

Sources, Impact and Resident Perceptions of Noise Pollution in Selected Residential Areas of Lagos State, Nigeria

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Abstract

This study sought to identify the sources and impact of noise pollution in selected residential areas in Lagos State and compare the residents' perception of their nuisance value on the noise sources using a quantitative research design. The study area chosen for this study was Obalende and Oworonshoki in Lagos state, Nigeria. These areas were selected in the mainland and the island of Lagos State, used for commercial and residential purposes. The convenience sampling technique was used based on the heterogeneous nature of the respondents from the areas. One hundred questionnaires were distributed in Obalende and Oworonshoki (fifty, respectively). From the former, 41 were received while 46 were returned from the latter. Statistical Package for Social Sciences (SPSS) 21st version was used to analyse the data. Descriptive and inferential statistical tools were used, and they included mean, frequency, percentage, Spearman rank correlation, and t-test for proportion. The findings from the study show that noise levels in the residential areas were very high, thus negatively impacting the residents' health. Electricity generating plant and vehicle horns were the highest sources of noise nuisance in Obalende and Oworonshoki area respectively. In conclusion, the noise generated in these residential areas is high and have a profound adverse impact on the health and well-being of the people residing in these residential areas leading to annoyance, stress, and fatigue, sleep disturbance, high blood pressure as well as aggression to and from neighbours. Therefore, the reduction of traffic density in residential areas is deemed necessary. Sound protection proof should be provided in the construction materials to reduce the impact of noise.

Keywords: Decibel, Noise, Obalende, Oworonshoki, Residential communities of Lagos

1.0 INTRODUCTION

Noise is an unwanted signal or sound that may cause psychological and physical stress to the living and non-living objects exposed to it (Hessler and Hessler, 2010; Jamir *et al*, 2014). Certain factors, such as pitch irregularities, duration, and rhythm, determine the impact of noise on the objects. (Ebeniro and Abumere, 1999 as cited in Otutu, 2011). The primary noise sources are due to the increase in several vehicles, musical instruments, small-scale industries, urbanisation and human activities (Singh and Joshi, 2010; Kalshetty and Karalatti, 2013).

Goswami *et al*, (2011) noted that noise pollution is a global factor common in developing nations. In a similar vein, Kalshetty and Karalatti (2013) characterised noise pollution as a significant environmental problem that is common in both urban and industrial nations. This observation is confirmed by research based on different countries like India (Kalshetty & Karalatti, 2013; Jamir *et al*, 2014), Iran (Ehrampoush *et al*, 2012), Finland (Okokon *et al*, 2015), and Uttar Pradesh, India (Singh & Joshi, 2010). Meanwhile, according to the World Health Organisation (WHO, 1995), about 40% of European populations are affected by daytime sound intensities higher than 55 dB(A), while 20% suffer from intensive sound above 65 dB(A). The WHO also advises that noise in bed during nighttime ought to be below 30 dB(A), while outdoors it is 40 dB(A), to ensure a healthy living condition. For an educational institution, maximum intensity is 35 dB(A), which is intended to provide sound learning and teaching (Jamir *et al*, 2014). As a result, noise pollution is an integral and increasing factor causing various health, socio-cultural, aesthetic, and economic consequences.

Achieving a healthy noise environment within occupied spaces is critical for all buildings (Swift & Stead, 2008). It is a fact that constant exposure to high levels of noise may lead to consequences, such as Noise-Induced Hearing Loss (NIHL), which has irreversible and insidious characteristics and causes hearing disability and psychosomatic difficulties that interfere with the quality of life of those who suffer from it. According to Wokocha (2013), approximately 16% of the population, approximately 110 million people in member countries of the Organisation for Economic Co-operation and Development (OECD), are exposed to noise levels high enough to pose significant health risks.

Occupational noise is the most frequent cause of alterations in the population's hearing, where hearing loss was prevalent in around 77 cases in 1000, among men and 70 cases in 1000, among women (Pankaj *et al*, 2009). According to Onuu and Tawo (2006), there is general agreement that exposure to sound levels less than 70dB does not produce hearing damage, regardless of the duration of exposure and exposure for more than eight hours to sound levels above 85dB is potentially hazardous. To place this in context, 85dB is roughly equivalent to the noise of heavy truck traffic on a busy road.

Though noise's impact on workers' hearing is well-known, measures to control noise in the workplace, especially in factories and industries, are still in their early days. It has been observed that architectural projects often consider thermal, ergonomic and lighting aspects much more than aspects aimed at acoustic treatment. It can, therefore, be seen that there is a need for evaluations and monitoring of noise levels by professional teams that are involved both in the health area as well as in the civil construction and production engineering areas, to achieve practical solutions for controlling noise (Claudia *et al*, 2006).

In most developed countries like the United Kingdom and Canada, Environmental Impact Assessment (EIA) laws are usually formulated to guide against the adverse effects of noise pollution in industrial areas. These laws are adequately enforced (Hessler and Hessler, 2010). For most developing countries like Nigeria, it is either that the rules are not in existence, or they are not well enforced. In Nigeria, the Federal Environmental Protection Agency (FEPA) (1991) recommends a permissible limit of 90dB(A) for a maximum of 8 hours in occupational settings. Oloruntoba *et al*, (2012) study shows that only three residential areas studied in Ibadan, Nigeria, had a low noise level compared with the World Health Organisation (WHO) limit. It shows that many of the residents are exposed to noise.

Due to ignorance of Nigerians on the fact that there exists a close relationship between noise pollution and climate change, little or no attention is paid to the control of noise pollution in Nigeria (Aremu *et al*, 2015). Even though noise pollution was part of the National policy on the Environment since 1989 (Olorutoba, 2012), not much had been done to enforce the policy. The execution and implementation of the existing environmental pollution law is never enforced (Igboroje *et al*, 2004 cited in Oloruntoba *et al*, 2012). It is observed that the persistence of these problems could endanger the future stability of human health and could aggravate the human health catastrophe in the fast-growing cities in Nigeria (Aremu *et al*, 2015). The challenges posed by noise pollution on human health and the Environment have not yet received the full attention they deserve.

In Lagos, industries keep sprawling at various places, including places meant to be residential areas, generating high noise from their multiple plants, equipment, and big industrial

generators, thereby negatively affecting the health of their community. Therefore, the regular increase of noise from industrial buildings in the industrial area due to heavy equipment is a source of concern to workers and people around the area.

Several studies have been carried out in India on the ambient sound level (Banerjee *et al*, 2008; Patel *et al*, 2008; Jamir *et al*, 2014), low-frequency noise (noise below 250Hz) sources and effects (Berglund *et al*, 1996). Huffeldt and Dabelsteen (2013) studied was on the comparison of the urban and rural area of frequency variation in the urban Danish Great Tits in Denmark. Oloruntoba *et al*, (2012) study assessed noise level using a sound level meter in the selected residential area. This study measures the residents' perception of the selected regions regarding identifying noise and its impact on the residents. Therefore, there is a need to identify the sources of this noise, measure the noise levels at various operation units of residential buildings in this area, and determine the impact of this noise on the residents. The purpose of this study is to ensure proper planning of roadways in relationship to proximity to human settlement and to monitor and control the impact of noise pollution by the government agency.

Objectives of the study

1. To identify the noise sources in Obalende and Oworonshoki areas in Lagos State, Nigeria.
2. To assess the impact of noise nuisance on the residents in Obalende and Oworonshoki.

Hypothesis of the study

Null Hypothesis:

There is no level of agreement on the sources of noise for residents in Obalende and Oworonshoki.

2.0 NOISE POLLUTION

Noise is a menace that could lead to health challenges for the individual. It affects an individual's physical, psychological, and mental well-being (Jamir *et al*, 2014). Goswami *et al*, (2011) identified community and industrial noise as the two primary noise sources. Community noise can also be called environmental, residential or domestic (Lercher *et al*, 2013). Sources of noise from community noise are automobiles, construction work, fireworks, loudspeakers, and recreational facilities (Oloruntoba *et al*, 2012; Jamir *et al*, 2014). Industrial noises are noises from the workplace because of machinery and equipment being used. This study is on commercial and industrial noise because the study area is a mixed-use area for both residential and commercial purposes.

Noise can be measured using sound-level meters. Sound-level meters were used in the study of Ehrampoush (2012) to record the changes in noise level based on sound pressure in selected areas in Yazd city in Iran. Noise measurement was taken at a distance of 3.5m from the building at a specific time of the day. All measurements were according to the International Standard for assessment of Environmental noise ISO 1996. This study intends to measure noise level through the residents' perception in the selected study area.

People are affected by noise exposure than by any other environmental stressor. However, noise has been at the bottom of most environmental priority lists because its associated health effects are less life-threatening than those for air, water, and hazardous waste. Traditionally,

much scientific evidence has been based on studies of occupational exposures and industrial noise (Agbalagba *et al*, 2013; Wokocha, 2013). These noise exposures tend to be of greater intensity over more extended periods than exposures to community noise. In earlier research, investigators also tended to assume that noise produced direct health effects, such as hearing loss with noise exposures above 90 decibels and paid little attention to individual differences in response to noise, and noise as a stressor (Barbosa *et al*, 2005, as cited in Jamir *et al*, 2014)

Wokocha (2013) and Aremu *et al*, (2015) researched the construction industry and reported that industrial activities create enormous noise that commences from 70 dB and extends to 140 dB. This includes noise generated by air compressors, concrete mixers, scrapers, dozers, power sand, generators and rock drillers. Such noise is uncomfortable and unwanted in society. According to Jamir *et al*, (2014), Brazil workers exposed to road traffic noise reported 28.5% induced hearing loss on audiometric assessment. While in Bangladesh, about 78% are unaware of the effect of noise on their hearing.

Noise has several adverse effects on health. Anthrop (1990), as cited in Wokocha and Sopruchi (2010), revealed that long-run exposure to noise will result in deafness, high blood pressure and hypertension, headache, dry skin, weak eyesight, and abnormal conscience state of mind. Noise effects are healthy and behavioural; thus, unwanted sounds can damage physiological and psychological health.

Noise pollution can cause annoyance and aggression, hypertension, high-stress levels, tinnitus, hearing loss, sleep disturbances, difficult conversation, and productivity losses due to poor concentration (Lercher *et al*, 2011; Jamir *et al*, 2014). Kryter (2006), as cited in Wokocha and Sopruchi (2010), explained in his study that noise pollution leads to ecological imbalance. Noise harms animals by causing stress, increasing mortality risk by changing the delicate balance in predator/ prey detection and avoidance. Noise affects their usage of sounds in communication, especially regarding reproduction and navigation.

When faced with noise, annoyance is the most common outward symptom of stress building up in humans. Exposure to excessive noise can also induce or aggravate stress-related health outcomes, including those on the cardiovascular system, immune system, sleep, task performance, behaviour, and mental health. According to Onuu and Tawo (2006), the effects of noise pollution on cognitive task performance have been well-studied. Noise pollution impairs task performance at school and work, increases errors, and decreases motivation. Reading attention, problem-solving, and memory are most strongly affected by noise. Two types of memory deficits have been identified under experimental conditions: recall of subject content and recall of incidental details. Both are adversely influenced by noise.

Cognitive and language development and reading achievement are diminished in noisy homes, even though the children's schools may be louder than average. Mental development is impaired when homes or schools are near sources of noise such as highways and airports (Omubo-Pepple *et al*, 2010; Shield and Dockrell, 2003). Noise produces negative after-effects on performance, particularly in children. Children from noisy areas have been found to have heightened sympathetic arousal, indicated by increased stress-related hormones and elevated resting and blood pressure. There is good evidence, mainly from laboratory studies, that noise exposure impairs performance. Performance may be impaired if speech is played while a subject reads and remembers verbal material, although this effect is not found with non-

speech noise. The effects of irrelevant speech are independent of the intensity and meaning of the speech. The susceptibility of complex mental tasks to disruption by irrelevant noise suggests that reading relying on memory may be impaired by noise.

Noise exposure may also slow rehearsal in memory, influence processes of selectivity in memory, and choice of strategies for carrying out tasks (Olokooba *et al*, 2002; Witte, 2004; Pankaj *et al*, 2009). Table 1 shows the assessment of reported responses to occupational noise exposure. There is also evidence that noise may reduce helping behaviour and increase aggression.

Table 1: Assessment of reported responses to occupational noise exposure

Outcome	Observation threshold evidence	dB(A)
Performance	Limited	
Biochemical effects	Limited	
Immune effects	Limited	
Birth weight	Limited	
Annoyance	Sufficient	< 55 (office) < 85(industry)
Hypertension	Sufficient	55 - 116
Hearingloss (adult)	Sufficient	75
Hearingloss (unborn children)	Sufficient	< 85

Source: Adapted from HCN (1999) and DeHollander *et al*, (2004) as cited in WHO (2004)

3.0 MATERIALS AND METHODS

Quantitative research design was used, and the population was the residents in the study area. The study areas were Obalende and Oworonshoki in the Lagos Mainland and Lagos Island in Lagos State, Nigeria. Lagos state is located in the southwest of Nigeria and bordered by Ogun state to the north and east, the Atlantic Ocean to the south and the Republic of Benin to the west, with the geographic point coordinate given as 6°27'11"N 3°23'45"E.

The suitability of the selected residential areas in Lagos state for this research follows from the fact that there are sprawling residential areas with a sizeable number of residential buildings involved in different types of activities. These residential areas are very active, and the emission of noise can occur for a significant part of the day as well as during late hours of the day. These residential areas have provided this research with an avenue for identifying the different sources of residential noise and the effects of this noise on occupants and environs in line with the objectives of this research. The convenience sampling technique was used based on the heterogeneous nature of the respondents from the areas.

One hundred questionnaires were distributed by hand in Obalende and Oworonshoki (fifty, respectively). From the former, 41 were received while 46 were returned from the latter. Statistical Package for Social Sciences (SPSS) 21st version was used to analyse the data. The study aimed to identify noise sources and assess their impact on residents in the study areas, analysing the data using frequency, percentage and mean. The hypothesis, to show the significant difference in the level of agreement between the residents in Obalende and Oworonshoki on the noise sources, was analysed using Spearman rank correlation and t-test for proportion statistical tool. For identified noise sources, the respondents were told to rank the frequency of the noises. The respondents were also told to rank the impact of noise nuisance on the selected area using a Likert scale of low impact (1) to highly impact (5), and the mean was calculated accordingly.

4.0 RESULTS AND DISCUSSION

4.1 Sources of Noise

Table 2 indicates the sources of noise in the selected areas. The results show that in Obalende, the most identified sources of noise were activities/voices in neighbouring houses (98%), electricity plant (95%), music from neighbours (95%), traffic (95%) and traffic (motor bicycles) (88%). It was followed by commercial blender (85%), mosque (81%), night club beer parlour (81%) and record shop (76%). The least ranks sources of noise were a market (15%), factory/industry (15%) and pet (13%). This finding shows that Obalende combines the commercial and residential areas.

Table 2: Sources of Noise in Selected Residential Areas in Lagos State

Sources of Noise	Obalende				Oworonshoki				$d (R_1 - R_2)$	d^2
	N	F	%	R_1	N	F	%	R_2		
Electricity generating plant	41	39	95	2	46	37	80	1	1	1
Activities/voices in the neighbouring Houses	41	40	98	1	46	35	76	2	-1	1
Vehicle horns	41	34	74	4	46	34	74	3	1	1
Music from neighbours	41	39	95	2	46	34	74	3	-1	1
Mosque	41	33	81	6	46	34	74	3	3	9
Commercial Blender	41	35	85	5	46	32	70	4	1	1
Traffic (Motor Bicycles)	41	36	88	4	46	32	70	4	0	0
Street party	41	27	66	8	46	31	67	5	3	9
Traffic (cabs, lorries, heavy trucks)	41	39	95	2	46	30	65	6	-4	16
Church	41	25	61	9	46	30	65	6	3	9
Night club/beer parlour	41	38	81	6	46	30	65	6	-3	9
Bus Stop	41	19	46	11	46	29	63	7	4	16
Carpentry/welding workshop	41	24	59	10	46	25	54	8	2	4
Record Shop	41	31	76	7	46	25	54	8	1	1
Motor park	41	9	22	14	46	23	50	9	5	25
School	41	13	32	12	46	21	46	10	2	4
Market	41	6	15	15	46	19	41	11	4	16
Pets (e.g dogs, goats)	41	4	10	16	46	19	41	11	4	16
Factory/Industry	41	6	15	15	46	15	33	12	3	9
Construction site	41	11	27	13	46	13	28	13	0	0
The air-conditioner of neighbours	41	13	32	12	46	13	28	13	-1	1
Air traffic	41	27	5	8	46	8	17	14	6	36
Rail traffic	41	13	15	12	46	6	13	15	3	9

N= Number of respondents; F =Frequency; R =Rank

For Oworonshoki, the most identified sources of noise were an electricity generating plant (80%), activities/voices in neighbouring houses (76%), mosque (74%), vehicle horns (74%) and music from neighbours (74%). It was followed by commercial blender (70%), night club beer parlour (70%) and street party traffic (67%). The least sources of noise were a construction site and air-conditioning from neighbours (28%), air (17%) and rail traffic (13%).

The Spearman rank correlation was calculated using the difference in the ranking of Obalende and Oworonshoki. It shows a positive correlation. It implies that there is a strong correlation between the identified sources of noise from Obalende and Oworonshoki.

4.2 Hypothesis Testing

The null hypothesis that there is no agreement between residents of Obalende and Oworonshoki on noise sources was tested by using a t-test for proportion to compare two proportions or percentages (Kasumu, 2000). From Table 3, there is an agreement between sources of noise in Obalende and sources of noise in Oworonshoki because the t-test calculated (t_{cal}) for sources of noise (t_{cal} 11.0) is greater than the t-test tabulated (t_{tab}) with a confidence level of 95%. Thus, the alternate hypothesis (H_1) is accepted. The Spearman rank correlation (r) between the two residential areas (Obalende and Oworonshoki), as indicated in Table 3, shows a positive correlation among the variables.

Table 3: T-test for proportion on sources of noise

Variables	r	t_{tab}	t_{cal}	Sig.	Remark
Sources of noise	0.92	1.782	11.0	0.001	H_1 accepted

r = Spearman Rank Correlation

Impact of noise nuisance

Table 4 indicates the impact of noise nuisance on the residents at Obalende and Oworonshoki. From the results, annoyance (mean = 3.37), aggression to neighbours (mean = 3.32), aggression from neighbours (mean = 3.12) and sleep disturbance (mean = 3.05) are the most noise nuisance to the residents from Obalende. The least ranks impact of noise nuisance from Obalende respondents was forgetfulness (mean = 1.59), high blood pressure (mean = 1.37) and accidents (mean = 1.17).

Table 4: Impact of Noise Nuisance on the Residents in Obalende and Oworonshoki

Noise Effects	Obalende		Oworonshoki	
	Mean	Rank	Mean	Rank
Annoyance	3.37	1	3.00	4
Aggression to neighbours	3.32	2	2.87	6
Aggression from neighbours	3.12	3	3.09	3
Sleep disturbance	3.05	4	3.46	1
Stress level and setting in of fatigue	2.76	5	2.83	7
Headache	2.63	6	2.59	9
Hearing	2.59	7	3.17	2
Concentration	2.29	8	2.93	5
Task performance	2.22	9	2.46	10
Shock and panic	2.20	10	2.72	8
State of mind	1.83	11	2.41	11
Forgetfulness	1.59	12	2.07	12
High blood pressure	1.37	13	1.80	14
Accidents	1.17	14	1.89	13

For Oworonshoki respondents, the most noise nuisance impacts were sleep disturbance (mean = 3.46), hearing (mean = 3.17), aggression from neighbours (mean = 3.09) and annoyance (mean = 3.00). The least ranked noise nuisance impact were high blood pressure (mean = 1.80), accidents (mean = 1.89) and forgetfulness (mean = 2.07).

5.0 DISCUSSION OF FINDINGS

The results indicated that for the source of noise in selected residential areas, in the Obalende area, activities/voices in neighbouring houses, the electricity generating plant, night club/beer parlour were the most identified sources of noise. At the same time, air traffic was the least significant noise source in that area.

In the Oworonshoki area, the electricity generating plant, activities/voices in neighbouring houses, vehicle horns, music from neighbours, mosque were the most identified noise sources. Oloruntoba *et al*, (2012) in Ibadan show that vehicles and power generating sets were the most significant noise sources. They also find out that the noise source varies from one neighbour area to another in terms of the density of the area and the peak period. The effects of noise nuisance on the residents from Obalende are an annoyance, aggression to neighbours and aggression from neighbours.

While in the Oworonshoki area, sleep disturbance, hearing and aggression from neighbours are identified as the most common noise nuisance. This finding supports the study of Jamir *et al*, (2014) that the noise impact on human health includes hypertension and aggression. Joshi *et al*, (2003) and Oloruntoba *et al*, (2012) identified headache, lack of concentration, irritation, and fatigue as the factors affecting the impact of noise pollution on the residents. There is a significant difference in the level of agreement between the identified noise sources in Obalende and Oworonshoki.

6.0 CONCLUSION AND RECOMMENDATIONS

From the research results, it could be concluded that there are many noise sources in the two residential areas in Lagos State. The sources of noise generated vary from residential area to residential area. The noise generated in these residential areas is high. It seriously impacts the health and well-being of the people residing in these residential areas, leading to annoyance, stress, fatigue, sleep disturbance, high blood pressure, and aggression towards and from neighbours. In addition, these noise sources affect the residents' comfort in the areas. However, some residents concluded they were comfortable with the high noise generated in the area because they had little or no control over it. In contrast, a large majority of the residents were uncomfortable with the area's noise level.

Given the findings above, the following recommendations are made to find a lasting solution to the issue of noise pollution in the selected residential areas. It is vital that residents, as well as business owners, find a way of reducing the noise generated by electricity generating plants by using noise attenuation materials, adequate silencers for industrial generators. It is essential to construct the walls of residential buildings with materials that will reduce the noise generated in the building, thus preventing the transmission outside and with materials that will not reflect the sound produced in the building. Finally, there is legislation against noise pollution in Lagos State, but the government does not enforce these laws. Therefore, the government should set up an organisation to implement and enforce these laws. This organisation should have similar responsibilities to those of Kick Against Indiscipline (KAI), ensuring orderly and rational behaviour among individuals in Lagos State. Anyone who fails to comply with noise pollution control laws should face appropriate sanctions.

The Government of Nigeria had realised the side effects of noise pollution, especially in Lagos State, and actions had been taken to ensure the masses comply with noise reduction, especially in residential areas concerning noises generated from religious places such as Churches, Mosques, Event centres and clubhouses. Measures taken include closing down such facilities.

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