-related factors was observed, but no strong evidence of effect modification of health problems by these factors was found.

Conclusions

In chapter 8 the main findings were presented, considerations and key insights were discussed, and recommendations for different stakeholders were presented. On the basis of the studies presented in this thesis the following can be concluded:

- Workers with a high work engagement have a better physical and especially mental health after one year than workers with a low work engagement;
  - the positive influence of work engagement on health is more pronounced than that of favourable work-related factors on health.
- Workers with active and non-avoidant coping styles have a better work ability than those with non-active and avoidant coping styles.
- Poor health has an adverse influence on productive and sustained employment;

  - this influence differs between health problems, workers with psychological health problems had the greatest reduction in productive and sustained employment,
  - this influence also differs between facets of productive and sustained employment, and is especially seen for work ability, sickness absence, and disability benefits.
- Favourable psychosocial work-related factors are beneficial for productive and sustained employment;
  - this is especially the case among workers with chronic health problems.
- Longitudinal observational studies allow for different analyses to be conducted;
  - it is, however, not always necessary to 'adjust for baseline' values of the outcome of interest, this depends on the interest in change and the relevance hereof in the given time frame,
  - when studying effect modification, assessing departure from additivity may be more applicable than departure from multiplicity.
- Future research should integrate quantitative and qualitative techniques when studying complex processes such as how older workers can remain in productive employment for longer and in good health. Analyses of different units should also be integrated, e.g., the individual, organisation, and social system.
- Findings from this thesis provide useful input for the development of workplace interventions; in turn more evidence is needed on effective workplace interventions.
- Employers and employees should work together to create favourable psychosocial working conditions.
- Tailored approaches are necessary for workers with health problems; generic accommodations may not be effective. The individual's imbalance needs to be taken into consideration.
- As more employees will face chronic health problems at the workplace in the years to come, policies should be put in place that leave room for the flexibility necessary for favourable psychosocial work-related factors to be stimulated and for tailored accommodations to be made.

SAMENVATTING

Door de vergrijzing, verhoging van de pensioenleeftijd en hoge prevalentie van chronische gezondheidsproblemen onder ouderen is het van belang om te begrijpen hoe oudere werknemers [met gezondheidsproblemen] langer en productief door kunnen werken. Naar aanleiding hiervan zijn de volgende onderzoeksvragen opgesteld in dit proefschrift:

1. Wat is de invloed van werkfactoren en bevlogenheid op gezondheid?
2. In welke mate beïnvloedt gezondheid duurzame inzetbaarheid?
3. Modificeren werkfactoren en copingstijl de invloed van gezondheid op duurzame inzetbaarheid?

Het vermogen om langer gezond en productief te kunnen doorwerken wordt aangeduid als 'duurzame inzetbaarheid'. In dit proefschrift zijn gegevens gebruikt van oudere (45-64 jaar) werknemers die deel hebben genomen aan STREAM ('Study on Transitions in Employment, Ability and Motivation'). STREAM is een observationele longitudinale vragenlijststudie.

Wat is de invloed van werkfactoren en bevlogenheid op gezondheid?

In hoofdstuk 2 is met twee STREAM-metingen het verband tussen werkfactoren en bevlogenheid op baseline met gezondheid na één jaar follow-up onderzocht. Hieruit bleek dat gunstige psychosociale werkfactoren, d.w.z. lage psychosociale taakeisen, hoge autonomie en hoge sociale steun, een positieve invloed hebben op mentale gezondheid. Sommige van deze factoren, d.w.z. lage psychosociale taakeisen en hoge autonomie, hebben ook een positieve invloed op fysieke gezondheid. Lage fysieke taakeisen hebben een positieve invloed op fysieke gezondheid, maar houden geen verband met mentale gezondheid. Bevlogen werknemers hebben ten opzichte van werknemers die minder bevlogen zijn een betere fysieke gezondheid en vooral een betere mentale gezondheid. Ook is uit deze studie gebleken dat bevlogenheid het effect van werkfactoren op gezondheid slechts marginaal modificeert.

In welke mate beïnvloedt gezondheid duurzame inzetbaarheid?

Werkvermogen, productiviteit op werk, ziekteverzuim en de daadwerkelijke duur van participatie in betaald werk zijn concepten die onder duurzame inzetbaarheid vallen. In hoofdstuk 3 is onderzocht wat het verband is tussen mentale en fysieke gezondheid met werkvermogen, gebruikmakend van data van twee STREAM-metingen. Hieruit kwam naar voren dat slechte mentale en vooral slechte fysieke gezondheid verband houden met een lager werkvermogen in het volgende jaar.

In hoofdstuk 4 zijn drie STREAM-metingen en verschillende statistische methoden gebruikt om de relatie van gezondheidsproblemen met werkvermogen en met pro-

ductiviteit op het werk na één jaar in kaart te brengen. Zeven verschillende chronische gezondheidsproblemen zijn onderzocht: bewegingsapparaatklachten, ernstige hoofdpijn en migraine, hart- en vaatziekten, respiratoire aandoeningen, diabetes mellitus, maag- en darmklachten en psychische gezondheidsproblemen. Werknemers met een gezondheidsprobleem hebben een lager werkvermogen in het daarop volgende jaar dan werknemers zonder een gezondheidsprobleem. Minder sterke verbanden zijn gevonden tussen gezondheidsproblemen en productiviteit op het werk: alleen werknemers met bewegingsapparaatklachten en psychische gezondheidsproblemen hebben een lagere productiviteit na één jaar follow-up ten opzichte van werknemers zonder deze gezondheidsproblemen.

Vooral wanneer er een verandering in de gezondheid van werknemers plaats vindt in één jaar, vindt er ook een verandering in werkvermogen en productiviteit op het werk plaats in datzelfde jaar; de stabiele aanwezigheid of afwezigheid van een gezondheidsprobleem houdt minder sterk verband met een verandering in deze uitkomsten binnen één jaar. Het grootste effect is gevonden voor de incidentie van psychische gezondheidsproblemen: deze werknemers hebben gedurende één jaar follow-up een daling van gemiddeld 1.48 punten in werkvermogen en van 0.92 punten in productiviteit (beide gemeten op schalen van 0-10).

Een kwalitatieve studie naar de invloed van gezondheid op productiviteit is omschreven in hoofdstuk 5. Hierin is gevonden dat gezondheid productiviteit negatief beïnvloedt als er een disbalans is ontstaan tussen wat een werknemer kan en moet (bronnen en eisen), de benodigde aanpassingen om deze balans terug te krijgen niet gemaakt worden of bepaalde ongunstige factoren aanwezig zijn. In overeenstemming met de bevindingen uit hoofdstuk 4, bleek dat wanneer werknemers psychisch problemen hadden dit het vermogen om productief te kunnen blijven verhinderden.

In hoofdstuk 6 is de relatie tussen de hierboven genoemde zeven chronische gezondheidsproblemen op baseline met het ziekteverzuim gedurende één jaar follow-up onderzocht. Werknemers met een gezondheidsprobleem hebben een verhoogde kans om veel te verzuimen, gedefinieerd als meer dan 9 dagen over het afgelopen jaar. Werknemers met psychische gezondheidsproblemen, ten opzichte van werknemers zonder psychische gezondheidsproblemen, hebben opnieuw de grootste kans op veel ziekteverzuim gedurende follow-up (odds ratio (OR)=3.67), gevolgd door maag- en darmklachten (OR=2.07) en bewegingsapparaatklachten (OR=1.98).

In hoofdstuk 7 is de invloed van de zeven chronische gezondheidsproblemen op vervroegde uittreding gedurende drie jaar follow-up onderzocht. Hierbij is gevonden dat werknemers met een chronisch gezondheidsprobleem, behalve hart- en vaatziekten, een verhoogd risico hebben om arbeidsongeschikt te worden. In overeenstemming met de studies die hierboven beschreven zijn, is het risico het grootst voor werknemers met psychische gezondheidsproblemen (hazard ratio (HR)=2.79), gevolgd door werkne-

mers met diabetes mellitus (HR=2.19) en bewegingsapparaatklachten (HR=1.35). Alleen werknemers met psychische gezondheidsproblemen (HR=2.58) en hart- of vaatziekten (HR=1.35) hebben een verhoogd risico om gedurende de follow-up werkloos te worden en alleen degene met psychische gezondheidsproblemen (HR=1.57) en bewegingsapparaatklachten (HR=1.23) hebben een verhoogd risico om met vroegpensioen te gaan.

Modificeren werkfactoren en copingstijl de invloed van gezondheid op duurzame inzetbaarheid?

Of copingstijl de invloed van gezondheid op werkvermogen modificeert is ook onderzocht in hoofdstuk 3. Het gevonden modificatie-effect was marginaal en werd overschaduwd door de directe effecten die gezondheid en copingstijl op werkvermogen hebben. Er werd namelijk gevonden dat voor werknemers, onafhankelijk van hun gezondheidsstatus, een vermijdende copingstijl gepaard gaat met een lager werkvermogen en een actieve copingstijl met een hoger werkvermogen.

Bevindingen van de kwalitatieve studie omschreven in hoofdstuk 5 bevestigen het beeld dat copingstijl van direct belang is voor de duurzame inzetbaarheid van werknemers: een belangrijke factor voor het verkrijgen van benodigde aanpassingen is het durven en kunnen vragen om hulp van collega's of leidinggevende, wat een niet-vermijdende en actieve copingstijl vereist.

In hoofdstuk 5 is ook naar voren gekomen dat werkfactoren een rol spelen in de relatie tussen gezondheid en productiviteit. In bijna alle gevallen resulteren gezondheidsproblemen in een disbalans tussen wat werknemers kunnen en moeten doen. Of benodigde aanpassingen dan gemaakt worden hangt voor een deel af van werkfactoren. Sommige werknemers werden bijvoorbeeld verplicht om van baan of taak te veranderen door de disbalans, terwijl er bij andere werknemers een hoge mate van autonomie bestond waardoor zij zelf handige aanpassingen konden maken, zoals collega's vragen bepaalde taken over te nemen. Andere voorbeelden van aanpassingen om de productiviteit te behouden bij werknemers met gezondheidsproblemen in het werk domein zijn het aanpassen van de fysieke omgeving, zoals de werkplek, of het aanpassen van werkschema's.

In hoofdstuk 6 en hoofdstuk 7 is de effect modificatie van werkfactoren in de gezondheid-duurzame inzetbaarheid relatie gekwantificeerd. De bevindingen van deze twee studies zijn vergelijkbaar: lage psychosociale taakeisen, hoge autonomie en hoge sociale steun verminderen de invloed van verscheidene gezondheidsproblemen op ziekteverzuim en op arbeidsongeschiktheid. In termen van risico hebben bijvoorbeeld werknemers met psychische gezondheidsproblemen en hoge psychosociale taakeisen een grotere kans op veel ziekteverzuim (>9 dagen in de afgelopen 12 maanden) dan werknemers met psychische gezondheidsproblemen en lage psychosociale taakeisen (OR=7.04 en OR=3.27, respectievelijk). Voor arbeidsongeschiktheid zijn de bevindingen

erg vergelijkbaar, het risico is 5.46 (HR) ten opzichte van 2.62 (HR). Werknemers met ongunstige psychosociale werkfactoren hebben een marginaal verhoogd risico om uit te stromen via werkloosheid of vroegpensioen. Er is echter geen sterk bewijs gevonden voor een modificerend effect van werkfactoren op de relatie tussen gezondheid en deze vormen van uitstroom.

Conclusies

In hoofdstuk 8 zijn de hoofdbevindingen omschreven, kanttekeningen en kerninzichten besproken en aanbevelingen voor verschillende stakeholders gepresenteerd. Op basis van de verschillende studies uit dit proefschrift kan het volgende geconcludeerd worden:

- Bevlogen werknemers hebben na één jaar een betere fysieke en vooral betere mentale gezondheid dan werknemers die minder bevlogen zijn;
  - de positieve invloed van bevlogenheid op gezondheid is duidelijker dan dat van gunstige werkfactoren op gezondheid.
- Werknemers met een actieve en niet-vermijdende copingstijl hebben een hoger werkvermogen dan werknemers met een niet-actieve en vermijdende copingstijl.
- Slechte gezondheid heeft een nadelige invloed op duurzame inzetbaarheid;
  - de mate van invloed verschilt tussen gezondheidsproblemen, werknemers met psychische gezondheidsproblemen hebben de laagste duurzame inzetbaarheid,
  - de invloed van gezondheid op duurzame inzetbaarheid verschilt ook tussen facetten van duurzame inzetbaarheid, en is vooral te zien bij werkvermogen, ziekteverzuim en arbeidsongeschiktheid.
- Gunstige psychosociale werkfactoren hebben een positieve invloed op duurzame inzetbaarheid;
  - dit is vooral het geval voor werknemers met gezondheidsproblemen.
- Observationele longitudinale studies maken het mogelijk om verschillende analyses toe te passen;
  - het is echter niet altijd nodig om voor de baseline waarde van de uitkomst te corrigeren, dit hangt af van in hoeverre het onderzoek verandering in kaart tracht te brengen en van de relevantie hiervan binnen de follow-up duur,
  - wanneer er gekeken wordt naar effect modificatie is het vaak relevanter om te kijken of de effecten van twee determinanten samen groter zijn dan hun som, in plaats van groter dan hun product.
- Toekomstig onderzoek zou kwantitatieve en kwalitatieve methoden moeten integreren wanneer complexe processen onderzocht worden, zoals hoe ou-

dere werknemers langer, gezond en productief aan het werk kunnen blijven. Ook moet er gekeken worden naar verschillende niveaus: het individu, de organisatie en het sociale systeem.

- De bevindingen uit dit proefschrift bieden belangrijke inzichten voor het ontwikkelen van interventies op de werkvloer. Vervolgens is er meer kennis nodig over de effectiviteit van deze interventies.
- Werkgevers en werknemers moeten samen gunstige psychosociale werkomstandigheden creëren.
- Aanpassingen voor werknemers met gezondheidsproblemen moeten toegespitst zijn op hun unieke disbalans; generieke aanpassingen zullen niet altijd effectief zijn.
- Omdat meer werknemers te maken zullen krijgen met chronische gezondheidsproblemen op de werkvloer in de komende jaren, moet er beleid gemaakt worden dat werkgevers de ruimte geeft om gunstige psychosociale werkfactoren te stimuleren en om passende aanpassingen te maken voor werknemers.

DANKWOORD
ABOUT THE AUTHOR
LIST OF PUBLICATIONS
PHD PORFOLIO

DANKWOORD

Dit is een uitdagend, gevarieerd, leerzaam en, allerbelangrijkst, leuk promotietraject geweest. Dat ik de periode zo heb ervaren heb ik aan meerdere mensen te danken.

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ABOUT THE AUTHOR

Fenna Ruby Marie Leijten was born on September 25th, 1988 in The Hague, the Netherlands. Growing up in Pennington, New Jersey, USA, she completed her secondary education at Hopewell Valley Central High School. In 2006, she started studying at the Rijksuniversiteit Groningen (RUG), where she obtained parallel bachelor's degrees in American Studies and Psychology. After earning a master's degree in Social Psychology at the RUG in 2011, she started her PhD studies, jointly at the Department of Public Health (Erasmus MC) and at the Department of Work, Health and Care (Netherlands Organisation for Applied Scientific Research TNO). During her PhD, she completed a master's degree in Public Health at the Netherlands Institute for Health Sciences (Erasmus MC). In the last year of her PhD, she worked part time at TNO as a researcher on healthcare and participation. As of September 2015, she works as a researcher at the institute of Health Policy & Management (Erasmus University Rotterdam).

LIST OF PUBLICATIONS

2013

*Leijten F, van den Heuvel S, Geuskens G, Ybema JF, de Wind A, Burdorf A, Robroek S. How do older employees with health problems remain productive at work?: A qualitative study. Journal of Occupational Rehabilitation. 2013;23(1):115-24.

*Leijten FRM, van den Heuvel SG, Ybema JF, Robroek SJW, Burdorf A. Do work factors modify the association between chronic health problems and sickness absence among older employees? Scandinavian Journal of Work, Environment & Health. 2013;39(5):477-85.

*van de Vijfeijke H, Leijten FRM, Ybema JF, van den Heuvel SG, Robroek SJW, van der Beek AJ, Burdorf A, Taris TW. Differential effects of mental and physical health and coping style on work ability: A one-year follow-up study among aging workers. Journal of Occupational & Environmental Medicine. 2013;55(10):1238-43.

2014

*Leijten FRM, van den Heuvel SG, Ybema JF, van der Beek AJ, Robroek SJW, Burdorf A. The influence of chronic health problems on work ability and productivity at work: A longitudinal study among older employees. Scandinavian Journal of Work, Environment & Health. 2014;40(5):473-82.

Leijten FRM, Bolderdijk JW, Keizer K, Gorsira M, van der Werff E, Steg L. Factors that influence consumers' acceptance of future energy systems: The effects of adjustment type, production level, and price. Energy Efficiency. 2014;7(6):973-85.

Ybema JF, Geuskens GA, van den Heuvel SG, de Wind A, Leijten FRM, Joling CI, Blatter BM, Burdorf A, van der Beek AJ, Bongers PM. Study on Transitions in Employment, Ability and Motivation (STREAM): The design of a four-year longitudinal cohort study among 15,118 persons aged 45 to 64 years. British Journal of Medicine and Medical Research. 2014;4(6):1383-99.

Papageorgiou K, Vermeulen KM, Leijten FRM, Buskens E, Ranchor AV, Schroevers MJ. Valuation of depression co-occurring with a somatic condition: feasibility of the Time-Trade-Off task. Health Expectations. Online first (Nov 2014); doi: 10.111/hex.12303.

2015

*Leijten FRM, van den Heuvel SG, van der Beek AJ, Ybema JF, Robroek SJW, Burdorf A. Associations of work-related factors and work engagement with mental and physical health: a one-year follow-up study among older workers. Journal of Occupational Rehabilitation. 2015;25(1):86-95.

*Leijten FRM, de Wind A, van den Heuvel SG, Ybema JF, van der Beek AJ, Robroek SJW, Burdorf A. The influence of chronic health problems and work-related factors on loss of paid employment among older workers. Journal of Epidemiology & Community Health. Online first (Jun 2015); doi: 10.1136/jech-2015-205719.

van der Meer L, Leijten FRM, van den Heuvel SG, Ybema JF, de Wind A, Burdorf A, Geuskens GA. Company policies on working hours and night work in relation to older workers' work ability and work engagement: Results from a Dutch longitudinal study with 2 year follow-up. Journal of Occupational Rehabilitation. Online first (Aug 2015); doi: 10.1007/s10926-015-9599-9.

Submitted

de Wind A, Leijten FRM, Hoekstra T, Geuskens GA, Burdorf A, van der Beek AJ. Mental retirement? - Trajectories of work engagement preceding retirement among older workers.

Ybema JF, van der Meer L, Leijten FRM. Longitudinal relationships between organizational justice, productivity loss and sickness absence among older employees.

**In this thesis.*

PHD PORTFOLIO

Summary of PhD Training and Teaching

Name: Fenna RM Leijten

Erasmus MC Department: Public Health

Research School: Netherlands Institute of Health Sciences (NIHES)

PhD period: September 2011 - September 2015

Promotor: Prof Dr A Burdorf

Copromotors: Dr SJW Robroek (Erasmus MC) & Dr SG van den Heuvel (TNO)

	Year	Workload (ECTS)
1. PhD Training		
General academic skills		
Time and project management course for PhD students	2012	0.6
Research integrity for PhD students	2014	0.3
In-depth courses		
MSc. Health Sciences: Public Health, NIHES	2011-2013	70
'General Medicine' course, VUmc Amsterdam	2014	6
Work Disability and Prevention Training Program (Toronto)		
-Online course: introduction to work disability prevention	2014	0.6
-Online course: introduction to ethical challenges	2014	0.6
-Summer program: ethical challenges	2014	2.6
-Online course: introduction to methodological challenges	2015	0.6
-Online course: introduction to sociopolitical challenges	2015	0.6
-Summer program: methodological & sociopolitical challenges	2015	3.5
International conferences		
European Society for Health and Medical Sociology & German Association for Medical Sociology (DGMS) conference 'Health inequalities over the lifecourse,' Hannover: attendance and poster presentation 'How do older employees with health problems remain productive at work?: A qualitative study.'	2012	0.7
Work Disability Prevention and Integration conference 'Healthy ageing for a working society,' Groningen: attendance and poster presentation 'How do older employees with health problems remain productive at work?: A qualitative study.'	2012	0.9
Werkgroep Epidemiologisch Onderzoek Nederland (WEON) conference 'Epidemiologie in de wereldwijde gezondheidszorg: uitdagingen en methoden,' Utrecht: attendance and oral presentation 'Associations of work-related factors and work engagement with mental and physical health: A 1-year follow-up study among older workers.'	2013	0.9

STREAM symposium 'European cohort studies on healthy ageing at work,' Hoofddorp: attendance and oral presentation 'The influence of chronic health problems on work ability and productivity: A longitudinal study among older employees.'	2013	0.4
International Conference for Occupational Health and Work Organisation and Psychosocial Factors, Adelaide, Australia: attendance and oral presentation 'Do Common Health Problems Cause Decreased Work Ability and Productivity?: A Longitudinal Study Among Older Employees.'	2014	0.9
Nederlands Congres Volksgezondheid 'Decentralisatie en Gezondheid,' Rotterdam: attendance and poster presentation 'Proeftuin Beter Samen in Noord: Design en eerste resultaten.'	2015	0.6
International Conference for Integrated Care 'Complex Needs, Integrated Solutions.' Edinburgh, Scotland: attendance.	2015	0.9

Seminars and workshops

Leuftinklezing 'Duurzaam aan het werk,' Zeist: attendance.	2012	0.2
NSvP Kennisnetwerk Duurzame Inzetbaarheid Symposium Nijmegen: attendance.	2012	0.3
Body@Work Retraite 'Knowledge valorisation,' VUmc Amsterdam: attendance.	2013	0.1
Werkgroep Epidemiologisch Onderzoek Nederland pre-conference 'New developments in causal epidemiological research,' Utrecht: attendence.	2013	0.1
The Survey of Health, Ageing and Retirement in Europe wave 4 book launch, Brussels: attendance.	2013	0.1
'Priorities, issues and avenues for future research in occupational health' workshop, Högbo, Sweden: attendance.	2013	0.9
Netherlands Bureau for Economic Policy Analyses & Dutch Ministry of Social Affairs and Employment 'A working labourforce for older persons,' conference, the Hague: attendance.	2014	0.3

Other presentations

'How do older employees with health problems remain productive at work?: A qualitative study' oral presentation, Research meeting, Department of Public Health, Erasmus MC.	2013	0.02
'How do older employees with health problems remain productive at work?: A qualitative study' oral presentation, Job engineering symposium, TNO.	2013	0.02
'Longitudinal analyses using different GEE models' oral presentation, Longitudinal analyses methods meeting, Department of Public Health, Erasmus MC.	2013	0.02
'Longitudinal analyses using different GEE models: an example' oral presentation, Social epidemiology methods meeting, Department of Public Health, Erasmus MC.	2014	0.02
'Predictors of productivity loss and sickness absence' oral presentation, Dutch Ministry of Social Affairs and Employment.	2014	0.02
'The Dutch Study on Transitions in Employment, Ability and Motivation: Results thus far' oral presentation, Research meeting, Faculty of Health Sciences, La Trobe University Melbourne.	2014	0.02
'The influence of chronic health problems and work-related factors on loss of paid employment among older workers' oral presentation, Research meeting, Department of Public Health, Erasmus MC.	2015	0.02

'STREAM: The Study on Transitions in Employment, Ability and Motivation: The influence of health and work-related factors on sustainable employability' oral presentation, Dutch National Network on Chronic Diseases and Work.	2015	0.02

Didactic skills

'Teach the teachers' course Erasmus MC, part-qualification teaching.	2013	0.6
'Individual supervision' course Erasmus MC, part-qualification teaching.	2013	0.1

2. Teaching activities

Supervising practicals and excursions

Supervision of third year medical students''community projects'.	2013	0.6
Supervision of first year medical students''tutoraat'.	2013	1

Supervising master's theses

Thesis supervisor of a master student Work and Organizational Psychology, University of Utrecht. Thesis title 'The influence of coping on the health-work ability relationship'	2012-2013	2

Other

Intern supervision TNO, 'STREAM' project.	2012	0.5
Intern supervision TNO, 'de Omslag' project.	2015	1

TOTAL		98.66