

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

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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.

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

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Methodology: A cross – sectional analytical design using a combination of cluster and simple random sampling technique was used to select 200 participants. Data was collected using a pretested semi – structured interviewer administered questionnaire. Descriptive analysis were 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.

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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. 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.

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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 environment¹. Air pollution and its attendant health effects are getting increasing attention from the environmental regulatory agencies, environmental health research communities, governments, industries, as well as the public^{2,3}.

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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 concentrations⁴. 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 years⁵. 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 world⁶.

The air quality in Owerri is sickening as a result of the obnoxious fumes spilling from the smoldering garbage⁷. PM2.5 concentration in Owerri is currently 2.2 times the WHO annual air quality guideline value⁸. Douglas market is a busy market that serves Owerri Municipal with one of the major occupational practices in the Municipal 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 2015⁹, 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, Nigeria¹⁰. 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 group, literates and the employed¹⁰.

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 (40sq mi) in area¹¹. The major metropolis (Wetheral, Douglas and Okigwe roads) are engaged by various people using different shops along the route for different businesses¹².

2.2 Study design

A descriptive cross-sectional study design was used for this study. Sample size was calculated using Cochran's formula¹³ 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 effect¹⁴), q = 1- p, d = degree of precision set at 0.05. To make room for non-response, 10%

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non-response rate was added to the minimum sample size¹⁵. 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 study.

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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. 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.

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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 was grouped into three sections which seek to gather the following information;

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- Socio-demographic characteristics; This section seeks 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.

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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.

2.6 Ethical consideration

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.

3. RESULTS

Of the 200 questionnaires distributed, 189 were duly filled and returned given 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

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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.

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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.

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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.

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

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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, $p = 0.0006$) were significantly more likely to have poor knowledge of air pollution when compared to those with tertiary level of education. Table 6.

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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 ($\geq 80\%$)	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 State¹⁰ which shows that majority of the respondents are fully aware and knowledgeable about air pollution. This is also in line with the finding of Arigbola et al that respondents are highly aware of air pollution¹⁴.

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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 pollution¹⁶.

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 by Qian et al⁹.

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This study also revealed 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 in the households causing air pollution¹⁷.

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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 al¹⁹.

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 have 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, 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 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.

REFERENCES

1. Park K, Park's textbook of preventive and social medicine, Environment and health, 23rd edition, India: Bhanot publishers, 2015, p 739-740
2. Nakano T, Otsuki T. Environmental air pollutants and the risk of cancer. Gan To Kagaku Ryoho 2013;40:1441- 5.
3. Kampa M, Castanas E. Human health effects of air pollution. Environ Pollut 2008;151:362- 7.

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4. World Health Organization Air Quality Guidelines for Europe, WHO Regional Publications, European Series No. 91, WHO Regional Office for Europe, Copenhagen. 2000
5. Cohen AJ, Anderson H.R, Ostro B, Prandey K.D, Krzyzanowski M, Kunzil. Urban air pollution, Comparative quantification of health risk: Global and regional burden of diseases attribution to selected major risk. Geneva: World Health Organization 2004, 2012 [accessed 3 September 2010], p. 1353- 1434.
6. CNN, 'Dirtied by success? Nigeria is Home to City with Worst PM10 Levels', 2016 [Available at <http://www.edition.cnn.com/2016/05/31/africa/nigeria-cities-pollution/index.html>]
7. TheGuardian, "Douglas: The shame of Owerri", 2015, available at <https://guardian.ng/opinion/douglas-the-shame-of-owerri/>. Retrieved 2023-09-23.
8. IQAir, "Air quality in Owerri", Retrieved 2023-09-25 available at <https://www.iqair.com/nigeria/imo/owerri>.
9. Xujun Q, Guozhang X, Yueping S, Tianfeng H, Yajun L, Zuyao Y, et al. Knowledge and perceptions of air pollution in Ningbo, China; BMC Public Health, 16:1138, 2016.
10. Justine T. N.,Joan I. O, COMMUNITY PERCEPTION ON AIR POLLUTION AND PUBLIC HEALTH: A CASE OF EWEKORO AND REMO-NORTH COMMUNITIES IN OGUN STATE, NIGERIA, Vol.8, No.1, February 2020, pp.1-16,
11. Uzoho, A. R., Ibe, C. C. and Ejem, E A, ANALYZING THE EFFECTS OF ROAD EXPANSION PROGRAMME ON SHOPPING ATTRIBUTES OF OWERRI CITY INHABITANTS, International Journal of Civil Engineering, Construction and Estate Management Vol.9, No.2, 2021, pp.1-18
12. Alex D.W. Acholonu, Water quality studies of Nworie River in Owerri, Nigeria, 2008, Retrieved 2009-10-14
13. Cochran WG. Sampling Techniques. Third Edition. New York: John Wiley 1977; 149-156
14. Aribigbola A., Fatusin A. F. and Fagbohunka A, 'Assessment of Health and Environmental Challenges of Cement Factory on Ewekoro Community Residents, Ogun State, Nigeria', *American Journal of Human Ecology* 1(2), 2012, pp 51-57.
15. Alex D.W. Acholonu, Water quality studies of Nworie River in Owerri, Nigeria, 2008, Retrieved 2009-10-14
16. F. Morar and A. Peterlicean, "The role and importance of educating youth regarding biodiversity conservation in protected natural areas," *Procedia Economics and Finance*, vol. 3, pp. 1117–1121, 2012
17. Stanley, A.M., Mbamali, I. and Dania, A. A. (2010), Effect of fossil-fuel electricity generators on indoor air quality in Kaduna Nigeria. Retrieved from www.abu.ng/publications/2012-03-30
18. R. Wang, Y. Yang, R. Chen et al., "Knowledge, attitudes, and practices (KAP) of the relationship between air pollution and children's respiratory health in Shanghai, China," *International Journal of Environmental Research and Public Health*, vol. 12, no. 2, pp. 1834–1848, 2015.

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Comment [L43]: Morar, F??

Comment [L44]: Wang, R ??

19. T. Rotko, L. Oglesby, N. Kunzli, P. Carrer, M. J. Nieuwenhuijsen, and M. Jantunen, "Determinants of perceived air pollution annoyance and association between annoyance scores and air pollution (PM2.5, NO2) concentrations in the European EXPOLIS study," *Atmospheric Environment*, vol. 36, no. 29, pp. 4593–4602, 2002.

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