Journal of Chemical Health Risks

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JCHR (2025) 15(6), 1975-1985 | ISSN:2251-6727

Respiratory Symptoms and its Risk Factors among University Janitorial Workers in East Malaysia: A Cross-sectional Study

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(Received: 27 October 2025 Revised: 05 November 2025 Accepted: 04 December 2025)

KEYWORDS

Janitor, cleaner, waste worker, farmer, respiratory symptom

ABSTRACT:

Introduction: Janitorial workers are vulnerable to respiratory symptoms and occupational lung diseases due to exposure to chemical hazards. Despite the significant health risks related to this occupation, limited research exists on this population.

Objectives: This study aimed to address the research gap pertaining to respiratory symptom prevalence and its association with sociodemographic and occupational factors among janitorial workers at Universiti Malaysia Sabah, Malaysia.

Methods: A cross-sectional study was conducted with 200 janitors among cleaners and landscape workers. A standardized and validated Malay Version of American Thoracic Society Division of Lung Disease Questionnaire (ATS-DLD-78A) was adopted to evaluate the prevalence of respiratory symptoms. Multivariable logistic regression was employed to identify the risk factors associated with respiratory symptoms.

Results: The prevalence of having at least one respiratory symptom was 32.5%, with cough being the most common symptom (22.5%). Landscape workers reported a higher prevalence than cleaners (41.1% versus 27.6%). Duration of employment was significantly associated with respiratory symptoms (AOR=1.273, 95% CI=1.173-1.381, p-value < 0.001). Non-compliance with respiratory PPE was associated with an AOR of 2.800 (95% CI=0.966-8.121, p =0.058) compared to compliant workers. Landscape workers had an AOR of 1.916 (95% CI=0.823-4.461, p =0.132), compared to cleaners.

Conclusions: Given the high prevalence of respiratory symptoms among janitors and employment duration as a significant risk factor, control measures targeting long-term workers, such as enhancement of administrative control, for instance, regular medical surveillance especially on symptomatic patients are crucial to prevent chronic respiratory symptoms leading to irreversible occupational lung disease in this population.

1. Introduction

Respiratory symptoms commonly emerge as early indicators of respiratory disorders, including occupational lung diseases. These symptoms (cough, phlegm, wheezing, and breathlessness) have a significant impact on an individual's health-related quality of life (HRQOL) [1]. Respiratory symptoms may arise from occupational exposure to chemical hazards such as dust, fumes, cleaning agents, and pesticides, particularly without appropriate respiratory personal protective equipment (PPE) usage [2]. Exposure to these chemicals irritates the respiratory tract, making it susceptible to chronic cough and dyspnea [4]. Janitorial workers such as cleaners and landscape workers, are at a greater risk of developing respiratory symptoms than the general population due to their work [3]. The exposure faced by

Journal of Chemical Health Risks
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JCHR (2025) 15(6), 1975-1985 | ISSN:2251-6727

janitors depends on the building size, infrastructure, workforce, and occupational tasks, which can be amplified in large facilities like educational institutions [5]. In this study, the presence of respiratory symptoms was defined as a respondent's report of frequent cough, phlegm, wheezing, or breathlessness, as stipulated by the American Thoracic Society Guidelines [6–8].

Worldwide, the prevalence of respiratory symptoms among janitors is notably high, ranging from 17.5% to 59.0% in cleaners, waste collectors, and street sweepers [3,5,9–13]. Early intervention may prevent the progression of lung disease and protect workers' health. Occupational lung diseases are prevalent globally, with statistics from the International Labour Organization (ILO) documenting 160 million occupational diseases contracted annually, with most deaths attributed to respiratory and cardiovascular diseases [14,15]. The Department of Occupational Safety and Health (DOSH) Malaysia reported an increase in occupational diseases from 546 cases in 2007 to 6327 cases in 2019, with occupational lung disease being the fourth leading cause of occupational diseases [16]. Despite the high global prevalence, reported occupational lung diseases in Malaysia remain low, questioning whether under-detection leads to under-diagnosis and under-reporting [16]. The ILO notes that occupational history is often overlooked during respiratory assessment, causing lung disease diagnosis to be attributed to non-occupational factors [15]. Studies have shown that the true prevalence of occupational lung disease is difficult to establish due to inadequate reporting, poor recognition of exposure symptoms, and lack of proper understanding of diagnostic guidelines [17,18].

The Use and Standard of Exposure of Chemicals Hazardous to Health (USECHH) Regulations 2000, under the Occupational Safety and Health Act 1994 (OSHA 1994) provides a framework for employers in Malaysia to manage hazardous chemicals in the workplace [19]. Key components include risk assessment, control measures, training, and medical surveillance to maintain chemical exposure within permissible limits, thereby preventing occupational diseases [19]. OSHA 1994 requires employers to ensure employee safety and health through hazard identification, risk assessment, and risk control implementation (HIRARC) [20,21]. Conversely, employees must follow the safety guidelines provided by employers, including the use of personal protective equipment (PPE) [21]. Therefore, early detection of work-related respiratory symptoms and its associated factors is necessary to prevent occupational lung disease [9,20].

2. Objectives

To date, there is no guidelines addressing the health risks of janitorial workers. The findings of this study are crucial for enhancing workplace policies and creating standard operating procedures (SOP) to protect the health of these workers. This aligns with the Occupational Safety and Health Master Plan 2021-2025 (OSHMP2025) for occupational health in Malaysia [22]. Hence, this study aimed to determine the prevalence of respiratory symptoms and its associated sociodemographic and occupational factors among janitorial workers at Universiti Malaysia Sabah (UMS), Malaysia.

3. Methods

Study Design and Study Population

This cross-sectional study was conducted in the main campus of Universiti Malaysia Sabah (UMS), Kota Kinabalu (the capital city of Sabah), on the island of Borneo in East Malaysia, from October 2023 to July 2024. Sabah is one of the two Malaysian states situated on the island of Borneo, collectively known as East Malaysia, alongside the state of Sarawak. UMS is a major public university and key academic institution in the region.

The study population comprised of 200 janitors from UMS's total of 250 working janitors distributed across five zones: administrative buildings, faculties, residential college, UMS Treatment Centre and UMS Polyclinic, and sports facilities (including field areas). The initial sample size, estimated at 292 using Cochran's formula, was adjusted to 135 for a finite population. With a 90% expected response rate, the minimum required sample size was 150.

Sample size calculation using single-proportion formula or Cochran's formula [23]**;**

$$n = \frac{\left(z^2_{\left\{\left(1-\frac{\alpha}{2}\right)\right\}} \times p \times (1-p)\right)}{d^2}$$

Journal of Chemical Health Risks

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JCHR (2025) 15(6), 1975-1985 | ISSN:2251-6727

Where:

z is the desired statistical significance level at a 95% confidence interval (z=1.96);

d is the margin of error (d=0.05);

p is the population proportion with respiratory symptoms taken from a West Malaysia Public University study conducted among cleaners (25.5%) [5].

n is the initial sample size (non-adjusted) (n = 292)

Sample size calculation using Cochran's formula for a finite population [23];

$$n = \frac{n_0}{1 + \left(\frac{(n_0 - 1)}{N}\right)}$$

Where:

n_0 is Cochran's recommended sample size based on the previous formula (n_0 = 292);

N is the estimated janitorial worker population in the UMS (N = 250);

n is the newly adjusted sample size (n = 135)

Simple random sampling was employed using a computer random number generator from the janitor's name list [24]. Only janitors who consented and had a minimum of three months working experience were selected [25]. Workers with physician-diagnosed cardiopulmonary problems, chest surgery history, family history of respiratory disease, current respiratory infection, smoking history, part-time job, and absence from work for ≥ three months were excluded.

Measures

Dependent variables

According to the American Thoracic Society Association and other authors, respiratory symptoms were defined as the respondent's report of one or more symptoms: frequent cough (4-6 times daily on most days of the week; ≥5days for 3 consecutive months or more in a year), frequent phlegm (sputum expectoration twice daily on most days of the week; ≥5days for at least 3 consecutive months in a year), frequent wheezing (whistling sounds on expiration most days within 2 years), and breathlessness (breathlessness when either hurrying on the level or walking up a slight hill or having to walk slower than peers on the level because of breathlessness or having to stop for breathing when walking at own pace on the level) [7,25–27].

Independent variables

The independent variables included age (18-24, 25-44, 45-59 or ≥60 years), sex (male/female), ethnicity (Bajau, Dusun, Suluk, Kadazan or others), marital status (single/married), education (no formal, primary or secondary), job type (cleaner/landscape worker), and employment duration (≤4, 5-9, 10-19 or ≥20 years). Respiratory PPE is categorized as compliant or non-compliant. These variables may influence respiratory symptoms through sociodemographic and occupational factors.

Measurements

The research instrument adopted was the Malay Version of the American Thoracic Society Division of Lung Disease in Adults (ATS-DLD-78A) Respiratory Questionnaire [27]. This version was previously translated, validated, and tested for reliability, with an overall Cronbach's alpha coefficient of (α=0.812) and significant Pearson correlations of p <0.0.5 [27]. The questionnaire comprised of four parts: sociodemographic information (age, sex, marital status, ethnicity, and education level), past medical history of cardiopulmonary diseases, respiratory symptoms (cough, phlegm production, wheezing, or breathlessness), and occupational history (types of job, duration of employment, respiratory PPE compliance, and exposure to occupational hazards).

Statistical Analysis

Descriptive analysis was used to determine the prevalence of respiratory symptoms. Kolmogorov-Smirnov test and histogram assessed the normality of continuous variables (age and employment duration). Logistic Regression Analysis was used to determine the association between sociodemographic and occupational factors with respiratory symptoms. In Simple Logistic Regression, variables with a p-value <0.25 were retained for Multivariable Logistic Regression [28]. Multivariable Logistic Regression Analysis was employed to adjust for the effects of other variables, and variables with a p-value <0.05 and good model fit were significantly associated with respiratory symptoms [28]. The forward and backward likelihood ratio methods were

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(6), 1975-1985 | ISSN:2251-6727

compared for model fit. Analyses were conducted using IBM SPSS Statistics, Version 29.0.

4. Results

Descriptive Analysis

The p-value for the Kolmogorov-Smirnov test was $p<0.001$ with right skewness of the age and employment duration histogram, indicating non-normally distributed data. A summary of the participants' characteristics is displayed in Table 1. Table 2 presents the prevalence of respiratory symptoms among janitors, with 32.5% of them reporting at least one symptom of respiratory illness. Cough was the most prevalent symptom (22.5%), followed by breathlessness (12.0%). Table 3 shows the symptom prevalence by job type, with landscape workers reporting a higher prevalence than cleaners (41.1% versus 27.6%).

Logistic Regression

The simple Logistic Regression Analysis in Table 4 revealed three significant sociodemographic factors associated with respiratory symptoms ($p <0.25$): age, marital status, and educational level (primary school). Additionally, all three occupational factors (types of job, duration of employment, and compliance with respiratory PPE) were also significant. These six factors underwent Multivariable Logistic Regression Analysis [28]. Using the backward likelihood ratio method, the best final model comprised of three key variables (Table 5).

Ethnicity was excluded from the inferential analysis due to homogeneity, with 184 workers (92%) being Bajau.

Multivariable Logistic Regression Analysis showed that employment duration significantly affected the prevalence of respiratory symptoms among UMS janitorial workers, with longer-tenured workers more likely to experience symptoms (Table 5). Although the types of jobs and respiratory PPE compliance showed statistically insignificant p-values, their confidence interval (CI) values and direction which were far greater than 1.00 indicated crucial associations with respiratory symptoms. The final model demonstrated a good fit with a Nagelkerke R Square of 49.7% and Hosmer-Lemeshow test p-value of 0.307, explaining almost 50% of respiratory symptom variability, and there was no significant difference between the observed and predicted values.

5. Discussion

Prevalence of respiratory symptoms among janitors

A total of 32.5% of the participants self-reported having at least one symptom, which was consistent with prior studies conducted among Ethiopian street sweepers (35.3%) and agricultural workers (37.5%) [12,29].

The prevalence of cough in our study (22.5%) was in line with findings from a previous research conducted among cleaners at a public university in West Malaysia (25.5%) [5]. Our findings were further supported by studies conducted among professional cleaners in New Zealand and domestic waste collectors in West Malaysia (22.1% and 20.7% respectively) [9,30].

The prevalence of respiratory symptoms was higher among landscapers than among cleaners (41.1% versus 27.6%) (Table 3). Agricultural workers typically experience a higher prevalence of respiratory symptoms than cleaners, as reported in studies on Ethiopian agricultural workers and sweepers [12,29]. The higher prevalence among landscapers can be attributed to their exposure to harsher irritants such as outdoor allergens, dust, particulate matter and toxic gases from motor vehicles, agrochemicals from pesticides and fertilizers, and physical exertion, which are common in landscaping activities [31,32].

Association of Sociodemographic Factors and Occupational Factors with Respiratory Symptoms

Duration of employment

The AOR indicated that with each additional year of employment, the likelihood of experiencing respiratory symptoms increased by approximately 27.3%, highlighting the cumulative effects of prolonged exposure to occupational hazards in the cleaning and landscaping industry.

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(6), 1975-1985 | ISSN:2251-6727

Table 1. Summary characteristics of study participants (N=200)

Variables	Frequency, n	Percentage (%)	Median (IQR)
Age (years)			33 (18)
18-24	37	18.5	
25-44	115	57.5	
45-59	44	22.0	
≥60	4	2.0	
Sex			
Male	59	29.5	
Female	141	70.5	
Ethnicity			
Bajau	184	92.0	
Dusun	6	3.0	
Suluk	3	1.5	
Kadazan	2	1.0	
Others	5	2.5	
Marital Status			
Single	56	28.0	
Married	144	72.0	
Level of Education			
No formal education	111	55.5	
Primary school	67	33.5	
Secondary school	22	11.0	
Types of Job			
Cleaners	128	64.0	
Landscape Workers	72	36.0	
Duration of employment (years)			3 (9)
≤4 years	113	56.5	
5-9 years	31	15.5	
10-19 years	33	16.5	
≥20 years	23	11.5	

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(6), 1975-1985 | ISSN:2251-6727

Compliance to Respiratory PPE		
Compliance	53	26.5
Non-Compliance	147	73.5

IQR=Interquartile range

Table 2. Prevalence of respiratory symptoms among janitors in UMS (N=200)

Respiratory symptoms	Frequency, n (%)	95% CI
Cough	45 (22.5)	16.71-28.29
Phlegm	17 (8.5)	4.64-12.36
Wheezing	6 (3.0)	0.64-5.36
Breathlessness	24 (12.0)	7.50-16.50
At least 1 symptom above	65 (32.5)	26.01-38.99

CI=Confidence Interval

Table 3. Prevalence of respiratory symptoms according to types of job (N=200)

Types of Job	Frequency, n (%)	95% CI
Cleaners	35 (27.6)	19.79-35.33
Landscapers	30 (41.1)	29.81-52.38

CI=Confidence Interval

Table 4. Simple Logistic Regression of sociodemographic and occupational factors with respiratory symptoms among janitorial workers (N=200)

Variables	COR	95% CI	p-value
Age (years)	1.076	1.045-1.108	<0.001
Sex			
Male	Ref	Ref	Ref
Female	1.232	0.634-2.392	0.539
Marital Status			
Single	Ref	Ref	Ref
Married	2.136	1.037-4.399	0.040
Education level			
Secondary school	Ref	Ref	Ref
Primary school	0.462	0.162-1.320	0.150
No formal education	1.107	0.428-2.858	0.834

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(6), 1975-1985 | ISSN:2251-6727

Types of Job			
Cleaners	Ref	Ref	Ref
Landscape Workers	1.898	1.033-3.489	0.039
Duration of employment (years)	1.272	1.183-1.368	<0.001
Compliance to Respiratory PPE			
Compliance	Ref	Ref	Ref
Non-compliance	6.621	2.490-17.605	<0.001

significant if p<0.25, COR= Crude Odds Ratio, CI=Confidence Interval

Table 5. Final model results of Multiple Logistic Regression of associated factors and respiratory symptoms (N=200)

Variables	COR	95% CI	p-value	AOR	95% CI	p-value
Types of Job						
Cleaners	Ref	Ref	Ref	Ref	Ref	Ref
Landscaper workers	1.898	1.033-3.489	0.039	1.916	0.823-4.461	0.132
Duration of Employment (years)	1.272	1.183-1.368	<0.001	1.273	1.173-1.381	<0.001
Compliance to Respiratory PPE						
Compliance	Ref	Ref	Ref	Ref	Ref	Ref
Non-Compliance	6.621	2.490-17.605	<0.001	2.800	0.966-8.121	0.058

significant if p<0.05, Nagelkerke R Square=49.7%, Hosmer-Lemeshow Test=p-value of 0.307, CI=Confidence Interval, COR=Crude Odds Ratio, AOR=Adjusted Odds Ratio

A meta-analysis revealed that Ethiopian employees with more than five years of working experience had a significantly higher likelihood of respiratory symptoms, with an OR of 2.24 compared to shorter tenure workers [33]. Similar evidence was found in large cross-sectional studies involving 34 countries and 28 823 workers in 11 occupations including the farming sector, whereby farmers with ≥ 20 years of working experience were more likely to develop respiratory symptoms [34].

Types of job

In Multivariable Logistic Regression, the relationship between respiratory symptoms and landscape workers was not statistically significant (AOR: 1.916; 95% CI: 0.823-4.461, p= 0.132). Nevertheless, we observed a strong positive association between landscape workers and the risk of developing respiratory symptoms compared to cleaners, as indicated by the CI, which was in the direction of ≥1.000. This finding suggests that occupation still plays a crucial role in the prevalence of respiratory symptoms, although other factors may also influence its impact [35]. Our findings also showed that

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(6), 1975-1985 | ISSN:2251-6727

the prevalence of respiratory symptoms was higher among landscapers than among cleaners (41.1% versus 27.6%) (Table 3).

Cleaners who were exposed to higher levels of respirable dust were more likely to report symptoms, such as coughing and wheezing [5]. A meta-analysis of 24 studies revealed that occupational cleaners had a 50% and 43% increased risk of asthma and COPD respectively, compared to other occupations [4]. Moreover, the risk of adverse respiratory outcomes is higher with specific chemicals in cleaning agents such as aldehydes and chlorine [36].

Similar to farmers in Pakistan, Ethiopia, and Macedonia who were exposed to agricultural dust, fertilizers, and pesticides, workers in related occupations such as landscaping may also be at an increased risk of developing respiratory symptoms [25,29,37].

Despite the lack of research comparing health-associated risks between landscape workers and cleaners, cleaners are typically exposed to various indoor pollutants, such as cleaning agents and particulate matter derived from indoor air, which may be less hazardous than outdoor pollutants encountered by landscapers [31,32]. Consequently, the higher prevalence of respiratory symptoms observed among landscapers may be attributed to a combination of these outdoor pollutants [31].

Our findings revealed non-significant results which could be due to several factors such as the presence of confounding variables that were not accounted for, including non-cardiopulmonary-related illnesses, exposure to cigarette smoke either at work or at home, and air quality status in the working environment.

Respiratory PPE compliance

Non-adherence to respiratory PPE usage was associated with a higher likelihood of respiratory symptoms as can be seen from the strong direction of CI ≥1.000 from this study (AOR: 2.800, 95% CI: 0.966-8.121, p-value: 0.058). Despite the lack of statistical significance in the p-value, there is a clear trend that non-compliant workers are at a greater risk of experiencing respiratory symptoms.

A systematic review in Pakistan demonstrated the protective function of face masks against respiratory pathogens, leading to a significant reduction in respiratory infections among workers who consistently used face masks in healthcare settings [38].

A study conducted among cleaning service employees in Arizona, United States identified potential obstacles to the use of respiratory PPE. These include respiratory difficulties with face masks, particularly in extreme temperature conditions, such as non-air-conditioned homes, and during physically demanding tasks such as lifting heavy garbage [3]. Not surprisingly, adherence to respiratory PPE among janitors was only 26.5% in this study and 42.3% among domestic waste workers in West Malaysia [9].

The non-significant result in our study might suggest that the protection provided by PPE might not always be effective due to other factors, such as incorrect use by janitors [39]. The effectiveness of PPE depends on its quality and proper fit [40]. Lower-quality or ill-fitting respiratory PPE may not provide adequate protection, leading to harmful exposure despite usage. Research with significant outcomes may have used higher-quality PPE with monitored compliance, as in Pakistan's healthcare setting [38]. The work environment and exposure levels also affect PPE effectiveness. For instance, janitors exposed to less hazardous gases or working in well-ventilated environments may experience fewer respiratory issues, making it challenging to detect significant associations with PPE use.

There are some limitations while conducting the study. The cross-sectional design of this study prohibits the inference of causality between these factors and respiratory symptoms. Self-reported data may introduce recall and social desirability biases. Participants may have under-reported their symptoms due to fear of job loss. The literature on respiratory symptoms among cleaners and landscape workers is limited, partly due to challenges in reaching workers from racial minorities and immigrant communities [3]. Therefore, we used studies with comparable exposures as references, including research on farmers, agricultural workers, waste collectors, and street sweepers. Despite these limitations, this study managed to highlight positive findings with a high prevalence of respiratory symptoms and established its associated factors.

Future research should focus on longitudinal studies, objective measures, and psychosocial factor assessments

Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(6), 1975-1985 | ISSN:2251-6727

to expand the current findings and enhance respiratory health outcomes for janitors.

Conclusions

This study revealed that while sociodemographic factors such as age, marital status, and education level might influence respiratory health, occupational factors play a more significant role in determining the prevalence of respiratory symptoms among janitors. Respiratory medical surveillance should focus on long-term workers employed for over five years, especially those with symptoms through lung function assessments. Workers must be trained in the proper PPE usage, with penalties for non-compliance. Standard Operating Procedures (SOPs) should be developed at both the national and workplace levels to incorporate safety measures and mandatory face mask use when handling or exposed to chemicals. Employers should provide necessary PPE such as 3-ply masks, inspect and replace damaged ones, and ensure compliance through regular meetings.

Acknowledgements

The authors wish to convey their sincere gratitude to the lecturers of the Public Health Medicine Department, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, whose guidance was instrumental in this study. We sincerely appreciate the authors of the Malay Version of American Thoracic Society Division of Lung Disease Questionnaire (ATS-DLD-78A) for granting permission to use the questionnaire in this study.

Ethics Statement

The study was approved by the Universiti Malaysia Sabah Medical Research Ethics Committee (No. JKEtika 1/24(9)) with formal approval from the Maintenance and Development Department, UMS to facilitate the study. The study objective was explained and written informed consent was obtained from all participants.

Conflict of Interest

The authors declare no conflicts of interest associated with the material presented in this paper.

Funding

None.

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