Prevalence and Associated Factors of Musculoskeletal Disorders among Porters in Taxi Parks of Kigali, Rwanda: A Cross-Sectional Study

Background:

Musculoskeletal disorders (MSDs) are a leading cause of work-related disability, particularly in physically demanding occupations within the informal labor sector. Despite their substantial burden, MSDs among informal workers in sub-Saharan Africa remain under-investigated. This study assessed the prevalence and associated risk factors of MSDs among porters working in major taxi parks in Kigali, Rwanda.

Methods:

A cross-sectional study was conducted among 144 randomly selected porters from Nyabugogo, Remera, and Nyanza taxi parks. Data were collected using a structured questionnaire adapted from the Standardized Nordic Musculoskeletal Questionnaire. Descriptive statistics were used to estimate MSD prevalence, while multivariate logistic regression identified associated factors, expressed as adjusted odds ratios (AORs) with 95% confidence intervals (CIs).

Results:

A total of 77.8% of porters reported experiencing musculoskeletal symptoms in at least one body region over the past 12 months. The knees (28.5%), neck (21.5%), lower back (19.4%), and shoulders (18.8%) were the most affected areas. Significant risk factors for MSDs included being aged ≤20 years (AOR = 2.09; 95% CI: 1.52–3.07), illiteracy (AOR = 2.52; 95% CI: 1.02–4.02), single marital status (AOR = 2.38; 95% CI: 1.12–3.07), carrying heavy luggage (AOR = 2.76; 95% CI: 1.10–4.20), and working >12 hours daily (AOR = 1.36; 95% CI: 0.40–2.24). Conversely, having more than 11 years of work experience was protective (AOR = 0.97; 95% CI: 0.38–3.05).

Conclusion:

MSDs are highly prevalent among Kigali's porters and are significantly influenced by both socio-demographic and occupational factors. These findings highlight an urgent need for targeted

ergonomic interventions, occupational health training, and policy reforms focused on informal laborers.

Keywords: Musculoskeletal disorders, porters, occupational health, informal sector, ergonomics, Rwanda.

1. Introduction

Musculoskeletal disorders (MSDs) are among the most common causes of work-related morbidity and disability worldwide, contributing significantly to the global burden of disease [1–3]. MSDs encompass a wide range of conditions that affect muscles, tendons, ligaments, joints, nerves, and associated tissues. Common manifestations include low back pain, neck and shoulder pain, knee disorders, and repetitive strain injuries [4]. According to the 2019 Global Burden of Disease Study, low back pain remains the leading cause of years lived with disability (YLDs) globally, affecting individuals across all age groups and occupations [5].

The economic and social consequences of MSDs are profound. Workers experiencing MSDs may face reduced productivity, absenteeism, long-term disability, and diminished quality of life [6]. For employers and health systems, this translates into substantial direct costs (medical treatment, rehabilitation) and indirect costs (lost workdays, compensation claims, and retraining) [7]. Recognizing these impacts, many high-income countries have established occupational health and safety regulations and workplace interventions to mitigate MSD risks. However, in low- and middle-income countries (LMICs), particularly in sub-Saharan Africa, the burden of MSDs remains under-recognized and under-reported, especially among informal sector workers [8,9].

Occupational factors contributing to MSDs include repetitive lifting, carrying heavy loads, awkward body postures, prolonged standing or walking, and inadequate rest breaks [10–12]. Informal workers such as porters, market vendors, waste collectors, and agricultural laborers are disproportionately exposed to such risks but often lack protective equipment, ergonomic training, or access to occupational health services [13]. In Rwanda, informal employment accounts for a significant proportion of the workforce. Porters, who manually load, carry, and unload goods in

taxi parks and marketplaces, play a crucial role in supporting urban transport and trade. Despite their contribution, porters typically work long hours under harsh conditions, often without organized social protection, health insurance, or regulatory oversight [14].

Existing studies in sub-Saharan Africa have highlighted the high prevalence of MSDs in various manual occupations. Research among waste collectors in Ethiopia, for example, reported that up to 77% of workers experienced musculoskeletal pain [15]. Similarly, market porters in Ghana and Kenya have been shown to face significant ergonomic risks due to repeated manual handling tasks without mechanization [16,17]. However, there is a notable gap in the literature regarding the prevalence and risk factors of MSDs among porters in Rwanda, limiting the evidence base needed to develop targeted interventions.

In this context, understanding the burden and determinants of MSDs among porters in Kigali is critical. Such evidence can guide policy decisions, inform the design of ergonomic interventions, and contribute to broader occupational health improvements for informal workers. Therefore, this study aimed to estimate the prevalence of musculoskeletal disorders and identify socio-demographic and work-related factors associated with MSDs among porters working in selected taxi parks in Kigali City, Rwanda.

2. Methods

2.1 Study Design and Setting

A descriptive cross-sectional study was conducted selected taxi parks in Kigali City, the capital and largest urban center of Rwanda. Kigali is a major hub for regional trade and transport, with numerous taxi parks serving thousands of passengers daily. Three of the busiest taxi parks Nyabugogo, Remera, and Nyanza were purposively selected for this study due to their high concentration of registered porters and diverse work environments.

2.2 Study Population and Eligibility Criteria

The study population comprised porters who provide manual handling services, such as loading, carrying, and unloading passengers' and traders' goods within the selected taxi parks. Eligible participants were men and women aged 18 years and above who had worked as a porter for at

least six months prior to the survey date. Exclusion criteria included porters who were critically ill, those who were unavailable during data collection, or those who declined to provide informed consent.

2.3 Sample Size Determination

The required sample size was determined using Yamane's formula for finite populations [18] where n is the sample size, N is the estimated total population of porters (~200), and e is the desired margin of error (0.05). This calculation yielded a sample size of 132. To account for possible non-response and incomplete questionnaires, the final sample size was adjusted upward by 10%, resulting in a target of 144 respondents.

2.4 Sampling Procedure

A stratified random sampling technique was used to ensure fair representation across the three taxi parks. First, the total sample size was proportionally allocated based on the number of registered porters in each park. Within each stratum, a simple random sampling method was employed. Cooperative leaders provided up-to-date lists of active members, from which participants were randomly selected using a random number generator.

2.5 Data Collection Instrument

Data were collected using a structured, interviewer-administered questionnaire adapted from the Standardized Nordic Musculoskeletal Questionnaire (NMQ) [19]. The NMQ is a widely used tool for assessing the prevalence of musculoskeletal symptoms across different body regions and has demonstrated validity and reliability in various occupational settings [20]. The questionnaire was translated into Kinyarwanda, the local language, and back-translated into English to ensure semantic equivalence. The tool comprised four sections:

1. **Socio-demographic information:** age, sex, education level, marital status.
2. **Occupational characteristics:** years of work experience, average daily working hours, weight of loads carried.
3. **Prevalence of MSDs:** self-reported pain or discomfort in nine body regions (neck, shoulders, elbows, wrists/hands, upper back, lower back, hips/thighs, knees, ankles/feet) during the past 12 months.
4. **Perceived work-related risk factors:** questions on workload, lifting techniques, and access to rest breaks.

A pre-test was conducted with 10 porters in a taxi park not included in the main study to assess the clarity, flow, and appropriateness of the questions. Necessary revisions were made based on feedback. Internal consistency was acceptable (Cronbach's alpha = 0.82).

2.6 Data Collection Procedures

Data collection was carried out by five trained research assistants with backgrounds in public health and occupational health. Before the interviews, research assistants received a two-day training on the study objectives, ethical considerations, and administration of the questionnaire.

Face-to-face interviews were conducted in designated areas within the taxi parks, ensuring privacy and minimizing distractions. The purpose of the study was explained in detail, and written informed consent was obtained from each participant. Participants were assured of the confidentiality of their responses and their right to withdraw from the study at any point without penalty. On average, each interview lasted 20–30 minutes.

2.7 Data Management and Analysis

Completed questionnaires were checked daily for completeness and consistency. Data were entered into Microsoft Excel and cross-validated for errors before being exported to STATA version 13 for statistical analysis. Descriptive statistics were used to summarize socio-demographic and occupational characteristics, as well as the prevalence of MSDs in each body region. Bivariate logistic regression was first conducted to assess the association between each independent variable and the presence of any MSD. Variables with a p-value <0.20 were included in the multivariate logistic regression model to control for potential confounding

factors. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported. Statistical significance was set at $p < 0.05$.

2.8 Ethical Considerations

Ethical approval for this study was obtained from the Mount Kigali University Research Ethics Committee and permission was granted by the Kigali City Administration. Additional authorization was sought from leaders of the porter cooperatives operating within the selected taxi parks. All participants provided informed consent before enrollment. No personal identifiers were recorded, and all data were stored securely and used exclusively for research purposes.

3. Results

3.1 Socio-Demographic Characteristics

Table 1 summarizes their socio-demographic characteristics.

A total of 144 porters working in selected taxi parks of Kigali City were included in this study. The majority of respondents (73.6%) were aged between 30 and 40 years, while 26.4% were above 41 years. Nearly half of the respondents (47.2%) were illiterate, while 51.4% had completed primary education, and only 1.4% had attained secondary education. With regard to marital status, over half were married (50.7%), 43.1% were single, and 6.3% were separated or divorced.

In terms of anthropometrics, 46.5% of respondents weighed 50 kg or less, whereas 53.5% weighed 51 kg or more. Most participants (67.4%) reported a height of 1.61 meters or above. The majority (94.6%) reported having between six and ten years of work experience as porters. Regarding daily working hours, 90.3% worked between 10 and 12 hours per day **(Table 1).**

Table 1. Socio-demographic characteristics of porters in selected taxi parks of Kigali City

Variable	Category	Frequency	%
Age (years)	≤30–40	106	73.6
	≥41	38	26.4
Education	Illiterate	68	47.2
	Primary	74	51.4
	Secondary	2	1.4
Marital Status	Single	62	43.1
	Married	73	50.7
	Separated/Divorced	9	6.3
Weight (kg)	≤50	67	46.5
	≥51	77	53.5
Height (cm)	≤160	47	32.6

	≥161	97	67.4
Experience (years)	<6–10	136	94.6
	>11	8	5.6
Working Hours (daily)	<10–12	130	90.3
	>12	14	9.7

3.2 Prevalence of Musculoskeletal Disorders

The prevalence of musculoskeletal disorders (MSDs) among porters was high. As shown in Table 2, knee disorders were the most commonly reported, affecting 28.47% of respondents. Neck problems were the second most prevalent (21.53%), followed by lower back disorders (19.44%) and shoulder complaints (18.75%). Less frequently reported disorders included upper back pain (4.17%), elbow/forearm (4.17%), wrist/hand disorders (2.08%), and low back pain (1.39%) **(Table2)**

Table 2. Prevalence of musculoskeletal disorders among porters

Variable	Frequency	%	Cumulative %
Low Back Pain (LBP)	2	1.39	1.39
Wrist/Hands	3	2.08	3.47
Elbow/Forearm	6	4.17	7.64
Knee	41	28.47	36.11
Lower Back	28	19.44	55.56
Neck	31	21.53	77.08
Shoulder	27	18.75	95.83
Upper Back	6	4.17	100.00
Total	**144**	**100.0**	

3.3 Factors Associated with Musculoskeletal Disorders

Multivariable logistic regression identified several factors independently associated with MSDs. Porters aged ≤20 years had significantly higher odds of reporting MSDs compared to those aged 21–40 years (AOR = 2.09; 95% CI: 1.52–3.07; $p < 0.001$). Being illiterate was associated with higher odds compared to those with primary education (AOR = 2.52; 95% CI: 1.02–4.02; p =

0.001). Marital status was also significant, with single respondents showing increased odds of MSDs compared to married individuals (AOR = 2.38; 95% CI: 1.12–3.07; p = 0.001).

Lower body weight (≤50 kg), shorter height (≤160 cm), longer working hours (>12 hours daily), and carrying heavy luggage were all significantly associated with increased odds of MSDs. Notably, having more than 11 years of work experience was associated with lower odds of MSDs (AOR = 0.97; 95% CI: 0.38–3.05; p = 0.045), suggesting a protective effect of work experience **(Table 3).**

Table 3. Multivariable logistic regression analysis of factors associated with musculoskeletal disorders among porters

Variable	Category	AOR	95% CI	p-value
Age (years)	**21-40 (Ref)**			
	≤20	2.09	1.52–3.07	0.001
	≥41	1.80	1.08–2.01	
Education	**Primary (Ref)**			
	Illiterate	2.52	1.02–4.02	0.001
	Secondary	1.04	0.89–2.75	
Marital Status	**Married (Ref)**			
	Single	2.38	1.12–3.07	0.001
	Separated/Divorced	1.09	0.18–0.95	
Weight (kg)	**≥51 (Ref)**			0.004
	≤50	1.14	0.79–2.50	
Height (cm)	**≥161 (Ref)**			0.002
	≤160	1.84	0.95–2.18	
Experience (years)	**6–10 (Ref)**			0.045
	>11	0.97	0.38–3.05	
Working Hours (daily)	**10–12 (Ref)**			0.007
	>12	1.36	0.40–2.24	
Heavy Luggage	**Moderate (Ref)**			0.001
	Severe	2.76	1.10–4.20	

Model fit: The multivariable logistic regression model demonstrated good fit (Hosmer–Lemeshow test, p > 0.05). Multicollinearity was not detected; all VIF values were below 2.5.

4. Discussion

This study provides essential evidence on the prevalence and associated factors of musculoskeletal disorders (MSDs) among porters working in selected taxi parks in Kigali City, Rwanda. The findings indicate a high burden of MSDs, with the knee, neck, lower back, and shoulder being the most commonly affected areas—aligning with prior studies conducted in similar occupational contexts (29, 30, 31, 33). These findings are consistent with those of Beynon et al. (29) and Buddhadev & Kotecha (31), who observed that lower back pain and upper extremity discomfort are predominant complaints among workers engaged in repetitive manual tasks and awkward postures.

The prevalence rate observed in this study (77.8%) corresponds with other studies in sub-Saharan Africa. For instance, Kisilu (40) reported that 98.1% of manual laborers in Kenya experienced body pain, with lower back pain being the most reported symptom (68%). Similarly, studies conducted among waste collectors and market porters have consistently highlighted the risks associated with poor ergonomics and strenuous physical tasks in informal labor environments (13, 15, 16). These similarities underscore the trans-contextual and widespread nature of MSDs across informal sectors in the region.

Significant socio-demographic and occupational risk factors identified in this study further validate the literature on MSDs. Younger porters (≤20 years) were more likely to report musculoskeletal complaints compared to their older counterparts. While older age is often cited as a risk factor in formal sector workers (1, 5), in informal labor settings, inexperience and lack

of body conditioning among younger workers may predispose them to early-onset MSDs (11, 21, 42).

Educational level was another critical determinant. Illiterate participants had significantly higher odds of reporting MSDs compared to those with primary or secondary education, likely due to limited knowledge of occupational safety practices and lack of access to information regarding safe handling techniques (8, 11, 25). Marital status also emerged as a significant factor, with single individuals being more vulnerable. This may reflect reduced psychosocial support, higher levels of economic pressure, or engagement in riskier labor practices (21, 42).

Work-related exposures—such as long working hours (>12 hours), carrying heavy loads, and physical attributes like lower weight and height—were significantly associated with MSD prevalence. These findings align with occupational health models indicating that biomechanical overload, forceful exertion, and prolonged physical strain are core contributors to musculoskeletal pathology (10, 12, 19, 42). Notably, carrying severe loads was associated with nearly three times the odds of MSDs, affirming the need for practical ergonomic interventions.

Interestingly, porters with over 11 years of work experience were found to have lower odds of developing MSDs. This protective effect may be attributed to adaptive coping mechanisms, refined lifting techniques, and possibly the exclusion of individuals who left the profession due to injury—a phenomenon known as survivor bias (43).

This study also contributes unique insights into an under-researched occupational group in Rwanda. While earlier surveys, such as those by Atijosan et al. (13, 24), reported national-level musculoskeletal impairment, they did not disaggregate the data by specific occupations. By focusing on Kigali's porters, this research fills a critical gap and supports the broader call for inclusion of informal workers in occupational health policy frameworks (4, 14, 23).

Although previous studies have predominantly focused on formal health sectors or industrial workers (25, 33), our findings stress the importance of expanding occupational health interventions to cover informal laborers. The documented burden of MSDs in this population represents a significant threat to productivity, income stability, and long-term health outcomes (6, 12, 30).

5. Study Strengths and Limitations

This study is the first to explore the prevalence and determinants of MSDs among porters in Kigali City taxi parks, addressing a significant gap in occupational health research in Rwanda. By employing a robust stratified sampling method and multivariable logistic regression to adjust for confounders, the study enhances the reliability and relevance of its findings.

However, limitations exist. First, the cross-sectional design restricts causal inferences between associated factors and MSDs. Second, data were self-reported, raising the possibility of recall bias. Third, the study focused on selected taxi parks in Kigali City, which may limit generalizability to other settings or informal workers in different regions. Despite these limitations, the use of a standardized tool and rigorous ethical procedures strengthen its credibility and ensure that findings contribute valid evidence to inform occupational health policies in Rwanda.

6. Conclusion

This study demonstrates an alarmingly high prevalence of musculoskeletal disorders among porters in selected taxi parks in Kigali City. Significant associations were observed with socio-demographic and occupational factors such as age, education, marital status, body weight and height, work experience, working hours, and the severity of loads carried. These findings reinforce the need for targeted interventions to address ergonomic hazards and improve occupational health practices among informal laborers in Rwanda.

7. Clinical and Policy Implications

The implications of these findings are critical for public health practice and policy in Rwanda. First, occupational safety training should be integrated into porter cooperatives, focusing on safe lifting techniques and early symptom recognition. Second, policies must address socio-economic vulnerabilities, such as low education and poor working conditions, that compound MSD risk. Finally, this study's unique focus on an overlooked occupational group supports the development of comprehensive national strategies to reduce MSDs and their impact on workers' health and productivity.

Originality Statement

This study represents the first documented evidence on the prevalence and determinants of musculoskeletal disorders among porters in Rwanda's informal labor sector. By highlighting the occupational health risks faced by this vulnerable group, it contributes novel data to the national and regional discourse and provides a foundation for future research and policy interventions.

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