

## Air Pollution as Correlates of Anxiety, Depression and Criminal Behaviour in Obio/Akpor Local Government Area in Rivers State

Iyagba P. W.

Department of educational Psychology, Guidance and Counseling, Faculty of Education  
Ignatius Ajuru University of Education Rumuolumeni, Port Harcourt, Rivers State, Nigeria

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**Annotation:** The study investigated air pollution as correlates of anxiety, depression and criminal behaviour (indoor and outdoor crimes) in Obio/Akpor Local Government Area in Rivers State. The study adopted correlation design. Population consisted of all the communities in Obio/Akpor LGA. A 3-year panel of 10 Obio/Akpor communities was collected and analyzed to investigate the effects of air pollution on anxiety, depression and three crime categories. Community-level air pollution data was sourced from the EPA between 2019 and 2021 on six major pollutants: carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), total suspended particulate (TSP), particulate matter PM<sub>10</sub>, and particulate matter PM<sub>2.5</sub>. We standardized each of the six pollutants and then averaged the standardized scores to compute a composite measure of air pollution for each community. Community-level crime data from the Crime Fighters Program was collected from the Nigeria Police Force. A self-structured questionnaire on Anxiety and Depression Scale was used. Content validity of the questionnaire was established by two experts in Measurement and Evaluation. Cronbach alpha reliability method was used to establish the reliability of the questionnaire. Pearson Product Moment Correlation was used to answer research questions and their corresponding hypotheses at 0.05 alpha level of significance using SPSS version 23. Overall, according to the result, air pollution was found to be positively related to indoor and outdoor crime (domestic violence and robbery). However, air pollution was also found to have a positive association with anxiety and depression. The Ministry of Environment should put in measures to control air pollution. Indoor and outdoor recreation should be promoted to avoid anxiety and depression.

### Introduction

In recent years, the problem of air pollution has become much more serious. According to the World Health Organization's Global Health Risk report published in 2016, three million people died because of air pollution worldwide. Approximately 87% of these deaths occurred in low and middle-income countries, which represent 82% of the world's population (WHO, 2016). The accumulation of air pollutant density and the length of exposure have many negative impacts on human health, including both physical and mental illnesses. However, most researchers have exclusively focused on the former, such as respiratory, cardiovascular, nervous, urinary, and digestive system problems (Kampa, 2008). Relatively few scholars have examined the effects of air pollution on mental health and how it could lead to changes in human behaviour and daily activities. For example, Shin *et al.* (2018) and Zeng *et al.* (2019) argue that air pollution could increase stress and inflammatory reactions. They have found an association between the subjective stress of daily activities and long-term, exposure to ambient air pollutants. According to Shin *et al.* (2018), men as well as anyone under the age of 65 are at greater risk of developing mental problems because these groups are more likely to have been exposed to air pollution due to their higher mobility rates and greater activity levels.

Lu *et al.* (2018), who explore the correlation between air pollution's effect on the mental health and increase in crime rates, found that severe air pollution increases the anxiety levels of the respondents and may lead people to behave unethically. The reason is the anxiety might arise in threatening situations, and then the brain

will develop self-protection responses (Herrnstadt et al, 2016), which make people focus more on their own personal needs and self-interests, and therefore they become less mindful of the environmental defect that's causing them to act unethically. Therefore, since air pollution can directly affect the human body and mind, it may indirectly be associated with human behaviour and crime rates.

Recently, several scholars have performed large scale observational studies using open datasets to analyze the relationships among air pollution and various crimes (Barlett, & Anderson, 2014). Among various types of crime, the association between air quality and crime varies for property and violent crimes. Herrnstadt et al. (2016) found an increase of 6.14 percent in violent crime when air quality deteriorated due to the occurrences of windy days that brought dirty air in Los Angeles. Similarly, their study case in Chicago also had 2.2 percent increase in violent crime when the downside wind came. This effect was expected to occur on the same day where the high concentration of air pollution on that day only impacted the number of criminals on the same day (Brooks & Schweitzer, 2011). The authors speculated that excessive concentrations of air pollution could lead to more aggressive behaviour and, hence, violent crime increased.

On the other hand, Baryshnikova (2015) found a negative correlation between air pollution and property crime. A ten percent increase in ozone concentrations reduced the number of crimes committed hourly by 0.68 percent. As air pollution levels increased, people avoided leaving their homes, and this reduced the likelihood of a successful property crime. Although scholars have determined that air pollution is associated with crime, they have only begun to explore its influence in a large-scale study area and have not specified how they are correlated locally. Research shows that pollution can make one feel sad and depressed. It can keep us indoors when we want to be outside (Lu, 2018). It can lead to violent and self-destructive behaviour. He averred that people don't even need to inhale pollution for it to have an effect. Just knowing that the air is contaminated can make them miserable. Also, air pollution erodes not just our

physical well-being, but our mental acuity, which allows one to stay motivated, productive and resilient, and enables them to behave ethically, as well as feel good about ourselves and our lives (Lu, 2018).

A recent report from Environment America found that, in 2018, more than 100 million Americans lived in areas that endured more than 100 days of degraded air quality. Similarly, a report from the American Lung Association found that four in 10 Americans live in counties that have registered unhealthy levels of ozone or particulate matter. According to UCLA Laboratory for Stress Assessment and Research, air pollution can cause increases in inflammation which, in turn, is associated with a wide variety of serious mental and physical health problems, including anxiety disorders, depression, suicide, cardiovascular disease, and autoimmune and neurodegenerative disorders. In tandem with this, Lu (2018) affirmed that when the air is bad, your anxiety level can go up. Air pollution itself can contribute to peoples' existential anxiety about their health."

The studies he examined show that air pollution can contribute to annoyance, anxiety, depression and general dissatisfaction with life. Pollution is also linked to substance abuse, self-harm and suicide, as well as crime. In his own 2018 study, Lu found that high levels of pollution were associated with hikes in murder, rape, robbery and assaults, as well as property crimes such as burglary and auto theft. For his recent paper, Lu (2018) also reviewed studies showing that pollution impairs cognitive functioning, and hurts academic performance and worker productivity. Air pollution can even drive down stock prices and lead umpires to make worse calls. One study found that even indoor workers—those in call centers—handled fewer calls on days when air pollution was high.

Residents of Port Harcourt in Rivers State, Nigeria, and its environs have since the last quarter of 2016 been experiencing adverse environmental impacts of particle (soot) pollution. This "double air pollution burden"—the unresolved prevailing widespread air pollution and the "added" emergence of particle pollution considered an environmental health threat, led to protests against government inaction in some

parts of the state. In February 2017, several months following the onset of the pollution, the government declared an Emergency, and set up a Task Force to investigate and find a solution to the problem. Global research suggests that particle pollution correlates positively with a range of morbidities and an increased risk of mortality among exposed populations. This underscores the need for rigorous implementation of existing environmental legislations established to protect the environment and public health. Studies of the affected population is imperative.

### Statement of the Problem

Air pollution may be directly (cognitive function) and indirectly (physical health, and behaviour) be associated with mental illnesses including depression and anxiety. There is also an evidence that the latter may contribute to both violence and aggression (Brooks & Schweitzer, 2011). For instance, anxiety due to, negative social changes (for example, economic distress) may cause individuals to become more aggressive and hostile because if people stay at home for extended periods, they are likely to become more stressed, which may increase negative attitudes toward family members. This stress can then lead to high rates of domestic violence.

### Purpose of the Study

The study investigates the air pollution as correlates of anxiety, depression, and criminal behaviour (indoor and outdoor crimes) in Obio/Akpor Local Government Area in Rivers State. Specifically, the study tends to;

1. Find out the extent air pollution relates to anxiety amongst residents in Obio/Akpor LGA.
2. Determine the extent air pollution relates to depression amongst residents in Obio/Akpor LGA.
3. Examine the extent air pollution relates to criminal behaviour (indoor and outdoor crimes) amongst residents in Obio/Akpor LGA.

### Research Questions

The following research questions guided the study:

1. What is the relationship between air pollution and anxiety amongst residents in Obio/Akpor LGA?

2. What is the relationship between air pollution and depression amongst residents in Obio/Akpor LGA?
3. What is the relationship between air pollution and criminal behaviour (indoor and outdoor crimes) amongst residents in Obio/Akpor LGA?

### Hypotheses

The hypotheses guided the study:

1. There is no significant relationship between air pollution and anxiety amongst residents in Obio/Akpor LGA?
2. There is no significant relationship between air pollution and depression amongst residents in Obio/Akpor LGA?
3. There is no relationship between air pollution and criminal behaviour (indoor and outdoor crimes) amongst residents in Obio/Akpor LGA?

### Literature Review

#### Conceptual Review

Air pollution is a serious problem that affects billions of people across the globe. According to the Environmental Protection Agency (EPA), about 142 million Americans still reside in counties with dangerously polluted air ("The Colour of Pollution," 2014). In India, air pollution is the primary cause of death, killing over 1.6 million people a year ("Air Pollution in India," 2015). Similarly, breathing Beijing's air is equivalent to smoking almost 40 cigarettes a day ("Mapping the Invisible Scourge," 2015). Although the environmental and health costs of air pollution are clear, limited research has examined its ethical costs. We theorize that air pollution can increase criminal activity and unethical behaviour by inducing anxiety. Following Brooks and Schweitzer (2011), we define anxiety as a state of distress or physiological arousal in reaction to the potential for undesirable outcomes. It is well established that air pollution increases anxiety (e.g., Power et al., 2015). For example, air pollution can heighten mortality salience, thereby elevating anxiety (Greenberg et al., 2003). As a result, air pollution has been linked to increases in depression (Szyszkowicz, 2007) and suicide attempts (A. C. Yang, Tsai, & Huang, 2011).

There is also evidence that anxiety can increase both violent unethical behaviour (e.g., aggression; Corrigan & Watson, 2005) and non-violent unethical behaviour (e.g., cheating to earn money; Kouchaki & Desai, 2015). For example, anxiety due to negative societal changes (e.g., economic crisis) can lead individuals to be more hostile and aggressive (Barlett & Anderson, 2014). This is partly because transgressive behaviour itself (e.g., damaging public property, cheating to get ahead) can function as an aberrant strategy for coping with anxiety (Lazarus & Folkman, 1984). Consistent with the reasoning that transgressing can lower anxiety, the level of the stress hormone cortisol tends to drop after individuals engage in unethical acts (Lee, Gino, Jin, Rice, & Josephs, 2015).

Several economics researchers have recently explored the effect of air pollution on criminal activity in two cities (Chicago and Los Angeles; Herrnstadt, Heyes, Muehlegger, & Saberian, 2016). Exploiting daily changes in wind direction as a source of quasi experimental variation in air pollution exposure, this study found that air pollution increased violent crime. The present research extended this study in several important ways. First, Herrnstadt and colleagues (2016) were “agnostic on the mechanism (or mechanisms) underpinning the results” (pp. 4–5). To fill this gap in knowledge, we drew on the psychology literature (e.g., Kouchaki & Desai, 2015; Lee et al., 2015) to propose and test anxiety as an underlying mechanism for the effect of air pollution on unethical behaviour. Second, whereas Herrnstadt et al.’s (2016) research involved two U.S. cities, our large-scale panel study examined the effect of air pollution on crime across all U.S. cities for which air pollution and crime data were available (N = 9,360). Third, the present research not only investigated the effect of experiencing air pollution on criminal behaviour but also used three different measures to investigate the effect of experiencing air pollution on unethical behaviour in general. Importantly, the definition of unethical behaviour—behaviour that is “illegal or morally unacceptable to the larger community” (Jones, 1991, p. 367)—includes but is not limited to criminal behaviour.

There are many complex factors which are correlated with crime, such as opportunity, location, the behaviour of both the offender and the victim, and time (Azoulay, 2005). According to the routine activity theory, people’s daily comings and goings may determine where and when a vulnerable victim and a motivated offender might come into contact with each other. For example, robberies usually take place in public areas such as restaurants, on public transportation, in parking lots, and in banks, whereas domestic abuse usually occurs at home. According to Khan (2015), there are two types of crime scenes: indoor crimes and outdoor crimes. Therefore, changes in people’s lifestyles and daily activities can provide opportunities for potential perpetrators and related with the spatial and temporal distribution of crime. Tompson and Bowers (2016) applied the negative impact escape (NAB) model to an early study conducted by Rotton and Cohn (2017) to determine if bad weather is associated with crime risk. According to the model, there is a steady linear temperature violence relationship in which extreme temperatures (too hot or too cold) may be associated with aggressive behaviour and violent crimes.

According to Yan *et al.* (2018), an increase in air pollution affects how people get to work and leads to a decrease in the number of people who use public transportation to reduce exposure risk from air pollution by using private vehicle and avoiding waiting time for the public transit. In addition, Evans (2019) found that when pollution is severe, people limit their outdoor leisure activities but do not change their indoor activities and tend to spend more time indoors. Taking Moretti and Neidell’s (2010) study as an example, when air pollution levels became dangerous, the number of visitors to the Los Angeles Zoo drops significantly. Thus, high levels of air pollution change people’s activity patterns because they are unwilling to go out and subject themselves to possible health risks.

### Theoretical Review

#### Social Learning Theory

The social learning theory developed by B. Skinner (Hjelle & Ziegler, 2003), from our point of view, deals

with the very adaptive human interaction with the social environment. According to Skinner, the success of human actions in a given situation is determined by the acquired set of the learned behavioural patterns (Hjelle & Ziegler, 2003) generated in the process of learning. These are the patterns of behaviour that allow a person, as rather rightly from our point of view the researcher observes, to achieve social balance between the individual and the group, conflict-free relations with the closest social environment - that is, to adapt to the society; the approach diametrically opposed to the ideas of B. Skinner is traced in the works of A. Bandura (Hjelle & Ziegler, 2003) who argues that human behaviour cannot be explained only from the standpoint of only environmental factors. In everyday life, men are aware of the consequences of their actions and adjust their behaviour accordingly. Thus, the social theory of cognition by A. Bandura advances an idea of the activity of individual. Instead of passively accepting whatever the environment presents, personality can actively control the events that affect his life; he can in some degree control the environmental conditions by selecting a method of his reaction to them (Hjelle & Ziegler, 2003).

### Methodology

This aspect presented the methodology in carrying out the research which includes the research design, population, sampling technique, sample of the study, instrument for data collection, validity of the instrument, reliability of the instrument, administration of the instrument and method of data analysis.

### Research Design

The study adopted correlational research design. Ajoku (2006) posits that in this type of research which determines the extent or degree of relationship existing between two or more variables. Nwankwo (2013) assert that correlational research is used whenever a researcher is determining or finding out whether there is a relationship between two or more variables and data from such variables are in ratio or interval scale (scores) to create the possibility for the scores to be correlated, such is a correlational design. Obilor (2018) explains that correlational research involves collecting numerical data to determine whether a

relationship exists between two or more variables and the extent of the relationship. Thus, correlational research design is used to determine the relationship between two or more variables and the magnitude and direction of such relationship. This research design is useful in this study as it will help in determining the relationship between principals' leadership style and teacher work attitude in public secondary schools in Obio/Akpor Local Government Area of Rivers State was well as the magnitude and direction of such relationship.

### Population of the Study

Population consisted of all the communities in Obio/Akpor Local Government Area of Rivers State.

### Sampling Technique

Simple sampling technique without replacement was used in selecting the sample of the study.

### Sample of the Study

The sample of the study was a 3 year panel of 10 Obio/Akpor Local Government Area of Rivers State.

### Instrument for Data Collection

The instrument for data collection in the study was a self-structured questionnaire titled: "Anxiety Depression Linked to Air Pollution and Criminal Behaviour Questionnaire (ADLAPCBQ)". The instrument for data collection was segmented into two sections A and B. The section A contained information on the Bio-Data or personal data of the respondents while the section B contained information on the anxiety depression questionnaire. The section B of the ADLAPCBQ was patterned alongside the modified 4-point likert scale. The responses and the weight are: Strongly Agree (SA) = 4; Agree (A) 3; Disagree (D) = 2 and Strongly Disagree (SD) = 1.

### Validity of the Instrument

The instrument was validated by experts in Measurement and Evaluation in the Department of Educational Psychology, Guidance and Counseling, Ignatius Ajuru University of Education, Rumuolumeni, Port Harcourt, Rivers State.

**Reliability of the Instrument**

The reliability of the instrument was established through the use of Cronbach alpha reliability method and yielded a reliability coefficient of 0.72.

**Administration of Instrument**

The researcher personally administered the copies of the instrument to the respondents to ensure immediate and timely retrieval and this was done with the help of two trained research assistants.

**Method of Data Analysis**

Product Moment Correlation was used to answer the research questions and tested the null hypotheses at 0.05 level of significance.

**Results**

**Research Question One:** What is the relationship between air pollution and anxiety amongst residents in Obio/Akpor LGA?

**Hypothesis One:** There is no significant relationship between air pollution and anxiety amongst residents in Obio/Akpor LGA.

**Table 1: Relationship between Air Pollution and Anxiety amongst Residents**

Variables	N	Df	r-cal	R2	r-crit	p-value	Sig. level	Decision
Air pollution	79	77	0.813	0.717	0.195	0.00	0.05	Significant
Anxiety								

p<0.05

Table 1 shows that the correlation co-efficient (r) was 0.813, indicating a high positive relationship between air pollution and anxiety. The coefficient of determinant (R<sup>2</sup>) is 0.717, this means that 71.7% of the variations in anxiety was accounted for by air pollution. Also, the p-v alue of 0.00 was less than 0.05 level of significance at the degree of freedom. We therefore reject the null hypothesis (HO1) and conclude that there is a significant relationship between air pollution and anxiety in Obio-Akpor LGA.

**Research Question Two:** What is the relationship between air pollution and depression amongst residents in Obio/Akpor LGA?

**Hypothesis Two:** There is no significant relationship between air pollution and depression amongst residents in Obio/Akpor LGA.

**Table 2: Relationship between the air pollution and depression**

Variables	N	Df	r-cal	R2	r-crit	p-value	Sig. level	Decision
Air pollution	79	77	0.842	0.611	0.195	0.00	0.05	Significant
Depression								

p<0.05

Table 2 revealed that there is a positive correlation between air pollution and depression, r = 0.842, p<.05. Also, the coefficient of determinant (R<sup>2</sup>) is 0.611, this indicates that air pollution relates depression to an extent of 61.1% percentage. In addition, the p-value (0.00) was less than 0.05 level of significance. Hence, the null hypothesis (HO2) was rejected. As a result, there is a significant relationship between air pollution and depression.

**Research Question Three:** What is the relationship between air pollution and criminal behaviour (indoor and outdoor crimes) amongst residents in Obio/Akpor LGA?

**Hypothesis Three:** There is no relationship between air pollution and criminal behaviour (indoor and outdoor crimes) amongst residents in Obio/Akpor LGA.

**Table 3: Relationship between air pollution and criminal behaviour (indoor and outdoor crimes)**

Variables	N	Df	r-cal	R2	r-crit	p-value	Sig. level	Decision
Avoiding type	79	77	0.791	0.552	0.195	0.00	0.05	Significant
Education attainment								

p<0.05

Table 3 shows that the correlation co-efficient (r) was 0.791 indicating a high positive relationship between air pollution and criminal behaviour (indoor and outdoor crimes).The coefficient determinant (R<sup>2</sup>) is 0.552, this implies that 55.2% variance in criminal behaviour was accounted for .by air pollution. The table also indicate that air pollution has relationship with criminal behaviour, r = 0.79 1, p<.05. With this result, the HO: is thus, rejected. This suggests the fact that there is a significant relationship between air pollution and criminal behaviour (indoor and outdoor crimes).

**Conclusion**

Three types of crime were highlighted in this study namely: domestic violence (indoor crime), robbery (outdoor crime), and fraud (an indoor cybercrime). Also, anxiety and depression was revealed. Based results, all variables exhibited high variation, which shows that air pollution very high coefficient distributions regarding these three types of crimes and psychological variables. Overall, according to the result, air pollution was found to be positively related to indoor and outdoor crime (domestic violence and robbery). However, air pollution was also found to have a positive association with anxiety and depression.

**Recommendations**

The study recommends as follows:

1. The Ministry of Environment should put in measures to control air pollution
2. Indoor and outdoor recreation should be promoted to avoid anxiety and depression.
3. Government should organize skill acquisition programmes to empower the youth for sustainable development of the community.

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