ECOTOXICOLOGY AND ENVIRONMENTAL HEALTH

# Assessment of Health Impact of Noise Pollution among Communities Around Selected Airports in Southern Nigeria

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## Abstract

The fast pace of urbanization has led to an increased spring-up of residential buildings around many airports, especially in developing countries. Amongst all these enormous impacts posed by airports on their host communities, this research focused on assessing the health-related challenges suffered by the host communities due to airport noise. The Port Harcourt International Airport, Margaret Ekpo International Airport and Benin Airport and their nearby communities (5) were selected for the study. With three hundred and seventy-two (372) respondents, a questionnaire was used to gather information regarding health-related impacts. The data was analysed using descriptive statistics such as mean value, frequency count and percentage. The finding revealed that aircraft noise causes difficulty in sleeping and restlessness in the surrounding communities (45.7%), hearing impairment in people (47.0%), affecting community people mentally and physical (54.6%); however, community people don't find it difficult to sleep during the day (47.0%) and communicate (45.2%). The outcome revealed that aircraft noise is causing many people in the community panic-attack that can cause high blood pressure (42.0%). It was concluded that the generated noise pollution from aircraft activities such as landing and taking-off expose communities to extremely dangerous noise level status and have significant impact on the wellbeing of the people living nearby the selected airports. Communities should be restricted to 10km radius distance away from the airport area.

**Keywords:** Noise Pollution, Aircraft Noise, Public Health, Health Impact, Nigerian Airports

## Introduction

The fast pace of urbanization has led to an increased spring up of industries, residential buildings and businesses that tend to allow these settlements to continuously have much closer contact with the aviation environments, which were initially intended to be sighted far away from these businesses and residential zones (Orikpete *et al*., 2021). Noise

annoyance is an emotional and attitudinal reaction from a person exposed to noise in a given context (Pedersen, 2007; Orikpete *et al*., 2021). From this definition, it is evident that other factors, like daily activities, feelings, thoughts, and negative emotional responses, such as irritability, distress, exhaustion, a wish to escape the noise and other stress-related symptoms, are highly relevant if one wants to quantify the annoyance (Orikpete *et al*., 2021).

The World Health Organization (WHO) recognizes noise pollution as unfavourable noise caused by human activity as a serious public health issue (Jamalizadeh *et al*., 2018; Jacyna *et al*., 2017). Noise pollution is considered the third most harmful factor in large cities. As such, the Occupational Safety and Health Association (OSHA) has set 90 dBA as the time-weighted average (TWA) for an 8-hour workday exposure to noise, while the National Institute of Occupational Safety and Health (NIOSH) sets the limit at 85 dBA. Noise pollution in urban areas is caused by a variety of sources, such as road traffic, construction, businesses, airports, and industrial and residential areas; vehicle traffic contributes the most to the production of urban noise and results in physiological effects that subsequently contribute to a significant burden of disease (Moroe and Mabaso, 2022).

The adverse effects of noise pollution are numerous and stretch over a wide range. It has far-reaching effects on mental and physical well-being. The length of exposure to the pollutant determines how badly an individual is affected by noise pollution. Noise pollution effects can be categorized into auditory and non-auditory (Usikalu & Kolawole, 2018). The adverse effects of noise pollution observed result from continuous constant exposure to it. Auditory effects are also known as the physical effects of hearing defects. Non-auditory effects are associated with work performance, such as reduced productivity and misunderstanding what is heard; psychological effects, such as

disorders, sleeplessness, irritability and stress; physiological effects, such as increased blood pressure, irregular heart rhythms and ulcers. Noise pollution can havoc the nervous system, affecting individuals' physical and psychological behaviour (Usikalu *et al*., 2016). People differ in their sensitivity to noise in that what one perceives to be sound may be perceived as noise by another.

World Health Organization (WHO, 2018; Olalekan and Adindu, 2019) described their scientific findings on the health implications of noise in guidelines for community noise to include hearing impairment, speech intelligibility, sleep disturbance, physiological functions, increased stress hormone level, etc. Several researches have also exposed the health challenges resulting from airport noise exposure suffered by residents of the airport vicinity and have summarized the typical impacts of airports to include employment generation, wealth creation, world trade contribution, and tourism stimulation (Price, 2006; Jarup *et al*., 2008; Sondakh *et al*., 2014; Olalekan and Adindu, 2019). Amongst all these enormous impacts posed by airports on their host communities, this research focused on assessing the health-related challenges suffered by the host communities due to airport noise.

## Materials and Method

*Study Area*

The study area covers the entire South-South Region of Nigeria and the selected Airport of interest (Figure 1). The region comprises the present-day Akwa-Ibom, Bayelsa, Cross River, Delta, Edo and Rivers states. The study was limited to selected regional states with airport presence, including Rivers, Edo, and Cross River. The selected states for the study were chosen because of the presence of active airports suitable for the present study. The communities in the Local Government Areas (LGAs) were purposively selected based on the proximity to the location of the airport (Figure 1).

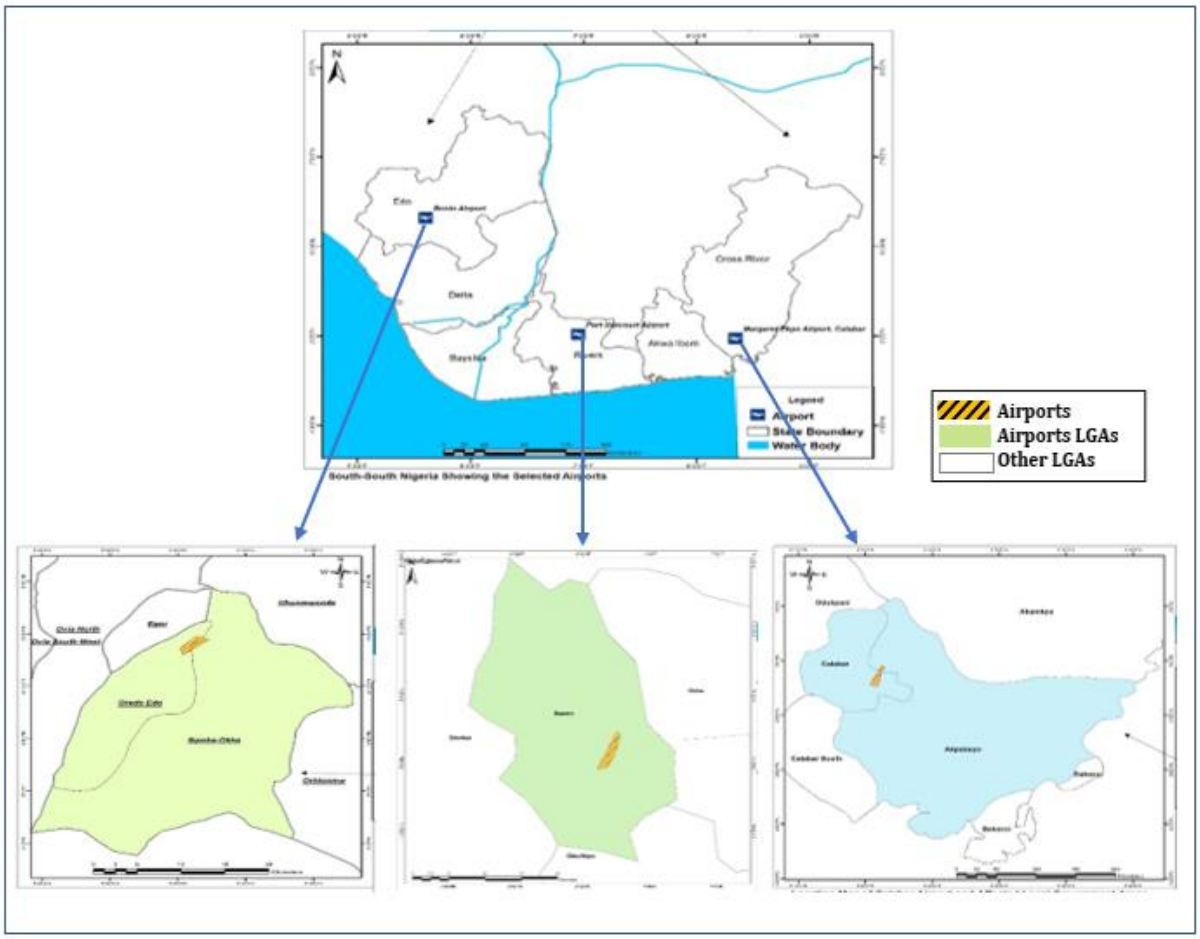


**Figure 1:** Overview of South-South Region, Selected Airports, Airports Host LGAs

**Sample Method, Sampling Techniques and Sample Size**

Based on the eligibility criteria, the State, LGAs and communities for the study were selected and presented in Table 3.1. Also, the National Population Commission data 2006 for each LGA was used as the base year and projected to 2023 at an annual growth rate of 3.2% (Table 3.1). The Malthus Exponential Model was adopted to project the current population of the study areas. The formula for the Malthus Exponential Model is given thus:

$$P_t = P_o e^{r*t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where $P_t$ = Population to be projected, $P_o$ = population of the base year; t = time, r = rate of increase (natural increase divided by 100), e = exponential factor and constant at 2.718.

To get an accurate representative sample of the target population, the Taro Yamane (1964) formula for sample size determination was used;

$$n = \frac{N}{1 + N(e)^2} \quad \text{..... (2)}$$

Where: e= Level of precision (0.05)

N= Population

n= Sample size

1= Constant

$$n = \frac{2384457}{1 + 2384457\ (0.05)^2}$$

$$n = \frac{2384457}{1 + 2384457 \times 0.0025}$$

$$n = \frac{2384457}{1 + 5961.1}$$

$$n = \frac{2384457}{5962.1}$$

$$n = 399.9 \sim 400$$

Therefore, the study involved 400 respondents distributed across the communities around the selected airports in the South-South region of Nigeria.

*Data Collection*

The questionnaire was used to elicit information from respondents. The questionnaire was divided into sections. There was a section designed to collect information on the demographic characteristics of respondents to be able to describe respondents in terms of gender, age, occupation, income, ethnicity and religion, while another section aimed at gathering information on the perception of nearby communities on the impact of aircraft

Table 1: Distribution of the Questionnaire among the LGAs of Study

| State | LGAs of Study | Communities of Study | 2006 Population (NPC) | Projected Population (2023) | Percentage in Projected Population | Distribution of the Questionnaire |
|---|---|---|---|---|---|---|
| Rivers | Ikwerre | Omu-Ali<br>Omu-Olo<br>Igwuruta-Alimini | 188,930 | 324,960 | 13.6 | 54 |
| Edo | Oredo<br>Edo | Iguasa<br>Oko<br>Ogboyoko<br>Benin City | 374,515 | 644,166 | 27.0 | 108 |
| | Ikpoba-Okha | Ugbeku<br>Idunmwunivdiode | 372,080 | 639,978 | 26.8 | 107 |
| Cross River | Calabar Municipal | Calabar<br>Ishie Town<br>Ikot Ansa<br>Ediba Beach | 179,392 | 308,554 | 13.0 | 52 |
| | Akpabuyo | Oro Ukun<br>Idundu | 271,395 | 466,799 | 19.6 | 78 |
| Total | **5** | **15** | | **2,384,457** | **100** | **400** |

noise on their health. The questionnaire made use of a close-ended and Likert-5-point scale format. The Likert scale was based on a 5-point scale, where **1:** Undecided **2:** Strongly Disagree **3:** Disagree **4:** Agree **5:** Strongly Agree. At the point of analysis, the scales were combined to derive definite feedback where "Strongly Disagree" and "Disagree" combined to form a "Disagreed" option, "Strongly Agree" and "Agreed" combined to create an "Agreed" option while "*Undecided*" was untouched. The decision rule was based on the average mean score of the scale.

$$\frac{1+2+3+4+5}{5}$$

$$\frac{15}{5}$$

$$Mean\ Score\ for\ Decison = 3$$

The range of interpretation of the Likert Scale based on the mean score is given as 0.1 – 1.9 (Neutral), 2.0 – 2.9 (Disagreed) and 3.0 – 3.9 (Agreed).

*Data Analysis*

The retrieved questionnaires were coded and subjected to Statistical Package for the Social Sciences (SPSS) for proper analysis. The retrieved questionnaire coding was done with MS Excel before being transferred to the SPSS data entry. Using the SPSS window (Version 22), descriptive statistics tools such as frequency counts, percentages of responses and chats were adopted for the analysis. Using such statistics allows the researcher to present the evidence of the study in a way that can be understandable and make a conclusion concerning the study variables (Baridam, 2001).

## Results and Discussion

A total of four hundred (400) questionnaires were distributed across the three (5) LGAs selected for the study, while three hundred and seventy-two (372) returned as correctly filled and fit for further analysis. This represents 93% of the returned questionnaire. From the outcome, 55.1% of the respondents were male, while 44.9% were female. Regarding educational qualifications, 17.7% of the respondents had no formal education, 30.1% possessed primary education, and 36.8% and 15.3% had secondary and tertiary education. On the occupation, 19.9% of the respondents are unemployed, 35.5% indicated to be self-employed/trading/commerce while 31.5% and 12.4% of the respondents into skilled/managerial and manual/partly-skilled occupations, respectively.

*Health-Related Impacts of the Selected Airports Activities on the Surrounding Communities*

The health-related impact of the selected airport's activities on the surrounding communities was assessed, and the outcome was presented in Table 2. From the outcome, 47.0% of the respondents agreed that noise from aircraft activities has caused hearing impairment in people in the community, while 40.6% and 12.4% disagreed and were undecided about whether the noise from aircraft activities causes hearing

impairment in people in the community. 45.7% of the respondents agreed that the aircraft noise causes difficulty in sleeping and restlessness in the surrounding communities, while 44.9% and 9.4% of the respondents disagreed and were undecided about the aircraft noise causing difficulty in sleeping and restlessness in the surrounding communities. From the study outcome, 27.7% of the respondents agreed that the aircraft noise makes it difficult for community people to sleep during the day, while 47.0% and 25.3% of the respondents disagreed and were undecided about the aircraft noise makes it difficult for the community people to sleep during the day. The outcome indicated that 42.0% of the respondents agreed that people find it difficult to communicate in the community due to aircraft noise, while 45.2% and 12.9% of the respondents disagreed and were undecided about people finding it difficult to communicate in the community due to aircraft noise. 42.0% of the respondents agreed that the aircraft noise is causing many people in the community panic-attack that can cause high blood pressure, while 42.4% and 15.6% of the respondents disagreed and were undecided about the aircraft noise is causing many people in the community panic-attack that can cause high blood pressure. From the analysis, it was revealed that 54.6% of the respondents agreed that the aircraft noise is affecting community people's mental and physical health, while 40.1% and 5.4% of the respondents disagreed and were undecided about the aircraft noise is affecting community people's mental and physical health.

Considering the health-related impact of airport activities, the outcome revealed that noise from aircraft activities has caused hearing impairment among people in the community; the aircraft noise causes difficulty in sleeping and restlessness, although the aircraft noise does not make it difficult for the community people to sleep during the day. Furthermore, the respondents agreed that the people find it difficult to communicate in the community due to aircraft noise. Also, the aircraft noise is causing many people in the

community panic attacks that can cause high blood pressure and affect the community people's mental and physical health. The outcomes share similarities in some of the impacts listed by Ahmadabadi (2023) regarding noise pollution, which include heart problems, communication interruptions, distress, headaches, deafness and hearing loss, increase in accidents, increase in blood pressure, nervousness, carelessness, lack of memory, anxiety and disorders in sleep. The findings from this study share similarities with the study conducted by Ishaku and Avwiri (2024), which indicated hearing impairment, difficulty in sleeping (during the day and night), panic-attack that can cause high blood pressure and overall mental and physical well-being as the significant health-related impact of aircraft noise from their study. A similar outcome was reported in the study conducted by Olalekan and Adindu (2019) and Orikpete et al. (2021), while Moroe and Mobaso (2022) indicated related health impacts due to noise from the commercial areas**.**

## Conclusion

Generally, airports are mostly sited away from residential environments; however, the fast pace of urbanization has led to an increased spring-up of industries, residential buildings, and businesses, which are evolving around many airports, especially in developing countries. Having considered the health-related impacts of noise pollution as a result of aircraft activities from the selected airports in Southern Nigeria and their nearby communities, it was concluded that the generated noise pollution from aircraft activities such as landing and taking-off expose communities to extremely dangerous noise levels status and have a significant impact on the wellbeing of the people living nearby the selected airports causing many people in the community panic-attack that can cause high blood pressure and affecting the community people mental and physical health.

Table 2: Health-Related Impacts of the Selected Airports Activities on the Surrounding Communities

| | Rivers State (N (%)) | | | | Edo State (N (%)) | | | | Cross River State (N (%)) | | | | Overall | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **A** | **D** | **U** | **Total** | **A** | **D** | **U** | **Total** | **A** | **D** | **U** | **Total** | **A** | **D** | **U** | **Total** | **Mean** | **Decision** |
| A | 31 (63.2) | 15 (30.6) | 3 (6.2) | 49 (100) | 73 (36.7) | 90 (45.2) | 36 (18.1) | 199 (100) | 47 (37.9) | 70 (56.5) | 7 (5.6) | 124 (100) | 175 (47.0) | 151 (40.6) | 46 (12.4) | 372 (100) | 3.14 | Agreed |
| B | 22 (44.9) | 23 (46.9) | 4 (8.2) | 49 (100) | 97 (48.7) | 78 (39.2) | 24 (12.1) | 199 (100) | 51 (41.2) | 66 (53.2) | 7 (5.6) | 124 (100) | 170 (45.7) | 167 (44.9) | 35 (9.4) | 372 (100) | 3.28 | Agreed |
| C | 5 (10.2) | 11 (22.4) | 33 (67.3) | 49 (100) | 52 (26.1) | 97 (48.7) | 50 (25.1) | 199 (100) | 46 (37.1) | 67 (54.0) | 11 (8.9) | 124 (100) | 103 (27.7) | 175 (47.0) | 94 (25.3) | 372 (100) | 2.71 | Disagreed |
| D | 4 (8.1) | 28 (57.1) | 17 (34.7) | 49 (100) | 89 (44.7) | 88 (44.3) | 22 (11.1) | 199 (100) | 63 (50.8) | 52 (42.0) | 9 (7.3) | 124 (100) | 156 (42.0) | 168 (45.2) | 48 (12.9) | 372 (100) | 3.08 | Agreed |
| E | 9 (18.4) | 16 (32.7) | 24 (49.0) | 49 (100) | 96 (48.3) | 82 (41.2) | 21 (10.6) | 199 (100) | 51 (41.1) | 60 (48.4) | 13 (10.5) | 124 (100) | 156 (42.0) | 158 (42.4) | 58 (15.6) | 372 (100) | 3.16 | Agreed |
| F | 23 (47.0) | 26 (53.0) | - | 49 (100) | 94 (57.3) | 72 (36.2) | 13 (6.5) | 199 (100) | 66 (53.2) | 51 (41.1) | 7 (5.7) | 124 (100) | 203 (54.6) | 149 (40.1) | 20 (5.4) | 372 (100) | 3.60 | Agreed |

*Agreed (A): Agreed + Strongly Agreed, Disagreed (D): Disagreed + Strongly Disagreed; Undecided (U)*
*The range of interpretation of the Likert Scale based on the mean score is given as 0.1 – 1.9 (Neutral), 2.0 – 2.9 (Disagreed) and 3.0 – 3.9 (Agreed)*

KEY:
Variable A: Noise from aircraft activities has caused hearing impairment among the people in the community
Variable B: The aircraft noise causes difficulty in sleeping and restlessness
Variable C: The aircraft noise makes it difficult for community people to sleep during the day
Variable D: The aircraft noise makes it difficult for community people to sleep during the night
Variable E: The aircraft noise is causing many people in the community to have panic attacks that can cause high blood pressure
Variable F: The aircraft noise is affecting community people's mental and physical health

Social systems such as communities should be restricted to a 10km radius distance away from the airport area. The government can achieve this by establishing the right of way in the areas within this radius.

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