

RESEARCH ARTICLE

The impact of manual patient handling on work ability: A cross-sectional study in a Brazilian hospital

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Abstract

Aim: To investigate the level of self-reported work ability and its association with manual patient handling in healthcare workers.

Design: Cross-sectional study adhering to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Methods: A total of 320 healthcare workers answered a self-administered questionnaire regarding manual patient handling, work ability, occupational factors, occurrence of low back pain and sociodemographic and lifestyle factors from November 2016 to March 2017. The association between manual patient handling and low back pain was analysed with Poisson regression models.

Results: The prevalence ratio of inadequate work ability was 43.42%. Manual patient handling (PR 1.375, 95% CI 1.038–1.821), bachelor education (PR 2.150, 95% CI 1.272–3.632), less than bachelor education (PR 2.166, 95% CI 1.218–3.855), seniority (PR 1.049, 95% CI 1.024–1.086), poor sleep quality (PR 1.425, 95% CI 1.13–1.796) and presence of low back pain (PR 2.003, 95% CI 1.314–3.052) were all positively associated with an inadequate work ability.

KEYWORDS

cross-sectional study, epidemiology, healthcare workers, moving and lifting patients, nurses, work ability

1 | INTRODUCTION

With the ageing work population and extension of work years there is a growing need to promote adequate work ability among workers' professional careers (Martinez & Fischer, 2019; Sippli et al., 2021).

The concept of work ability (WA) is multifactorial. It is related to a worker's capacity to manage, perform and interact with his work

(demands, work arrangement and management), given his health conditions, functional capacities, competence, values, attitudes and motivation (Ilmarinen, 2019). WA is a dynamic process that changes greatly during the working life, due to changes in the nature of work, work organization, methods, tools and ageing (Martimo & Takala, 2020). A low WA level increases the probability of long-term sickness absence, early retirement due to illness and even death

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(Bethge et al., 2018, 2021; El Fassi et al., 2013; Lundin et al., 2017; Tomietto et al., 2019).

Over the past decades, several studies have addressed determinants of a low WA level. The results of these studies have shown that WA is influenced by individual factors (age, obesity, lack of leisure-time physical activity, etc.) and work-related factors (high mental requirements, heavy physical workload, poor physical work environment, etc.) (van den Berg et al., 2009; El Fassi et al., 2013; Fischer & Martinez, 2013; Martinez et al., 2010).

Due to the nature of healthcare work, which presents multiple characteristics associated with a poor WA (Fischer et al., 2006; Fischer & Martinez, 2013; Golubic et al., 2009; Rotenberg et al., 2009) and the healthcare workforce ageing (Scott & Newman, 2013; Uthaman et al., 2016), many studies on WA among healthcare workers have been carried out. However, very few studies have been conducted to examine the impact of manual patient-handling activities (MPH), an extremely hazardous work task (Schröder & Nienhaus, 2020), on WA among healthcare workers' (HCWs).

Patients with reduced mobility or dependent to move or maintain their posture, need assistance from healthcare personnel for lifting, transferring, repositioning and ambulating. MPH consists of doing these activities without the use of assistive equipment. MPH has been associated to back pain and musculoskeletal disorders such as sprains/strains, low back pain and wrist, knee and shoulder injuries (Choi & Brings, 2015). These injuries suffered by the HCW can be reduced, thanks to the safe patient-handling programmes (Teepel et al., 2017). Additionally, safe patient-handling and movement programmes reduce costs from workplace injuries, improves job satisfaction for healthcare workers, makes them feel supported and improves patient outcomes (Mayeda-Letourneau, 2014).

2 | METHODS

2.1 | Aims

The aim of this study was to assess the level of self-reported WA and its association with manual patient-handling activities (MPH) among HCWs.

2.2 | Study design, participants and setting

This study utilized a cross-sectional data collection strategy to investigate the level of self-reported WA, and examine its associated factors, in HCWs of a tertiary hospital in Brazil. Participants were willing to participate and provided written informed consent. Data collection was conducted from November 2016–March 2017.

The minimum sample size was estimated as 300 HCWs, considering 15% of unexposed presenting the outcome, 35% of exposed presenting the outcome (Smedley et al., 1995), 1:1 ratio of exposed to non-exposed and corrected for type I (5%) and type II (20%) error effects respectively.

Inclusion criteria consisted of (1) being one of the following HCWs: nurse, nursing technician, nurse assistant, physical therapist and radiography technician and (2) to be working for at least 1 year at the current job. While the exclusion criteria were: (1) being on work vacation, maternity leave or sick leave and (2) if the HCW had returned to modified work after a sick leave.

At the start of the study, the total number of nurses, nursing technicians, nurse assistants, physical therapists and radiography technicians working in the university hospital was 859 people. Of these, 488 (56.8%) were considered eligible for participation and were personally invited to participate in the study at work during work hours by the researchers. Three follow-up invitations were made 1, 2 and 4 weeks after the first contact, following the same procedure as described earlier, in order to minimize the number of non-respondents. A total of 320 HCWs consented to participate and were successfully recruited in the research (response rate of 65.6%). Among the 320 participants, 16 (5%) were subsequently excluded from data analysis due to missing data. Therefore, 304 subjects constituted the final study sample on which the data analyses were based. Figure 1 presents a flow diagram showing participant enrolment and inclusion throughout the study.

2.3 | Instrument and data collection

Data were collected using a self-administered anonymous paper questionnaire which was distributed and collected in unmarked envelopes, and participants could choose to fill it out during regular work hours or outside. The questionnaire was divided into seven sections: (1) demographic characteristics, five questions developed by the authors; (2) manual patient handling, nine questions based on Holtermann et al. (2013) questionnaire; (3) low back pain, four questions adapted from the Nordic Musculoskeletal Questionnaire (Barros & Alexandre, 2003) and Campo et al. (2008) questionnaire; (4) occupational variables, four questions developed by the authors; (5) psychosocial work conditions, nine questions from the Copenhagen Psychosocial Questionnaire II; (6) lifestyle variables, three questions developed by the authors and (7) work ability ten questions, from the Work Ability Index.

The questionnaire was evaluated by five occupational safety and health experts for face and content validity, item relevance and comprehensibility. In response to their feedback, changes were made accordingly and the questionnaire was tested in a pilot survey by 15 HCW. This study also adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

2.4 | Outcome variable

As described earlier, WA was measured by the Brazilian version of the Work Ability Index (WAI; Tuomi et al., 2005), which has shown adequate psychometric properties, regarding reliability and construct validity (Martinez et al., 2010; Silva Junior et al., 2011).

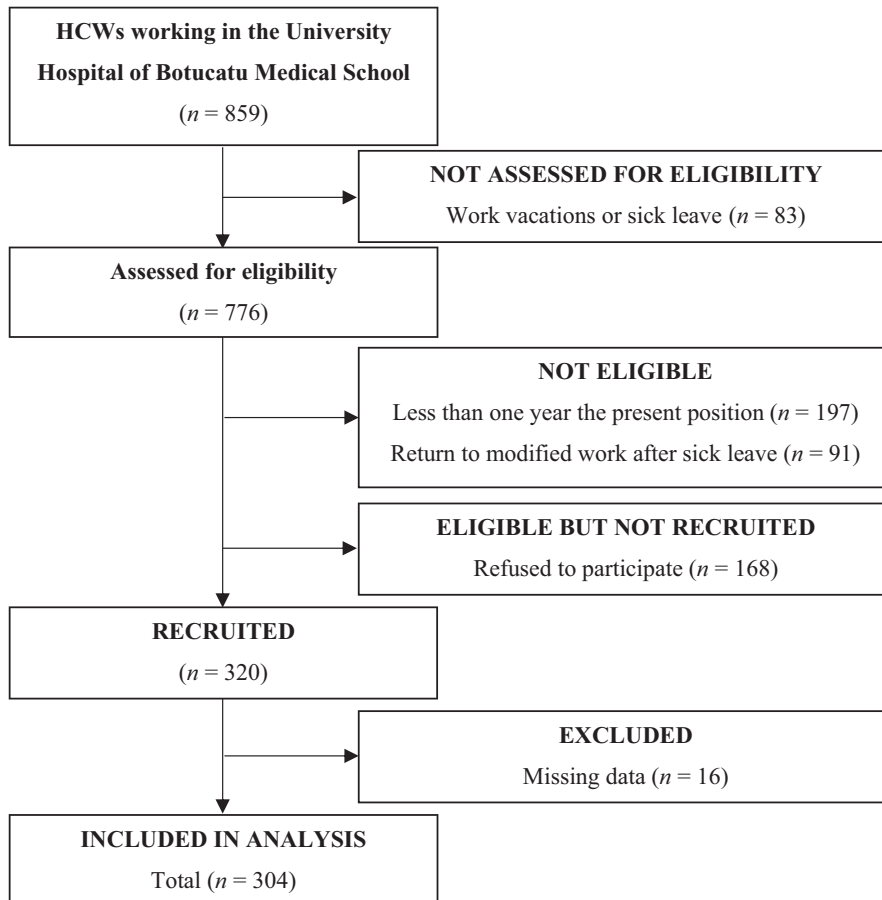


FIGURE 1 Flow diagram of study participants

The WAI is the most used and accepted instrument to measure work ability (van den Berg et al., 2009). It consists of seven (self-assessed) dimensions: current WA compared with the lifetime best; WA in relation to physical and mental work demands; number of current diagnosed diseases; estimated impairment due to disease(s); sick leave during the past 12 months; self-prognosis of WA 2 years from now and mental resources (on life in general and both at work and at leisure time). The WAI score ranges from 7 to 49 points and is classified into four categories as follows: poor (7–27), moderate (28–36), good (37–43) and excellent (44–49) (Tuomi et al., 2005).

In this study, as in others (El Fassi et al., 2013; Golubic et al., 2009; Mazloumi et al., 2012; Neto et al., 2021), participants who achieved a WAI score lower than 37 points were classified as having an inadequate WA, while those with a score of 37 and above were classified as having an adequate WA (reference category).

2.5 | Predictive variable

Manual patient handling was measured using three questions: 'How many times do you move patients from one surface to another during your daily work?', 'How many times do you move patients on the same surface during your daily work?' and 'How many times do you help patients to ambulate during your daily work?'. The response options were: 'never', 'seldom', '1–2 times daily', '3–10 times daily' and '>10 times daily'. In the analyses, the responses 'never' and

'seldom' were combined and defined as 'not performing the activity'. Participants who performed at least one of the three activities were classified as performing MPH.

2.6 | Other variables of interest

Sex was treated as a dichotomous variable. Age was self-reported as age in years at last birthday, and treated as a continuous variable. BMI was calculated using weight and height self-reports and treated as a continuous variable, then categorized as follows: eutrophic (BMI > 18.5 and <25.0) and non-eutrophic (BMI < 18.5 and >25.0). Educational level was categorized into three groups: master or doctorate, bachelor and less than bachelor.

Low back pain (LBP) was assessed by the following questions: 'At any time during last 3 months have you had trouble (ache, pain, discomfort) in the lower back?', 'Choose a number between 0 and 10, where 0 represents no pain at all and 10 the worst pain imaginable, that indicates your pain level.', 'How long does the pain usually last?' (response options were: 1 day or less, 1 day to 1 week, 1 week to 1 month, 1 month to 3 months) and 'How many times have you had the pain in the last 3 months?' (response options were: less than once a month, once a month, once a week, more often than once a week). A case definition that was broad enough to discriminate serious cases from minor complaints was adopted. A case was defined as a report of LBP rated at least 4 on a numerical pain rating scale

from 0 to 10 and lasting more than 1 week or present at least once a month in the last 3 months.

Seniority was evaluated by the question 'For how long have you been employed at your current job?' and treated as a continuous variable in years. Employment work status was coded into three categories: civil servant, regular employee and outsourced employee. Daily and weekly hours of work were treated as continuous variable measured in hours.

Domains of psychosocial work conditions were: (1) social support from colleagues, three-item scale from the Copenhagen Psychosocial Questionnaire II (COPSOQ II) (Pejtersen et al., 2010) and (2) social support from supervisors, three-item scale from the COPSOQ II. Responses to the individual items were scored on 5-point Likert scale. Responses were recoded into scales ranging from 0–100, then categorized as follows: high, moderate and low. These domains of psychosocial work conditions were chosen because there is evidence for an effect of low workplace social support on low levels of WA in nurses (Fischer & Martinez, 2013) and in other professions (Godinho et al., 2016; Mazloumi et al., 2012).

Smoking status was assessed by asking 'Do you currently smoke and has smoked 100 cigarettes in your lifetime?'. Responses were dichotomized into smoker and not smoker, based on the current smoker definition used in the Third National Health and Nutrition Examination Survey (NHANES III). The self-reported leisure-time physical activity was classified into two different categories: sedentary and active. Participants were considered physically active if engaging in a minimum of 150 min of moderate physical activity per week or 75 min of vigorous physical per week, based in the 2010 World Health Organization global recommendations for physical activity and health. Sleep quality was assessed by the following question: 'How do you consider your sleep?', and the response options were 'very good', 'good', 'poor' and 'very poor'. The responses 'very good' and 'good' were combined to indicate perceived sleep quality as good and 'poor' and 'very poor' were also combined to indicate perceived sleep quality as poor.

Receiving assistance from someone while performing MPH activities was measured with the questions: 'Do you receive assistance when you transfer a patient?', 'Do you receive assistance when you reposition a patient?', 'Do you receive assistance when you help patients to ambulate?', with the response options: 'never', 'seldom', '1–2 times daily', '3–10 times daily' and '>10 times daily'. In the analyses, the responses 'never' and 'seldom' were combined and the variable was coded categorically as never, sometimes and always.

The use of patient-handling equipment during patient-handling tasks was measured by using the questions: 'Do you use patient-handling equipment when you transfer a patient?', 'Do you use patient-handling equipment when you reposition a patient?', 'Do you use patient-handling equipment when you help patients to ambulate?', with the response options: 'never', 'seldom', '1–2 times daily', '3–10 times daily' and '>10 times daily'. In the analyses, the responses 'never' and 'seldom' were combined and the variable was coded as never, sometimes and always.

2.7 | Data entry

Completed questionnaires were entered into IBM SPSS Statistics v.26.0. To minimize entry bias and ensure accuracy of data entry, all data from questionnaires were entered twice into separate files and then were checked for errors by comparing the two versions. Any discrepancies were checked against the original questionnaires and corrected. Finally, 32 questionnaires were randomly selected, and the entered data were compared with the original paper-based questionnaires.

2.8 | Data analysis

Descriptive statistics were obtained for all variables. Measures of central tendency and dispersion were calculated for continuous variables, while frequency statistics were calculated for categorical ones.

The impact of MPH on WA was analysed using a Poisson regression model, which is similar to logistic regression, with the advantage that, in high-prevalence scenarios, the prevalence ratio estimation (PR) is a more conservative approach which tend to produce narrower confidence intervals. Initially, simple Poisson regression models with robust variance were conducted for each covariate. Those variables with a $p \leq .25$ were selected for inclusion in a multiple Poisson regression model with robust variance, and those with $p < .05$ were considered statistically significant. All reported p values were two-sided.

The possibility of interactions was investigated by including interaction terms between the variables that were significant in the final main effects model in a multiple Poisson regression model, including the variables demonstrating significant associations with the outcome as well.

2.9 | Ethical considerations

The study design, protocol and informed consent form were reviewed and approved by an ethics committee; all participants provided written informed consent prior to any study procedure or activity. The privacy rights of human subjects were always observed.

3 | RESULTS

Most respondents were female (83.6%), the mean age was 40.35 years (SD 9.74, range 22–66). The average duration of employment was 10.67 years (SD 9.36, range 1–40) and the mean working hours per day was 9.97 (SD 2.54, range 5–18). The participants were for the most part nursing technicians (72%), 18.1% were nurses, 5.6% were nurse assistants, 2.3% were physical therapists and 2% were radiography technicians. Three quarters (75.3%) were engaged

in manual patient-handling activities. Table 1 shows descriptive statistics for the study variables.

The WAI mean score was 38.03 points (SD 6.15, 95% CI 37.33–38.72), and the prevalence of adequate WA (equal to or above 37 points) was 56.58% (Table 2).

In the univariate analysis, all variables except daily and weekly hours of work corresponded to $p \leq .25$ (Table 3).

As can be seen in Table 4, in the multiple Poisson regression model, MPH (PR 1.375, 95% CI 1.038–1.821), bachelor education (PR 2.150, 95% CI 1.272–3.632), less than bachelor education

	Total (n = 304)	Performing MPH (n = 229)	Not performing MPH (n = 75)
	Percentage or mean (SD)	Percentage or mean (SD)	Percentage or mean (SD)
Sex			
Male	16.4	16.2	17.3
Female	83.6	83.8	82.7
Age	40.35 (9.74)	39.31 (9.5)	43.52 (9.85)
BMI			
Eutrophic	33.6	31.4	40
Non-eutrophic	66.4	68.6	60
Educational level			
Master or doctorate	25	21.8	34.7
Bachelor	15.5	17	10.7
Less than bachelor	59.5	61.2	54.6
Seniority	10.67 (9.36)	10.12 (8.89)	12.36 (10.55)
Employment status			
Civil service	29.9	24.9	45.3
Regular	60.2	64.2	48
Outsourced	9.9	10.9	6.7
Daily hours of work	9.97 (2.54)	10.18 (2.62)	9.32 (2.17)
Weekly hours of work	41.53 (7.91)	41.96 (8.62)	40.23 (4.95)
Colleagues' social support			
High	42.1	41	45.3
Moderate	38.5	37.6	41.3
Low	19.4	21.4	13.4
Supervisors' social support			
High	60.2	59.4	62.7
Moderate	28.3	27.9	29.3
Low	11.5	12.7	8
Smoking status			
Non-smoker	80.3	78.6	85.3
Smoker	19.7	21.4	14.7
Physical activity			
Active	44.4	45.4	41.3
Sedentary	55.6	54.6	58.7
Sleep quality			
Good	70.4	71.2	68
Poor	29.6	28.8	32
LBP			
Absent	42.8	39.3	53.3
Present	57.2	60.7	46.7

TABLE 1 Characteristics of study participants, total and stratified by exposure to MPH activities (n = 304)

level (PR 2.166, 95% CI 1.218–3.855), seniority (PR 1.049, 95% CI 1.024–1.086), poor sleep quality (PR 1.425, 95% CI 1.13–1.796) and presence of LBP (PR 2.003, 95% CI 1.314–3.052) were significantly associated with an inadequate level of WA.

Even though efforts were made to test for the presence of potential interaction terms, no significant interactions emerged.

4 | DISCUSSION

Our study showed a high prevalence of inadequate WA level among Brazilian HCWs and that MPH was negatively associated with WA.

The average WAI score found in this study (38.03) corresponded to the good WA level. Previous studies with Brazilian HCWs (Silva Junior et al., 2011; Vasconcelos et al., 2011) and in other developing countries such as Poland (Rypicz et al., 2021) have found similar scores, while studies conducted in developed countries, such as Israel and Italy, have demonstrated higher scores (Carel et al., 2013; Viola & Larese Filon, 2015). The combination of poorer working conditions, less favourable living and social conditions, quite present in developing countries, can aggravate health, well-being and, consequently, WA (Eurofound & International Labour Organization, 2019; Fischer et al., 2002).

Even though the mean WAI score corresponded to the good level, there was a substantial percentage (43.42%) of inadequate WA (WAI score < 37 points) among the participants. Here again, previous studies with Brazilian HCWs have found similar percentages (Helioterio et al., 2016; Vasconcelos et al., 2011), however, other studies, also conducted in Brazil (Cordeiro & Araújo, 2018; Fischer et al., 2006; Fischer & Martinez, 2013; Hilleshein et al., 2011) and in Croatia (Golubic et al., 2009), have found much lower percentages of inadequate WA.

Past research on WA have found that individual and work-related factors are associated with inadequate WA (van den Berg et al., 2009; Skovlund et al., 2020; Tonnon et al., 2019), and our results corroborate these findings.

In this study, MPH was negatively associated with WA. Patient handling is extremely physically demanding. During MPH activities compression forces significantly exceed the spinal compression tolerance recommended by the National Institute for Occupational Safety and Health (NIOSH; Garg & Owen, 1992; Marras et al., 1999). MPH also require the adoption of multiple awkward and strenuous postures, like trunk flexion, axial rotation of the spine and lateral bending (Garg et al., 1992). High physical workload can lead not only to the occurrence of musculoskeletal disorders (Du et al., 2021), but also to less energy or motivation for leisure-time physical activity (Møller et al., 2019) and has already been associated with decreased WA (van den Berg et al., 2009; Skovlund et al., 2020; Tonnon et al., 2019). A past research has found no association between lifting patients and inadequate WA (Fischer et al., 2006), however, this research did not control for receiving assistance and/or the use of patient-handling equipment, like we did.

TABLE 2 Work Ability Index (WAI) level and score, total and stratified by exposure to MPH activities (n = 304)

	n (%)	Mean (95% CI)
Total (n = 304)		
WAI level		
Excellent	63 (20.72)	
Good	109 (35.86)	
Moderate	111 (36.51)	
Low	21 (6.91)	
WAI score		38.03 (37.33–38.72)
Performing MPH (n = 229)		
WAI level		
Excellent	45 (19.65)	
Good	83 (36.24)	
Moderate	84 (36.68)	
Low	17 (7.43)	
WAI score		38.25 (37.58–38.91)
Not performing MPH (n = 75)		
WAI level		
Excellent	18 (24)	
Good	26 (34.67)	
Moderate	27 (36)	
Low	4 (5.33)	
WAI score		37.36 (36.59–38.12)

Abbreviation: MPH, manual patient handling.

In our study, seniority was negatively associated with WA. This result is consistent with the findings of previous studies with Brazilian and Polish nurses (Fischer & Martinez, 2013; Rypicz et al., 2021). Since HCWs are exposed to high mental and physical demands, usually combined with adverse working conditions, the longer they remain active the higher is the risk of functional reduction and, consequently, of decreased WA (Fischer & Martinez, 2013).

Our results show that a lower educational level was negatively associated with WA. Other studies corroborate this finding (Golubic et al., 2009; Håkansson et al., 2020; Mazloumi et al., 2012; Rypicz et al., 2021). A higher level of education is related with less physical job demands and increased professional skills; also, workers who have a higher educational level have better socioeconomic status and better health, all of which have a substantial impact on WA (Mazloumi et al., 2012; Mehrdad et al., 2016).

As in other studies (Fischer et al., 2006; Lian et al., 2015; Mazloumi et al., 2012; Mokarami et al., 2020), poor sleep quality was associated with inadequate WA. Since poor sleep quality, chronic fatigue, lowered cognitive function and mental and somatic ill health are connected (Lalluka & Kronholm, 2016; Mazloumi et al., 2012; Mokarami et al., 2017), it seems logical that sleep quality was negatively associated with WA.

There was, unsurprisingly, a negative association between LBP and WA. Musculoskeletal disorders, like LBP, predominantly affect physical function, but mental and social domains are also impaired

TABLE 3 Prevalence ratio (PR), 95% confidence interval (CI) and *p* values obtained by the simple Poisson models

Variable	PR	95% CI for PR	<i>p</i>
Manual patient handling			
Does not perform	Ref.	Ref.	Ref.
Perform	1.672	1.092–2.560	.018
Assistance to perform MPH activities			
Always	Ref.	Ref.	Ref.
Sometimes	1.262	0.890–1.789	.191
Never	1.315	0.918–1.884	.136
Use of patient-handling equipment			
Always	Ref.	Ref.	Ref.
Sometimes	0.670	0.349–1.288	.230
Never	0.724	0.446–1.176	.192
Sex			
Male	Ref.	Ref.	Ref.
Female	1.297	0.844–1.993	.236
Age	1.026	1.011–1.040	<.001
BMI			
Eutrophic	Ref.	Ref.	Ref.
Non-eutrophic	1.255	0.919–1.714	.153
Educational level			
Master or doctorate	Ref.	Ref.	Ref.
Bachelor	3.191	1.708–5.964	<.001
Less than bachelor	3.315	1.882–5.839	<.001
Seniority	1.024	1.012–1.037	<.001
Employment work status			
Civil service	Ref.	Ref.	Ref.
Regular	0.706	0.457–1.091	.117
Outsourced	1.107	0.719–1.703	.645
Daily hours of work	0.994	0.942–1.049	.751
Weekly hours of work	1.006	0.990–1.022	.454
Colleagues' social support			
High	Ref.	Ref.	Ref.
Moderate	1.354	0.983–1.866	.630
Low	1.446	1.004–2.084	.048
Supervisors' social support			
High	Ref.	Ref.	Ref.
Moderate	1.146	0.831–1.580	.406
Low	1.770	1.284–2.439	<.001
Smoking status			
Non-smoker	Ref.	Ref.	Ref.
Smoker	1.395	1.039–1.873	.027
Physical activity			
Active	Ref.	Ref.	Ref.
Sedentary	1.357	1.015–1.815	.040
Sleep quality			
Good	Ref.	Ref.	Ref.
Poor	1.938	1.495–2.512	<.001

TABLE 3 (Continued)

Variable	PR	95% CI for PR	<i>p</i>
LBP			
Absent	Ref.	Ref.	Ref.
Present	3.774	2.455–5.711	<.001

Abbreviations: BMI, body mass index; LBP, low back pain; MPH, manual patient handling.

TABLE 4 Prevalence ratio (PR), 95% confidence interval (CI) and *p* values determined in the multiple Poisson regression

Variable	PR	95% CI for PR	<i>p</i>
MPH			
Does not perform	Ref.	Ref.	Ref.
Perform	1.375	1.038–1.821	.026
Educational level			
Master or doctorate	Ref.	Ref.	Ref.
Bachelor	2.150	1.272–3.632	.004
Less than bachelor	2.166	1.218–3.855	.009
Seniority	1.049	1.024–1.086	<.001
Sleep quality			
Good	Ref.	Ref.	Ref.
Poor	1.425	1.130–1.796	.003
LBP			
Absent	Ref.	Ref.	Ref.
Present	2.003	1.314–3.052	.001

Abbreviations: LBP, low back pain; MPH, manual patient handling.

(Campbell et al., 2017; Dutmer et al., 2019). Other studies have also found a consistent relationship between LBP and decreased WA (Dutmer et al., 2019; Monteiro & Alexandre, 2009; Oberlinner et al., 2015), and that LBP in persons with widespread musculoskeletal pain predict long-term work disability (Natvig et al., 2002).

4.1 | Implications for practice and research

Currently it is recognized that the primary objective of occupational health nurses' work includes ensuring the health and work ability of employees through the promotion of healthy workplaces (Kuronen et al., 2020; Seppänen et al., 2020). Thus, the high prevalence of participants with inadequate WA that we have found highlights the urgent need for occupational health nurses (OHN) to facilitate and support collaboration between health services management and occupational health and safety services to design more effective workplace programmes aimed at maintaining and improving HCWs' WA. The fact that MPH was negatively associated with WA (even when controlling for several well-known predictors, including LBP) makes clear that these programmes should not be based only on individual-focused interventions (behaviour change through education, cardiorespiratory fitness, strength

training exercises, etc.). Since OHN may be responsible for leading the occupational health services team in designing and implementing evidence-based worksite health and work ability promotion programmes (Dombrowski et al., 2014), this finding indicates that OHN should aim for these programmes to be multifactor interventions, promoting and strengthening the implementation of safe patient-handling practices. Finally, in relation to nursing science, more studies regarding the mechanisms behind the relation of WA with patient handling are needed to enable more effective safe patient-handling practices and, consequently, WA programmes to be more successful.

4.2 | Limitations

When interpreting the results of this study, its potential limitations must be taken into consideration. First, due to its cross-sectional design, causative conclusions may not be drawn. Second, as the sampling was not randomized and the response rate was not ideal, the existence of a selection bias is possible. If HCWs that had lower levels of WA were more inclined to participate in the research, the percentage of workers presenting inadequate WA found in the study may be in part higher than the real one. Third, since the analysis was limited to currently working HCWs, workers who were not working (due to sick leave or retirement) or moved to another trade due to declining health status and/or lower levels of perceived WA might have been excluded from the study, resulting in the bias known as 'healthy worker effect'. Healthy worker effect generally reduces the association between exposure and outcome by an average of 20%–30% (Shah, 2009). Fourth, due to the multidimensional nature of WA, some variables associated with the WAI may not have been analysed. Finally, the study was limited to one healthcare facility, a public university hospital, therefore, any extrapolations should be carefully done and interpreted. Despite these limitations, it is important to note that the relation between MPH and WA has not been investigated in detail previously.

5 | CONCLUSION

In conclusion, in our study there was a high percentage of workers presenting inadequate WA among HCWs. Our results also indicate that MPH is associated with decreased WA among HCWs, even when controlling for LBP. Thus, in order to prolong the working life of HCWs, healthcare services should plan and implement interventions to maintain HCWs' WA, and these interventions should include the limitation of MPH activities and focus on the use of proper mechanical patient-handling equipment.

AUTHOR CONTRIBUTIONS

All the authors have intellectually contributed to the work, met the conditions of authorship and approved its final version. This work is original and has not been previously published and is not

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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