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Risk Perception Assessment for Sawmill workers in Benin Metropolis, Edo State, Southern Nigeria.

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Abstract

Sawmills are a common site especially in developing countries and studies suggest that this practice comes with attendant health risks. This study seeks to assess the risk perception of air quality around sawmills in Benin Metropolis, Edo State, Southern Nigeria. The study relied primarily on the administration of questionnaires. A total of 150 structured questionnaires were administered to workers in the three major sawmills in Benin City. Data analysis was done using Statistical Package for Social Science (SPSS) version 16.0. Statistical tools such as frequency, percentage, and Chi-square were also used to analyze relevant variables. 95% confidence level, a P<0.05 was considered statistically significant for the study. Results from the study revealed that the majority (82%) of respondents were males; the majority (30%) were between the ages of 51 and 60; and the majority (34%) had worked in sawmills for ten years or more. Findings from the study revealed that headache, catarrh, bronchitis and eye irritation were the most prevalent health risks amongst sawmill workers indicative of poor air quality. The study also revealed that though the air quality around sawmill is polluted sawmill workers have low adaptive capacity toward associated risks. Furthermore, other health risks reported by workers include asthma, chest pain, throat irritation, eczema, sneezing and coughs. The study concludes that sawmill workers in Benin City need more information about the dangers of inhaling polluted air as well as the need for adequate use of personal protective equipment.

Keywords: *Risk perception, Sawmill, Air quality, Health.*

1. Introduction

It is documented knowledge that the sawmill environment can cause health hazards for sawmill workers, and there is sufficient evidence that exposure to air pollution has negative effects on health (Faremi et al., 2014; Héroux et al., 2015; Raimi et al., 2018; Rückerl et al., 2011). Sawmill workers belong to a group of workers who are often exposed to many health risks in the workplace (Odibo et al., 2018). Natural and anthropogenic activities both contribute to air pollution around sawmill locations; however, anthropogenic activities such as emissions from sawmills and sawdust burning have contributed to an increase in air pollution (Odunaike et al., 2008, EPA South Australia, 2001). Health-related issues such as coughing, difficulty breathing, nasal irritations, throat irritations, itching of the eyes, sneezing, and asthma have been reported among sawmill workers (Raimi et al., 2020; Vallieres et al., 2015).

It has been reported that sawmill workers are exposed to a high level of wood dust and other air pollutants such as carbon (IV) oxide, oxides of nitrogen, and sulfur due to inadequate control measures, poor awareness of occupational hazards, and poor availability and use of protective equipment (Adeoye et al., 2014; Agu et al., 2016). Despite the potentially hazardous nature of the sawmill workplace, little attention has been given to the worker's health and safety in Benin City. It is therefore pertinent to carry out a risk perception assessment of air quality around sawmills to support or oppose existing literature.

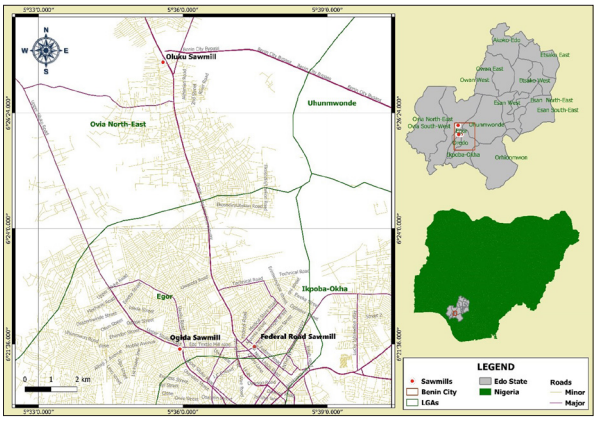

Figure 1. Location map showing the study area.

2. Materials and Methods

2.1. Study Area

The study was conducted in Benin City, the capital of Edo state, at latitude 6° 20' 5.95" N and longitude 5° 36' 13.49" E (Dimuna and Olotuah, 2020). Benin City is located in the southern region of Nigeria. It is the capital of Edo State, and in 2022, it boasted a population of 1,841,000, making it one of the largest cities in Nigeria. It is approximately 40 kilometers north of the Benin River and 320 kilometers by road east of Lagos State. The majority of the residents speak Bini language. The population is largely made up of Christians, Muslims, and traditional African worshippers.

The study was typically limited to three major sawmill sites because they host approximately 95% of wood milling

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in the metropolis. They are precisely Federal sawmill, Oluku sawmill and Ogida sawmill. Federal sawmill was established at Oredo Local Government Area which is 2 km North East from the center of the city. Ogida sawmill was established at Egor Local Government Area, which is 1.5 km north-east from the center of the city, and Oluku sawmill was established at Ovai North East Local Government Area which is 5 km north-east (Ediagbonya et al., 2013).

2.2 Data Type and Data Source

For the purpose of achieving the research aim, data were collected from primary field study. The primary data was collected by administering questionnaire at the three (3) study sites (Federal Sawmill, Ogida Sawmill, and Oluku Sawmill).

2.3 Method of Data Collection

Data were collected through the administration of a comprehensive and well-structured questionnaire. The questionnaire contained structured questions adopting the Likert scale method, whereby respondents answered on a scale of strongly agree (SD), agree (A), disagree (D), and strongly disagree (SD). The questionnaires were administered to workers at the various sawmills. The information obtained from the respondents was divided into two sections: section one included demographic characteristics (sex, age, period of work); section two included the certainty of air pollution, adaptive capacity, and health risks that are associated with sawmilling activities. The questionnaires were administered randomly to workers in the three selected sawmills; a total of 150 questionnaires were administered, and 150 were completed, giving a completion rate of 100 percent.

2.4 Method of Data Analysis

Data analysis for this study was done with Microsoft Excel 2018 and Statistical Package for Social Science (SPSS) version 16.0. Questionnaire survey data about the certainty of air pollution, adaptive capacity, and health risk were analyzed using descriptive statistics, which were used to obtain frequency and percentages. While chi square (X^2) techniques was used to test for relationship between certainty of air pollution, adaptive capacity and health risk within sawmill workers in the study site with Statistical Package for Social Science (SPSS) 16.0 version. Descriptive statistics like tables and figures were used in the study to describe the sociodemographic characteristics of the sampled sawmill workers and to examine risk perception. A five percent level of $p > 0.05$, there is no significant differences and when $p<0.05$, there is significant relationship. The gathered data were analyzed, and the results were presented using tables to draw conclusions in relation to the research.

3. Results

3.1 Demographic characteristics of respondent

Table 1 shows the gender distribution of the respondents. The trends observed show that the highest number of workers are male (82%), and the lowest number are female (18%). Using the chi square goodness of fit, there was a very high significant difference ($p< 0.001$) between the ages of respondents in the study area.

The trend also shows in Table 1 that respondents aged 18–20 years made up 4% of the 150 respondents. The highest was seen in respondents within the age range of 51–60 years, which makes up 30% of respondents, while the age of respondents from 41–50 years was 22.7%, those who fell between 31–40 years were 34.7%, and the age of respondents from 21–24 years was 10.7%, as seen in table 1. Using the chi-square goodness of fit, there was a very high significant difference ($p< 0.001$) between the ages of respondents in the study area.

The variation observed in the frequency counts of workers who have worked in sawmills, as seen in Table 1 shows that workers aged 10 years and older are the most numerous (34%), while workers aged 4 to 6 years are the least numerous (9.3%). Workers between 1 month and 2 years recorded 28.7%, workers between 2 and 4 years recorded 18%, and workers between 6 and 8 years recorded 10%. Using the chi square goodness of fit, there was a very high significant difference ($p<0.001$) between the years of working experience.

Table 1. Demographic characteristics of the respondent

		Egor LGA	Oredo LGA	Ovia Northeast LGA	Frequency	Percentage	
		Ogida Sawmill	Federal Sawmill	Oluku Sawmill	n=150	%	p-value
Sex	MALE	44	39	40	123[a]	82.0	p<0.01
	FEMALE	6	11	10	27[b]	18.0	
Age Range	18 -20	4	2	0	6[d]	4.0	
	21- 24	8	3	5	16[c]	10.7	
	25-30	4	2	6	12[c]	8.0	p<0.01
	31-40	9	19	9	37[b]	24.7	
	41-50	8	15	11	34[b]	22.7	
	51-60	17	9	19	45[a]	30.0	
Work Experience	1month to – 2 years	13	18	12	43[a]	28.7	
	2 – 4 years	8	11	8	27[b]	18.0	
	4-6 years	5	3	6	14[c]	9.3	p<0.01
	6-8 years	2	8	5	15[c]	10.0	
	10 years and above	22	10	19	51[a]	34.0	

No significant difference ($p > 0.05$), *$p < 0.05$ (significant difference) **$p < 0.01$ (highly significant difference)
***$p<0.001$ (very high significant difference)
Note: Similar letters (superscripts) indicate values that are not significantly different from each other ($P>0.05$)

3.1.2 Certainty of air pollution around sawmill

Table 2 shows the certainty of air pollution around the study area. This section consists of a total of eight (8) questions. The first question (Q1) was on the dusty environment around the sawmill. The highest frequency count of respondents who agreed on the dusty environment around sawmills was 72.7%, followed by respondents who strongly agreed with a percentage of 22%, respondents who disagreed with a percentage of 5.3%, and respondents who strongly disagreed that sawmill environments get dusty during working processes had a percentage of 0%. Using the chi square goodness of fit, there was a very high significant difference ($p<0.001$) between respondents on the dusty environment around sawmill.

The second question (Q2) was on the intensity of emission of dust during work hours. The highest frequency counts of respondents who agreed that the dust produced during work hours is intense had a percentage of 64.7%, followed by respondents who strongly agreed with a percentage of 22%, respondents who disagreed with a percentage of 13.3%, and respondents who strongly disagreed with a percentage of 0%. Using the chi square goodness of fit, there was a very high significant difference ($p<0.001$) between respondents on the intensity of dust produced during work hours.

The third question (Q3) was to ascertain if the sawdust stuck to the bodies of workers during working hours. The highest frequency counts of respondents who agreed that the sawdust stuck to their bodies during working periods had a percentage of 69.3%, followed by respondents who strongly agreed with a percentage of 23.3%, respondents who disagreed with a percentage of 7.3%, and respondents who strongly disagreed with a percentage of 0%. Using the chi square goodness of fit, there was a very high significant difference ($p<0.001$) between respondents on sawdust sticking to their bodies.

The fourth question (Q4) was to assess if workers were aware of the health implications of sawdust/particulate. The trend observed shows that 60% of respondents were aware that sawdust or other particles, when inhaled, cause health risks. Respondents who strongly agreed had a percentage of 30.7%; respondents who disagreed had a percentage of 9.3%; and respondents who strongly disagreed had a percentage of 0%. Using the chi square goodness of fit, there was a very high significant difference ($p<0.001$) between respondents on the health implications of inhaling sawdust or other particles from sawmill processes.

The fifth question (Q5) was enquiry on whether sawmill machines require diesel or fuel for operation. The highest frequency counts of respondents who agreed that sawmill machines require diesel or fuel to operate had a percentage of 76.7%, followed by respondents who strongly agreed with a percentage of 23.3%, and respondents who disagreed with a percentage of 0%. Using the chi square goodness of fit, there was a very high significant difference ($p<0.001$) between respondents.

The sixth question (Q6) was to assess if the sawmill machine or generator emits gases or smoke during operation. The highest frequency counts of respondents who agreed that sawmill machines emit smoke or gases during operation had a percentage of 76%, followed by respondents who strongly agreed with a percentage of 17.3%, respondents who disagreed with a percentage of 6.7%, and respondents who strongly disagreed with a percentage of 0%. Using the chi-square goodness of fit, there was a very high significant difference ($p<0.001$) between respondents on dust or gases emitted from sawmill machines or generators.

The seventh question (Q7) was to ascertain if the smoke or gases emitted during work hours are high. The highest frequency counts of respondents who agreed that the smoke or gases were high had a percentage of 44.7%, followed by respondents who strongly agreed with a percentage of 12.7%, respondents who disagreed with a percentage of 40.7%, and respondents who strongly disagreed with a percentage of 0%. Using the chi-square goodness of fit, there was a very high significant difference ($p<0.001$) between respondents on the high emission of smoke during work hours.

The eighth question (Q8) was to ascertain if temperature increased significantly around the work environment. The highest frequency counts of respondents who agreed that temperature increased during work had a percentage of 55.3%, followed by respondents who strongly agreed with a percentage of 12.7%, respondents who disagreed with a percentage of 32.7%, and respondents who strongly disagreed with a percentage of 0%. Using the chi-square goodness of fit, there was a very high significant difference ($p<0.001$) between respondents on increased temperature during work hours.

Table 2. Certainty of air pollution around sawmill.

Questions	Response	Egor LGA (Ogida Sawmill)	Oredo LGA (Federal Sawmill)	Ovia Northeast LGA (Oluku Sawmill)	Frequency n=150	Percentage %	p-value
Q1. The work environment gets dusty during working hours	SA	14	9	10	33[b]	22.0	p<0.01
	A	32	38	39	109[a]	72.7	
	D	4	3	1	8[c]	5.3	
	SD	0	0	0	0	0.0	
Q2. The quantity of dust particles produce during work hours is intense	SA	16	9	8	33[b]	22.0	p<0.01
	A	28	36	33	97[a]	64.7	
	D	6	5	9	20[b]	13.3	
	SD	0	0	0	0	0.0	
Q3. Particles/sawdust stick to the body during the working process	SA	15	11	9	35[b]	23.3	p<0.01
	A	31	39	34	104[a]	69.3	
	SD	4	0	7	11[c]	7.3	
	D	0	0	0	0	0.0	
Q4. Particles/sawdust when inhaled causes risk to health	SA	20	12	14	46[b]	30.7	p<0.01
	A	16	38	36	90[a]	60.0	
	D	14	0	0	14[c]	9.3	
	SD	0	0	0	0	0.0	
Q5. The sawmill machine requires diesel/fuel to operate	SA	15	11	9	35[b]	23.3	p<0.01
	A	35	39	41	115[a]	76.7	
	D	0	0	0	0	0.0	
	SD	0	0	0	0	0.0	
Q6. There is the release of smoke/gases during the operation of sawmill machines	SA	10	9	7	26[b]	17.3	p<0.01
	A	36	40	38	114[a]	76.0	
	D	4	1	5	10[c]	6.7	
	SD	0	0	0	0	0.0	
Q7. The degree of smoke released during the working period is high	SA	10	6	6	22[b]	14.7	p<0.01
	A	22	24	21	67[a]	44.7	
	D	18	20	23	61[a]	40.7	
	SD	0	0	0	0	0.0	
Q8. Temperature increases during work hours	SA	7	4	7	18[c]	12.0	p<0.01
	A	29	28	26	83[a]	55.3	
	D	14	18	17	49[b]	32.7	
	SD	0	0	0	0	0.0	

SA- Strongly Agree, A-Agree, D-Disagree, SD-Strongly Disagree, No significant difference (p> 0.05), *p < 0.05 (significant difference) **p < 0.01 (highly significant difference) ***p<0.001 (very high significant difference).

3.1.3 Adaptive capacity of sawmill workers

Table 3 shows the adaptive capacity of sawmill workers to protect themselves and improve their health while carrying out their daily activities. Question one (Q1) assessed workers' ability to afford personal protective equipment (PPE). The result shows that 66% of respondents agreed that they can afford to buy PPE, 17% strongly agreed, 17%. Disagreed, and 0% strongly disagreed. Using the chi-square goodness of fit, there was a very high significant difference (p<0.001) between respondents.

The result obtained from question two (Q2) shows that 68.7% agreed that sawmills as a wood processing industry can make PPE available for workers; 27.3% of the respondents strongly agreed to this, while 4% disagreed and 0% strongly disagreed. Using the chi square goodness of fit, there was a very high significant difference (p<0.001) between respondents.

The result obtained from question three (Q3) shows that 76% of respondents drink enough water to stay hydrated during working hours, 3% of respondents strongly agreed; 0.7% disagreed; and 0% strongly disagreed. Using the chi square goodness of fit, there was a very high significant difference (p<0.001) between respondents.

The result obtained from question four (Q4) shows that 77.3% of respondents take a shower and change into new clothes upon returning to their homes; 21.3% of respondents strongly agreed to taking their shower and changing into new clothes, while 1.3% disagreed and 0% strongly disagreed. Using the chi square goodness of fit, there was a very high significant difference (p<0.001) between respondents.

The result obtained from question five (Q5) shows that 61.3% of respondents eat fruits and supplements to improve their health; 3% of respondents strongly agreed to this, while

25.3% disagreed and 0%0 strongly disagreed. Using the chi square goodness of fit, there was a very high significant difference (p<0.001) between respondents.

The result of question six (Q6) shows that 69.3% of respondents think that air pollution is bad for health, 30.7% of respondents strongly agree, 0% of respondents don't agree, and 0% of respondents strongly disagree. Using the chi-square goodness of fit, there was a very high significant difference (p<0.001) between respondents.

Table 3. Adaptive capacity to air pollution

Questions	Response	Egor LGA (Ogida Sawmill)	Oredo LGA (Federal Sawmill)	Ovia Northeast LGA (Oluku Sawmill)	Frequency n=150	Percentage %	p-value
Q1. You have money to buy personal protective equipment to help reduce the risk of exposure to air pollutants	SA	10	6	10	26[b]	17.3	p<0.01
	A	34	37	28	99[a]	66	
	D	6	7	12	25[b]	16.7	
	SD	0	0	0	0	0	
Q2. The sawmill can help reduce the risk posed by coming in contact with air pollutants	SA	14	10	17	41[b]	27.3	p<0.01
	A	30	40	33	103[a]	68.7	
	SD	6	0	0	6[c]	4	
	D	0	0	0	0	0	
Q3. You drink enough water during the working period	SA	12	9	14	35[b]	23.3	p<0.01
	A	38	40	36	114[a]	76	
	D	0	1	0	1[c]	0.7	
	SD	0	0	0	0	0	
Q4. You take a shower and change into new cloths upon returning to your residence	SA	14	7	11	32[b]	21.3	p<0.01
	A	36	43	37	116[a]	77.3	
	D	0	0	2	2[c]	1.3	
	SD	0	0	0	0	0	
Q5. You eat fruits/ supplements to improve your health	SA	7	7	6	20[b]	13.3	p<0.01
	A	24	37	31	92[a]	61.3	
	D	19	6	13	38[b]	25.3	
	SD	0	0	0	0	0	
Q6. There is the negative impact of air pollution on health	SA	22	12	12	46[b]	30.7	p<0.01
	A	28	38	38	104[a]	69.3	
	D	0	0	0	0	0	
	SD	0	0	0	0	0	

SA- Strongly Agree, A-Agree, D-Disagree, SD-Strongly Disagree, No significant difference (p > 0.05), *p < 0.05 (significant difference) **p < 0.01 (highly significant difference) ***p<0.001 (very high significant difference)
Note: Similar letters (superscripts) indicate values that are not significantly different from each other (P>0.05)

3.1.4 Health risk perception of sawmill workers

Table 4 shows the variation observed in the frequency counts of the health risks experienced by sawmill workers. The highest frequency counts of respondents who agreed on having headache for question one (Q 1) had a percentage of 44%, followed by respondents who strongly agreed with a percentage of 24%, respondents who disagreed with a percentage of 32%, and respondents who strongly disagreed on having headache had a percentage of 0%. Using the chi-square goodness of fit, there was a very high significant difference (p<0.001) between respondents on having headache.

The highest frequency counts of respondents who agreed on having catarrh for question two (Q 2) had a percentage of 47.3%, followed by respondents who strongly agreed with a percentage of 35.3%, respondents who disagreed with a percentage of 17.3%, and respondents who strongly disagreed on having catarrh had a percentage of 0%. Using the chi-square goodness of fit, there was a very high significant difference (p<0.001) between respondents on had catarrh.

The highest frequency counts of respondents who agreed on having a cough for question three (Q 3) had a percentage of 35.3%, followed by respondents who strongly agreed with a percentage of 24%, respondents who disagreed with a high percentage of 40.7%, and respondents who strongly disagreed on having cough had a percentage of 0%. Using the chi square goodness of fit, there was a very high significant difference (p<0.001) between respondents on having cough.

The highest frequency counts of respondents who agreed on having chest pain for question four (Q 4) had a percentage of 30%, followed by respondents who strongly agreed with a percentage of 17.3%, Respondents who disagreed had a high percentage of 52.7%, while respondents who strongly disagreed on having chest pain had a percentage of 0%. Using the chi-square goodness of fit, there was a very high significant difference (p<0.001) between respondents having chest pain.

The highest frequency counts of respondents who strongly agreed on having a health challenge associated with bronchitis for question five (Q 5) had a percentage of 66%, followed by respondents who agreed with a percentage of 0.7%, respondents who disagreed with a high percentage of 30%, and respondents who strongly disagreed on having health challenges associated with coughing with a percentage of 3.3%. Using the chi square goodness of fit, there was a very high significant difference ($p<0.001$) between respondents on the health challenges associated with bronchitis.

The highest frequency counts of respondents who strongly agreed on having asthma for question six (Q 6) had a percentage of 7.3%, followed by respondents who agreed with a percentage of 4.7%. Respondents who disagreed had a high percentage of 82.7%, while respondents who strongly disagreed on having asthma had a percentage of 5.3%. Using the chi square goodness of fit, there was a very high significant difference ($p<0.001$) between respondents on having asthma.

The highest frequency counts of respondents who agreed on having eczema for question seven (Q 7) had a percentage of 23.3%, followed by respondents who strongly agreed with a percentage of 19.3%. Respondents who disagreed had a high percentage of 52%, while respondents who strongly disagreed on the skin disorder associated with eczema had a percentage of 5.3%. Using the chi-square goodness of fit, there was a very high significant difference ($p<0.001$) between respondents on had eczema.

The highest frequency counts of respondents who strongly agreed and agreed on having eye irritation for question eight (Q 8) were similar, with a percentage of 47.3%, followed by respondents who disagreed, who had a percentage of 5.3%, while respondents who strongly disagreed on having eye irritation had a percentage of 0%. Using the chi-square goodness of fit, there was a very high significant difference ($p<0.001$) between respondents on challenges of eye irritation.

The highest frequency counts of respondents who strongly agreed on having throat irritation for question nine (Q 9) had a percentage of 25.3%, respondents who agreed had a percentage of 24.7%, respondents who disagreed had a high percentage of 48%; and respondents who strongly disagreed on having throat irritation had a percentage of 2%. Using the chi-square goodness of fit, there was a very high significant difference ($p<0.001$) between respondents on had throat irritation.

The highest frequency counts of respondents who strongly agreed on having health challenges associated with sneezing for question ten (Q 10) had a percentage of 37.3%, respondents who agreed had a percentage of 27.3%, respondents who disagreed had a percentage of 33.3%; and respondents who strongly disagreed on having health challenges associated with sneezing had a percentage of 2%. Using the chi-square goodness of fit, there was a very high significant difference ($p<0.001$) between respondents on challenges of sneezing.

The frequency counts for question eleven (Q 11) of respondents who strongly agreed and also agreed on the incidence of cancer among sawmill workers were similar, with a percentage of 0%; respondents who disagreed had a percentage of 88.7%; and respondents who strongly disagreed on the incidence of cancer among sawmill workers had a percentage of 11.3%. Using the chi square goodness of fit, there was a very high significant difference ($p<0.001$) between respondents on the incidence of cancer among sawmill workers.

Table 4. Health risk reported by respondents.

Questions	Response	Egor LGA (Ogida Sawmill)	Oredo LGA (Federal Sawmill)	Ovia Northeast LGA (Oluku Sawmill)	Frequency n=150	Percentage %	p-value
Q1. Do you often have headache	SA	16	10	10	36[b]	24.0	
	A	16	25	25	66[a]	44.0	p<0.05
	D	18	15	15	48[b]	32.0	
	SD	0	0	0	0	0.0	
Q2. Do you often have catarrh	SA	23	15	15	53[b]	35.3	
	A	23	24	24	71[a]	47.3	p<0.01
	D	4	11	11	26[c]	17.3	
	SD	0	0	0	0	0.0	
Q3. Do you often have cough	SA	16	10	10	36[b]	24.0	
	A	19	17	17	53[a]	35.3	p<0.05
	D	15	23	23	61[a]	40.7	
	SD	0	0	0	0	0.0	
Q4. Do you often have often have chest pain	SA	14	6	6	26[c]	17.3	
	A	15	15	15	45[b]	30.0	p<0.01
	D	21	29	29	79[a]	52.7	
	SD	0	0	0	0	0.0	
Q5. Have you ever had bronchitis	SA	1	0	0	1[c]	0.7	
	A	1	49	49	99[a]	66.0	p<0.01
	D	43	1	1	45[b]	30.0	
	SD	5	0	0	5[c]	3.3	

Table 4. continuation: Health risk reported by respondents.

Questions	Response	Egor LGA (Ogida Sawmill)	Oredo LGA (Federal Sawmill)	Ovia Northeast LGA (Oluku Sawmill)	Frequency n=150	Percentage %	p-value
Q6. Have you ever had asthma	SA	7	2	2	11[b]	7.3	
	A	1	3	3	7[b]	4.7	p<0.01
	D	36	44	44	124[a]	82.7	
	SD	6	1	1	8[b]	5.3	
Q7. Do you often have Eczema	SA	13	8	8	29[b]	19.3	
	A	11	12	12	35[b]	23.3	p<0.01
	D	22	28	28	78[a]	52.0	
	SD	4	2	2	8[c]	5.3	
Q8. Do you often have eye irritation	SA	31	20	20	71[a]	47.3	
	A	17	27	27	71[a]	47.3	p<0.01
	D	2	3	3	8[b]	5.3	
	SD	0	0	0	0	0.0	
Q9. Do you often have throat irritation	SA	16	11	11	38[b]	25.3	
	A	7	15	15	37[b]	24.7	p<0.01
	D	26	23	23	72[a]	48.0	
	SD	1	1	1	3[c]	2.0	
Q10. Do you often have sneezing	SA	34	0	22	56[a]	37.3	
	A	15	0	26	41[b]	27.3	p<0.01
	D	1	47	2	50[a]	33.3	
	SD	0	3	0	3[c]	2.0	
Q11. Have sawmill workers ever had cancer	SA	0	0	0	0	0.0	
	A	0	0	0	0	0.0	p<0.01
	D	39	47	47	133[a]	88.7	
	SD	11	3	3	17	11.3	

SA- Strongly Agree, A-Agree, D-Disagree, SD-Strongly Disagree, No significant difference ($p > 0.05$), *$p < 0.05$ (significant difference) **$p < 0.01$ (highly significant difference)
***$p<0.001$ (very high significant difference) Note: Similar letters (superscripts) indicate values that are not significantly different from each other ($P>0.05$)

3.2 Discussion

The socio-demographic characteristics of the respondents showed that the majority of the respondents were males and this was not out of place considering the strenuous and dusty nature of the job. Similar male dominance was found among sawmill workers in Kwara State, Nigeria (Agbana et al., 2016). Most sawmill workers in this study are 31–40 years old, contrary to the results found by Sutcu and Semerci (2019). Additionally, thirty-four percent of the workforce has worked with the same sawmill for at least 10 years, similar to the report of Johnson and Umoren (2018), who discovered a high percentage (45.5%) of workers who have worked at the same sawmill for 10 years.

The results of this research supported earlier claims made by Adelagun et al. (2012) that sawmilling activities contribute to air pollution within the sawmill environment. Likewise, Olawuni and Okunola (2014), in their study carried out in Ile-Ife, Nigeria, ascertained that smoke is a major pollutant around sawmills and the second-most significant environmental issue in sawmills resulting from the burning of sawmill waste. Sawdust being burned every day sends smoke and ash into the air, which can be spread by the wind. This pollutes the air and makes the environment bad, and Masoudi et al. (2020) generally noted that the air we breathe is not pure. The results obtained from this study are in line with the study of Oguntoke et al. (2019) on the assessment of air pollution and health hazards associated with sawmills and municipal waste burning in Abeokuta Metropolis, Nigeria. As a result, we can see that effects like smoke disturbance, air pollution, and bad smell were ranked as almost certain in sawmill environment (Oguntok et al., 2019). Also, a lot of smoke is emitted into the air from the burning of wood and sawdust across the three sawmills. Wood and wood dust burning contribute smoke to the atmosphere, and this smoke produces dust and soot composed of tiny particles. Burnt wood produces gases and fine microscopic particles. These microscopic particles can get into the eyes and respiratory system, where they can cause health problems such as burning eyes, runny noses, and illnesses.

Akinbode and Owoeye (2019) stated that among the most frequent health risks faced by sawmill workers in Nigeria are occupational hazards brought on by inhaling wood dust, noise, and heat. Temperature has a lot to do with how close you are to heat sources, such as where sawdust is burned or where sawmill machines make heat. Temperature is a major factor that determines human comfort, work performance, and efficiency (Sütük and Semerci, 2019). Employees are less productive when the temperature in the room is too low or too high. In a study carried out by Sutcu and Semerci (2019)

on the health problems of sawmill workers in Turkey who process red pine, it was found that about 40% of respondents said they felt very hot during working hours.

Agu et al, (2016) in their study on health problems among sawmill workers in Abakaliki and workplace risk assessment, found that 85.3% of respondents were aware of PPE. However, only 39.5% of respondents use PPE, which shows that awareness doesn't mean use. During the walk-through survey, it was noticed that personal protective equipment (PPE) wasn't used very much in any of the sawmills visited. However, a lot of workers have enough money to buy PPE to protect themselves as a control measure. It was also found that employers can provide PPE and that workers know that the air pollution around sawmills can be bad for their health. A lot of workers always stay hydrated to boost their immune systems take a shower and change into new clothes to prevent skin diseases like eczema, while others take supplements to improve their health.

Adeoye et al. (2014) opined that workers don't use PPE because they can't afford it and that employers are responsible for giving workers PPE that is right for the risk involved and the conditions in which it will be used. There are a lot of particles in the air around sawmills, which could cause health problems. If workers don't take precautions, like wearing PPE, they are more likely to be vulnerable to health hazards.

The study reviews that the most common work-related hazards experienced by the sawmill workers were headache, catarrh, cough, chest pain, bronchitis, asthma, eczema, eye irritation, throat irritation, and sneezing. The lack of eye protection for the respondents may be the cause of eye irritation in the study group. This finding was similar to what was obtained by Agbana et al. (2016) in a related study done in Kwara state, where the study reported that one of the most common self-reported health problems by respondents was eye irritation. The findings of this research are in line with those of Aletan and Garba (2022) that health problems associated with sawmill workers include headaches and respiratory ailments, among others. Jagtap and Deshmukh (2018) found that conjunctivitis, rhinitis, hearing loss, acute respiratory infections, asthma, chronic bronchitis, and dermatitis were common illnesses among sawmill workers. In their research on occupational hazards and health problems among sawmill workers in Osun State, Nigeria, Adeoye et al. (2015) found that coughing, chest pain, and sneezing were among the most common symptoms.

From this research, there was no report of cancer among sawmill workers. However, sawmill workers in factories that process wood regularly come in contact with allergenic, immunotoxin, noxious, carcinogenic, and toxic substances that can be produced by wood dust, bacteria, and fungi that grow on timber, as reported by Mumuni (2015). After being exposed to these chemicals for a long time, people can get asthma, allergic rhinitis, bronchial hyperreactivity, contact dermatitis, allergic alveolitis, and cancer (Mumuni, 2015).

4.0 Conclusion

The study suggests that the air quality around sawmills is poor, this is indicative by the various associated health risks reported by the sawmill workers as well as correlative findings from previous studies. This study has shown that the air around sawmills is polluted and therefore impacts the health of workers. It further shows that the sawmill sites do not pay much attention to the provision and use of PPE, as they are generally not provided. It is imperative to adopt precautionary measures to reduce and or eliminate the incidence of these health risks. The study concludes that the sawmill workplace is not safe and poses a grave health risk to sawmill workers.

4.1 Recommendation

The recommendations from this study include:

I. The researchers of the study recommend that further studies be carried out using scientific instrumentation for air quality analysis to further buttress the findings of this study.

II. Workers in sawmills should be given the right personal protective equipment (PPE) and be mandated to wear them at all times during work hours.

III. Raise awareness about the health risks that pollutants pose to sawmill workers.

IV. Reduce air pollution from sawmills by creating monitoring and enforcement measures and regulations. Air quality monitoring should be carried out consistently to check air quality, and the enforcement agency should make sure sawmill workers adhere to the permissible limit of air pollution.

V. Appropriate measures should be implemented to eliminate waste burning in sawmills; controlled waste burning in incinerators can also be implemented to reduce pollutant emissions.

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Appendix

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RISK ASSESSMENT TOOL

SECTION ONE

Instruction: Please tick ☐ the most appropriate response for all the questions

Name of LGA…….
Name of Sawmill…….....
Date questionnaire was completed……..

BACKGROUND CHARACTERISTICS		
Q1	Sex of Respondent	Male ☐ Female ☐
Q2	Age range	18-20years…… ☐ 21-24 years ……... ☐ 25-30 years …… ☐ 31-40 years …… ☐ 41-50 years …… ☐ 50-60 years …… ☐
Q3	When did you start working at this sawmill	1- 5 months…….. ☐ 5months -1year…… ☐ 1 - 2 years…….. ☐ 2 - 4 years…… ☐ 4 - 6 years…… ☐ 6 - 8 years…… ☐ 10 years and above…… ☐

SECTION TWO (PART A, B, AND C)

QUESTIONNAIRE FOR CERTAINTY OF AIR POLLUTION, ADAPTIVE CAPACITY, AND HEALTH IMPLICATIONS ON EXPOSURE TO POLLUTANTS

PART A

Instruction: Please tick ☐ the most appropriate response for all the questions

S/N	CERTAINTY OF AIR POLLUTION AROUND THE SAWMILL	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
1	The work environment gets dusty during working hours				
2	The quantity of dust particles produced during work hours intense				
3	Particles/sawdust stick to the body during the working process				
4	Particles/sawdust when inhaled cause risk to health				
5	The sawmill machine requires diesel/fuel to operate				
6	There is the release of smoke/gases during the operation of sawmill machines				
7	The degree of smoke released during the working period is high				
8	Temperature increases during work hours				

PART B

Instruction: Please tick ☐ the most appropriate response for all the questions

S/N	ADAPTIVE CAPACITY TO AIR POLLUTION IN SAWMILL	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
1	You have money to buy personal protective equipment to help reduce the risk of exposure to air pollutants				
2	The sawmill can help reduce the risk posed by coming in contact with air pollutants				
3	You drink enough water during the working period				
4	You take a shower and change into new cloths upon returning to your residence				
5	You eat fruits/supplements to improve your health				
6	There are negative impacts of air pollution on health				

PART C

DO YOU EXPERIENCE ANY OF THESE HEALTH CHALLENGES?

Instruction: Please tick ☐ the most appropriate response for all the questions

S/N	HEALTH IMPLICATION	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
1	Headache				
2	Catarrh				
3	Cough				
4	Chest pain				
5	Respiratory problems				
6	Asthma				
7	Eczema				
8	Eye irritation				
9	Throat irritation				
10	Sneezing				