KNOWLEDGE OF AIR POLLUTION AND ITS PREDICTORS AMONG TRADERS IN DOUGLAS MARKET, IMO STATE, SOUTH – EASTERN NIGERIA

ABSTRACT

Background: Air pollution is currently a major threat globally, particularly in a developing country such as Nigeria. With its dire implication for human health, it is imperative to study and understand the knowledge and contributory practices of the populace as key to the development of necessary intervention measures.

Aims and Objectives: To assess knowledge and its predictors, also contributory practices towards air pollution among traders in Douglas Market, Owerri, Imo State, Nigeria.

Methodology: A cross – sectional analytical design using a combination of cluster and simple random sampling techniques were used to select 200 participants. Data was collected using a pretested semi – structured interviewer administered questionnaire. Descriptive analysis was done with frequencies and summary statistics. Chi square statistics were computed to determine significant relationship and simple binary regression was used to determine predictors of knowledge of air pollution. The p – value was set at 0.05 significance level.

Result: The mean age of the respondents was 36.2 ± 10.4 years with a slightly higher female proportion (59.0%). Almost all the respondents (97.9%) are aware of air pollution and the most common sources of information were the social media (38.8%) and the internet (23.2%). Respondents with good knowledge of air pollution in this study stood at 84.1%. Use of generators (73.5%) was the most common source of air pollution among the study participants. Factors significantly associated with knowledge of air pollution were age (p = 0.0000), marital status (p = 0.0192) and level of education (p = 0.0000). Predictors of poor knowledge of air pollution were: being within the ages of 42 – 49 years (OR: 27.33) and having non – formal education (OR: 32.50).

Conclusion: There is overall good knowledge of air pollution, however there was still relatively low knowledge in the less educated and elderly populace. This should inform policy making with targeted advocacy towards the education and guidance of people to become knowledgeable about air pollution and related health risks. Also efficient generation and supply of power will reduce the use of generators.

Keywords: *Air pollution, Knowledge, Predictors, Traders, Imo State, Nigeria*

1. INTRODUCTION

The term “air pollution” signifies the presence in the ambient (surrounding) atmosphere of substances (e.g. gases, mixture of gases and particulate matter) generated by activities of man in concentrations that interfere with human health, safety, or are injurious to man and his environment[1]. “Air pollution and its attendant health effects are getting increasing attention from the environmental regulatory agencies, environmental health research communities, government agencies, industries, as well as the public” [2,3].

“Urban air pollution is becoming one of the major areas of concern for both the developed and developing world. On a global scale, more than 0.5 million deaths per year are due to exposure to ambient PM concentrations” [4]. “Outdoor PM air pollution is estimated to be responsible for about 3% of adult cardiopulmonary disease mortality; about 5% of trachea, bronchus and lung cancer mortality; and about 1% of mortality in children from acute respiratory infection in urban centers worldwide. This amounts to 0.80million (1.2%) premature deaths and 6.4million (0.5%) lost life years” [5]. “Nigeria is classified among the countries in the world with high levels of air pollution, four of its cities (Onitsha, Kaduna, Umuahia, and Aba) ranked worse among the cities with high levels of air pollution in the world” [6].

“The air quality in Owerri is sickening as a result of the obnoxious fumes spilling from the smoldering garbage” [7]. PM2.5 concentration in Owerri is currently 2.2 times the WHO annual air quality guideline value[8]. Douglas market is a busy market that serves Owerri Municipal Council with one of the major occupational practices in the Municipal Area being trading. The emission discharged from the exhausts of generators used by shop owners and vehicles plying through dilapidated roads, and obnoxious fumes spilling from the smoldering garbage expose traders and other citizens to environmental hazards. These traders may or may not be aware of their contributory practices, and the resultant consequences of their action because of their determination to survive and make a living.

In a study conducted in Ningbo, China in January 2015[9], “the awareness rate was 64.59 % and varied significantly with age, levels of education, and occupation. Most respondents (78.80 %) expressed concern about the possible aggravation of the haze. Television and internet resources have replaced books and newspapers as the primary sources for obtaining knowledge about haze and related protective measures. 85.22 % of respondents were concerned about the air quality index (AQI)” [9]. Also in another study conducted in Ewekoro and Remo-North Local Government Areas in Ogun State, Nigeria[10], the focus of study was “Ewekoro as a result of the activities of the LAFARGE Cement factory in the community. The study revealed that age, level of education and socio economic status were determinants to the knowledge of air pollution as both communities had a predominance of younger age groups, literates and the employed” [10].

Therefore, this study aimed to determine knowledge of air pollution, its predictors and contributory practices among traders in Owerri, in order for informed control measures on air pollution moving from the level of the community to the individual.

2. MATERIALS AND METHODS

2.1 Study area

Owerri is the capital of Imo State in Nigeria set in the heart of Igbo land. It is also the state’s largest city with three Local Government Areas including Owerri Municipal, Owerri North and Owerri West. It has an estimated population of about 1,460,873 as of 2016 and is approximately 100 square kilometers in area[11].

The major metropolis (Wetheral, Douglas and Okigwe roads) are engaged by various people using different shops along the route for different businesses[12].

2.2 Study design

A descriptive cross-sectional study design was used for this study. Sample size was calculated using Cochran's formula[13] for descriptive study ($n = Z^2 pq/ d^2$), where n = Minimum sample size, Z= Standard normal deviate set at 1.96 (at 95% confidence interval), p = prevalence rate of a particular characteristics of the target population (92% based on the proportion of people with good knowledge of air pollution and its adverse effect[14]), q = 1- p, d = degree of precision set at 0.05. To make room for non-response, 10% non-response rate was added to the minimum sample size[15]. Thus, the final minimum sample size for this study is 125. However, for the purpose of this study, a sample size of 200 was used. The target population were traders (retail shop owners, distributors, general business operators) in Douglas road within the age bracket of 18 years and 65 years that also gave consent during the time of the study.

2.3 Sampling method

This study was carried out between October, 2021 and April 2022. Multi-stage sampling procedure comprising of a cluster and simple random sampling, was adopted. In the first stage, the study area was divided into 5 clusters (stations). Division into clusters was based on the different merchandise sold in the market (clothing line, grocery stalls, phone/media accessories, drug stalls, and electronics). In the second stage 40 respondents were selected from each cluster by simple random sampling.

2.4 Data collection

A semi–structured questionnaire was used as the research instrument. The questionnaire was developed by the researchers and pre-tested among 20 traders (ten percent of the sample size) from neighboring Orji market. The aim was to test the questionnaire for correctness and understanding by the respondents to aid appropriate collection of data. Corrections were made where applicable to the questionnaire before commencement of the survey. Data was obtained from respondents using semi-structured interviewer administered questionnaires designed to meet the objectives of this research. The questionnaires were grouped into three sections which sought to gather the following information;

- Socio-demographic characteristics; this section sought answers concerning respondents' age, sex, marital status, occupation, religion, tribe, level of education.

- Assessment of the level of knowledge of air pollution among respondents; this was assessed using 15 questions and the level of knowledge was graded as thus; $\geq$ 80% (Good knowledge), 50 – 79% (Average knowledge), $\leq$ 50% (Poor knowledge)

- Assessment of contributory practices towards air pollution; this was assessed using 5 questions derived from common practices towards air pollution.

2.5 Data analysis

Data was entered and analyzed into IBM Statistical Package for Social Sciences (SPSS) Statistics version 23.0 software. Descriptive analysis of variables, means, standard deviations (SDs) and percentages were considered. Bivariate analysis was done to determine association of socio-demographic data with knowledge of air pollution using chi-square test. Simple binary logistic regression was done to assess the predictors of knowledge of air pollution. The test of significance was set as $P < 0.05$. Data presentation was done using frequency tables.

3. RESULTS

Of the 200 questionnaires distributed, 189 were duly filled and returned giving a response rate of 94.5%. The mean age of the respondents was 36.2 ± 10.4 years. Majority of the study participants were female (59.0%), single (69.8%) and engaged in non-skilled occupation (59.3%). Most of the respondents were of the Igbo tribe (93.7%) and practice the Christian religion (98.9%). Slightly more than half of the respondents (51.3%) had a secondary level of education (Table 1).

Almost all the study participants (97.9%) were aware of air pollution and the most common sources of information were social media (38.8%) and the internet (23.2%) (Table 2). Likewise, most of the respondents (84.1%) had good knowledge of air pollution (Table 3).

Use of generators for domestic and commercial purposes (73.5%) was the most common practice of the respondents that contributes to air pollution (Table 4).

Sociodemographic factors significantly associated with knowledge of air pollution were: Age (χ^2 = 25.73, p = 0.0000), marital status (χ^2 = 7.90, p = 0.0192) and level of education (χ^2 = 27.72, p = 0.0000) (Table 5).

On bivariate analysis, respondents who were 42 – 49 years (OR = 27.33; 4.13 – 180.785, p = 0.0006) were significantly more likely to have poor knowledge of air pollution in comparison to those aged 18 – 25 years. Likewise, respondents with non-formal education (OR = 32.50; 4.51 – 234.22, p = 0006) were significantly more likely to have poor knowledge of air pollution when compared to those with tertiary level of education (Table 6).

Table 1: Sociodemographic characteristics of respondents

Variable	**Frequency (%)**
	N = 189
Age (years)	
18 – 25	86 (45.5)
26 – 33	44 (23.3)
34 – 41	40 (21.2)
42 – 49	15 (7.9)
>50	4 (2.1)
Mean ± SD = 36.2 ± 10.4 years	
Gender	
Male	77 (41.0)
Female	112 (59.0)
Marital Status	
Married	55 (29.1)
Single	132 (69.8)
Widow	2 (1.1)

Occupation	
Non skilled	112 (59.3)
Skilled manual	28 (14.8)
Skilled non-manual	44 (23.3)
Professional/ Managerial	5 (2.6)
Religion	
Christianity	187 (98.9)
African traditional religion	2 (1.1)
Tribe	
Igbo	177 (93.7)
Yoruba	5 (2.6)
Hausa	3 (1.6)
Others*	4 (2.1)
Level of education	
Non formal	8 (4.2)
Primary	10 (5.3)
Secondary	97 (51.3)
Tertiary	74 (39.2)

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Table 2: Awareness of air pollution

Variable	**Frequency (%)**
Heard of air pollution	
Yes	185 (97.9)
No	4 (2.1)
Source of information*	
Social media	116 (38.8)
Internet	70 (23.2)
Health professionals	44 (14.8)
School/ Seminars	38 (12.6)
Family/Friends	26 (8.5)
Government agencies	6 (2.1)

***Multiple responses applicable**

Table 3: Assessment of respondents' level of knowledge on air pollution

Variable	Correct response	Wrong response
Meaning of air pollution	158 (83.6%)	31 (16.4)
Air pollution can cause health problems	177 (93.7)	12 (6.3)
Common sources of air pollution	182 (96.3%)	7 (3.7%)
Adverse effects of exposure to air pollution	168 (88.9%)	21 (11.1)
Air pollution can cause global warming	140 (74.1)	49 (25.9)
Self-protection from air pollution	136 (72.0)	53 (28.0)
Grading of knowledge		
Good knowledge (≥80%)	159 (84.1)	
Average knowledge (50 – 79%)	19 (9.6)	
Poor knowledge (< 50%)	11 (6.3)	

Table 4: Respondents' practices that may contribute to air pollution

Variable	Frequency (%)
Do you use generators?	
Yes	139 (73.5)
No	50 (26.5)
Do you smoke?	
Yes	4 (2.1)
No	185 (97.9)
Open burning of refuse	
Yes	37 (19.6)
No	152 (80.4)
Use of firewood or charcoal	
Yes	45 (23.8)
No	144 (76.2)

Table 5: Association between sociodemographic variables with level of knowledge of air pollution

Variable	Poor knowledge	Good knowledge	χ^2	p-Value
Age (years)				
18 – 25	2	82	25.73	0.0000*
26 – 33	4	34		
34 – 41	0	33		
42 – 49	4	6		
>50	1	4		
Gender				
Male	3	69	1.09	0.2953
Female	8	90		
Marital status				
Married	6	44	7.90	0.0192*
Single	4	113		
Widow	1	2		
Level of education				
Non – formal	4	4	27.73	0.0000*
Primary	1	8		
Secondary	4	85		
Tertiary	2	62		
Occupation				
Non skilled	8	101	1.30	0.7290
Skilled manual	2	21		
Skilled non – manual	1	33		
Professional/Managerial	0	4		
Tribe				
Igbo	10	147	1.52	0.6782
Yoruba	1	5		
Hausa	0	3		
Others	0	4		
Religion				
Christianity	10	157	3.64	0.0564
African traditional religion	1	2		

Table 6: Predictors of poor knowledge of air pollution among the study participants.

Variable	OR (estimate)	95% C.I	p-Value
Age			
18 – 25	1.00		
26 – 33	4.82	0.84 – 27.59	0.0770
34 – 41	0.49	0.02 – 10.53	0.6504
42 – 49	27.33	4.13 – 180.75	0.0006
>50	10.25	0.76 – 138.26	0.0796
Marital status			
Married	1.00		
Single	0.26	0.07 – 0.96	0.0440
Widow	3.67	0.29 – 46.84	0.3175
Level of education			
Non – formal	32.50	4.51 – 234.22	0.0006
Primary	4.06	0.33 – 50.00	0.2737
Secondary	1.53	0.27 – 8.61	0.6298
Tertiary	1.00		

4. DISCUSSIONS

Results from the study showed majority (84.1%) of the respondents had good knowledge of air pollution and its adverse effects on health which is comparable with a study conducted in Ewekoro and Remo-North local government areas in Ogun State[10] which shows that majority of the respondents are fully aware and knowledgeable about air pollution. This is also in line with the findings of Aribigbola et al that respondents are highly aware of air pollution[14].

Results also revealed that "age and level of education were significant determinants of knowledge of air pollution. Getting to know about air pollution in an environment at a young age could be a crucial step towards minimizing prolonged exposure to its adverse effects extending to old age. Additionally, youths possess the exuberance and energy needed to protect the environment against pollution" [16].
This study showed that Social media and the Internet are gradually replacing books and local newspapers as the most popular ways of obtaining information on air pollution and protective measures. This finding is consistent with similar studies carried out in January 2015 by Qian et al[9].

This study also revealed the use of generators for domestic and commercial purposes (73.5%) as the most common practice of the respondents that contributes to air pollution. This is in keeping with the inadequate electric power supply to households, businesses and industries. The result is that many households, businesses and even industries operate small, medium and large capacity fossil fuel electric power generators for electric power supply whose exhaust is a source of air pollution that releases poisonous carbon monoxide. A recent study conducted in 2010 showed that "small household generators in Nigeria operate an average of six (6) hours daily, while average distance of generator away from

buildings was 5.6m. These alongside poor ventilation have negatively influenced the quality of indoor air circulation in the households causing air pollution" [17].

Univariate and bivariate analysis in this study showed an association between respondent's age, marital status and level of education on the knowledge of air pollution. This was consistent with studies by Wang et al.[18] and Qian et al.[9] and inconsistent with a similar study by Rotko et al[19].

5. CONCLUSION

In answering this survey, the majority of the study participants had good knowledge of air pollution and the most common sources of information were social media and the internet. Age, marital status and level of education were significantly associated with knowledge of air pollution. Use of generators for domestic and commercial purposes was the most common practice of the respondents that contributes to air pollution.

Currently, air pollution is a major threat globally, including Nigeria. Particularly in urban cities like Owerri, Imo state capital, where the quest for infrastructural development and high standards of living had led to uncontrolled or unlimited exploitations of the environment resulting in serious outcomes. A long-lasting improvement in air pollution levels requires a concerted effort between government and individuals.

Despite overall good knowledge of air pollution, there was still relatively low knowledge in some groups, such as the less educated and the elderly. This should inform policy making with targeted advocacy towards the education and guidance of people to become knowledgeable about air pollution and related health risks.

Enforcement of air pollution legislations across the country will ensure that people, organizations, and groups that carry out activities that are sources of air pollution are reduced.

Efficient generation and supply of power will reduce the use of generators. The use of fuel wood can be reduced by providing readily available alternative means of cooking and heating both for homes and small scale industrial use. Biogas is an alternative energy source that can be promoted and subsidized.

Regular and effective refuse collection across markets and the metropolis should be carried out to avoid accumulation and decomposition of waste which release toxic fumes to the environment. The market management should enforce proper waste disposal by traders and market commuters.

Abbreviations: AQI: Air quality index; CI: Confidence interval; OR: Odds ratio; PM2.5: Particulate matter that has an aerodynamic diameter of 2.5 microns or smaller; SPSS: Statistical Package for Social Sciences; WHO: World Health Organization.

Limitations: The study was carried out in a market setting, thus caution should be exercised in generalizing the findings to the general population.

Ethical Approval and Consent

Ethical approval for this work was obtained from Imo State University ethical review committee. Consent was also obtained from each participant in line with Helsinki's declaration.

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