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ORIGINAL ARTICLE

## Influence of physical and psychosocial working conditions for the risk of disability pension among healthy female eldercare workers: Prospective cohort

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### Abstract

**Aim:** To investigate the influence of physical and psychosocial working conditions on the risk of disability pension among eldercare workers. **Methods:** After responding to a questionnaire in 2005, 4699 healthy female eldercare workers – free from chronic musculoskeletal pain, depressive symptoms and long-term sickness absence – were followed for 11 years in the Danish Register for Evaluation of Marginalization. Time-to-event analyses estimated the hazard ratio (HR) for disability pension from physical exertion during work, emotional demands, influence at work, role conflicts, and quality of leadership. Analyses were mutually adjusted for these work environmental factors as well as for age, education, smoking, leisure physical activity and body mass index. **Results:** During follow-up, 7.6% received disability pension. Physical exertion and emotional demands were associated with risk of disability pension, and both interacted with age. In age-stratified analyses, older eldercare workers (mean age 53 years at baseline) with moderate and high physical exertion (reference: low) were at increased risk with HRs of 1.51, 95% CI [1.06–2.15] and 2.54, 95% CI [1.34–4.83], respectively. Younger eldercare workers (mean age 36 years at baseline) with moderate emotional demands (reference: low) were at decreased risk with an HR of 0.57, 95% CI [0.37–0.85]. **Conclusions:** While a higher level of physical exertion is a risk factor for disability pension among older female eldercare workers, a moderate level of emotional demands is associated with lower risk among the younger workers. The age of the worker may be an important factor when providing recommendations for promoting a long and healthy working life.

**Keywords:** Care worker, nurses, physical workload, psychosocial work environment, disability, age

### Introduction

The demographic changes in Europe with a growing proportion of elderly in the population have led to changes in national pension schemes towards increased retirement age. Although this may be a necessity for national economies, some individuals may not be able to work to a high age due to health problems and high work demands. Involuntary early retirement from the labour market in terms of disability pension is associated with costs and negative consequences for individuals, workplaces and societies.

Poor health is the strongest early predictor of disability pension later in life [1]. However, the work environment plays an important role in health-related early retirement from the labour market [2, 3]. High physical work demands and poor psychosocial working conditions are risk factors for poor health [4] that may lead to long-term sickness absence and early retirement. Studies from the Scandinavian countries with access to high-quality registers on work- and retirement-status at the individual level have shown in the general working population as well as in specific occupations that high physical workload is a risk

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factor for disability pension [5, 6]. Considering the psychosocial working conditions, previous studies have shown that low influence at work [3] and low social support [7] predicts increased risk of disability pension. Moreover, these findings are replicated in a systematic review by Knardahl and colleagues, who concluded that adverse psychosocial working conditions contribute to an increased risk of disability pension [8].

The European countries are facing a shortage of nurses and the increased proportion of elderly adds to the pressure on healthcare systems [9]. This is further challenged by the fact that healthcare work, e.g. at hospitals or in eldercare, can be both physically and mentally demanding. In the Danish eldercare sector, we have previously found that high physical exertion during healthcare work is associated with increased risk of developing [10] and sustaining [11] musculoskeletal disorders as well as long-term sickness absence [12]. Likewise, psychosocial working conditions – such as low influence at work – are associated with development of musculoskeletal disorders [13]. Other studies indicate that adverse psychosocial working conditions, such as low influence at work, poor quality of leadership, high emotional demands and high role conflicts are associated with increased risk of long-term sickness absence in employees with client-centred work tasks [14]. Such findings are important because poor health, expressed as sickness absence from work, can be an early predictor for later disability pension [15]. Contrary to these findings, a 15-year prospective cohort study among nurses in Denmark reported that work environment influenced the risk of disability pension only to a minor degree, and that the main prognostic factor was poor musculoskeletal health at baseline [1]. However, because the work environment can also contribute to poor musculoskeletal health such conclusions should be considered with care. Another way could be to investigate the influence of the work environment among currently healthy workers on the risk of future disability pension.

The inherent age-related changes in the physical capacity of the worker should also be considered in relation to healthcare work. Ageing is associated with a decrease of physical capacity, and from the age of 30 muscle strength starts to decline by 1–2% per year [16]. Thus, at the age of 60 the average healthcare worker will have lost more than a third of the initial muscle strength capacity. This may lead to an imbalance between physical work demands and the physical capacity of the individual worker. This imbalance increases the risk of a range of health-related consequences, especially in jobs characterized by high physical demands [17]. This was supported by Burr

and colleagues, showing that physical work demands interacted with age in relation to development of self-rated poor health in the general working population, where the consequences of high physical work demands were higher for older workers [18]. Thus, taking age into account in the interplay between physical work demands and health-related consequences seems vital. In the same population, Burr and colleagues found no significant interactions between psychosocial work factors and age for development of poor self-rated health [19]. Thus, a possible interaction with age may differ depending on the type of exposure in the working environment.

The aim of this study is to investigate the influence of the physical and psychosocial work environment for the risk of disability pension among healthy female eldercare workers. We hypothesized that adverse physical and psychosocial working conditions would be prospectively associated with increased risk of disability pension. We also tested for possible interactions with age, and based on the study by Burr and colleagues we hypothesized that physical working conditions would interact with age [18]. The analyses concerning the interaction between psychosocial working conditions and age were exploratory.

## Methods

### *Study design and population*

The design is a prospective cohort study with long-term register follow-up. Collection of the baseline data started ultimo 2004, but the main data collection took place in the spring of 2005. Questionnaires were sent to 12,744 eldercare workers of which 9949 (78%) responded. For the present analyses, we excluded male respondents ( $N = 234$ ) and workers who were not directly engaged in care services ( $N = 1021$ , of which some were also included in the male population of 234). Of the remaining population ( $N = 8952$ ), we excluded those who were not completely healthy ( $N = 4253$ ). The definition of being healthy was based on three criteria, 1) not having chronic musculoskeletal pain (>30 days during the last year) in the low back, neck/shoulders or knees (not in any of the regions) [20]; 2) having a normal score on the major depressive inventory (i.e. less than 20) [21]; and 3) being free from long-term sickness absence (Danish Register for Evaluation of Marginalization (DREAM) register) during the year prior to responding to the questionnaire [22]. All three conditions needed to be fulfilled. Thus, a total of 4699 healthy female eldercare workers were included. This comprised social and healthcare assistants, social and healthcare helpers, other care

Table I. Baseline characteristics of the 4699 healthy female eldercare workers. Characteristics of the age-stratified groups  $\leq$  and  $>$  45 years are also shown.

	All			age $\leq$ 45 years			age $>$ 45 years		
	Mean	SD	%	Mean	SD	%	Mean	SD	%
<i>N</i>	4699			2336			2363		
Age	44.7	10.3		36.2	6.6		53.1	4.9	
Sex									
Women			100			100			100
Men			0			0			0
BMI	24.6	4.2		24.7	4.5		24.6	4.0	
Smoking									
Yes			35.8			34.0			37.7
No			64.2			66.0			62.3
Leisure time physical activity									
Low			24.8			24.9			24.7
Moderate			45.3			45.7			44.9
High			29.9			29.4			30.4
Physical exertion during work (1–7)	3.6	1.1		3.7	1.1		3.6	1.1	
Psychosocial work environment (0–100)									
Emotional demands	43.6	18.1		42.9	17.9		44.3	18.4	
Influence at work	47.3	20.2		46.9	19.6		47.7	20.8	
Role conflicts	39.9	15.3		41.3	14.9		38.4	15.6	
Quality of leadership	59.3	21.3		59.2	21.4		59.4	21.3	

1–7: Seven point physical exertion scale from ‘very, very light’ to ‘very, very strenuous’. 0–100: Normalized COPSQ score, where 0 is lowest and 100 is highest. BMI = body mass index.

staff with no or short-term education and registered nurses/therapists. Table I shows the baseline characteristics on the included population of healthy female eldercare workers.

#### Ethical approval and data protection

The Danish Data Protection Agency was notified of and registered the study. According to Danish law, questionnaire- and register-based studies need neither approval from ethical and scientific committees nor informed consent. All data was de-identified and analysed anonymously.

#### Risk factors

**Physical work environment.** To obtain a global impression of the physical work demands, we asked about the perceived physical exertion during work based on Borg’s Rate of Perceived Exertion (RPE) scale, which in relation to the physical demands of healthcare work has shown predictive validity for development of musculoskeletal disorders [10] and long-term sickness absence [12]. The Borg RPE scale is the most validated tool to measure physical exertion in different contexts, e.g. during manual handling tasks [23]. Using a 7-point scale, participants replied to the question: ‘How would you rate your physical exertion while working with the patients?’ Participants replied on a scale of 1) very, very light; 2) very

light; 3) light; 4) somewhat strenuous; 5) strenuous; 6) very strenuous; and 7) very, very strenuous [24]. For the subsequent statistical analyses we trichotomized responses, where 1–3 were defined as ‘low physical exertion’, 4–5 as ‘moderate physical exertion’ and 6–7 as ‘high physical exertion’.

**Psychosocial work environment.** Using the Copenhagen Psychosocial Questionnaire (COPSQ), we assessed four distinct dimensions of the psychosocial work environment relevant for eldercare workers: 1) emotional demands (four items; Cronbach’s  $\alpha$ : 0.81); 2) influence at work (four items; Cronbach’s  $\alpha$ : 0.75); 3) role conflicts (four items; Cronbach’s  $\alpha$ : 0.66); and 4) quality of leadership (four items; Cronbach’s  $\alpha$ : 0.89) [13, 25]. Sample items for each of the four respective dimensions are as follows: 1) ‘Is your work emotionally demanding?’ 2) ‘Do you have a large degree of influence concerning your work?’ 3) ‘Are contradictory demands placed on you at work?’ 4) ‘To what extent would you say that your immediate superior is good at work planning?’ Participants replied on a 5-point Likert scale. The sum of the scales were normalized on a scale of 0–100 according to the COPSQ test score manual [13, 25]. For the subsequent statistical analyses we trichotomized responses based on the response quartiles, where the lower quartile was defined as ‘low’, the two middle quartiles as ‘moderate’ and the upper quartile as ‘high’.

### Outcome

Registered disability benefit payments were obtained from the DREAM register, which was initiated in 1991 [26]. The DREAM register contains weekly information on granted disability benefits, sickness absence, employment, education, etc. for Danish residents. It is only possible for residents with permanent full or partial loss of workability to obtain disability benefits. The municipality decides whether a person is entitled to disability benefits. Normally the person goes through a process with involvement of different departments in the municipality (work-, health-, education-, and social-department) before disability benefits can be granted. A full disability pension entails a complete dropout from the labour market. However, there are also disability benefits with partial work or work on certain conditions. Because all of these conditions require loss of workability, we defined ‘disability pension’ in the present study as receiving any type of registered disability benefit, requiring permanent full or partial loss of workability. This included flex jobs and variants hereof, sheltered jobs, and full disability pension comprising a total of 13 categories of disability benefits payment in the DREAM register.

### Confounders

Potential confounders from the baseline questionnaire included age (continuous variable), education (categories of specific healthcare education, e.g. social and health care assistant, social and health care helper, nurse, nurse aide, therapist, none), body mass index (BMI) (kg/m<sup>2</sup>, continuous variable), smoking status (dichotomous variable depicting smoker/non-smoker), and leisure time physical activity (low, moderate, and high level) [27]. These confounders were chosen as both education and lifestyle are associated with the risk of disability pension.

### Statistical analysis

The Cox proportional hazards model was used to estimate hazard ratios (HR) and 95% confidence intervals (95% CI) of the physical and psychosocial work environment variables for receiving disability pension during follow-up. The follow-up time was 11 years (until week 26 of 2016) or until censoring, which occurred in the case of death, voluntary early retirement pension, state pension, or emigration. If an individual had a registered disability benefit payment in any given week within the follow-up period, the survival times were non-censored and referred to as event times. The estimation method was maximum likelihood and the PHREG procedure of SAS

9.4 (SAS Institute, Cary, NC, USA) was used. We used the LIFETEST procedure to produce Kaplan–Meier curves for a visual representation of the hazards.

The analyses were mutually adjusted for physical exertion and the four psychosocial work environment variables. In addition to the mutual adjustments for the work environment variables, Model 1 was adjusted for age and Model 2 for age, education, smoking, BMI, and leisure time physical activity. Based on the work by Burr and colleagues [18], we also tested each of the work environment variables for interaction with age. In case of significant interaction, we performed age-stratified analyses.

### Results

Table I shows the baseline characteristics of the 4699 healthy female eldercare workers as well as for the age-stratified groups  $\leq$  and  $>$  45 years. The mean age of the study population was 45 years and the mean BMI in the normal range, i.e. below 25. About one third was smokers and the majority had a moderate level of leisure time physical activity. The younger and older workers were on average 36 and 53 years, and were quite comparable in terms of lifestyle and work.

During 11 year follow-up, 7.6% received disability pension. Table II shows the overall results for the risk of disability pension *before* testing for possible interactions. In these analyses only physical exertion and emotional demands were significantly associated with disability pension. In subsequent interaction analyses, significant interactions between age and physical exertion ( $p < 0.05$ ) as well as age and emotional demands ( $p < 0.05$ ) were found. Thus, age-stratified analyses were performed. None of the other psychosocial variables interacted with age.

Table III shows the age-stratified analyses for the variables that significantly interacted with age. Among the older eldercare workers, moderate and high physical exertion (reference: low) were risk factors for disability pension during follow-up, HRs 1.51, 95% CI [1.06–2.15] and 2.54, 95% CI [1.34–4.83], respectively. Among the younger eldercare workers, moderate emotional demands (reference: low) were in the fully adjusted model associated with decreased risk of disability pension during follow-up, HR 0.57, 95% CI [0.37–0.85].

### Discussion

The main finding of this study is that age interacted with physical exertion and emotional demands in the risk of disability pension during 11 year follow-up.

Table II. Hazard ratios for disability pension during 11 year follow-up among the 4699 healthy female eldercare workers.

	<i>N</i>	Model 1	Model 2
Physical exertion			
Low	1891	1	1
Moderate	2392	1.22 (0.96–1.54)	1.15 (0.89–1.48)
High	236	<b>1.83 (1.18–2.85)</b>	<b>1.67 (1.05–2.66)</b>
Emotional demands			
Low	978	1	1
Moderate	2521	<b>0.72 (0.55–0.94)</b>	0.87 (0.65–1.16)
High	1144	<b>0.69 (0.49–0.96)</b>	0.88 (0.62–1.26)
Influence at work			
High	1285	1	1
Moderate	2139	1.02 (0.78–1.32)	1.04 (0.79–1.37)
Low	1221	0.88 (0.64–1.21)	0.82 (0.59–1.15)
Role conflicts			
Low	987	1	1
Moderate	2126	0.81 (0.61–1.08)	0.89 (0.65–1.20)
High	1538	0.99 (0.72–1.35)	1.12 (0.80–1.57)
Quality of leadership			
High	1360	1	1
Moderate	2057	0.81 (0.62–1.05)	0.82 (0.62–1.07)
Low	1126	0.87 (0.64–1.18)	0.91 (0.66–1.26)

Model 1: Controlled for age + mutually adjusted for all five working environment variables.

Model 2: Controlled for the same as Model 1 + education + smoking + BMI + leisure time physical activity.

Table III. Age-stratified analyses with hazard ratios for disability pension during 11 year follow-up among younger ( $\leq 45$  years, mean age 36 years) and older workers ( $> 45$  years, mean age 53 years). Interactions with age were only significant for physical exertion and emotional demands, respectively.

	<i>N</i>	Model 1	Model 2
<b><math>\leq 45</math> years</b>			
Physical exertion			
Low	898	1	1
Moderate	1244	0.95 (0.68–1.35)	0.80 (0.55–1.17)
High	130	1.46 (0.77–2.77)	1.03 (0.52–2.02)
Emotional demands			
Low	493	1	1
Moderate	1286	<b>0.48 (0.33–0.71)</b>	<b>0.57 (0.37–0.85)</b>
High	532	<b>0.52 (0.32–0.84)</b>	0.71 (0.43–1.19)
<b><math>&gt; 45</math> years</b>			
Physical exertion			
Low	993	1	1
Moderate	1148	<b>1.49 (1.08–2.06)</b>	<b>1.51 (1.06–2.15)</b>
High	106	<b>2.19 (1.19–4.03)</b>	<b>2.54 (1.34–4.83)</b>
Emotional demands			
Low	485	1	1
Moderate	1235	1.02 (0.69–1.51)	1.30 (0.85–1.97)
High	612	0.87 (0.55–1.40)	1.10 (0.66–1.84)

Model 1: Controlled for age + mutually adjusted for all five working environment variables.

Model 2: Controlled for the same as Model 1 + education + smoking + BMI + leisure time physical activity.

While higher levels of physical exertion were risk factors for disability pension among older female eldercare workers, a moderate level of emotional demands was associated with lower risk among younger eldercare workers. In the present study, influence at work, role conflicts and quality of leadership were not significant risk factors for disability pension.

Physical work demands interacted with age in relation to the risk of disability pension during 11 year follow-up. In the age-stratified analyses, only older workers were at increased risk. In the fully adjusted statistical model, moderate and high physical exertion among older workers were associated with 51% (HR 1.51) and 154% (HR 2.54) increased

risk, respectively. The present results elaborate on previous findings showing increased risk of developing poor general health and musculoskeletal disorders, as well as long-term sickness absence from high physical work demands among healthcare workers [10–12] and in the general working population [4, 18, 28]. Some of the previous studies also included age-stratified analyses. In the general working population of Denmark, high physical work demands were associated with development of self-rated poor health among older, but not younger, workers [18]. Together with the present results, these findings could indicate several things. First, younger workers may be more resilient to high physical work demands. Physical capacity, in terms of muscle strength, peaks around 30 years of age and declines 1–2% per year hereafter [16]. Thus, older workers may be less fit than younger workers to deal with high physical work demands. Second, in Denmark, granted disability benefits require that there is a permanent full or partial loss of workability. Poor health and workability from high physical work demands may take decades to fully develop, and younger workers exposed to high physical demands may therefore be less likely to initially fall into this category. Third, the process of achieving disability benefit in Denmark is long. Normally the person goes through a process that often takes several years with involvement of different departments in the municipality, including the work-, health-, education-, and social department, before disability benefits can be granted. Therefore, younger workers applying for disability benefits will have to go through a number of different attempts to improve workability. Thus, although younger workers were not at increased risk of disability pension from high physical work demands in the present study with 11 year follow-up, this does not exclude that they are at increased risk of developing poor health from high physical work demands. A recent study from our research centre showed that both younger and older workers in the general working population were at increased risk of long-term sickness absence from combined factors related to the physical working environment, including physical exertion during work, poor working postures, bodily fatigue after work, and work-limiting pain [4]. Thus, in comparison with long-term sickness absence or a decline in self-rated health, granted disability pension may simply reflect an endpoint with a worse and more permanent loss of workability.

For psychosocial working conditions, emotional demands interacted with age, and in the age-stratified analysis we found a protective effect from medium levels of emotional demands in predicting risk of disability pension. This finding may seem surprising

at first glance, but it seems plausible that certain levels of emotional demands can be construed as positive occupational challenges that may provide employees with the opportunity to develop new skills and abilities to deal successfully with emotionally demanding situations [29]. Successful mastery of occupational challenges may contribute to enhancing the experience of meaning at work, which again has been found to be negatively associated with risk of disability retirement [30].

We were surprised not to find significant associations between the three other indicators of psychosocial working conditions and risk of disability pension: influence at work, role conflicts, and quality of leadership. In contrast to the present study, some previous studies have shown an association between low influence at work and disability pension [3, 8]. There may be several reasons for the differences between findings. First, the present study used any type of registered disability benefit, requiring permanent full or partial loss of workability as endpoint, whereas another Danish study used only full disability pensioning as endpoint [3]. Second, there were differences in the duration of follow-up in the two studies (11 years vs. 5.9 years), and a possible change in psychosocial working conditions over the years may have increased the risk of null-findings. Third, we excluded respondents with ill health (i.e. musculoskeletal disorders, depression, and long-term sickness absence) from the present study, which may have led to more conservative risk estimates than in the other study, where respondents with symptoms of ill health were not excluded. The advantage of excluding respondents with symptoms of ill health is that we reduce the risk of observing spurious associations between working conditions and risk of disability pension that in effect may reflect the ill health of respondents. The disadvantage of excluding respondents with symptoms of ill health may be that we provide more conservative associations between working conditions and risk of disability pension, because the healthy population may be more robust than those who have already developed ill health from the poor working conditions. Fourth, the previous Danish study had a sample size of more than 40,000 individuals from four different occupational groups, whereas the present study included only 4000 healthy female healthcare workers. The difference in sample size will per se influence the likelihood of statistically significant findings. Finally, different psychosocial risk factors may simply exist in different occupational groups.

Our study has both strengths and limitations. The inclusion of a homogenous group of healthy

female eldercare workers has several methodological advantages. First, poor health at baseline may lead to misclassification bias of exposures in the working environment, and simply adjusting for health status at baseline as a confounder may not fully control for this. For this reason, we excluded those with poor health at baseline. Second, the study population reduces the bias from socioeconomic confounding as they were all eldercare workers. Third, the type of exposure at work leading to the perception of physical exertion – e.g. patient handling – is quite uniform between eldercare workers. By contrast, studies in the general working population asking about perceived physical exertion may include a mixture of static and dynamic work tasks with manual material handling and/or handling of humans depending on the specific occupation. However, there are also limitations to our study. First, because of the inclusion and exclusion criteria, the results should be interpreted only in relation to female healthcare workers and cannot be generalized to the general working population or other occupations with high physical work demands. Second, the inclusion and exclusion criteria did not allow us to investigate the influence of poor health at baseline in relation to disability pension. However, as it is known that poor health per se is a predictor of later disability pension [1], this research question was not relevant in relation to the aim of the present study investigating the influence of the working environment on the risk of disability pension. Third, the entire life history of exposures in the working environment cannot be captured by a single questionnaire, and previous unknown exposures may also influence the risk of disability pension.

## Conclusions

While a higher level of physical exertion is a risk factor for disability pension among older female eldercare workers, a moderate level of emotional demands is associated with lower risk among the younger workers. The age of the worker should be considered when providing recommendations for promoting a long and healthy working life.

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## Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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