

# An Assessment of Noise Pollution and Its Health Implications in Hospitals in Anyigba, Kogi State

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## ABSTRACT

Noise pollution undesirable sound capable of disturbing normal activities such as working, sleeping, and conversations. The World Health Organization, 2001 warned that noise pose a serious threat to human wellbeing. But little is known about noise pollution in hospitals in study area. The study is aimed at assessing the level of noise pollution in selected private and public hospitals in Anyigba town, Kogi state. While sound measuring meters were used to measure the sound intensity at the selected hospitals, questionnaires were used to elicit responses from the respondents. Findings shows that 101 (63%) of the respondents indicated that noise pollution has effect on patients in the hospital, stressing that excessive noise in hospitals reduces the intelligibility of speech and impairs communication, causing annoyance, irritation, fatigue and reduction of the quality and safety of healthcare delivery. The paper found that noise levels in some hospitals in Anyigba have exceeded the WHO and EPA recommended noise decibel levels (35dB) in hospital rooms. These hospitals include Kogi State University Teaching Hospital (60dB), Kogi State University, Medical Center, (59dB), Grimard Catholic Hospital (58dB), Good Shepard hospital (58dB), Nebo Multi-Care Hospital (55dB), Pacific Hospital (54dB), and Blue House Hospital (52dB). Hypothesis tested says there is no statistically significant variation in the level of noise pollution between selected hospitals in Anyigba. The paper suggested that hospital noise emission level in the study area should not exceed the WHO and EPA standard (i.e., 35dB).

**Keywords:** noise pollution, hospital noise level, sound level meter, hospitals in Anyigba.

## INTRODUCTION

. Noise is normally defined as ‘unwanted sound’. A more precise definition of noise is audible sound that causes disturbance, impairment, or health damage. The terms ‘noise’ and ‘sound’ are often synonymously used when purely acoustical dimension is meant (e.g., noise level, noise indicator, noise regulation, noise limit, noise standard, noise action plan, aircraft noise, road traffic noise, occupational noise, etc.). Managing noise is crucial for enhancing the living condition of a dwelling. Noise is an unwanted sound whose detrimental effects have been widely observed in terms of auditory and/or non-auditory damages.

Noise is any undesired sound, either one that is intrinsically objectionable or one that interferes with other sounds that are being listened to (Encyclopedia Britannica, 2012). Noise in hospitals is a common source of grievance among patients, families, and staff (Thompson 2015). When the noise in the environment is beyond certain limit, it is termed as noise pollution. Sound becomes undesirable when it disturbs the normal activities such as working, sleeping, and conversations. It is an underrated environmental problem because of the fact that it cannot be seen, smelt, or tasted. Hence, the World Health Organization (2001) warned that

noise must be recognized as a major threat to human wellbeing.

The health effects of noise pollution have been studied by many researchers in recent years. Some researchers studied the impact of noise pollution on exposed population (Ising and Kruppa, 2004; Piccolo et al., 2005; Tang and Wang, 2007; Banerjee, 2008; Banerjee, et al., 2009; Monazzam and Nassiri, 2009; Omidvari and Nouri, 2009), while some others investigated the risk of workers exposed to noise pollution in different working places (Nassiri and Golbabai, 1993; Giardino and Durkt, 1996; Morrison et al., 2003; Yildirim et al., 2007; Roozbahani et al., 2009). Many studies have revealed that extended exposure to noise pollution may cause auditory and non-auditory disorders, such as temporary or permanent hearing loss (Selfe, 1982; Willett, 1991; Nassiri and Golbabai, 1993; Yildirim et al., 2007; Keipert, 2008), sleep disruption (Freedman et al., 1999; Freedman et al., 2001), vertigo, agitation, weariness, hypertension, gastrointestinal system problems (including gastric and duodenal ulcer), cardiac arrhythmia, nervous and psychic disorders (Nicholas et al., 1993; Buemi et al., 1995; Job, 1996; Holmberg and Coon, 1999; Van Kempen et al., 2002; Ising and Kruppa, 2004; Penney and Earl, 2004; Roozbahani et al., 2009) and so on. Therefore, it is very important that Medicare givers should provide a quit environment for the patients since unwanted sound could have a negative impact on patient outcomes.

The aim of this study is to assess the level of noise pollution in selected private and public hospitals in Anyigba town, Kogi state. The objectives of this research are:

1. To examine the level of noise in public and private hospitals in Anyigba,
2. To compare the hospital noise pollution values obtained in the morning with that of the evening,
3. to determine major sources of noise pollution in the hospital in Anyigba and
4. to identify the effect of noise pollution on patients in public and private hospitals.

Several studies regarding noise pollution and its consequences on the hospital environment have been conducted by researchers in several countries (Zheng, 1996; Zeid et al., 2000; Ugwuanyi et al., 2005; Armah et al., 2010; Thangadurai et al., 2015), but little is known about noise pollution in hospitals in Anyigba, Kogi state. In order to address this gap, this paper attempts to assess the extent of noise pollution in public and private hospitals in Anyigba town, Kogi State.

The study tested the hypothesis that says: There is no statistically significant variation in the level of noise pollution between public and private hospitals in Anyigba. The instruments used are sound measuring meters and questionnaires. While the sound level meter was used to measure the sound intensity at the selected hospitals in the study areas, questionnaires were used to elicit responses from the respondents. Consequently, conclusions were drawn from the results of the analysis based on the existing environmental regulatory standards.

## 1.2 StudyArea

Figure 1 shows that Anyigba is in the eastern part of Kogi State precisely in Okura District in Dekina Local Government Area. Anyigba lies between latitude  $7^{\circ} 15'$  and  $7^{\circ} 29''$  North of the equator and longitude  $7^{\circ} 11'$  and  $7^{\circ} 32'$  East of the Greenwich meridian. Anyigba is on the attitude of above sea level (Ifatimehin& Musa 2012). The region is also surrounded by many communities; it is bordered by Ajiolo and Dekina communities to the north, Egume to the south east, Ologba and Iyale to the North east and Agbeji to the west. The town also has linkage with smaller communities such as Eti-Ukpolo, Agala-Ate, Agala-Ogane, Agbenema, Abadigba and Ojikpadala-Egume. Anyigba has a total land area of about  $62.5 \text{ km}^2$  (Ucholi, 2018).

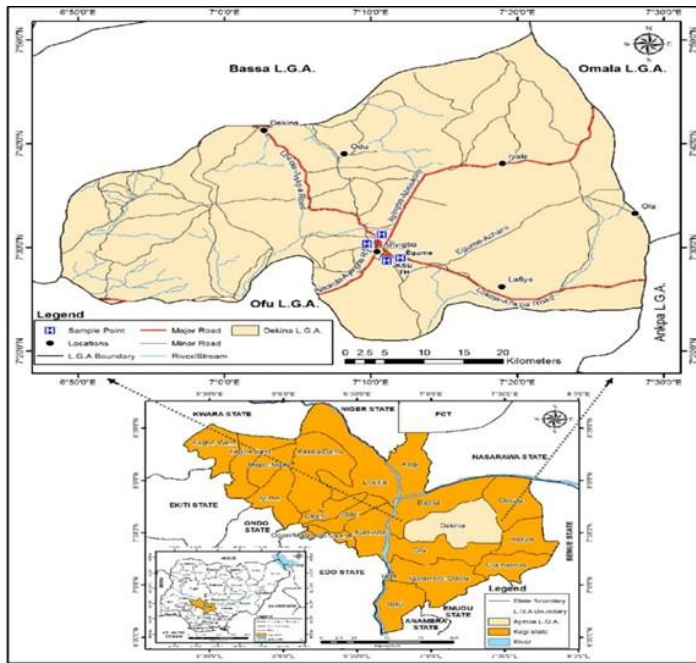


Figure 1: Kogi State Showing Dekina LGA

Source: – GIS Lab, Geography Department, KSU, 2023

## MATERIALS AND METHODS

This paper set out to investigate how noise pollution affects the health of patients in hospitals in Anyigba town, Kogi state. In order to obtain relevant data, the survey research method was used in which questionnaire was administered by the researchers and supported with observation to revalidate the facts generated from the questionnaire. This method was adopted since it is relatively inexpensive, less time consuming, easier to make use of, and most appropriate for data collection from a sampled population to make inferential generalization about the population on the phenomenon under study.

The data required for this study included data which determined the level of noise in hospitals; data that compared the hospital sound pollution values obtained in the mornings with that of the evenings in the study area; data that sought to determine major sources of noise pollution in the hospital and data that identified the effect of noise pollution on patients in the selected health centres within the study area.

A simple random Sampling technique was adopted in this study. Simple Random sampling was chosen as it ensures the law of Statistical Regularity which states that if on an average the sample chosen is a random one, the sample will have the same composition and characteristics as the universe. Research instrument was questionnaire administration

Two methods of data collection were applied in this research. The first was the use of a noise level measurement device (a digital mini sound level meter) which was used for the measurements of the noise level in the study area with records taking. The measurement was taken in the morning and evening for six (6) consecutive months, and the average of data were obtained. Consequently, questionnaires were used to collect data relating to the effects of noise pollution on patients.

The questionnaire contained concise questions tailored towards getting reaction of patients about noise. Both the descriptive and inferential statistics were used for data analysis in this study. Hypothesis tested says there is no statistically significant variation in the level of noise pollution between selected hospitals in

Anyigba.

**Table 1: Study Population**

S/No	List of Hospitals	Numbers of patient's	Calculation of questionnaires'	Numbers of questionnaires distributed (%)
1.	Blue house hospital	28	28/160 X 200	35
2.	K.S.U Medical center.	6	6/160 X 200	8
3.	K.S.U teaching Hospital	14	14/160 X 200	17
4.	Grimard catholic hospital	46	46/160 X 200	57
5.	Pacific hospital	13	13/160 X 200	17
6.	Maria Goretti hospital	26	29/160 X 200	32
7.	Nebo-multi-care hospital	10	10/160 X 200	12
8.	Good Shepard hospital	17	17/160 X 200	22
<b>9.</b>	<b>Total</b>	<b>160</b>		<b>200</b>

Source: Author's fieldwork, 2023

## RESULTS AND DISCUSSIONS

**Table 2: Socio Demographic Characteristics of Respondents**

		FREQUENCY	PERCENTAGE
<b>Gender</b>	Male	52	67.5
	Female	108	32.5
	<b>Total</b>	<b>160</b>	<b>100</b>
<b>Age</b>	18-30	60	38
	31-40	48	30
	41-50	32	20
	50 above	20	12
	<b>Total</b>	<b>160</b>	<b>100</b>
<b>Educational background</b>	Master's degree	17	11
	Bachelor's degree	44	27
	“O” level certification	56	35
	Others (primary school certification)	43	27
	<b>Total</b>	<b>160</b>	<b>100</b>

Source: Authors fieldwork, 2021

Majority of the respondents are female with a percentage of 67.5% and the male respondents has a population of 32.5%, (see table 2). This is likely due the fact that most of the workers employed in these hospitals (as caregivers) and patients on admission were female. However, statistics regarding the age distribution of the respondents indicated that people aged 18-30 years constitute 38%, while 31-40 old were made up of 30% of the respondents. Similarly, 41-50 years old respondents and those above 51 years constituted 20% and 12% respectively. Regarding the educational qualification of the respondents, the table showed that majority of the respondents have Master's degrees, with about 11% of the population, Bachelor's degree with 27% of the population, while 35% of the respondents have "O" Level certification, and 27% of the respondents have others qualification primary school certification. The findings further revealed that most of the respondents for this study have "O" Level certification.

**Table 3: Effect of noise on patients**

Variables	Number of respondents	Percentage (%)
Yes	101	63
No	59	37
<b>Total</b>	<b>160</b>	<b>100</b>

Source: Author's fieldwork, 2023

Table 3 indicates that 101 (63%) of the respondents indicated that noise pollution has effect on patients in the hospital while 59 (37 %) of the respondent said that noise pollution has no effect on patients. Excessive noise in hospitals reduces the intelligibility of speech and impairs communication, causing annoyance, irritation, and fatigue (Basner,2014) and reducing the quality and safety of healthcare. It has been implicated in the development of intensive care psychosis, hospitalization induced stress, increased pain sensitivity, high blood pressure, and poor mental health (Choiniere,2010). Hospital noise disrupts sleep; machine sounds in particular have a greater negative effect on arousal than human voices (Wang,2012).

**Table 4: Effects of noise pollution**

Variables	Number of respondents	Percentage (%)
Loss of sleep/insomnia	49	31
Headache	57	36
Stress	3	15
Irritation	19	11
No disturbance	8	5
Others	4	2
<b>Total</b>	<b>160</b>	<b>100</b>

Source: Author's fieldwork, 2023

Table 4 indicates that 49 respondent representing 31% agree that noise pollution has caused loss of sleep, 57 respondent representing 36% agreed that noise pollution caused headache, 23 respondent representing 15% agreed that noise pollution causes stress, 19 respondents representing 11% agreed that noise pollution caused irritation, while 8 respondents representing 5% agreed that noise pollution does not disturb and 2% of the respondents indicated that noise pollution has other effects e.g. causes weakness, anger, anxiety and concentration disorder. The above results on the effects of noise pollution are revealed that average hospitals noise levels have increased over the last seven (7) decades. This position was supported by Eggertson(2012), who found that there has been steady increase in the effects of noise pollution since the past 50 years.

He stressed that it increased from 57 decibels in 1960 to 72 decibels in 2012. The dangers of high noise level cannot be overemphasized, as WHO (2018) reported that noise level as high as 45 decibel portends high risk blood pressure on patients. Also, WHO and EPA recommended that noise decibel levels in hospital rooms should not to exceed 35db, noting that high noise level is capable of causing high blood pressure (Berglund & Lindvall, 1995), yet many studies have shown that hospital sound decibel levels frequently exceed these recommendations (Lawson et al., 2010; Pope, 2010; Richardson, Thompson, Coghill, Chambers, & Turnock, 2009).

**Table 5: Level of noise pollution in hospital**

Variables	Number of respondents	Percentage (%)
Low	84	53
Medium	46	29
High	30	18
<b>Total</b>	<b>160</b>	<b>100</b>

Source: Author’s fieldwork, 2023

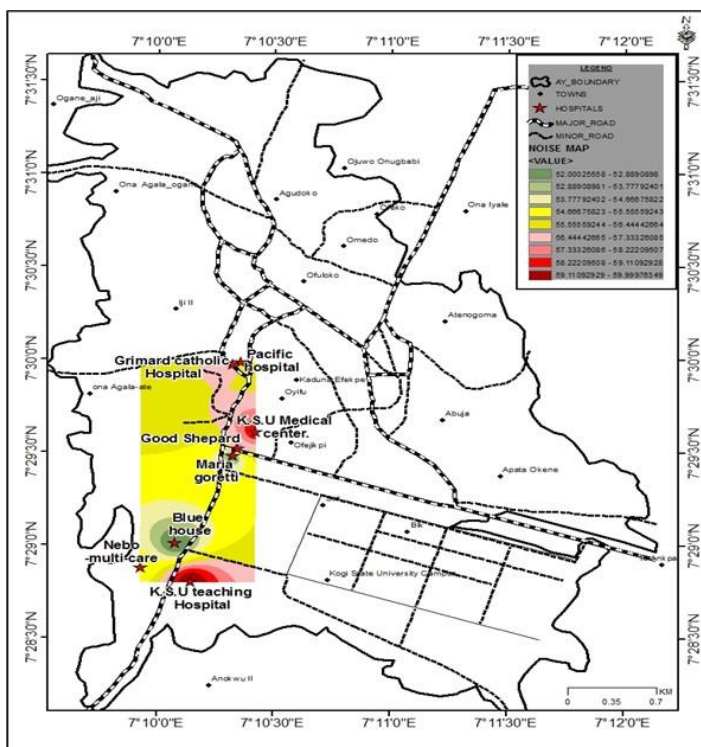
Table 5 reveals that 84 (53%) of the respondents ticked that the level of noise pollution in the hospital is low; 46,(30%) of the respondents observed that the level of noise pollution in the hospital is at medium, while 30 (18%) of the respondents said the level of noise pollution in the hospital is relatively high. This implies that an extensive range of noise pollution, damages human hearing, even causes diseases of nervous system, digestive system, and cardiovascular system (Yuan and Li, 2012).

**Table 6: Causes of Noise pollution in hospital wards (as perceived by patients)**

S/No	Hospital	Medical equipment in-ward	Television sets	Monitor alarms	Patients moaning or crying	Talking of visitor’s or patient’s family member’s	Others (e.g. children playing, cryng)
1.	Blue house hospital	3	1	1	8	18	5
2.	K.S.U, Medical center	1	1	0	2	5	0
3.	K.S.U teaching Hospital	3	1	0	4	9	1
4.	Grimard catholic	8	1	1	6	35	7
5.	Pacific hospital	2	1	0	2	11	1
6.	Maria gorette	8	1	0	5	17	3
7.	Nebo-multi-care	2	1	0	3	10	0
8.	Good Shepard	3	1	1	5	12	1

Source: Author’s fieldwork, 2023

Table 6 above indicates that major causes or sources of noise in hospitals wards. Blue house hospital medical equipment in ward 3%, television set 1%, monitor alarm 1% recorded, while patients moaning or crying 8%, talking of visitors or patient’s family members” 18%, is the major source of noise inside the wards, and others e.g. children playing 5%. Kogi state university, Medical center (KSU), medical equipment in ward 1%, television set 1%, patients moaning or crying 2%, 5% mentioned that talking of visitors or patient’s family members” is the major source of noise inside the wards, Kogi State University Teaching Hospital medical equipment in ward 3%, television set 1%, patients moaning or crying 3%, talking of visitors or patient’s family members” is the major source of noise inside the wards 4%, others e.g. children playing 1%., Grimard catholic hospital medical equipment in ward 8%, television set 1%, monitor alarm 1%, patients moaning or crying 6%, mentioned that talking of visitors or patient’s family members” is the major source of noise in wards 35%, others e.g. children playing 7%., Pacific hospital medical equipment in ward 2%, television set 1%, while patients moaning or crying 2%, talking of visitors or patient’s family members” is the major source of noise in wards 11%, others e.g. children playing 1%., Maria Goretti Hospital medical equipment in ward 8%, television set 1%, patients moaning or crying 5%, talking of visitors or patient’s family members” is the major source of noise in wards 17%, others e.g. children playing 3%., Nebo multi-care hospital medical equipment in ward 2%, television set 1%, patients moaning or crying 3%, talking of visitors or patient’s family members” is the major source of noise in wards10%, and Good Shepard hospital medical equipment in ward 3%, television set 1%, monitor alarm 1% recorded, patients moaning or crying 5%, talking of visitors or patient’s family members” is the major source of noise in the hospital wards 12%, and others e.g. children playing 1%.This implies that excessive noise can impact patients’ ability to rest, heal and recover hospitalization-induced stress, increased pain sensitivity, high blood pressure and poor mental health.



**Figure 2: Showing noise pollution map**

**Source: – GIS Lab, Geography Department, KSU, 2023.**

The map on figure 2, was generated based on the noise value obtained from medical wards of eight popular hospitals in Anigbala town during the morning session of data collection. These hospitals includes; Kogi State University Teaching Hospital which as (60dB which is indicated with darker red), while Kogi State

University, Medical Center, (59dB- dark red), Grimard Catholic Hospital (58dB -light red), Good Shepard Hospital (58dB- light red), Nebo Multi-Care Hospital (55dB -yellow), Pacific Hospital (54dB- lighter yellow), Blue House Hospital (52dB- light green), and Maria Goretti Hospital (52dB- light green).The result of the analysis indicates that the areas with the highest decibels are often shown in red, with quieter areas in different colors. This implies that high decibel of noise can impact patients’ ability to rest, heal and recover hospitalization-induced stress, increased pain sensitivity, high blood pressure and poor mental health (Xyrichis, 2018).

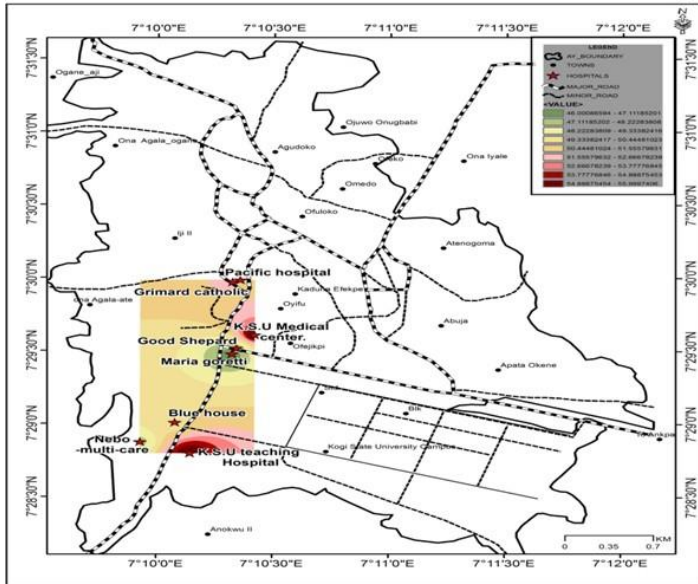


Figure 3: Showing noise pollution map

Source: GIS Lab, Geography Department, KSU, 2023.

The map on figure 3 was generated based on the noise value obtained from medical wards of eight popular hospitals in Anyigba town in the evening sessions of data collection. These hospitals include:Kogi State University Teaching Hospital which has (56dB indicated with darker red), while Kogi State University, Medical center, (56dB- dark red), Grimard catholic hospital (52dB- light red), Good Shepard hospital (48dB- light yellow), Nebo multi-care hospital (48dB- light yellow), Pacific hospital (51dB lighter green), Blue house hospital (50dB dark yellow) and Maria Goretti hospital (46dB- green). The result of the analysis indicates that the areas with the highest decibels are often shown in red, with quieter areas in different colors. This implies that high decibel of noise can impact patients’ ability to rest, heal and recover and also hospitalization-induced stress, increased pain sensitivity, high blood pressure and poor mental health (Xyrichis, 2018)

**Table 7: Analysis of noise levels measured at different units in hospitals in Anyigba.**

Hospital	Coordinate	Measuring Time	Outpatient	Reception/enquiry	Medical ward	Ward corridor	registration counter	In-patients	Consulting room	Nursing dept
Blue house	7°29'00"N	9-Aug	52	51	52	53	54	57	49	58
	7	16-17	49	50	50	51	50	51	47	52
K.S.U Medical center.	7°29'58"N	9-Aug	55	59	59	53	62	52	52	61
	7	16-17	51	58	56	50	60	49	49	58



K.S.U teaching Hospital	7N 7	9-Aug	56	57	60	57	60	55	51	62
		16-17	52	53	56	52	58	53	48	60
Grimard catholic	7°29'57'' N 7 10' 19''E	9-Aug	58	59	58	53	56	54	51	57
		16-17	51	55	52	51	54	51	46	51
Pacific hospital	7°29'58'' N 7	9-Aug	58	52	54	56	57	56	56	58
		16-17	53	50	51	51	55	52	50	52
Maria Goretti	7°29'28'' N 7	9-Aug	55	57	52	49	53	48	52	53
		16-17	44	54	50	46	50	51	50	51
Nebo- multi- care	7 7	9-Aug	57	52	55	50	56	56	48	57
		16-17	52	50	53	48	53	50	47	51
Good Shepard	7°29'7	9-Aug	55	56	58	53	58	49	51	59
		16-17	50	51	54	48	56	47	50	56

Source: Author's fieldwork, 2023.

Table 7 shows the statistical analysis of sound levels measured at different units/locations in Hospitals: Blue House Hospital, Kogi State University, Medical Center (KSU), Kogi State University Teaching Hospital, Grimard Catholic Hospital, Pacific Hospital, Maria Goretti Hospital, and Nebo Multi-Care Hospital and Good Shepard Hospital. Apparently, the noises were higher in the following locations for all the hospitals: Reception/enquiry, Nursing department and registration counter were higher than those at the locations of in patient. The aforementioned were the general situation, except for the medical nursing station in Maria Goretti Hospital, which had a daily average sound level of 53.0 dB. The sound levels in the medical nursing station and medical ward in Kogi State University Teaching Hospital were also higher compared in those in other hospitals like Blue House Hospital, Kogi State University Hospital, Grimard Catholic Hospital, Pacific Hospital, Maria Goretti Hospital, Nebo Multi-Care Hospital and Good Shepard Hospital. The results from analysis of variance (ANOVA) on the eight hospitals showed that the sound levels in the medical nursing station, medical ward corridor, medical ward interior, outpatient waiting area, and registration counter had significant variation ( $p < 0.05$ ). The average sound levels measured in these hospitals during daytime were between 47 and 61 dB, a range similar to those previously reported by other works (Ann et al., 1996; Baqar et al., 2017; Baruti et al., 2014; Bayo et al., 1995; Chen et al., 2009 Kele & Faculty, 2011; Kracht et al., 2007; Xyrichis et al., 2018). However, all of the sound levels measured in the hospitals in the present study were much higher than those suggested by USEPA and Federal Environmental Protection Agency (FEPA) in Nigeria provided daily noise exposure limits for any building used as hospital maximum permissible noise limits Bd 90 (A) (Leq) (i.e., for day 45 Bd and night 35 Db (A) for 8h exposure). This exceeds the regulatory limit for commercial noise level of 90 decibel by the National Environmental Standard and Regulation Enforcement Agency (N.E.S.R.E.A), Federal Environmental Protection Agency (FEPA) and World Health Organization (WHO). The findings confirmed the findings of Thompson (2010); Bergeret, (2002 Hill, (2015); Darbyshire, (2016); Gilchrist et al., (2003); Zheng, (1996); Zeid et al., (2000); Ugwuanyi et al., (2005); Armah et al., (2010); Thangadurai et al., (2015), who found that Staff conversations, delivery carts, stretchers, medical emergency alarms, telephones, clinical monitors, creaking sounds of furniture, patient

attendant conversations have been identified as common sources of noise pollution in hospital settings.

### Testing of Hypothesis

The procedure which enables us to decide whether to accept or reject hypothesis or determine whether observed samples differ significantly from expected result is called test of hypothesis. Olizikwe (1988). The hypotheses were tested using ANOVAs.

Table 8: sources of noise pollution by hospital units

Hospital	Outpatient	Reception/enquiry	Medical ward	Ward corridor	registration counter	In-patients	Consulting room	Nursing dept
Blue house	52	51	52	53	54	57	49	58
	49	50	50	51	50	51	47	52
K.S.U Medical center.	55	59	59	53	62	52	52	61
	51	58	56	50	60	49	49	58
K.S.U teaching Hospital	56	57	60	57	60	55	51	62
	52	53	56	52	58	53	48	60
Grimard catholic	58	59	58	53	56	54	51	57
	51	55	52	51	54	51	46	51
Pacific hospital	58	52	54	56	57	56	56	58
	53	50	51	51	55	52	50	52
Maria gorette	55	57	52	49	53	48	52	53
	44	54	50	46	50	51	50	51
Nebo-multi-care	57	52	55	50	56	56	48	57
	52	50	53	48	53	50	47	51
Good Shepard	55	56	58	53	58	49	51	59
	50	51	54	48	56	47	50	56

Source: Author’s computation 2023.

Table 9: Decision rule for statistically significant variation in the level of noise pollution in the hospitals in Anyigba.

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	532.4911	10	53.24911	4.936356	8.43E-06	1.925726
Within Groups	1089.5	101	10.78713			
Total	1621.991	111				

**Decision rule:** Since  $P > .05$ , we reject  $H_1$ . In other words, there is no statistically significant variation in the level of noise pollution in the hospitals in Anyigba.

## SUMMARY AND CONCLUSION

The paper revealed that the medical ward is the major source of noise pollution in hospitals in Anyigba. Conclusively the study revealed that the dominant effect of noise pollution on patients is loss of sleeps and headache accounting for 31% and 36% of respondents respectively. The study concluded that noise affects individuals in several ways which results in improper communication, sleeplessness and reduced efficiency.

## RECOMMENDATIONS FOR POLICY DIRECTIONS

- Relevant regulatory agencies like National Environmental Standard and Regulations Enforcement Agency (NESREA), should make sure the legislation for noise pollution is enforced.
- The public should be made aware of the adverse effects of noise pollution.
- Hospitals should limit the numbers of People allowed to visit patients in the hospital.
- There should be a ban on the use of high-sounding alarms in the hospital environment,
- Hospital management must ensure that labor rooms are kept far from the patient wards

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