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ENVIRONMENTAL AND HEALTH EFFECTS OF AIR POLLUTION AND THE SOLUTIONS (A CASE STUDY OF AWKA NORTH LOCAL GOVERNMENT AREA OF ANAMBRA STATE, NIGERIA).

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ABSTRACT:

Air pollution has long been a major global concern in developing countries, posing serious health and environmental challenges. The awareness of the effects of air pollution on human health and the environment and various ways to mitigate the impact of air pollution was investigated in Awka, Anambra State. The population size was 1000. In carrying out this research, three hypotheses were postulated and tested at a 5% level of agreement. A well-structured questionnaire was used to collect data from the subjects, and simple percentages, and weighted mean statistics were used to analyze the data. In contrast, the Chi-square was used in testing the hypotheses. Results reveal that over 50 % of the residents of Awka are fully aware of the air pollution problem in the town and are knowledgeable about the dangers of air pollution. Air pollution is prevalent in Awka town, which is largely caused by heavy traffic resulting in increased vehicular emissions of poisonous gases. The findings show that air pollution significantly negatively impacts human health and the environment. The study recommends awareness creation, enactment of suitable legislation, and activities that promote air pollution, such as open incineration of wastes and bush burning, especially for agricultural purposes, should be discouraged. We underscore the necessity of facilitating more research on the associations between exposure and health in marginalized communities that are disproportionately affected by air pollution yet inadequately represented in existing investigations.

KEYWORDS: Health effects, Air pollution, Environmental effects, Human health, Awka Town.

1. INTRODUCTION

Air gets contaminated when items that are not originally part of the atmosphere—such as chemicals, solid objects, or even biological materials—find their way into the atmosphere in a way that disrupts the environment or puts human life in danger. The persistence of substances deemed pollutants in the air at concentrations unfit for biological systems is called air pollution (WHO, 2022).

Substances that may not have originated in the air but are nevertheless present in sufficient amounts to threaten ecological systems are commonly referred to as air pollutants. Any type of material can be a pollutant, and many air pollutants are aerosolized. Both natural and artificial sources can produce air pollution (WHO, 2022).

The intricate layer of gases that makes up the earth's atmosphere is necessary for the survival of biosystems. Ozone is a significant gas in the earth's atmosphere, and its depletion due to unchecked and ongoing air pollution has long been thought to threaten the survival of biological systems and the biosphere (Ritchie, 2023). According to a 2008 analysis from the Blacksmith Institute, two of the biggest pollution issues are indoor air pollution and urban air quality. We must address the global health issue of air pollution. The growing need for a cleaner environment and air is evidence of this. A third of the world's population, or around 2.4 billion people, cook over open flames or inefficient stoves powered by coal, kerosene, and biomass, which includes wood, animal dung, and agricultural waste. This causes dangerous air pollution in homes. An estimated 3.2 million deaths annually, including approximately 237,000 deaths of children under the age of five, were attributed to household air pollution in 2020 (WHO, 2022).

Many people and stakeholders have taken up the task of raising awareness of the causes of air pollution and its negative impacts. Still, no one has truly taken on the duty of solving this issue. Thick fog, smog, and black soot, common in our towns and cities, are evidence that much more needs to be done to combat the harmful consequences of pollution in general and air pollution in particular (Manisalidis*et al*, 2020).

The 1956 finding of petroleum in Nigeria is the source of one of the major contributing factors to air pollution in Nigeria today. Decades of exploration and exploitation have ensued after the discovery of crude oil resources in what is now Bayelsa State, resulting in several adverse environmental effects and repercussions. Environmental damage, particularly in the Niger Delta region, has resulted from a lack of environmental regulations and the exponential growth of Nigeria's petrochemical industry, which has caused an explosion in population in the region's urban areas (Otumala and Olatunde, 2021). Nigeria faces severe environmental problems due to air pollution and desertification. The former is visible in the northern Sahel savannah regions of the country, while the latter is seen in the southern, densely populated cities of Lagos, Port-Harcourt, and Onitsha (Bizi and Sidi, 2023).

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In Nigeria, the most significant environmental challenges facing the people and environment are oil spills, gas flaring, and deforestation. In Nigeria today, there are few things that are as hotly contested in environmental circles as gas flaring. To explore petroleum resources, gas flaring involves burning untapped natural gas (Aigbe et al., 2023). Gas that has been trapped is released during the drilling of crude oil deposits. Combustion removes this trapped gas since it is not used. We call this process "gas flaring." When gas exploration is not economically prudent, flaring removes the gas. However, the oil companies and their agencies' extensive exploration and exploitation have only resulted in more negative outcomes, which has heightened public reactions ranging from protests to accusations of gravely detrimental health effects on the local population and wildlife (Benson, 2020).

Even once gas flaring is discontinued, air pollution in Nigeria will probably still be an issue. This is because the saturated and poisonous air in Nigerian cities results from several important sources of air pollution, including cars and energy generators (Addis, 2023). The abundance of clean air can occasionally define an area's activities, and an increase in population highlights the need for cleaner, more breathable air. Technological advancements threaten the ecosystem on which we rely, and pollution of the natural air and the environment as a whole is a persistent concern (Otumala and Olatunde, 2021).

According to Nwanakwere and Oyedokun (2020), the main sources of anthropogenic contributions include soil dumps, water runoff, and household and industrial wastes. The concentrations of these pollutants have significantly increased in the last few years due to increased industrial operations, which is producing major environmental difficulties. These contaminants are typically present in high amounts in the ecosystems found in these contaminated areas (Woo *et al*., 2021).

This research will verify the effect of air pollution on the following hypotheses;

1. H_1: Air pollution has a significant effect on theenvironment.

Ho: Air pollution does not have a significant effect on the environment.

2. H_1: Air pollution has a significant effect on human health.

Ho: Air pollution does not have a significant effect on human health.

3. H_1: There are measures to mitigate the dangers of air pollution

Ho: There are no measures to mitigate the impact of air pollution.

According to a literature review, there is currently little information on the consequences of air pollution on the environment and human health, nor are there remedies for it in Awka and the surrounding areas of Anambra State. This study aimed to determine the extent of public awareness regarding air pollution, pinpoint the causes of air pollution, assess the consequences and obstacles associated with air pollution for both the environment and human health, and create plans for reducing air pollution in the research area.

2. MATERIALS AND METHODS

2.1 Study Location

From May to October of 2023, this study was conducted in the university town of Awka, in the Awka North Local Government Area of Anambra. With a handful of Igalla and Hausa-Fulani immigrants, the population is primarily Igbo. The Awka North Local Government Area comprises 10 settlements, including Awka. The others include Achalla, which is the headquarters, Ofemili, Awba, Ugbene, Ugbenu, Ebenebe, Urum, Mgbakwu, Isu-Anocha, and Mgbakwu (Figures 1 and 2). The places were selected based on the quantity of dustbins, open pits, abandoned drainage systems, landfills, and population density. Most of the areas are home to several markets, small businesses, factories, and services available to the public and students (Akawuku, 2023). The 2006 census estimates that the Awka hamlet has roughly 312 thousand people living in 762 square meters.

The mangrove rainforest area that includes Awka experiences considerable rainfall and humidity. The settlement is between the Greenwich Meridian at 7^0 10'E and the Equator at 6^0 15' N.

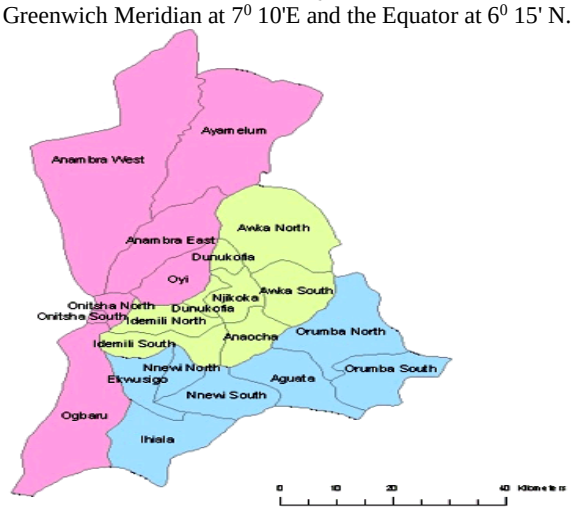

Figure 1: Map of Anambra state showing research location

2.2 Sampling Technique

After utilizing the stratified sampling technique for a while, basic random sampling was implemented. Researchers usually utilize stratified random sampling when attempting to analyze data from several strata or subgroups. It enables them to get a sample population that accurately represents the total population understudyveryquickly. For the purposes of this work, Awka town was divided into four parts in this instance. Following the stratification of the population, the size from which 250 individuals were randomly selected from each quadrant and a total of 1000 subjects were selected to represent the population was determined using a straightforward random procedure .

Figure 2: Map of Nigeria showing the border and transit states where samples were collected.

Table 1: Distribution of Target Population

S/N	Quarter	Sample Size	% Population
1	Amudo	250	25%
2	Omukor	250	25%
3	Ifite-Awka	250	25%
4	Umuokpu	250	25%
Total		1000	100

2.3 Research Instrument

Oral interviews and questionnaires served as the main research instruments for this project. The questionnaire gathered data from the 1000 adult participants in the study who gave their consent. Well-structured questionnaires were administered to determine the degree of awareness among literate respondents regarding the impacts of air pollution and how it affects them. Oral interviews were performed for subjects who were illiterate or who wished to use that method.

In this research, consenting participants between 18 and 70 participated. Comparable numbers of participants from both genders took part in this investigation. Nonetheless, values had to be assigned to the various scaling in the following ways to ascertain the level of agreement or disagreement in each scaling statement in the questionnaire:

Strongly Agreed **(SA)** **= 5**
Agreed **(A)** **= 4**
Disagreed **(D)** **= 3**
Strongly Disagreed **(SD)** **= 2**
Undecided **(UD)** **= 1**

The cut-off point was calculated as follows:

$$\frac{(5+4+3+2+1)}{5} = \frac{15}{5} = 3.0$$

The response whose mean score is below 3.0 is not accepted as agreed and the responses whose mean score is 3.0 and above are accepted as agreed.

2.4Validity of the Instrument

Copies of the instruments were distributed to environmental health professionals, community health workers, and environmental science specialists for critical evaluation. The procedure enhanced the instrument's face validity, content validity, and construct validity. Their recommendations were considered for the instrument's final draft before the respondents were given questionnaires, which improved the instrument's quality. Expert reviews were utilized.

2.5 Reliability of the Instrument

Using the test-retest procedure, a smaller sample of the same respondents was chosen to guarantee the reliability of the constructed instrument. The questionnaires were given to the subjects, and they were given again three weeks later. The results of the two administrations were computed using a straightforward percentage.

2.6 Data Analysis Techniques

The research's data will be displayed in tabular form. The CHI-SQUARE (X^2) is the statistical instrument that is used to examine and analyze the data to reach a reliable result. A way to compare a set of observed frequencies with a set of expected frequencies is to use CHI-Square

3. RESULTS AND DISCUSSION

3.1 Level of Awareness of Air Pollution in Awka

Table 2: Level of awareness of air pollution in Awka and environs.

S/N	Responses	SA	A	D	SD	UD	No. Of Resp.	Mean Score	Remarks
1	Generally speaking, there is high awareness of air pollution in Awka.	360	500	55	0	85	1000	4.1	Accepted
2.	Air pollution is a pressing problem in Awka	380	362	200	0	58	1000	4.0	Accepted
3.	I live in a part of Awka with polluted air	290	500	200	0	10	1000	4.1	Accepted
4.	I know about air pollution	620	319	2	0	59	1000	4.4	Accepted
5.	I consider Awka to be a polluted city	570	411	0	10	9	1000	4.5	Accepted

Source: Field Survey, 2023

3.2 Factors Responsible for Air Pollution in Awka

Table 3**:** Possible factors responsible for air pollution in Awka.

S/N	Responses	SA	A	D	SD	UD	No. Of Resp.	Mean Score	Remarks
1.	Open refuse dumps contribute to air and environmental pollution.	600	355	0	0	45	1000	4.5	Accepted
2.	Poor road network of Awka encourages the presence of heavy traffic and in turn contributes to air pollution by increased vehicular emissions.	418	266	16	100	200	1000	3.6	Accepted
3.	Practice of open burning of refuse contributes to air pollution.	730	216	2	0	52	1000	4.6	Accepted
4.	Pollution from the use of fossil fuels for domestic and commercial purposes is significant	40	100	500	300	60	1000	2.8	Rejected

Source: Field Survey, 2023

3.3 Effects of Air Pollution on Human Health and the Environment

Table 4: The effects of air pollution on human health and the environment.

S/N	Responses	SA	A	D	SD	UD	No. Of Resp.	Mean Score	Remarks
1.	Air pollution can be linked to symptoms such as Asthma, coughs and chest pain	500	352	55	0	93	1000	4.2	Accepted
2.	Air pollution can lead to untimely deaths of children and adults.	250	500	200	0	50	1000	3.9	Accepted
3.	Smokes, fumes and particulate matter can damage the eyes and other organs of the body.	502	50	150	50	248	1000	3.5	Accepted
4.	Lung cancer and bronchitis are diseases associated with air pollution.	560	300	50	50	40	1000	4.3	Accepted
5.	Habitat loss due to polluted environment is a growing concern.	247	559	100	92	2	1000	4.0	Accepted
6.	Extinction of local flora and fauna is a direct consequence of increased air and environmental pollution.	200	500	200	0	100	1000	3.7	Accepted
7	Increased cases of blindness and visual impairment can be linked to air pollution.	100	314	514	15	57	1000	3.4	Accepted

Source: Field Survey, 2023

3.4 Strategies That Can be Adopted to Mitigate the Effects of Air Pollution

Table 5: Strategies to control air pollution.

S/N	Responses	SA	A	D	SD	UD	No. Of Resp.	Mean Score	Remarks
1.	Checking road-worthiness of vehicles can help reduce pollution from emissions.	507	200	30	33	230	1000	3.7	Accepted
2.	Improving the electricity supply in Awka can help to reduce emissions from generating sets.	560	250	39	100	51	1000	4.2	Accepted
3.	Encouraging the use, assemblage, or manufacturing of electric vehicles.	350	110	300	40	200	1000	3.4	Accepted
4.	Utilizing cleaner energy sources such as solar and wind energy.	400	180	200	20	200	1000	3.6	Accepted
5.	Enacting and enforcing legislation against bush burning and refuse burning.	205	560	40	190	5	1000	3.8	Accepted
6.	Planting of trees and establishing reforestation programs can help control air pollution by preventing or slowing desertification	150	350	300	150	50	1000	3.4	Accepted
7	Enacting appropriate legislation against illegal logging.	350	360	100	90	100	1000	3.8	Accepted

Source: Field survey, 2023

3.5 Discussion of Findings

As shown in Table 2 above, of the 1000 respondents in the study area, 500 (or 50%) agreed that there is a high level of awareness regarding air pollution in Awka and its environs, 380 (or 38%) strongly agreed that air pollution is an urgent issue in Awka, and 500 (or 50%) respondents agreed that they live in areas of Awka with polluted air. On the other hand, 570 (57%) respondents strongly agreed that Awka is regarded as a dirty city, and 620 (62%) respondents strongly agreed that they are aware of the current air pollution.

The diverse viewpoints expressed by the respondents are consistent with the research findings of Nwanakwere and Oyedokun (2020), who found that the people in Ewekoro were aware of air pollution and that it was a common occurrence, primarily due to LAFARGE cement's operations. According to Manisalidis*et al*. (2020), 83.9% of the participants were aware of indoor air pollution, and the mass media (radio and television) (23.1%), health professionals (40.2%), and teachers (33%), were the respondents' main information sources.

Table 3 presents the findings regarding the factors that contribute to air pollution in Awka and its surrounding areas. Of the 600 residents, 60% strongly agreed that open waste dumps cause pollution of the air and environment; 418 (41.8%) strongly agreed that Awka's poor road network encourages heavy traffic, which increases air pollution due to increased vehicular emissions; 730 (73%) strongly agreed that open burning of refuse is a contributing factor to air pollution; and 500 (50%) disagreed that pollution from using fossil fuels for home and commercial purposes is a significant issue. The aforementioned results are consistent with the writings of the following authors: Effiong *et al.* (2024), who enumerated a few factors contributing to air pollution, such as the use of biomass for cooking and cooking smoke, rapid population growth and the continuous reliance on forest wood for cooking, solid waste management. According to Sogbanmu*et al*. (2020), the primary sources of air pollution emissions in Nigeria include factories, residential cooking stoves, landfill gasses, and vehicles burning biomass fuel. By enumerating some of the anthropogenic sources of air pollution, such as vehicle emissions, mining operations, businesses like

cement and quarry factories, agricultural practices, and solid waste dumps, Abaje*et al*. (2020) enhanced the work of other writers.

Out of 1000 respondents, 500 (or 50%) strongly agreed that air pollution can cause symptoms like asthma, coughs, and chest pain; another 500 (or 50%) strongly agreed that air pollution can cause premature deaths in children and adults; and 502 (50.2%) strongly agreed that smokes, fumes and particulate matter can harm the eyes and other organs of the body. These findings are presented in Table 4's results on the effects and challenges of air pollution on human health and the environment. Nonetheless, 560 (56%) people strongly agreed that bronchitis and lung cancer are illnesses linked to air pollution; also, 559 (55.9%) of the well-informed participants agreed that habitat loss results from a polluted environment. Finally, 514 (51.4%) respondents disagreed that there is a connection between rising rates of blindness and visual impairment and air pollution. Of the respondents, 500 (50%) agreed that the extinction of the local flora and fauna directly results from growing air pollution. The results are consistent with the research conducted by Croitoru *et al*. (2020), which found that over 11,200 premature deaths in Lagos were due to air pollution in 2018. They discovered that adults suffered from heart conditions, lung cancer, and chronic obstructive pulmonary disease, while children under five were the worst impacted, accounting for around 60% of the deaths.

The results of this study were corroborated by Ukpere*et al*. (2018) research, which found that air pollution in the Niger Delta region can have a variety of negative effects, such as decreased visibility, bronchial and upper respiratory tract disorders, irritation of the eyes, throat, and lungs, headaches, nausea, carcinogens, and unexpected deaths. The results were further corroborated by Ukpere and Igwe (2021), whose research indicates that metal corrosion, decreased visibility, eye discomfort, and bronchial and respiratory illnesses are all caused by air pollution in Port Harcourt.

The results of the strategies to mitigate air pollution (Table 5) show that 350 (35%) respondents strongly agreed that encouraging the use, assembly, or manufacturing of electric vehicles could reduce air pollution. In comparison, 507 (50.7%) participants strongly agreed that evaluating and checking a vehicle's roadworthiness can help reduce air pollution in Awka. Additionally, 560 (56%) residents strongly agreed that improving Awka's electricity supply can help reduce emissions from generating sets. However, 560 (56%) participants agreed that passing and enforcing laws against bush burning and garbage burning may reduce air pollution, and 400 (40%) strongly agreed that using cleaner energy sources, such as solar and wind energy, could. Finally, 360 respondents (36%) agreed that passing suitable regulations against illegal logging might reduce air pollution. 350 respondents (35%) agreed that planting trees and developing forestry programs can assist in controlling air pollution by preventing or slowing down desertification. The aforementioned results are consistent with the research conducted by Urhie*et al*. (2020), which proposed that government efforts to guarantee environmentally friendly manufacturing and consumption will reduce air pollution and avert negative health consequences. They added that manufacturers who release harmful gasses into the atmosphere should face consequences.

To ensure a safe environment for people to live in, Effiong *et al.* (2024) advocated preventive measures and sustainable solutions, such as vehicle inspection, law enforcement, efficient garbage collection and evacuation, and a consistent supply of energy to stop the usage of gasoline generators. The research of Manisalidis*et al*. (2020), which discovered that the only way to address the issue of air pollution is through public awareness combined with a multidisciplinary approach by scientific experts, supports these conclusions. National and international organizations also need to address the suggested sustainable solution. This demonstrates that actions can be taken to reduce air pollution.

According to the results above, the first hypothesis stated that air pollution significantly affects the environment. The results of hypothesis two demonstrated that air pollution significantly affects people's health, and hypothesis three indicates that steps can be taken to reduce the risks associated with air pollution.

CONCLUSION

Based on the study, air pollution in Awka, Anambra State, has a detrimental and statistically significant influence, which raises the risk of environmental deterioration and hurts human health. A strong correlation exists between low crop and animal productivity and air pollution.

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Significance Statement

The World Health Organization estimates that air pollution-related morbidities claim the lives of roughly 543,000 children under the age of five each year. Ambient air pollution is responsible for an additional 4.7 million premature deaths (WHO, 2021). Air pollution must now be seen as a global health concern, a kind of pandemic causing an increase in morbidity and death. Pathologies like ischemic heart disease, stroke, lung, and acute respiratory issues in both adults and children. This has necessitated research into the new global health issue. The results of this study will be very helpful to the Federal and State Ministries of Health and Environment in addressing the negative impacts of the health and environmental risks associated with air pollution. Researchers who plan to investigate related topics will find this study helpful.

Conflict of Interest

There is no conflict of interest

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