Musculoskeletal pain and associated factors among waste collectors in Hanoi, Vietnam: A cross-sectional study.

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Abstract

Background: Musculoskeletal disorders are prevalent among waste collectors in developing countries. This study aimed to investigate the prevalence of musculoskeletal disorders and risk factors of persistent musculoskeletal disorders among waste collectors in Hanoi, Vietnam. Methods: A cross-sectional survey was utilized to study 468 waste collectors in 2017. The Örebro Musculoskeletal Pain Questionnaire and questionnaires on demographic and work conditions were used to collect data. Descriptive and Multivariate logistics regression analyses were applied at the significant level p<0.05. Findings: 67.4% waste collectors participating into this study reported musculoskeletal disorders in at least one body region. Lower back was the most affected site, followed by pain in the neck and shoulders. The risk of persistent musculoskeletal disorders associated with age, gender, work hours, work shift, duration of poor postures of the neck and back, carrying heavy objects, and experience of work dissatisfaction, stress or anxiety. Conclusions: High prevalence of musculoskeletal disorders among waste collectors and association with self-assessed unfavorable work postures and work-related stress imply the need of mechanical and social support at work for waste collectors to prevent the development of musculoskeletal disorders.

Background

Work-related musculoskeletal disorders (MSDs) consist of wide range of degenerative and inflammatory conditions that affect the supporting blood vessels, peripheral nerves, joints, ligaments, tendons, and muscles in workers [1]. MSDs are the leading cause of disability [2], result in impairing body function, affecting the workers' quality of life and reducing their working capability [3], which in turn will have significant economic ramifications for the workers [1]. Although high prevalence of MSDs has been reported in various occupations [3-11], many employees with pain have to keep working for a living, hence continuously expose to specific occupational hazards which aggravate their pain conditions. Evidence on factors of persistent musculoskeletal pain is needed to develop effective prevention and control measures. However, many studies on chronic MSDs focus on patients [12-16], only few studies have investigated the development of musculoskeletal pain chronicity in the workforce [3].

Waste collectors (WC) are particularly susceptible to work-related MSDs, especially in developing countries [8-10, 17]. With limited resources, inadequate work equipment and poor labor conditions, WCs collect municipal waste manually in daily routine. They frequently perform vigorously intense physical activities such as carrying, pushing, pulling or lifting heavy objects in long working hours [8-10]. These harmful movements and postures inflict serious strain on workers' musculoskeletal system.[9, 10] The collection process is mainly outdoor and on the street without access to adequate street shelters for temporary rest, WCs are directly affected by changes in climatic conditions such as temperature, humidity or, sunlight [8, 9, 18, 19]. Beside physical hazards of manual labor, WCs are also at high risk of psychological stress [20] which associate with the development of MSDs [21]. In addition, individual factors such as age, gender, BMI can contribute to the elevated risk of MSDs among workers [3, 22].

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 such a metropolis as Hanoi city, the capital of Vietnam, generate huge amounts of solid waste everyday which is collected manually (23). The heavy workload, coupled with harsh working conditions such as extreme heat in summer and low temperature in winter, in association with lack of support tools for manual work, put the WCs at high risk of MSDs, particularly persistent pain. However, evidence on the risk of chronic musculoskeletal pain among workers worldwide and particular waste collectors in Vietnam is scarce. Hence, the present study aims to assess the prevalence of MSDs and identify factors associated with persistent musculoskeletal pain among WCs in Hanoi, Vietnam. Results from this study can yield many insights to develop appropriate policy and program responses on MSD prevention for WCs both in Vietnam and other similar settings in the world.

Methods

Study design and inclusion criteria of participants

A cross sectional study was conducted in the period of January to October 2017. Selection criteria included having a labor contract, being directly involved in waste collection process, and having 18 months of work experience by the time of recruitment. All eligible WCs (488) from a branch of the urban environmental company in Hanoi, Vietnam, were invited and recruited to partake in the study. After removing 20 questionnaires with missing data, the final sample of 468 WCs was used for analysis (response rate 95.9%).

Data collection

At first we contacted the Personal Department of the company to obtain their permission and the list of eligible WCs. Then data collectors came to the WCs worksite, introduced the study and invited participants to join with the assistance of the WCs team leaders. In each worksite, data collectors conveniently visited three times within one month to invite as many WCs as possible. In case the WCs were not presented at the worksite by the time of all visits due to any reasons (e.g. sick leave, work absence), they were not invited to participate into this survey.

Participants were interviewed at their worksites after or before their shift. Because WCs simultaneously worked and provided information so data collectors read aloud questions and recorded response instead of the original self-administered method (16). WCs participating into this study were provided with and signed the consent form before the interview. The survey questionnaires included two parts: Demographic and work characteristics and The Örebro Musculoskeletal Pain Questionnaire which were presented in the Appendix 1.

Variables

Prevalence of MSDs and Risk of persistent MSDs based on The Örebro Musculoskeletal Pain Questionnaire

The Örebro Musculoskeletal Pain Questionnaire (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 (12-16). Only 21 questions (Q5 to Q25) contributed to the total ÖMPQ score, the first 4 questions on personal information were categorized in part A General information about the waste collectors. These 21 items covered different aspects of MSDs. Q5 to Q7 indicated the body regions with pain, the duration of concerned pain and the number of work days lost because of pain during the last 18 months. Q9 to Q12 examined the participant's self-evaluation of pain and coping strategies. Q8 and Q17 measured workers' perception of their working conditions. Q13 to Q16 addressed 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 workers' pain. The final 5 questions from Q21 to Q25 described workers' ability to participate into daily activities with current pain condition (16). In this study, the English version of ÖMPQ was translated, piloted and revised before the actual survey. The Cronbach's alpha of the Vietnamese ÖMPQ was 0.76 which indicated the acceptable reliability (24).

The prevalence of MSDs was calculated from WCs who reported pain in at least one body region by answering this question "Where do you have pain?" (ÖMPQ, Q5). The risk of persistent MSDs was evaluated based on the total ÖMPQ score (ranging from 3 to 210) which was the sum of 21 individual items' scores..A cut-off score below 105 was used to indicate low risk of persistent MSDs, score from 105 to 130 meant moderate risk and score above 130 was equal to high risk (16).

Demographic and work characteristics

Two groups of factors were collected and analyzed for their potential relationships with the risk of chronic pain (1, 3, 4, 10).

Demographic information of individual WCs included age, gender, education level and number of years working as WC (work seniority). Age and work seniority were categorized into two groups (>39 versus ≤ 39 years old and ≥15 versus < 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 described with 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 versus 9-12 hours/shift) and shift work in the last three months (Shift 1 from 5 a.m. to 1 p.m.; Shift 2 from 1 p.m. to 8 p.m.; Shift 3 from 6 p.m. to 2 a.m. and Frequently changed shift). Physical occupational hazards contained the self-reported frequency of exposure to sunlight, hot/cold/wet weather conditions (frequent exposure versus seasonal to none exposure). Unfavorable working postures were expressed by time spent performing

twelve specific postures which were common among WCs (≥2 versus < 2 hours per shift, see Illustration in Appendix 1). Experience of psychological stress at work included level of anxiety and stress during the previous week (high versus acceptable), level of satisfaction about work conditions during the previous week (unsatisfied versus acceptable), exposure to threat of physical and psychological violence at work (yes versus never).

Statistical analysis

The collected data were analysed 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 MSDs. WCs were divided into two groups, low risk of persistent MSDs (Örebro score <105) and moderate to high risk of persistent MSDs (Örebro score ≥ 105). To examine factors associated with the risk of persistent MSDs, multivariate logistics regression was applied (Enter method, probability for entry 0.05; probability for removal 0.1, significant level < 0.05).

Results

Table 1 presents background information of study subjects. The mean (SD) age of participants was 38.3 (7.7). Majority of waste collectors were female (83.1%) or completed primary to high school education (95.5%). One third of workers had been working as waste collectors for more than 15 years (31.8%). More than 80% participants worked 8 hours per shift and most of them took night shift from 6p.m to 2a.m in the last three months (75.2%).

Table 1: Characteristics of waste collection workers participating into this study (N = 468)

Variables	Group	N	%
Age (year)	>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 last 3 months	Shift 3 (6p.m – 2p.m)	352	75.2
	Others	116	24.8
Total		468	100.0

The prevalence of musculoskeletal pain

348 WCs reported pain in at least one body region (74.4%). The prevalence of musculoskeletal pain at the lower back was the highest (62.9%), followed by pain at the neck (59.1%), shoulders (56.9%) and

forearms (56%) (Figure 1). 13.9% WCs had pain in only one body site and 60.5% workers experienced pain in several studied body sites. Pain was persistent (duration at least 3 months) in 290 (83.3%) subjects. The Örebro mean score of the whole sample was 68.9±47.7. One fourth of WCs were exposed to moderate to high risk of persistent musculoskeletal pain (Örebro mean score ≥ 105) (Table 2).

Table 2: Risk of persistent MSDs among 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
Duration of current pain problem (ÖMPQ, Q7) N = 348	Less than 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

Factors related to the risk of persistent MSDs

Four groups of variables were put into the multivariate logistics regression analysis to identify the association between personal and work-related characteristics and the risk of persistent musculoskeletal pain. These groups included (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. The results in Table 3 show that WCs with higher risk of musculoskeletal pain were older (OR 2.31, 95%CI 1.05-5.09), female workers (OR 3.29, 95%CI 1.28-8.44), worked more than 8 hours per day (OR 2.35, 95%CI 1.12 – 4.92) and worked at day shift or frequently changed shift (OR 0.48, 95%CI 0.26-0.92). Workers with the neck and the back bent for a prolonged duration at an angle of over 45º without supportive equipment for more than 2 hours during their shift reported reduced risk of musculoskeletal pain, compared to those who had these postures less than 2 hours (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 study participants (p<0.01). Carrying heavy objects with one hand was not a common task with majority of workers doing it less than 2 hours per shift, but it significantly associated with the elevated risk of long-term disability (OR 2.94, 95%CI 1.15-7.48). Workers who felt highly anxious, stressed or unsatisfied with work during one week before the survey also reported significantly higher risk than those who rated these psychological conditions as "acceptable" (p<0.01).

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	
			N	%		Lower	Upper
	Total	468	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 to 12 hours	66	28	42.4	2.35	1.12	4.92
	≤8 hours	402	93	23.1			
Working shift during the last 3 months*	Shift 3 (6p.m – 2p.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 45º 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 45º 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 30º 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.

Discussion

This study results imply that MSDs are prevalent among study participants and a considerable number of WCs report moderate to high risk of persistent musculoskeletal pain. Factors significantly associated with the risk of chronic musculoskeletal pain include age, gender, work hours, work shift, several work postures and psychological conditions one week before the survey.

The prevalence of musculoskeletal pain among waste collectors

Musculoskeletal pain is very common among waste collectors in this study. Three fourth of them experienced pain in at least one body region by the time of the survey (74.4%), which was a higher percentage than what was reported by other studies among WCs in low and middle income countries with similar settings like Vietnam (44.7%-73.5%) (8, 9, 25). Lower back, neck, shoulders,forearms and upper back were the most affected body regions among WCs in this study. Other studies on WCs also reported that MSDs most occurred in the lower back (9, 10), upper limbs (9, 11) and shoulders (10). The manual waste collection process involves whole body movements. Lower back however, bears the highest amount of impact (1). 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 said body parts. Continuous exposure to a variety of awkward postures might triggered the onset of musculoskeletal pain at multi-body sites (60.5%). Comparing with other occupations, the prevalence of multi-site MSDs among WCs in this study was also higher (5, 10). Within our knowledge, this study is the first attempt to examine the risk of long term disability due to musculoskeletal pain among waste collectors. The remarkable proportions of WCs with chronic pain and WCs with moderate to high risk of persistent MSDs emphasize the importance of prompt measures to improve current working conditions.

Factors related to the risk of persistent MSDs

Our results are in line with studies among working population, which reported the variance of MSDs among different gender and age groups (4, 5, 7), Being a female is often described as a "risk factor" for musculoskeletal disorders with higher prevalence of MSDs among women compared to men (22). Because of different physical strength in musculoskeletal system, the negative impact of the same physical labor is generally greater on females than males. In addition, older age and longer work experience contribute to the increased impacts of long-term exposure to occupational hazards, resulting in higher prevalence of MSDs among older workers (22). This results imply the need of support at work for female waste collectors and workers in their older age to prevent the risk of chronic MSDs and reduce any compensated cost MSDs might cause.

Regarding work organization, longer working hour significantly associated with a higher risk of persistent MSDs (OR 2.35, 95%CI 1.12 − 4.92) and WCs working at night reported less MSD complaint (OR 0.48, 95%CI 0.26-0.92). This results is quite exceptional because among work shifts, night shift (shift 3) has the most strenuous work. At night, WCs are exposed to 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 has been collected and transported to the processing plant. Hence, sometimes work hour exceeds the regulation of 8 hours per shift. By the time of this survey, WCs with existed musculoskeletal problems might be scheduled to day shift since their physical health conditions were not suitable for night shift. Future longitudinal studies should be conducted to better identify the association between shift work and the risk of persistent MSDs among WCs.

No significant association is observed between the risk of persistent MSDs and exposure to physical work environment such as sunlight, heat, coldness and wetness. This result is different from findings of other studies. Magnavita et al. (19) in their study on hospital workers reported that exposure to temperature and light increased the risk of MSDs in the upper limbs (OR = 1.92 and 1.68, respectively). That study also found that temperature elevated the risk of MSDs in the lower back (OR = 1.31) (19).

Our study found that longer duration of unfordable 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 >5kg with one hand) would elevate the risk of persistent MSDs. Empirical evidence was available to support the association between the increased risk of MSDS and poor working postures, quick motion and continuous bending or twisting while carrying or lifting heavy objects (1, 7, 10, 26).

Psychological stress, anxiety and job satisfaction could be an indicator of persistent MSDs. Mental stress diverts resources spent on attention, and can lead to fatigue and injury (1, 19). Study reported the significantly higher prevalence of depression, sleep disorders and occupational accidents among workers who had MSDs compared to those who did not (27). It is increasingly evident that addressing psychological factors impacting workers, is crucial for prevention of persistent MSDs.

Limitations of this study

We recognize several limitations of the current study. First, application of self-reported health conditions and work conditions could create a certain level of bias on the prevalence and level of persistent MSDs among the investigated participants. Second, it is not possible to create the causal relationship between demographic and work conditions and the persistent MSD with the cross-sectional study design in this paper. Third, generalization of the study results is limited to companies with similar work conditions, not all waste collectors in Vietnam Hence, future studies should consider more robust study design such as cohort or randomized control trial to evaluate the impact of work conditions on MSD among waste collectors in particular and different groups of occupation in general. Future studies also should include participants from different companies to enable the generalization of study results to broader population. However, this is the first paper reporting the risk of persistent MSDs among waste collectors in Vietnam, using the ÖMPQ.

Conclusions

This study showed that the prevalence of MSDs among participated WCs was high (74.4%), multiple-site MSDs (at least two sites) were reported by 60.5%. Lower back was the most affected site, reported by 62.3% participants, followed by pain in the neck (59.1%) and shoulders (56.9%). Workers with higher risk of persistent MSDs were female workers, in older age and worked more than 8 hours per shift. Work factors associated with persistent MSDs included poor postures, dissatisfaction with work, stress or anxiety during one week before the survey. The high percentage of workers with MSDs and risk factors of persistent MSDs such as unfavorable work postures and work related psychological stress imply the need of mechanical and social support at work for waste collectors to prevent the development of chronic musculoskeletal pain. The application of machine on the job will be useful in several work tasks such as lifting/ carrying heavy objects or sweeping the street to replace the current manual operation. Social support might include better rewarding methods, coworker support, provision of adequate personal protective equipment and timely provision of medical treatment for occupational injuries and other health problems.

List Of Abbreviations

MSD: Musculoskeletal disorder

ÖMPQ: Örebro Musculoskeletal pain questionnaire

OR: Odd ratio

WC: Waste collector

Declarations

Ethics approval and consent to participate

The study was approved by the ethics committee of 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 upon data collection.

Consent for publication: Not applicable

Availability of data and materials

Additional data and materials are available upon requests sent to the corresponding author.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

NVB and TTTT analyzed data and prepared the drafted manuscript, TTTT and NTQ coordinated the survey to collect data. NTQ and NNB commented on the manuscript. TTTT finalized the manuscript and submitted it.

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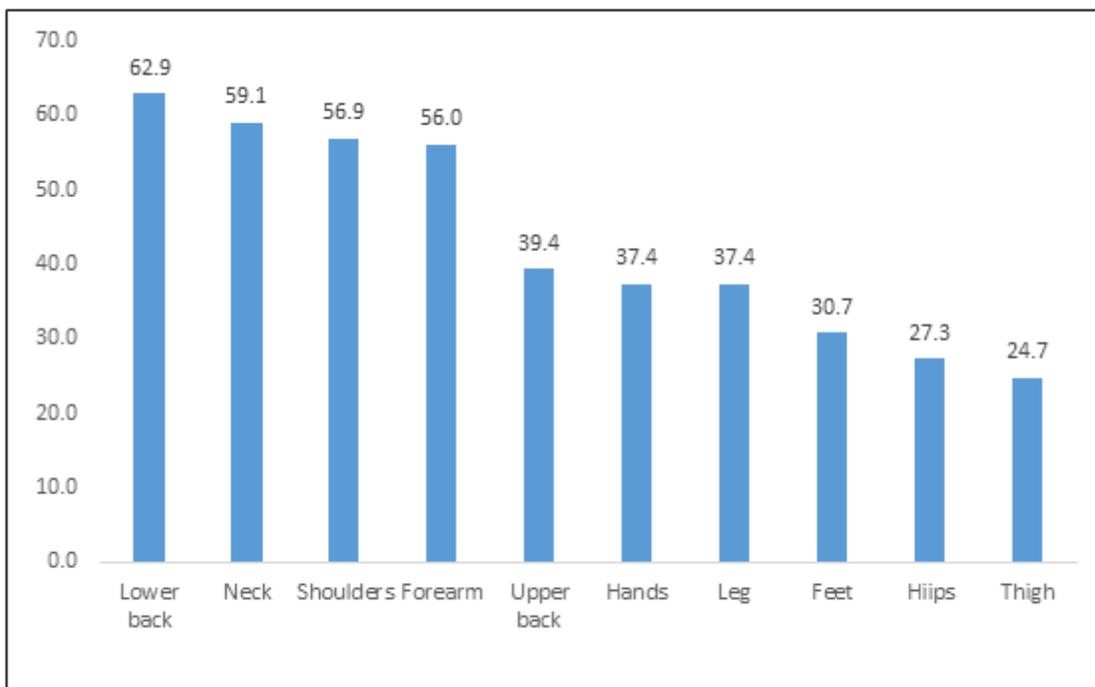
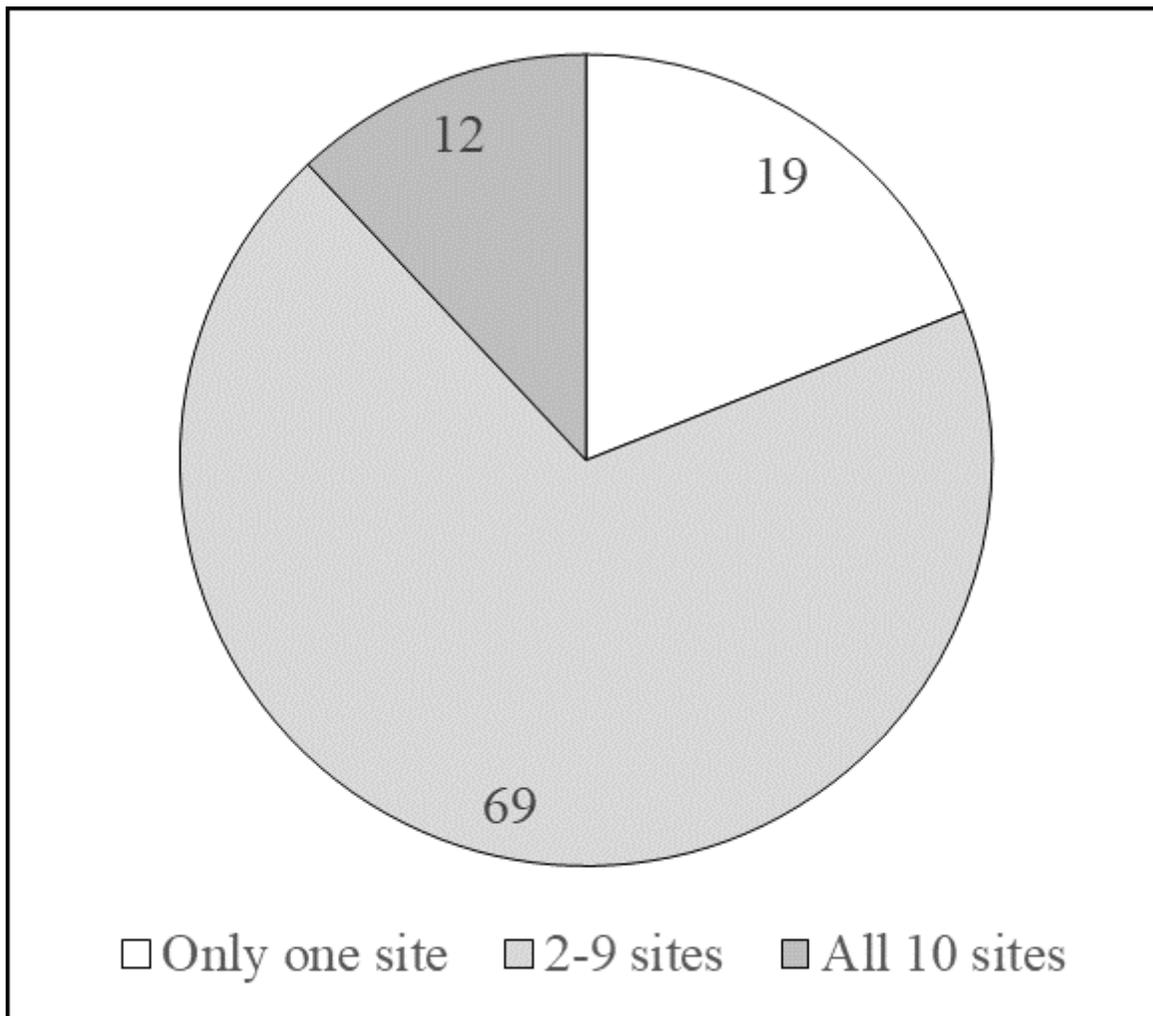# Figures

Figure 1

Prevalence of MSDs by body sites

Figure 2

Prevalence of MSDs by number of affected sites

Supplementary Files

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- Supplementmaterialsappendix1.docx
- STROBEchecklistcrosssectional.doc