Sleep-Related Problems and Associations with Occupational Factors among Home Care Personnel[1]

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ABSTRACT

Recent demographic developments in Europe have increased the demand for home care. Working in other people's home environment is challenging. Home care personnel's musculoskeletal disorders are common, and care personnel overall often have sleep disturbances. In this study, associations between occupational physical and psychosocial factors and possible sleep-related problems among home care personnel were explored using a questionnaire. The questionnaire was distributed to 19 workplaces in Stockholm County in 2017–2019, and 665 home care personnel answered. Several factors, including job contentment, physical burden of care, client-related burnout, quantitative demands, and pain, were significantly associated with sleep-related problems. The results highlight the need for implementing measures to improve psychosocial and organizational working conditions in home care service.

KEYWORDS

Home care personnel / musculoskeletal disorders / occupational safety and health / pain / physical factors / psychosocial factors / sleep / sleep disturbance

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Introduction

Recent demographic developments in Europe have increased the need for cost-effective social- and health solutions and practices in which care service is provided outside hospitals and nursing homes, for instance at the care recipients' homes. Home care and informal care are often preferred by the care recipients and are considered more cost-efficient when compared with hospital health care and nursing home care (Eurostat 2019; Hiel et al. 2015; Tarricone & Tsouros 2008). In informal care, the care is provided by actors outside a professional framework such as relatives and partners (International Alliance of Carer Organizations 2018). Home care services includes a broad variety of tasks including personal care such as personal hygiene, cleaning, cooking, and basic medical tasks (Szebehely & Trydegård 2012; Tarricone & Tsouros 2008).

In most European countries as well as in the Nordic countries, in the past decades, there has been a shortage of health care professionals (Nordic Council of Ministers 2014; Simoens et al. 2005), and for instance in the United States, turnover rates of 44–65% have been reported, indicating substantial challenges to keep the employees at work. Examples of factors contributing to this include low wages, lack of benefits and inconsistent working hours (Butler 2018). The home care personnel in high-income western countries face multiple occupational safety and health (OSH) issues including heavy physical exertion, psychosocial stressors and accident risks (Markkanen et al. 2014, 2017). A lack of significant progress can be identified in improving OSH in the home care sector as musculoskeletal disorders (MSDs) and sleep problems are recurrently identified as adverse health outcomes among care personnel (Ono et al. 1995; Smart & Wilson 2013; Swedish Work Environment Authority 2007). Among care- and service occupations, home care personnel often reported higher occurrence of work-related MSDs and injuries compared with other care- and service occupations (Ono et al. 1995; Swedish Work Environment Authority 2007).

Home care personnel commonly encounter verbal abuse, such as home care recipients' inappropriate use of language, physical abuse, such as care recipients' biting or hitting them with objects, and sexual harassment (Denton et al. 2002; Markkanen et al. 2014). In addition, factors such as feelings of being rushed or hurried, increasing number of care recipients, combative care recipients, aggressive animals, and problems with access to beds or toilets, forceful exertions and awkward postures have been associated with an increased risk of MSDs or occupational accidents among home care personnel (Galinsky et al. 2001; Merryweather et al. 2018). The time pressure in home care service has increased, likely due to declining resources and organizational changes in recent years (Stranz & Szebehely 2017; Tufte 2013).

Sleep problems are of growing concern in home care sector, and home care personnel report higher occurrence of sleep problems when compared with other service occupations concerning eldercare, but the reasons for this are poorly understood (Uehli et al. 2014; Vehko et al. 2018). Only a few attempts have previously been made to address sleep problems in home care, while such efforts are more frequent among health care employees in hospital environments. Accordingly, heavy workload, back pain, and occupational stress have been associated with sleep problems in other type of services sectors such as in hospital health care and nursing home care, but such information is scarce within the home care sector which has different prerequisites (Deng et al. 2020; Dorrian et al. 2008; Hsieh et al. 2011; Smart & Wilson 2013; Thapa et al. 2017). Furthermore,

high workload, low perceived control, low social support, social exclusion, back pain, and depression have been associated with increased risk of sleep problems (Hsieh et al. 2011; Litwiller et al. 2017; Pilcher & Morris 2020; Thapa et al. 2017). Moreover, the type of employment contract and occupational stress have been associated with the sleep problems (Deng et al. 2020). In the care sector, sleepiness and prolonged work shifts among hospital nurses have been associated with increased likelihood of medical errors and attentional failure, occupational injuries, motor vehicle crashes, and decreased likelihood of identifying someone else's error (Caruso et al. 2017; Dorrian et al. 2008; Lockley et al. 2007). In general, the quality of sleep is also influenced by individual factors like age, gender, family responsibilities, psychosocial state of mind, and lifestyle factors (Knutson 2013; Litwiller et al. 2017; Parkes 2016).

Physical and psychosocial work-related risk factors may hinder well-being at work (Schulte & Vainio 2010). For instance, in Sweden, where this study was conducted, over one-third of the work-related diseases relate to physical ergonomics issues like monotonous work, strenuous movements, or postures. Four out of 10 of the work-related diseases relate to poor organizational or social factors (Swedish Work Environment Authority 2020). In Finland, as the neighbor country for Sweden, mental and behavioral disorders and MSDs are the two most common reasons for retirement on disability pension (Finnish Centre for Pensions 2020). Globally, it has been estimated that the economic burden of poor OSH is 4% of the annual global gross domestic product (GDP) (ILO, 2020), while the World Health Organization (WHO) (2017) has assessed that the economic loss of work-related health problems is 4–6% of GDP for most countries.

Factors like high workload, lack of support, physical and psychosocial work environment, and irregular working hours have been associated with sleep problems. In general, sleep problems are more common in shift work. Sleep problems are associated with increased risks of adverse health and safety outcomes such as occupational injuries (Bendak & Rashid 2020; Brossoit et al. 2019; Magnavita & Garbarino 2017; Pilcher & Morris 2020; Van den Berg et al. 2020; Vanttola et al. 2019). In general, sleep problems, including sleep disturbances, low sleep quality, non-restorative sleep, and sleepiness not only induce or aggravate negative health effects but also affect the work performance. The health effects include, for instance, an increased risk of cardiovascular diseases, diabetes, dementia, and other adverse health issues (Pilcher & Morris 2020). Furthermore, sleep problems and pain often coexist. Multi-site pain is itself associated with increased risks of sickness absence, disability pension and poor self-rated work ability, and sleep problems together with pain in the lower back or neck-shoulder region have been noted to predict future sickness absence (Aili et al. 2015; Haukka et al. 2013; Kamaleri et al. 2009; Miranda et al. 2010). Finally, lack of rest and long working hours have been linked to work stress and adverse health outcomes (Bae & Fabry 2014). Hence, sleep problems as well as lack of rest have large impact on well-being as well as work performance, and therefore need attention to secure sound prerequisites. Figure 1 shows the above-mentioned connections between sleep problems, occupational and individual factors, and adverse health and safety outcomes to present the framework for this study of home care personnel.

The demand for home service is increasing. At the same time, home care personnel are often exposed to many occupational physical and psychosocial risk factors and have relatively high sick leave rates and a high turn-over rate compared with the general working population (Butler 2018; Markkanen et al. 2017; Swedish Work Environment

Figure 1 Connections between sleep problems, occupational and individual factors, and adverse health and safety outcomes (based on Deng et al. 2020; Dorrian et al. 2008; Hsieh et al. 2011; Knutson 2013; Litwiller et al. 2017; Magnavita & Garbarino 2017; Parkes 2016; Pilcher & Morris 2020; Schulte & Vainio 2010; Smart & Wilson 2013; Thapa et al. 2017).
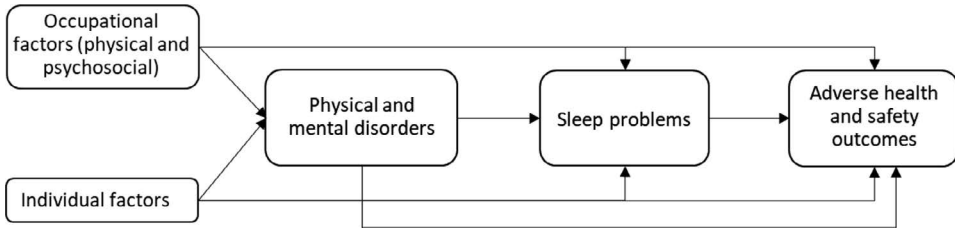
Authority 2007). When compared with nurses working in hospitals, home care personnel work more often without the direct support of colleagues, and in the care recipients' home, which are often inadequately designed. As presented in the literature earlier, indications of sleep problems and their connections to occupational physical and psychosocial factors have been studied in health care settings. Still, there has been only a little previous attention on sleep problems in home care settings. The aim of this study is to increase knowledge on sleep-related problems and their associations with occupational physical and psychosocial factors among home care personnel.

Methods and material

In Sweden, where this study was conducted, the municipalities have the overall responsibility for the health and social care of elderly and disabled persons. This service is carried out by both private and municipal care providers. The home care service is one of the largest occupational sector in Sweden with about 135,300 employees, which provides services to approximately 225,000 people aged 65 years or more (SCB 2020; Swedish Institute 2019; Szebehely & Trydegård 2012).

Data

In this study, occupational physical and psychosocial factors and their association with sleep-related problems and negative health outcomes among home care personnel were studied using a cross-sectional questionnaire survey. The study was carried out in the Stockholm County (now Region Stockholm), which is the largest County in Sweden, occupying more than one-fifth of all residents in Sweden. The questionnaire was distributed between 2017 and 2019 to 19 workplaces, from the municipal sector (N = 13) and private sector (N = 6). The questionnaire was distributed to the respondents through the managers at each workplace. Altogether, 665 employees responded, giving a response rate of 56%. Those who completed the questionnaire received two movie tickets as an incentive. Only those personnel working directly in home care were invited to the study. Ethical approval for the study was obtained from the Regional Ethical Review Board in Stockholm.

The questionnaire included questions about background information, psychosocial factors, physical, and psychosocial burden of care, MSDs, general health, fatigue, and sleep. The questions on background information, physical, and psychosocial burden of care, general health, and fatigue were constructed based on a previous questionnaire applied on home care personnel in Sweden (Målqvist 2015; Petterson et al. 2006). The questions on psychosocial factors were based on the Copenhagen Psychosocial Questionnaire (COPSOQ), which assesses psychosocial factors at work, stress, and the well-being of employees (Kristensen et al. 2005). COPSOQ has demonstrated a good internal reliability with Cronbach's alpha of 0.7 for 28 items and Cronbach's alpha between 0.5 and 0.7 for five items. COPSOQ has been used for workplace surveys, research, and comparisons (Pejtersen et al. 2010). Questions on MSDs prevalence were measured using the Standardized Nordic Questionnaire, which is a widely used tool for analyzing musculoskeletal symptoms in an occupational setting (Kuorinka et al. 1987; López-Aragón et al. 2017). The reliability has been interpreted as acceptable after test-retest results showing numbers of non-identical answers between 0% and 23%, and Cohen's Kappa values between 0.60 and 0.81 (Gómez-Rodríguez et al. 2020; Kuorinka et al. 1987). Sleep disturbances were measured using the Karolinska Sleep Questionnaire, containing items on difficulties falling asleep, repeated awakenings with difficulties going back to sleep, premature awakening, disturbed/restless sleep. The questionnaire has been used in assessing, for example, sleep quality, non-restorative sleep and sleepiness and it has been demonstrated to be reliable and valid with Cronbach's alpha for each dimension varying from 0.71 to 0.87 (Akerstedt et al. 2008; Nordin et al. 2013). The questions used are presented in Appendix 1 and Table 1.

Data analysis

The relations between occupational physical and psychosocial factors and sleep-related problems of Swedish home care personnel were examined using eight indexes (seven for exposure and one for sleep quality outcome), three questions concerning pain frequency and amplitude, and two outcome questions concerning sleep quality. The indexes and questions were chosen since they according to the literature may influence sleep quality. They also represent relevant occupational physical and psychosocial factors among home care personnel. The indexes were *Sleep quality, Quantitative demands, Qualitative demands, Leadership, Job contentment, Client-related burnout, Physical burden of care,* and *Mental and emotional burden of care* index. *Sleep quality* includes questions about difficulties falling asleep, repeated awakenings, premature awakening, and disturbed sleep. *Quantitative demands* include questions related to having enough time to complete the tasks without stress and if there is time to calm down. *Qualitative demands* comprise questions about unpredictable occurrences, making decisions and having responsibility. *Leadership* contains questions about receiving support and help from supervisor. *Job contentment* focuses on the enjoyment of work. *Client-related burnout* considers how working with care recipients feels. *Physical burden of care* determines the amount of heavy work, lifting heavy objects and difficult working positions. Finally, *Mental and emotional burden of care* has the same questions as *Qualitative demands* but is dependent on how many care recipients the respondent estimated have dementia or mental illness/discomfort. The eight indexes and five other questions used in this

study along with principles for dichotomizing are presented in detail in Appendix 1 and in Table 1.

Table 1 Sleep and pain related questions used in this study

Questions used	Answer options*	Dichotomizing
(Restless sleep due to thoughts of work) Have you had problems to sleep/ restless sleep during the last 30 days because of thinking of work?	1 = Never 2 = On rare occasions 3 = Few times in a week 4 = Daily	The range is from 1 to 4. Problems to sleep during the last 30 days because of thinking of work > 2.
(Lack of rest) Apart from your sleep, do you get enough rest between workdays?	1 = Yes, definitely enough 2 = Yes, mostly enough 3 = No, somewhat insufficient 4 = No, clearly insufficient 5 = No, far from enough	The range is from 1 to 5. Not enough rest between workdays > 2.
Standardized Nordic Questionnaire – Pain point prevalence (seven days)	0 = No 1 = Yes	Pain = 1.
Standardized Nordic Questionnaire – How often have you had pain in neck/shoulders/back during the last 12 months?	1 = Never 2 = Rarely 3 = Sometimes 4 = Often 5 = Very often	The range is from 1 to 5. Pain during the last 12 months often or very often > 3.
Standardized Nordic Questionnaire – How strong has the pain been in neck/shoulders/back during the last 12 months?	Scale from 0 (not at all) to 10 (very, very strong pain, almost maximum)	The range is from 0 to 10. Strong pain ≥ 5.

*Responses were given values from 1 to 4 or 5 depending on the number of answer options. One equals least exposed and 4 or 5 most exposed.

In this study, *sleep-related problems* is used as an umbrella term when referred to the *Sleep quality* index, the *Restless sleep due to thoughts of work* and *Lack of rest* questions. In order to identify occupational physical and psychosocial factors that were associated with increased prevalence of sleep-related problems among the home care personnel, a statistical analysis was conducted. The associations between occupational physical and psychosocial factors and dichotomized outcomes variables were analyzed using a generalized linear model with a logarithmic link function and a binomial distribution, to calculate prevalence proportion ratios (PPR). PPR was chosen since it is usually used in cross-sectional studies to describe how common something is. The alternative ratio that is computed in the same way, that is, the incidence rate ratio (IRR), was not chosen, because it is more commonly used in longitudinal studies to explain the number of new cases during a specific period. The PPR is estimated as:

$$PPR = \frac{A/(A+B)}{C/(C+D)}$$

Where A is the number of cases among exposed subjects, B is the number of non-cases among exposed subjects, C is the number of cases among unexposed subjects, and D is the number of non-cases among unexposed subjects, while the variances are calculated

differently between them. Since several occupational, physical, and psychosocial factors existed with no evident rank of importance between them, a so-called predictive modelling was applied. This type of modeling requires the use of a stepwise technique in order to receive those variables that have the strongest association to the outcome.

A stepwise Cox regression specifying time equal to 1 was employed to analyze the associations between occupational physical and psychosocial factors and *Restless sleep due to thoughts of work* and *Lack of rest*, while stepwise linear regression analyzed the *Sleep quality* index. Model A tested the associations between indexes and sleep-related problems, while model B tested the associations between indexes and MSDs, and sleep-related problems. Once the final models were received from the stepwise Cox regressions, generalized linear models were used to generate correct confidence intervals for those variables, being the most important from the two stepwise regression models. The so-called models $A_{Adjusted}$ and $B_{Adjusted}$, respectively, were tested when analyzing each of the three outcomes including the potential confounders age, work experience in home care services, work experience with the current employer, workplace and level of education. The final models A and B show the occupational physical and psychosocial factors associated with increased prevalence of sleep-related problems. The analyses were performed using SPSS (IBM SPSS Statistics 25, New York, USA).

Results

Respondent group in short

Of the 665 respondents, 546 were women (82.1%), and 118 (17.7%) were men, which closely resembles the general gender distribution in the full home care sector in Sweden (Swedish Work Environment Authority 2013). One respondent did not provide information about his/her gender. The mean age was 44.3 years (13.6 SD). The respondent stated their highest education as elementary school 98 (14.7%), high school 358 (53.8%), university or university college 113 (17.0%), or something else 81 (12.2%), while 15 (2.3%) did not provide any information. Their work experience in home care services ranged from ≤5 years (N = 277, 42.6%), 6–9 years (N = 100, 15.0%), ≥10 years (N = 267, 40.2%), while 21 respondents (3.2%) did not provide information in their work experience.

Of the respondents, 58.2% of were less satisfied with the leadership while 47.7% and 46.0% perceived higher qualitative demands and higher mental and emotional burden of care, respectively. Regarding sleep-related problems, 22.4% of the respondents reported *poor sleep quality*, while for two additional sleep questions, 45.0% of the respondents reported *lack of rest*, and 23.3% reported *restless sleep due to thoughts of work*. The body regions with the highest 7 days prevalence rate of pain were reported for the lower back (40.6%), shoulders (37.1%), and neck (35.6%). For the 12-month period, 33.1% reported having had lower back pain, 30.8% having had shoulder pain, and 29.9% having had neck pain, often or very often. Furthermore, there were 24.2%, 25.9%, and 26.2%, respectively, who described their neck pain, shoulder pain, and lower back pain, as strong.

The results are presented in Appendix 2.

Occupational physical and psychosocial factors associated with sleep-related problems

Job contentment (beta estimate = 3.21, *p*-value < 0.001), client-related burnout (beta estimate = 1.56, *p*-value < 0.001), and physical burden of care (beta estimate 1.49, *p*-value < 0.001) were associated with increased prevalence of *poor sleep quality* in model A, while job contentment (beta estimate 2.60, *p*-value < 0.001), physical burden of care (beta estimate 1.04, *p*-value 0.027), and pain in lower back (beta estimate 2.11, *p*-value < 0.001), shoulders (beta estimate 1.78, *p*-value < 0.001), and knees (beta estimate 1.67, *p*-value = 0.001) were associated with increased prevalence of *poor sleep quality* in model B (Table 2). None of the potential confounders were significant.

Job contentment (PPR = 2.42, *p*-value < 0.001) was associated with increased prevalence of *restless sleep due to thoughts* of *work* in model A, while job contentment (PPR = 2.08, *p*-value < 0.001) and pain in lower back (PPR = 2.07, *p*-value < 0.001) were associated with increased prevalence of *restless sleep due to thoughts* of *work* in model B (Table 3). None of the potential confounders were significant. Finally, quantitative job demands (PPR = 1.27, *p*-value = 0.009), job contentment (PPR = 2.11, *p*-value < 0.001), and client-related burnout (PPR = 1.28, *p*-value = 0.003) were associated with increased prevalence of *lack of rest* in model A, while job contentment (PPR = 2.28, *p*-value < 0.001), physical burden of care (PPR = 1.45, *p*-value = 0.020), and pain in lower back (PPR = 1.32, *p*-value = 0.002) were associated with increased prevalence of *lack of rest* in model B (Table 3). In both models, work experience was a confounder.

Low(er) job contentment occurred most often, as it was associated with increased prevalence of *poor sleep quality, lack of rest,* and *restless sleep due to thoughts of work* in all final models. Likewise, pain issues were associated with increased prevalence of *poor sleep quality, lack of rest,* and *restless sleep due to thoughts of work* in all models B it was tested. Client-related burnout and physical burden of care were associated with increased prevalence of *poor sleep quality* and *lack of rest* in models A or B. Finally, quantitative job demands occurred once and were associated with the increased prevalence of *lack of rest* in model A.

Discussion

In this study, new insights into factors associated with sleep-related problems among home care personnel were shown. Sleep-related problems were quite frequent among the respondents in this study (*poor sleep quality* 22.4%, *lack of rest* 45.0%, and *restless sleep due to thoughts of work* 23.3%), but relatively not as frequent as reported in previous studies; sleep problems among home care personnel (52%), personnel in nursing home (47%), and personnel in supported accommodation (41%) (Vehko et al. 2018), and among community hospital nurses (46%) (Deng et al. 2020). Low(er) job contentment, client-related burnout, and physical burden of care were associated with poor sleep quality, lack of rest, and restless sleep due to thoughts of work. From the pain perspective, especially lower back pain was associated with sleep-related problems.

The findings above deepened and strengthened the previous knowledge (see Figure 1) about the home care personnel's sleep-related problems. In health care, a heavy workload, high work demands, low social support, occupational stress, and working

Table 2 Beta estimate from a linear regression with corresponding 95% confidence intervals (C.I.), and p-value for sum of *Sleep quality* index in models A and B and adjusted models

Poor sleep quality (n = 149)	Model A*			Model A_adjusted**			Model B*			Model B_adjusted**		
	Beta estimate	95% C.I.	p-value	Beta estimate	95% C.I.	p-value	Beta estimate	95% C.I.	p-value	Beta estimate	95% C.I.	p-value
Job contentment (lower)	3.21	2.20 – 4.23	<0.001	3.27	2.19– 4.35	<0.001	2.60	1.50 – 3.69	< 0.001	2.59	1.42–3.76	<0.001
Client-related burnout	1.56	0.72 – 2.39	<0.001	1.47	0.56 – 2.37	0.001	–	–	–	–	–	–
Physical burden of care (higher)	1.49	0.67 – 2.31	<0.001	1.23	0.36 – 2.11	0.006	1.04	0.12 – 1.95	0.027	–	–	–
Lower back pain (last 7 days)	–	–	–	–	–	–	2.11	1.16 – 3.06	<0.001	2.37	1.35–3.38	<0.001
Shoulder pain (last 12 months)	–	–	–	–	–	–	1.78	0.79 – 2.76	<0.001	1.80	0.75–2.85	0.001
Knee pain (last 7 days)	–	–	–	–	–	–	1.67	0.68 – 2.65	0.001	1.49	0.44–2.54	0.006

*Model A tested the associations between indexes (*Quantitative demands, Qualitative demands, Leadership, Job Contentment, Client-related burnout, Physical burden of care,* and *Mental and emotional burden of care*) and *Sleep quality,* while model B tested the associations between indexes (*Quantitative demands, Qualitative demands, Leadership, Job Contentment, Client-related burnout, Physical burden of care,* and *Mental and emotional burden of care*), MSDs (Pain point prevalence (seven days and 12-months)), and *Sleep quality.* The beta estimates are presented only to those factors that were significantly associated with *Sleep quality.*
**Model A_adjusted and model B_adjusted are as model A and B but with all background variables in the final model. In model B, adjusted, physical burden of care was no longer significant. None of the background variables had a p-value <0.05.

Table 3 PPR with corresponding 95% C.I. and *p*-value for the questions *Restless sleep due to thoughts of work* and *Lack of rest* in models A and B and adjusted models

	Model A*			Model A$_{adjusted}$**			Model B*			Model B$_{adjusted}$**		
	PPR	95% C.I.	*p*-value	PPR	95% C.I.	*p*-value	PPR	95% C.I.	*p*-value	PPR	95% C.I.	*p*-value
Restless sleep due to thoughts of work (n = 155)												
Job contentment (lower)	2.42	1.86–3.15	<0.001	2.58	1.93–3.45	<0.001	2.08	1.53–2.81	<0.001	2.17	1.57–3.01	<0.001
Lower back pain (last 7 days)	–	–	–	–	–	–	2.07	1.43–3.00	<0.001	2.09	1.39–3.14	<0.001
Lack of rest (n = 299)												
Quantitative demands (higher)	1.27	1.06–1.52	0.009	1.27	1.04–1.54	0.016	–	–	–	–	–	–
Job contentment (lower)	2.11	1.50–2.94	<0.001	2.08	1.47–2.95	<0.001	2.28	1.61–3.24	<0.001	2.26	1.58–3.25	<0.001
Client-related burnout	1.28	1.09–1.51	0.003	1.31	1.10–1.56	0.003	–	–	–	–	–	–
Physical burden of care (higher)	–	–	–	–	–	–	1.45	1.03–1.45	0.020	1.26	1.05–1.50	0.020
Lower back pain (last 12 months)	–	–	–	–	–	–	1.32	1.10–1.59	0.002	1.36	1.12–1.65	0.002

*Model A tested the associations between indexes (*Quantitative demands, Qualitative demands, Leadership, Job Contentment, Client-related burnout, Physical burden of care,* and *Mental and emotional burden of care*) and *Restless sleep due to thoughts of work* and *Lack of rest,* while model B tested the associations between indexes (*Quantitative demands, Qualitative demands, Leadership, Job Contentment, Client-related burnout, Physical burden of care,* and *Mental and emotional burden of care*), MSDs (Pain point prevalence (seven days and 12-months)) and *Restless sleep due to thoughts of work* and *Lack of rest.* The values are presented only to those factors that were significantly associated with *Restless sleep due to thoughts of work* and *Lack of rest.*

**Model A$_{adjusted}$ and model B$_{adjusted}$ are as model A and B but with all background variables in the final model. Only in *Lack of rest* both in model A$_{adjusted}$ and B$_{adjusted}$, the work experience had *p*-values of 0.027 and 0.018, respectively. None of the other background variables had a *p*-value <0.05.

atmosphere have been associated with sleep problems (Deng et al. 2020; Hsieh et al. 2011; Thapa et al. 2017). In other fields, a high workload, lack of company or social support, job strain, workplace injustice, workplace harassment, scheduling related causes, low job control, and adverse physical environment predicted shorter sleep duration, impaired sleep quality or other sleep problems (Bendak & Rashid 2020; Magnavita & Garbarino 2017; Parkes 2016; Van den Berg et al. 2020). In this study, having higher physical burden of care, higher quantitative job demands, and being closer to client-related burnout can be interpreted, for example, as heavy workload and job strain. Similarly, lower job contentment (i.e., enjoyment of workplace and work) is connected to poor working atmosphere. Pain has been associated with sleep problems (De Souza et al. 2020; Litwiller et al. 2017; Magnavita & Garbarino 2017). Lower back pain was also associated with sleep-related problems in this study.

The body regions with the highest 7-days prevalence rate in this study were slightly higher than reported among hospital nurses with 7-days prevalence rate for the lower back (35%), shoulders (32%), and neck (28%) pain (Davis & Kotowski 2015), and slightly lower than Brulin et al. (1998) reported among home care personnel with 7-days prevalence rate for the lower back (40%), shoulders (47%), and neck (44%) pain. The 7-days prevalence rate was lower than the four-weekly pain prevalence rate among eldercare workers for lower back pain and neck/shoulder pain (between 61% and 72%) (Rasmussen et al. 2019).

Limitations

Both sleep and MSDs were assessed with validated self-administrative questions (Forsman et al. 2020; Kuorinka et al. 1987; Nordin et al. 2013; Pejtersen et al. 2010). Alternatively, for example, musculoskeletal symptoms could have been assessed using clinical tests, and sleep-related problems using interviews. Although physical examination may be preferred, fair to good agreement have been reported between information on pain based on self-reports when compared with physical examination (Perreault et al. 2008). On the other hand, Descatha et al. (2007) have shown that clinical examination by experts might produce lower symptom rates compared with using self-reports. Hence, some caution should be applied when interpreting these symptom rates. Given the large sample size of 665 employees, clinical examination and in-depth interviews with all participants were, however, not seen as a feasible alternative in this study. Additionally, the questions used were taken from validated questionnaires used in earlier studies, and we have no reasons to suspect that having clinical examinations and in-depth interviews would have altered the direction of the observed associations.

The exact response rate value was hard to estimate since the questionnaire was distributed through the employers. In order to calculate an approximate response rate, we have taken the number of respondents and employees in the units where the data was provided to us. A conservative estimation of the response rate is 56%. Since not all employees in the units were given access to the questionnaire, the true response rate most likely exceeds 56%. Only those units were included in this study whose managers agreed to participate. Therefore, we cannot guarantee that the units included in the study represent a random sample. The questionnaire contained altogether 20 pages which may have introduced respondents fatigue resulting in that some questions were

ignored (Ben-Nun 2020). However, the completion rate for the indexes studied in this paper was between 90.2% and 99.3%, for *Restless sleep due to thoughts of work* and *Lack of rest* 97.7% and 95.6%, respectively, and for the questions about how often the pain occurred and how strong has the pain been during the last 12 months between 88.7% and 94.4%. For the pain point prevalence (7-days), the completion rate varied between 69.6% and 77.0%, indicating quite large drop-out in some of the questions.

As the data is cross-sectional, causal relationships cannot be concluded. However, the results of sleep problems and MSDs are consistent with previous studies in health care (Deng et al. 2020; Hsieh et al. 2011; Thapa et al. 2017; Vehko et al. 2018). Regarding the chosen analysis method, reporting PPR is robust against non-representative samples since it is a measure of association considering two variables, exposure and outcome as opposed to considering only one variable at a time which instead is much more influenced by non-representative samples. Furthermore, when conducting the analyses, forward regression (Wald test), backward regression (likelihood ratio) and backward regression (Wald test) were performed. The final models remained the same irrespective the choice of stepwise technique.

Practical and managerial implications

Sleep problems impact the functioning and alertness of personnel and may lead to negative outcomes such as errors and occupational injuries (Dorrian et al. 2008; Lockley et al. 2007; Pilcher & Morris 2020). Sleep problems with lower back or neck-shoulder pain can lead to future sickness absence (Aili et al. 2015). Uehli et al. (2014) have found in their study that workers with sleep problems had a higher risk of being injured than workers without sleep problems. In addition, fatigue can contribute to medical errors and deteriorate the performance (Barker Steege & Nussbaum 2013; Dorrian et al. 2008).

A holistic OSH management that not only acknowledges the challenges but also understand the specific characteristics of the home care work is needed. OSH management should not be left merely for the employees and their foremen. Authors like Hollnagel (2014) and Carayon et al. (2015) encourage utilizing proactive and design-oriented OSH approaches in risk management. As described by various authors (Dul et al. 2012; Reiman & Väyrynen 2018; Smith & Carayon-Sainfort 1989), the positive aspects of work need to be increased if it is not possible to improve or eliminate negative aspects to increase employee well-being and productivity. If the negative aspects are prevalent it may result in different adverse health outcomes as well as accidents and injuries that may inhibit and decrease work performance (Carayon 2009; Kleiner 2008; Reiman & Väyrynen 2018), in this context the quality of care. Given the adverse effects home care personnel had in this study, that is, sleep-related problems, MSDs, experienced higher physical burden of care and higher mental and emotional burden of care, and being less satisfied with the leadership, it could be argued that the home care personnel encountered negative aspects in their work environment. Such challenges should be managed in a participatory and design-oriented process where the needs of all of the relevant stakeholders are considered (Carayon 2006; Carayon et al. 2015; Dul et al. 2012). Not addressing these issues may eventually lead to increase in employee turnover, which in turn cause extra costs through the lost workdays and costs of training of new employees. The relatively large turnover rates in health and home care indicate

an imbalance between work demands and existing resources to meet the increasing need of home care services of aging population (Butler 2018; Eurostat 2019; Tarricone & Tsouros 2008). To address this imbalance, employment conditions, work and leisure time balance, working environment, education and training, and management need to be improved (Nordic Council of Ministers 2014).

Home care could learn from other fields when the sleep problems are considered. It is recommended, especially for safety-sensitive operations, that fatigue management should be a part of a safety management system (Caldwell et al. 2019). In Van den Berg's et al. (2020) study on cabin crew employees, company support, effective communication, and management's engagement were attributed to a reduction of sleep problems. Bendak and Rashid (2020) found in their systematic review that scheduling of workdays and rest times is crucial to reduce fatigue and napping and in-flight breaks are recommended under appropriate circumstances. Home care personnel usually cannot take breaks in the care recipients' homes, but the ability to have short breaks often is recommended to reduce fatigue (Caldwell et al. 2019). In addition, increased (visual) light exposure may promote alertness (Pilcher & Morris 2020). Finally, the education of adequate sleep and fatigue recovery, optimal sleep hygiene and individuals' lifestyles are recognized as countermeasures to sleep-related problems. Technology could be used to track and improve sleep habits and alertness (Bendak & Rashid 2020; Caldwell et al. 2019; Pilcher & Morris 2020).

Future studies may include initiating a design-oriented participatory process where the root causes of the sleep problems are specified in-depth to facilitate participatory OSH management processes. For its part, such a participatory process would contribute to the discussion raised by Larsson et al. (2013) on creating and utilizing participatory solution-oriented risk management models where both the home care employees and supervisors are invited to participate. In the light of the earlier literature, acquiring sustainable solutions requires the participation of different stakeholders from different decision-making levels in addition to internal stakeholders (Dul et al. 2012). Participatory ergonomics intervention has been found effective for reducing workload in physically demanding tasks and decreasing undesirable psychosocial stress related to job content in home care work (Pohjonen et al. 1998). Example also exist when a participatory approach is used to improve scheduling of work to manage the exposure of personnel to higher needs care recipients with the aim of reducing employees' risk factors for musculoskeletal injuries (Czuba et al. 2012).

Conclusions

This study showed that several occupational physical and psychosocial factors are associated with sleep-related problems among home care personnel. Lower job contentment and low back pain were significantly associated with all three outcomes, *poor sleep quality*, *lack of rest*, and *restless sleep due to thoughts of work*. Also, client-related burnout and physical burden of care were significantly associated with sleep-related problems.

The results highlight the importance of implementing measures to promote sound psychosocial- and organizational working conditions and to increase, for example, enjoyment of work and job contentment in order to prevent sleeping disorders, as they may be an early indicator of adverse health and safety outcomes and increased sick leave, and may lead to high staff turnover rates and reduced quality of home care service.

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Appendix 1 The eight indexes used in the study along with principles for dichotomizing.

Index	Questions used in the index	Answer options*	Dichotomizing
			The questions are summed using their corresponding values and dichotomized using median split. Higher scores mean higher exposures (i.e., worse conditions).
Sleep quality	– Have you experienced any of the following complaints the past three months? – Difficulties falling asleep – Repeated awakenings with difficulties going back to sleep – Premature awakening – Disturbed/restless sleep	1 = Never 2 = Rarely – A few times (per year) 3 = Sometimes – Several times per mo. 4 = Often – 1–2 times per week 5 = Mostly – 3–4 times per week 6 = Always – 5 times or more per week	The range of the sum is from 6 to 24. Poor sleep quality >14.
Quantitative demands	– Do you usually have enough time to give the granted help? – Do you have opportunities yourself to determine the pace of work at the home of care recipients? – Do you have enough time to move between care recipients without feeling stress? – Can you complete the work tasks within time without feeling stress? – In my work, there is time to calm down between the visits to care recipients – I feel that I have time to calm down during my lunch break	1 = All the time 2 = Often 3 = Rarely 4 = Never	The range of the sum is from 6 to 24. Higher quantitative demands >16.
Qualitative demands	– Are contradictory demands placed on you at work? – In my work, I have to handle occurrences for which I was not prepared – In my work, I have to make fast and difficult decisions – In my work, the responsibility for care recipients feels too great	4 = All the time 3 = Often 2 = Rarely 1 = Never	The range of the sum is from 4 to 16. Higher qualitative demands >10.

(*Continued*)

Appendix 1   (*Continued*)

Index	Questions used in the index	Answer options*	Dichotomizing
			The questions are summed using their corresponding values and dichotomized using median split. Higher scores mean higher exposures (i.e., worse conditions).
Leadership	– How often do you get help and support from your supervisor when needed?	1 = All the time $2\frac{1}{3}$ = Often $3\frac{2}{3}$ = Rarely 5 = Never	The response alternatives of the first question were recoded in order to have the same range as for response alternatives to the other three questions.
	– To what extent would you say that your immediate superior makes sure that the individual member of staff has good development opportunities? – To what extent would you say that your immediate superior gives a high priority to job satisfaction? – To what extent would you say that your immediate superior is good at solving conflicts?	1 = To a very large extent 2 = To a large extent 3 = To some extent 4 = To a small extent 5 = To a very small extent	The range of the sum is from 4 to 20. Less satisfied with the leadership >9.
Job contentment	– How much do you enjoy your present workplace? – How much do you enjoy your present work?	1 = Very much 2 = Moderately 3 = Neither much nor none 4 = Not much 5 = Very little	The range of the sum is from 2 to 10. Less content with work >4.
Client-related burnout	– Do you feel that it is exhausting to work with the care recipients? – Do you feel that it is frustrating to work with the care recipients? – Does the work with the care recipients take all your energy? – Do you feel that you give more than you get back when working with the care recipients?	1 = To a very low degree 2 = To a low degree 3 = Somewhat 4 = To a high degree 5 = To a very high degree	The range of the sum is from 6 to 30. Closer to client-related burnout >14.
	– Are you tired of working with care recipients? – Are you not sure whether you will continue to work with care recipients or not?	1 = Never/Almost never 2 = Seldom 3 = Sometimes 4 = Often 5 = Always	

Index	Questions used in the index	Answer options*	Dichotomizing
			The questions are summed using their corresponding values and dichotomized using median split. Higher scores mean higher exposures (i.e., worse conditions).

Physical burden of care	– How often does the following occur in your work?
	  – Carrying and lifting of heavy objects
	  – Other heavy work, e. g. cleaning work, which makes you sweat or breathless
	  – Helping, for example, with shower or toilet visits in narrow spaces
	  – Forward bent, twisted, or other difficult working positions
	  – Sudden unexpected strains
	
	The sum of scores was multiplied by 0, 1, or 2, depending on their response to the question about how many clients the respondent estimated have physical illness/discomfort.
		1 = Never
		2 = Rarely
		3 = Often
		4 = All the time
			The range of the sum is from 0 to 40. Higher physical workload >26.

Mental and emotional burden of care	– Are contradictory demands placed on you at work? – In my work, I have to handle occurrences for which I was not prepared – In my work, I have to make fast and difficult decisions – In my work, the responsibility for care recipients feels too great. The sum of scores was multiplied by 0, 1, 2, 3, or 4, depending on their response to the questions about how many clients the respondent estimated have dementia or mental illness/discomfort.	1 = Never 2 = Rarely 3 = Often 4 = All the time	The range of the sum is from 0 to 64. Higher mental and emotional burden of care >26.

*Responses were given values from 1 to 4, 5, or 6 depending on the number of answer options. One equals least exposed and 4, 5, or 6 most exposed.

Appendix 2 Answer distribution to the indexes and other questions used (N = 665) according to the dichotomizing criteria in Appendix 1. Those who did not answer have been omitted

Indexes and questions	Respondents (%)
Sleep quality	
Not poor	70.8
Poor (>14)	22.4
Quantitative demands	
Lower	56.4
Higher (>16)	42.0
Qualitative demands	
Lower	50.8
Higher (>10)	47.7
Leadership	
More satisfied	41.1
Less satisfied (>9)	58.2
Job contentment	
More content with work	78.3
Less content with work (>4)	20.3
Client-related burnout	
No client-related burnout	54.3
Closer to client-related burnout (>14)	43.5
Physical burden of care	
Lower	51.7
Higher (>26)	38.5
Mental and emotional burden of care	
Lower	51.4
Higher (>26)	46.0
Restless sleep due to thoughts of work	
Not restless	74.4
Restless (>2)	23.3
Lack of rest	
Enough rest	50.7
Lack of rest (>2)	45.0

Indexes and questions	Respondents (%)
Pain point prevalence (seven days)	
No pain in neck	40.3
Pain in neck	35.6
No pain in shoulders	39.8
Pain in shoulders	37.1
No pain in arms	55.3
Pain in arms	14.3
No pain in upper back	44.8
Pain in upper back	29.8
No pain in lower back	36.2
Pain in lower back	40.6
No pain in hips	51.6
Pain in hips	19.2
No pain in knees	43.5
Pain in knees	27.1
No pain in feet	42.7
Pain in feet	31.0
12-month pain prevalence	
Never-seldom in neck	60.5
Often or very often in neck (>3)	29.9
Never-seldom in shoulders	57.9
Often or very often in shoulders (>3)	30.8
Never-seldom in lower back	57.4
Often or very often in lower back (>3)	33.1
Pain perception (12-months)	
Less strong in neck	69.6
Strong-maximum in neck (>4)	24.2
Less strong in shoulders	68.3
Strong-maximum in shoulders (>4)	25.9
Less strong in lower back	65.3
Strong-maximum in lower back (>4)	26.2