



ORIGINAL ARTICLE

Prevalence and Factors associated with Respiratory Symptoms among Sawmill Workers in Sokoto State, North West, Nigeria

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Keywords

Prevalence;

Predictors;
Respiratory
symptoms;

Sawmills;

North-West
Nigeria

ABSTRACT

Background: Dust exposure in sawmills predisposes workers to respiratory health problems with characteristic respiratory symptoms. This study assessed the prevalence and the factors associated with respiratory symptoms among sawmill workers in Sokoto state, North-West Nigeria.

Methods: This was a cross-sectional study conducted in Sokoto State, Nigeria. A total of 360 respondents were recruited using a two-stage sampling technique. Data were collected using a pre-tested interviewer-administered questionnaire and analysed using IBM® SPSS version 23. Categorical data were presented using frequencies and percentages, while the Chi-square test was used to test for association between respiratory symptoms and socio-demographic/work variables. Binary logistic regression was used to assess predictors of respiratory symptoms. The level of significance was set at $p < 0.05$.

Results: The respondents' age ranged from 19 to 73 years, with a mean of 34.12 ± 10.2 years. A quarter 92 (25.6 %) of the workers smoked cigarettes. None of the workers had training on safety practices, and only a few 84 (23.3%) used personnel protective equipment (PPE). The most prevalent respiratory symptom was morning cough 164 (45.6%), followed by cough on exertion 143 (39.7%). Cigarette smoking (aOR = 3.96, 95% CI = 2.03-7.73, $p < 0.001$) and loading of plank (aOR = 2.16, 95% CI = 1.21-3.85, $p = 0.01$) were the only predictors of respiratory symptoms.

Conclusion: Periodic safety training and promotion of PPE use through education and advocacy and smoking cessation programs among sawmill workers will go a long way in reducing the burden of respiratory problems among them.

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INTRODUCTION

Wood processing in sawmills constitutes a major industrial and socio-economic activity globally.¹ However, due to poor or improper use of personal protective equipment (PPE), workers in the industry are exposed to different work-related hazards resulting in health problems. The

main objective of sawmilling is to reduce logs to sizes used for various purposes in building and construction activities. This activity results in generation of huge amount of dust affecting the respiratory airway, and other forms of physical, chemical, and biological hazards.² Dust in sawmills is high in particulate matter (PM), and thus impacts workers' respiratory health

negatively.^{3, 4} Inhalation of dust leads to the activation of macrophages, dendritic cells and innate immune cells. This initiates responses from specific immune cells such as helper T cells, cytotoxic T cells and B cells.⁵ Repeated dust exposure triggers inflammatory processes which culminate in respiratory diseases.⁵ Respiratory diseases constitute a major health problem affecting sawmill workers.^{6, 7} Also, evidence suggests that workers exposed to wood dust are at increased risk of developing nasal and lung cancers.^{6, 8-10} Exposure to wood dust over time leads to abnormalities in lung function with characteristic symptoms.^{11,12} The severity of these abnormalities progress as the duration of exposure increases.^{3,13,14} The commonly reported respiratory symptoms among sawmill workers include; cough, dyspnea, phlegm, chest pain, chest tightness and in severe cases breathlessness.^{11, 14} Aside the respiratory system, sawmill dust affects the eyes, nose, and skin.¹⁵⁻¹⁷

Occupational lung diseases are of grave concern due to their long latency period as some diseases manifest long after employees might have left work,¹⁸ and may lead to death in some workers. Work-related death rate in Nigeria is one of the highest in the world with about 24 fatalities reported per 100,000 employees annually.¹⁹ Despite these high fatalities, little attention is being paid to workers' safety, especially among small and medium businesses to which sawmills belong.

A healthy worker is productive and is also an asset to the organization, on the contrary, an unhealthy one constitutes liabilities that limit the organization's marginal profit.²⁰ In developed countries, the use of technology has minimized workers' exposure to harmful work processes, however, evidence in developing countries shows most work processes are still done manually and mostly in an unhygienic environment.^{21, 22} Poor knowledge of the importance of safety devices, sociocultural factors and lack of access to occupational health services are other major contributing factors to the high rate of work-related illness among workers in developing countries.²³ The poor and improper use of PPE, poor safety practices, ageing equipment and poor ventilation in the work area are some of the factors responsible for

the increase in dust exposures in sawmills.^{12,13,17,24,25} All these contributes to the increased risk of work-related illness, injuries and death among sawmill workers.^{3,25,26}

The southern part of Nigeria has a vast rainforest vegetation, and contributes majorly to sawmilling activities here in Nigeria. It is therefore not surprising that the majority of the available work on the problems of sawmill workers are from the region.^{11, 12, 16, 27, 28} The few available study in Sokoto state have not focused on the respiratory problems of the workers despite its significance. This study, therefore, aims to bridge this gap by determining the prevalence of respiratory symptoms and the associated factors among sawmill workers in Sokoto state. It is our hope that findings from the study will create awareness of the problems associated with sawmilling among the workers and will stimulate appropriate responses from the regulatory agencies and stakeholders in the sawmilling industry at large.

METHODOLOGY

This was a cross-sectional study conducted in Sokoto state Nigeria between August and September 2019. Sokoto State is one of the oldest states in Nigeria created in 1976, bordered to the North by Niger Republic, Zamfara State to the east, and Kebbi State to the west and south. Sokoto lies between latitudes 13°04'59" north and longitudes 05°15'00" east of Greenwich. There are 23 Local Government Area (LGA) in Sokoto State. There are 274 registered sawmills in the Sokoto metropolis and most of these are located within the Sokoto South LGA because of its central location. These mills serve almost all the other Local Government Areas (LGAs) in the state. Workers who had worked for at least one year in the sawmills were eligible to participate, while administrative staff and workers with a prior history of allergy before joining sawmilling work were excluded from the study. The sample size was calculated using Fisher's formula²⁹ for cross-sectional studies. A total of 360 participants were recruited for this study based on a prevalence of cough of 35.1% obtained in a previous study among sawmill workers in Benin City, Nigeria.¹¹ Sample size was adjusted with a

3% non-response rate because data were collected electronically using ODK by the interviewer with no missing data.³⁰ Participants were recruited using a two-stage sampling technique. In the first stage, 68 out of the 274 registered sawmills in the metropolis were selected using simple random sampling by balloting. Sample size were proportionately allocated to selected sawmills based on the population of workers in each selected sawmill, then a systematic random sampling technique was used to select eligible participants based on the proportionate allocation. The data collection instrument was an interviewer-administered questionnaire pre-tested in clusters of sawmill in Kware LGA, Sokoto State. The questionnaire had sections on participants' socio-demographic characteristics, frequently reported respiratory symptoms, and safety methods.

Data analysis was done using IBM® SPSS version 23. The reported respiratory symptoms and safety practices were presented using frequency and percentages, while associations between independent socio-demographic/work profile variables and respiratory symptoms were assessed using the Chi-square test. Factors that were significant in bivariate analysis were subjected to binary logistics regression to control for confounders. The level of significance (α) was set at <0.05 and 95% confidence interval for all the analyses. Ethical approval was obtained from the Sokoto State Research Ethics Committee with protocol number SKHREC/121/018, and permission was also obtained from the Health Department of the Sokoto South LGA. Verbal informed consent was obtained from all participants. The participants were enlightened about the benefit of the study, that the study will assess the occurrence of respiratory symptoms, factors responsible for the occurrence in them and the adequacy their safety practices. This will inform paying advocacy to their management and government to put in safety measures to safe guard their health and also educate them on how to best prevent unusual respiratory symptoms.

RESULTS

A total of 360 questionnaires were administered using ODK data collection tool and all were submitted, giving a response rate of 100%.

Table 1 shows that respondents' age ranged from 19 to 73 years, with a mean and standard deviation of 34.12 ± 10.2 years. Those between 20 and 29 years old were the highest proportion 140 (38.9%). All the respondents were male. Half of the respondents were married 183 (50.8%), and nearly all 356 (98.9%) were Muslims. About half of the respondents had Quranic education 192 (53.3), while only a few 10 (2.8%) had tertiary education. About a quarter of the respondents 92 (25.6 %) smoked cigarettes. Almost half of the workers 169 (46.9%) had worked for less than 10 years while nearly all 330 (91.7%) worked more than five days a week. None of the workers had training on workplace safety before commencing work at the sawmill.

Table 2 shows that less than two-thirds of the respondents 223 (61.9%) reported having had at least a symptom of respiratory morbidity. Morning cough was the commonest symptom 164 (45.6%), followed by cough on exertion 142 (39.4%), while the least reported symptom was wheezing 29 (8.1%).

Table 1: Respondents' socio-demographic characteristics

| Variables | Frequency (n=360) | Percent |
|--|--------------------------|----------------|
| Age group (years) | | |
| ≤ 19 | 2 | 0.6 |
| 20 – 29 | 140 | 38.9 |
| 30 – 39 | 124 | 34.4 |
| 40 – 49 | 63 | 17.5 |
| ≥ 50 | 31 | 8.6 |
| Sex | | |
| Male | 360 | 100 |
| Female | 0 | 0 |
| Religion | | |
| Islam | 356 | 98.9 |
| Christianity | 04 | 1.1 |
| Marital status | | |
| Married | 183 | 50.8 |
| Single | 171 | 47.5 |
| Separated | 4 | 1.1 |
| Divorced | 2 | 0.6 |
| Educational status | | |
| Nil formal | 21 | 5.8 |
| Quranic | 192 | 53.3 |
| Primary | 89 | 24.7 |
| Secondary | 48 | 13.3 |
| Tertiary | 10 | 2.8 |
| History of cigarette smoking | | |
| Yes | 92 | 25.6 |
| No | 268 | 74.4 |
| *Job descriptions | | |
| Loading of log | 134 | 37.2 |
| Machine operator | 112 | 31.1 |
| Plank pushing | 76 | 21.1 |
| Trading | 91 | 25.3 |
| Length of working experience (years) | | |
| ≤9 | 169 | 46.9 |
| 10-19 | 127 | 35.3 |
| ≥ 20 | 64 | 17.8 |
| Number of working days per week | | |
| 1-5 | 30 | 8.3 |
| ≥6 | 330 | 91.7 |
| Number of working hours per day | | |
| 1-8 | 185 | 51.4 |
| ≥9 | 175 | 48.6 |
| Had training on safety at the workplace | | |
| Yes | 0 | 0.0 |
| No | 360 | 100 |

*Multiple responses allowed, Mean age (SD); 34.12 ± 10.2 years

Table 2: Commonly reported respiratory symptoms among the respondents

| *Symptoms | Frequency (n = 360) | Percent |
|---|------------------------|---------|
| Reported at least one symptom | 223 | 61.9 |
| Morning cough | 164 | 45.6 |
| Cough on exertion | 142 | 39.4 |
| Chest tightness | 135 | 37.5 |
| Difficulty in breathing on exertion | 80 | 22.2 |
| Difficulty in breathing at rest | 57 | 15.8 |
| Attack of wheezing or whistling in the last twelve months | 29 | 8.1 |

*Multiple responses allowed

Table 3 shows that less than a quarter 84 (23.3%) of the participants reported the use of one form of PPE or the other. The face mask was the most used form used 53 (14.7%), this was closely followed by hand gloves 52 (14.4%). Goggle was the least used form of PPE with only (0.6%) of respondents reporting its use. The reasons for the poor use of PPE by respondents included non-availability 224 (81.1%), slowing down of work process 187 (67.8%), high cost 178 (64.4%), discomfort 154 (55.8%), not being aware of it 90 (32.5%) and no need for it 49 (17.8%).

Table 4 shows that the proportion of respondents with symptoms of respiratory morbidity was significantly higher among those that were at least 30 years old ($\chi^2 = 14.19, p < 0.001$), as well as the married ($\chi^2 = 5.34, p = 0.021$). Also, significantly higher proportions of symptoms of respiratory morbidity were reported among respondents who smoked cigarettes ($\chi^2 = 27.34,$

$p < 0.001$) and those who worked for more than five days a week ($\chi^2 = 6.69, p = 0.01$). Other factors which were significantly associated with having respiratory symptoms included having worked for at least 20 years ($\chi^2 = 9.174, p = 0.01$), not having a formal education ($\chi^2 = 9.64, p = 0.002$), and not being involved in loading and pushing planks ($\chi^2 = 4.62, p = 0.032$).

Table 5 shows that cigarette smoking and loading of plank were the only predictors of symptoms of respiratory morbidity. Respondents who smoked cigarettes were about four times more likely to have symptoms of respiratory morbidity compared to non-smokers (aOR = 3.96, 95% CI = 2.03-7.73, $p < 0.001$), while those involved in the loading of plank had approximately 2 times more odds of having symptoms of respiratory morbidity compared to those not involved in loading of planks (aOR = 2.155, 95% CI = 1.205-3.854, $p = 0.01$).

Table 3: Usage of PPE and the types used by respondents

| Variables | Frequency (n = 360) | Percent |
|------------------------------------|------------------------|---------|
| Use of PPE | | |
| Yes | 84 | 23.3 |
| No | 276 | 76.7 |
| *PPE type | | |
| Face masks | 53 | 14.7 |
| Hand gloves | 52 | 14.4 |
| Safety boots | 28 | 7.8 |
| Helmets | 16 | 4.40 |
| Goggles | 2 | 0.6 |
| *Reasons for not using PPEs | | |
| It is not provided | 224 | 81.1 |
| It slows work process | 187 | 67.8 |
| It is expensive | 178 | 64.4 |
| It causes discomfort | 154 | 55.8 |
| Not aware of it | 90 | 32.5 |
| No need for it | 49 | 17.8 |

* multiple responses allowed

Table 4: Factors associated with having symptoms of respiratory morbidity

| Variables | Symptoms of respiratory morbidity | | ^a Test statistic, (p-value) |
|---|-----------------------------------|--------------------|--|
| | Yes | No | |
| | (n = 223) n (%) | (n = 137) n (%) | |
| Age (years) | | | |
| ≤29 | 71 (50.0) | 71 (50.0) | $\chi^2 = 14.19, (p < 0.001)$ |
| ≥30 | 152 (69.7) | 66 (30.3) | |
| Marital status | | | |
| Unmarried* | 99 (55.9) | 78 (44.1) | $\chi^2 = 5.34, (p = 0.021)$ |
| Married | 124 (67.8) | 59 (32.2) | |
| Educational status | | | |
| Informal | 146 (68.5) | 67 (31.5) | $\chi^2 = 9.64, (p = 0.002)$ |
| Formal | 77 (52.4) | 70 (47.6) | |
| Cigarette smoking | | | |
| No | 145 (54.1) | 123 (45.9) | $\chi^2 = 27.34, (p < 0.001)$ |
| Yes | 78 (84.8) | 14 (15.2) | |
| Type of work | | | |
| Loading of plank | | | |
| No | 121 (53.5) | 105 (46.5) | $\chi^2 = 18.194, (p < 0.001)$ |
| Yes | 102 (76.1) | 32 (33.9) | |
| Machine operator | | | |
| No | 158 (63.7) | 90 (36.3) | $\chi^2 = 1.054, (p = 0.305)$ |
| Yes | 65 (58.0) | 47 (42.0) | |
| Plank pusher | | | |
| No | 184 (64.8) | 100 (35.2) | $\chi^2 = 4.62, (p = 0.032)$ |
| Yes | 39 (51.3) | 37 (48.7) | |
| Plank trader | | | |
| No | 169 (62.8) | 100 (37.2) | $\chi^2 = 0.35, (p = 0.554)$ |
| Yes | 54 (59.3) | 37 (40.7) | |
| Number of working days per week | | | |
| ≤ 5 | 12 (40.0) | 18 (60.0) | $\chi^2 = 6.69, (p = 0.01)$ |
| ≥ 6 | 211 (63.9) | 119 (36.1) | |
| Number of working hours per day | | | |
| ≤ 8 | 104 (56.2) | 81 (43.8) | $\chi^2 = 5.297, (p = 0.021)$ |
| ≥ 9 | 119 (68.0) | 56 (32.0) | |
| Length of working experience (years) | | | |
| ≤ 9 | 91 (53.8) | 78 (46.2) | $\chi^2 = 9.174, (p = 0.01)$ |
| 10 – 19 | 86 (67.7) | 41 (32.3) | |
| ≥ 20 | 46 (71.9) | 18 (28.1) | |

^a Pearson's chi-square test;

*(single, divorced, and separated)

Table 5: Predictors of symptoms of respiratory morbidity among respondents

| Variables | aOR (95% CI) | p-value |
|-------------------------------------|--------------------|-------------|
| Age group (years) | | |
| ≤29 (RC) | 1 | |
| ≥30 | 1.45 (0.67 – 3.11) | 0.35 |
| Marital status | | |
| Unmarried (RC) | 1 | |
| Married | 1.35 (0.62 – 2.96) | 0.45 |
| Educational status | | |
| Informal (RC) | 1 | |
| Formal | 0.83 (0.50 – 1.39) | 0.48 |
| Cigarette smoking | | |
| Non-smokers (RC) | 1 | |
| Smokers | 3.96 (2.03 – 7.73) | <0.001 |
| Loading plank | | |
| No (RC) | 1 | |
| Yes | 2.16 (1.21 – 3.85) | 0.01 |
| Pushing plank | | |
| No (RC) | 1 | |
| Yes | 0.83 (0.45 – 1.54) | 0.56 |
| No. of working hours per day | | |
| ≤8 (RC) | 1 | |
| ≥9 | 1.91 (0.71 – 1.99) | 0.50 |
| Length of working experience | | |
| ≤9yrs (RC) | 1 | |
| ≥10yrs | 1.58 (0.76 – 3.29) | 0.22 |
| Number of working days per | | |
| ≤5 (RC) | 1 | |
| ≥6 | 1.61 (0.69 – 3.73) | 0.27 |

*RC-Reference category; aOR- adjusted odds ratio; CI-Confidence Interval

DISCUSSION

Workers' health is a major determinant of their productivity, and it is important to always review how exposures in workplaces affect their health status and also determine the factors that play key roles in the morbidities that result from these exposures to initiate programs to control them. In this study, we observed a high burden of symptoms of respiratory morbidity among sawmill workers with six out of every ten respondents having symptoms of respiratory morbidity despite being largely preventable. Similar findings have been reported in previous studies in Jos North-central Nigeria,³¹ and Benin South-south Nigeria.¹³ The respiratory symptoms among sawmill workers have been attributed to the high content of monoterpenes and moulds in wood products which are highly irritating to the airways.³² Also, the mucus produced by the cell lining of the airways traps inhaled dust particles which are then moved upward by tiny hair cells triggering cough and phlegm production³³

Morning cough was the most commonly reported symptom among workers in this study with nearly half of the workers reporting the symptom. This is one of the early symptoms to appear among workers exposed to dust. It is due to the protective effect of the cilia in the bronchus which tends to expel the accumulated dust from the lungs, this is then coughed up the morning after a pause in the exposure overnight. The high prevalence of morning cough in the current study compares to findings in Abakaliki, South-east Nigeria,²⁵ and in Benin City, South-south Nigeria.¹³ However, a study from South-west, Nigeria reported a higher prevalence of morning cough among the workers²⁸ This difference may be a result of differences in duration of exposure and differential use of protective devices. The high prevalence of morning cough in all the studies reflects the poor environmental hygiene practices in the sawmills and the inadequate use of personal protective devices and this underscores the need for enforcement of

environmental control measures by regulatory agencies, and increase sensitization of workers on the use of PPE across sawmills in Nigeria. Wheezing was the least reported respiratory symptom among the workers. A study in Benin City, Nigeria reported a similarly low prevalence of wheezing in their study and averred this may be because workers with such severe symptoms would have changed work due to their inability to cope in a dusty environment.¹¹

Having symptoms of respiratory morbidity was associated with age, marital status, educational status, cigarette smoking, number of days worked per week, hours worked per day, type of work, and the length of working experience, however, only smoking and being involved in the loading of planks were the factors found as predictors. Cigarette smoking increased the odds of having respiratory symptoms by four folds (aOR 3.98, $p < 0.001$) further confirming the positive multiplicative effect cigarette smoking has on occupational lung disease.³⁴ A study in Edo state, Nigeria reported a similar effect in their study among sawmill workers.¹⁶ Also, respondents involved in loading planks were twice more likely to have respiratory symptoms compared to those who were not involved in loading planks. Particulate matter with smaller diameter has higher likelihood of escaping the respiratory protective mechanism and traveling far down the airway thereby causing more damage. Because finished planks are often covered with film of these small particles which are displaced during the loading process, workers involved in loading plank are more exposed. This may explain why they have higher odds of having respiratory symptoms. Other factors that have been identified as predictors for respiratory symptoms in previous studies among workers exposed to dust are the length of work experience and age, however, both were not significant in the current study.^{35,36}

Very few workers in this study reported the use of PPE which may not be unconnected with employers' failure to provide the devices. Aside from this, the majority of workers expressed concerns that the use of PPE makes the work process slower and causes discomfort. Education influences safety practices³⁷ therefore their

misconception about the use of PPE could have arisen because of their low level of education and non-training on safety practices before commencing work in the sawmills. Similarly, sub-optimal use of PPE has been reported among workers in similar occupations^{3, 25, 38} and thus underscores the need for educating both employers and employees on the importance of using these safety devices and all other measures to safeguard their health.

Even though this was an observational study and may be prone to reporting bias due to self-reports of respiratory symptoms and safety practices, this appeared to have been minimized due to the comparability of findings across several other studies, and the reported practices among the workers mirrored earlier reports among workers in similar occupations.

In conclusion, the study found a high prevalence of respiratory symptoms among sawmill workers with cough being the most prevalent respiratory symptom. Also, cigarette smoking and being involved in the loading planks were the factors found as predictors for respiratory symptoms. Therefore, there is a need for a collaborative effort by regulatory agencies and associations of sawmill owners in ensuring safety training for workers, promote access to a hygienic work environment, and provision of necessary safety devices. Lastly, instituting a smoking cessation program among the workers will go a long way in improving their respiratory health.

Acknowledgement: The authors wish to appreciate all the executives of sawmillers association for their support during the course of this study, we also wish to appreciate Prof M.O Oche for his guidance.

Conflict of interest: None

Authors' contributions: ASA: Research conceptualization, protocol design, data analysis and preparation of the manuscript; YUE: Research instrument and protocol design, and preparation of final draft of the manuscript; IA: Review of literature, instrument design, and preparation of final draft of the manuscript; EZA:

Data acquisition, and data analysis; AOT: Data interpretation, instrument design, and preparation of the final draft of the manuscript; RAS: Data interpretation, and preparation of the final draft of the manuscript for publication; AMS: Literature review, and revision of the final draft of the manuscript.

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