

Prevalence and Severity of Musculoskeletal Discomfort Among Female Street Sweepers in Ujjain, Madhya Pradesh: A Cross-Sectional Study

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Background: Street sweeping is a physically demanding occupation involving repetitive movements, prolonged standing, and manual handling of waste, leading to increased risk of musculoskeletal disorders (MSDs). Despite the prevalence of MSDs among street sweepers globally, limited research exists focusing on female street sweepers in India, particularly regarding the occupational health hazards associated with ergonomic risk factors.

Objective: This study aimed to determine the prevalence and severity of musculoskeletal discomfort among female street sweepers in Ujjain, Madhya Pradesh, and to identify specific body regions most affected by work-related musculoskeletal problems.

Methods: A cross-sectional observational study was conducted over two months involving 50 female street sweepers aged 25 to 60 years from randomly selected areas of Ujjain city. The validated nordic musculoskeletal questionnaire (NMQ) was administered through face-to-face interviews to assess musculoskeletal discomfort across nine body regions. Data were analyzed using descriptive statistics and Chi-square tests to examine associations between age groups and MSD prevalence.

Results: The mean age of participants was 44.76 ± 10.71 years. Over the past 12 months, knee problems were most prevalent (68.0%), followed by upper back (62.0%), hip (52.0%), and neck (46.0%) troubles. Significant age-related associations were found for neck ($p = 0.035$), upper back ($p = 0.035$), wrist ($p = 0.014$), and hip ($p = 0.042$) disorders, with higher prevalence in older age groups. Work disruption due to MSDs was reported by 50.0% of participants for both neck and knee problems. In the past seven days, knee issues remained most common (54.0%), with significant age associations for shoulder ($p = 0.012$), hip ($p = 0.004$), and ankle ($p = 0.006$) problems.

Conclusion: Female street sweepers in Ujjain experience high prevalence of musculoskeletal disorders, particularly affecting the knees, upper back, and hips, with age being a significant risk factor. These findings emphasize the urgent need for ergonomic interventions, workplace modifications, health education programs, and preventive strategies to reduce the burden of occupational MSDs among this vulnerable population.

Introduction

The Swachh Bharat Mission, launched by Prime Minister Narendra Modi on October 2, 2014, aimed to create a Clean India by mobilizing citizens to take responsibility for maintaining cleanliness in their communities.¹⁻³ This national initiative highlighted the critical role of street sweepers in maintaining urban sanitation and hygiene. However, the occupational health challenges faced by

these workers, particularly female street sweepers, remain largely overlooked in public health discourse.

Street sweeping is a vigorous occupation involving continuous physical activities such as manual sweeping in standing postures for prolonged durations, repetitive bending while collecting waste, pushing and pulling wheelbarrows, and manual lifting of waste baskets for disposal.⁴ These activities expose workers to significant ergonomic risk factors, leading to the development of work-related musculoskeletal disorders (MSDs). Musculoskeletal disorders are defined as pain, ache, or discomfort in anatomical areas including the neck,

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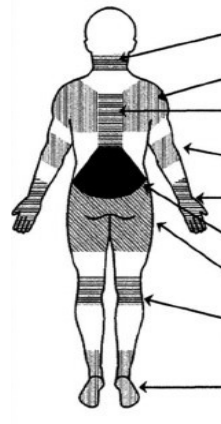
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Musculoskeletal disorders, Street sweepers, Occupational health, Nordic musculoskeletal questionnaire, Ergonomic hazards, Female workers

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	Have you at any time during the last 12 months had trouble (such as ache, pain, discomfort, numbness) in:	During the last 12 months have you been prevented from carrying out normal activities (e.g. job, housework, hobbies) because of this trouble in:	During the last 12 months have you seen a physician for this condition:	During the last 7 days have you had trouble in:
NECK	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
SHOULDERS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
UPPER BACK	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
ELBOWS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
WRISTS/HANDS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
LOWER BACK	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
HIPS/THIGHS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
KNEES	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
ANKLES/FEET	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes

Figure 1: Nordic musculoskeletal questionnaire (NMQ)

shoulders, upper back, lower back, elbows, wrists, hands, hips, thighs, knees, and ankles.⁴

Previous research has documented that solid waste collectors have a relatively higher probability of developing MSDs compared to the general population.⁷ Workers engaged in repetitious physical activities involving bending, lifting, pushing, and pulling for extended periods face increased risk factors for MSD development. International studies have identified street sweepers as particularly vulnerable to occupational health hazards, including respiratory diseases, skin conditions, eye irritation, and musculoskeletal problems.⁴⁻⁶

However, research focusing specifically on female street sweepers in India remains limited. Past studies among Indian street sweepers have predominantly addressed respiratory, eye, and skin morbidities, with minimal attention to musculoskeletal health.⁷ Women workers face unique physiological challenges, including hormonal changes during menstruation, pregnancy, and menopause, which may exacerbate musculoskeletal vulnerabilities. Additionally, gender-specific ergonomic considerations are often overlooked in workplace design and equipment provision.

The nordic musculoskeletal questionnaire (NMQ), developed through a project funded by the Nordic Council of Ministers, provides a standardized methodology for assessing and comparing musculoskeletal complaints across different body regions in epidemiological studies.³ The NMQ has been extensively validated and applied to diverse occupational groups, including manual

laborers, making it an appropriate tool for assessing MSD prevalence among street sweepers (Figure 1).

This study addresses the research gap by investigating the prevalence and severity of musculoskeletal discomfort among female street sweepers in Ujjain, Madhya Pradesh. Understanding the burden and distribution of MSDs in this population is essential for developing targeted interventions, informing occupational health policies, and implementing preventive measures to protect the health and well-being of these essential workers.

Materials And Methods

Study Design and Setting

This cross-sectional observational study was conducted over a two-month period in Ujjain, Madhya Pradesh. The study focused on female street sweepers employed by the municipal corporation (Nagarnigam) working in various streets and public areas of Ujjain city.

Sample Size and Sampling

A sample of 50 female street sweepers was recruited using random sampling from 10 randomly selected areas of Ujjain city. The sample size was determined based on feasibility and time constraints of the study period.

Inclusion and Exclusion Criteria

Inclusion criteria

Female street sweepers actively employed full-time; age range 25 to 60 years; minimum work experience of 6 months; regular exposure to typical street-sweeping tasks and equipment; no pre-existing non-occupational

musculoskeletal conditions; willingness to provide informed consent.

Exclusion criteria

Not actively employed as street sweepers; pre-existing musculoskeletal disorders unrelated to work; pregnancy; less than 6 months of work experience; age outside 25 to 60 years range; refusal to provide informed consent; medical conditions that could independently contribute to musculoskeletal discomfort (e.g., neurological disorders); recent surgeries or ongoing treatments unrelated to occupation; participation in another study that could affect outcomes.

Data Collection Instrument

The validated nordic musculoskeletal questionnaire (NMQ) was used to assess work-related musculoskeletal problems.³ The NMQ evaluates musculoskeletal discomfort across nine major body regions: neck, shoulders, upper back, elbows, wrists/hands, lower back, hips/thighs, knees, and ankles/feet. The questionnaire includes questions about:

- Presence of musculoskeletal trouble in the past 12 months
- Work prevention due to musculoskeletal problems in the past 12 months
- Musculoskeletal problems experienced in the past 7 days

Additionally, demographic information was collected, including age, marital status, educational level, work experience, duty shifts, working hours, rest break patterns, street sweeping distance, and physical exertion levels.

Procedure

After obtaining ethical approval, street sweepers were approached at their work locations during break times. Written informed consent was obtained from each participant before data collection, ensuring voluntary participation and confidentiality. Face-to-face interviews were conducted using the semi-structured questionnaire. Participants were shown anatomical diagrams to help identify specific body regions while responding to questions about musculoskeletal discomfort. All responses were recorded directly on data collection forms during the interviews.

Statistical Analysis

Data were analyzed using descriptive statistics. Continuous variables were expressed as mean $\pm$ standard deviation and median. Categorical variables were presented as frequencies and percentages. Chi-square

tests were performed to examine associations between age groups and the prevalence of musculoskeletal problems in different body regions. Statistical significance was set at.

Results

Demographic Characteristics

The mean age of participants was 44.76 ± 10.71 years, with a median age of 43.5 years. Age distribution showed that 46.0% (n=23) of participants were ≤ 40 years, 28.0% (n=14) were 41 to 50 years, and 26.0% (n=13) were >50 years.

Prevalence of Musculoskeletal Problems in the Past 12 Months

Table 1 presents the prevalence of musculoskeletal problems across different body regions over the past 12 months. Knee problems were most prevalent, affecting 68.0% of participants, followed by upper back (62.0%) and hip (52.0%) issues.

Table 2 shows the distribution of upper limb musculoskeletal problems by laterality. Shoulder problems affected 64.0% of participants overall, with right-sided involvement being most common (30.0%). Elbow discomfort was reported by 58.0% and wrist problems by 54.0% of participants.

Age-Related Associations with Musculoskeletal Problems

Table 1: Prevalence of musculoskeletal problems in major body regions over 12 months

Body region	Affected n (%)	Not affected n (%)	Total N=50
Knee	34 (68.0)	16 (32.0)	50 (100.0)
Upper Back	31 (62.0)	19 (38.0)	50 (100.0)
Hip (both sides)	26 (52.0)	24 (48.0)	50 (100.0)
Neck	23 (46.0)	27 (54.0)	50 (100.0)
Ankle (both sides)	21 (42.0)	29 (58.0)	50 (100.0)
Lower Back	16 (32.0)	34 (68.0)	50 (100.0)

Table 2: Distribution of upper limb musculoskeletal problems by laterality (past 12 months)

Body region	Both sides n (%)	Right side n (%)	Left side n (%)	No problem n (%)	Total N = 50
Shoulder	12 (24.0)	15 (30.0)	5 (10.0)	18 (36.0)	50 (100.0)
Elbow	18 (36.0)	9 (18.0)	2 (4.0)	21 (42.0)	50 (100.0)
Wrist/Hand	11 (22.0)	16 (32.0)	0 (0.0)	23 (46.0)	50 (100.0)

Table 3: Age-related associations with musculoskeletal problems (past 12 months) * $p < 0.05$, ** $p < 0.01$

Body Region	≤ 40 years ($n=23$) n (%)	41–50 years ($n=14$) n (%)	>50 years ($n=13$) n (%)	χ^2 value	p -value
<i>Significant associations</i>					
Neck	5 (21.7)	8 (57.1)	10 (76.9)	11.154	0.004**
Upper back	10 (43.5)	10 (71.4)	11 (84.6)	6.699	0.035*
Wrist	11 (47.8)	9 (64.3)	12 (92.3)	8.576	0.014*
Hip	8 (34.8)	8 (57.1)	10 (76.9)	6.115	0.042*
<i>Non-significant associations</i>					
Lower back	6 (26.1)	5 (35.7)	5 (38.5)	0.763	0.591
Shoulder	13 (56.5)	10 (71.4)	9 (69.2)	1.023	0.439
Elbow	11 (47.8)	10 (71.4)	8 (61.5)	2.145	0.123
Knee	15 (65.2)	10 (71.4)	9 (69.2)	0.198	0.839
Ankle	9 (39.1)	6 (42.9)	6 (46.2)	0.289	0.736

Table 4: Work prevention due to musculoskeletal problems (past 12 months)

Body region	Work prevented n (%)	Not prevented n (%)	Total $N=50$
Neck	25 (50.0)	25 (50.0)	50 (100.0)
Knee	25 (50.0)	25 (50.0)	50 (100.0)
Upper back	21 (42.0)	29 (58.0)	50 (100.0)
Wrist	18 (36.0)	32 (64.0)	50 (100.0)
Ankle	17 (34.0)	33 (66.0)	50 (100.0)
Hip	16 (32.0)	34 (68.0)	50 (100.0)
Shoulder	13 (26.0)	37 (74.0)	50 (100.0)
Lower back	11 (22.0)	39 (78.0)	50 (100.0)
Elbow	8 (16.0)	42 (84.0)	50 (100.0)

Table 5: Prevalence of musculoskeletal problems in the past 7 days

Body region	Problem present n (%)	No problem n (%)	Total $N=50$
Knee	27 (54.0)	23 (46.0)	50 (100.0)
Shoulder	21 (42.0)	29 (58.0)	50 (100.0)
Hip	21 (42.0)	29 (58.0)	50 (100.0)
Ankle	20 (40.0)	30 (60.0)	50 (100.0)
Elbow	19 (38.0)	31 (62.0)	50 (100.0)
Lower back	18 (36.0)	32 (64.0)	50 (100.0)
Wrist	18 (36.0)	32 (64.0)	50 (100.0)
Upper back	17 (34.0)	33 (66.0)	50 (100.0)
Neck	15 (30.0)	35 (70.0)	50 (100.0)

Chi-square analysis revealed significant associations between age groups and several musculoskeletal problems (Table 3). Significant age-related increases were observed for neck, upper back, wrist, and hip problems, with the highest prevalence in the >50 years age group.

Work Prevention Due to Musculoskeletal Problems

Table 4 presents the proportion of participants who reported work disruption due to musculoskeletal problems in various body regions over the past 12 months. Neck and knee problems caused the highest work prevention rates (50.0% each).

Musculoskeletal Problems in the Past Seven Days

Table 5 shows the prevalence of recent musculoskeletal problems experienced in the past 7 days. Knee problems remained the most commonly reported recent complaint (54.0%).

Age-related associations for musculoskeletal problems (past 7 days).

Significant age-related associations for recent problems (Table 6) were found in the shoulder ($\chi^2 = 8.876$, $\chi^2 = 8.876$), hip ($\chi^2 = 8.876$, $\chi^2 = 8.876$), and ankle ($\chi^2 = 8.876$, $\chi^2 = 8.876$) regions, all showing higher prevalence in the >50 years age group (76.9% for each region).

Discussion

This cross-sectional study reveals a high burden of work-related musculoskeletal disorders among female street sweepers in Ujjain, with knee problems being the most prevalent (68.0%), followed by upper back (62.0%) and hip (52.0%) complaints. These findings align with international research documenting elevated MSD risk among sanitation workers.^{2,4-6,8}

The predominance of lower extremity problems, particularly knee disorders, is consistent with the occupational demands of street sweeping, which require prolonged standing, repetitive walking on hard surfaces, frequent bending, and pushing/pulling of wheelbarrows.

Table 6: Age-related associations for musculoskeletal problems (past 7 days). * $p < 0.05$, ** $p < 0.01$

Body region	≤ 40 years ($n = 23$) n (%)	41–50 years ($n = 14$) n (%)	> 50 years ($n = 13$) n (%)	χ^2 value	p -value
Shoulder	6 (26.1)	5 (35.7)	10 (76.9)	8.876	0.012*
Hip	6 (26.1)	5 (35.7)	10 (76.9)	11.124	0.004**
Ankle	5 (21.7)	5 (35.7)	10 (76.9)	10.234	0.006**

A study by Salve and Bansod (2017) similarly reported high prevalence of shoulder, wrist, and hand MSDs among Mumbai street sweepers, attributing these to continuous use of long-handle brooms and manual waste handling.⁷ The current study extends these findings to demonstrate that lower extremity involvement is equally, if not more, significant.

Age emerged as a significant risk factor for musculoskeletal problems affecting the neck, upper back, wrist, and hip regions. This age-related increase likely reflects cumulative occupational exposure combined with age-related physiological changes, including decreased muscle strength, reduced bone density, joint degeneration, and diminished tissue repair capacity. Similar age-related patterns have been documented among street sweepers in Thailand and Ethiopia.^{5,6,8}

The finding that 50.0% of participants experienced work disruption due to neck and knee problems highlights the substantial occupational disability burden associated with MSDs in this population. This work limitation not only affects individual workers' income and quality of life but also has broader implications for organizational productivity and healthcare costs. These findings underscore the urgent need for workplace interventions.

The high prevalence of upper back problems (62.0%) may be attributed to prolonged forward-bent postures during sweeping activities, combined with the repetitive nature of the work. Studies have shown that sustained flexed spinal postures increase mechanical loading on intervertebral discs and paraspinal muscles, leading to pain and dysfunction.⁴ Ergonomic modifications, including adjustable broom handles, improved work techniques, and scheduled rest breaks, could potentially reduce this burden.

From a women's health perspective, the findings are particularly concerning. Women are physiologically more susceptible to musculoskeletal problems due to hormonal influences on bone density and joint laxity, lower average muscle mass compared to men, and additional biomechanical stress from reproductive

factors.⁸ Hormonal fluctuations during menopause, particularly estrogen decline, accelerate bone density loss and increase vulnerability to osteoporosis and joint problems. The high prevalence of hip and knee problems in older female participants may reflect this hormonal influence combined with cumulative occupational stress.

Several studies have demonstrated that multi-dimensional ergonomic interventions are more effective than single-component approaches in reducing MSDs among street sweepers. Pintakham and Siri Wong (2023) reported that an intervention combining cognitive behavioral therapy, ergonomic education, stretching exercises, and equipment modifications significantly reduced musculoskeletal discomfort among Thai street sweepers.⁵ Similar comprehensive approaches should be considered for Indian street sweepers.

Limitations

This study has several limitations that should be acknowledged:

- Small sample size ($n=50$) may limit generalizability to all female street sweepers
- Cross-sectional design precludes causal inference
- A two-month study duration may not capture seasonal variations in work demands
- Self-reported data subject to recall bias
- Lack of objective clinical assessment or diagnostic confirmation
- Exclusion of workers with pre-existing conditions may underestimate true MSD burden
- Age range limitation (25–60 years) excludes younger and older workers
- Single geographic location (Ujjain) may not represent other regions

Conclusion

This study demonstrates a high prevalence of work-related musculoskeletal disorders among female street sweepers in Ujjain, Madhya Pradesh, with knees, upper back, and hips being the most affected body regions. Age significantly influences MSD prevalence, particularly

for neck, upper back, wrist, and hip problems, with older workers bearing a disproportionate burden. These musculoskeletal problems substantially impact work capacity, with half of the participants reporting work disruption due to neck and knee troubles.

The findings emphasize the urgent need for comprehensive occupational health interventions targeting this vulnerable population. Multidimensional approaches combining ergonomic workplace modifications, health education, preventive exercise programs, appropriate work organization, and gender-sensitive healthcare services are essential to reduce the burden of musculoskeletal disorders among female street sweepers. Collaborative efforts involving employers, healthcare providers, policymakers, and occupational health specialists are crucial to protect the health and well-being of these essential workers who play a vital role in maintaining urban sanitation and public health.

Future research should employ larger sample sizes, longitudinal designs, multiple geographic locations, objective clinical assessments, and intervention studies to further understand and address the occupational health challenges faced by female street sweepers in India.

Recommendations

The following measures can be taken to avoid and prevent the severity of the problem :

Ergonomic interventions

Provide adjustable long-handle brooms to reduce spinal flexion, introduce wheeled waste collection carts with improved maneuverability, ensure proper footwear with cushioning and arch support, implement mechanical aids for waste lifting when feasible.

Work organization

Establish mandatory rest breaks during shifts, rotate tasks to vary physical demands, limit continuous sweeping duration, and provide adequate hydration facilities.

Health promotion

Implement workplace stretching exercise programs, provide health education on proper work techniques and

posture, conduct regular occupational health screening, and establish referral systems for physiotherapy services.

Policy measures

Develop occupational health standards specific to sanitation workers, ensure access to preventive healthcare services, provide compensation for work-related injuries, and conduct regular ergonomic assessments of work environments.

Gender-specific considerations

Tailor interventions for female workers' physiological needs, provide bone density screening for women over 40 years, ensure calcium and vitamin D supplementation programs, and address menstrual and menopausal health concerns.

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