Annals of HEALTH RESEARCH

(The Journal of the Medical and Dental Consultants Association Of Nigeria, OOUTH, Sagamu, Nigeria)

Volume 10 | Issue 4 | October – December 2024

IN THIS ISSUE

ORIGINAL RESEARCH

Factors Associated with Musculoskeletal Disorders Among Cleaners in a Nigerian University

Ojo TO*[1], Faremi FA[2], Gbolade AJ[1], Esebame JO[1], Felix JA[1], Ebutu OJ[1]

[1]Department of Community Health, [2]Department of Nursing Science, Obafemi Awolowo University, Ile Ife, Nigeria

*Correspondence: Dr TO Ojo, Department of Community Health, Obafemi Awolowo University, P.M.B. 13, Ile-Ife, Osun State 220282, Nigeria. E-mail: linktopeojo@yahoo.com ; ORCID - https://orcid.org/0000-0003-1899-5213.

Abstract

Background: Musculoskeletal disorders (MSDs) remain a significant public health concern worldwide, particularly among cleaning personnel, due to their physically demanding tasks and often strenuous work conditions.

Objective: To assess the factors associated with work-related MSDs among cleaners in a public university.

Methods: A cross-sectional study of 320 informal cleaning staff employed on contract in Obafemi Awolowo University, Ile-Ife, Nigeria, was conducted. A semi-structured questionnaire with questions adapted from the Nordic musculoskeletal questionnaire was used to obtain information on socio-demographics, work practices and prevalence/sites of MSD.

Results: The majority (190; 59.4%) of respondents were aged 40-60 years, and most (298; 93.1%) were females. Most respondents (280; 87.5%) earned < N19,000= $50 monthly, and 247 (77.2%) had worked for ≤10 years. A majority (88.1%) worked 6-8 hours daily, with 99.1% working in a bent position and 83.4% standing for >2 hours at a time. In the preceding 7 days, the MSD prevalence was 58.2%, while the common MSD-affected sites were the lower back (35.9%), knees (23.1%), hips/thighs (15.9%), and right shoulder (15.6%). The predictors of MSDs included age >50 years, having no formal education, lack of prior safety training and being overweight/obese.

Conclusion: The study highlighted a significant MSD burden among cleaning staff, primarily affecting the lower back, knees and thighs. It is recommended that employers implement ergonomics and safety training, improved welfare packages, and regular health screenings to reduce MSD burden and promote cleaners' well-being.

Keywords: Cleaning staff, Disability, Musculoskeletal disorder, Obesity, Rehabilitation services, Nigeria.

Introduction

Musculoskeletal disorders (MSDs) remain a global public health challenge, ranking as the leading cause of disability worldwide with attendant economic and healthcare burdens.[1]. Approximately 1.71 billion people worldwide are affected by musculoskeletal disorders (MSDs), thus making MSDs the predominant factor driving the increasing demand for rehabilitation services. [2] Musculoskeletal disorders (MSDs) encompass a range of impairments that affect various body structures, including joints, ligaments, muscles, bones, tendons, cartilages, and nerves. Work-related musculoskeletal disorders (WMSDs)

can arise from or be aggravated by the physical demands of work and the working environment.[3] The economic burden of work-related musculoskeletal disorders (WMSDs) is enormous, and estimates may be as high as $180 billion annually.[4] This substantial loss extends beyond individual workers and impacts nations, industries, organizations, families, and the overall economy. Individuals suffering from WMSDs may face debilitating financial setbacks, including lost wages, compensation costs, and diminished productivity. The associated medical expenses can also lead to significant debt accumulation, further exacerbating the economic strain on workers. This is particularly true for cleaning staff who often earn little and are quite vulnerable in developing countries.[5]

In Nigerian public universities, many staff rendering cleaning services are casual workers who lack access to health insurance benefits and receive limited or no paid vacation time. [6] Typically, cleaning services staff are predominantly women with limited educational backgrounds and with poor adherence to safe work practices.[7] Also, most cleaning tasks are conducted manually during the morning, using basic tools like short brooms, mops, small towels, and manual debris collection.[6]

Cleaning services staff play a crucial role in maintaining a hygienic and healthy environment in workplaces and establishments, but their work comes with a heightened risk of developing musculoskeletal disorders (MSDs). [8] These disorders are linked to work practices involving repetitive movements, prolonged physical exertion, and awkward postures common with cleaning tasks. [9] Cleaning staff are particularly susceptible to musculoskeletal disorders MSDs) owing to the physical demands and ergonomic hazards inherent in their profession. Incorrect lifting techniques, prolonged standing, improper tool handling, and inadequate workplace support all strain muscles and joints. [10] Also, factors such as the

daily weight of objects carried, type of workspace arrangement, inappropriate or non-use of personal protective equipment (PPE) and other workplace conditions can further elevate the risk of MSDs.

Studies consistently demonstrate that a significant proportion of cleaning personnel and street sweepers experience musculoskeletal disorders (MSDs), with prevalence rates ranging between 24.8% and 78.2% in Nigeria.[9–12] Low back pain emerged as the most prevalent MSD among this group. This pattern of MSD prevalence among cleaning staff extends across other countries in Africa, where rates have been reported to range from 73% to 83%.[6,11-13] Similar prevalence rates, ranging from 68.3% to 88%, have been observed in other regions of the world, [15–18] thus highlighting the global nature of this occupational health issue. Furthermore, several factors have been associated with an increased risk of MSDs among cleaning staff, as documented in the literature. These factors include older age, being female, years of experience as cleaning staff, lack of safety training and job stress [12,15,19]

Assessing the true burden of work-related musculoskeletal disorders (WMSDs) among cleaning staff in developing countries is quite challenging. Inadequate documentation and lack of comprehensive data hamper precise evaluation, worsened by the absence of standardized reporting systems for WMSDs across diverse workplaces. Consequently, cleaning staff often remain overlooked in occupational epidemiology studies focusing on work-related musculoskeletal disorders in numerous developing countries. This hinders a comprehensive understanding of the prevalence and impact of work-related musculoskeletal disorders in this occupational group.

This situation raises concerns about their susceptibility to work-related musculoskeletal disorders (WMSDs). Hence, this study aimed to investigate MSD burdens among university cleaning staff. Gaining insights into these

factors can enhance awareness among cleaners about occupational hazards, encourage adopting safe work practices, and improve the health and well-being of these vulnerable workers. This understanding may provide a basis for developing interventions to reduce unsafe work practices and minimize the prevalence of MSDs among cleaning staff.

Methods

Study design, setting and population
The study employed a descriptive cross-sectional design. This study was conducted in February 2021 at the Obafemi Awolowo University campus, Ile Ife, Osun state. Established in 1962, this university is one of Nigeria's largest public institutions of higher learning. It currently serves nearly 35,000 students and employs over 12,000 dedicated staff members. However, cleaning and security staff are usually used as casual staff. Cleaning staff are predominantly female and are typically required to work five days a week, starting early in the morning and finishing at 2 pm. The university has a central campus area, the student hostels, the staff quarters and the teaching research farm. The university campus, which is built on about 5000 acres of land, is organized into 13 faculties, 101 departments and two colleges.

The study population comprised cleaning staff at Obafemi Awolowo University, Ile Ife, Nigeria. The university has approximately 420 cleaning staff; various contractors employ the cleaning staff. There are 11 contractors in total. Each contractor has about 30-50 cleaners whom they recruit and manage. These contractors are responsible for delivering safety training and supervision to the cleaning staff within their workforce. University cleaning staff are tasked with maintaining the cleanliness of offices, laboratories, lecture halls, hostels and walkways across the campus, typically carrying out these tasks starting early in the

mornings, before the commencement of academic and administrative operations.

Inclusion criteria: Cleaners working in all the faculties and hostels within the university who have been employed for a minimum of six months were eligible for inclusion in the study. Exclusion criteria: Pregnant cleaners, those who were ill at the time of the study, and cleaners with obvious musculoskeletal deformities, such as limb-length discrepancies or kyphosis, were excluded from participation.

Sample size calculation
The minimum sample size was determined using the following sample size formula:

$$n = \frac{Z^2 P(1-P)}{d^2} \text{ (Leslie Fisher's Formula)}$$

Where n = sample size. Z = Z statistic for a 95% confidence level with 1.96 as the value for a two-tailed test. P = 24.8% (prevalence past study). [13] d = precision (in proportion to one usually set at 0.05) based on a confidence level of 95%:

$$n = \frac{1.96^2 \times 0.248 \times 0.752}{0.05^2}$$

= 286.58, approximately 290

A 10% non-response rate was anticipated; therefore, the adjusted sample size was 319,320.

Sampling
Participants were recruited using a proportionate-to-size allocation (a form of stratified sampling technique) across all 11 cleaning firms contracted by Obafemi Awolowo University, where the total number of cleaners employed is 420. The number of participants from each contractor was based on the size of their workforce relative to the total. The required number of participants was calculated proportionally for each cleaning team, and serial recruitment was conducted to achieve the target sample size of 320. This method ensured a representative sample from all contractors.

Data collection tools and techniques
An interviewer-administered questionnaire was used to collect the data. The questionnaire

was adapted from past studies. The questionnaire for this study had four sections: socio-demographic characteristics, knowledge and use of personal protective equipment (PPE), work practices and prevalence of musculoskeletal disorders (Nordic Questionnaire). The study instrument was translated into Yoruba, the local language in the study area, and then back-translated into English.

Height: The height was measured using a stadiometer, a specialized measuring tool consisting of a horizontal platform, a vertical perpendicular rule, and a sliding headboard. Participants stood barefooted, adopting an upright stance against the vertical rule, with their chests out and feet together. The measurement process included ensuring the correct alignment of the heels and buttocks to ensure precise height measurement. Measurements were taken to the nearest centimetre following the sliding down of the headboard and viewing by the investigator.

Weight: Body weight was measured while clad in light clothing and barefooted. The measurements were obtained for the nearest kilogram using a calibrated Axiom® weighing scale, ensuring consistency and precision by undergoing daily standardization before each weighing session.

Measurement of variable outcomes
Knowledge and use of PPE: These assessed the understanding and use of PPE among the study subjects. The first part consisted of seven questions to determine the knowledge base of PPE. The second part of the section consisted of seven questions to assess the use of PPE based on the frequency of use (regularly, occasionally, rarely and never). The work practices section of the questionnaire evaluated the cleaning staff's workplace habits and encompassed questions covering various work-related practices. The Nordic questionnaire assessed the prevalence of musculoskeletal disorders (MSDs) among the cleaners. It evaluated nine body parts, each with three columns to assess trouble in the previous 12 months, restriction from

performing normal activities in the previous 12 months, and trouble in the last seven days—the questions involved binary "Yes" or "No" responses.

Data analysis
All completed questionnaires were collected for subsequent data entry and analysis. The data entry and statistical analysis were conducted using the IBM-Statistical Product and Service Solutions (SPSS) version 25.0 software. At the univariate level, frequencies, means, standard deviations, and percentages of respondents' background socio-demographic characteristics were presented using tables. Using the Chi-Squared test, bivariate analysis was employed to assess the relationship between work practices and musculoskeletal disorders (MSDs) prevalence among the subjects. Also, a multivariable binary logistic regression analysis alongside an adjusted odds ratio and 95% confidence interval was used to assess the determinants of MSD. A significance level of 0.05 and below was considered statistically significant.

Ethical considerations
Ethical clearance for this study was secured from the Health Research Ethics Committee of the Institute of Public Health, Obafemi Awolowo University, Ile-Ife, Nigeria, with the approval number HREC: IPH/OAU/12/1748. Voluntary informed consent was obtained from all respondents/and their legal representatives after being informed of the study's procedures, risks and benefits. The study adhered to the principles outlined in the Declaration of Helsinki for human subject research. All persons with musculoskeletal disorders were counselled and referred to the university health centre for investigation and treatment.

Results

Table I shows the socio-demographic characteristics of the study participants. The age group with the highest frequency was age

groups 41 to 50 years (141; 44.1%). Most cleaners were females (298; 93.1%), and 153 had primary school education (47.8%). Most respondents were Yoruba (285; 89.1%), married (282; 88.1%) and earned between 17000-18999

Naira monthly. Most (201; 62.8%) of the cleaners had normal body mass index, with most (247; 77.2%) having 1-10 years of work experience.

Table I: Socio-demographic characteristics of the respondents

Variable		Frequency (n = 320)	Percentage
Age Group	≤40	59	18.4
(Years)	41-50	141	44.1
	>50	120	37.5
Sex	Male	22	6.9
	Female	298	93.1
Level Of Education	No Formal Education	40	12.5
	Primary	153	47.8
	Secondary	112	35.0
	Post-Secondary	15	4.7
Ethnicity	Yoruba	285	89.1
	Hausa	8	2.5
	Igbo	18	5.6
	Others	9	2.8
Religion	Islam	41	12.8
	Christianity	279	87.2
Marital Status	Single	9	2.8
	Married	282	88.1
	Separated/Divorced	19	5.9
	Widowed	10	3.1
Average Monthly Income (₦)	<19000 ($50)	280	87.5
	≥19000 ($50)	40	12.5
Work Experience (Years)	1-10	247	77.2
	11-20	64	20.0
	>20 years	9	2.8
BMI (Kg/ m²)	Underweight (<18.5)	9	2.8
	Normal (18.5-24.9)	201	62.8
	Overweight/Obese (≥25.0)	110	34.4

Table II shows the work practices and knowledge of PPE among respondents. Most (239; 74.7%) of the respondents worked 5 days a week, and 282 (88.1%) worked 6-8 hours per day. Almost all (317; 99.1%) cleaners worked in a bent position, with the majority (267; 83.4%) standing for more than two hours at a time. Most (315; 98.4%) wear uniforms while working, while 235 (73.4%) have received safety and health training since starting work. Changing rooms were available for 301 (94.1%) respondents. Most cleaners knew that nose masks and hand gloves were PPE that could protect them while working. However, fewer

cleaners knew head covers (91; 28.4%), safety boots (45; 14.1%), waterproof aprons (11; 3.4%), safety googles (3; 0.9%), face shields (9; 2.8%), were essential PPE for cleaning tasks.

Table III shows the respondents' use of personal protective equipment. The commonly used PPE were hand gloves (287; 89.7%) and nose masks (288; 90.0%). Other PPE were less widely used. Most respondents had never used safety boots (291; 90.9%), waterproof aprons (314; 98.1%), safety goggles (318; 99.4%), head cover (224; 70.0%) and face shields (319; 99.7%).

Table II: Work Practices and Knowledge of PPE among respondents

Variable		Frequency	Percentage (%)
Number of days worked per week	5days	239	74.7
	6days	81	25.3
Number of hours worked per day	<6 Hours	27	8.4
	6-8 Hours	282	88.1
	>8Hours	11	3.4
Work in a bent position	Yes	317	99.1
	No	3	0.9
Stand for more than 2 hours at a time	Yes	267	83.4
	No	53	16.6
There are job rotations or shifts	Yes	3	0.9
	No	317	99.1
Wear uniforms while working	Yes	315	98.4
	No	5	1.6
Changing rooms are available	Yes	301	94.1
	No	19	5.9
Ever received training on work safety and health since you started work as a cleaner	Yes	235	73.4
	No	85	26.6
Knowledge of PPE to be used by cleaning staff			
Safety Boots	Yes	45	14.1
	No	275	85.9
Water-Proof Apron	Yes	11	3.4
	No	309	96.6
Safety Goggles	Yes	3	0.9
	No	317	99.1
Hand Gloves	Yes	315	98.4
	No	5	1.6
Nose Mask	Yes	318	99.4
	No	2	0.6
Face Shield	Yes	9	2.8
	No	311	97.2
Head Cover	Yes	91	28.4
	No	229	71.6

Table III: The use of personal protective equipment among cleaners

Use of personal protective equipment	Regularly n (%)	Occasionally n (%)	Rarely n (%)	Never n (%)
Safety Boots	7 (2.2)	22 (4.7)	7 (2.2)	291 (90.9)
Waterproof Apron	3 (0.9)	0 (0.0)	3 (0.9)	314 (98.1)
Safety Google	0 (0.0)	2 (0.6)	0 (0.0)	318 (99.4)
Hand Gloves	287 (89.7)	16 (5.0)	14 (4.4)	3 (0.9)
Nose Mask	288 (90.0)	17 (5.3)	13 (4.1)	2 (0.6)
Face Shield	0 (0.0)	1 (0.3)	0 (0.0)	319 (99.7)
Head Cover	60 (18.8)	31 (9.7)	5 (1.6)	224 (70.0)

Table IV shows the prevalence of MSDs in different parts of the body. The lower back (253; 79.1%), knee (171; 53.4%), and both shoulders (147; 45.9%) were the most affected body site by musculoskeletal disorders in the last 12 months. However, in the previous seven days preceding the survey, the lower back (115; 35.9%), knees (74; 23.1%), thigh (51; 15.9%) and right shoulder (50; 15.6%) were the common site affected by MSD.

Table V shows the association between the prevalence of MSD and the selected characteristics of respondents. A higher proportion of cleaners over 50 years had MSD, which was statistically significant (p<0.001). In comparison, a higher proportion of persons with no formal education had MSD, which was statistically significant (p<0.001). A higher proportion of cleaners who have never had on-the-job training on work safety and health had MSD, which was statistically significant (p<0.001). In comparison, a significantly higher proportion of those who worked more than 8 hours per week had MSD (p=0.015). Similarly, a substantially lower proportion of persons with normal body mass index had MSD (p=0.001).

Table IV: Prevalence of musculoskeletal disorders among respondents using the Nordic Questionnaire

Body site affected	One Year Prevalence of MSD (%)	Limitation in Function (%)	7-Day MSD Prevalence (%)
Neck	127 (39.7)	11 (3.4)	9 (2.8)
Shoulders			
Right Shoulder	54 (16.9)	16 (5.0)	50 (15.6)
Left Shoulder	2 (0.6)	0 (0.0)	0 (0.0)
Both Shoulders	147 (45.9)	0 (0.0)	0 (0.0)
Elbows			
Right Elbow	19 (5.9)	14 (4.4)	25 (7.8)
Left Elbow	4 (1.3)	0 (0.0)	0 (0.0)
Both Elbows	70 (21.9)	0 (0.0)	0 (0.0)
Wrist/ Hands			
Right Wrist/Hand	24 (7.5)	9 (2.8)	22 (6.9)
Left Wrist/Hand	5 (1.6)	0 (0.0)	0 (0.0)
Upper Back	108 (33.8)	11 (3.4)	25 (7.8)
Lower Back	253 (79.1)	52 (16.3)	115 (35.9)
Hips/Thigh	140 (43.8)	14 (4.4)	51 (15.9)
Knees	171 (53.4)	22 (6.9)	74 (23.1)
Ankles/Feet	66 (20.6)	7 (2.2)	22 (6.9)
Overall prevalence	317 (99.1%)	94 (29.4%)	187 (58.2%)

The binary logistic regression analysis of the factors influencing musculoskeletal disorders among respondents is presented in Table VI. Cleaners older than 50 years were 3.5 times more likely to have MSD as compared to persons aged 40 years or less (A.O.R = 3.5; 95% C.I = 1.5-8.0; p = 0.004). In addition, persons with primary education had lower odds of having MSD than cleaners with no formal education (A.O.R = 0.2; 95% C.I = 0.1-0.5; p = 0.001). Also, cleaners who have never had training on work safety and health were 5.5 times more likely to have MSD than their counterparts who have been trained (A.O.R = 5.5; 95% C.I = 2.6-11.5; p<0.001). Persons with normal BMI were twice less likely to have MSD compared to their counterparts who are overweight/obese (A.O.R: 0.5; 95% C.I 0.3-0.9; p = 0.014).

Discussion

This study assessed the factors associated with musculoskeletal disorders (MSDs) among cleaning services staff in a university setting, making it one of the few research endeavours to focus on this vulnerable demographic group

in Nigeria. The observation that most cleaning staff are female is consistent across studies in Nigeria[7,11,12] and other countries.[8,20,21] This disparity can be attributed to a combination of

factors, including ingrained gender stereotypes that portray cleaning as a traditional "women's job".[22]

Table V: Association between prevalence of MSD and selected characteristics of respondents

Variables	1 Year Prevalence of MSD		χ^2 p-value	7 -Day MSD Prevalence		χ^2 p-value
	Yes n (%)	No n (%)		Yes n (%)	No n (%)	
Age Group (Years)						
≤40	58 (98.3)	1 (1.7)	LR=3.508	25 (42.4)	34 (57.6)	17.637
41-50	141 (100.0)	0 (0.0)	p=0.173	75 (53.2)	66 (46.8)	p<**0.001**
>50	118 (98.3)	2 (1.7)		87 (72.5)	33 (27.5)	
Gender						
Male	22 (100.0)	0 (0.0)	0.224	17 (77.3)	5 (22.7)	3.451
Female	295 (99.0)	3 (1.0)	p = 0.636	170 (57.0)	128 (43.0)	p = 0.063
Level of Education						
No Formal Education	40 (100.0)	0 (0.0)	0.748	35 (87.5)	5 (12.5)	29.350
Primary	151 (98.7)	2 (1.3)	p = 0.862	68 (44.4)	85 (55.6)	**p<0.001**
Secondary	111 (99.1)	1 (0.9)		74 (66.1)	38 (33.9)	
Post-Secondary	15 (100.0)	0 (0.0)		10 (66.7)	5 (33.3)	
Average Income (₦)						
<19000 ($50)	277 (98.9)	3 (1.1)	LR = 0.805	163 (58.2)	117 (41.8)	0.046
≥19000 ($50)	40 (100.0)	0 (0.0)	p = 0.370	24 (60.0)	16 (24.0)	p = 0.830
Work Experience (Years)						
1-10	244 (98.8)	3 (1.2)	0.895	138 (55.9)	109 (44.1)	4.940
11-20	64 (100.0)	0 (0.0)	p = 0.639	41 (64.1)	23 (35.9)	p = 0.085
≥21	9 (100.0)	0 (0.0)		8 (88.9)	1 (11.1)	
Ever had training on work safety and health						
Yes	232 (98.7)	3 (1.3)	1.095	114 (48.5)	121 (51.5)	35.895
No	85 (100.0)	0 (0.0)	p = 0.295	73 (85.9)	12 (14.1)	p<**0.001**
Working Hours						
<6hours	27 (100.0)	0 (0.0)	LR = 3.507	14 (51.9)	13 (48.1)	8.384
6-8 Hours	280 (99.3)	2 (0.7)	p = 0.173	171 (60.6)	111 (39.4)	p = **0.015**
>8	10 (90.9)	1 (9.1)		2 (18.2)	9 (81.8)	
Body mass index (Kg/m²)						
Underweight (<18.5)	9 (100.0)	0 (0.0)	LR = 1.396	7 (77.8)	2 (22.2)	15.044
Normal (18.5-24.9)	200 (99.5)	1 (0.5)	= 0.498	101 (50.2)	100 (49.8)	p = **0.001**
Overweight/Obese (≥25.0)	108 (98.2)	2 (1.8)		79 (71.8)	31 (28.2)	

Additionally, cleaning jobs often demand less formal education than other professions, making them a viable option for women with limited educational backgrounds. The gendered nature of cleaning work has significant implications for workers' health and well-being.

The observation that most respondents earned less than $50, which falls below the recommended minimum wage (approximately $80 at the time of the survey) in Nigeria, raises concerns about the economic conditions of cleaning staff. This situation may be attributed to their employment's informal or casual nature. The pattern of low wages for cleaning staff has been observed in previous studies

conducted in Nigeria[12,23] and in similar studies from East Africa.[8,24] Addressing the wage disparities and improving the financial conditions of cleaning staff in Nigeria is essential for their socioeconomic well-being and promoting overall health and productivity among this vulnerable group.

Table VI: Binary logistic regression analysis of the factors influencing musculoskeletal disorders among the respondents

Variable	Adjusted Odds Ratio	95% Confidence Interval	p- values
Age Group (Years)			
≤40	Ref		
41-50	2.1	1.0-4.3	0.054
>50	**3.5**	**1.5-8.0**	**0.004**
Gender			
Male	Ref		
Female	1.8	0.6-5.5	0.338
Level Of Education			
No Formal Education	Ref		
Primary	**0.2**	**0.1-0.5**	**0.001**
Secondary	0.5	0.2-1.5	0.203
Post-Secondary	0.5	0.1-2.5	0.392
Ever had training on work safety and health			
Yes	Ref		
No	**5.5**	**2.6-11.5**	**<0.001**
Work Experience (Years)			
1-10	0.4	0.04-3.8	0.409
11-20	0.6	0.1-5.5	0.595
≥21	**Ref**		
Working Hours			
<6hours	Ref		
6-8 Hours	1.4	0.6-3.4	0.483
>8	0.6	0.1-3.6	0.576
BMI(Kg/m²)			
Underweight (<18.5)	0.2	0.04-1.4	0.110
Normal (18.5-24.9)	**0.5**	**0.3-0.9**	**0.014**
Overweight/Obese (≥25.0)	Ref		

The study found that the use of PPE was generally low, with only hand gloves and nose masks being the most prevalent types of PPE used. Utilizing other essential PPE, such as eye protection, footwear, and protective clothing, was suboptimal. This finding aligns with previous studies conducted in Nigeria,[6,12] suggesting that a combination of factors contributes to the low prevalence of PPE use among cleaning staff. These factors include a lack of awareness or knowledge about the importance of PPE, inadequate provision of PPE by employers, poor supervision and oversight of PPE usage, and the discomfort associated with certain PPE items.[8,12,24]

This study reported a high prevalence of musculoskeletal disorders (MSDs) at 58% among cleaners, aligning with similar studies in Ethiopia (53.3%),[25] Nigeria (55%),[6] and Egypt (60.8%).[28] However, some studies reported higher prevalence rates, ranging from 74% to 93%.[16,27,28] These disparities may stem from inherent differences in study methodology and population characteristics. However, the uniformity of MSD burden

among cleaners across countries underscores the global scope of this occupational health problem.

The lower back was the most common body site affected by MSD among cleaners in our study. This finding aligns with past literature, which reported similar trends. [20,21] The high prevalence of lower back issues is not surprising, as cleaning tasks typically involve repetitive movements, sometimes awkward postures and lifting heavy objects. These activities significantly strain the lumbar region, making it susceptible to discomfort and injury. The lower back bears the most weight and strain during these manual tasks, further contributing to the high incidence of MSDs among this group of workers. [29]

Age was a significant predictor of MSD, as older cleaners were more likely to be affected. Some past 8studies also reported this strong link between increasing age and MSD among workers.[8,13,18,30] The higher prevalence of musculoskeletal disorders (MSDs) among older cleaning staff is not surprising, considering the physiological changes associated with increasing age, especially the mismatch between physical work capacity and the demands of their job tasks. [31] This increased susceptibility to musculoskeletal disorders is further compounded by the repetitive, forceful, and awkward movements often required in cleaning tasks. To effectively address the burden of MSD among older cleaning staff, a comprehensive approach is needed to foster a supportive, inclusive, and productive work environment.

Cleaners with primary education were significantly less likely to experience musculoskeletal disorders (MSDs) compared to those with no formal education. This finding is consistent with previous research [6,19], which suggests that higher levels of educational attainment may facilitate improved comprehension of workplace safety information and enhanced self-efficacy in

adhering to safe work practices, thereby reducing the risk of developing MSDs. However, a small number of studies present a contradictory finding, indicating that cleaners with higher educational attainment may be more likely to have MSDs. [23] The observed variation can be linked to the literacy level among participants in each study population. When a significant number of respondents have advanced educational qualifications, they tend to identify and report more MSDs than their less educated peers, and this may lead to an inverse correlation between educational attainment and MSDs.

This study reinforces the link between having a healthy body mass index (BMI) and a reduced risk of developing MSDs among cleaners. This finding is consistent with past literature, [4,8,16,23] highlighting the biomechanical strain placed on joints by an elevated BMI, leading to decreased flexibility and potentially increasing the likelihood of MSDs. The physical demands of cleaning tasks further underscore the importance of weight management as a preventive measure for MSD. Encouraging healthy BMI levels among cleaners could be a proactive approach to reducing MSD risk and promoting a work environment supporting musculoskeletal well-being.

This study highlights the association between lack of safety training and musculoskeletal disorders (MSDs) among cleaners. This finding aligns with past studies that reported that safety training is critical in preventing or managing MSDs at work.[32,33] Therefore, providing pre-service and ongoing education and skills development to cleaners to foster their safety and well-being is essential. Such training should encompass practical demonstrations, ergonomic principles, proper lifting techniques, effective use of personal protective equipment (PPE), and awareness of workplace hazards to effectively equip workers with the necessary knowledge and skills to execute their tasks safely and efficiently.

The study had a few limitations: the study's cross-sectional nature precludes the establishment of causality in relation to MSD. Also, the study was conducted at one university in Nigeria, limiting the generalizability of findings to other parts of the country.

Lines of future research should focus on conducting longitudinal studies to provide an objective assessment of the MSD burden among cleaners. Also, qualitative studies can help understand the contextual factors that underlie MSDs among cleaning staff and provide valuable insights into the specific challenges they face in their work environment and how to address them.

Conclusion

The study highlights the burden of MSD among cleaners, showing strong associations with factors like age, BMI, education, and safety training. Addressing MSDs in cleaning requires a holistic approach encompassing comprehensive training, regular health checks, advocacy for better remuneration, and improved working conditions. Proactive measures, including ergonomic interventions and comprehensive health and safety initiatives, are crucial for the well-being of cleaners and can significantly contribute to minimizing the impact of MSDs.

Authors' Contributions: OTO conceptualized and designed the study, while FFA, GAJ, EJO, FJA, and EOJ participated in study design and literature review. OTO, FFA and GAJ did data analysis and interpretation. OTO drafted the manuscript. All authors revised the draft manuscript and approved the final manuscript.

References

1. Cieza A, Causey K, Kamenov K, Hanson SW, Chatterji S, Vos T. Global estimates of the need for rehabilitation based on the Global Burden of Disease study 2019: a systematic analysis for the Global Burden of Disease Study 2019. The Lancet [Internet] 2020 [cited 2023 Dec 25];396(10267):2006–2017.

2. World Health Organization. Musculoskeletal health [Internet]. 2022 [cited 2023 Dec 25]; Available from: https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions

3. Afsharian A, Dollard MF, Glozier N, Morris RW, Bailey TS, Nguyen H, *et al.* Work-related psychosocial and physical paths to future musculoskeletal disorders (MSDs). Safety Sci [Internet] 2023 [cited 2023 Dec 25];164:106177. Available from: https://www.sciencedirect.com/science/article/pii/S0925753523001194

4. Chen N, Fong DYT, Wong JYH. Health and Economic Outcomes Associated With Musculoskeletal Disorders Attributable to High Body Mass Index in 192 Countries and Territories in 2019. JAMA Netw Open [Internet] 2023 [cited 2023 Dec 25];6:e2250674.

5. Degavi G, Dereso CW, Shinde S, Adola SG, Kasimayan P. Prevention of Occupational Hazards Among Sanitary Workers: Knowledge, Attitude, and Practice Survey in Bulehora, West Guji Zone, Oromia, Ethiopia. Risk Manag Health Policy [Internet] 2021 [cited 2023 Dec 25];14:2245–2252.

6. Yunoos AO, Dankoly US. Prevalence of low Back Pain among Street Cleaners in Northeastern Nigeria. Nigerian Journal of Basic and Clinical Sciences [Internet] 2021 [cited 2023 Dec 26];18(1):24. Available from: https://journals.lww.com/nbcs/fulltext/2021/18010/prevalence_of_low_back_pain_among_street_cleaners.6.aspx

7. Faremi FA, Ogunfowokan AA, Olatubi MI, Ogunlade B, Ajayi OA. Knowledge of Occupational Hazards among Cleaning Workers: A Study of Cleaners of a Nigerian University. Int J Health Sci 2014;(8).

8. Alie M, Abich Y, Demissie SF, Weldetsadik FK, Kassa T, Shiferaw KB, *et al.* Magnitude and possible risk factors of musculoskeletal disorders among street cleaners and solid waste workers: a cross-sectional study. BMC Musculoskeletal Disorders [Internet] 2023 [cited 2023 Dec 25];24:493. Available from: https://doi.org/10.1186/s12891-023-06619-z

9. Wami SD, Dessie A, Chercos DH. The impact of work-related risk factors on the development of neck and upper limb pain among low wage hotel housekeepers in Gondar town, Northwest Ethiopia: institution-based cross-sectional study. Environ Health Prev Med 2019;24:1;24(1):1–10.

10. Risk Factors | Environmental Health and Safety | Iowa State University [Internet]. [cited 2021 Aug 9]; Available from: https://www.ehs.iastate.edu/services/occupational/ergonomics/risk-factors

11. Ilesanmi OS, Omotoso BA, Ayodeji OO, Falana DT. Health problems and health seeking behaviour of hospital cleaners in a tertiary health facility in South west Nigeria. Acad J Interdiscip Studies 2014;3:187.

12. Johnson OE, John UA. Occupational hazards and health problems among street sweepers in Uyo, Nigeria. Ibom Med J [Internet] 2020 [cited 2023 Dec 25];13:90–100. Available from: http://ojs.ibommedicaljournal.org/ojs/index.php/imjhome/article/view/191

13. Aweto HA, Owoeye OB, Adegbite KS. Work-related musculoskeletal disorders in highway sanitary workers. Niger J Med Rehab [Internet] 2015 [cited 2023 Dec 26]; Available from: https://njmr.mrtb.gov.ng/index.php/njmr/article/view/102

14. Suleyman J, Gelaw AY. Work-related musculoskeletal disorders and associated factors among cleaners of health institutions in Gondar town, Northwest Ethiopia: an institution based cross-sectional study [Internet]. Occu Environ Health; 2021 [cited 2023 Dec 25]. Available from: http://medrxiv.org/lookup/doi/10.1101/2021.12.06.21266337

15. Laithaisong T, Aekplakorn W, Suriyawongpaisal P, Tupthai C, Wongrathanandha C. The prevalence and risk factors of musculoskeletal disorders among subcontracted hospital cleaners in Thailand. J Health Res [Internet] 2021 [cited 2023 Dec 25];36:802–812. https://doi.org/10.1108/JHR-01-2021-0040

16. Kanjanar Pintakham, Wattasit Siriwong. (Surname, Initial) Prevalence and Risk Factors Associated with Musculoskeletal Discomfort among Street Sweepers in Chiang Rai Province, Thailand. 3 [Internet] 2016 [cited 2023 Dec 25];30:J Health Res. Available from: http://doi.nrct.go.th/?page=resolve_doi&resolve_doi=10.14456/jhr.2016.28

17. Joseph B, Naveen R, Suguna A, Surekha A. Prevalence, pattern and factors associated with work-related musculoskeletal disorders (WRMD) among housekeeping workers in a private tertiary care hospital in Bangalore. J Health Manag 2016;18:545–554.

18. Idrees A, Kashif M, Kompal R, Umar A, Nadeem I, Fatima R. Musculoskeletal discomfort and wrist flexor tendonitis among street sweepers and associated risk factors. Work [Internet] 2023 [cited 2023 Dec 25];76:1395–1405.

19. Salve PS, Chokhandre P. Assessing the exposure of street sweeping and potential risk factors for developing musculoskeletal disorders and related disabilities: a cross-sectional study. BMJ Open [Internet] 2016 [cited 2023 Dec 25];6:e012354.

20. Melese H, Gebreyesus T, Alamer A, Berhe A. Prevalence and Associated Factors of Musculoskeletal Disorders Among Cleaners Working at Mekelle University, Ethiopia. J Pain Res [Internet] 2020 [cited 2023 Dec 27];13:2239–2246. Available from: https://www.tandfonline.com/doi/abs/10.2147/JPR.S263319

21. Sánchez-Rodríguez C, Capitán-Moyano L, Malih N, Yáñez AM, Bennasar-Veny M, Velasco-Roldán O, *et al.* Prevalence of musculoskeletal disorders among hotel housekeepers and cleaners: A systematic review with meta-analysis. Musculoskeletal Sci Pract [Internet] 2024 [cited 2023 Dec 27];69:102890.

22. Akanle O, Oluwakemi EO. Traditionalism and Household Chores in Ibadan, Nigeria. Int J Sociol Fam [Internet] 2012 [cited 2023 Dec 27];38:203–224.

23. Adebusoye LA, Ogunbode AM, Alonge TO. Factors associated with low back pain among cleaners in a tertiary hospital in Nigeria. Res J Health Sci [Internet] 2015 [cited 2023 Dec 27];3:100–112.

24. Gebreeyessus GD. Knowledge, attitude, and practices on occupational health and safety principles among cleaners: the case of Tikur Anbassa Specialized Referral Hospital, Addis Ababa, Ethiopia. Open Health [Internet] 2022 [cited 2023 Dec 25];3:22–33. Available from: https://www.degruyter.com/document/doi/10.1515/openhe-2022-0004/html

25. Gebremedhn MG, Raman PV. Socioeconomic and health status of street sweepers of Mekelle city, Ethiopia. Waste Manag [Internet] 2020 [cited 2023 Dec 27];103:251–259.

26. Abou-ElWafa HS, El-Bestar SF, El-Gilany AH, Awad EES. Musculoskeletal disorders among municipal solid waste collectors in Mansoura, Egypt: a cross-sectional study. BMJ Open [Internet] 2012 [cited 2023 Dec 27];2:e001338.

27. Nguyen BV, Tran TTT, Hoang NT, Nguyen BN, Nguyen QT. Musculoskeletal Pain and Work-related Risk Factors among Waste Collectors in Hanoi, Vietnam: A Cross-sectional Study. Open Access Maced J Med Sci [Internet] 2020 [cited 2023 Dec 27];8:498–508.

28. Abbaspour M, Habibi EA. Identification Prevalence of Musculoskeletal Disorders and its Related Factors among Street Cleaners of Isfahan Municipality. Arch Occ Health [Internet] 2020 [cited 2023 Dec 27];4:485–492.

29. Sauter M, Barthelme J, Müller C, Liebers F. Manual handling of heavy loads and low back pain among different occupational groups: results of the 2018 BIBB/BAuA employment survey. BMC Musculoskeletal Dis [Internet] 2021 [cited 2024 Oct 19];22:956. Available from: https://doi.org/10.1186/s12891-021-04819-z

30. Besharati A, Daneshmandi H, Zareh K, Fakherpour A, Zoaktafi M. Work-related musculoskeletal problems and associated factors among office workers. Int J Occ Safety Erg [Internet] 2020 [cited 2023 Dec 27];26:632–638. https://doi.org/10.1080/10803548.2018.1501238

31. De Zwart BC, Broersen JP, Frings-Dresen MH, Van Dijk FJ. Repeated survey on changes in musculoskeletal complaints relative to age and work demands. Occupational and Environmental Medicine [Internet] 1997 [cited 2023 Dec 27];54:793–799. Available from: https://oem.bmj.com/lookup/doi/10.1136/oem.54.11.793

32. Emmatty FJ, Panicker VV. Ergonomic interventions among waste collection workers: A systematic review. International Journal of Industrial Ergonomics [Internet] 2019 [cited 2023 Dec 28];72:158–72. Available from: https://www.sciencedirect.com/science/article/pii/S0169814118304190

33. Van Eerd D, Irvin E, Le Pouésard M, Butt A, Nasir K. Workplace Musculoskeletal Disorder Prevention Practices and Experiences. Inquiry [Internet] 2022 [cited 2023 Dec 28];59:00469580221092132.