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Research Article

Impact of Airport Noise on the Health Situation of Host Communities: A Case Study of Obong Victor Attah International Airport, Akwa Ibom State, Nigeria

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Abstract

Environmental noise causes at least 10,000 cases of premature death in Europe each year and noise pollution have been known to have a negative impact on all sectors of society, rich and poor. However, it seems likely that some groups of society are more affected than others. These health inequalities may arise as a result of increased exposure to pollution, increased sensitivities, increased vulnerabilities, or a combination of all three. Moreover, noise from aircraft and from traffic going to and from airports is probably the most obvious environmental impact of the aviation industry because it is easily perceived and annoying, especially where this occurs frequently. An increased use of air transportation has overtime resulted into a corresponding increase in aircraft noise which has placed the health of residents of the airport vicinity at great risk. All these notwithstanding, negative activities like noise generation from airports generate impacts of great concern. These impacts have been the major concern of residents at the airport vicinity. Interestingly, this research work measured the impacts of airport noise on the health situation of host communities of Uruan, Okobo and Nsit-Atai. LGA's in Akwa-Ibom State. Health is the major parameters used in measuring these impacts. A buffer was used to demarcate the study into zones and a systematic sampling technique was employed in selecting the households to be sampled. The sample size composed of 400 respondents and this was determined from the population of the host communities using the Taro Yamane formula. Data needed for this study was obtained from questionnaires administered to the 400 respondents. Secondary data was collected from Obong Victor Attah International Airport Development Company. A sound meter was also used to determine the noise levels within the buffer distance. Data collected were analyzed using; percentages, charts, maps and simple linear regression statistical tools. The hypothesis formulated was tested using simple linear regression analysis, the null hypothesis which stated that airport does not significantly impact health was rejected. Results from the analysis indicated that the major health issues resulting from the airport noise were annoyance (43.8%), sleep disturbance (37.9%), increased heart beat (12%) and hearing loss (5%). From this result it is inferred that, Obong Victor Attah International Airport influences negatively on the health of the host communities in the study area. It is recommended that the members of the host community should be enlightened and educated about the dangers of the airport noise on their health. Also, citizen advocacy should be intensified and encouraged on the health impact of noise. It is also imperative that residential buildings should not be approved too close to the Airport this would reduce the severity of these health issues associated with Airport noise.

Introduction

As Nigeria strives towards achieving sustainable development goals, vision 20:2020 and adequate health care for an estimated population of about 198 million people that is growing at the rate of 3.2% per annum, Nigeria faces the challenges of population impact on its environmental resources [1]. Nigeria ranks among the most urbanized countries in the world. In 1980 the urbanization rate was 28.6 percent rising to 35.3 percent in 1999 and 49.8% in 2010 with the rate projected to increase to 56.8 percent and 63.6 percent in 2020 and 2030 respectively. Interestingly, the global concerns for environmental protection and sustainable development stem out of the fact that noise pollution cause disasters. This affect both the rich and the poor, though the poor are the highest hit and most vulnerable.

Noise pollution has been on the increase in this 21st century and has become an issue of serious global concern. It is a social problem with public health impact which has become a part of the urban culture. Despite this obvious positive impact of air transport, air transport has also generated negative impacts. One of such impact is Aircraft noise. Aircraft noise has been a significant source of community noise. Of concern are impacts on people and communities near the airport site performing activities which are totally unrelated to airport activities (e.g., area residents, office workers, school children and hospital residents and staffs). An increased use of air transportation has overtime resulted into a corresponding increase in aircraft noise which has placed the health

of residents of the airport vicinity at great risk. World Health Organization (WHO) [2] described their scientific findings on the health implication of noise in guidelines for community noise to include; hearing impairment, speech intelligibility, sleep disturbance, physiological functions, increased stress hormones level, etc. A number of researches have also exposed the health challenges resulting from airport noise exposure suffered by residents of airport vicinity [3-8] have summarized the typical impacts of airports to include; employment generation, wealth creation, world trade contribution, and tourism stimulation. Amongst all these enormous impacts posed by airports on its host communities, this research was focused on assessing the health-related challenges suffered by the host communities as a result of airport noise. Also, the committee final report of 1963 (Wilson Report) on the problem of noise, stated that of 1400 people interviewed about noise in 1948, 25% said they were disturbed by noise, but by 1961 the proportion had doubled to 50%. However, gradually over the last decade a growing concern about noise has developed. Many people now regard noise as a pollution component that contributes to a deterioration of the environment.

All these notwithstanding, negative activities like noise generation from airports generate impacts of great concern. These impacts have been the major concern of residents at the airport vicinity. Various studies have looked at various aspects of airports and its contribution to development. For example, Ihuoma and Raimi [9] looked at Obong Victor Attah International Airport Contributions to Tourism; Adindu and Raimi [10] looked at Obong Victor Attah International Airport and its contributions to the Income of the Host Communities; Morgan [11] looked at the benefits and cost of Economic Development process like airports in the U.S.A. These benefits were looked at from the qualitative and quantitative aspects Luke and Jackie [12] also researched on the economic impact of South Africa International airports. Anofofun, Zakaree and Iluno [13] also looked at Air transportation development and Economic growth in Nigeria. Fu and Zhang [14] looked at the Effect of Airport Revenue on Social Welfare in London. Blair, Diechert and Drozd [15] looked at the Influence of small airports and air transportation on local Economic Development in Nebraska Nwogbeet [16] looked at the Impact of Air Transport Sector on Economic Development in Nigeria.

Related researches have been carried out in different parts of the world on airports to assess the health implication of airport noise on host communities [3-6]. However, it would seem that since the Ibom international Airport is a recent development, little or no research has been carried out on the airport. This has necessitated this research, to assess the impact of the airport on host communities. The purpose of this study was to examine the impact of the Airport noise on the health situation of the host community.

Research Questions

How has noise from the Obong Victor Attah International Airport affected the health of host communities?

Hypothesis

The following null hypothesis would be tested;

HO = Obong Victor Attah International Airport does not significantly impact on health.

Materials and Methods

Study Area: Location

The Obong Victor Attah International Airport is an Airport in Akwa Ibom State, Nigeria. This Airport is hosted by three (3) local governments which constitute the study area. They are Okobo, Nsit Atai and Uruan local governments. The area is located within the coordinates 8.00E, -8.50E and 4.500N and 4.550N (Figure 1).

People and Population

The people are mainly Ibibio's, with Ibibio language as the major spoken language. Ibibio constitute the largest ethnic group in Akwa Ibom state. According to projected population of 2015 by the Ministry of Economic Development Uyo, Akwa Ibom State, Nsit-Atai has a population of 99,164, with 50,242 males and 48,922 females. Okobo has a population of 138,828; made up of 70,790 males and 68,038 females. Uruan, has a population of 95,576 this is composed of 48,920 males and 46,656 females. Population of the study area was vital to the study because population is pivotal to the development of any region.

Climate

Two major types of rainfall are prevalent in the area. They are the convectional and the frontal rainfall. The convectional rainfall varies with season and is common during dry season when the intensity of insolation is high. Though this type of rainfall is intense it last for a short duration. The frontal type of rainfall is mostly prevalent in the area. These types of rainfall are associated with lightening and thunders and usually occur late in the afternoon, at the beginning and the end of raining season when maritime air mass is less deep. These areas receive frontal rainfall in all months of the year at least on the average even though it varies in quantity. The remarkable seasons in the area are majorly the dry and the rainy season. The dry season usually starts from November and last till March. The dry seasons is usually characterized by prevailing influences of the dry and dusty North West wind commonly known as "Harmattan". While the wet or rainy season begins from March and ends in October. The average annual rainfall totals 2500 mm [17].

Atmospheric temperatures within these areas are continually high and changes slightly within the year. The highest temperatures are recorded between February and April and do not usually exceed 37°C. The temperature variations in these areas are not much. Generally, the mean annual temperature is above 23°C and does not exceed 29°C. However, the mean annual temperature ranges between 27°C and 28°C.

Humidity is generally known as the dampness of the atmosphere which is largely a function of temperature. The highest values of temperature are recorded in the morning when the temperature is low, usually between 90-95% and the lowest in the afternoon when the temperature increases and is usually between 50-60%. The relative humidity is highest in April and lowest in January. Climate was an important factor that influenced the location of Ibom Airport in the host LGA's.

Sampling Procedures and Methods of Data Collection

Sampling procedures: (Table 1) [18].

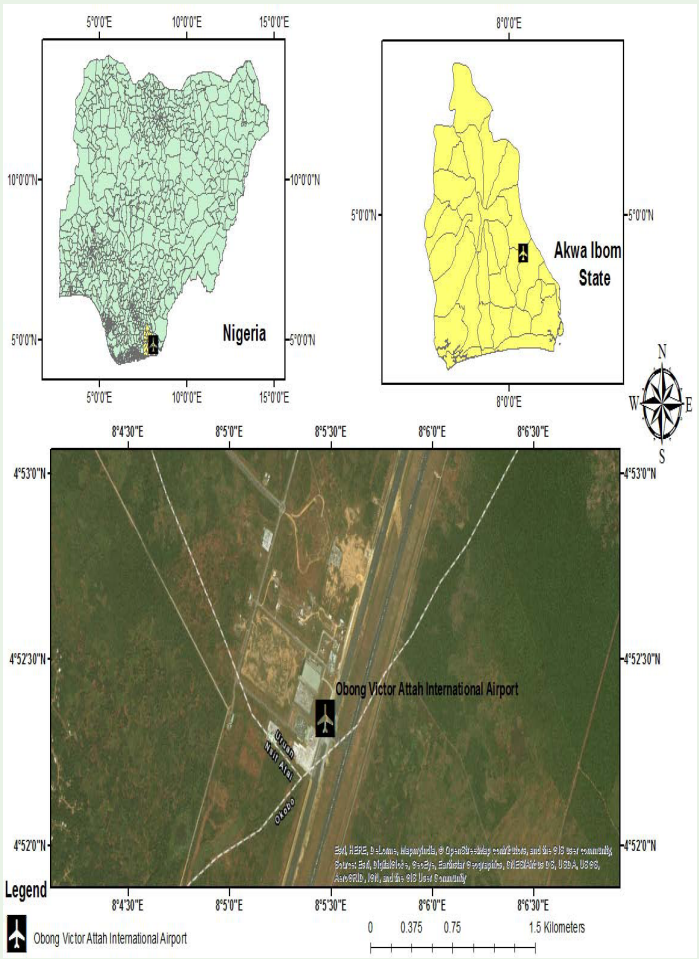

Figure 1: Akwalbom State Showing the Study Area.

Table 1: Sample Population.

Local Governments	Projected Population (2017)	Percentage Represented (%)	Villages Projected Population (2017)	
Okobo	134,264	35%	EgbghiEta	1,848
			Nung Atai	7,232
			Amammong	20,534
			Total	29614
Uruan	153,101	39.90%	Ekpene Ukim	14,774
			Ishiet Ekim	4,657.12
			Ndon Ebom	17,046
			Esuk Inwang	2,199
			Total	38676
Nsit Atai	95,903	25.02%	IkotInyang	948
			Idibia	21,299
			Ndon Ekpe	698
			Ikotmkpo	587w
			Total	23,533.48
Total	383,268	99.90%	91,822.92	

Source: 2017 Population projected from 2006 National population census (NPC, 2006) [18].

Sample Size

The Taro Yamane Formula was used

$$n = \frac{N}{1 + N(e)2}$$

$$n = \frac{91,822.92}{1 + 91,822.92(0.05)2}$$

$$n = \frac{91,822.92}{1 + 91,822.92(0.0025)}$$

$$n = \frac{91,822.92}{959.17}$$

n = 399.6≈400

Based on this a total of 400 respondents was the sample size. Table 2 shows the percentage of questionnaire administration (Table 2).

In administrating the questionnaire, quota system was used. The LGA's were given questionnaires based on their percentage contribution to the total population. Okobo was given 32.25 % (129) of the questionnaires, Uruan was given 42.11% (168) and Nsit Atai was given 25.6% (103) of the questionnaires respectively. A systematic sampling technique was employed in selecting households to be sampled (Table 3).

Table 3 presents the communities where the respondents were drawn. A five kilometers (5km) buffer was drawn around the Ibom International airport and all the communities were listed according to buffers (1km, 2km, 3km, 4km, 5km). A buffer was used to delimit the study area to enable the research study the distance decay in the area of tourism income, employment, education and noise level. Ten percent of the communities were selected at random from each of the buffer levels. Ten percent is the minimum level for any sample to considered valid [19]. The buffer map is presented in Figure 2.

Method of Data Collection

The following variables were sought for socio-economic information using structured questionnaires; socio-demographic information on health (Table 4).

Method of Data Analysis

Table 2: Questionnaire Administration.

LGA	Percentage (%)	Sample Size
Okobo	32.25	129
Uruan	42.11	168
NsitAtai	25.6	103
TOTAL	100	400

Table 3: Community Residence of Respondents.

Community of residence	Number of respondents
Amammong	88
EbighiEtai	9
Ekpene Ukim	64
Esuk Inwang	7
Idiabia	90
IkotInyang	4
Ikotmkpo	4
Ishiet	22
Ndon Ebom	74
Ndon Ekpe	4
Nung Atai	33
TOTAL	400

Source: Field data (2017).

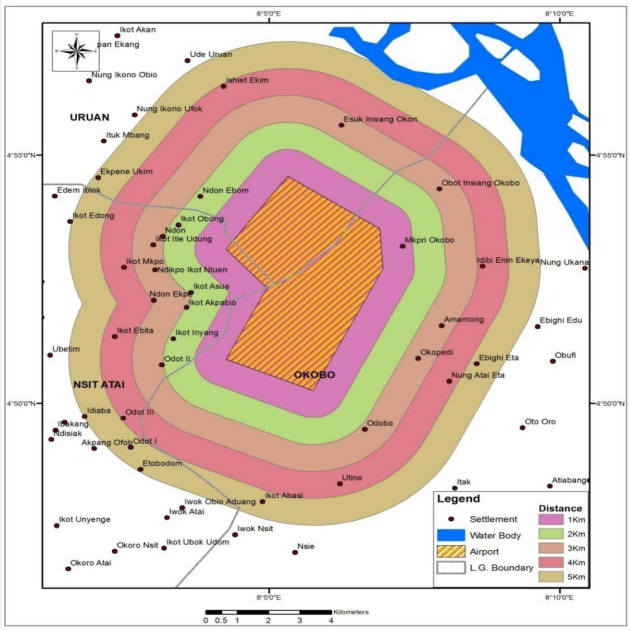

Figure 2: Buffer Map of Communities 5km from the Airport.

Table 4: Data set and method of collection.

1) Socio-demographic information.

Variable	Method of Data Collection
Gender	Structured Questionnaire
Marital status	Structured Questionnaire
Levels of education	Structured Questionnaire
Religion	Structured Questionnaire
Community	Structured Questionnaire
Employment Status	Structured Questionnaire
Family Size	Structured Questionnaire

2) Health.

Variable	Indicators	Method of Data Collection	Method of Data Analysis
Health consequences of airport noise	Increased number of patients with hearing loss, sleep disorder, annoyance and others	Questionnaire was used to collect data on health situation of residents	Descriptive statistics; percentage was employed to present the percentages of residents who report various health implications of airport noise. Maps were used to show these health implications with distance

Descriptive and inferential statistics were the major method of analysis used. Percentages and charts and maps were used to describe the extent of impact the airport has on employment, income local tourism and health of the airport host communities. Data collected on each of the variables were mapped to indicate their strength with distance.

Result and Discussion

Impact of Airport Noise on Health Status of People

The study also assessed the impact of Airport noise on the health status of the people in the study area. Figure 3 shows that the major health issue associated with the Airport noise were; annoyance (43.8%), sleep disturbance (37.9%), increased heart beat (12%) and hearing loss (5%). Ammamong, Ekpene Ukim and Idiabia suffered more from annoyance, Sleep disturbance as a result of airport noise. Ammamong, Idiabia and Ndon Ebom. Ndon Ebom, Ammamong and Idiabia suffered more from increased heartbeat. Ammamong, Ekpene Ukim and Idiabia suffered more from hearing loss. It could be inferred that Ammamong suffered the most from the health issues reported in the study (Figure 3).

Noise levels at different distances from the study area were measured. The readings show that, whereas, Ndon- Ebom and Ikot Inyang which are found at 2km buffer distance had the highest Noise level in decibels, Ekpene Ukim and Idiabia at 5km, had the lowest noise level in decibels. These readings are presented in Figure 4 (Figures 4 and 5).

Figure 5 further showed that the noise levels increased with distance. Communities closer to the Airport (Ndon Ebom, Ikot Inyang, Esuk Inwang Okon) had higher noise level than those ones farther from the Airport (Ekpene Ukim, Idiabia). This is in accordance with the distance decay model. The noise levels were classified based on US Environmental Protection Agency [20] (Table 5).

Test of Hypothesis

A certainty in the study was needed to affirm if Obong Victor Attah International Airport contributed significantly to employment, income, tourism and health status of the selected host communities. Hence this hypothesis was tested

Ho= Airport does not significantly impact health (Table 6).

Table 5: Noise Qualities Zones.

dB(A)	Quality
55<60	Risky
60<65	Moderately Risk
65<70	Highly Risky
70<75	Dangerous
75<80	Highly dangerous
Higher than 80	Extremely dangerous

Source: US Environmental Protection Agency, (2004).

Table 6: Summary of Simple Linear Regression Analysis of the Impact of the Obong Victor Attah International Airport on Health.

Indicator	R	R^2	ADJ R^2	STD ERR	SIG	B	F
Health	0.978	0.96	0.951	1.801	0	-978	197.77

Analysis by Author (2017).

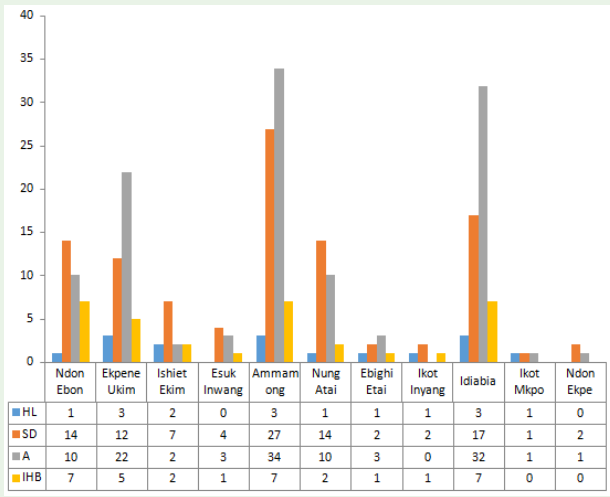

Figure 3: Health Issues Associated with Airport Noise.

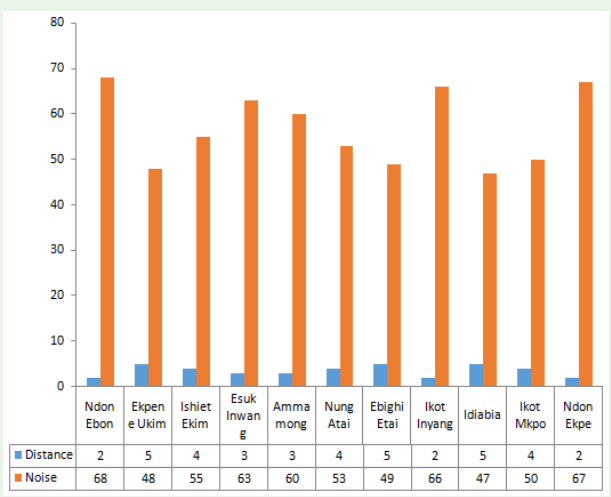

Figure 4: Noise levels at Different Distances from the Study Area.

Information on the relationship between Airport and employment, income, tourism and health impact of Airport noise were subjected to simple linear regression using SPSS version 20. The results indicated that the R which was the correlation between the observed (Airport) and predicted dependent variables (Health) and high for Health (97.8%) and the R-Square or coefficient of determination indicated that the Airport contributed poorly and greatly to noise as it concerns health (95.6%). The magnitude and influence of these variables are shown by the B values. The negative B values for the variables (health) indicate that airport does not make any positive contribution to health. The proportion of variance in the dependent variable (health) which was explained by the independent variable (Airport as represented by the distances from the Airport) is 95.1%.Based on the high (strong) correlation indicated by the R coefficient for Health, it was concluded that Obong Victor Attah International Airport was an important factor in noise generation in the host communities (Uruan, Okobo and Nsit-Atai LGA's of Akwa Ibom State).

The Impact of Airport Noise on the Health Situation of the Host Community

The study established that Obong Victor Attah International Airport had a negative impact on the health status of the host communities this is shown by the negative B value (-0.978) of the linear regression analysis. This result aligns with noise level readings which declined with distance from the airport. An assessment of the major health issues resulting from the Airport revealed that annoyance (43.8%), sleeping disturbance (37.9%), increased heart beat (12%) and hearing loss were mostly suffered by these communities. This is in line with the study by Haines [21] which was conducted to investigate whether aircraft noise exposure had an effect on cognitive impairments, annoyance and stress responses in school children. The study also examined whether those children exposed to high levels of social disadvantage are at greater risk of the effects of noise. The participant sample consisted of children attending ten schools in a high aircraft noise urban area compared to children from ten matched low aircraft noise urban areas. The results from this study established that there was an association between noise exposure and some cognitive impairments and annoyance in children, but did not find an association with reading impairments, memory, attention and self-reported stress. There was a weak association between airport noise exposure and hyperactivity and psychiatric morbidity. The results indicated that aircraft noise exposure was associated with annoyance after adjustment for age and social deprivation. The study also found that annoyance had an effect on health but there was no evidence of its long-term effect on general health [21]. This result also supports that airport noise has a significant impact on the physical health of people living around the Airport [3].

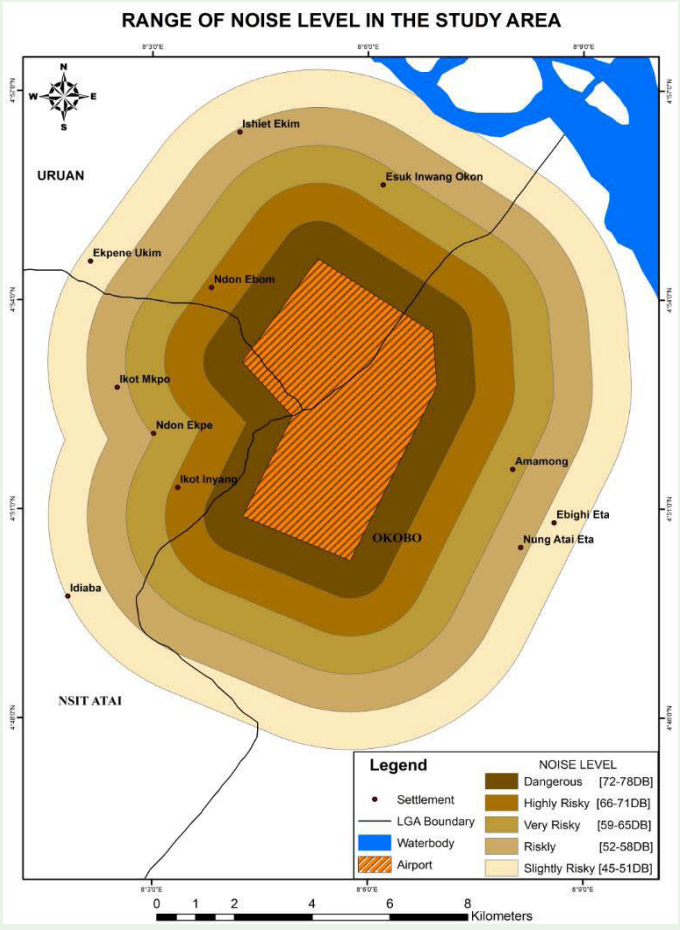

Figure 5: Buffer Map of Noise Level with Distance.

Conclusion

Noise pollution has a negative impact on all sectors of society, rich and poor. However, it seems likely that some groups of society are more affected than others. These health inequalities may arise as a result of increased exposure to pollution, increased sensitivities, increased vulnerabilities, or a combination of all three. However, lower socioeconomic status is associated with poorer health in a more general sense. This potentially means that deprived populations are more vulnerable to the effects of noise pollution, for instance, through existing long-term health conditions. Health research already shows that people of low socioeconomic status face a greater risk of heart disease, mental health problems and poor sleep. These are also some of the most commonly studied health impacts of noise pollution, which could be exacerbated by exposure.

Noise pollution contributes to a wide range of factors influencing the health of populations, which include aspects of the living environment to individual lifestyle choices. Although their specific contributions may be difficult to measure, 'multiple risk exposures' are thought to accumulate in deprived populations in a fairly linear fashion. Lower socioeconomic groups thus face a greater risk of poor health for a variety of reasons. Addressing this socioeconomic health gradient is complex since it requires all sectors of society to have access to the same resources and quality of living.

Conclusively, the findings of the study showed that host communities suffer community annoyance, sleeping disorder, hearing loss and increased heart beat as a result of the Airport noise. This also implies that there may be other health issues associated with the Airport noise, which are not easily discerned by the respondents. However, the factors which are important in determining noise levels that will potentially impact such population/communities include distance from the noise source; natural or man-made barriers between the source and the impacted population/communities; weather conditions which could potentially absorb, reflect or focus sound (such as wind speed and direction and temperature inversions) and the scale and intensity of the particular operational phase impacts. It is therefore necessary to document the resulting noise-environment impact report in relation to human health and other effects.

Recommendations

Based on these findings, recommendations are suggested in order to reduce the impact of the Obong Victor Attah International Airport on the host communities as follows:

The findings of the study showed that the major health issue that resulted from the airport noise was community annoyance and sleeping disorder. This also implies that there may be other health issues associated with the airport noise which may not be able to be discerned by the respondents. It is recommended that the members of the host community should be enlightened and educated about the dangers of the airport noise on their health. This is to reduce money spent on health matters. The study showed that noise level and the corresponding health issues decreased with distance, it is recommended that residential buildings should not be approved too close to the Airport this would reduce the severity of these health issues associated with Airport noise. Similarly, it is also recommended that putting strict regulatory constraints on the amount of noise that can be generated by aircrafts and on the flight paths to be followed; refusing planning permission where noise levels exceed 66dB(A) Leq at day time and 57 dB(A)Leq at nighttime and making technical adjustments to thrusts, angle of flight decent/ take-off, speed of aircraft accent etc.

Furthermore, promoting research and development into new low noise engine and air frame technologies, implementing the regulatory framework agreed by the International Organization for Standardization (ISO) and International Civil Aviation Organization (ICAO) and periodic noise mapping to identify day and night noise problems and action plans to deal with them. Also, emphasis on local controls of noise pollution (and air quality) problems should be giving priority. However, local solutions should be devised for local problems wherever possible, and airport master plans can help describe the package of measures that an airport operator can best apply to deal with such problems; widening the use of economic instruments, including the use of differential landing charges according to noise levels at all airports in Nigeria where a significant local noise problem exists. Funds from a noise related element in user charges could be used to finance local mitigation and compensation schemes.

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