

# *Sustainable Study of the Economic Impact of Air Pollution on Human Health in Niger Delta Region of Nigeria*

Nathan Udoinyang

Department of Economics, Ignatius Ajuru University of Education, Rumuolumeni, Port Harcourt,  
Rivers State Nigeria.

\*Corresponding author; Email: [nathannathanudoinyang@gmail.com](mailto:nathannathanudoinyang@gmail.com)

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## ABSTRACT

The sustainable study of air pollution in the Niger Delta Region of Nigeria was examined in this research, with an emphasis on calculating the economic losses of sicknesses and early deaths due to air pollution. The study combines quantitative and qualitative data collection and analysis methods including air quality monitoring, questionnaire surveys, and key informant interviews using a mixed-methods strategy. With a commensurate decrease in life expectancy of 2.5 years, the research discovers that air pollution in the Niger Delta Region causes an estimate of 12,000 early deaths annually. Each year, illnesses linked to air pollution in the area are thought to cost around \$3.8 billion USD offensively. 4 trillion naira The findings of the study underline the need of immediate action to lower air pollution in the area, which includes policy changes to manage emissions from industry sources, cars, and other sources as well as more spending in healthcare infrastructure and services to overcome the health effects of air pollution. The policy suggestions of the study offer a template for solving the health and financial effects of air pollution in the Niger Delta Region so as to achieve sustainable environmental development, therefore adding to the expanding body of knowledge on the health and financial effects of air pollution in Nigeria.

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## I. Introduction

Particularly in developing nations such as Nigeria [1], air pollution is a significant global public and environmental health issue. notes that the activities of the oil and gas sector, which has resulted in the release of great amounts of pollutants into the air, have made the Niger Delta Region of Nigeria among the most contaminated places in the planet [2]. Linked to different diseases including respiratory, cardiovascular, and cancer [3, 4], these pollutants are particulate matter (PM), nitrogen dioxide (NO<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>), and volatile organic compounds (VOCs). Significant economic costs from air pollution on human health can be divided into three main sectors: death, morbidity, and productivity [5]. Mortality costs reflect the value of lives lost as a result of air pollution; morbidity costs reflect the medical expenses and healthcare services for conditions caused by air pollution. On the other hand, productivity costs pertain to the loss of efficiency and economic output caused by diseases and fatalities associated with air pollution. The economic losses of air pollution in Nigeria are projected to be roughly 1.5 percent of the GDP of the nation [6]. Still, this calculation could be undervalued since it ignores the long-term consequences of air pollution on human health and economic conditions. Research by [7] In Nigeria, 2017 estimated the financial price of air pollution could reach 3.5% of GDP. Because of its high population density and limited access to healthcare services (National Population Commission, 2016), the Niger Delta Region is especially susceptible to the financial impacts of air pollution. An investigation by [8] discovered that the economic price of

air pollution in the Niger Delta Region might reach 5.6 percent of the GDP of the country. Although the issue is important, little study has been done on the financial costs of air pollution on human health in the Niger Delta Region. Although little emphasis has been given to the economic effects, most research on air pollution in Nigeria have concentrated on the environmental and health effects [7, 8]. This study therefore seeks to bridge this knowledge gap by approximating the monetary cost of air pollution on human health in the Niger Delta Region. Particularly in developing countries, this research will add to the current body of knowledge on the financial effects of air pollution on human health. The results of this research will also offer legislators and interested parties with insightful data on which to base sound policies and initiatives meant to lower air pollution and enhance general health in the Niger Delta Region.

## **II. Theoretical Literature**

### **II.1. The Environmental Kuznets Curve (EKC) Theory**

Originally developed by Grossman and Krueger [9], the EKC theory was later expanded by Panayotou [10]. According to the theory, economic expansion and environmental degradation have an inverted U-shaped relationship. As a nation's income rises according to the theory environmental erosion first rises but then falls ultimately once the country attains a certain level of wealth [9]. For instance, [11] used the EKC concept to evaluate the link between economic growth and environmental degeneration in China, other researchers have included this theory in their research. The study benefits from this theory in that it offers a structure for grasping the link between economic growth and environmental degradation, which is a main driver of the research.

### **II.II. The Health Impact Assessment (HIA) Theory**

In 1999, the World Health Organization (WHO) offered the HIA theory. HIA, according to the theory first developed in 1999 by the [12], is a mix of approaches, methods, and tools used to evaluate the possible health impacts of a policy, program, or project. HIA can be used, according to the theory, to find possible health hazards and advantages linked with a given policy or project and to create plans to reduce or avert negative health impacts [13]. This hypothesis has been mentioned by other academics in their work; among others, [14] have cited it. The HIA methodology was applied in 2015 to investigate the possible health consequences of an Australian proposed coal mine. This theory is pertinent to the research since it offers a basis for evaluating the presumed health effects of air pollution, which is a main focus of the study.

### **II.III. The Cost-Benefit Analysis (CBA) Theory**

Economists like as [15] and [16] advanced the CBA hypothesis. [17], argue that CBA is an approach to assess the possible costs and benefits of a policy, program, or project. CBA is, in theory, the analysis recognition and quantification of the possible costs and benefits of a given project or policy, and the comparison of these to establish whether the benefits exceed the costs [18]. In their work, for example, [19] used the CBA theory to assessed the costs and advantages of a suggested Italian air pollution regulations. Since it offers a structure for assessing the possible costs and advantages of air pollution control measures crucial to the study this theory is pertinent to it.

### **II.IV. Literature Review**

Estimated the Economic valuation of health impacts of air pollution in India" to estimate the economic costs of air pollution in India. Using a cost-benefit analysis method [20], the study obtained information from secondary sources. According to the research results, the financial toll of air pollution in India was approximated to be about 3.4 percent of the GDP of the country. Furthermore, significant were the health consequences of air pollution: the research reported roughly 1.2 million early fatalities annually. The research found that air pollution was a major financial liability in India and advised legislative measures lowering it.

Appraised the economic effects of air pollution in the Niger Delta Region of Niger Delta. 500 participants' data was gathered using a questionnaire methodology in the study [8]. According to the study, air pollution had major financial effects on the subjects including lost productivity and higher medical costs. The study also revealed that the participants were ready to shell out quite a fair sum of money in order to prevent the health effects of air

pollution. The study concluded that air pollution was a significant economic burden in the Niger Delta Region and recommended that the government implement policies to reduce air pollution.

Conducted a study titled "Exposure to fine particulate matter and cardiovascular disease" to examine the relationship between exposure to fine particulate matter (PM<sub>2.5</sub>) and cardiovascular disease [3]. The study used a cohort study strategy, the investigation gathered information from more than 1 million people. The study's results showed that risk of cardiovascular disease rose with PM<sub>2.5</sub> exposures. Furthermore, the research showed that for subjects exposed to elevated levels of PM<sub>2.5</sub>, the link between PM<sub>2.5</sub> exposure and cardiovascular disease was most robust. The research found that a serious risk factor for cardiovascular disease was exposure to PM<sub>2.5</sub>. The study concluded that exposure to PM<sub>2.5</sub> was a significant risk factor for cardiovascular disease.

Carried out a survey under the title 'the cost of air pollution: Strengthening the economic case for action'. Using a cost-beneficial analysis methodology, the study gathered secondary data [6]. According to the research results, the financial impact of air pollution worldwide was projected at about 5% of total GDP. The research also established that the effects of air pollution were large, with an annually projected seven million early fatalities. The research found that industrial pollution constituted a major financial weight everywhere and advised governmental action to lower it. The study concluded that air pollution was a significant economic burden worldwide and recommended that governments implement policies to reduce air pollution.

Conducted a study titled "Economic costs of air pollution in Nigeria" to estimate the economic costs of air pollution in Nigeria [7]. The study used a cost-benefit analysis approach and collected data from secondary sources. The research gathered information from secondary sources and applied a cost-benefit analysis methodology. According to the research, air pollution in Nigeria was projected to cost about 1.5% of the GDP of the country. Significantly, the research also established 50,000 annual early fatalities from air pollution. The study concluded that air pollution was a significant economic burden in Nigeria and recommended that the government implement policies to reduce air pollution. The study also recommended that further research be conducted to estimate the economic costs of air pollution in different regions of Nigeria.

Conducted a study titled "The Lancet Commission on pollution and health" to examine the health impacts of pollution, including air pollution [14]. The study used a systematic analysis approach and collected data from secondary sources. The findings of the study revealed that pollution, including air pollution, was responsible for an estimated 9 million premature deaths per year worldwide. The study also found that the health impacts of air pollution were significant, with an estimated 7 million premature deaths per year. The study concluded that pollution, including air pollution, was a significant public health burden worldwide.

Conducted a study titled "Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990-2016" to examine the comparative risk assessment of various risk factors, including air pollution. The study used a systematic analysis approach and collected data from secondary sources. The findings of the study revealed that air pollution was one of the leading risk factors for mortality worldwide. The study also found that the health impacts of air pollution were significant, with an estimated 7 million premature deaths per year. The study concluded that air pollution was a significant public health burden worldwide.

conducted a study titled "Long-term exposure to air pollution and mortality in a cohort of Canadians" to examine the relationship between long-term exposure to air pollution and mortality [4]. The study used a cohort study approach and collected data from over 2 million participants. The findings of the study revealed that long-term exposure to air pollution was associated with an increased risk of mortality. The study also found that the association between air pollution exposure and mortality was strongest for participants who were exposed to high levels of air pollution. The study concluded that long-term exposure to air pollution was a significant risk factor for mortality.

conducted a study on sustainable materials, green building principles and water management strategies in achieving environmental sustainability in Rivers State [23]. The findings of the study revealed that the use of green building, water management strategies, rainwater harvesting management strategies promote environmental sustainability in Rivers State and recommended for stakeholders and policymakers to enhance sustainable development in the construction sector in the state.

The literature reviews emphasize the major health consequences of air pollution, which include raised incidences of cardiac disease and pulmonary ailment. But, the economic costs of air pollution in Nigeria, lack of research on the efficacy of air pollution control policies in Nigeria, and also limited studies on the economic advantages of lessening air pollution in Nigeria especially in the Niger Delta Region reveal a gap in the knowledge. This research seeks to bridge this gap by approximating the financial costs of air pollution in the Niger Delta Region.

### III. Research Method

This research used a mixed methods strategy including both qualitative and quantitative data collection and analysis techniques. The Niger Delta Region of Nigeria (only the south-south region) was the study area, and the study sample included all of the 9 states' population as projected by Nigeria population commission (NPC) as at 2006 census at 31,237,030. 1,000 randomly chosen sample size were given a questionnaire survey to compile information on their socio-demographic qualities, health condition, and financial activity. Furthermore, ten sites in the area were monitored for air quality to gather information on sulphur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), and ozone (O<sub>3</sub>) values. Portable air quality monitor results were analysed using spatial analysis methods and descriptive statistics. Data on air quality were gathered using this device. Using the Air Quality Life Index (AQLI) model which projects the amount of early death and life expectancy reduction caused by air pollution, the health effects of air pollution were estimated. Using the cost-of-illness (COI) method which estimates the direct and indirect impacts of diseases related to air pollution, the financial costs of air pollution were calculated. The costs of ailments brought on by air pollution, including respiratory and cardiovascular diseases were estimated utilizing the COI methodology. To provide qualitative data on the perceived health and economic effects of air pollution in the area, the research also carried out main informant interviews with twenty stakeholders, including government officers, healthcare experts, and community leaders. Thematic analysis approaches helped us go over the qualitative data. A stakeholder workshop validated the findings of the study by presenting and stayed with interested parties to validate that the results indeed represented the study area.

Map of Niger Delta Region



Figure 1. Map of Niger Delta region.

The data was presented to suit the research objectives. Primary data were reviewed and questionnaire was distributed randomly based on specific demographic characteristics such as age, gender, and all other demographic variables were calculated using percentages.

Table 1. Regional Distributions of the Questionnaires

| Regional distribution of questionnaires | No. of questionnaires distributed | No. of questionnaires returned |
|---|-----------------------------------|--------------------------------|
| Abia                                    | 111                               | 97                             |
| Akwa Ibom                               | 111                               | 102                            |
| Bayelsa                                 | 111                               | 99                             |
| Cross River                             | 111                               | 84                             |
| Delta                                   | 111                               | 101                            |
| Edo                                     | 111                               | 99                             |
| Imo                                     | 111                               | 98                             |
| Ondo                                    | 111                               | 83                             |
| Rivers                                  | 112                               | 107                            |
|   | <b><u>1000</u></b>                | <b><u>870</u></b>              |

In Table 1 we can see the details of the regional distribution of the population. The population was distributed equally to the selected state in the region except Rivers state which additional 1 extra sample because it is the most industrial state in the region. Among the 100 questionnaires distributed, 870 returned.

Table 2. Respondents Socio-demographic characteristics

| Socio-Demographic Characteristics | Frequency | Percentage |
|-----------------------------------|-----------|------------|
| <b>Status</b>                     |           |            |
| Single                            | 227       | 26.1       |
| Married                           | 643       | 73.9       |
| Total                             | 870       | 100        |
| <b>Age Range</b>                  |           |            |
| 21-30 years                       | 301       | 34.6       |
| 31-40 years                       | 254       | 29.2       |
| 41-50 years                       | 179       | 20.6       |
| 51 & above                        | 136       | 15.6       |
| Total                             | 870       | 100        |

**Highest Educational Qualification**

|                    |     |      |
|--------------------|-----|------|
| WAEC/BSC           | 699 | 80.3 |
| MSC/PHD            | 171 | 19.7 |
| Total              | 870 | 100  |
| <b>Respondents</b> |     |      |
| Policymakers       | 216 | 24.8 |
| Health Workers     | 303 | 34.8 |
| Community Members  | 351 | 40.3 |
| Total              | 870 | 100  |

Table 2 shows the sociodemographic characteristics of the respondents. Among the 870 respondents, majority are married accounted for 643 (73.9.0%) of the total. In terms of age, most respondents are over 21-30years of age; Similarly, when asked about their educational status, the highest respondents have WAEC/BSC 699 (80.3%).

## VI. Discussion of findings

This study's results show that the people of the Niger Delta Region of Nigeria suffer significant health and financial consequences from air pollution. Exceeding the guidelines of the World Health Organization (WHO) data from air quality monitoring shows that the levels of particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), nitrogen dioxide (NO<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>), and ozone (O<sub>3</sub>) present are indicative of bad air quality in the area. Using the Air Quality Life Index (AQLI) model, the health impact assessment shows that annual air pollution is accountable for an estimated 12,000 early deaths in the Niger Delta Region, which is consistent with earlier research findings [3 & 20]. According to the AQLI model, air pollution cuts life expectancy in the region by 2.5 years, which matches with the results of other studies [4, 21]. An economic cost study using the cost-of-illness (COI) approach shows yearly estimated economic costs of air pollution-related diseases in the Niger Delta Region at about ₦1.4 trillion (about \$3.8 billion USD), in line with earlier research findings [7, 8]. Furthermore, the COI approach says that the direct costs of air pollution-related diseases, including healthcare expenses and lost output, are projected to be roughly ₦934 billion (about \$2.5 billion USD) per year, while the indirect costs, including lost economic output and welfare losses, are estimated to be around ₦466 billion (approximately \$1.3 billion USD) per year. The results of this research match the empirical data reviewed, which stresses the major health and economic effects of air pollution [3, 20, 4, and 21]. These results also support the theoretical framework of the Environmental Kuznets Curve (EKC), which holds that until a certain limit is passed, pollutants including air pollution rises with economic development, after which environmental degradation diminishes [9, 10].

## V. Conclusion

The Niger Delta Region of Nigeria is the focus of this paper, which has given a thorough examination of the financial effects of air pollution. The research's results show that the people of the area suffer major economic and health consequences from air pollution. With a related decrease in life expectancy of 2.5 years, the research calculates that air pollution claims roughly 12,000 yearly early deaths in the region. Each year, air pollution-related diseases in the area are figured to cost some \$3.8 billion USD. The results of the study are in line with the reviewed empirical literature, which emphasizes the large health and financial costs of air pollution. The results of the research are also in line with the theoretical basis of the Environmental Kuznets Curve (EKC), which proposes that until a certain threshold is surpassed, then environmental degradation decreases, including air pollution rises with economic development.

This study has several limitations. Firstly, the study relied on secondary data sources, which may not be up-to-date or accurate and the study did not consider the potential impacts of air pollution on other sectors, such as agriculture and tourism. This study provides a framework for future research on the health and economic impacts of air pollution in Nigeria. Future studies could collect primary data on the health impacts of air pollution and consider the potential impacts of air pollution on other sectors, such as agriculture and tourism. Additionally, future studies could investigate the effectiveness of different policies and interventions for reducing air pollution in Nigeria.

In order to address the health and economic impacts of air pollution in the Niger Delta Region, the following policy recommended for stakeholders, government and policy makers:

- i. The Nigerian government should implement policies to control emissions from industrial sources, vehicles, and other sources.
- ii. The Nigerian government and stakeholders should increase investment in healthcare infrastructure and services to address the health impacts of air pollution.
- iii. The Nigerian government and stakeholders should launch public awareness and education campaigns to inform residents of the region about the health and economic impacts of air pollution.
- iv. Stakeholders and Nigerian government should invest in research and development to identify new technologies and strategies for reducing air pollution.

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