World-Wide Sanitation Workers' Occupational Health and Safety Outcomes and Their Contributing Factors: A Systematic Review

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Abstract

This study identifies various factors contributing to occupational health and safety injuries and musculoskeletal disorders (MSDs) among sanitary workers, largely due to challenging working conditions. A systematic review of PubMed, Medline, Embase, and Lilacs databases from 2000 to April 2022 identified 78 studies, with 13 meeting inclusion criteria. Among 4,564 workers, 84% were solid waste collectors, 10% street sweepers, and 6% cleaners. Occupational injury risks were linked to socio-demographic factors, including age (OR: 22.57; 95% CI: 7.29-69.88), education (OR: 2.22; 95% CI: 1.22-4.00), and work experience (OR: 1.92; 95% CI: 1.11-3.31). Behavioral risks included cigarette smoking (OR: 2.6; 95% CI: 1.55-4.34), sleep disturbances (OR: 2.57; 95% CI: 1.48-4.47), and eating or drinking at the workplace (OR: 3.85; 95% CI: 1.34-11.06), with lack of personal protective equipment (PPE) as a significant safety factor (OR: 2.62; 95% CI: 1.48-4.63). MSD risks were similarly affected by education (OR: 6.73; 95% CI: 1.92-23.51), age (OR: 7.56; 95% CI: 2.18-26.18), work experience (OR: 10.79; 95% CI: 3.49-33.38), and behaviors like smoking (OR: 0.14; 95% CI: 0.03-0.64) and job satisfaction (OR: 11.43; 95% CI: 2.04-64.08). Occupational safety factors included time pressure (OR: 3.25; 95% CI: 1.08-9.77), working over eight hours (OR: 3.5; 95% CI: 1.543-8.204), extended periods in strained positions (OR: 8.0; 95% CI: 2.25-28.85), and awkward posture (OR: 15.7; 95% CI: 6.47-38.18). Sanitation workers face increased occupational risks due to socio-demographic, safety, work pattern, and behavioral factors, underscoring the need to address these areas to reduce injuries and MSDs in this workforce.

Keywords: *Associated Factors; Musculoskeletal Disorders; Occupational Injuries; Sanitary workers*

1. INTRODUCTION

Sanitation workers encompass a wide range of services, making it difficult to estimate their global numbers, as they often hold multiple jobs or are grouped with other sectors such as solid waste and healthcare facility management (WHO, 2019a). Despite this essential work, they face numerous health and safety challenges, including musculoskeletal disorders, injuries, respiratory and gastrointestinal problems, infectious diseases, dermatitis, hepatitis B and C, parasitic diseases, eating and sleep disorders, depression, and allergic and toxic reactions, along with acute and chronic infections like HIV (Arruda, 2010; Souza, 2016). This exposes millions of sanitation workers globally, especially in low- and middle-income countries, to dangerous working conditions that risk their health, dignity, and human rights (Gomathi & Kamala, 2020; WHO, 2019). Studies have found factors contributing to occupational health and safety (OHS) outcomes, such as lack of institutional support, education, adequate experience, supervision, and occupational health measures (Comaru & Werna, 2013). In many cases, sanitation workers, particularly in low-income areas, are informally employed, making them challenging to locate (WHO, 2019b). Furthermore, societal perceptions regard professional cleaning as unskilled work, which diminishes job satisfaction and contributes to stress, negatively impacting both mental and physical health (Woods & Buckle, 2006; Krüger et al., 1997; Bering, 2000).

This review focuses on the factors associated with occupational injuries and musculoskeletal disorders. Studies indicate that occupational injuries may be influenced by gender, marital status, family size, work experience, education level, income, and behaviors such as smoking and Khat chewing (Alamgir & Shicheng, 2014; Eskezia et al., 2016; Wahab & Ogunlola, 2014). Institutional factors, including lack of supervision, heavy workloads, and insufficient occupational health measures, further contribute to OHS risks (Amissah et al., 2019; Leitão, 2008; Souza, 2016). Musculoskeletal disorders are associated with factors like age, job satisfaction, time pressure, and work hours, with older and more experienced workers more prone to MSDs, especially in high-slum areas or those working in sustained awkward postures (Salve & Chokhandre, 2016; Singh & Chokhandre, 2015). This review aims to identify contributing elements to OHS issues among sanitation workers to raise awareness, address these challenges, and ultimately advocate for sanitation workers' health and safety protections.

2. METHOD AND MATERIALS

The review methods adhered to the updated Preferred Reporting Items for Systematic Reviews (PRISMA) guidelines, as outlined by Page et al. (2021).

2.1. Population Group

The study population consisted of sanitary workers aged 18 and above. This group included a range of sanitation professionals, such as street sweepers, sewage workers, wastewater treatment employees, as well as solid waste collectors, pickers, and emptiers.

2.2. Study Eligibility Criteria

Inclusion Criteria

Studies were included if they were published in English, used a cross-sectional study design, and focused on either Occupational Related Injuries (ORI) or Musculoskeletal Disorders (MSDs) as outcomes among the specified sanitary worker groups.

Exclusion Criteria

Studies were excluded if they were published in languages other than English, specifically French or Spanish. Additionally, studies were not included if they focused on office cleaners, hotel and restaurant cleaners, or if they used quasi-experimental, case-control, or cohort study designs.

2.3. Study Design and Setting

The review searched across multiple databases, including MEDLINE, PubMed, Embase, and LILACS, as well as Google Scholar. The search covered studies and reported data spanning from 2010 to April 2022.

2.4. Searching Strategies

The search strategy incorporated a combination of terms related to occupation, injuries, and health factors. For instance, terms like "Occupational," "Job," and "Work" were combined with "Occupational Injuries" or "Musculoskeletal Disorder" and keywords for related factors such as socio-demographic characteristics, behavioral variables, institutional factors, and work patterns. Additionally, terms for "Sanitary Workers" (including "Waste Collectors," "Street Sweepers," and "Sewage Workers") were used along with geographical descriptors (e.g., "developed" or "developing") and "cross-sectional studies."

2.5. Data Screening

The initial data screening was conducted using Microsoft Excel to manage titles and abstracts from the search results. Relevant full-text articles were then collected, and duplicates were removed through the Zotero reference management tool.

2.6. Data Extraction

A predefined extraction form in Microsoft Excel was used to systematically capture and organize data from the included studies.

2.7. Data Synthesis

The synthesis of studies focusing on occupational outcomes was structured according to the type of outcome. Additional outcomes that were relevant but outside the primary scope were described narratively and presented in tabular format.

2.8. Outcomes Operational Definitions

Occupational Related Injuries (ORI):

Occupational Related Injuries were defined as self-reported injuries linked to occupational exposure, including any physical harm resulting from accidents or diseases. This included injuries such as punctures, abrasions, lacerations, cuts, or trauma caused by blunt-force impact (Oza et al., 2022).

Musculoskeletal Disorders (MSDs):

Musculoskeletal Disorders in this study referred to self-reported MSDs assessed across nine body regions among sanitary workers: neck, shoulder, upper back, elbow, lower back, wrist/hand, hips/thighs, knee, and ankle/feet trauma (Oza et al., 2022).

Occupational Health and Safety Outcomes:

In this review, occupational health and safety outcomes were limited to self-reported ORIs and MSDs, focusing specifically on injuries and musculoskeletal issues related to the occupational settings of the sanitary workers.

3. RESULT

3.1. Selection studies

A total of 78 studies were identified using various databases, recovered data, and relevant publications. Of these, three studies were from earlier evaluations, while 59 studies were newly identified from databases and registers. An additional 15 studies were retrieved through alternative methods. For the specific analysis on the prevalence of work-related injuries and musculoskeletal disorders, thirteen studies were selected (see Figure 1)
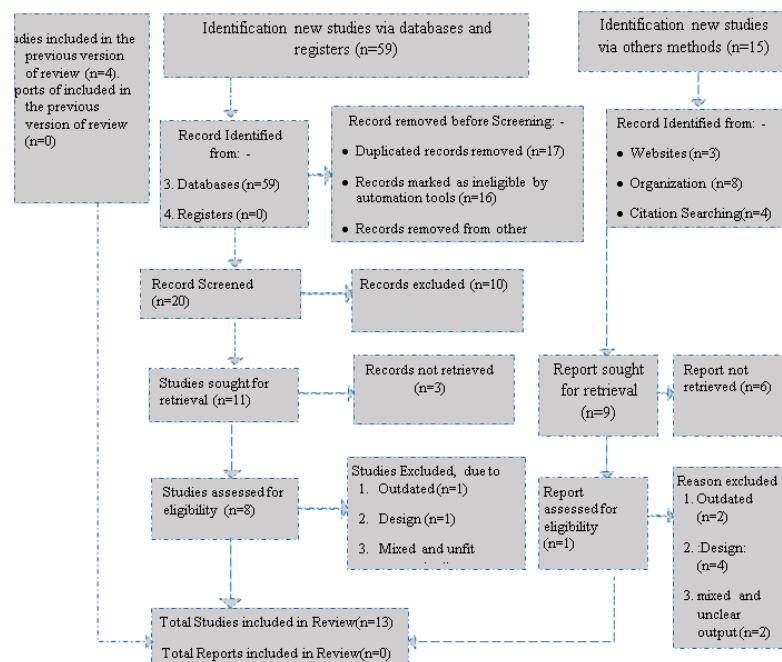

Figure 1. Flow diagram for systematic reviews adopted from PRISMA 2020

3.2. Countries Reviewed

Among the thirteen studies reviewed, ten originated from developing countries, with the remaining studies from developed countries. This distribution means that over three-quarters of the data came from articles published by developing nations.

3.3. Studied Population

The total population of sanitary workers covered in these studies was 4,564 individuals. Of this group, the majority, 3,844 workers (84%), were solid waste collectors. Street sweepers accounted for 450 individuals (10%), and cleaners comprised 270 individuals (6%) (see Figure 2).
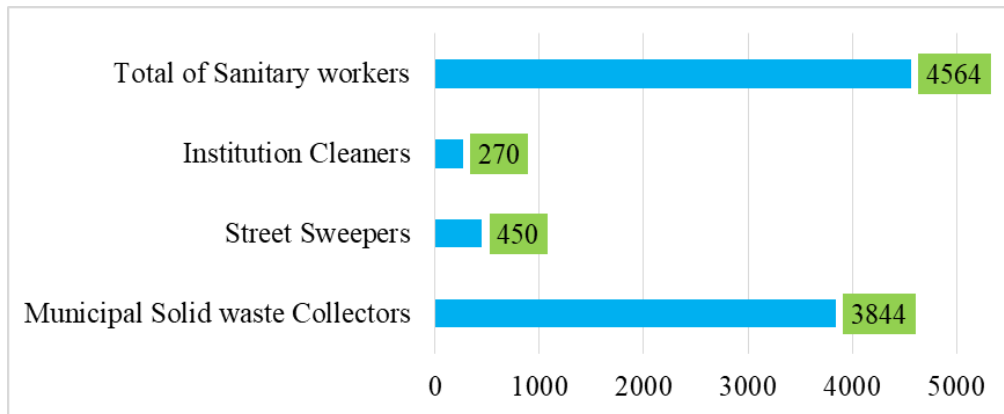
Figure 2. Workers

3.4. Techniques of statistical

More than half of the authors employed logistic regression techniques to analyze the factors associated with occupational-related injuries and musculoskeletal disorders (see Figure 3). This statistical method allowed them to assess the relationships and risks associated with these health outcomes among the studied populations.

Figure 3. Statistical used in Reviewed studies on Occupational health and safety outcomes, 2022

3.5. Associated Factors of Occupational injuries

The main factors associated with the occurrence of occupational injuries were identified across several domains. Socio-demographic facto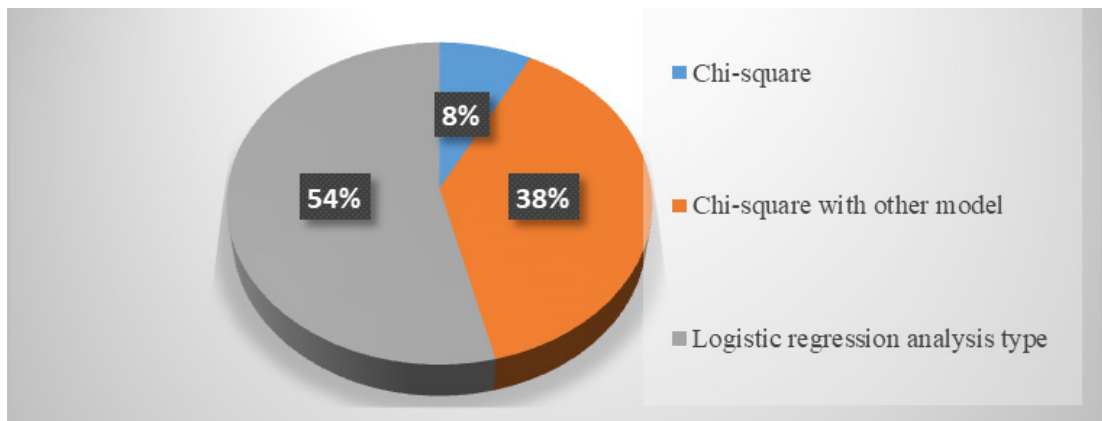rs included age, with an odds ratio (OR) of 22.57 (95% confidence interval [CI]: 7.29–69.88; p < 0.001), indicating a significant correlation between older age and the likelihood of injuries. Education also emerged as a relevant factor, with an OR of 2.22 (CI: 1.22–4.00; p < 0.05), suggesting that lower educational attainment may increase risk. Additionally, work experience was associated with occupational injuries, presenting an OR of 1.92 (CI: 1.11–3.31; p < 0.05), indicating that less experienced workers might be at higher risk.

Behavioral factors contributing to occupational injuries included cigarette smoking, with an OR of 2.6 (CI: 1.55–4.34; p < 0.05), and sleeping disturbances, which had an OR of 2.57 (CI: 1.48–4.47; p < 0.05). Engaging in eating, smoking, or drinking at work was also associated with an increased risk, presenting an OR of 3.85 (CI: 1.34–11.06; p < 0.001).

In terms of safety factors, the lack of personal protective equipment (PPE) was significant, with an OR of 2.62 (CI: 1.48–4.63; p < 0.05), highlighting the importance of proper safety measures in preventing occupational injuries (see Table 1).

Table 1. Studies on associated Factors of occupational related injuries/ORI among sanitary workers

Associated Factors of ORI		Confidence Interval (CI=95%)			
Authors	Socio-demographic	OR	Lower Limit	Upper Limit	P-value
(Rachiotis et al., 2012a)	Age years >42* vs <42 years	22.57	7.29	69.88	P<0.001
(Rachiotis et al., 2012b)	Age years >42* vs <42 years	5.22	1.35	20.10	p<0.001
(Bogale et al., 2014)	Experience < 1*vs 1 year	1.73	1.06	2.84	p<0.001
(Rachiotis et al., 2012b)	Educated vs illiterate*	2.19	1.01	4.78	p<0.05
(Eskezia et al., 2016)	Educated vs illiterate*	2.22	1.22	4.00	p<0.05
(Melaku & Tiruneh, 2020)	Experience <5 years* vs >5 year	1.86	1.01	2.18	p<0.05
(Eskezia et al., 2016)	Experience <3 years* vs >5 year	1.92	1.11	3.31	p<0.05
(Melaku & Tiruneh, 2020)	Family size >4*vs < 4 families	1.76	1.15	2.71	p<0.05
(Bogale et al., 2014)	Family size >5* vs < 5 families	0.21	0.1	0.44	p<0.05
(Bogale et al., 2014)	Family >4 size * vs < 2-4 families	0.52	0.3	0.93	p<0.05
(Bogale et al., 2014)	Married families* vs Single	1.89	1.09	3.28	p<0.05
Behavioral variables					
(Bogale et al., 2014)	Drinkers* vs Non drinkers	1.85	1.14	3.00	p<0.01
(Mamuya & Badi, 2019)	Smoker* vs non smoker	2.6	1.55	4.34	p<0.05
(Eskezia et al., 2016)	Had job stress* vs hadn't	1.94	1.11	3.40	p<0.05
(Eskezia et al., 2016)	Sleeping disturbance* vs hadn't	2.57	1.48	4.47	p<0.05
(Bogale et al., 2014)	Sleeping disturbance* vs hadn't	1.64	0.77	3.46	p<0.01
(Rachiotis et al., 2012a)	Eating/smoking/ drinking* vs hadn't	3.85	1.34	11.06	p <0.001
Occupational Safety variables					
(Melaku & Tiruneh, 2020)	Transport and collection* vs sweeping	8.5	0.34	48.81	p <0.05

Associated Factors of ORI		Confidence Interval (CI=95%)			
Authors	Socio-demographic	OR	Lower Limit	Upper Limit	P-value
(Bogale et al., 2014)	Lack of PPE* vs fully suited ad	2.62	1.48	4.63	p <0.05
(Melaku & Tiruneh, 2020)	More than 8hours * vs <8 hours	1.76	1.22	2.68	p <0.05
(Melaku & Tiruneh, 2020)	Only use mask* vs fully suit PPE	2.31	1.32	4.04	p <0.05
(Ephraim et al., 2021)	lack of PPE* vs fully suited	2.24	1.21	4.17	p <0.001

Asterisk (*) Shows that those were more likely had occupational related injured

3.6. Associated Factors of Musculoskeletal Disorders

Among the thirteen eligible studies, six were specifically selected to analyze the associated factors of musculoskeletal disorders (MSDs) among sanitary workers. The findings indicated several socio-demographic factors contributing to the development of MSDs. Education was a significant factor, with an odds ratio (OR) of 6.73 (95% confidence interval [CI]: 1.92–3.51; $p = 0.006$), suggesting that lower educational levels may increase the risk of developing MSDs. Age also played a crucial role, presenting an OR of 7.56 (CI: 2.18–26.18; $p = 0.006$), indicating that older workers are more susceptible to these disorders. Furthermore, work experience was identified as a significant factor, with an OR of 10.79 (CI: 3.49–33.38; $p = 0.010$), highlighting that those with less experience may be at higher risk.

Behavioral factors were also examined, revealing a notable association with cigarette smoking, which showed an OR of 0.14 (CI: 0.03–0.64; $p = 0.04$), suggesting that smoking may be inversely related to MSD risk in this population. Job satisfaction emerged as a critical factor, with an OR of 11.43 (CI: 2.04–64.08; $p = 0.010$), indicating that lower job satisfaction is linked to a higher likelihood of developing MSDs.

Occupational safety variables further highlighted the risks associated with specific work conditions. Time pressure was found to significantly increase the risk of MSDs, with an OR of 3.25 (CI: 1.08–9.77; $p = 0.035$). Working more than eight hours a day was also associated with an increased risk, presenting an OR of 3.5 (CI: 1.543–8.204; $p = 0.003$). Additionally, working in positions for more than two hours showed a strong correlation, with an OR of 8 (CI: 2.25–28.85; $p = 0.001$). Awkward posture during work was notably significant as well, with an OR of 15.7 (CI: 6.47–38.18; $p < 0.001$), underscoring the importance of ergonomics in preventing musculoskeletal disorders (see Table 2).

Table 2. Associated Factors of Musculoskeletal Disorders among Sanitary workers

Authors	Associated Factors	Odd Ratio	Lower Limit	Upper Limit	P-value
(Reddy & Yasobant, 2015)	Socio-demographic				
(Reddy & Yasobant, 2015)	Primary/Secondary	6.73	1.92	23.51	p=0.006
(Reddy & Yasobant, 2015)	Age (<45* vs >45 yr)	7.56	2.18	26.18	p=0.006
(Salve et al, 2017)	Age (>35* vs <35yr vs) with high	3.04	1.28	7.23	p<0.001
(Salve et al, 2017)	Experience >10* vs 10 years	5.78	1.57	21.3	p<0.001

Authors	Associated Factors	Odd Ratio	Lower Limit	Upper Limit	P-value
(Melese et al., 2020]	Experience(>6* vs <60 month)	2.5	1.127	5.522	p=0.024
(Salve & Chokhandre, 2016)	Experience (>10* vs <10) on Elbow	10.79	3.49	33.38	p=0.010
(Pintakham & Siriwong, 2015)	Experience (<13* vs >13 years)	1.12	1.1	12.4	p=0.024
(Singh & Chokhandre, 2015)	Work experience (>10 vs <10 years	2.15	1.12	4.14	p=0.010
(Pintakham & Siriwong, 2015)	Age (>40* vs < 40year)	1.11	1.03	1.19	p=0.006
	Behavioral Factors				
(Pintakham & Siriwong, 2015)	Cigarette smokers* vs Non smokers	0.14	0.03	0.64	p=0.04
(Pintakham & Siriwong, 2015)	Alcohol drinker* vs Non drinkers	0.18	0.04	0.83	p=0.028
(Salve, 2016)	Job dissatisfaction* vs satisfaction	11.43	2.04	64.08	p=0.010
(Salve et al, 2017)	Substance use (>2* vs <2)	3.07	1.17	8.02	P<0.05
(Salve et al, 2017)	Mental Health * vs good status	6.35	1.63	24.68	p<0.001
(Melese et al., 2020]	Feeling exhausted* vs not feeling	2.7	1.161	6.203	p=0.021
(Melese et al., 2020]	Occupational safety variables				
(Melese et al., 2020]	Existence of time pressure* vs Not	3.25	1.084	9.777	p=0.035
(Melese et al., 2020]	Working hours/day* vs Not	3.5	1.543	8.204	p=0.003
(Melese et al., 2020]	Working (vs >2hr)* vs not	8	2.25	28.85	p=0.001
	Posture, BMI and others				
(Melese et al., 2020]	Awkward posture* vs hadn't	15.7	6.47	38.18	p<0.001
(Pintakham & Siriwong, 2015)	BMI (<23 vs >23*)	1.18	1.03	1.35	p=0.013
(Pintakham & Siriwong, 2015)	Distance (km/day) (<2 vs 2<*)	25.91	2.87	23.36	p=0.004
(Pintakham & Siriwong, 2015)	Weight of the broom (g)(<800 vs 800<*)	4.64	1.02	21.08	p=0.047
(Pintakham & Siriwong, 2015)	Length of the broom (cm)(<160 vs 160<*)	10.01	1.72	58.37	p=0.010
(Pintakham & Siriwong, 2015)	Weight of dustpan (g)(<1700 vs 1700<*)	2.64	1.073	6.48	p=0.035
(Singh & Chokhandre, 2015)	Waste pickers* vs gardens	3.52	1.69	7.36	p=0.047
Salve and Chokhandre 2016)	Location of work: Slum* vs not	10.64	3.48	32.5	p=0.010

Asterisk [*] Shows that those were more likely to developed Musculoskeletal Disorders

4. DISCUSSION

4.1. Reviewed Data

The review process yielded a total of 78 studies from various databases and other sources. Out of these, 59 studies were identified based on their titles. Seventeen studies were eliminated due to duplication prior to screening, and sixteen were flagged as ineligible by automation tools. An additional six studies were excluded for unspecified reasons. Abstracts of the remaining twenty studies were screened, leading to the exclusion of ten. Eleven studies were sought for retrieval, but only eight were ultimately included. Furthermore, searches on the internet, organizations, and citations yielded fifteen additional studies, of which only one was included. Four studies from the previous version of the review were also incorporated (Melaku & Tiruneh, 2020).

Inclusion criteria restricted certain studies due to unmatched designs, outdated information, mixed populations, unclear outputs, and unspecified methods. Consequently, thirteen (13) studies were included for the associated factors of occupational-related injuries and

musculoskeletal disorders (MSDs) (Figure 1). The study population comprised all sanitary workers, including street sweepers, wastewater treatment workers, hospital cleaners, general sanitary workers, garbage collectors, and sewage workers, with the majority being street sweepers, followed by solid waste collectors (Figure 2).

Regarding study design, over three-quarters of the included studies utilized cross-sectional designs with observational checklists. A smaller number incorporated control groups and focus groups. Statistical analyses predominantly employed binary and multiple regression methods, including chi-square tests, Fisher's exact test, and logistic regression (Figure 3).

4.2. Factors for Occupational-Related Injuries

The factors influencing the occurrence of work-related accidents can be categorized into socio-demographic characteristics, occupational safety variables, and behavioral variables (Table 1). Each category is discussed in detail below.

Socio-Demographic Variables:

Age: The age of sanitary workers is a significant factor in the occurrence of occupational injuries. Rachiotis et al. reported that individuals over 42 years old were 22.57 times more likely to be exposed to hepatitis A virus compared to those under 42 (OR = 22.57; 95% CI = 7.29–69.88) (Rachiotis et al., 2012a). In other studies, waste collectors over 42 years were found to be 5.22 times more likely to be positively associated with anti-hepatitis B virus infection (Rachiotis et al., 2012b).

Gender: According to Bogale et al., male workers reported more injuries than female workers, with males being 2.2 times more likely to sustain injuries (OR = 2.2, 95% CI = 1.39–3.56) (Bogale et al., 2014). This disparity may be attributed to males typically engaging in heavier tasks, such as lifting and loading, while females often perform less strenuous roles, like transferring waste.

Marital Status: Married solid waste collectors were found to be 1.89 times more likely to suffer injuries than their single counterparts (OR = 1.89, 95% CI = 1.09–3.28) (Bogale et al., 2014). Furthermore, the risk of injury decreased significantly for those with fewer children; those with two or fewer children had a 79% reduced risk compared to those with five or more (AOR = 0.21, 95% CI: 0.10-0.44).

Work Experience: A significant association exists between work experience and the prevalence of occupational injuries. Solid waste collectors with more than one year of experience were more likely to report injuries (OR = 1.73, 95% CI = 1.06–1.84) (Bogale et al., 2014). Rachiotis et al. also reported that longer duration of employment was associated with a higher risk of hepatitis A virus infection (Rachiotis et al., 2012a).

Monthly Income: Those earning less than 600 Eth Birr were found to be 4.09 times more likely to sustain injuries compared to those earning more (AOR = 4.09 95% CI: 2.15, 7.76) (Eskezia et al., 2016).

Education: Illiterate waste collectors were 2.22 times more likely to sustain injuries than their literate counterparts (AOR = 2.22, 95% CI: 1.22, 4.04) (Eskezia et al., 2016).

Occupational Safety Variables:

Several studies highlighted a significant association between the lack of personal protective equipment (PPE) and occupational injuries among solid waste collectors. Ephraim et al. found that those involved in collection and transportation were 8.5 times more likely to sustain injuries compared to those in other roles (AOR = 8.5; 95% CI: 0.34, 48.81). Additionally, respondents lacking PPE were 2.24 times more likely to experience injuries (AOR = 2.24; 95% CI: 1.21, 4.17) (Ephraim et al., 2021).

Behavioral Variables:

Alcohol consumption was found to be statistically associated with occupational injuries, with waste collectors consuming alcohol being 1.85 times more likely to sustain injuries than non-drinkers (OR = 1.85, 95% CI = 1.14–3.00) (Bogale et al., 2014). Cigarette smoking also showed a significant correlation with injuries, as smokers were 2.60 times more likely to sustain injuries than non-smokers (OR = 2.60, 95% CI = 1.55–4.34) (Mamuya & Badi, 2019). Job-related stress and disturbances also contributed significantly to injury risk (Eskezia et al., 2016).

4.3.   Associated Factors of MSDs

The primary factors identified as associated with the development of MSDs among sanitary workers include socio-demographic variables, occupational safety variables, behavioral variables, work design and patterns, materials used, location of work, distance traveled by workers, and body mass index (Table 2).

Socio-Demographic Variables:

Sanitary workers with ten or more years of experience were significantly more likely to experience elbow MSDs (OR = 10.79; $p<0.01$) compared to those with less than ten years (Salve, 2016). Those with six months or more of work experience were three times more likely to develop MSDs than those with less experience (AOR = 2.5, 95% CI = 1.12–5.52) (Melese et al., 2020). Additionally, workers over 40 years were 5.41 times more likely to suffer knee MSDs compared to younger workers (Singh & Chokhandre, 2015).

Behavioral Variables:

Job satisfaction was significantly correlated with MSDs, as unsatisfied sweepers were more likely to report wrist and hand MSDs (OR = 11.43; $p<0.01$) (Salve & Chokhandre, 2016). Time pressure also emerged as a significant factor, with workers under time constraints being 3.2 times more likely to develop MSDs (AOR = 3.25, 95% CI = 1.08–9.77) (Melese et al., 2020). Furthermore, feelings of exhaustion post-work were linked to a higher likelihood of MSDs (AOR=2.7, 95% CI=1.16–6.20; p=0.02) (Melese et al., 2020).

Posture, Work Design, and Patterns:

Workers in awkward positions were found to be 15 times more likely to develop MSDs (AOR=15.7, 95% CI=6.47–38.17, p<0.001) (Melese et al., 2020). Additionally, those working over eight hours a day were 3.55 times more likely to develop MSDs (AOR = 3.55, 95% CI = 1.54–8.20, p = 0.003) (Melese et al., 2020).

4.4. Limitations

A significant limitation of this systematic review is that nearly all included studies utilized cross-sectional designs, which may introduce selection bias and information bias during the sampling process. Moreover, potential confounders could weaken the findings, leading to erroneous interpretations. Despite employing a comprehensive search strategy, some relevant studies may have been overlooked due to variations in terminology used to describe sanitation employees across different geographic regions, nations, languages, and cultures.

5. CONCLUSION

Despite the limitations of this review, the overall consistency of the evidence indicates an increased risk of occupational problems, including injuries and musculoskeletal disorders (MSDs), among sanitation workers. These risks are significantly influenced by socio-demographic factors, occupational safety related to work patterns, and behavioral factors. Given the substantial harm arising from these interconnected causes, it is imperative for governmental and institutional bodies to implement guidelines, regulations, and interventions aimed at minimizing risks for sanitary employees. The findings underscore the urgent need for comprehensive strategies to address the total probabilities of occupational-related injuries and MSDs in this vulnerable workforce.

6. FUNDING

7. CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

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