



EXPOSURE AND CONSEQUENCES OF NOISE POLLUTION AMONG RESIDENTS OF BICHI TOWN, KANO STATE, NIGERIA

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ABSTRACT

Environmental pollution is the most important public health problem densely in populated areas in the developing countries and often the underlying cause of many diseases of public health importance. Noise pollution is an undesirable sound that interferes with wellbeing in the environment with significant effects. With the current rapid growth and technological advancement, noise pollution is increasingly becoming environmental menace that deserves appropriate attention in order to mitigate its health effects. This paper aims to determine the sources, awareness and health effects of noise pollution in a typical Nigerian sub-urban population. Descriptive cross-sectional study using interviewer administered questionnaire and measurement of environmental noise using acoustic metre. Majority of the respondents (75.8%) were exposed to noise levels above the 55dB WHO safe noise level without health effects. Power generators, automobiles and grinding machines are the commonest sources of noise pollution in the studied environment amounted to a value of 55.8%, 40% and 35.8% respectively and to a lesser extent hawker (16.4%) and loudspeaker (9.6%) among others. Sleep disturbance, headache, and poor concentration were commonly reported effects of noise in the environment with magnitudes of 52.7%, 50.9%, 15.8% respectively. Anxiety (12.1%) and hearing disturbances (11.5%) were also common. Noise pollution associated health problems are common in the community with significant effects on the quality of life of the inhabitants. Stable power supply, effective legislation and improvement in living condition of the people are key to minimize noise pollution and avert its deleterious health effects.

Keywords. Awareness, exposure, health, noise, pollution

INTRODUCTION

Environment has a critical role in human health as many diseases can be traced to adverse environmental factors (Miner *et al.*, 2005). Environmental pollution is one of the major causes of deteriorating living conditions for the inhabitants of densely populated areas (Buadee, Gawu and Foli, 2018). It can be defined "as the introduction by man into the environment of substances or energy liable to cause hazards to human health, harm to living resources and ecological systems; damage to structure or amenity or interference with legitimate uses of the environment" (Reddy, 2017; El-sharkawy and Alsubaie, 2014). It occurs when there is actual or potential harm for humans often not restricted to injury but encompasses all effects to any of his senses or harm to possessions.

Therefore, noise which usually does not lead to physical injury constitutes an important yet largely underscored source of environmental pollution. Noise has been defined as the undesirable sounds emitted from all activities in the community except industrial work areas (Ademola, 2012; El-sharkawy and Alsubaie, 2014). Such activities include automobiles, construction works, entertainments and neighborhood activities

which are common in the urban areas, however, villages and small towns along side roads are also similarly affected (Singh & Davar, 2004). Gaganija *et al.*, (2012) noted that noise is the third most hazardous environmental pollution after air and water; as a result of increasing population growth, technological advancement and urbanization, the magnitude of the problem will likely increase (Ibekwe *et al.*, 2012 and Tsaloglidou *et al.*, 2015).

Noise is an age-long health problem as Florence Nightingale in 1859 in her seminal book titled "Notes on Nursing" wrote that "unnecessary noise is the most cruel abuse of care which can be inflicted on either the sick or the well" (Tsaloglidou *et al.*, 2015). It can damage the hearing, disrupt meaningful and seamless communications, causes irritability, fatigue and reduces efficiency. In addition, noise can interfere with the teaching and learning process, disrupt the performance of certain tasks and increase the incidence of antisocial behavior and accidents (Nwali & Agumwamba, 2005).

Very high levels of noise are also associated with enhanced risk of pathological changes such as hypertension, increased levels of heart beat rate, headaches, irritability, nervousness, feeling

of fatigue (Tsaloglidou *et al.*, 2015).

Due to the harmful effects of noise, many countries have enacted various laws to minimize noise pollution in the environment. For example; Singh and Davar (2004) noted that United States of America (USA) has designated places where human-caused noise pollution is tolerated. Similarly; in Netherlands, constructing houses in areas where 24-hour average noise levels is higher than 50dB is not allowed by law. In the same vein, the United Kingdom (UK) has also enacted noise act which empowers the local authorities to confiscate the noisy equipment and fine people who create excess noise at night. And recently, many countries are investing in 'porous asphalt' technology, which can reduce vehicular noise by up to 5dB.

The World Health Organization (WHO) stated that maximum desirable safe noise level is 55dB; Noise above this level is regarded as hazardous to human health as such industrial and commercial exposure to noise pollution should not exceed 70dB and 85dB respectively (Adeke, *et al.*, 2018).

Noise is a common challenge both developed and developing countries particularly in densely populated areas and economic hub of major cities. For example; Gulliver, *et al.*, (2014) found that about 12% each of residents of London, Leicester and Norwich cities in UK were exposed to daytime levels of noise more than 65dB and another 19% were similarly exposed to 55dB during the night. Also, automobile movements, power generators and construction works are the most important sources of noise pollution in Beirut, Lebanon (Korfali & Massoud, 2003).

In a Tanzanian city of Morogoro, Gaganija, *et al.*, reported that up 91% of the residents in the area were experiencing disturbing levels of noise and about 86% of them are aware of its health effects.

In Nigeria most of the work on noise pollution focused either on occupational noise exposure or they consider some specific forms of environmental noise pollution for example a work by Ekata (2016) on the awareness and exposure to generator noise pollution; Ibrahim *et al.*, (2014) on noise pollution among workers in wheat processing plant and Aremu, *et al.*, (2015) work on noise exposure sawmill workers among other similar studies.

To our knowledge, no similar study has been conducted to explore the exposure and consequences of noise pollution in the general population/community particularly in the sub-urban areas of a developing country. This created a potential gap in our full understanding of noise pollution in such areas. This study will determine the degree of exposure and the consequences of noise pollution in this area, which may serve as a yardstick in measuring the effects in similar local governments to help in educating the populace on the menace and help guide the policy makers in proper town planning, control programs and relevant legislature.

This paper aimed to assess the exposure and consequences of noise pollution among residents of Bichi town. It specifically

seeks to determine the degree of exposure and common sources of noise pollution; people's awareness and knowledge on its health effects and the consequences of noise exposure among residents of Bichi town.

MATERIALS AND METHODS

This is a descriptive cross-sectional study conducted among heads of the households or their representatives in the towns of Sabon Gari, Zango, and Tsohuwar Tasha of Bichi ward, Bichi local government area of Kano state. The sample size for the study was determined using Leslie Fischer's formula for estimating minimum sample size for health studies, as shown by the formula below;

$$n = \frac{Z^2 Pq}{d^2}$$

Where:

n= Minimum sample size

Z= Standard normal deviate corresponding to 95% confidence interval = 1.96

P= Prevalence obtained from previous similar study =0.89 (Patrick & Olumuyiwa, 2016).

q= Complementary probability to p which is equal to 1-p thus, q=1-0.89 = 0.11

d= Degree of precision = 0.05

$$n = \frac{(1.96)^2 \times 0.89 \times 0.11}{(0.05)^2}$$

$$= \frac{3.8416 \times 0.89 \times 0.11}{0.0025}$$

$$\frac{0.3761}{0.0025}$$

$$n = 150.44 \sim 150$$

Ten percent of the calculated minimum sample size was added to increase precision and account for no response, the sample size is therefore 165.

Respondents were selected via multistage sampling technique by first selecting Bichi local government from a list of local governments in Kano state. Bichi ward was also randomly selected from a list of wards in Bichi Local Government area. Similarly, Sabon Gari, Zango, and T/Tasha were also randomly selected from the list of Bichi wards. Noise level was measured using sound level meter for android phones. The values were taken before and after administering the questionnaire to minimize errors.

Data collected was analysed using Statistical Package for Social Sciences (SPSS) version 20.0. Categorical data was summarized using frequencies and percentages while quantitative data was expressed using means and standard deviation as required. Chi square (X^2) test was used to determine association between qualitative variables, a p-value of less than or equal to 0.05 was considered significant.

Results and Discussion

All the 165 questionnaires were completed and returned making a response rate of 100%. Majority (74.5%) of the respondents

were males or male representatives of the households with a mean age 33.5years. Over half of the respondents (53%) were married, followed by singles (46%) and widows (1%) The single represents the representatives of the head of households excluding their wives, and the high value may be explained by the age group of the respondents that were found during

research. Hausa is the predominant tribe of most (86.1%) of the respondents followed by Fulani (12.7%) and other tribes mainly Yorubas, who constitute 1.3% of the population.

Education is common in the community as half of the respondents have tertiary level of education with 8.9% having Quranic education only.

Table 1: Socio-demographic characteristics of the participants

SOCIO-DEMOGRAPHIC CHARACTERISTICS		n (%)
Age (years)	20-29	74 (44.9)
	30-39	53 (32.1)
	40-49	18 (10.9)
	50-59	15 (9.1)
	60-69	5 (3.0)
Sex	Male	123 (74.5)
	Female	42 (25.5)
Tribe	Hausa	142 (86.1)
	Fulani	21 (12.7)
	Yoruba	2 (1.2)
Marital status	Single	87 (52.7)
	Married	76 (46.1)
	Widow	2 (1.2)
Level of education	Primary	19 (11.5)
	Secondary	48 (29.1)
	Tertiary	84 (50.9)
	Qur'anic	14 (8.5)
Occupation	Students	48 (29.1)
	Artisans	48 (29.1)
	Civil servants	35 (21.2)
	Retired	3 (1.8)
	Farmers	31 (18.8)

Noise is a common problem in the studied community as more than two-third (76%) of the respondents were exposed to at least one source of noise pollution with majority (74%) lived in close proximity to the various sources of noise. This has profound health effects especially with long duration of continuous exposure to high level of noise. These findings were comparable to that of a similar study by Patrick & Olumuyiwa,

(2016) in Ilesha Osun state where 88.8% of the respondents were exposed to noise pollution.

Various sources of noise pollution exist in the studied area and many respondents were exposed to more than one source of noise; however, the commonest source of noise pollution in the environment was power generator (55.6%) for domestic or occupational/business power supply, this is common feature of a fast-developing area and due to the proximity of the study area

to the major road, noise from automobiles is also very common (40%). Other important noise sources include grinding machine

(35.8%) loudspeakers (9.7%) from entertainment events, worship centres and street/market hawkers (16%) (Figure 1).

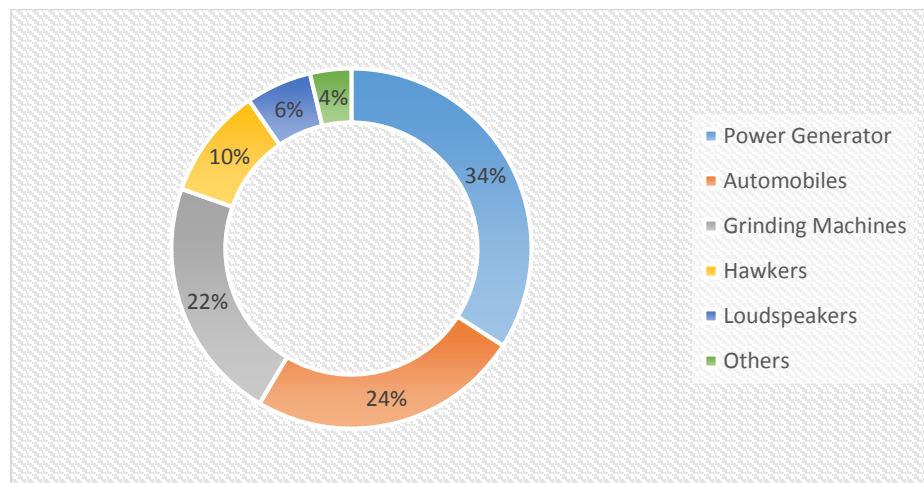


Figure 1: Sources of noise pollution among the respondents

Similar findings were reported by Ekata, (2016) in a related study conducted in Abuja, Lagos, Kaduna, Port Harcourt and Benin City where power generator and automobiles were the commonest sources of noise 67% and 20% respectively while loudspeakers form worship centers and neighborhood accounts for 11% of cases.

Only about 5% of the respondents were living in the WHO recommended noise level of <55dB while a similar proportion were exposed to dangerous levels of noise >70dB (Table 1).

Table 2: Residential noise level in dB

Noise level dB	Frequency	Percentage (%)
<55	8	4.9
55-70	149	90.0
>70	8	4.9
Total	165	100

Majority of the residents (90%) have noise level within 55-70dB and 4.9% were exposed to noise level above the recommended value of 55dB. The remaining 4.9% were living within a recommended noise level of <55dB.

According to WHO guideline for community noise, 55dB is the maximum recommended level for prolonged exposure associated with annoyance and 70dB is the maximum recommended value for industrial, commercial, shopping and traffic areas, prolonged indoor/outdoor noise exposure, and prolonged exposure is associated with hearing impairment.

Although, there is significant association between exposure to noise and awareness of its health implication (Table 2), more than half (69.7%) of the respondents have poor knowledge of the adverse effects of noise on their health despite high level (88.5%) of awareness of noise pollution among them.

Many respondents complained about more than one adverse effects of noise on their health and wellbeing. Commonest self-reported problems are sleep disturbance (52.7%), headaches (50.9%) and poor concentration (15.7%). Other noise associated problems include anxiety (20%), hearing difficulties (19%) and forgetfulness among others.

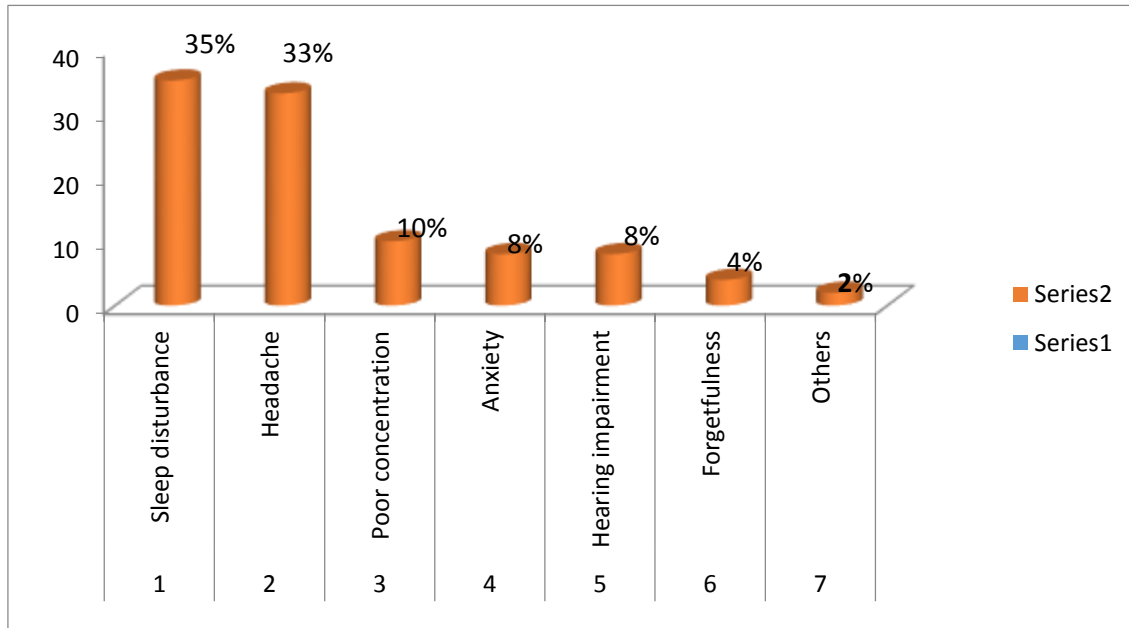


Figure 2: Health effects of noise among the respondents

These findings were slightly lower than that obtained by Aremu *et al.*, (2015) in Ilorin among sawmill workers, where the commonest complaints were “tinnitus (96.6%), headache (86.6%) and hearing loss (71.9%)”. Fewer complaints of annoyance (3.3%), difficulty in concentration (2.5%), and diplacusis (1.8%) were also observed. This disparity may be explained by the difference in the composition of the study groups as the former was conducted among factory workers, and therefore more likely to be exposed to constant high level of noise compared to other community members, and thus more likely to developed more adverse effects. But a closely related study in Ibadan, Oyo state Nigeria reported headache (30.2%), poor concentration (23.70%), and irritability (12.20%) as the major health effects of noise among (Ademola, 2012).

Table 3: Exposure to noise pollution and awareness of its health effects.

Awareness	Exposure		
	Exposed	Non-Exposed	
Aware	115 (78.8%)	31 (21.2%)	146 (100%)
Not Aware	10 (52.6%)	9 (47.4%)	19 (100%)
Total	125	40	165

$\chi^2=6.253, df=1, P>0.05$

In spite of the reported health effects of noise, only 30.3% of the respondents have ever reported about noise pollution in the environment. And among them 10.9% have complained to their neighbors, 7.9% to their family members, 5.5% to traditional rulers, 2.4% to local government authority and 3.64% have complained to others not among those mentioned above (Table 3). This relatively low value can be explained by the poor knowledge of most of the respondents concerning the health effects of noise.

Table 4: cross tabulations of some health impacting parameters

S/NO	PARAMETERS	χ^2	p-value/ INTERPRETATION
1	Educational level and tendency to complain about noise pollution	3.044	p>0.05, not statistically significant
2	Educational level and knowledge of health effects of noise pollution	0.011	p>0.05, not statistically significant
3	Exposure to noise pollution and awareness of its health effects	6.253	p>0.05, not statistically significant

Only the relationship between exposure to environmental noise pollution and awareness of its health effects showed statistically significant association

Table 5: Complaint redress system

Complaint redress system	Frequency	Percentage (%)
Family	13	7.9
Neighbors	18	10.9
Traditional rulers	9	5.5
Local government	4	2.4
Others	6	3.6
Total	50	30.3

CONCLUSION

Noise pollution is one of the inevitable environmental problems, and because of the increasing urbanization and human populations, the sources and exposure to noise pollution is also increasing. Exposure to noise pollution is associated with a lot of health consequences which are directly related to the duration of exposure and the intensity of the noise exposed to. However, despite these, little concern is given to noise both by the individual, community and the policy makers. Only few respondents lived within areas with noise level > 70 dB

The high level of awareness obtained in the study does not correlate with reduction in exposure as majority of the respondents get exposed, even though there is statistically significant association between the two. Also, only few of the respondents have good knowledge of health effects of noise pollution despite good awareness.

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