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Original Research Article

Awareness of Occupational Hazards and Health Problems among Sawmill Workers in Osun State, Nigeria

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ABSTRACT

Background: Sawmilling operations involves lots of manual handling which makes workers to be exposed to higher levels of risks. The study aimed to assess awareness of occupational hazards and health problems of sawmill workers.

Methodology: It was a cross sectional analytical design carried out among 100 sawmill-workers in Osun State, Nigeria selected via multi-stage sampling technique from September 2012 to January 2013. Pre-tested questionnaire, walk-through survey checklist and In-depth interview guide were used to collect data from respondents. Some pulmonary function parameters of respondents were also measured. One hundred matched vehicle mechanics were used as control. Level of significance was set at $P<0.05$ and chi-square, z and t tests were used for comparison.

Result: Mean ages were 33.64±11.01 and 33.14±9.98 for the study and control group respectively. Most of the sawmill workers did not use personal protective equipment mainly due to non availability. Respiratory symptoms like cough (53%), phlegm production (39%), and sneezing (54%) as well as dermatitis (8%) and conjunctivitis (60%) were significantly higher among sawmill workers than the controls ($p<0.05$). Mean peak expiratory flow was significantly ($p<0.001$) lower among sawmillers (332.6±66.23 l/min) than the control (488.7±60.23 l/min). Mean respiratory rates (19.68± 2.31 cpm) and the anterior-posterior to transverse diameter ratio of chest (1.01±0.06) of sawmillers were also significantly higher than the controls' (18.00±1.35 cpm and 0.99 ± 0.04 respectively)

Conclusion: Respiratory symptoms and injuries in sawmills can be prevented by dust control and the use of personal protective equipment

Key Words: Occupational hazards; Sawmill workers; Mechanics; Peak Expiratory Flow

INTRODUCTION

Sawmilling is one of the oldest wood processing industries in Nigeria. [1] The most important wood products, produced, consumed and traded in Nigeria are sawn-wood, plywood, particle board, news-print, printing and writing paper and other paper boards that are gotten from sawmills. [2] A sawmill worker performs any combination of the following duties: unloads logs from

trucks or lorries, roll logs onto sawmill deck, examines logs for defects such as embedded pieces of iron or stone and marks defects for removal, rolls logs from deck onto log or carriage, rides log carriage of head saw and adjusts position of logs on carriage to cut planks of required thickness, sorts and guides planks emerging from saw onto roller tables or conveyors for trimming edges, straightens lumber on moving conveyors, straightens edges of rough lumber, using saw, sharpens and adjusts teeth of woodworking saws.[3] The sawmill is therefore made up of different sections, and each section has hazards that are inherent to it.

There are lots of human involvements (manual handling) in sawmilling operations which makes workers to be exposed to higher levels of risks. [4] Hazards and injuries in sawmills include: mechanical hazards such as being caught-in or struck by machinery; chemical hazards such as breathing in noxious or toxic chemicals like wood dust, as well as physical hazards such as unfavourable weather conditions and noise pollution. [5]

Adverse effect associated with breathing in wood dust include allergic and non-allergic respiratory symptoms and cancer. Other health effects of wood dust in addition to impairment of pulmonary functions include its irritating effect on the eyes, nose and throat as well as dermatitis. [6-8] The air sawmill workers breathe in at work contains excessive amount of wood dust; this, combined with poor ventilation and closed-in-working areas made difficulty in breathing to be prevalent among them. [9] Studies have shown lower lung function among saw mill workers compared to the control subjects; 49% and 43% of workers exposed to wood dust in India were found to have nasal symptoms and cough respectively.[10] High prevalence of respiratory symptoms (cough, chest pain, sputum production), conjunctivitis, skin irritation and hearing difficulties was reported among sawmill workers compared to controls in Ile–Ife. [11] In Oyo State, Nigeria, high prevalence of respiratory symptoms elevated nose and eye irritations and skin symptoms were observed among workers exposed to wood dust compared to unexposed. [12] Dermatitis is also a common health hazard associated with exposure to wood dust. Apart from wood dust, chemicals such as chlorophenols used as preservatives for wood have been associated with soft tissue sarcomas and non-Hodgkin's lymphomas. [13,14]

High levels of noise have long been recognized by industrial safety technicians as unsafe to workers, and in a typical wood industry, decibel levels often exceed industry limits and may cause hearing loss and workplace accidents. [15,16] In Ilorin, Nigeria, a cross sectional study of sawmill workers revealed 21.6% of respondents perceived noise as one of the occupational hazards. [9]

Minor accidents and injuries which is the most common health problems experienced in sawmills, [9] usually result from improper usage of machines, improperly designed machine or faulty machine. Fatal or very serious injuries could also occur as a result of workers being struck by mobile equipment, falls from elevated platforms, injury resulting from failure to switch off equipment during maintenance or attempts to remove jams, and injury from saws and other machineries. [17] Machines may be obsolete with most of the safety guards removed or non-functional. [2] Sawmill workers with poor psychosocial working conditions have also been reported to be at increased risk of both attempted and completed suicide. [18]

Majority of the sawmill industries are located in the wood producing rain forest areas of the country in which Osun State is

among. [19] Guaranteed log supply from the rain forest areas is a major factor in the location of sawmills, thus making Osun State to have lots of sawmills. It follows that a large number of workforce is engaged in the sawmill industries in Osun State and awareness of hazards inherent to these workers will make them take necessary steps in protecting themselves from the adverse health effects of these hazards, thus making our present and future work force healthy and productive.

Awareness of hazards and health problems associated with sawmilling in Osun State is therefore the aim of this study.

MATERIALS AND METHODS

The study was conducted in Osun state, Nigeria. It is situated in the southwestern part of the country and lies in the rainforest belt of the country with altitudes of between 121.92m and 298.70m above the sea level. [20]

The State has 3 senatorial districts and has 10 local governments and 1 area office, located in Osun east senatorial district. [21] There are 106 registered sawmill industries in Osun State and average number of workers per sawmill industry is about 15-20.

The study was a cross sectional analytical design. Study population was made up of sawmill workers (study group) and vehicle mechanics (control group) in Osun State. Sawmill workers and vehicle mechanics that have been in continuous employment for at least 1 year were those eligible for the study while those excluded from the study population were people with history of chronic respiratory diseases prior to being employed as well as current or past smokers. Those excluded from the control were also people with history of chronic respiratory diseases, current or past smokers as well as people with past history of exposure to wood dust.

Sample size was calculated using the formula for comparing two independent proportions assuming an equal number for both study and control groups [22] and the calculated minimum sample size obtained for each group was 53 but 100 respondents were used per group to adjust for non–response and for convenience.

Multistage sampling technique was used to select respondents. Simple random sampling by balloting was first used to pick 7 sawmill sites and mechanic workshops from one of the senatorial districts, the study group (sawmill workers) were then selected by simple random sampling using the table of random numbers from the 7 sawmills. Mechanics were purposively selected from the mechanic workshops by matching them with the selected sawmill workers in terms of some socio-demographic characteristics which influence lung function such as sex, age and height (frequency matching).

Respondents were interviewed using a pre-tested semi structured questionnaire, a walk-through survey was also conducted in the sawmill industries using a check list guide to identify potential health hazards. An In-depth interview was conducted for 4 respondents (who did not participate in responding to the questionnaire) per chosen sawmill.

Peak Expiratory Flow (PEF) was measured with a mini-Wright's peak flow meter (with disposable mouth pieces) and recorded in litres/minute. Peak flow meter measures the degree of obstruction in the airways. The readings are higher when there is no obstruction in the airways and lower when the airways are constricted. [23] The PEF measurement was obtained in the upright sitting position and the highest of 3 readings per respondent was taken. [24] In addition to measurement of the PEF, the respiratory rates of respondents were also counted and the transverse diameter and anterior-posterior (AP) diameter of their

chest walls were measured using tape measure and recorded in centimetres. The transverse diameter was measured from one mid axillary line to the other using the nipples as landmark; while the AP diameter was measured from the sternum to the vertebral xyphoid process also using the nipple as landmark. AP to transverse diameter ratio greater than one (>1) signifies barrel shaped chest which may be seen in obstructive respiratory problems.

Data were analyzed using Statistical Package for Social Sciences (SPSS) version 16. Results were presented and demonstrated in summary frequency distribution tables, charts and graphs. Categorical variables were expressed in proportions and comparisons between the study and controls were done using z-test and chi-square. Whenever the expected cell frequencies were less than five, likelihood ratio chi-square was used for comparisons of the proportions. The arithmetic means of continuous variables of the study and control groups were compared using the t-test. Statistical significance was set at *P*-value less than 0.05 for all values of test statistic.

Responses from the In-depth interviews were transcribed to notes. Observations from walk-through survey were also transcribed and detailed content analysis was done.

Ethical clearance for the study was obtained from the LAUTECH Teaching Hospital, Osogbo Ethical Review Committee. Permission of the sawmill workers association and vehicle mechanic association, Osun State chapter was also taken before carrying out the study.

Reasons for the study were explained in details to the participants, participation was voluntary and verbal consent was obtained from each participant.

RESULTS

Questionnaire Survey

Respondents were within similar age groups, 66 (66%) and 62 (62%) of sawmill workers and mechanics respectively in the age group 20–39 years. Mean ages were 33.64 ± 11.01 years for sawmill workers and 33.14 ± 9.98 years for mechanics and their mean heights were 1.66 ± 0.06 metres (sawmill workers) and 1.67 ± 0.07 metres (mechanics). (Table 1)

Table 1 - Socio-demographic characteristics of sawmill workers and mechanics.

Variables	Sawmill workers (n = 100) Frequency (%)	Mechanic (n = 100) Frequency (%)	$\chi 2$	df	*P* value*
Religion					
Christianity	44 (44)	17 (17)	17.195	1	<0.001
Islam	56 (56)	83 (83)			
Height (m)**	1.662	1.673	1.19	1	0.234
Age (years)**	33.64	33.14	0.34	1	0.737
Age group (years)					
< 20	2 (2)	3 (3)			
20 – 39	66 (66)	62 (62)	0.459	4	0.795
≥40	32 (32)	35 (35)			
Marital Status					
Single	31 (31)	31 (31)			
Married	68 (68)	69 (69)	1.394	2	0.498
Separated	1 (1)	0 (0)			
Educational Level					
None/Incomplete primary	4 (4)	1 (1)			
Primary	28 (28)	55 (55)			
Secondary	54 (54)	44 (44)	31.303	4	<0.001
Technical/Diploma	12 (12)	0 (0)			
First degree	2 (2)	0 (0)			

**P* values less than 0.05 are statistically significant
**mean values with t statistic

Respondents' frequency of usage of personal protective equipment (PPE) was enquired. The only PPE used always by some sawmill workers were facemask, gloves and goggle by 2 (2%), 5 (5%) and 10 (10%) respondents respectively. (Table 2)

Table 2 – Reported frequency of usage of personal protective equipment among sawmill workers.

Personal protective device	Always Frequency (%)	Occasionally Frequency (%)	Never Frequency (%)
Facemask (n = 100)	2 (2.0)	24 (24.0)	74 (74.0)
Ear muffs (n = 100)	0 (0.0)	0 (0.0)	100 (100.0)
Boot (n = 100)	0 (0.0)	4 (4.0)	96 (96.0)
Gloves (n = 100)	5 (5.0)	20 (20.0)	75 (75.0)
Goggle (n = 100)	10 (10.0)	17 (17.0)	73 (73.0)
Helmet (n = 100)	0 (0.0)	2 (2.0)	98 (98.0)
Overall clothing (n = 100)	0 (0.0)	0 (0.0)	100 (100.0)

Table 3 shows what sawmill workers considered as hazard in sawmill and how these hazards constitute problems. Almost all of them [96 (96%)] considered wood dust as hazardous, among these 26 (27.1%) considered respiratory problems could result from inhalation of the wood dust, 4 (4.2%) said it could cause red eyes and 66 (68.7%) said it could cause both respiratory problems from inhalation as well as red eyes.

Table 3 – Sawmillers' perceptions of possible hazards in their workplace.

Variable	Frequency	%
Consider **Noise** as Hazard (n=100)	57	57.0
Can cause hearing defect (n=57)	39	68.5
Can cause distraction and facilitate injury (n=57)	8	14.0
Can cause both hearing defect and distraction (n=57)	10	17.5
Consider **Heat** as Hazard (n=100)	23	23.0
Can cause heat exhaustion (n=23)	11	47.8
Can cause excess sweat and thirst (n=23)	12	52.2
Consider **Chemical** as Hazard (n=100)	12	12.0
Through inhalation (n=12)	8	66.7
By mistaken ingestion (n=12)	4	33.3
Consider **Wood dust** as Hazard (n=100)	96	96.0
Can cause respiratory problems through inhalation (n=96)	26	27.1
Can cause red eye (n=96)	4	4.2
Both respiratory problems and red eye (n=96)	66	68.7
Consider **Fire** as Hazard (n=100)	56	56.0
Through burning of Wood dust (which is combustible) (n=56)	56	100.0
Consider **Machine** as Hazard (n=100)	90	90.0
Can cause cut/laceration/bruises (n=90)	72	80.0
Small machines can fall on limbs (n=90)	2	2.2
Can be from both cut/laceration/bruises and machine fall (n=90)	10	11.1
Can be from both cut/laceration/bruises and electric shock (n=90)	6	6.7
Consider **Electrical fault** as Hazard (n=100)	78	78.0
From exposed electric wire (n=78)	72	92.3
From machine (n=78)	6	7.7
Consider **Manual lifting of heavy objects** as Hazard (n=100)	86	86.0
Can fall on limbs (n=86)	22	25.6
Can cause chest pain (n=86)	11	12.8
Can cause back pain (n=86)	4	4.6
Can cause general body pains (n=86)	49	57.0
Consider **Snake bite** as Hazard (n=100)	17	17.0
Can be from trees from the bush (n=17)	2	11.8
Can be from the sawmill yard (n=17)	4	23.5
Can be from either trees from the bush or sawmill yard (n=17)	11	64.7
Consider **Insect bite/bee sting** as Hazard (n=100)	23	23
Can be from trees from the bush (n=23)	2	8.7
Can be from the sawmill yard (n=23)	4	17.4
Can be from either trees from the bush or sawmill yard (n=23)	17	73.9

Fifty seven (57%) respondents also considered noise as hazardous and 39 (68.5%) among the fifty seven said the noise could cause hearing defect, 8 (14%) said it could cause distraction and thus facilitate injuries while 10 (17.5%) said noise could result in hearing defect as well as cause distraction. Ninety (90%), 86 (86%) and 78 (78%) respondents also considered machines, manual lifting of heavy objects and electrical fault respectively as hazardous.

Table 4 shows comparison between sawmillers and mechanics' perception of possible injuries/illnesses at their workplaces. They all (100%) reported that bruises and lacerations can occur. Sawmill workers said the bruises and lacerations could be from machine injuries, wood logs and planks, while mechanics said they could occur from contacts with vehicle parts. Sixty nine percent of sawmillers and 10% of mechanics reported that sprain could occur, this difference was statistically significant ($z = 8.39$, $P < 0.001$). There was also minimal significant difference ($z = 1.99$, $P = 0.046$) concerning fracture as 52% of sawmillers and 37% of mechanics respectively reported that fracture could occur in their workplaces. Among the sawmillers, 29% reported fainting attack, 48% burns, 76% electric shock, 47% hearing impairment and only 8% reported mental/depressive illness could result from sawmill work. On the other hand 11% of mechanics reported fainting attack, 66% reported burns, 44% electric shock and none reported hearing impairment or mental/depressive illness could occur in their occupation.

Table 4 – Respondents' perceptions of possible health problems associated with their occupation

Variable	Sawmillers Frequency (%)	Mechanics Frequency (%)	z	*P* -value*
Bruises (n=100)	100 (100.0)	100 (100.0)		
From machines parts/vehicle parts (n=100)	40 (40.0)	100 (100.0)		
From wood logs (n=100)	3 (3.0)			
From sawn planks (n=100)	10 (10.0)			
From both wood logs and planks (n=100)	47 (47.0)			
Sprain (n=100)	69 (69.0)	10 (10.0)	8.39	<0.001
From machine fall on body part (n=69)	31 (45.1)			
From wood log fall on body part (n=69)	38 (54.9)			
Vehicle engine fall (n=10)		10 (100.0)		
Laceration (n=100)	100 (100.0)	100 (100.0)		
From machine/vehicle blades/parts (n=100)	42 (42.0)	100 (100.0)		
From sharp edges of wood log (n=100)	2 (2.0)			
From sharp edges of sawn planks (n=100)	11 (11.0)			
From either machine, wood log and planks (n=100)	45 (45.0)			
Fracture (n=100)	52 (52.0)	37 (37.0)	1.99	0.046
From machine fall on limbs (n=52)	8 (15.4)			
From wood log fall on limbs (n=52)	44 (84.6)			
Vehicle engine's fall on limbs (n=37)		37 (100.0)		
Fainting attack (n=100)	29 (29.0)	11 (11.0)	3.01	0.003
From not eating well/at all before work (n=29)	10 (34.5)	11 (11.0)		
Due to existing underlying illness (n=29)	10 (34.5)			
Due to overwork (n=29)	9 (31.0)			
Burns (n=100)	48 (48.0)	66 (66.0)	2.43	0.015
Due to fire from wood dust combustion (n=48)	48 (100.0)			
Vehicle engine/wire system (n=66)		66 (100.0)		
Electric shock (n=100)	76 (76.0)	44 (44.0)	4.47	<0.001
Due to electrical fault (n=76)	12 (15.8)	44 (44.0)		
Careless contact with naked electric wire (n=76)	64 (84.2)			
Hearing impairment (n=100)	47 (47.0)	0 (0.0)	7.67	<0.001
Due to persistent exposure to machine noise (n=47)	47 (100.0)			
Mental/Depressive illness (n=100)	8 (8.0)	0 (0.0)	2.53	0.012
Due to poor remuneration (n=8)	8 (100.0)			

*P value less than 0.05 are statistically significant

Table 5 shows one month prevalence of injuries and illnesses among sawmill workers compared with that of vehicle mechanics. More sawmill workers were significantly ($P < 0.001$) found to have cough (53%), phlegm production (39%) and Red eyes (60%) than the mechanics (23% for cough, 10% for phlegm production and 11% for Red eyes). Prevalence of sneezing was also found to be significantly ($P = 0.016$) higher among sawmill workers (54%) than mechanics (36%). None of the mechanics reported they had wheeze, chest pain, chest tightness and skin problems while 11%, 29%, 8% and 8% of sawmill workers had wheeze, chest pain, chest tightness and skin problems respectively, an observation that was statistically significant. There was also no significant difference in the prevalence of bruises and lacerations among the two groups; although more sawmill workers (31% and 34%) had bruises and lacerations than the mechanics (23% each). None of the mechanics had fainting attack, hearing impairment and mental/depressive illness, while 2% each of the sawmill workers had these injuries/illnesses. The differences were however not significant ($P = 0.477$). None of the mechanics also had dizziness from heat exhaustion, electric shock and bee sting, but the corresponding prevalence for these injuries among sawmill workers was 6%, 14% and 8% respectively. The differences were statistically significant. There was also significant difference ($P = 0.021$) in the prevalence of burns injury as 7% of the mechanics had it, while none of the sawmill workers had it.

Table 5 - One month prevalence of some injuries and illnesses among respondents

Variable	Sawmill workers Frequency % n=100	Mechanics Frequency % n=100	z	*P* value*
Cough	53 (53.0)	23 (23.0)	4.22	<0.001
Phlegm production	39 (39.0)	10 (10.0)	4.60	<0.001
Have wheeze	11 (11.0)	0 (0.0)	3.10	0.002
Chest pain	29 (29.0)	0 (0.0)	5.62	<0.001
Chest tightness	8 (8.0)	0 (0.0)	2.53	0.012
Shortness of breath	2 (2.0)	0 (0.0)	0.71	0.477
Sneezing	54 (54.0)	36 (36.0)	2.42	0.016
Skin problem	8 (8.0)	0 (0.0)	2.53	0.012
Eye problem/Red eye(s)	60 (60.0)	11 (11.0)	7.09	<0.001
Bruise	31 (31.0)	23 (23.0)	1.11	0.265
Sprain	5 (5.0)	0 (0.0)	1.81	0.070
Laceration	34 (34.0)	23 (23.0)	1.57	0.117
Fracture	0 (0.0)	0 (0.0)	–	–
Dizziness from heat	6 (6.0)	0 (0.0)	2.07	0.038
Fainting attack	2 (2.0)	0 (0.0)	0.71	0.477
Burns	0 (0.0)	7 (7.0)	2.31	0.021
Electric shock	14 (14.0)	0 (0.0)	3.60	<0.001
Hearing impairment	2 (2.0)	0 (0.0)	0.71	0.477
Insect bite/bee sting	8 (8.0)	0 (0.0)	2.53	0.012
Mental/Depressive illness	2 (2.0)	0 (0.0)	0.71	0.477

*P values less than 0.05 are statistically significant

There were statistically significant differences in the mean values of the PEF (332.6 ± 66.23 for sawmill workers and 488.7 ± 60.23 litres/min for mechanics), respiratory rates (19.68 ± 2.31 for sawmill workers and 18.00 ± 1.35 for mechanics) and anterior-posterior to transverse diameter of chest ratios (1.01 ± 0.06 for sawmill workers and 0.99 ± 0.04 for mechanics) (Table 6).

Table 6 - Mean respiratory functions of sawmill workers and mechanics

Variable	Sawmill workers	Mechanics	t	*P* value*
	Mean (95% C.I***)	Mean (95% C.I***)		
PEF (litres/min)****	332.6 (316.4 – 347.1)	488.7 (476.2 – 495.4)	17.44	<0.001
Respiratory rate (breaths/min)	19.68 (19.22 – 20.14)	18.00 (17.73 – 18.27)	6.274	<0.001
A-P to transverse ratio of chest**	1.06 (0.99 – 1.02)	0.99 (0.98 – 0.99)	3.038	0.003

**P* values less than 0.05 are statistically significant
**Anterior-Posterior to Transverse diameter ratio of chest
***95% Confidence Interval for mean
****Peak expiratory flow

Observations (Walk-through Survey)

General Appearance

A major risk factor easily noticeable in most of the seven sawmills visited was the lack of order and dirty environment. Wood logs and planks were kept in such ways that they could disrupt easy movement. The workshops where the milling machines were placed were made of open shed, thus giving adequate illumination for workers. There were no designated or marked walk ways underneath these sheds and workers were at risk of mistakenly being injured by stacks of planks or even machines. The ground areas under the logs and planks were hard and flat enough to bear their weights, but some of these planks were not properly stacked and could easily fall. Another observation was that none of the mills visited loaded their logs to the saw table mechanically, the workers constitute themselves to conveyors, rolling, pushing and jacking the heavy logs to the saw tables.

Sanitation

On site observation also revealed that environmental sanitation was not taken seriously, none of the mills had toilets and washing facility. Only 2 (28.6%) of the 7 sawmills had designated waste dump sites for burning, others heaped their wood wastes for local food vendors and livestock farmers to come and pack for their own use, and in cases where the wood waste exceeded what was needed by these packers, the sawmill workers packed it together and burnt it within the open spaces in the sawmill. None of the sawmills visited had designated cloak rooms, food canteen and any recreation or games facilities, one however had a mini shed built with iron roofing sheet suspended by four poles on cemented floor which served as mosque for praying.

Machine and other Safety Measures

All the machines, although old looking had safety guards in place, but only 1 sawmill had a properly closed electric board switch, others had theirs exposed. Many of the machine operators were also observed not to have adequate working space because of the disorderliness around. None of the sawmills had fire extinguishers and first aid boxes.

In-Depth Interview

All the respondents interviewed identified wood dust and the machines as potential hazards. Many of them also said manual lifting of logs constitute a hazard. Few respondents mentioned noise and electricity shock as hazard.

In one of the sawmills, a worker said although noise could be a hazard in sawmills, they are already used to it, he stated thus:

"This work/job is a noisy type of work because the machines used are the noisy type, but we are used to it and we do not believe it can cause any problem for us"

A couple of respondents also said the chemicals used while repairing/melting saws could constitute a hazard if mistakenly ingested.

Lacerations/cuts and bruises, especially to the hand were the most

common health problems/injuries acknowledged by all respondents interviewed. These they said could be from machine saw blades, wood log, and plank splinters.

"Cutting/lacerating our fingers/hands here is a normal thing that happens almost every day; in fact I just got a cut on my right thumb from wood splinters while stacking planks yesterday"

"Even if I do not come to work in a day and I am asked about what injury is likely to occur at work, I can boldly say someone must have had a cut/laceration"

These are comments of two respondents from different sawmills.

Three respondents, two from the same sawmill and the third from another also said the small circular machine if not properly fixed could fall on workers limbs causing fracture or crush injury. Wood dust getting into the eyes, thus causing red eye is the effect of wood dust mentioned by many of the respondents that identified wood dust as hazard, some also said inhalation of the dust and even some species of wood logs could cause sneezing/running nose and cough.

"There is a particular specie of tree, once it is brought to the sawmill, we will all start sneezing"

Electric shock from mistakenly touching naked wire while switching on the machine or while removing saw blade from the machine was also mentioned.

When asked about hazard prevention in sawmills, all respondents said being cautious on the part of the workers is the major way of preventing the hazard. Some also believed that use of personal protective equipment (PPE) can help to prevent the hazards. They want their employers to provide them with durable PPE.

"Some of us were once given gloves, but mine did not last more than a week, it got turn into pieces because the material is not durable"

DISCUSSION

Most sawmill workers are usually males and in the active age group due to the demands of the work; a study carried out in Kenya had more than ninety five percent of his respondents to be males. [25] This study's respondents were all males, with about sixty percent of them in the active age group. Most sawmills in Nigeria are small scaled, [1,19] and this was reflected in this study based on the number of workers per mill. [26] The impact of sicknesses and accidents is greater for small businesses or organisations compared to large industries; loss of or the temporary unfitness of one employee will have an appreciable effect on the productivity and efficiency of the organisation.

Reported usage of PPE was very low with the highest users being those using goggle and they were just a tenth of the sawmill workers. Osagbemi *et al*'s study also revealed very low usages of PPE among sawmill workers. [9] Reasons given by respondents during the In-depth interview were non-availability because the employers rarely provided them and when provided, they are not durable. This is in agreement with previous studies that have reported similar findings. [9,24,27] Provision of right and durable PPE is the responsibility of employers. [28]

Wood dust had been reported as a major hazard of sawmills, [29-31] this probably accounts for wood dust as the most perceived hazard by almost all of the sawmill workers in this study. The questionnaire survey as well as interviews revealed wood dust as a well known hazard among respondents. All the respondents that acknowledged wood dust as hazardous knew that its inhalation could cause cough, phlegm production, wheeze, dyspnoea and

sneezing/running nose as well as irritate the skin and eyes, a finding similar to previous studies. [11,12,29,30,32,33]

Nine of every ten respondents also perceived machine as hazard, a higher number than the ones obtained in a previous study, [9] the difference may be due to increased knowledge of sawmill workers about machine with time. The belief was that machine could cause cuts, lacerations and bruises. Various injuries from machines which ranged from minor accident to fatal trauma as well as vibration had been reported. [2,9,34]

About one-fifth of the sawmillers said chemical could constitute hazard in sawmills and less than one-fifth perceived heat as hazard. The low perception is similar to what obtained in a study in North central part of Nigeria. [9] Awareness of these two hazards was low compared to awareness of wood dust and machine. Just two respondents mentioned chemicals as constituting hazards in the In-depth interviews. The possibility of chemical hazard resulting from chemical emissions from exposed surfaces of some wood species had however been documented [2,6] some chemicals such as arsenic and chromium compounds used as wood preservatives have also been found to constitute hazard. [30]

Sawmill machines are very noisy, although noise level was not measured; my observation was that verbal communication during operation of the machines was almost impossible. Reports had it that noise level in wood industries could be up to 85 dB or more, [35] a level which is known to contribute significantly to occupational injuries. [36] In spite of this, only a little above half of the respondents were aware that noise poses a hazard in sawmills. Previous studies also reported lower percentages [9] and unsatisfactory knowledge and attitude of sawmill workers about noise. [37] The perception gotten from the questionnaire was also reflected in the interviews, as few respondents acknowledged noise as hazard. This finding may be due to the fact that hearing loss is not a dramatic life threatening illness or injury, it occurs gradually, insidiously and has uncertain time course. The process of hearing impairment is gradual[38] and people who developed noise induced hearing loss (NIHL) are usually unaware their hearing are affected until the loss are quite significant. [37]

Lots of manual handling were observed in all the sawmill sites visited, this was also pointed out by Aruofor, [4] and more than four-fifth of the respondents in this study perceived manual lifting of heavy objects as hazardous. Fracture, sprain, body pains, and chest pain were all reported as consequences of manually carrying heavy objects, an observation comparable with previous studies that talked about ergonomic hazards. [2,4] The transportation of log to milling table manually which was observed during the walk-through survey constitutes a major hazard and mechanizing this procedure will go a long way in reducing injuries in sawmills.

Respondents that perceived electricity which could cause electric shock as hazards in this study were almost 8 out of 10, although high, it is lower than what was found in an Ilorin study where all the respondents perceived electric shock as hazardous. [9] The nonchalant attitude of workers to electric shock was also observed, as all but one of the sawmill sites has properly sealed electric switch board, the electric boards all have their cut-outs, wires and fittings carelessly and dangerously exposed. About half of the respondents also perceived fire as hazard, and they said it could be from burning wood dust/shavings, thus causing burns injury. Sawmill sites visited in this study were observed to

carelessly heap wood dust/shavings in open spaces. Accumulated wood dust particles are easily combustible and can cause fire explosion. [8]

Less than a tenth of the respondents acknowledged psychological hazard which could lead to mental impairment/depressive illness in sawmills. Poor psychosocial conditions had been reported to increase the risk of both attempted and completed suicide. [18] About a fifth of respondents also perceived snake bite, insect bite and bee sting as a form of (biological) hazard. These are less documented hazards.

This study also compared one month prevalence of some injuries and illnesses of sawmill workers with controls. Sawmill workers all had respiratory symptoms to be higher among them than in the controls as observed in previous studies. [11,12,29,32,39] Cough and sneezing/running nose were parts of the most prevalent symptoms among respondents. Ige and Onadeko also reported cough and running nose as the most prevalent pulmonary symptoms in their study. [12] Fatusi and Erhabor reported cough as one of the most prevalent pulmonary symptoms too. [11] Other prevalent pulmonary symptoms reported in past studies were sputum/phlegm production [11,29] and chest pain. [11] Almost a third of the sawmillers in this study had chest pain and about one tenth had wheeze while none of the controls had these symptoms. The prevalence of conjunctivitis was also high among the study group with 6 out of 10 of them reporting it, while only 1 out of 10 mechanics had it. About one tenth of sawmill workers in this study also reported dermatitis, none in the mechanics. Half of the sawmillers had cough and sneezing while only one fifth and one third of mechanic respectively had them. The mean PEF of respondents was also lower than the control in spite of no differences in their mean ages and heights, similar to the Ugheoke *et al*'s study in Benin. [29] The mean values of respiratory rates and anterior-posterior to transverse diameter ratio of chest of the respondents were also found to be more than that of the controls, all these are in agreement with previous studies [11,12,29] thus emphasizing the deleterious effect of wood dust on pulmonary function.

A dominance of bruises and lacerations were found to have been experienced by the sawmillers. The finding is similar to an Ilorin study which reported minor accidents that resulted into bruises and cuts as the most common health problems experienced by sawmill workers. [9] Machine saws, failure to switch off machine during maintenance or attempts to remove jams, falls due to heavy lifting and repetitive movements had all been shown to cause these injuries. [2,17] Interestingly, a sizeable proportion of the mechanics too had bruises and lacerations. This is not surprising as such injuries have been found to be prevalent among vehicle mechanics too. [40,40]

Almost one–sixth had electric shock, a finding different from a previous study where none of the respondents had electric shock. [9] The past study pointed out that all the respondents perceived electric shock as a hazard, thus indicating that they were probably more careful. [9]

Less than a tenth of the respondents had dizziness from heat exhaustion as well as bee sting. Although the machines were usually operated under sheds, they were exhaling so much heat that made operators sweat profusely sometimes. Only two respondents each had fainting attacks, hearing impairment and depressive illnesses. The prevalence, even though low, they all could result in loss of manpower. None of the controls however had fainting attack, dizziness from heat exhaustion, hearing impairment as well as depressive illness.

Fatusi and Erhabor similarly reported more sawmill workers having hearing difficulties than controls. [11] It is also important to know that noise induced hearing impairment are unfortunately irreversible. [37]

CONCLUSION

This study concluded that sawmill workers' perception about wood dust and machine as hazards was high but usage of PPE was however very low. The most common injuries and illnesses in sawmills were bruises, lacerations, cough, conjunctivitis and sneezing. The study also showed that sawmill workers have higher prevalence of respiratory symptoms and reduced pulmonary function due to exposure to wood dust compared with non exposed population. Measures should therefore be put in place to mitigate against these hazards in sawmills, especially by the employers. There should be dust control at the milling sites as well as provision of PPE for workers.

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Contribution of authors: This work was carried out by all authors. "Author AOA" designed concept of study, wrote the protocol, did the literature search and led the team in data collection. "Author AAA" was involved in literature search, data acquisition, data and statistical analysis. "Authors AOL and OAI" were involved in data analysis, manuscript preparation and manuscript editing. "Author AST" was also involved in manuscript editing as well as manuscript review.

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