Original Research

Prevalence and correlates of work-related musculoskeletal disorders among construction workers at a building site in Colombo, Sri Lanka

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Abstract

Introduction: Work-related musculoskeletal disorders (WMSDs) are a major occupational concern among construction workers, affecting well-being and productivity.

Objectives: To describe the prevalence and associated factors of WMSDs among construction workers at a building site in Colombo District

Methods: A cross-sectional descriptive study was conducted among 374 male construction workers selected using stratified random sampling based on job categories. Workers aged ≥18 years with ≥ 6 months of work experience were included. Data were collected through an interviewer-administered questionnaire covering socio-demographic details, work-related factors and musculoskeletal complaints. WMSDs were defined as discomfort or pain within the past month related to occupational tasks. Prevalence was calculated with 95% confidence interval (CI). Logistic regression identified associations between WMSDs and factors such as age, work experience, job category, rest breaks and working hours. A p-value <0.05 considered statistical significance.

Results: Of the 361 respondents, most were aged 26-40 years (38.5%) and predominantly structural workers (55.1%). The prevalence of WMSDs was 59.6% (95% CI: 54.3%, 64.7%), most commonly affecting the neck (27.1%), shoulders (24.6%), upper back (19.7%) and lower back (18.8%). Workers aged 26–40 years were less likely to report shoulder WMSDs (odds ratio (OR)=0.39). Greater work experience (>15 years) was protective for neck (OR=0.43) and shoulder (OR=0.31) WMSDs. Mechanical workers and general labourers had significantly fewer WMSDs than structural workers. Regular rest breaks were protective against WMSDs for neck (adjusted OR (AOR)=0.9), shoulder (AOR=0.7) and lower back (AOR=0.41).

Conclusions & Recommendations: WMSDs are prevalent among construction workers. Ergonomic interventions and promoting regular rest breaks are recommended.

Keywords: *construction workers, ergonomics, musculoskeletal diseases, occupational diseases, occupational health*

Introduction

Work-related musculoskeletal disorders (WMSDs) are a major global health concern affecting workers across various occupational sectors (1). The prevalence of WMSDs varies widely, with studies reporting rates of 35.1-88.0% in Asia (2-4), and 44.1-94.0% in Africa (5-6). Globally, WMSDs accounted for approximately 1.71 billion cases and 149 million years lived with disability in 2019, highlighting their substantial contribution to the disease burden (7). These disorders impair individual well-being and productivity, leading to absenteeism, early retirement and financial losses, especially in labour-intensive industries like construction (8).

WMSDs encompasses conditions affecting the musculoskeletal system, including injuries or muscles, nerves, tendons, joints and spinal discs. They are primarily associated with occupational hazards such as repetitive movements, awkward postures, heavy lifting and insufficient rest (1). Unlike musculoskeletal conditions caused by aging, WMSDs are directly linked to workplace environments and tasks, often developing gradually and affecting the back, neck, shoulders, and upper limbs (9). Effective management typically involves ergonomic interventions, job rotation, and training on safe work practices (10-12).

Despite extensive global research on WMSDs, there is limited data on their prevalence and associated factors in Sri Lanka, particularly in high-risk sectors like construction. The construction industry plays a vital role in economic development in Sri Lanka but poses significant occupational health risks due to physically demanding tasks performed under challenging conditions (13). Activities such as heavy lifting, prolonged standing and awkward postures elevate the risk of WMSDs among construction workers. This study aims to bridge this knowledge gap by exploring the prevalence and associated factors of WMSDs among construction workers in Sri Lanka. The findings will provide valuable insights to inform targeted interventions, enhancing the health, safety, and productivity of this workforce.

Methods

A descriptive cross-sectional study was conducted among male construction workers aged 18 years and above, with at least six months of work experience, at a construction site in Colombo District. Foreign employees were included, while workers on leave for more than five consecutive working days or participating in off-site workshops during the data collection period were excluded. These criteria ensured participants had consistent and recent exposure to construction-related physical demands, crucial for accurately assessing WMSD prevalence and associated factors.

The data were collected from 1 August to 31 October 2020. A stratified random sampling method with probability proportionate to size was used to ensure proportional representation of four key job categories:

- *Structural workers:* Tasks included masonry, bricklaying, and concrete work, often involving heavy lifting and repetitive movements
- *Finishing workers:* Responsible for tasks like plastering, painting, and tile laying, which require precision and repetitive hand movements
- *Mechanical workers:* Roles included plumbing and electrical work, typically requiring awkward postures and work in confined spaces
- *General labourers:* Performed tasks such as material transportation and site cleaning, often involving prolonged physical effort

The sample size was calculated using a reported WMSD prevalence of 67.0% from a study conducted at a construction site in the Netherlands due to lack of local data (14-16).

WMSDs were defined as musculoskeletal complaints that developed after starting the current job and were aggravated by occupational tasks such as heavy lifting, repetitive movements or awkward postures. Data were collected using a pre-tested, interviewer-administered questionnaire based on the Nordic Musculoskeletal Questionnaire (NMQ) and prior occupational health surveys (9-11). The questionnaire was adapted to address specific tasks and risk factors relevant to the Sri Lankan construction sector. It comprised four main sections, namely socio-demographic characteristics, work related information, musculoskeletal complaints in specific body regions along with identifying aggravating tasks or movements and aggravating factors. The tool was pre-tested on a group of 15 construction workers from a different site. Data were collected during weekends, public holidays and scheduled break hours to minimize disruption to the work schedule and ensure high participation rate.

Data analysis

Statistical analysis was conducted using IBM Statistical Package for the Social Sciences (SPSS) version 27 (17). Prevalence of WMSDs was calculated with 95% confidence interval (CI). Odds ratios (OR) with 95% CIs were calculated to assess the relationship between WMSDs and associated factors. Multivariate logistic regression models adjusted for potential confounders were used to assess factors associated with WMSDs using adjusted odds ratio (AOR). Separate models were developed to evaluate the impact of associated factors on specific body regions, such as the neck, shoulders, upper- and lower back. A p-value of <0.05 was considered statistically significant.

Table 1: Socio-demographic and economic characteristics of the construction trade workers (N=361)

Characteristic	No.	%
Age group (in completed years)		
Less than 25	85	23.5
26 – 40	139	38.5
Above 40	137	38.0
Ethnicity		
Sinhalese	161	44.6
Tamil	93	25.8
Muslim	107	29.6
Marital status		
Unmarried	120	33.2
Married	136	37.7
Separated/ divorced	60	16.6
Widowed	45	12.5
Family monthly income level (LKR)		
Less than 20,000	36	9.9
20,001 – 30,000	99	27.5
30,001 – 40,000	174	48.3
40,001 – 50,000	18	4.9
More than >50,000	34	9.4
Educational level		
Never schooling	32	8.9
Primary education	214	59.3
Secondary education	115	31.8

Results

The study included 374 male construction workers (response rate of 96.5%). The majority of participants were aged 26-40 years (mean age=37.3; standard deviation (SD)=11.5 years), of Sinhala ethnicity and had completed primary education. Nearly half of the workers drew a monthly family income of LKR 30,001-40,000 (Table 1). Nearly half of the workers were employed as structural workers, with the majority between 6-15 years of work experience. On average, workers reported 6.1 days of work per week (SD=0.6) and 7.5 hours per day (SD=0.9), with approximately one hour of rest during the workday (Table 2).

The overall prevalence of WMSDs was 59.6% (95% CI: 54.3, 64.7%). The most affected body parts were neck (27.1%), shoulders (24.6%), upper back (19.7%) and lower back (18.8%) (Table 3).

Table 2: Job categories and working experience among construction trade workers (N=361)

Characteristics	No.	%
Job categories		
Structural workers	199	55.1
Finishing workers	80	22.2
Mechanical workers	52	14.4
General Labourers	30	8.3
Work experience		
≤ 5 years	132	36.6
6 – 15 years	164	45.4
> 15 years	65	18.0
Daily working hours		
≤ 8 h	267	73.9
> 8 h	94	26.1
Working days per week		
≤ 5 days	27	7.5
> 5 days	334	92.5
Rest break		
Never	98	27.1
Occasionally and more	263	72.9

Bivariate analysis revealed significant associations between WMSDs and several factors. Workers aged 26–40 were less likely to experience WMSDs in the shoulder (OR=0.39), while those aged over 40 years of age were less likely to experience WMSDs in the lower back (OR=0.26). Work experience was inversely related to WMSDs as workers with more than 15 years of experience were less likely to experience WMSDs in the neck (OR=0.43) and shoulder (OR=0.31). In relation to job category, mechanical workers and general labourers had significantly lower risk of experiencing WMSDs compared to structural workers, particularly in the neck and shoulder. Taking rest breaks was found to be protective against WMSDs, with workers who took breaks more frequently having significantly lower odds of WMSDs in the neck (AOR=0.9; 95% CI: 0.07, 0.98), shoulder (AOR=0.7; 95% CI: 0.1, 0.89), and lower back (AOR=0.41; 95% CI: 0.39, 0.56). However, the effect of rest breaks on the upper back was not statistically significant (AOR=0.28; 95% CI: 0.18, 1.89).

Table 3: Prevalence of WMSD symptoms among the construction trade workers

Body regions*	Type of workers, No. (%)			
	Structural	Finishing	Mechanical	Others
Neck (n=98)	37 (10.2)	45 (12.5)	10 (2.8)	6 (1.7)
Shoulder (n=89)	38 (10.5)	42 (11.6)	7 (1.9)	2 (0.6)
Upper back (n=71)	43 (11.9)	22 (6.1)	3 (0.8)	3 (0.8)
Elbow (n=36)	20 (5.6)	15 (4.5)	1 (0.3)	0 (0.0)
Wrist/ hand (n=25)	6 (1.7)	10 (2.8)	8 (2.2)	1 (0.3)
Low back (n=68)	30 (8.3)	15 (4.5)	12 (3.3)	1 (0.3)
Hips/thigh (n=45)	12 (3.3)	13 (3.6)	15 (4.5)	5 (1.5)
Knees (n=18)	7 (1.9)	7 (1.9)	2 (0.6)	2 (0.6)
Ankles/feet (n=11)	5 (1.5)	4 (1.2)	2 (0.6)	0 (0.0)

*One responded could be reported symptoms in more than one body region

Additionally, mechanical workers were significantly less likely to experience WMSDs in the upper back (AOR: 1.42; 95% CI: 1.23, 1.79) and the general labourers in the shoulder (AOR: 0.12; 95% CI: 0.06, 0.28) compared to structural workers. Workers aged 26-40 years had a lower risk of WMSDs related to the shoulder (AOR: 0.42; 95% CI: 0.2, 0.85).

Table 4: Factors associated with WMSDs in different body parts of construction trade workers

	Unadjusted odds ratio (95% CI)			
Variable	**Neck**	**Shoulder**	**Upper back**	**Lower back**
Age category (years)				
26 – 40	0.68 (0.37, 1.25)	**0.39 (0.19, 0.81)**	1.11 (0.53, 2.32)	0.58 (0.25, 1.38)
Above 40	1.09 (0.57, 2.04)	0.54 (0.26, 1.13)	0.55 (0.28, 1.11)	**0.26 (0.12, 0.59)**
Work experience				
6 – 15 years	0.95 (0.56, 1.63)	**0.31 (0.17, 0.57)**	0.68 (0.37, 1.25)	0.62 (0.33, 1.14)
>15 years	**0.43 (0.23, 0.82)**	0.54 (0.28, 1.03)	0.50 (0.24, 1.04)	0.61 (0.28, 1.32)
Job category				
Finishing	0.96 (0.49, 1.89)	1.13 (0.52, 2.43)	1.27 (0.55, 2.49)	1.41 (0.58, 3.39)
Mechanical	**0.36 (0.21, 0.62)**	**0.29 (0.17, 0.53)**	**0.42 (0.23, 0.79)**	**0.38 (0.21, 0.71)**
General	**0.18 (0.08, 0.41)**	**0.11 (0.05, 0.26)**	**0.15 (0.06, 0.34)**	**0.18 (0.08, 0.43)**
Rest break				
Occasionally & more	**0.89 (0.17, 0.91)**	**0.80 (0.17, 0.99)**	**0.51 (0.49, 0.66)**	**0.51 (0.49, 0.66)**
Daily working hours				
≤8 h	0.91 (0.75, 1.28)	0.89 (0.68, 1.23)	0.65 (0.56, 0.92)	0.85 (0.62, 1.28)
>8 h	1.1 (0.78, 1.54)	1.12 (0.81, 1.56)	1.54 (1.09, 2.16)	1.17 (0.85, 1.61)

Reference categories: Age category less than 25 years; work experience ≤5 years; Job category structural workers; rest breaks never; Daily working hours ≤ 8 hours

Table 5: Factors associated with WMSDs in different body parts in construction workers adjusted for covariates

Variable	Neck	Shoulder	Upper back	Lower back
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Age category (years)				
26-40	0.8 (0.45, 1.46)	**0.42 (0.2, 0.85)**	0.43 (0.34, 1.35)	0.72 (0.67, 1.24)
Above 40	1.2 (0.61, 2.37)	0.6 (0.3, 1.2)	0.47 (0.39, 2.96)	0.85 (0.65, 1.21)
Work experience				
6–15 years	1.05 (0.59, 1.87)	**0.35 (0.2, 0.6)**	0.56 (0.38, 1.95)	0.62 (0.56, 1.24)
>15 years	0.55 (0.3, 0.77)	0.55 (0.3, 1.05)	0.67 (0.45, 1.02)	0.86 (0.81, 1.02)
Job category				
Finishing	1.13 (0.52, 2.43)	1.2 (0.6, 2.5)	1.27 (0.55, 2.49)	1.32 (0.98, 2.39)
Mechanical	0.42 (0.23, 0.79)	0.30 (0.20, 1.55)	**1.42 (1.23, 1.79)**	0.46 (0.36, 1.56)
General	0.18 (0.08, 0.43)	**0.12 (0.06, 0.28)**	0.45 (0.60, 1.14)	0.78 (0.40, 1.03)
Rest break				
Occasionally and more	**0.90 (0.07, 0.98)**	**0.70 (0.10, 0.89)**	0.28 (0.18, 1.89)	**0.41 (0.39, 0.56)**
Daily working hours				
≤8 h	0.9 (0.64, 1.27)	0.88 (0.63, 1.22)	0.64 (0.46, 0.9)	0.84 (0.61, 1.16)
>8 h	1.11 (0.79, 1.56)	1.14 (0.82, 1.58)	1.56 (1.11, 2.19)	1.19 (0.86, 1.63)

Reference: Age Below 25 years, Work experience ≤ 5years, job category Structural workers, Rest breaks Never, Daily working hours ≤ 8 hours

Discussion

This study aimed to assess the prevalence of WMSDs among construction workers at a building site in the Colombo district, identifying risk factors to inform health policy reforms and workplace interventions. The overall prevalence of WMSD in this study was 59.6% (95% CI: 54.3, 64.7%). This figure is notably higher than those reported in Hong Kong (41.0%) and China (23.4%) (18-19), but lower than studies conducted in Korea (87.0%), Ethiopia (43.9%), and India (80.0%) (21-22). These discrepancies in prevalence rates may be attributed to variations in sample characteristics, data collection methods, and work environments, highlighting the importance of considering contextual factors when interpreting WMSD prevalence across different settings. Further, this high prevalence is likely due to factors such as poor workstation ergonomics, prolonged standing or sitting, repetitive tasks and limited awareness of proper posture among workers. In Sri Lanka, where many workplaces lack formal ergonomic assessments and interventions, these findings emphasize the urgent need for targeted measures. Incorporating ergonomic training programs, promoting the use of adjustable workstations, and implementing regular workplace assessments can help reduce the burden of WMSDs and improve occupational health outcomes in the country.

The body regions most affected in this study were the neck (27.1%), shoulders (24.6%), upper back (19.7%) and lower back (12.6%). These findings consistent with previous research, which also highlights the neck, shoulders, and back as the most affected areas among construction workers (20). However, lower back pain was reported less frequently in our study compared to others, which could be due to the adoption of mechanical equipment that has reduced

the reliance on manual lifting. This finding suggests that technological advancements in construction work such as cranes, lifts, and other mechanical tools may play a significant role in alleviating the physical strain on workers and could be a key component in future workplace interventions aimed at reducing WMSDs (21). Our study found no significant association between age and the occurrence of lower back WMSDs. Experiencing lower back WMSDs were similar for workers aged over 40 and those aged 26-40 years, which suggests that factors other than age may play a more prominent role in the development of lower back WMSDs (21). The use of mechanical lifting devices and job rotation could be mitigating the strain that is typically associated with older workers. Additionally, the frequency of rest breaks was significantly associated with WMSD prevalence, with workers who rarely took breaks experiencing higher rates of musculoskeletal pain. These findings reinforce the importance of implementing structured rest periods to mitigate the risk of WMSDs in construction.

The AOR for shoulder disorders in the 26-40 age group was 0.42 (95% CI: 0.2, 0.85), indicating a lower reported risk compared to the below 25 age group. This difference might not solely reflect a true variation in prevalence but could also be influenced by underreporting among younger workers. Individuals below 25 years may avoid reporting shoulder discomfort due to stigma, fear of being perceived as weak or incapable, or concerns about job security. Additionally, younger workers may lack awareness of the importance of addressing musculoskeletal symptoms and may dismiss discomfort as trivial. To address this, organizations should promote a culture that encourages open reporting of health issues, implement anonymous reporting systems, provide education on the importance of early symptom management, and conduct regular health check-ups to identify problems proactively, especially among younger employees. Further, with the construction industry increasingly relying on advanced machinery and tools, there is a unique opportunity to embed ergonomic principles into the design and use of new technologies. Policies should support training programs focused on the safe and efficient use of equipment to prevent musculoskeletal strain, particularly for older workers who are more vulnerable to these conditions. Additionally, age-specific interventions, including targeted preventive strategies, should be considered to help mitigate the risks of musculoskeletal degeneration in older workers.

While the large sample size and prospective design of this study provide valuable insights into the prevalence of WMSDs, several limitations should be acknowledged. First, the study was conducted at a single construction site, which limits its generalizability to other sites in Sri Lanka or internationally. The risk factors for WMSDs may differ across regions, depending on various environmental, cultural, and occupational practices. To mitigate this limitation, the study focused on a diverse group of construction workers from different job categories, ensuring a broader representation of the workforce at the site. However, future studies should consider a multi-site approach to enhance the generalizability of the findings. Second, the reliance on self-reported data introduces the possibility of recall bias, as participants may not accurately recall or report their symptoms. This bias could lead to either overreporting or underreporting of WMSD symptoms, affecting the accuracy of prevalence estimates. To minimize this risk, a pre-tested, structured interviewer-administered questionnaire was used, which ensured consistency in data collection across participants. Despite this, recall bias remains a potential limitation, and future studies could benefit from combining self-report with objective measures (e.g., physical assessments) to validate the findings. Additionally, this study's cross-sectional design limits the ability to establish causality between the identified risk factors and the onset of WMSDs. As a snapshot of workers'

musculoskeletal health at one point in time, the study can only identify associations rather than causal relationships. To address this limitation, future longitudinal studies are needed to track changes over time and establish clearer causal links between workplace factors and WMSD development. Long-term studies could also assess the effectiveness of ergonomic interventions in reducing WMSD prevalence over time.

Another limitation is that certain key work characteristics, such as detailed postural assessments and physical loading, were not accounted for in this study. These factors are crucial for understanding the full scope of ergonomic risks in construction work. While the study examined job categories and work practices, future research could incorporate more granular assessments of posture, lifting techniques, and work environments to provide a more comprehensive evaluation of risk factors. Lastly, the possibility of confounding factors or the "healthy worker effect" could have influenced the results. Workers who are healthier or have fewer musculoskeletal issues may be more likely to remain in physically demanding jobs, leading to potential bias in the sample. While we controlled for some confounders, future studies should explore additional factors that could impact the development of WMSDs, such as lifestyle factors and pre-existing health conditions.

By addressing these limitations, future research can provide a more nuanced understanding of the factors contributing to WMSDs in construction workers and inform more targeted interventions. This study highlights the critical need for enhanced occupational health policies and interventions in Sri Lanka's construction sector. By integrating ergonomic principles, ensuring adequate rest breaks, and addressing the specific needs of older workers, the construction industry can reduce the burden of WMSDs and improve the long-term health and productivity of workers.

Conclusions & Recommendations

This study revealed a high prevalence of WMSDs among construction trade workers, with significant associations identified between age, work experience, job category and rest breaks. The findings underscore the need for targeted strategies to reduce WMSD risks. Based on the identified risk factors, it is recommended that construction companies implement measures such as regular workplace assessments, proper training, and encouraging rest breaks to mitigate the prevalence of WMSDs. To address the physical demands placed on workers, recommendations include improving workplace design, promoting task rotations, and using advanced tools and machinery to reduce repetitive strain. Training workers on proper posture, lifting techniques, and ergonomics is also crucial. Moreover, early access to healthcare services for workers reporting musculoskeletal symptoms is essential to prevent further complications, improve overall health outcomes, and reduce absenteeism in Sri Lanka’s construction sector.

Public Health Implications

- The involvement of medical officers of health (MOHs) and public health inspectors (PHIs) in addressing WMSDs among construction workers is limited by resource constraints, lack of targeted training and insufficient focus on ergonomics. This research emphasizes the need for a proactive approach, including training MOHs and PHIs on WMSD prevention, fostering partnerships with industry stakeholders, and integrating ergonomic interventions into occupational health practices. Strengthening public health capacity and enforcing regulations are essential to safeguard workers' musculoskeletal health.

Author Declarations

Competing interests: The authors declare that they have no competing interests.

Ethics approval and consent to participate: Ethics approval was obtained from the Ethics Review Committee of National Institute of Health Sciences, Kalutara (NIHS_ERC_19_09R). Informed written consent was obtained from each participant prior to data collection.

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Author contributions: GDRS, SADCNJ, MAAM, HADSS participated in the design of the study, coordinated data collection, and performed the statistical analysis. KK participated in the design of the study, performed the statistical analysis, interpreted the data and drafted the first version of the manuscript. All authors read and approved the final manuscript.

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