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Musculoskeletal Pain and Work-related Risk Factors among Waste Collectors in Hanoi, Vietnam: A Cross-sectional Study

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Abstract

BACKGROUND: Musculoskeletal disorders (MSDs) are prevalent among waste collectors (WCs) in developing countries.

AIM: This study aimed to investigate the prevalence of MSDs and the factors associated with the risk of persistent musculoskeletal pain among WCs in Hanoi, Vietnam.

METHODS: A cross-sectional survey was utilized to study 468 WCs in 2017. The Örebro Musculoskeletal Pain Questionnaire and a questionnaire on demographic and work conditions were used to collect data. Descriptive and multivariate logistics regression analyzes were applied at a significance level of 0.05 to examine the factors related to the risk of persistent pain.

FINDINGS: About 74.4% of the participants of this study experienced MSDs in at least one body region and 9.4% reported MSDs in all 10 body sites. The lower back was reported to be the most affected followed by the neck and shoulders. The risk of persistent musculoskeletal pain was significantly associated with age (odds ratio (OR) = 2.31, confidence interval (CI) = 1.05–5.09), gender (OR = 3.29, CI = 1.28–8.44), work hours (OR = 2.35, CI = 1.12–4.92), work shift (OR = 0.48, CI = 0.26–0.92), duration of poor postures of the neck (OR = 0.31, CI = 0.13–0.76), bent back (OR = 0.4 CI = 0.18–0.92) and for medial rotation (OR = 3.01, CI = 1.42–6.36), carrying heavy objects (OR = 2.94, CI = 1.15–7.48), and experience of work dissatisfaction (OR = 3.31, CI = 1.46-7.52), stress (OR = 7.14, CI = 3.14–16.24), or anxiety (OR = 6.37, CI = 3.07–13.21).

CONCLUSIONS: High prevalence of MSDs among WCs and its association with self-assessed unfavorable work postures and work-related stress implies the need of mechanical and social support at work for WC to prevent the development of MSDs and persistent pain.

Introduction

Work-related musculoskeletal disorders (MSDs), consist of a wide range of degenerative and inflammatory conditions, affect the supporting blood vessels, peripheral nerves, joints, ligaments, tendons, and muscles. MSDs are the leading cause of disability [1], [2] among workers impairing body functions, reducing work capabilities, and affecting the quality of life [3], eventually causing significant economic ramifications to the workers [4]. Although a high prevalence of MSDs has been reported in various occupations [5], [6], [7], [8], [9], [10], [11], many employees have to keep working even with pain and discomfort for the income. Hence, these workers are continuously being exposed to a specific occupational hazard, further aggravating their pain conditions and inflicting persistent pain in the musculoskeletal system. However, the factors influencing persistent musculoskeletal pain are still unclear and understanding these factors is significant to develop effective prevention and control measures. In addition, most studies on chronic MSDs focused on patients (i.e., participants who are already injured or who have left work because of long-term musculoskeletal pain) [12], [13], [14], [15], [16] or the general population [17], while only a few studies have mentioned the persistence of musculoskeletal pain and disability in the workforce [3], [15], [18] and no study has reported on the potential risk of persistent musculoskeletal pain and associated factors for waste collectors (WCs) in Vietnam.

WCs are particularly susceptible to work-related MSDs, especially in developing countries [9], [19], [20], [21], [22]. With limited resources, inadequate work equipment, and poor labor conditions, WCs collect municipal waste manually in daily routine. They frequently perform intense physical activities such as carrying, pushing, pulling, or lifting heavy objects for long working hours [9], [19], [23], [24]. These movements if done wrongly and with bad postures may inflict serious strain on workers' musculoskeletal

system [9], [19], [24]. The collection process is mainly done outdoor and on the streets without access to adequate shelters for temporary rest, thus WCs are directly affected by changes in climatic conditions such as temperature, humidity, and sunlight [19], [23], [25], [26]. Aside from the physical hazards of manual labor, WCs are also at high risk of psychological stress [27], which is associated with the development of MSDs [28]. In addition, individual factors such as age, gender, and body mass index can contribute to the elevated risk of MSDs among workers in general [3], [21], [22], [29]. Continuous exposure to a variety of risk factors can stimulate the transition from acute to chronic MSDs among WCs, leading to long-term disability.

Rapid urbanization and high population density in a metropolis such as Hanoi city, the capital of Vietnam, generate huge amounts of solid waste everyday, which is collected manually [30]. The heavy workload coupled with harsh working conditions such as extreme heat in summer and low temperature in winter, in association with lack of mechanical support for manual work put the WCs at high risk of acute and chronic MSDs. However, evidence on the risk of chronic musculoskeletal pain among workers worldwide and particularly among the WCs in Vietnam is scarce. Hence, the present study aimed to assess the prevalence of MSDs and identify the factors associated with the risk of persistent musculoskeletal pain among WCs in Hanoi, Vietnam. To the best of our knowledge, this study is the first attempt to examine the risk of long-term disability due to musculoskeletal pain among WCs. Results of this study can yield many insights for the development of appropriate policies and programs in response to MSDs prevention in WCs, both in Vietnam and other similar settings in the world.

Methods

Study design and selection of participants

A cross-sectional study was conducted from January to October 2017. The selection criteria included (1) having a labor contract; (2) being directly involved in the waste collection process; and (3) having 18 months of work experience by the time of recruitment. All eligible WCs (488) from a branch of an urban environmental company in Hanoi, Vietnam, were invited to partake in the study. However, nine WCs were not included because they were not present at their worksite during the interview and 11 questionnaires with missing data were removed. The final sample size was 468 WCs (response rate of 95.9%).

Data collection

Initially, the personnel department of the company was contacted to obtain permission and acquire the list of eligible WCs. Then, the study was introduced to the WCs at their worksites, and participants were invited to join with the assistance of the WCs team leaders. Each worksite was conveniently visited 3 times within 1 month to interview as many WCs as possible. In case, the WCs were not present at the worksite during all visits due to any reasons (e.g., sick leave and work absence), they were excluded from the survey. Interviews were conducted after or before the work shift. Participating WCs were requested to sign a consent form before the interview. Since WCs worked simultaneously, the original self-administrated method [16] was not possible. Hence, the questions were read aloud, and responses were recorded by data collectors instead.

The survey questionnaires had two parts: Demographic and work characteristics and the Örebro Musculoskeletal Pain Questionnaire (ÖMPQ), which are presented in Appendix 1.

Measures

Prevalence of MSDs and multisite MSDs and Risk of persistent MSDs based on the ÖMPQ

The ÖMPQ was utilized to identify the body sites with MSDs and to assess the impacts of persistent MSDs on various body functions, daily activities, and work performance [12], [13], [14], [15], [16]. In this study, the English version of ÖMPQ was translated, piloted, and revised before the actual survey, as presented in Appendix 1. The Cronbach's alpha of the Vietnamese ÖMPQ was 0.76, which indicated acceptable reliability [31]. The first four questions (Part A) were about the personal information of the WCs. The next 21 questions (Q5 to Q25) covered the different aspects of MSDs (i.e., prevalence, duration, and effect of experienced MSDs) [16] and thus contributed to the total ÖMPQ score. Q5 to Q7 indicated the body regions with pain, the duration of the concerned pain, and the number of workdays lost because of pain during the past 18 months. Q8 and Q17 measured the workers' perception of their working conditions. Q9 to Q12 examined the participant's self-evaluation of pain and coping strategies. Q13 to Q16 addressed the participants' psychological state, the risk of their pain becoming persistent, and the ability to work in the next 6 months. Q18 to Q20 evaluated how much physical activities affected the workers' pain. The final five questions, from Q21 to Q25, described workers' ability to participate in daily activities with current pain condition [16].

The prevalence of MSDs was calculated from the WCs who reported pain in at least one body region based on ÖMPQ, Q5, "*Where do you have pain*?" The list of body regions included was the neck, the shoulder, the arm, the upper back, the lower back, and the leg but was not limited to these six areas. The multisite MSDs,

on the other hand, were considered if MSD pain in at least two body sites (ÖMPQ, Q5) were reported.

The risk of persistent MSDs was evaluated based on the total ÖMPQ score. The total ÖMPQ score was the sum of the score per question with different weight. Q5 score was the product of two and the number of reported pain sites, but should not exceed 10. The scores of Q6 and Q7 were the bracketed numbers after the ticked boxes of the answers. For Q8, Q9, Q10, Q11, Q13, Q14, Q15, Q18, Q19, and Q20, the score was the number that has been selected as an answer. For Q12, Q16, Q17, Q21, Q22, Q23, Q24, and Q25, the score was calculated by subtracting the circled number by 10 [16]. Originally, a cutoff score of <105 indicated a low risk of persistent MSDs, then a score from 105 to 130 meant moderate risk and a score of >130 signified high risk [16]. However, the prediction of chronicity varied from 90 to 105 [14], in which a lower score could lead to increased true positives (possibly including more participants at risk) while a higher score could result in reduced false positives (limiting to participants who were truly at risk) [14]. Therefore, a cutoff point of 105 was used to categorize participants into low-risk group (score <105) and moderate to high-risk group (score ≥105).

The definition of persistence or chronicity of MSD or pain in empirical literature is inconsistent [2]. Several studies reported persistent pain based on the duration of pain which ranged from weeks to months [17], even years, or decades [32]. A number of studies have defined persistent musculoskeletal pain as having pain for 3 months or less [3], [17], [33] or 6 months [18], [34]. In this study, the total ÖMPQ score was the only indicator to determine the risk of pain chronicity [16].

Demographic and work characteristics

Two groups of factors were collected and analyzed for their potential relationships with the risk of chronic pain, namely, the demographics and the work conditions.

The demographic information of individual WCs included age, gender, education level, and the number of years working as WC (work seniority). Age and work seniority were categorized into two groups (>39 vs. ≤39 years old and ≥15 vs. <15 working years, respectively). Gender included male and female groups and education level was classified into two groups, namely, primary to high school and above high school.

Work characteristics were divided into four groups of variables, namely, work organization, exposure to physical occupational hazards, self-reported unfavorable work postures, and psychological stress at work. Work organization variables included the number of work hours per shift (≤8 vs. 9–12 hours/shift) and work shift in the past 3 months (Shift 3 from 6 p.m. to 2 a.m. and others including Shift 1 from 5 a.m. to 1 p.m., Shift 2 from 1 p.m. to 8 p.m., and frequently changed shift). Physical occupational hazards focused on the frequency of exposure to sunlight, hot/cold/wet weather conditions (frequent exposure vs. seasonal to none exposure). Unfavorable working postures were expressed by time spent performing 12 specific postures which were common among WCs (≥2 vs. <2 hours per shift, illustration in Appendix 1). The experience of psychological stress at work included level of anxiety and stress during the previous week (high vs. acceptable), level of satisfaction about work conditions during the previous week (unsatisfied vs. acceptable), and exposure to the threat of physical and psychological violence at work (yes vs. never).

Statistical analysis

The collected data were analyzed using SPSS Version 22.0. Descriptive analysis was done to assess the mean Örebro score, the prevalence and body site of MSDs, and risk of persistent musculoskeletal pain. To investigate the factors associated with the risk of persistent musculoskeletal pain, two groups, the low risk (Örebro score <105) and the moderate to high risk of persistent musculoskeletal pain (Örebro score ≥105), were assigned as the dependent variables, while the demographic characteristics and working conditions were the independent variables (covariates). Specifically, the (1) personal and work organization variables; (2) exposure to occupational hazards; (3) duration performing unfavorable working postures; and (4) experience of psychological stress at work were used as covariates. The association between covariates and the risk of chronic musculoskeletal pain was examined using multivariate logistics regression (Enter method, a significance level of 0.05). Odds ratios (OR), 95% confidence interval (CI), and significance levels (p) were reported.

Ethics approval and consent to participate

The study was approved by the ethics committee for biomedical research at the Hanoi University of Public Health, Hanoi, under Decision No. 46/2017/YTCC-HDD3, dated 15/02/2017. The participation in the study was completely voluntary and written consent forms were obtained on data collection.

Results

Table 1 presents the personal information of the study participants. The mean age of participants was 38.3 (SD = 7.7). Majority of the WCs were female (83.1%) and were able to complete primary to high school education (95.5%). One-third of WCs had been working as WCs for more than 15 years (31.8%). More

than 80% of the participants worked for 8 hours per shift, and most of them took the night shift from 6 p.m. to 2 a.m. in the past 3 months (75.2%).

Table 1: Characteristics of waste collectors who participated in this study (n=468)

Variables	Group	n	%
Age	>39 years old	198	42.3
	≤39 years old	270	57.7
Gender	Female	389	83.1
	Male	79	16.9
Education level	Primary + high school	447	95.5
	Above high school	21	4.5
Work seniority	≥15 years	149	31.8
	<15 years	319	68.2
Working hours/shift	9–12 hours	66	14.1
	≤ 8 hours	402	85.9
Working shift during the past 3 months	Shift 3 (6 p.m.–2 p.m.)	352	75.2
	Others	116	24.8

The prevalence of musculoskeletal pain

Among the participants, 348 experienced experiencing pain in at least one body region (74.4%) (Table 2). The prevalence of musculoskeletal pain at the lower back was the highest (62.9%), followed by pain on the neck (59.1%), shoulders (56.9%), and forearms (56%) (Figure 1). Further, 13.9% of the WCs had pain in only one body site, while 60.5% experienced pain in several studied body sites.

Table 2: Risk of persistent MSDs among the study participants (n=468)

Variables	Group	n	%
Presence of musculoskeletal pain by body site (ÖMPQ Q5)	No	120	25.6
	1 body site	65	13.9
	2–9 body sites	239	51.1
	10 body sites	44	9.4
Number of workdays lost because of current pain in the past 18 months (ÖMPQ, Q6) n=348	No day lost	174	50.0
	1–2 days	87	25.0
	3–7 days	55	15.8
	≥7 days	32	9.2
Duration of current pain problem (ÖMPQ, Q7) n=348	<3 months	58	16.7
	3–12 months	56	16.1
	More than 1 year	234	67.2
Orebro score (Mean±SD=68.9±47.7, Median=87)	<105	347	74.1
	105–130	98	20.9
	>130	23	4.9

MSDs: Musculoskeletal disorders, ÖMPQ: Örebro Musculoskeletal Pain Questionnaire.

About 50% WCs reported work days lost due to musculoskeletal pain in the previous 18 months. More than 80% of the participants experienced current pain in at least 3 months (290 WCs). The Örebro mean score of the whole sample was 68.9 (SD ± 47.7). One-fourth of WCs were exposed to moderate to high risk of persistent musculoskeletal pain (Örebro mean score ≥105).

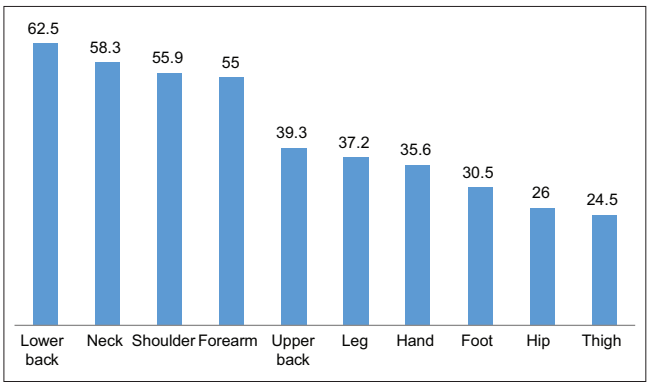

Figure 1: The prevalence of musculoskeletal pain by body site (n = 468)

Factors related to the risk of persistent MSDs

The results in Table 3 showed that WCs with higher risk of musculoskeletal pain were older (OR = 2.31, CI = 1.05–0.09), female workers (OR = 3.29, CI = 1.28–8.44), worked more than 8 h/day (OR = 2.35, CI = 1.12–4.92), and worked at day shift or frequently changed shift (OR = 0.48, CI = 0.26–0.92). Workers with the neck and the back bent for a prolonged duration at an angle of over 45° without supportive equipment for more than 2 h during their shift reported a reduced risk of musculoskeletal pain, compared to those who had these postures <2 h (OR = 0.31 and 0.4, respectively). Longer duration of medial rotation while walking (such as sweeping the street while walking) increased the risk of chronic musculoskeletal pain by 3.01 times among the study participants ($p < 0.01$). Carrying heavy objects with one hand were not a common task since majority of workers only did it for < 2 h per shift, but this task was significantly associated with the elevated risk of long-term disability (OR = 2.94, CI = 1.15–7.48). Workers who felt highly anxious, stressed, or unsatisfied with work during the week before the survey also had a significantly higher risk than those who rated these psychological conditions as "acceptable" ($p < 0.01$).

Discussion

MSDs were found to be prevalent among the study participants and a considerable number of WCs had moderate to high risk of persistent musculoskeletal pain. The factors that significantly associated with the risk of chronic musculoskeletal pain included age, gender, work hours, work shift, several work postures, and psychological conditions 1 week before the survey.

The prevalence of musculoskeletal pain among WCs

The percentage of WCs who experienced musculoskeletal pain in at least one body region in this study (74.4%) was much higher than those reported in other studies among WCs in low- and middle-income countries with similar settings such as Vietnam, India, or Brazil (44.7–73.5%) [19], [21], [22], [35] but lower than that of Iranian WCs (92.5%) [9]. The manual waste collection process involves whole-body movements with the lower back bearing the highest amount of impact [4], [24]. Moreover, waste collecting job requires workers to stay in poor postures such as standing, moving, twisting the body, and sweeping for a long time, which mainly affect the back, legs, and hands, resulting in high MSD prevalence in these body parts. This was confirmed by several studies that MSDs in WCs mostly occurred in the lower back [9], [19], [20], [21], [22], [35],

Table 3: Associations between demographic, work-related characteristics, and risk of persistent musculoskeletal pain in a multivariate logistics regression (n=468)

Variables[a]	Group	Study sample	Moderate to high risk (Orebro ≥105)		Adjusted OR	95.0% CI for OR	
	Total	468	n	%		Lower	Upper
			121	25.9			
Personal and work organization							
Age	>39	198	65	32.8	2.31*	1.05	5.09
	≤39	270	56	20.7			
Gender	Female	389	113	29.0	3.29*	1.28	8.44
	Male	79	8	10.1			
Working hours/shift	9–12 h	66	28	42.4	2.35*	1.12	4.92
	≤8 h	402	93	23.1			
Working shift during the past 3 months	Shift 3 (6 p.m.–2 p.m.)	352	83	23.6	0.48*	0.26	0.92
	Others	116	38	32.8			
Duration performing unfavorable working posture							
The neck bent for a prolonged duration at an angle of over 45° without supportive equipment	≥2 hours	271	71	26.2	0.31*	0.13	0.76
	<2 hours	197	50	25.4			
The back bent at an angle of over 45° without supportive equipment for a prolonged duration	≥2 hours	242	63	26.0	0.40*	0.18	0.92
	<2 hours	226	58	25.7			
Medial rotation while walking	≥2 hours	229	76	33.2	3.01**	1.42	6.36
	<2 hours	239	45	18.8			
Carrying >5 kg with one hand	≥2 hours	114	39	34.2	2.94*	1.15	7.48
	<2 hours	354	82	23.2			
Experience of psychological stress at work							
Level of anxiety and frustration during the last week	High anxiety	158	85	53.8	3.31**	1.46	7.52
	Acceptable	310	36	11.6			
Level of stress during the last week	Highly discomfort	162	90	55.6	7.14**	3.14	16.24
	Acceptable	306	31	10.1			
Level of satisfaction about work conditions during the last week	Unsatisfied	76	44	57.9	6.37**	3.07	13.21
	Acceptable	392	77	19.6			

*p<0.05, **p<0.01. [a]Variables without a significant association with the risk of persistent pain in this analysis (p>0.05) included education, number of working years, exposure to heat, cold, sunlight, and wetness at work; the hand raised above the head or elbow above the shoulder, the back bent at an angle of over 30° without supportive equipment for a prolonged duration, squatting, kneeling, thoracolumbar flexion, lifting >5 kg more than twice per minute, lifting >37.5 kg once/day or >27.5 kg 10 times/day, lifting >13.5 kg from the height of above the shoulder, below the knee or the distance of one arm more than 25 times/day, exposure to threat of psychological violence, and exposure to threat of physical violence.

upper limbs [19], [36], and shoulders [9], [20], [22], [35]. Further, continuous exposure to a variety of poor postures might trigger the onset of musculoskeletal pain at multi-body sites. Although more body sites with MSDs indicate the higher impact of this health problem, only a few studies report the prevalence of co-occurring pain among workers. The prevalence of multisite MSDs among WCs in this study (60.5%) was higher than those of general working occupation (34%) [10] and seafood processing workers (42.2%) [11]. The significant proportion of WCs with long-term pain and of WCs with multisite MSDs emphasizes the importance of prompt measures to improve current working conditions.

Factors related to the risk of persistent MSDs

The previous studies have reported that different gender [5], [8], [22] and age groups [6] among workers have varying influences for acquiring MSDs and these results are comparable to the findings of our study. Accordingly, being a female is often described as a “risk factor” for MSDs because of the difference in physical strength of the musculoskeletal system between men and women [29]; the negative impact of the same physical labor is generally greater on females than males, therefore higher prevalence of MSDs among women compared to men [22]. Further, a higher prevalence of MSDs among older workers or workers with longer work experience was observed because of the long-term exposure to occupational hazards [9], [13], [21], [29]. These results imply the need for mechanical support at work for female WCs and to older workers to prevent the risk of chronic MSDs and to reduce any compensated cost due to MSDs.

The results of this study regarding work organization, particularly on work shifts, were not as predicted because, among the work shifts, the night shift (Shift 3) had the most strenuous work, but lower risk of persistent pain was observed (OR = 2.35, CI = 0.26–0.92). At night, WCs are exposed to a higher level of psychological stress due to sleep deprivation, harsher climatic conditions (e.g., too wet or too cold), and fatigue. Moreover, the work shift only ends when all the garbage of the city have been collected and transported to the processing plant. Hence, sometimes work hour exceeds the regulation of 8 hours per shift. One probable explanation of the obtained results is that those WCs with existing musculoskeletal problems might be scheduled to the day shift before the study period since their physical health conditions were not suitable for the night shift. Therefore, further study on the association between work shift and the risk of persistent MSDs among WCs should be conducted to address the identified issue.

No significant association was observed between the risk of persistent MSDs and exposure to physical work environments such as sunlight, heat, coldness, and wetness. This result did not agree with the findings of another study. Magnavita *et al*. [26], in their study on hospital workers, reported that exposure to temperature and light (OR = 1.92 and 1.68, respectively) increased the risk of MSDs in the upper limbs and that temperature could also elevate the risk of MSDs in the lower back (OR = 1.31). In contrary, extended duration of carrying out the task in poor work postures (e.g., the neck/back bent for a prolonged time at an angle of over 45° without supportive equipment, medial rotation while walking and carrying >5 kg with

one hand) elevated the risk of persistent MSDs in the WCs and this result agreed with published studies that reported an association between the increased risk of MSDs and poor working postures, quick motion, and continuous bending or twisting while carrying or lifting heavy objects [4], [8], [9], [37].

Psychological stress, anxiety, and job satisfaction experienced by WCs contributed to the risk of persistent MSDs since mental stress diverts resources spent on attention and can lead to fatigue and injury [4], [9], [26]. A study in Korea reported a significantly higher prevalence of depression and anxiety among workers with MSDs compared to those who did not have MSDs [38]. It is increasingly evident that addressing psychological factors impacting workers is crucial to prevent the development of persistent musculoskeletal pain.

Limitations of this study

Several limitations of this study have been identified. First, the heterogeneity in definition and symptom of MSD [2], the duration of reported persistent musculoskeletal pain [17], and the scarcity of evidence on persistent MSD among WCs in literature are recognized. Therefore, the discussion of this paper was limited to published studies with similarity in a certain aspect of the study design. Second, the application of self-reported health conditions and work conditions could create a certain level of bias on the prevalence of MSDs and risk of persistent pain among the investigated participants. It was not possible to determine the condition of persistent pain without a proper medical diagnosis, thus this paper only aimed to provide the relative risk of persistent MSDs with a screening purpose. Third, it was not possible to create the causal relationship between demographic and work conditions and the risk of persistent MSD with the cross-sectional study design of this paper. In addition, the applicability of the study results is limited to companies with similar work conditions. Hence, future studies should consider more robust study design such as cohort or randomized control trial to evaluate the impact of work conditions on MSDs among WCs in particular and different groups of occupation in general. Future studies should also include participants from different environment and sanitation companies for the results to be generalized to all WCs in Vietnam. However, this is the first paper to report the risk of persistent MSDs among WCs in Vietnam, using the ÖMPQ.

Conclusions

This study showed that the prevalence of MSDs, as well as multiple site MSDs (at least two sites), among WCs was high. The lower back was found to be the most affected site followed by the neck and shoulders. Workers with a higher risk of persistent MSDs were female, older, and worked more than 8 hours per shift. Work factors associated with persistent MSDs included poor postures, dissatisfaction with work, and the incidence of stress or anxiety a week before the survey. The high percentage of MSDs and the presence of factors related to a higher risk of persistent MSDs such as poor work postures and work-related psychological stress imply the need of mechanical and social support at work to prevent the development of chronic musculoskeletal pain. Automation of operation and use of different machinery on the job to aid in several work tasks such as lifting/carrying heavy objects or sweeping the street to replace the current manual operation would be beneficial. Social support, on the other hand, may include implementation of a better reward system to motivate workers, development of a coworker support system to assist and encourage one another, provision of adequate personal protective equipment, and timely provision of medical treatment for occupational injuries and other health problems.

Availability of data and materials

Additional data and materials are available on request to the corresponding author.

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Appendix 1: Research questionnaires

The situation of musculoskeletal disorders and related factors among Hanoi urban environment workers in 2017.

Code	Questions	Response
	A. General information about the waste collectors	
A1	Year of birth (calendar)	Year: ……
A2	Sex	1. Male 2. Female
A3	Education level	1. Primary school 2. High school 3. Senior high school 4. Vocational school 5. College and above 6. Other (state):.....
A4	How old were you when you started working at your current position?	……. years old
	B. Working conditions	
	Work organization	
B1	On average, how many hours do you work per shift?	..... hours
B2	In the past 3 months, what was your assignment?	1. Shift 1 2. Shift 2 3. Shift 3 4. Frequently change
	Exposure to physical occupational hazards	
B3	What is your level of exposure to hot working environment?	1. Frequently 2. Low/seasonal exposure 3. No exposure
B4	What is your level of exposure to sunlight at work?	1. Frequently 2. Low/seasonal exposure 3. No exposure
B5	What is your level of exposure to cold working environment?	1. Frequently 2. Low/seasonal exposure 3. No exposure
B6	What is your level of exposure to wet working conditions?	1. Frequently 2. Low/seasonal exposure 3. No exposure
	Work postures (see the illustration)	
B7	In your shift, how many hours do you work in the posture with the hand raised above the head or elbow above the shoulder?	1. ≥ 4 h 2. ≥ 3 h 3. ≥ 2 h 4. < 2 h 5. Not perform
B8	In your shift, how many hours do you work in the posture with the neck bent for a prolonged duration at an angle of over 45° without supportive equipment?	1. ≥ 4 h 2. ≥ 3 h 3. ≥ 2 h 4. < 2 h 5. Not perform
B9	In your shift, how many hours do you work in the posture with the back bent at an angle of over 30° without supportive equipment for a prolonged duration?	1. ≥ 4 h 2. ≥ 3 h 3. ≥ 2 h 4. < 2 h 5. Not perform
B10	In your shift, how many hours do you work in the posture with the back bent at an angle of over 45° without supportive equipment for a prolonged duration?	1. ≥4 h 2. ≥3 h 3. ≥2 h 4. <2 h 5. Not perform
B11	In your shift, how many hours do you work in the squatting posture?	1. ≥4 h 2. ≥3 h 3. ≥2 h 4. <2 h 5. Not perform

Code	Questions	Response
	B. Working conditions	
	Work organization	
B12	In your shift, how many hours do you work in the kneeling posture?	1. ≥4 h 2. ≥3 h 3. ≥2 h 4. <2 h 5. Not perform
B13	In your shift, how many hours do you work in the posture of medial rotation while walking?	1. ≥4 h 2. ≥3 h 3. ≥2 h 4. <2 h 5. Not perform
B14	In your shift, how many hours do you work in the posture of thoracolumbar flexion?	1. ≥4 h 2. ≥3 h 3. ≥2 h 4. <2 h 5. Not perform
B15	In your shift, how many hours do you have to carry >5 kg with one hand?	1. ≥4 h 2. ≥3 h 3. ≥2 h 4. <2 h 5. Not perform
B16	In your shift, how many hours do you have to frequently lift >5 kg (more than twice per minute)?	1. ≥4 h 2. ≥3 h 3. ≥2 h 4. <2 h 5. Not perform
B17	In your shift, how many hours do you have to lift >37.5 kg once/day or >27.5 kg 10 times/day	1. ≥4 h 2. ≥3 h 3. ≥2 h 4. <2 h 5. Not perform
B18	In your shift, how many hours do you have to lift >13.5 kg from the height of above the shoulder, below the knee or the distance of one arm more than 25 times/day?	1. ≥4 h 2. ≥3 h 3. ≥2 h 4. <2 h 5. Not perform
	Psychological stress	
B19	What is your level of anxiety and frustration during the last week?	1. Completely comfortable/ not anxious 2. Mid anxious but acceptable 3. Anxious 4. Very anxious
B20	What is your level of stress during the last week?	1. Completely comfortable/ not stressful 2. Mid stressful but acceptable 3. Stressful 4. Very stressful
B21	What is your level of satisfaction with work during the last week?	1. Absolutely satisfied 2. Satisfied 3. Normal 4. Not satisfied
B22	What is your level of exposure to threat of psychological violence?	1. Frequently 2. Occasionally 3. Never/no exposure
B23	What is your level of exposure to threat of physical violence?	1. Frequently 2. Occasionally 3. Never/no exposure

Illustration of Working Postures

1. The hand raised above the head or elbow above the shoulder	2. The neck bent for a prolonged duration at an angle of over 45° without supportive equipment	3. The back bent at an angle of over 30° without supportive equipment for a prolonged duration	4. The back bent at an angle of over 45° without supportive equipment for a prolonged duration[n]
			
5. Squatting	6. Kneeling	7. Medial rotation while walking	8. Thoracolumbar flexion
			
9. Carrying >5 kg with one hand	10. Lifting >5 kg more than twice per minute	11. Lifting >37.5 kg once/day or >27.5 kg 10 times/day	12. Lifting >13.5 kg from the height of above the shoulder, below the knee or the distance of one arm more than 25 times/day
			

Örebro Musculoskeletal Pain Questionnaire (ÖMPQ) Linton and Boersma, 2003.

These questions and statements apply if you have aches or pains, such as back, shoulder, or neck pain. Please read and answer questions carefully. Do not take long to answer the questions, however, it is important that you answer every question. There is always a response for your particular situation.

1. Where do you have pain? Place a tick (√) for all appropriate sites. □Neck □Shoulder □Arm □Lower back □Leg □Other (state) □Upper back	Score=Number of pain site×2 (but max 10)
2. How many days of work have you missed because of pain during the past 18 months? Tick (√) one. □0 days (1) □1–2 days (2) □3–7 days (3) □8–14 days (4) □15–30 days (5) □1 month (6) □2 months (7) □3–6 months (8) □6–12 months (9) □over 1 year (10)	Score=The number bracketed after the ticked box
3. How long have you had your current pain problem? Tick (√) one. □ 0–1 week (1) □1–2 weeks (2) □3–4 weeks (3) □4–5 weeks (4) □6–8 weeks (5) □9–11 weeks (6) □3–6 months (7) □6–9 months (8) □9–12 months (9) □over 1 year (10)	
4. Is your work heavy or monotonous? Circle the best alternative 0 1 2 3 4 5 6 7 8 9 10 Not at all Extremely	Score=The number that has been circled
5. How would you rate the pain that you have had during the past week? Circle one. 0 1 2 3 4 5 6 7 8 9 10 No pain Pain as bad as it could be	
6. In the past 3 months, on average, how bad was your pain on a 0–10 scale? Circle one. 0 1 2 3 4 5 6 7 8 9 10 No pain Pain as bad as it could be	
7. How often would you say that you have experience pain episodes, on average, during the past 3 months? Circle one. 0 1 2 3 4 5 6 7 8 9 10 Never Always	
8. Based on all things you do to cope, or deal with your pain, on an average day, how much are you able to decrease it? Circle the appropriate number. 0 1 2 3 4 5 6 7 8 9 10 Cannot decrease it at all Can decrease it completely	Score=10 min the number that has been circled
9. How tense or anxious have you felt in the past week? Circle one. 0 1 2 3 4 5 6 7 8 9 10 Absolutely calm and relaxed As tense and anxious as I've ever felt	Score=The number that has been circled
10. How much have you been bothered by feeling depressed in the past week? Circle one. 0 1 2 3 4 5 6 7 8 9 10 Not at all Extremely	
11. In your view, how large is the risk that your current pain may become persistent? Circle one. 0 1 2 3 4 5 6 7 8 9 10 No risk Very large risk	
12. In your estimation, what are the chances that you will be able to work in 6 months? Circle one. 0 1 2 3 4 5 6 7 8 9 10 No chance Very large chance	Score=10 min the number that has been circled
13. If you take into consideration your work routines, management, salary, promotion possibilities and work mates, how satisfied are you with your job? Circle one. 0 1 2 3 4 5 6 7 8 9 10 Not satisfied at all Completely satisfied	
Here are some of the things that other people have told us about their pain. For each statement, circle one number from 0 to 10 to say how much physical activities, such as bending, lifting, walking, or driving, would affect your pain.	Score = the number that has been circled
14. Physical activity makes my pain worse. 0 1 2 3 4 5 6 7 8 9 10 Completely disagree Completely agree	
15. An increase in pain is an indication that I should stop what I'm doing until the pain decreases. 0 1 2 3 4 5 6 7 8 9 10 Completely disagree Completely agree	
16. I should not do my normal work with my present pain. 0 1 2 3 4 5 6 7 8 9 10 Completely disagree Completely agree	
Here is a list of five activities. Circle the one number that best describes your current ability to participate in each of these activities.	
17. I can do light work for an hour. 0 1 2 3 4 5 6 7 8 9 10 Cannot do it because of pain problem Can do it without pain being a problem	Score=10 min the number that has been circled
18. I can walk for an hour. 0 1 2 3 4 5 6 7 8 9 10 Cannot do it because of pain problem Can do it without pain being a problem	
19. I can do ordinary household chores. 0 1 2 3 4 5 6 7 8 9 10 Cannot do it because of pain problem Can do it without pain being a problem	
20. I can do the weekly shopping. 0 1 2 3 4 5 6 7 8 9 10 Cannot do it because of pain problem Can do it without pain being a problem	
21. I can sleep at night. 0 1 2 3 4 5 6 7 8 9 10 Cannot do it because of pain problem Can do it without pain being a problem	