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Physical work environment factors affecting risk for disability pension due to mental or musculoskeletal diagnoses among nursing professionals, care assistants and other occupations: a prospective, population-based cohort study

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ABSTRACT

Objective To study the influence of physical work factors on the risks of future disability pension (DP) due to mental or musculoskeletal diagnoses among nursing professionals, care assistants and all other occupations in the general working population in Sweden.

Methods The prospective population study was based on representative samples of working individuals (n=79 004) aged 16–64, interviewed in the Swedish Work Environment Survey between 1993 and 2013. Information on diagnosed DP in 1994–2014 was gathered from the Social Insurance Agency's database. The focus was on nursing professionals (registered nurses and midwives) and care assistants, for example, assistant nurses and hospital ward assistants. The outcome was DP, classified into two diagnostic groups. Associations between physical work factors and risk of DP were calculated using Cox regression with HR and 95% CI.

Results Physical work factors were associated with future DP after adjusting for sociodemographic conditions and psychosocial work factors among care assistants (n=10 175) and among all other occupations (n=66 253), but not among nursing professionals (n=2576). The increased risk among care assistants (n=197) exposed to heavy physical work was 66% (HR 1.66, 95% CI 1.39 to 1.97), and for those exposed to strenuous work postures (n=420) it was 56% (HR 1.56, 95% CI 1.35 to 1.80). Physical work indicators were mainly associated with musculoskeletal DP diagnoses among care assistants, but two indicators were significant also for mental diagnoses. An increased risk of DP was found among nursing professionals (n=102) exposed to detergents or disinfectants (HR 1.48, 95% CI 1.06 to 2.05), but not among care assistants.

Conclusions Heavy physical work and strenuous postures are predictors of future DP, particularly among care assistants and in the general working population. In order to reduce early exit from the workforce, efforts should be made to improve physical and ergonomic working conditions.

Strengths and limitations of this study

- The present study used a prospective design, a long follow-up time, a population-based sample and register data supplemented by data from personal interviews.
- The specific diagnoses underlying individuals' disability pension were obtained from high-quality national registers, and there were few cases where these were not available.
- The fact that all exposures and confounders were measured at least 1 year ahead of the outcomes reduces some of the problems related to causal interference.
- The risks of exposure to heavy physical work may be underestimated due to selection bias in cases where employees with health problems have switched to less physically demanding tasks or even left the occupation.

INTRODUCTION

There are large differences between occupations concerning working life exit before statutory pension age.[1 2] Disability pension (DP) is a major route towards early labour market exit. Individuals with poor health have an increased risk of being granted DP.[3–5] Long-term sickness absence (LTSA) from work is in many cases followed by DP.[6–8]

Staff shortages among employees in the health and personal care sector are a serious problem in Sweden and other European countries,[5 9 10] and have been linked to the fact that many employees leave the sector through DP before they reach retirement age.

The present study focuses on physical working conditions such as heavy physical

work, awkward work postures, and exposure to chemicals and other potentially harmful substances as predictors of future DP among nursing professionals and care assistants.

Poor physical working conditions play a significant role as risk factors for being granted DP in many occupations and labour market sectors.[11 12] Studies from the Nordic countries have shown that individuals in the general working population who are exposed to heavy physical work have an increased risk of between two and four times of being granted DP.[11–16] The negative effect of physical workload on future DP is particularly significant for unskilled workers, construction workers, restaurant workers and employees in manufacturing.[1 12 17–22] Similarly, increased risks for early exit and DP have been reported among employees in healthcare and personal social care in the Nordic countries.[5 23–26] Moreover, in these countries, a main cause of being granted DP due to medical reasons or voluntarily leaving the occupation at an early age among nursing professionals and care assistants is the adverse physical working conditions that are common in these occupations.[5 25–28]

The heavy lifting and strenuous work postures that are common in these occupations have been shown to specifically contribute to neck, shoulder and knee conditions, as well as to lower back pain and rheumatic disease, conditions that in turn have been found to increase the risk for leaving nursing employment early[26] and the risk of future DP.[5 23 29] Research has also shown an excess risk for skin diseases such as hand eczema among health and care staff, due to exposure to chemicals and other substances.[30–32] Even psychosocial factors such as high emotional demands and stress have been found to be associated with health problems and DP among healthcare employees.[33–35]

Most studies on the associations between work environment factors and DP among healthcare employees focus on one or two kinds of exposures.[15 23 24 29 33] Health and care workers are simultaneously exposed to a whole range of work-related physical and ergonomic risk factors for future DP.[34] Therefore, it may be important to scrutinise different aspects of these physical and ergonomic exposures. Since the characteristics of physical working conditions vary among occupations, it is also important to study specific occupational groups rather than mixed populations of employees. One study found that physical work exposures may even affect the risk of DP in mental diagnosis.[12]

Objectives

The main objective of the present study was to investigate the prevalence of various physical job exposures among nursing professionals, care assistants and all other occupations, and to analyse how these exposures are associated with risks of future DP. A specific objective was to compare nursing professionals and care assistants as to whether there were similarities or differences between them in the degrees to which the various physical job exposures affected their risk of DP. Further, psychosocial working conditions are included as a confounder. Another specific aim was to analyse whether there were differences between the occupational groups regarding whether mental or musculoskeletal diagnoses were the grounds for their DP.

METHODS

Study design and participants

The prime data sources were the Swedish Work Environment Surveys (SWES), which have been conducted every second year since 1989. The surveys are based on year-specific random samples of the Swedish employed population between 16 and 64 years old and were conducted as telephone interviews with supplementary postal enquiries. In this study, data from 80 740 individuals from 11 different surveys were included. The surveying was done by Statistics Sweden between 1993 and 2013, with the response rates varying between 66% and 89%. The data cover a broad range of physical and ergonomic working conditions and psychosocial conditions.[36] An official English translation of the survey questionnaire is available at Statistics Sweden (http://www.scb.se).

The study group comprised men and women who, according to the 1996 version of the Swedish Standard Classification of Occupations (SSYK-96), were in the occupational categories of nursing and midwifery professionals and nursing associate professionals (SSYK 223 and 323; n=2576) and personal care and related workers (SSYK 513; n=10 175). The data on these were obtained from the Longitudinal Integrated Database for Health Insurance and Labour Market Studies (LISA) database (www.scb.se; SSYK).[36] The first two categories include specialised and non-specialised nurses with a university degree working in hospitals and other healthcare organisations, and are labelled ‘nursing professionals’ in the present study. The personal care and related workers occupation includes assistant nurses, hospital ward assistants, home-based personal care workers and childcare assistants, and are here labelled ‘care assistants’. Ten to twelve years of education is generally required for these occupations. All of the other occupations in the SWES (n=66 253) were also included and served as a comparison group. The largest occupational groups within all other occupations were, for example, primary education professionals, shop and stall salespersons and demonstrators, business services agents and trade brokers, office secretaries, and data entry operators.

Information on background factors, the classification of occupations (SSYK-96), sickness absence, DP and diagnoses related to DP was derived from two population registers: LISA (1994–2014) at Statistics Sweden, and the Swedish Social Insurance Agency’s database Micro-Data for Analysis of Social Insurance (1994–2014).

Men and women who had obtained a DP prior to being interviewed or in the year of the interview (n=1736) were excluded. Of the 79 004 remaining individuals, 5196 (6.58

Table 1 Description of study group according to sex, age, occupation at interview (1993–2013) and DP during follow-up until 2014 (n=79 004)

	Total (n)						DP					
	Male		Female		Male and female		Male		Female		Male and female	
	n	%	n	%	n	%	n	%	n	%*	n	%*
Age at interview (years)												
16–29	4450	46	5191	54	9641	100	48	1	133	3	181	2
30–39	9019	48	9711	52	18 730	100	192	2	455	5	647	3
40–49	10 483	46	12 159	54	22 642	100	524	5	1133	9	1657	7
50–64	13 149	47	14 842	53	27 991	100	1064	8	1647	11	2711	10
All ages	37 101	47	41 903	53	79 004	100	1828	5	3368	8	5196	7
Occupation												
All other occupations	36 058	54	30 195	46	66 253	100	1782	5	2280	8	4062	6
Nursing professionals	194	8	2382	92	2576	100	6	3	166	7	172	7
Care assistants	849	8	9326	92	10 175	100	40	5	922	10	962	9
DP-granting diagnoses												
Musculoskeletal†							661	31	1490	69	2151	100
Mental‡							305	28	799	72	1104	100
All other diagnoses§							831	45	1021	55	1852	100
Unspecified diagnosis							31	35	58	65	89	100
Total case, 1994–2014							1828	35	3368	65	5196	100

*Per cent granted DP, 1994–2014, within sex, age group and occupation.
†ICD-10, M00–M99, granted DP 1994–2014.
‡ICD-10, F00–M99, granted DP 1994–2014.
§ICD-10, A–E, G–L, N–U, granted DP 1994–2014.
DP, disability pension; ICD, International Classification of Diseases.

%) were granted DP within the follow-up period of 1994–2014. Table 1 shows the characteristics of the study group. In Sweden, DP is granted to individuals aged 19–64 who have been assessed to be unable to work for the foreseeable future or at least a year due to disability, illness or injury. The compensation covers up to 64% of the income loss and can apply to 100%, 75%, 50% or 25% of regular working hours. Although the legislation has been altered a number of times during the follow-up period for this study, 1994–2014, the basic structure and conditions for eligibility have remained the same.

Measurements

Outcome variables

Three categories of DP were used: all DP cases (n=5196), DP with mental diagnoses (International Classification of Diseases (ICD)-10, F00–F99; n=1104; all other occupations n=833, nursing professional, n=69, care assistants n=202) and DP with musculoskeletal diagnoses (ICD-10, M00-M99; n=2151; all other occupations n=1686, nursing professional n=71, care assistants n=394). Neck or shoulder pain, as well as lower back pain and rheumatic disorders, dominate among the musculoskeletal diagnoses. No distinction was made between full-time and part-time DP.

Exposure variables

The data on *heavy physical work*, *strenuous work postures* and *exposure to substances* were obtained from SWES (1993–2013).[36] The total non-response rates including cases where the question was not available for a specific year and cases where the individual did not answer a specific question as shares of all respondents in the survey (%) are given in brackets below.

Three items were chosen as indicators of *heavy physical work*. The response scales were dichotomised closest to the upper quartile of the response alternatives. These responses were seen to indicate the most adverse conditions.

- Are you required to lift at least 15 kg at a time several times per day? Yes (≥1 out of every 2 days), no (≤1 out of every 5 days).
- Does your job mean that your work is purely physical, that is, do you put in more physical effort than you do when you walk, stand and move in the usual way? Yes

(≥1/2 of the working time), no (≤1/4 of the working time).
- Do you exert yourself so much that you breathe faster? Yes (≥1/4 of the working time), no (≤1/10 of the working time).

Information was missing on the first item for 1993 (total non-response rate: 13.95%) and for the other two for 2003 (total non-response rate: 8.04% and 8.17%).

The following three items were chosen as indicators of *strenuous work postures*. The response scales were dichotomised closest to the upper quartile of the response alternatives. These responses were seen to indicate the most adverse conditions.
- Do you bend or twist yourself in your work in the same way repeatedly in an hour, for several hours during the same day? Yes (every day), no (≤1 out of every 2 days).
- Do you work bent forward, without supporting yourself with your hands or arms? Yes (≥1/4 of the working time), no (≤1/10 of the working time).
- Do you work in a twisted position? Yes (≥1/4 of the working time), no (≤1/10 of the working time).

Information for the first item was available for all years (total non-response rate: 1.20%), but was missing for the other two items for 2003 (total non-response rate: 8.15% and 8.17%).

Three items were chosen as indicators of *exposure to substances* (biological or chemical risk factors). The response scales were dichotomised closest to the upper quartile of the response alternatives. These responses were seen to indicate the most adverse conditions.

Are you exposed to any of the following in your work?
- Detergents and/or disinfectants (in contact with the skin)? Yes (≥1/10 of the working time), no (no, not at all).
- Water that comes in direct contact with the skin several times per hour (including when washing)? Yes (≥1/4 of the working time), no (≤1/10 of the working time).
- Human secretions such as saliva, blood, urine, faeces or vomit? Yes (≥1/10 of the working time), no (no, not at all).

Information for the first item was available for all years (total non-response rate: 1.02%), but was missing for 1993 and 2003 for the two other items (total non-response rate: 13.87% and 13.99%).

Potential confounders

Sex, *age at interview* (16–29, 30–39, 40–49, 50–64 years), *education* (≤9 years, 10–12 years, >12 years of education), *country of birth* (born in Sweden, foreign-born), *number of years in current occupation* (1–4, 5–9, 10–19, 20–29, >30 years) and *sector of employment* (public sector (national, regional or local authorities), private sector) were selected as potential confounders. The data on these were obtained from the LISA database.

Being on LTSA for 60 days or more at the time of the interview was taken into consideration as a potential confounder but was not included as such in the final estimations. Data on LTSA were tested and found to be associated with DP, but inclusion in the final model did not change the results to any considerable extent.

As the impact of physical risks on DP may be affected by stress or other psychosocial conditions at work, it is reasonable to also adjust for the effects of psychosocial factors. The data on *psychosocial working conditions* were obtained from SWES.[36] They are seen as proxy indicators of the demand control model.[37 38]

Four items were used to measure *job demands*. The response scales were dichotomised closest to the upper quartile of the response alternatives. These responses were seen to indicate the most adverse conditions. After each item, the total non-response rate (%) is given in brackets.
- Is your work so stressful that you do not have time to talk or even think about something other than work? Yes (≥3/4 of the working time), no (≤1/2 of the working time) (total non-response rate: 0.81%).
- Does the work require your full attention and concentration? Yes (nearly all of working time), no (<3/4 of the working time) (total non-response rate: 1.11%).
- Do you have so much work that you must miss lunch, work late or take work home? Yes (≥1 out of every 2 days), no (≤1 out of every 5 days) (total non-response rate: 1.12%).
- How do you experience your work? – Far too much to do? Yes (agree), no (partly agree, neither agree nor disagree, disagree, partly disagree) (total non-response rate: 0.81%).

Four items provided indicators of job *control*. The response scales were dichotomised closest to the upper quartile of the response alternatives. These responses were seen to indicate the most adverse conditions.
- Do you have the opportunity to determine your work pace? No (≤1/10 of the working time), yes (≥1/4 of the working time) (total non-response rate: 0.90%).
- Are you able to determine when various working duties are to be carried out? No (no, not at all), yes (≥mostly not) (total non-response rate: 0.79%).
- Do you participate in decisions on the arrangement of your work? No (≤mostly not), yes (≥mostly) (total non-response rate: 1.20%).
- How do you experience your work? – Too little influence? Yes (agree, partly agree), no (neither agree nor disagree, disagree, partly disagree) (total non-response rate: 1.00%).

A two-dimensional combination of the demands and control variables resulted in four stress categories according to the Karasek-Theorell model[39]: *high strain jobs* (low control, high demands), *passive jobs* (low control, low demands), *active jobs* (high control, high demands) and *low strain jobs* (high control, low demands).

Statistical analyses

In the SWES surveys from 1993 to 2013, the participants were consecutively added to the cohorts, and the follow-up period for each subcohort started the year after

the interview (1 January 1994–31 December 2014). The mean number of years of follow-up was 11.05 years (SD 6.57). The follow-up period for the participants ended on 31 December 2014 or the year they reached 65 years of age, went on DP, emigrated or died, whichever came first (censored). It should be noted that individuals aged 16, 17 and 18 at participation in the interview were not eligible for DP until they reached the age of 19. The HRs for being granted DP, with 95% CI, were estimated using Cox proportional hazards regression analysis, using the PHREG procedure.

All analyses were stratified on occupation and categorised into three groups: 'nursing professionals', 'care assistants' and 'all other occupations'. The statistical analyses were conducted in three steps. First, sex, education, country of birth, years in current occupation, sector of employment and psychosocial index (combination of the demands and control variables) were related to the risk of DP one by one, adjusting for age (1-year intervals) and year of interview. Second, physical work exposures were related to risk of DP, adjusting for two sets of confounders: (1) age at interview and year of interview, and (2) age and year of interview plus sociodemographic conditions, sector of employment and psychosocial index. Third, HRs for DP due to mental or musculoskeletal diagnoses were studied and stratified according to procedure (2) described above.

All statistical analyses were conducted with SAS V.9.4 statistical software.

Patient and public involvement

No patients or the public were involved in this study.

RESULTS

In all three occupational groups, increased risks of DP were found among women, older individuals and individuals who had worked for 10 years or more in the current occupation (table 2). Being employed in public organisations was associated with an increased risk of DP among the groups of nursing professionals and all other occupations, but not among care assistants. Years of education and country of birth were not significantly related to DP among nursing professionals or care assistants, although both factors were associated with risk of DP among all other occupations.

Physical working conditions and risk of DP

The prevalence levels of heavy physical work and strenuous work positions were generally higher among care assistants, whereas they were similar or even lower among nursing professionals than among all other occupations (table 3). The prevalence of exposure to substances was similar among care assistants and nursing professionals, which was higher than among all other occupations.

For those reporting high prevalence of heavy physical work in all three measured dimensions (ie, heavy lifting, purely physical work, exertion to the point of breathing fast), significantly increased risks of future DP were found among care assistants and all other occupations, but not among nursing professionals (table 3, model 2). Care assistants who answered that they exerted themselves to the point of breathing fast during 25% or more of their working time had an increased risk of DP (HR 1.66, 95% CI 1.39 to 1.97).

The HR for having to work in strenuous positions was also significantly elevated among care assistants in all the three measured dimensions (ie, bending or twisting repeatedly, working in a bent-forward position, working in a twisted position). Care assistants who reported having to work in a twisted position during 25% or more of their workday showed an increased DP risk (HR 1.56, 95% CI 1.35 to 1.80) (table 3, model 2). However, among nursing professionals, exposure to strenuous work postures was not related to a significantly elevated risk of DP.

Regular exposure to substances was common among nursing professionals and it increased the risk of DP. Exposure to detergents or disinfectants and human secretions increased the risk of DP among nursing professionals (HR 1.48, 95% CI 1.06 to 2.05; HR 1.69, 95% CI 0.99 to 2.89) (table 3, model 2). Among care assistants, who showed a similarly high prevalence, no significant associations between these exposures and DP were found.

The HRs for heavy physical work, strenuous working positions and exposure to substances were not much affected by adjusting for sociodemographic conditions, sector of employment and psychosocial conditions, although the estimates were somewhat reduced.

Physical work and risk of DP with musculoskeletal or mental diagnoses

The results of the stratified analyses of how the physical work factors affected DP due to musculoskeletal and mental diagnoses are shown in table 4. For care assistants and all other occupations, heavy physical work and strenuous work postures were found to be associated with an increased risk of DP due to musculoskeletal diagnoses. No relation between exposure to substances and risk of DP due to musculoskeletal diagnoses was found among nursing professionals or care assistants. Two of the physical exposure variables were found to be related to an increased risk of DP due to mental diagnoses among care assistants and four physical exposure variables among all other occupations. Among nursing professionals no significant associations were found between indicators of physical work environment and the risk of DP due to mental diagnoses.

DISCUSSION

Among the occupational groups investigated in the present study, the results indicate that the share being granted DP was higher among care assistants and nursing professionals than it was among all other occupations. Nine per cent of the care assistants, 7% of the nursing professionals and 6% of all other occupations were granted DP in the follow-up period.

Table 2 Sociodemographic variables (sex, age, education, country of birth), years in current occupation, sector of employment and psychosocial working conditions in relation to the prevalence and risk of DP** among the study groups (n=79 004, SSYK 1993–2013)

	All other occupations (n=65 458–66 253)				Nursing professionals (n=2545–2576)				Care assistants* (n=10 053–10 175)			
Exposure	**n†**	**P‡**	**HR§**	**CI**	**n†**	**P‡**	**HR§**	**CI**	**n†**	**P‡**	**HR§**	**CI**
Sex												
Male	1782	54	1		6	7	1		40	8	1	
Female	2280	46	**1.61**	1.51 to 1.71	166	93	1.63	0.72 to 3.69	922	92	**1.48**	1.08 to 2.04
Age at interview (years)¶												
16–29	142	12	**1**		2	6	1		37	15	**1**	
30–39	493	24	**1.76**	1.46 to 2.12	23	22	2.30	0.54 to 9.75	131	24	**2.02**	1.40 to 2.91
40–49	1262	29	**3.74**	3.14 to 4.45	55	33	3.35	0.82 to 13.73	340	28	**5.21**	3.71 to 7.32
50–64	2165	36	**6.17**	5.21 to 7.31	92	39	**6.89**	1.70 to 27.97	454	33	**7.81**	5.59 to 10.93
Mean age (SD)	44.0 (11.1)				45.7 (9.9)				42.9 (11.5)			
Education (years)												
>12	1362	38	1		0	0	1		146	12	1	
10–12	1664	46	**1.17**	1.08 to 1.27	0	0	–	–	742	79	1.08	0.85 to 1.37
≤9	1034	17	**1.67**	1.53 to 1.81	172	100	–	–	74	9	1.18	0.88 to 1.56
Country of birth												
Sweden	3623	93	1		154	93	1		868	91	1	
Other country	439	7	**1.57**	1.42 to 1.73	18	7	1.31	0.81 to 2.15	94	9	1.22	0.90 to 1.51
Years in current occupation¶												
1–4	467	19	1		12	13	1		115	19	1	
5–9	624	20	1.04	0.92 to 1.17	23	17	1.08	0.54 to 2.19	178	19	1.24	0.98 to 1.57
10–19	1140	28	**1.35**	1.21 to 1.51	51	31	1.17	0.62 to 2.20	335	32	**1.44**	1.17 to 1.78
20–29	984	19	**1.75**	1.56 to 1.95	52	23	1.62	0.86 to 3.05	215	20	**1.74**	1.39 to 2.18
≥30	718	14	**2.06**	1.83 to 2.31	33	16	**2.25**	1.16 to 4.35	90	10	**2.34**	1.77 to 3.08
Mean years (SD)	14.4 (11.2)				16.1 (10.8)				13.7 (10.2)			
Sector of employment												
Private	2108	62	1		8	9	1		63	12	1	
Public sector	1814	39	**1.17**	1.10 to 1.25	161	91	**2.13**	1.04 to 4.33	874	89	1.17	0.91 to 1.52
Demand–control index												
Low strain (low demand, high control)	1876	57	**1**		59	41	1		397	50	**1**	

Continued

Table 2 Continued

Exposure	All other occupations (n=65 458–66 253)				Nursing professionals (n=2545–2576)				Care assistants* (n=10 053–10 175)			
	n†	P‡	HR§	CI	n†	P‡	HR§	CI	n†	P‡	HR§	CI
Passive (low demand, low control)	644	14	**1.39**	1.27 to 1.52	32	21	1.14	0.74 to 1.75	211	25	1.11	0.94 to 1.31
Active (high demand, high control)	752	20	**1.10**	1.01 to 1.20	37	19	1.25	0.83 to 1.88	134	12	**1.36**	1.12 to 1.66
High strain (high demand, low control)	516	9	**2.01**	1.82 to 2.21	34	19	**1.62**	1.06 to 2.47	140	14	**1.48**	1.22 to 1.79

*Including nursing assistants, home care assistants and childcare assistants.
†Number of cases (n).
‡Prevalence (P) of the exposure categories (%).
§HR of DP with 95% CI, adjusted for age (continuous variable) and year of interview. Significant figures are shown in bold (p<0.05).
¶Not adjusted for age.
**All incident cases of DP, including unspecified DP-granting diagnoses (n=4832–5196).
DP, disability pension; SSYK, Swedish Standard Classification of Occupations.

In general, similar exposure factors affected the risk of DP among care assistants and all other occupations. Care assistants and nursing professionals were partly affected by different work environment factors. DP among care assistants, but not among nursing professionals, was found to be associated with all of the investigated indicators of heavy physical work and strenuous work postures, even after adjusting for relevant confounders such as education and psychosocial working conditions, including job strain. On the other hand, DP among nursing professionals was found to be related to exposure to detergents and disinfectants, which was not the case among care assistants.

The results concerning care assistants are in line with previous studies from other countries which have shown that exposure to adverse physical working conditions is common among employees in personal social care and a main cause of future DP.[5 25 27] Some studies with mixed populations of healthcare workers have also found negative effects of heavy physical work or strenuous work postures.[2 23 24 26 28]

One reason why nursing professionals reporting negative physical working conditions did not have a significantly elevated risk of DP while care assistants reporting the same conditions did may be that nurses have more varied tasks and more opportunities to recover from periods of physical strain or awkward postures. It may also be easier for nursing professionals who experience symptoms of musculoskeletal disorders to avoid some tasks that involve physical strain. Another reason may be that nurses are well educated and may therefore know more about physiology and proper lifting techniques for reducing some of the negative effects of their physical work. A third reason may be that the measurement of negative physical factors, based on exposure during 25% of the working day, does not cover the two groups equally, as it may not proportionately capture the exposures among these groups. There is a risk that the average care assistant spends more time in negative situations than the average nursing professional.

Another finding was that DP due to musculoskeletal diagnoses was found to be linked to the different aspects of physical working conditions among nursing professionals, care assistants and all other occupations. The only finding related to DP due to mental diagnoses was that care assistants regularly working in twisted positions and those who exert themselves to the point of breathing fast had an increased DP risk. Further, among women above the age of 50 years, the risk for DP is higher within care assistants and nursing professionals compared within all other occupations.

In recent years, Finnish and Swedish studies have analysed the impact of the physical work environment on the risk of DP due to certain diagnoses.[12 40–42]Also, one review and individual studies support the finding that work involving a heavy physical workload and improper postures among healthcare personnel may lead to musculoskeletal and other disorders.[33–35]

Table 3 HR for DP** according to physical work exposure (n=79 004, 1994–2014)

	All other occupations (n=57 011–65 577)					Nursing professionals (n=2217–2550)					Care assistants* (n=8766–10 071)				
Exposure	**P†**	**n‡**	**HR§**	**HR¶**	**CI**	**P†**	**n‡**	**HR§**	**HR¶**	**CI**	**P†**	**n‡**	**HR§**	**HR¶**	**CI**
Heavy physical work															
Heavy lifting															
No (<1 day out of 5)	80	2068	1	1		78	108	1	1		61	387	1	1	
Yes (>1 day out of 2)	20	759	**1.49**	**1.47**	1.34 to 1.62	22	25	1.03	0.97	0.62 to 1.54	39	322	**1.23**	**1.17**	1.00 to 1.37
Work only physical															
No (<1/4 of working time)	76	2602	1	1		81	128	1	1		56	447	1	1	
Yes (>1/2 of working time)	24	1221	**1.67**	**1.56**	1.44 to 1.69	19	23	1.02	1.01	0.64 to 1.58	44	425	**1.42**	**1.34**	1.16 to 1.55
Exertion until breathing fast															
No (<1/10 of working time)	85	3068	1	1		92	141	1	1		82	662	1	1	
Yes (>1/4 of working time)	15	746	**1.68**	**1.64**	1.50 to 1.79	8	10	1.25	1.27	0.66 to 2.43	18	197	**1.80**	**1.66**	1.39 to 1.97
Strenuous work postures															
Bent or twist repeatedly															
No (≤1 day out of 2)	77	2491	1	1		88	145	1	1		72	606	1	1	
Yes (every day)	23	1469	**1.86**	**1.53**	1.42 to 1.64	12	24	1.19	1.14	0.73 to 1.78	28	332	**1.38**	**1.33**	1.15 to 1.54
Working bent forward															
No (≤1/10 of working time)	77	2533	1	1		69	101	1	1		54	402	1	1	
Yes (>1/4 of working time)	23	1283	**1.76**	**1.62**	1.50 to 1.74	31	50	1.31	1.28	0.90 to 1.82	46	466	**1.47**	**1.39**	1.20 to 1.60
Working in a twisted position															
No (≤1/10 of working time)	77	2546	1	1		73	110	1	1		60	450	1	1	
Yes (≥1/4 of working time)	23	1271	**1.70**	**1.49**	1.38 to 1.60	27	39	1.13	1.08	0.74 to 1.59	40	420	**1.66**	**1.56**	1.35 to 1.80
Exposure to substances															
Detergents/disinfections															
No (no, not at all)	77	2857	1	1		40	69	1	1		40	411	1	1	
Yes (≥1/10 of working time)	23	1127	**1.42**	**1.38**	1.28 to 1.48	60	102	**1.59**	**1.48**	1.06 to 2.05	60	531	1.06	1.01	0.88 to 1.16
Water in contact with skin															
No (≤1/10 of working time)	86	2252	1	1		44	62	1	1		39	259	1	1	
Yes (≥1/4 of working time)	14	588	**1.80**	**1.46**	1.32 to 1.61	56	74	1.27	1.12	0.78 to 1.61	61	461	**1.17**	1.07	0.91 to 1.27

Continued

Table 3 Continued

Exposure	All other occupations (n=57 011–65 577)					Nursing professionals (n=2217–2550)					Care assistants* (n=8766–10 071)				
	P†	n‡	HR§	HR¶	CI	P†	n‡	HR§	HR¶	CI	P†	n‡	HR§	HR¶	CI
Human secretions															
No (no, not at all)	91	2452	1	1		16	18	1	1		18	123	1	1	
Yes (≥1/10 of working time)	9	377	**1.69**	**1.45**	1.29 to 1.63	84	118	**1.77**	1.69	0.99 to 2.89	82	595	1.10	1.04	0.84 to 1.29

*Including nursing assistants, home care assistants and childcare assistants.
†Prevalence (P) of the exposure categories (%).
‡Number of cases (n).
§Model 1: HR of DP with 95% CI, adjusted for age (continuous variable) and year of interview. Significant figures are shown in bold (p<0.05)
¶Model 2: HR of DP with 95% CI, adjusted for age and year of interview, sex, education, country of birth, sector of employment, and demand–control index.
**All incident cases of DP, including unspecified DP-granting diagnoses (n=3639–5067).
DP, disability pension.

The present study also indicates that detergents and disinfectants in contact with the skin were associated with an increased risk of DP among nursing professionals, but no such association was found for care assistants. A hypothesis can be that because the other 'competing' physical and ergonomic exposures are so strongly associated with DP among care assistants, exposure to substances does not add to their risk even though they are highly exposed. Previous research has shown that exposure to chemicals and other potentially harmful substances constitutes an excess risk for skin diseases, but no study has yet explored DP risk due to such exposures.[30–32]

The present study demonstrates that factors from the physical work environment can influence the likelihood of being granted DP in the future, especially among care assistants. Reducing the physical and ergonomic demands of these occupations could thus lead to considerable financial savings from the reduced costs of DP. This may be facilitated by increasing staffing, improving education on lifting techniques, protecting against harmful substances, and introducing better ergonomic workplace design and technical lifting aids. However, in order to more extensively address the negative effects of physical and ergonomic risks among personal care workers, there is a need for findings from studies that also consider how psychosocial exposures and interactions among exposures may further increase the risk of DP. For example, investigations about combination effects of single items with physical and psychosocial exposures, as well as study synergy effects between these two items, would be valuable.

Strength and limitations

The main strengths of the present study were its prospective design and long follow-up period, as well as its use of a population-based sample, along with register data. Having been able to conduct longer follow-up examinations with a mean time period of almost 12 years was advantageous, considering that being granted DP is very often the end result of a long process including lengthy sickness absence periods and in many cases occupational rehabilitation activities. Over such a longer time period, however, consequential aspects at work and outside work may have changed without our notice, as we measured exposures only once. For example, employees might have changed workplace or occupation, or the work environment may have changed due to new regulations. However, the negative effects of adverse physical working conditions on the risk of DP, sickness absence and health have been shown in studies with both short and long follow-up times. A Danish study of men and women in a wide range of occupations found that demanding physical workload had effects on the risk of DP over a 10-year period.[17] Similarly, in a study on the general employed population in Norway with an 18-year follow-up period, demanding physical load was shown to have strong effects on the risk of DP.[19]

Still, comparison among members of different occupational groups can be uncertain because of the so-called

Table 4 HR for DP according to physical work exposure related to mental and musculoskeletal diagnoses (n=79 004, 1994–2014)

	Mental diagnoses*									Musculoskeletal diagnoses†								
	All other occupations (n=53 803–62 369)			Nursing professionals (n=2082–2414)			Care assistants‡ (n=8007–9312)			All other occupations (n=54 615–63 181)			Nursing professionals (n=2116–2449)			Care assistants‡ (n=8199–9504)		
	n§	HR¶	CI	n§	HR¶	CI	n§	HR¶	CI	n§	HR¶	CI	n§	HR¶	CI	n§	HR¶	CI
Heavy physical work**																		
Heavy lifting (≥1 day out of 2)	125	1.16	0.94 to 1.45	6	0.55	0.23 to 1.31	56	0.78	0.55 to 1.10	376	**1.98**	1.72 to 2.28	7	0.84	0.37 to 1.92	176	**1.47**	1.17 to 1.85
Work only physical (≥1/2 of working time)	196	1.17	0.98 to 1.40	4	–	–	84	1.18	0.87 to 1.61	665	**2.28**	2.04 to 2.55	11	1.38	0.70 to 2.72	237	**1.60**	1.31 to 1.95
Exertion until breathing fast (≥1/4 of working time)	131	**1.38**	1.11 to 1.70	2	–	–	45	**1.87**	1.31 to 2.66	360	**1.97**	1.72 to 2.25	2	–	–	96	**1.56**	1.22 to 2.00
Strenuous work postures**																		
Bent or twist repeatedly (every day)	267	**1.21**	1.03 to 1.41	5	0.65	0.26 to 1.64	57	1.03	0.75 to 1.43	771	**2.12**	1.91 to 2.37	9	1.07	0.50 to 2.29	197	**1.66**	1.36 to 2.02
Working bent forward (≥1/4 of working time)	223	**1.27**	1.08 to 1.45	11	0.65	0.33 to 1.27	92	1.16	0.86 to 1.58	648	**2.11**	1.90 to 2.36	19	1.36	0.76 to 2.43	257	**1.59**	1.30 to 1.95
Working in a twisted position (>1/4 of working time)	217	1.12	0.95 to 1.33	11	0.83	0.42 to 1.64	83	**1.40**	1.03 to 1.91	644	**1.97**	1.77 to 2.20	13	0.96	0.50 to 1.82	227	**1.71**	1.40 to 2.08
Exposure to substances**																		
Detergents/disinfections (≥1/10 of working time)	203	1.14	0.96 to 1.35	35	1.25	0.73 to 2.14	145	1.00	0.74 to 1.34	547	**1.62**	1.45 to 1.81	33	1.22	0.71 to 2.07	260	0.93	0.77 to 1.12
Water in contact with skin (≥1/4 of working time)	110	1.12	0.90 to 1.40	18	**0.50**	0.27 to 0.93	89	0.80	0.57 to 1.12	300	**1.90**	1.64 to 2.20	27	1.15	0.63 to 2.09	234	1.10	0.87 to 1.40
Human secretions (≥1/10 of working time)	103	**1.41**	1.12 to 1.77	41	1.26	0.55 to 2.86	130	1.02	0.66 to 1.58	157	**1.72**	1.43 to 2.08	42	1.82	0.76 to 4.35	294	0.97	0.72 to 1.31

Bold HR values are statistically significant at the p<0.05 level.
*Incident cases of DP, including mental DP-granting diagnoses (n=871–1101).
†Incident cases of DP, including musculoskeletal DP diagnoses (n=1521–2098).
‡Including nursing assistants, home care assistants and childcare assistants.
§Number of exposed DP cases (n).
¶HR of DP with 95% CI, adjusted for age and year of interview, sex, education, country of birth, sector of employment, and demand–control index.
**Exposure to adverse conditions reported in the table (reference categories the same as in table 3). Pearson's correlation coefficients (pairwise correlations between the three items within respective factors) for heavy physical work: 0.572, 0.424, 0.539; for strenuous work postures: 0.315, 0.392, 0.610; and for exposure to substances: 0.534, 0.404, 0.498.
DP, disability pension.

'healthy worker effect'.[43] There is a risk that individuals who experience various health problems linked to their occupation may try to change tasks or even change occupation to avoid the problems. A consequence of such a selection process may be an underestimation of the actual differences and lower risks for DP. Unfortunately, we have no information about health-related mobility and if there are differences between nursing professionals and care assistants in this respect. In Sweden, musculoskeletal disorders have traditionally been the most common reason for being granted DP, but mental DP diagnoses are today the most common among younger age groups.[44] In the present study there are age differences in the risk of DP, and DP due to mental diagnoses is more common among younger age groups. This may affect some of the risk estimates as some cases have been missed due to DP being granted prior or in the year of the baseline interview.

Despite the prospective design, the possibility of reversed causation cannot be entirely excluded. It is possible that employees with already somewhat reduced health, and consequently with an increased risk of DP, assess their work environment differently from healthy employees. However, that all exposures and confounders were measured at least 1 year ahead of the outcome reduces some of the problems related to causal interference—as does the fact that the study population was large and based on representative samples with satisfactory response rates. The specific diagnoses underlying participants' DP were obtained from high-quality national registers, and there were few cases where these were not available.

Due to the fact that information on physical working conditions originated from 11 different surveys, the information for some of the items may not be consistent or complete. In some cases, the measurements were not strictly similar or the response rates were lower. The incomplete information was particularly evident in the 1993 and 2003 surveys. Few cases of DP were especially a limitation among professional nurses. This reduced the number of cases, in particular when HRs were calculated in multiple regressions.

CONCLUSIONS

The study suggests that heavy physical work and physically strenuous work postures are predictors of future DP particularly among care assistants as well as among all other occupations, but less so among nursing professionals. Among nursing professionals, exposure to detergents or disinfectants was the only measured physical work factor associated with DP. In order to reduce early exit from the workforce and improve the health of these occupational groups, strong efforts should be made to improve physical and ergonomic working conditions.

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