

WORLD-WIDE SANITATION WORKERS' OCCUPATIONAL HEALTH AND SAFETY OUTCOMES AND THEIR CONTRIBUTING FACTORS: A SYSTEMATIC REVIEW

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ABSTRACT

*Different types of factors are contributing to the occurrence of occupational health and safety injuries and musculoskeletal disorders among sanitary workers due to their working conditions, which need to be identified to anticipate the problems. PubMed, Medline, Embase, and Lilacs databases were used from 2000 to April 2022. Searched strategies: Occupational *OR Job *OR Work AND Occupational Injuries OR Musculoskeletal Disorder AND Associated Factors [Socio-demographic Character *OR Behavioral Factors *OR Institution Factors *OR Work Pattern] AND sanitary workers [waste collectors and emptiers; street sweepers; sewage workers; health facilities] AND Countries [Developed *OR Developing] And cross-sectional studies. A total of 78 studies were identified from the databases and other retrieved data and reports and finally total 13 studies were included for ORI and MSD. From total of 4564 sanitary workers, majority of them 3844(84%) were solid waste collectors. The remaining are street sweepers 450 (10%) and cleaners 270 (6%). The main factors for occurrence of occupational injuries were socio-demographic: age (OR: 22.57; CI95%:7.29-69.88; p<0.001); education (OR: 2.22; CI95%:1.22-4.00; p<0.05); work experience (OR: 1.92; CI95% 1.11-3.31; p<0.05). From behavioral factors: Cigarette smoking (OR:2.6 CI95%*

:1.55-4.34; $p < 0.05$); sleeping disturbance (OR:2.57; CI95%:1.48-4.47; $p < 0.05$); eating/smoking/ drinking at work place (OR:3.85; CI95%: 1.34-11.06; $p < 0.001$). From safety factors: Lack of Personal protective equipment (OR: 2.62; 1.48-4.63; $p < 0.05$). For development of musculoskeletal disorders from socio-demographic factors; education (OR:6.73; CI95%:1.92-23.51; $p=0.006$); Age (OR: 7.56; CI95% :2.18-26.18; $p=0.006$); work experience (OR:10.79; CI95% 3.49-33.38; $p=0.010$). From behavioral factors; cigarette smoking Cigarette (OR: 0.14; CI95%:0.03-0.64; $p=0.04$); job satisfaction (OR: 11.43; CI95%:2.04-64.08; $p=0.010$). From Occupational safety variables; time pressure (OR: 3.25; CI95%:1.08-9.77; $p=0.035$); working more than 8hr (OR: 3.5; CI95%:1.543-8.204; $p=0.003$). Body position; working >2 hours (OR: 8; CI95%: 2.25; 28.85; $p=0.001$) and awkward posture (OR: 15.7; CI95%: 6.47-38.18; $p < 0.001$). Sanitation employees experienced heightened occupational-related outcomes as a result of sociodemographic characteristics, occupational safety with regard to work patterns, and behavioral factors.

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

1. INTRODUCTION

Sanitation workers encompass a vast line of services; the number of sanitation workers globally is difficult to estimate because they often have multiple jobs or are categorized with other sectors like solid waste and healthcare facility management (WHO, 2019a). However, they are facing many challenges related to their health and safety, such as musculoskeletal disorders, injuries, respiratory problems, gastro-intestinal problems, infectious diseases, dermatitis, rhinitis, hepatitis B and C, parasitic diseases, eating disorders and sleep, depression, neurosis, allergic and toxic reactions, HIV, and acute or chronic infections (Arruda, 2010; Souza, 2016). As a result, millions of sanitation workers across the world, particularly in low- and middle-income countries, are forced to work in conditions that endanger their health and lives and violate their dignity and human rights (Gomathi & Kamala, 2020; WHO, 2019).

A lot of studies found that lack of institutional support, lack of education, high or low experience of sanitary workers, behavioral factors, lack of supervisor, unregulated or unenforced environmental and labor protections, lack of pre-job training, and lack of occupational health and safety measures are the common associated factors for the occurrence of OHS outcomes (Comaru & Werna,

2013). Furthermore, many sanitation workers, especially in low-income areas, are informally employed and therefore difficult to localize (WHO, 2019b). Moreover, there was poor social recognition for these groups: As evidence indicates, professional cleaning is often considered unskilled extra work that everyone knows how to do. The fact that cleaning receives poor social recognition is a factor affecting negatively the cleaners' motivation and identification with the work (Krüger et al., 1997). Even some sanitary workers themselves are of the opinion that cleaning is a job that does not require special qualifications and that anyone can do it (Bering, 2000). Low appreciation of the job tends to harm workers' satisfaction and lead to stress, with subsequent negative effects on mental and physical health (Woods & Buckle, 2006).

In this review, the associated factors are limited to occupational-related injuries and musculoskeletal disorders. The occurrence of occupational-related injuries could be due to differences in gender (Alamgir & Shicheng, 2014), marital status, and family size (Melaku & Tiruneh, 2020). The other factors are work experiences (Alamgir & Shicheng, 2014; Eskezia et al., 2016; Melaku & Tiruneh, 2020) and training (Souza, 2016; Leitão et al., 2008). The other factors are due to formal education, the majority of sanitary workers being illiterate (Eskezia et al., 2016; Wahab & Ogunlola, 2014) and low income (Eskezia et al., 2016). Moreover, environment satisfaction (Shi et al., 2020), job satisfaction, sleeping disorder (Eskezia et al., 2016), and job stress (Eskezia et al., 2016) are also associated factors for the occurrence of occupational-related injuries. In addition, alcohol consumption, Khat chewing, and cigarette smoking (Souza, 2016; Mamuya & Badi, 2019) are also associated factors. In this review, institution factors could trigger an employee's action that could lead directly or indirectly to the occurrence of an accident and injury due to less attention from institutions, weak IPC practice, lack of supervision, work overload, and lack of follow-up (Amissah et al., 2019; Haagsma et al., 2016; Leitão, 2008; Souza, 2016).

Moreover, there were a lot of associated factors for the development of musculoskeletal disorders among sanitary workers. Studies indicating experiences were significantly more likely to suffer from MSDs (Salve & Chokhandre, 2016; Singh & Chokhandre, 2015). From this evidence, we learned that as work experience increases, the development of MSDs also increases among sanitary workers. Moreover, the respondents over the age of forty were 5.41 times more likely to develop MSDs of the knee as compared to those less than thirty years old (Singh & Chokhandre, 2015). Therefore, an

increase in age leads to the development of MSDs among sanitary workers. Furthermore, job satisfaction: It was also found to be significantly correlated, as the sanitary workers who were not satisfied with their job were more likely to have suffered from the MSDs (Salve & Chokhandre, 2016). Moreover, those who had time pressure, felt exhausted, and worked longer hours were more likely to develop MSDs as compared to those who didn't (Melaku & Tirunch, 2020; Melese et al., 2020).

The study revealed that those working in high-slum concentration areas and those who came far from their workplace were more likely to get MSDs as compared with those working in low-slum concentration areas (Salve & Chokhandre, 2016). While distance and length of the broom were positively associated with the weight of the broom and the total weight of the broom and dustpan (Pintakham & Siritwong, 2017), those working in awkward posture and sustaining positions for more than two hours were more likely to develop MSDs as compared to their counterparts (Melese et al., 2020). Furthermore, the study indicated people with poor mental health status were significantly more likely to report MSDs for the upper back and shoulders, respectively, as compared to those with good mental health (Salve et al, 2017). The goal of this review was to pinpoint the contributing elements to occupational health and safety outcomes and bring more attention to the issues so that they could be solved. Finally, this review will make an effort to be published for other researchers and decision-makers in order to support sanitation employees.

2. METHOD AND MATERIALS

The review methods used Preferred Reporting Items for Systematic Reviews (PRISMA) updated criteria adopted from Page et al. (Page et al., 2021).

2.1. Population Group

Sanitary workers those are greater than age of eighteen or above years of working age. These included street sweepers, sewage workers, waste water treatment employees, and solid trash collectors, pickers, and emptier.

2.2. Study Eligibility criteria

Inclusion criteria

Studies that were published in English, cross-sectional study design, and ORI and MSDs as outcomes on specified sanitary workers were included.

Exclusion criteria

Studies that were published in French, and Spanish were excluded. Office cleaners, Hotel and Restaurant cleaners, quasi-experiment, case-control studies and cohort studies were excluded.

2.3. Study design and setting

The review was searched from data bases: MEDLINE, PubMed, Embase, LILACS databases, Google Scholar, and other reported data from 2010 to April 2022.

2.4. Searching strategies

Occupational *OR Job *OR Work AND Occupational Injuries OR Musculoskeletal Disorder AND Related Factors [Socio-demographic Character *OR Behavioral Variables *OR Institution Factors *OR Work Pattern] is a sample search method from the web databases. Moreover, Sanitary Workers [Waste Collectors and Emptiers* OR Street Sweepers *OR Sewage Workers *OR Health Facilities] AND countries [developed or developing] AND cross-sectional studies

2.5. Data Screening

Microsoft Excel was used to screen the titles and abstracts that the search yielded, and full copies of the titles and abstracts were collected. Finally, using the reference management tool Zotero, the databases' output was monitored, and duplicates were eliminated.

2.6. Data extraction

A predetermined extraction form created in a Microsoft Excel spreadsheet was used to extract the data.

2.7. Data Synthesis

The studies published pertaining to occupational outcomes were synthesized according to the type of outcomes. Results for other outcomes are tabulated and described narratively.

2.8. Outcomes Operational definition

Occupational Related Injuries: Self-reported injuries that included physical harm caused by accident or disease associated with the occupational exposure.

Includes self-reported, clinically confirmed, or other recorded morbidity or mortality, including but not limited to punctures, abrasions, laceration wounds, cuts, or blunt force trauma (Oza et al., 2022) .

Musculoskeletal disorders: Self-reported MSDs, when evidence obtained from self-reported and nine body regions of sanitary workers such as 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, it is limited to self-reported occupational-related injuries and musculoskeletal disorders.

3. RESULT

3.1.Selection studies

Using the databases and other recovered data and publications, 78 studies in total were found. Three of these studies were from the earlier evaluation; 59 studies came from new research using databases and registers; and 15 studies came from new studies using other techniques (Figure 1). In order to determine the prevalence of work-related injuries and musculoskeletal diseases, thirteen (13) studies were considered (Figure 1).

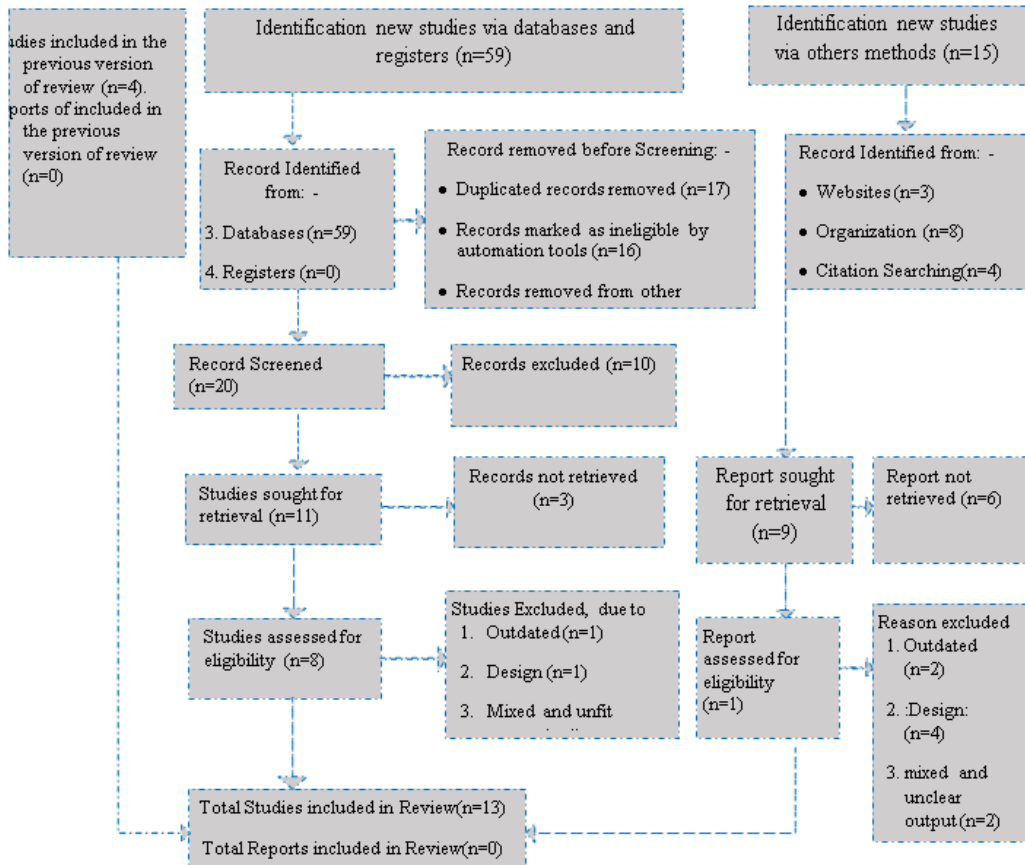


Figure 1. Flow diagram for systematic reviews adopted from PRISMA 2020

3.2. Countries Reviewed

Out of thirteen (13) studies, ten (10) were obtained from developing countries, and the rest were from developed countries. That means more than three-fourths of the data were extracted from articles published by developing countries.

3.3. Studied Population

From total of reviewed sanitary workers (4564), majority of them 3844(84%) were solid waste collectors. The remaining 450 (10% and 270 (6%) were street sweepers and cleaners, respectively (Figure 2)

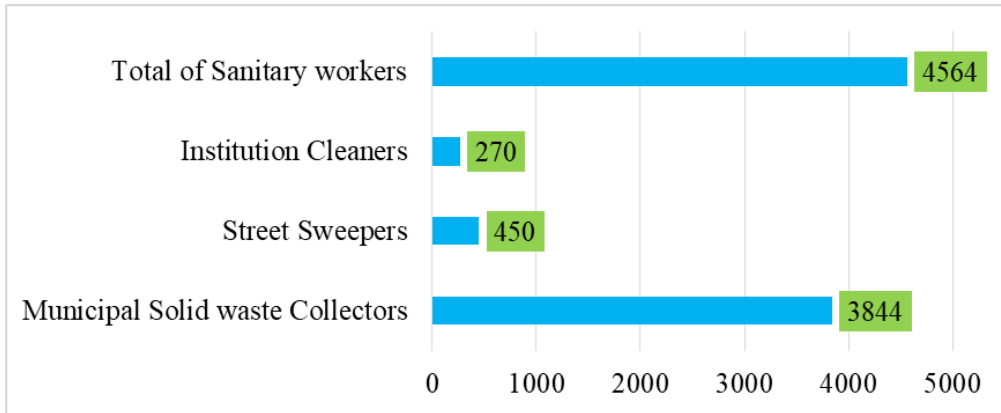


Figure 2. Workers

3.4. Techniques of statistical

More than half percent of the authors used logistic regression to regret associated factors with occupational related injuries and Musculoskeletal Disorders (Figure 3)

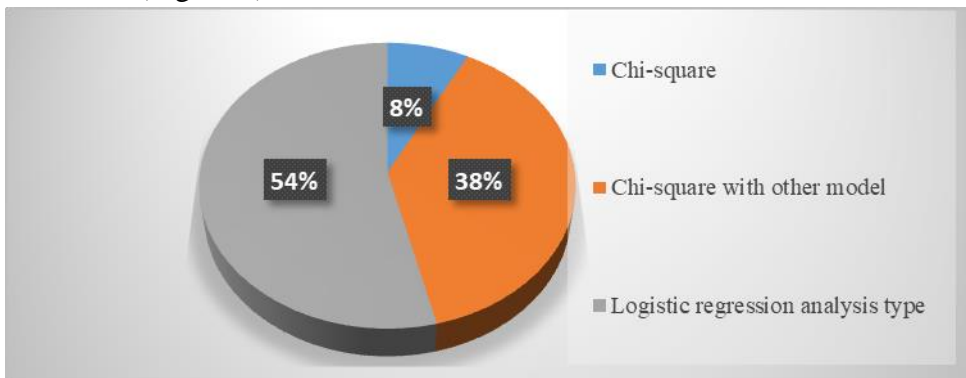


Figure 3. Statistical used in Reviewed studies on Occupational health and safety outcomes, 2022

3.5. Associated Factors of Occupational injuries

The main factors for the occurrence of occupational injuries were socio-demographic: age (OR: 22.57; CI95%:7.29-69.88; $p < 0.001$); education (OR: 2.22; CI95%:1.22-4.00; $p < 0.05$); and work experience (OR: 1.92; CI95%:1.11-3.31; $p < 0.05$). From behavioral factors: cigarette smoking (OR: 2.6, CI:1.55-4.34; $p < 0.05$); sleeping disturbance (OR: 2.57, CI: 1.48–4.47; $p < 0.05$); eating, smoking, or drinking at work (OR: 3.85, CI: 1.34–11.06; $p < 0.001$). From safety factors: Lack of personal protective equipment (OR: 2.62; 1.48–4.63; $p < 0.05$) (Table 1).

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

Associated Factors of ORI		Confidence Interval (CI=95%)			P-value
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	0.11	0.44	p<0.05
(Bogale et al., 2014)	Family >4 size * vs < 2-4 families	0.52	0.32	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	2.65	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	2.5 7	1.4 8	4.47	p<0.05
(Bogale et al., 2014)	Sleeping disturbance* vs hadn't	1.6 4	0.7 7	3.46	p<0.01
(Rachiotis et al., 2012a)	Eating/smoking/drinking* vs hadn't	3.8 5	1.3 4	11.06	p<0.01
Occupational Safety variables					
(Melaku & Tiruneh, 2020)	Transport and collection* vs sweeping	8.5	0.3 4	48.81	p<0.05
(Bogale et al., 2014)	Lack of PPE* vs fully suited ad	2.6 2	1.4 8	4.63	p<0.05
(Melaku & Tiruneh, 2020)	More than 8hours * vs <8 hours	1.7 6	1.2 2	2.68	p<0.05
(Melaku & Tiruneh, 2020)	Only use mask* vs fully suit PPE	2.3 1	1.3 2	4.04	p<0.05
(Ephraim et al., 2021)	lack of PPE* vs fully suited	2.2 4	1.2 1	4.17	p<0.01

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

3.6. Associated Factors of Musculoskeletal Disorders

From a total of 13 eligible studies, six (6) studies were selected for musculoskeletal disorders among sanitary workers. For the development of musculoskeletal disorders from socio-demographic factors: education (OR: 6.73; CI: 1.92–3.51; p = 0.006), age (OR: 7.56; CI: 2.18–26.18; p = 0.006), and work experience (OR: 10.79; CI: 3.49–33.38; p = 0.010) From behavioral factors: cigarette smoking (OR: 0.14; CI: 0.03-0.64; p = 0.04) and job satisfaction (OR: 11.43; CI: 2.04-64.08; p = 0.010) From occupational safety variables: time pressure (OR: 3.25; CI: 1.08–9.77; p = 0.035); working more than 8 hours (OR: 3.5; CI: 1.543–8.204; p = 0.003). Body position; working >2

hours (OR: 8; CI95%: 2.25; 28.85; $p = 0.001$); and awkward posture (OR: 15.7; CI95%: 6.47–38.18; $p < 0.001$) (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	$p < 0.001$
(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 ≥ 2 hr)* 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 & Siritwong, 2015)	BMI (<23 vs >23*)	1.18	1.03	1.35	p=0.013
(Pintakham & Siritwong, 2015)	Distance (km/day) (<2 vs $2 \leq$ *)	25.91	2.87	23.36	p=0.004
(Pintakham & Siritwong, 2015)	Weight of the broom (g)(<800 vs $800 <$ *)	4.64	1.02	21.08	p=0.047
(Pintakham & Siritwong, 2015)	Length of the broom (cm)(<160 vs $160 \leq$ *)	10.01	1.72	58.37	p=0.010
(Pintakham & Siritwong, 2015)	Weight of dustpan (g)(<1700 vs $1700 \leq$ *)	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 databases and other sources of retrieved data and reports yielded a total of

78 studies. Using databases and study titles, 59 studies were located. From these, seventeen studies were eliminated due to duplication prior to screening, sixteen studies were flagged as ineligible by automation tools, six studies were eliminated for unspecified reasons, and abstracts of the remaining twenty studies were screened, of which ten were excluded. Eleven studies were then sought for retrieval, but only eight studies were eventually included. In addition, internet, organization, and citation searches turned up fifteen additional studies and papers, but only one of them was included. In addition, four studies from the review of the previous version were incorporated (Melaku & Tiruneh, 2020).

Regarding inclusion, the review restricted some studies to being inclusive due to unmatched design, outdated, mixed with other occupations, and unfit output; an unknown population; and unclear methods and output. As a result, thirteen (13) studies were included for the associated factors of occupational-related injuries and musculoskeletal disorders (Figure 1). All sanitary workers, including street sweepers, waste water treatment workers, hospital and medical facility cleaners, general sanitary workers, garbage collectors, and sewage workers, were included in the study population. The majority of these were street sweepers, then solid waste collectors (Figure 2). Regarding study design, more than three-quarters of the researchers who conducted their investigations used cross-sectional studies with observational checklists. A small number of them were utilized in cross-sectional studies with control groups and cross-sectional studies with focus groups. The bulk of them used binary and multiple, bivariate, and multivariate regression analysis when it came to statistical models. Chi-square with additional models, such as chi-square with Fisher's exact test, logistic regression, multiple comparison, and binary logistic regression, are then shown (Figure 3).

Factors for occupational related injuries

The relevant factors for the occurrence of work-related accidents are socio-demographic characteristics variables and factors, occupational safety variables, and behavioral variables (Table 1). The following is a detailed discussion of each category of factors.

Socio demographic variables: The age of the sanitary workers was one of the associated factors for the occurrence of occupational injuries. Rachiotis et al. found those age greater than 42 years old 22.57 times (OR = 22.57; 95% CI = 7.29–69.88) exposed to hepatitis A virus as compared to those being less than

42 years old (Rachiotis et al., 2012a) . Rachiotis et al., with other studies, also indicated that waste collectors who were greater than 42 years old (5.22 times more likely) (OR: 5.22; 95% CI, 1.35–20.1) were independently associated with the anti-hepatitis B virus infection positivity exposed to waste (OR: 4.05; 95% CI, 1.23–13.33) as compared to those less than 42 years old (Rachiotis et al., 2012b) .

The other one is gender; the report obtained from Bogale et al.(n.a.) indicated that male workers reported more injuries than female workers; male workers were 2.2 times more likely to be injured than female workers (OR = 2.2, 95% CI = 1.39–3.56) (Bogale et al., 2014). This can be explained by the fact that more males perform heavy work, such as pulling, lifting, and loading trucks, than females, whose majority of them perform work such as waste transfer from the roadside to the nearby transfer station. The third one is the marital status of the sanitary workers. As this study indicated, married solid waste collectors were more injured than single solid waste collectors. Married solid waste collectors were 1.89 times more likely to be injured than single solid waste collectors (OR = 1.89, 95% CI = 1.09–3.28) ((Bogale et al., 2014).

Moreover, this study also revealed that the risk of occupational injury for those who had two or fewer children was reduced by 79% as compared with those who had five or more children (AOR = 0.21, 95% CI: 0.10-0.44). Similarly, the odds of injuries for those who had 3–4 children were reduced by half (AOR = 0.52, 95% CI: 0.30-0.93) (Bogale et al., 2014). The other study indicated solid waste collectors/MSW who had a family size of greater than four were 1.76 times more likely to have occupational health symptoms compared to those who had a family size of four or less (AOR = 1.76, 95% CI = 1.15–2.71) (Melaku & Tiruneh, 2020).

The fourth one is the work experience of sanitary workers. The study revealed that working experience had a significant association with the prevalence of occupational injuries. Solid waste collectors who reported working experience of more than 1 year were more likely to report occupational injury than their counterparts (OR = 1.73, 95% CI = 1.06–1.84) (Bogale et al., 2014). As Rachiotis et al. reported, duration of employment (3.57; 95% CI = 1.15–11.08) was independently associated with the risk of HAV infection (Rachiotis et al., 2012a) . The other study also confirmed that the likelihood of occupational injury was found to be significantly higher (OR = 1.92, 95% CI: 1.11, 3.31) among respondents with three or fewer service years (Eskezia et al., 2016). As

contrasted, MSW who had work experience greater than 5 years were 1.86 times more likely to have occupational health symptoms compared to those who had work experience of 5 or less years (AOR = 1.86, 95% CI = 1.01–2.18) (Melaku & Tiruneh, 2020). The first one is the monthly income salary. According to one study, those with a monthly salary of less than 600 Eth Birr were 4.09 times more likely (AOR = 4.09 95% CI: 2.15, 7.76) to be injured than those with a monthly salary of more than 600. In addition, illiteracy level was 2.22 times higher (AOR = 2.22, 95% CI: 1.22, 4.04) than that of injured waste collectors as compared to literate waste collectors (Eskezia et al., 2016). The sixth one is education, in which the educated (OR = 2.19; 95% CI = 1.01–4.78) were independently associated with the risk of HAV infection (Rachiotis et al., 2012a) .

Occupational safety variables: As some studies indicated, a lack of PPE was significantly associated with occupational injury among solid waste collectors. Ephraim et al. confirmed that those involved in collection and transportation were 8.5 times more likely to sustain an occupational injury (AOR = 8.5; 95% CI: 0.34, 48.81) than those involved in other work duties (collection and transportation). The likelihood of occupational injury was found to be 2.24 times more likely to occur among respondents who reported a lack of PPE (AOR = 2.24; 95% CI: 1.21, 4.17) (Ephraim et al., 2021). Moreover, the other study confirmed that solid waste collectors who used only a mask were 2.31 times more likely to have occupational health symptoms compared to those who used a fully body suit (AOR = 2.31, 95% CI = 1.32–4.04). This study also revealed that municipal solid waste collectors who worked more than 8 hours per day were 1.76 times more likely to have occupational health symptoms compared to those who worked 8 or less hours per day (AOR = 1.76, 95% CI = 1.22–2.68) (Melaku & Tiruneh, 2020). As Bogale et al. (2014) reported, waste collectors who were not using PPE all the time while on duty had 2.62 times higher occupational injury (AOR = 2.62, 95% CI: 1.48–4.63) than those who use PPE all the time while on duty (Bogale et al., 2014).

Behavioral Variables: The result of the study revealed that the occurrence of occupational injuries was statistically associated with alcohol consumption. The waste collectors who were eating, smoking, or drinking during waste collection were anti-HAV positive (OR = 3.85; 95% CI = 1.34–11.06) 3.85 times more than those who did not (Rachiotis et al., 2012a). This study revealed that alcohol consumption and cigarette smoking were statistically associated with occupational injuries. Alcohol drinking had an odd ratio of

1.85 times more likely to be injured than nondrinkers (OR = 1.85, 95% CI = 1.14–3.00) (Bogale et al., 2014). The study also found that cigarette smoking had a significant association with the prevalence of occupational injuries. Cigarette smokers were 2.60 times more likely to be injured than non-cigarette smokers (OR = 2.60, 95% CI = 1.55–4.34) (Mamuya & Badi, 2019).

Cigarette smoking showed a significant association with the prevalence of occupational injuries. Moreover, the odds of occupational injury were 2.57 times (OR: 2.57; 95% CI: 1.48, 4.47) higher among those who reported job-related sleeping disturbances as compared to their counterparts (Eskezia et al., 2016). The final factor is job-related stress. Job-related stress (AOR = 1.94, 95% CI: 1.11, 3.40) was also significantly and positively associated with occupational injury (Eskezia et al., 2016).

4.2. Associated Factors of MSDs

The main factors identified as associated factors for the development of MSDs among sanitary workers are socio-demographic characteristics variables, occupational safety variables, behavioral variables, work design and pattern, material used, location of work, distance where the sanitary workers came, and body mass index (Table 2).

Socio-demographic Variables: As the study indicated, sanitary workers working for 10 or more years were significantly more likely to suffer from MSDs in the elbows (OR = 10.79; $p < 0.01$) as compared to street sweepers working less than 10 years (Salve, 2016). Moreover, sanitary workers like cleaners who had more than or equal to 6 months of work experience were three times more likely to develop MSDs compared to those who had less than 6 months (AOR = 2.5, 95% CI = 1.12–5.52). MSDs are the cumulative effects of repetitive physical load, and work experience was found to be positively associated with MSDs among cleaners (Melese et al., 2020). Similarly, an increase in work duration was correlated with an increase in complaints of MSDs in different parts of the body. For instance, respondents working for more than 10 years were more likely to report MSDs of the shoulder (OR 2.01; $p < 0.1$) and lower back (OR 2.15; $p < 0.05$) compared to those who had been working for 4 years. Moreover, the respondents over the age of 40 were 5.41 times more likely to experience MSDs of the knee (OR 5.41; $p < 0.01$) compared to those in the 18–30-year-old age group (Singh & Chokhandre, 2015).

Behavioral variables: The study indicates that job satisfaction and MSDs were

also found to be significantly correlated, as the sweepers who were not satisfied with their job were more likely to have suffered from MSDs in the wrists and hands (OR = 11.43; $p < 0.01$) (Salve & Chokhandre, 2016). As Melese et al (2020) found, self-reported MSDs of cleaners were significantly associated with time pressure (AOR = 3.25, 95% CI = 1.08–9.77). That means cleaners who had time pressure while performing their tasks were 3.2 times more likely to develop MSDs compared to those who had no time pressure (Melese et al., 2020). Moreover, this study also revealed that feeling exhausted became statistically significant with adjusted odds (AOR=2.7, 95% CI=1.16–6.20; $p=0.02$). This indicates that those who felt exhausted after their work were 2.7 times more likely to develop MSDs than those who had not felt exhausted (Melese et al., 2020). Pintakham and Siriwong (2015) reported that age and BMI of were street sweeping were negative association with cigarette smoking, alcohol drinking ($p < 0.05$) for MSDs development. While distance and length of the broom were positively associated with working experience, weight of the broom, and total weight of the broom and dustpan ($p < 0.05$) (Pintakham & Siriwong, 2015),

Moreover, Salve et al. (2017) highlighted that the complaints of MSDs were significantly higher among the waste loaders aged 35 years and older, particularly for hips and thighs (odds ratio (OR) = 3.04, $p < 0.01$) and upper back (OR = 2.26, $p < 0.05$) as compared to 19–34 years old (Salve et al, 2017). This study also stated that waste loaders who were working for 10 or more years were more likely to suffer from MSDs for shoulders (OR = 4.57, $p < 0.01$), upper back (OR = 2.94, $p < 0.05$), and low back (OR = 3.14, $p < 0.05$) compared to those working for less than 10 years (Salve et al, 2017). The analysis of the effect of mental health on MSDs revealed that workers with poor mental health status were significantly more likely to report MSDs for the upper back (OR = 2.95, $p < 0.05$) and shoulders (OR = 3.26, $p < 0.05$) as compared to workers with good mental health status. As expected, those with 10 or more years of engagement in waste loading were significantly more likely to report disabilities for their wrists and hands (OR = 5.78, $p < 0.01$), shoulders (OR = 4.81, $p < 0.01$), hips and thighs (OR = 3.96, $p < 0.01$), upper back (OR = 3.94, $p < 0.01$), and low back (OR = 3.59, $p < 0.01$) as compared to those working for less than 10 years. This study also revealed that sanitary workers (waste loaders) had two or more types of addiction, particularly for the shoulders (OR = 3.03, $p < 0.05$), hips and thighs (OR = 3.07, $p < 0.05$), and low back (OR = 2.92, $p < 0.05$), as compared to those who were not consuming

any substances (Salve et al, 2017).

Posture and work Design and pattern:: A study found cleaners working in an awkward position were 15 times more likely to develop MSDs and were strongly associated with MSDs (AOR=15.7, 95% CI=6.47–38.17, $p<0.001$) as compared to their counterparts (Melese et al., 2020). The location of work, too, was found to be a significant predictor of developing MSDs. Sweepers working in high slum concentration areas were more likely to get MSDs in the hips and thighs (OR = 10.64; $p<0.01$) (Salve & Chokhandre, 2016). The other study indicated that those working hours greater than or equal to 8 hours per day were 3.55 times more likely to develop MSDs (AOR = 3.55, 95% CI = 1.54–8.20, $p = 0.003$) than those working hours less than 8 hours per day (Melese et al., 2020) . Moreover, cleaners who worked more than two hours in a sustaining position were 8.05 times more likely (AOR = 8.055, 95% CI = 2.25–28.85) than those who worked less than two hours in a sustaining position (Melese et al., 2020).

4.3.Limitations

Nearly all of the included studies in this systematic review used cross-sectional study designs, which could lead to selection bias and information bias during the sampling process, and confounders could be one of the weak points in this design that leads to erroneous interpretation. Although a thorough search approach was utilized, some studies may not have been found since the terminology used to describe sanitation employees differs among geographic regions, nations, languages, and cultures.

5. CONCLUSION

Despite the limitations, the overall consistency of the evidence points to an increased risk of occupational problems, such as occupational injuries and musculoskeletal disorders, among sanitation workers as a result of socio-demographic factors, occupational safety with regard to work patterns, and behavioral factors. As there is significant harm as a result of linked causes, government institutional guidelines, regulations, and other efforts must be made to minimize it among sanitary employees, as shown by the total probabilities of occupational-related injuries and musculoskeletal alignments.

ABBREVIATIONS

ILO: International Labor Organization; OHS: Occupational Health and Safety; ORI: Occupational related Injuries; PRISMA: Preferred Reporting Items for

Systematic Reviews; SS: Street sweepers; STW: Sewage and waste Treatment workers; SWCs: Municipality Solid waste collectors; WHO: World Health Organization

DECLARATION SECTION

Ethics approval and consent to participate

Not applicable

Consent for publication

The current publication is not published yet

Availability of data and material

We consent to the deposit of data in a public repository that meets appropriate standards of archiving, citation, and supplement information files alongside our manuscript; we can provide an explanation and details of any restrictions on access if data are not freely available, and acceptable justifications for restricting access may include legal and ethical concerns.

Competing interests

Not applicable

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Not applicable

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