



Evaluation of Noise Pollution on Health in Low and High Density Residential Area of Port Harcourt Metropolis.

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ABSTRACT

This study evaluated the effects of noise on human beings in low and high density residential areas of Port Harcourt Metropolis, Nigeria. Three research questions and one null hypothesis were formulated for the study. The instrument for the study is a structured questionnaire titled Noise Pollution in Low and High Density Residential Area Questionnaire (NPLHDRAQ). The study adopted comparative design. The research questions were analysed using mean, frequency and percentage, while the hypothesis was tested at 0.05 level of significance using Chi square. The population of the study consisted of all the residents in Port Harcourt metropolis, a simple stratified random sampling technique was used to get a sample of 154. The findings reveal that majority of the participants in both high density residential area (79.22%) and low density residential area (84.42%) agree that excessive noise is harmful to health. Respondents who live in high density area experience high effects of noise pollution compared to those that live in low density areas. (P=0.001). Individuals living in high density areas are exposed to noise levels above recommended levels, resulting in adverse health effects. Therefore the use of hearing protective devices (HPD) and behavioural modifications are hereby recommended.

Keywords: Hearing Protective Devices (HPD), low density, high density, residential areas.

INTRODUCTION

Noise is defined as an unwanted sound that results from the activities of man (Anomohanran, 2013). The loudness of sound is dependent on the physical sound pressure measured in decibels (dBA) and the sensitivity of the human ear (Okeke & George, 2015). Noise is perceived to be a normal phenomenon of life and is one of the most effective alarm systems in the physical environment of man (Oyedepo, 2012). Environmental noise is defined as noise generated from all sources (neighbourhoods, vehicles, rail, aircraft, construction and public works) not putting industrial environment into consideration. This has gradually increased in magnitude around communities and buildings where people reside and work and has become a public health concern in major cities worldwide, which can be consider as pollution. Noise, air, water and land pollution are all inclusive.

Noise pollution are disturbing to the hearer and has the possibility of causing short- or long-term harmful effects on the affected person's complete state of wellbeing (Palamuleni, 2015). Noise pollution has been associated with psychological (stress, fatigue, anxiety, depression), physiological (ringing sensation in the

ear (tinnitus), Noise induced Hearing Loss (NIHL), and physical (high blood pressure, headache, fast heart beat) impacts on exposed communities, in addition to being a disturbance to the urban environment. Standards for noise exposure are an important part of environmental policy in most developed countries to enhance local environmental quality; this is hardly the case in developing countries such as Nigeria. The problem of poverty and disease has already overwhelmed the majority, while noise that is insidious to health goes unnoticed (Ononugbo & Avwiri, 2019).

Appropriate noise levels for residential areas, business premises and social gatherings have been defined by various agencies in different countries. When the sound level exceeds the threshold limit of 85 decibels (dBA), the environment is said to be noise polluted (NIOSH, 2006). This study focuses on documenting the noise pollution level and health effects in low and high density residential areas of Port Harcourt metropolis.

Most individuals in Nigeria do not pay serious attention to noise pollution and its dangerous environmental consequences. This is unlike the developed countries where necessary actions have been put in place to regulate and control noise pollution. A study done in Delta State, Nigeria to determine the noise level in some of the towns showed that most noise pollutions are caused by lack of awareness and ignorance on the side of the people. Hence the reason why a lot of people are subjecting themselves to excessive noise (Anomohanran, 2013).

Currently, little is known regarding how noise levels may vary with forms of urban development and affect the health of a population (King et al., 2012). Hence it becomes very important to understand the noise pollution level and health effects in low and high-density residential areas of Port Harcourt metropolis and the information gathered in this research will create awareness on the detrimental effects of exposure to excessive noise levels.

Aim and Objectives of the Study:

The aim of the study is to evaluate the effects of noise pollution on health in low and high density residential areas of Port Harcourt metropolis. Specifically, the study is to:

- i. Identify the sources of noise pollution in low and high density residential areas of Port Harcourt metropolis.
- ii. Determine the effects of noise pollution in the different study areas in Port Harcourt low and high density residential areas.
- iii. Determine the levels of awareness of Noise -induced Hearing Loss (NIHL) amongst individuals living in Port Harcourt Metropolis.

Research Questions:

The following research questions are formulated to guide the study:

1. What are the sources of noise pollution in low and high density residential areas of Port Harcourt
2. What are the effects of noise pollution in the different study areas in Port Harcourt low and high density residential areas.
3. What is the awareness level of Noise -induced Hearing Loss amongst individuals in Port Harcourt Metropolis.

Hypothesis

Hypothesis (H₀₁) There is no significant difference in the effect levels of noise pollution in the different study areas.

Statement of the Problem

Noise is currently recognized worldwide as a major problem that affects the quality of life in developed town and cities due to an increase in noise pollution. However, it has been considered less important when compared to other environmental pollutants. Noise is a common feature and problem in the city of Port Harcourt which is due to several noise sources such as industries, vehicular movements, commercial activities, churches, marriages and social gathering going on within the city Centre (Okeke & George, 2015).

Since there is an apparent awareness of the danger of noise as pollutants and that prolonged exposure to high intensity noise is associated with damage to the inner ear sensory hair cells and the development of a permanent change in the hearing threshold, as well as poor speech. There is high tendency of having the

quality of life in the adult population affected and constitute a major limitation in relation to hearing in critical jobs, hence reducing the worker's chance of employment. It is necessary to evaluate the effect of noise pollution on health in low and high density residential area of Port Harcourt metropolis. Therefore, this study is out to evaluate the effect of noise pollution on health in low and high Density Residential Area of Port Harcourt Metropolis.

METHODOLOGY

The study is a comparative cross sectional study and the study area is Port Harcourt, the administrative and commercial capital of Rivers State is referred to as the Garden city of Nigeria because of its richness in greenery (Kio-Lawson & Dekor, 2014). It is the capital and largest city of Rivers State, Nigeria. It lies along the Bonny River and is located in the Niger Delta. The population of the study is from low and high density residential areas of Port Harcourt Metropolis. Simple stratified random sampling technique was used to select a sample of 154 from the population. The instrument for the study is a structured questionnaire titled Noise Pollution in Low and High Density Residential Area Questionnaire (NPLHDRAQ) A total of 3 Low Density Residential Areas and 3 High density residential areas were used for the study. 77 participants from each group was randomly selected from the population. These participants were administered the research Questionnaire with the help of two assistants who are residents each of the high and low density areas of Port Harcourt metropolis.

The observations were made by standing at a location at a time (road junctions, streets and so on), with the instrument pointing, in most cases, at any convenient direction and not at any specific noise source and at a one meter (1m) distance from the source of noise and between 1.2m to 1.5m above the ground. This was to ensure that the general ambient noise level was recorded and not the sound of a particular object or source of sound (Palamuleni, 2015). Two recordings were taken at the different locations and the average was recorded. This procedure was repeated twice for validation of result. Where possible the meter was placed away from walls and reflective surfaces to enhance accuracy of measurement. This procedure was carried out for morning (7:00 – 9:00 am), afternoon (12:00 – 2:00 pm), and evening (5:00 – 7:00 pm) on Monday, Wednesday, Friday, Saturday and Sunday.

The individuals recruited for the study were encouraged to voluntarily participate in the study, as they were given the opportunity to read and sign the consent forms. A self-administered questionnaire was used to obtain socio-demographic information, awareness, sources and effects of noise pollution.

The research questions were answered using percentages (%) mean and Standard Deviations (*SD*). While the hypotheses was tested using Chi-square (χ^2).

RESULTS

Research Questions 1: *What are the sources of noise pollution in the different study areas?*

The results for Sources of Noise Pollution among residence of High & Low density residential areas are presented in Table 1

Table:1 Sources of Noise Pollution among residence of High & Low density residential areas

Characteristics	HDRA n=77		LDRA n=77		Chi-Square (χ^2) (p-value)
	Freq (n)	%	Freq (n)	%	
Number that think there is excessive noise in their environment					
Yes	34	44.16	19	24.68	
No	6	7.79	28	36.36	19.21
Sometimes	37	48.05	30	38.96	(0.001)*
Sources of noise (Multiple response)					
Automobiles	48	37.80	48	39.34	
Loud speakers	36	28.35	28	22.95	
Industrial plant	15	11.81	10	8.20	
Air planes	13	10.24	22	18.03	11.53
Generator sets	7	5.51	12	9.84	(0.173)
Irrigation pumps	2	1.57	2	1.64	
Bakery	2	1.57	0	0.0	
Factories	2	1.57	0	0.0	
Railway engine	2	1.57	0	0.0	
Participants rating of noise intensity					
High	32	45.07	14	28.57	
Moderate	27	38.03	17	34.69	6.71
Low	12	16.90	18	36.73	(0.035)*
Number that think the noise affects their daily activity					
Yes	16	22.54	7	14.29	
No	9	12.68	12	24.49	3.40
Sometimes	46	64.79	30	61.22	(0.183)
Source of noise most bothersome					
Automobiles	24	38.10	12	23.53	
Loud speakers	23	36.51	12	23.53	
Industrial plant	4	6.35	15	29.41	27.26
Railway engine	0	0.0	8	15.69	(0.001)*
Factories	6	9.52	0	0.0	
Others	6	9.52	4	7.84	

*Statistically significant ($p < 0.05$)

HDRA=High Density Residential Area, LDRA=Low Density Residential Area

Majority of the participants in HDRA, 48.05% (37) and LDRA, 38.96% (30) feel there is excessive noise in their environment which is statistically significant ($p = 0.001$).

The source of noise was majorly from automobiles for both HDRA, 37.80% (48) and LDRA, 39.34% (48) when compared to other sources, though not statistically significant ($p > 0.05$).

Noise intensity was rated majorly as high for HDRA, 45.07% (32) and low for LDRA, 36.73% (18) which was statistically significant ($p = 0.035$).

Noise from automobiles was seen as most bothersome for participants in HDRA, 38.10% (24), while noise from industrial plants was seen as most bothersome for participants in LDRA, 29.41% (15) which was statistically significant ($p=0.001$).

Research Question 2: *What are the effects of noise pollution in the different study areas?*

Table 2: Effects of Noise Pollution among residence of High & Low density residential areas

Characteristics	HDRA n=77		LDRA n=77		Chi-Square (χ^2) (p-value)
	Freq (n)	%	Freq (n)	%	
Number that experience ringing noises in the ear					
Yes	20	25.97	4	5.19	
No	27	35.06	57	74.03	25.64
Sometimes	30	38.96	16	20.78	(0.001)*
Number that experience difficulty sleeping					
Yes	15	19.48	2	2.60	
No	28	36.36	51	66.23	18.36
Sometimes	34	44.16	24	31.17	(0.001)*
Number that have difficulty paying attention					
Yes	17	22.08	5	6.49	
No	36	46.75	50	64.94	8.91
Sometimes	24	31.17	22	28.57	(0.012)*
Number that forget things easily					
Yes	15	19.48	0	0.0	
No	34	44.16	51	66.23	18.47
Sometimes	28	36.36	26	33.77	(0.001)*
Number that feel their heart beating fast					
Yes	18	23.38	4	5.19	
No	32	41.56	55	71.43	16.79
Sometimes	27	35.06	18	23.38	(0.001)*
Number that feel like staying away from everybody around them					
Yes	27	35.06	3	3.90	27.20
No	24	31.17	48	62.34	(0.001)*
Sometimes	26	33.77	26	33.77	

*Statistically significant ($p<0.05$)

HDRA=High Density Residential Area, LDRA=Low Density Residential Area

Majority of participants in HDRA, 38.96% (30) that experienced ringing noise in the ear sometimes was statistically significant over participants in LDRA, 74.03% (57) that did not experience ringing noise in the ear. Participants in HDRA, 44.16% (34) experienced sleeping difficulty more, sometimes and were statistically significant over participants in LDRA, 66.23% (51) that did not experience sleeping difficulty. Both participants in HDRA, 46.75% (36) and LDRA, 64.94% (50) did not experience difficulty paying attention and this was statistically significant. Also, both participants in HDRA, 44.16% (34) and LDRA, 66.23% (51) did not experience forgetfulness and this was statistically significant. Again, HDRA, 41.56% (32) and LDRA, 71.43% (55) did not experience their heart beating fast and this was statistically significant. Majority of participants in HDRA, 35.06% (27) felt like staying away from everybody around

them and it is statistically significant over participants in LDRA, 62.34% (48) that do not feel like staying away from people around them.

Research Question 3: *What is the awareness level of noise induced hearing loss in individuals living in these study areas?*

The results for Awareness of NIHL among residence of High & Low density residential areas are presented in table 3

Table 3: Awareness of NIHL among residence of High & Low density residential areas

Characteristics	HDRA n=77		LDRA n=77		Chi-Square (χ^2) (p-value)
	Freq (n)	%	Freq (n)	%	
Number that have heard of NIHL					
Yes	32	41.56	40	51.95	1.28
No	45	58.44	37	48.05	(0.258)
Number that are aware that excessive noise cause hearing loss					
Yes	61	79.22	58	75.32	0.15
No	16	20.78	19	24.68	(0.701)
Number that are aware of WHO permissible noise level					
Yes	26	33.77	14	18.18	4.09
No	51	66.23	63	81.82	(0.04)*
Awareness value					
50 Db	12	46.15	2	14.29	
85 Db	10	38.46	10	71.43	6.09
90 Db	2	7.69	2	14.29	(0.107)
100 Db	2	7.69	0	0.0	
Number that think there is a difference in noise levels between high and low density residential areas					
Yes	60	77.92	69	89.61	3.06
No	17	22.08	8	10.39	(0.08)
Number that know that people should wear hearing protective device where noise exceeds 85 decibels					
Yes	50	64.94	48	62.34	0.03
No	27	35.06	29	37.66	(0.867)

*Statistically significant ($p < 0.05$)

HDRA=High Density Residential Area, LDRA=Low Density Residential Area

Majority of the participants in HDRA have not heard of NIHL, 58.44% (45) unlike those in LDRA where majority have heard of NIHL, 51.95% (40) though not statistically significant ($p > 0.05$). Majority of participants in both HDRA, 79.22% (61) and LDRA, 75.32% (58) are aware that excessive noise can cause hearing loss though not statistically significant ($p > 0.05$). Majority were not aware of the WHO permissible noise level which was statistically significant for both HDRA, 66.23% (51) and LDRA, 81.82% (63) ($p = 0.04$).

Awareness value was not statistically significant though was highest for LDRA, 71.43% (10). ($p > 0.05$). Participants that think there is a difference in noise level in both residential areas were more for both HDRA, 77.92% (60) and LDRA, 89.61% (69) though was not statistically significant ($p > 0.05$). Participants were aware that people should wear hearing protective devices where noise level exceeds 85

decibels, 64.94% (50) for HDRA and 62.34% (48) for LDRA, though not statistically significant ($p > 0.05$).

Hypothesis

Hypothesis (H0₁) There is no significant difference in the effect levels of noise pollution in the different study areas.

Table 4: Association between Effect levels of noise pollution and Residential area in Port Harcourt Metropolis

Effect levels of noise pollution	Residential Area		Total	Df	χ^2 (p-value)
	High-Density	Low-Density			
	Freq (%)	Freq (%)			
High (7-13)	55 (71.43)	8 (10.39)	63 (40.91)	1	56.84 (0.001)*
Low (≤ 6)	22 (28.57)	69 (89.61)	91 (59.09)		

*Statistically significant ($p < 0.05$), $\chi^2 = \text{Chi-Square}$

In measuring the effect levels of noise pollution, thirteen (13) questions that deals with different effects of noise pollution that could be encountered on a daily basis were asked and scored, based on a high and low effect. The scores were summed for all participants, from 1-13, with 1 being lowest effect and 13 being highest effect. Participants with overall low effect levels of noise pollution were scored 6 and below (≤ 6) and those with high effect levels were scored 7 and above (7-13) as shown in Table 1.

There is a statistically significant association observed between effect of noise pollution and residential area since the χ^2 calculated value at df 1 is 58 and 0.00393 the critical value (at $P \leq 0.05$; χ^2 critical $< \chi^2$ theoretical) hence the null hypothesis is rejected. There is a significant effect of levels of noise pollution between low density Residential area and those of high density residential areas. This means that those living in high density areas showed greater effects of noise pollution than those in low density residential areas ($P < 0.005$).

Summary of results

There is a statistical association observed between effect of noise pollution and residential areas. The High density Residential Areas (HDRA) experienced high noise pollution effect than the Low Density Residential Areas (LDRA) ($P \leq 0.05$). The noise levels and Awareness levels of Noise-induced Hearing Loss (NIHL) significantly differ amongst individuals in LDRA and HDRA of Port Harcourt Metropolis.

DISCUSSIONS

Noise pollution is significant in Port Harcourt Metropolis, with different sources involving man and industry. Findings of the study shown in Table 1.0 outlined that sources of noise pollution among residence of High and Low density residential areas is mostly as a result of automobiles and loud speakers in the areas at a high frequency of 37.80 in HDRA and 28.00 in LDRA. This agrees with Ouiss (2002) and Subraman et al; 2012 that noise resulting from automobiles (traffic noise) is high and dependent on the number of vehicles in urban network of roads due to increasing vehicular movement and number of road users. Iwuoha (2020) asserted that about 70% of the noise levels in High density residential areas are attributed to the vehicles engine and exhaust system, aerodynamic friction and interaction between the vehicles and road systems.

Most of the generated noise levels consistently exceed the permissible noise level according to the Nigerian National Environmental Standard and Regulation Act (2007) of a Bench mark of 75dB, Ononugbo & Avwiri, (2019). The study revealed that some residents in the HDRA and LDRA do not have the awareness of the significant danger or potency of noise on their health. The adverse effects including sleep disturbance, annoyance, Noise- induced Hearing Loss (NIHL), cardiovascular disease, amongst others. Results of investigations shown on Table 3 indicate that 66.23% of residents do not know the permissible noise level, 35.06% are unaware of the Hearing Protective Device and 20.78% unaware

the dangers of exposure to excessive noise to human health. The study finding further revealed that there is a significant difference between the Awareness levels and Noise Pollution levels amongst individuals in LDRA and HDRA of Port Harcourt Metropolis. This implies that environmental education should deliberately target road users and residents in the areas to create more awareness and imbibe regulatory measures in order to save the inhabitants of adverse health effects of noise pollution.

CONCLUSIONS

Noise pollution is statistically significant in Port Harcourt Metropolis and consequently responsible for Noise induced Hearing Loss (NIHL), sleep disturbance, speech interference, lack of concentration when studying, and other adverse effects. Residents have low awareness of the consequences of Noise on their health hence neglecting the use of noise protection devices in order to avert the adverse effects of Noise Pollution.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made:

1. Noise pollution control should be carried out on users of generators, vehicular movements (and other pollutants through an effective machinery set by government.
2. Residents in Port Harcourt Metropolis should be educated on the consequences of continual exposure to Noise (Noise induced adverse health concerns) and use of safety devices.
3. Teachers and students should be aware of the effect of noise in order for them to take precaution.

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