Assessment of The Perceived Effect of Noise on Workers' Health in Selected Construction Sites in Delta State

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Abstract
This study assessed the perceived effect of noise on workers' health in selected construction sites in Delta State by combining objective noise measurements with workers' perception-based health assessments. A mixed-methods research design was adopted. Environmental noise levels were measured across three construction phases, excavation, formwork, and beam placement—at PTI Junction and Enerhen Junction using a calibrated sound level meter, while structured questionnaires were administered to 152 construction workers selected through random sampling. Measured noise levels ranged from 73.3–90.3 dB at the PTI site and 70.8–88.0 dB at the Enerhen site, with beam placement activities consistently recording the highest noise levels. Several measurements exceeded the recommended occupational exposure limit of 85 dB. Statistical analysis revealed a significant difference in noise levels across construction phases at the PTI site ($p < 0.05$), while no significant difference was observed at the Enerhen site ($p > 0.05$). Perception survey results showed that workers demonstrated high awareness of noise pollution and its health effects; however, enforcement of personal protective equipment use and awareness of coping strategies were low. Reported health effects included fatigue, sleeplessness, communication difficulties, and symptoms associated with elevated blood pressure. The study concluded that construction site workers within the selected workplaces were exposed to potentially hazardous noise levels capable of causing adverse auditory and non-auditory health effects, worsened by inadequate enforcement of protective measures. It was therefore recommended that construction firms strengthen hearing conservation programmes through strict enforcement of hearing protection use, regular noise monitoring, and improved management commitment to noise control measures.

Keywords: *Noise, Workers', Health, construction sites*

1.1 Introduction

Any unwanted sound is considered noise, and it has been shown to have a significant impact in urban settings, especially in places with high population densities. Farouq (2018). Humans can suffer from hearing loss, sleep disturbances, cardiovascular problems, and other psychological stress due to noise (World Health Organization, (WHO), 2020). According to academics like Ikhenna (2006), noise pollution is a result of contemporary urban technology advancements and a significant element that lowers living standards, even in developing nations. The detrimental health consequences that follow noise exposure especially on residents have been demonstrated by earlier research conducted in urban settings (Ugbebor et al., 2019). The human ear's sensitivity to high

sound levels, which might have harmful effects, is the cause of this effect (Tsepav et al., 2011). Despite this data, little research has been done on how occupational noise affects health and, in certain situations, coping mechanisms. Many pollutants now have plausible entrance points due to industrial and technical advancements, particularly noise from activities like building that lack the required environmental standards (Fikadu, 2018). During construction operations, noise is produced on the site, particularly by building and demolition activities. Noise levels in urban areas rise above background concentrations due to the construction and/or maintenance of city streets, highways, and commercial/industrial buildings (Iwuoha & Avwiri, 2022). Numerous variables, including volume or loudness, the type of noise, the time of day, or the modality creating the resonance, are frequently linked to noise (Geetha & Ambika, 2015; Jacyna et al., 2017). Ugbebor et al. (2019) stated that noise is a prevalent pollutant linked to construction operations and is known to create dangerous conditions in the construction workspace.

Geetha and Ambika (2015) also highlighted that noise imposes a significant negative impact on 30% of construction workers. According to a different study, high-noise settings like building sites frequently lead to prolonged high-dose noise exposure levels, especially for certain groups or areas within the environment (Clark et al., 2020). Rather than analyzing the long-term health effects of noise in relation to guidelines or even assessing the efficacy of preventative measures across certain construction phases and project types, the majority of these research have merely concentrated on monitoring noise levels. Scholars and organizations worldwide, including the World Health Organization, are interested in conducting additional research regarding the assessment of noise levels, detrimental effects, and development exposure limits due to the inherent impact of noise on human health (Pirrera et al., 2010). The extended exposure to noise without adequate rest and potential healing time is the source of this interest. According to Tsepav et al. (2011), noise nevertheless causes silent harm to those who are subjected to elevated levels of it because the human ear does not adapt to the volume of sound over time.

Nigeria's expanding population has led to a number of infrastructure needs. Transportation networks and buildings are currently developing, which results in ongoing construction activities that produce noise and expose people to it, which leads to health issues. According to reports, noise pollution is a serious issue, particularly for people who live in large cities (Kalawapudi et al., 2020). Tsepav et al. (2011), Ugbebor et al. (2019), and the World Health Organization (WHO) (2020) are just a few of the studies that have shown the long-term effects of noise exposure on a number of aspects of human life, including high blood pressure, heart issues, anxiety, and insomnia. As a result, it leads to harmful human conditions, potential drug abuse, and serious illness (Farouq, 2018). Noise-producing machinery specifically exposes workers to noise pollution (beyond permissible limits), which is detrimental to their health and may have extra negative impacts depending on individual characteristics such as age, employment history, race, diet, and medical issues. This necessitates determining the risks that construction activities pose to human health. Nigeria currently lacks a recognized legislative framework for reducing noise pollution. To put it briefly, neither the Nigerian government nor its residents understands the consequences of loudness (Oyedepo, 2012). When pollution levels continue to rise, it becomes crucial to know how much the permitted limit has been exceeded in order to track the growth (Sampath et al., 2004). Proactive steps to mitigate noise in many industrial settings are inadequate, even though industrial environments are usually associated with the use of machinery and equipment that produce noise (Geetha & Ambika, 2015).

1.2 Statement of the Problem

According to research by Farouq (2018), noise pollution leads to an undesirable state of human life, potential drug usage, and serious illness. Heart disease is a potential side effect of observed noise levels from building activities (Singh et al., 2018). According to an evaluation study by Namrata and Kimbe (2018), worker characteristics were directly correlated with assessed noise levels and duration in a workplace, describing its detrimental impact on workers' cognitive abilities. According to Barikayeva et al. (2016), building and repair operations, particularly those carried out on highways, have a major influence on acoustic pollution due to the noise produced by the vehicles and equipment utilized for those operations. As a result, construction activities have an impact on public health by increasing the risk of early morbidity and mortality, cardiovascular disease, hypertension, and atherosclerosis (Guinta, 2020).

Noise levels over 85dB are linked to construction activities. According to studies, these processes can produce noise levels as high as 108dB for eight hours straight, which can raise people's blood pressure or levels of noradrenaline and adrenaline (Ebikabowei & Reginald, 2016). According to some academics, workers and nearby citizens who are exposed to loud noises for extended periods of time experience hearing problems (Zbysińska & Lachowska, 2020). Daniel (2017) states that the National Institute of Deafness and Other Communication Disorder confirms that noise pollution is an issue and that many construction sites frequently experience extended exposure to noise levels of 80 dB or higher. Environmental pollution from noise is still a major concern in many regions where building is still going on, even in spite of current regulations regarding noise exposure in communities and businesses. The issue is exacerbated by antiquated machinery, limited worker awareness, and inadequate noise control measures. Workers and the surrounding populations are exposed to hazardous noise levels due to improper assessment and execution of appropriate control techniques, which may cause health and well-being problems. Due to these shortcomings, this study is required to ascertain the current impacts of noise on the health of workers as well as the variations in noise levels across the various phases of building projects.

1.3 Aim and Objectives

The aim of this study was to assess the perceived effect of noise on workers' health in selected construction sites in Delta State.

The objectives of the study were to:

i. Evaluate the perceived effect of noise by construction site workers.
ii. Ascertain the relationship that exist between noise exposure and health outcomes amongst workers in the selected construction sites.

Methodology

Research Design

This research study adopts a mixed-methods design (qualitative and quantitative methods), which is aimed toward assessing the perceived effect of noise on workers' health in selected construction sites in Delta State. The quantitative method involved the direct measurement of noise levels. at selected construction sites using a sound level meter as described by Ugbebor *et al.* (2019). The field measurement exercise of Noise was conducted from 16th of June to 24th of October 2025. This approach would generate objective primary data on the intensity and variation of noise across different work zones and phases of construction. The qualitative exercise was done using a similar approach by Obiefuna *et al.* (2018) within the aforementioned period through the administration of structured questionnaires and interviews with construction workers to capture their perceptions

of noise exposure and its impact on their health and well-being. Both exercises were carried out with administrative and legal authorization from the study area and in accordance with national policy on the protection of the environment and public health. The objectives of this assessment is to understand the role of construction operations on noise generation and the adverse effects it poses to workers and the environment if not properly managed. Studies have shown that construction operation carries the risk of noise generation and hence are likely to have detrimental impacts on one's physical, physiological, and mental well-being, including sleep deprivation, stress, and elevated blood pressure.

Study Population

The study population targeted includes all active construction site workers, management personnel, and site supervisors within the selected construction companies and present on site. Data obtained from site visitation revealed that both construction sites comprised a total of 211 workers (Table 3.1).

Table 2.1: Population of Workers in the selected Construction Sites

Site	**No. of workers**
A	102
B	109
Total	**211**

Sampling Technique and Sample Size

This research work adopted a random sampling technique in sampling of respondents using quantitative research methods where the research instrument (questionnaire) was administered in a self-completion manner. The sample size was determined based on the Taro Yamane formula for finite populations.

$$n = \frac{N}{(1+N(e)\text{^}2)} \quad (3.1)$$

where n represents the sample size of the study, N denotes the total population from which the sample is drawn, and e is the margin of error set at 0.05. The sample size was calculated using this standard formula as represented in equation 1 above. This approach was adopted to ensure that the selected sample would be a sufficient representation of the entire population while maintaining statistical reliability. A suitable sample size of 152 respondents was obtained and employed for data collection in the study by using the formula with the specified parameters.

3.5 Nature/Sources of Data

The study employed a perception survey to assess health consequences and instrument-based field data to gauge the level of noise pollution in the study area. Initially, a noise level meter was used

to track noise levels in the morning and evening of each workday (over a three-week measurement period) while construction was continuing, and a structured questionnaire was used to collect primary data from workers. The method of measuring noise was carried out at several points in the research region. The average amount of noise pollution that employees are subjected to at various times of the day was determined by taking three measurements of the noise level at each site.

3.6 Method of data collection / Instrumentation

Construction workers' answers to the questionnaire were used to gather primary data. Using a 5-point Likert scale, the questionnaire utilized for this study included many parts that evaluated workers' health, management commitment to noise reduction, awareness of noise pollution, and personal protection equipment. Workers were given 200 questionnaires to complete on their own. After completion, the questionnaires were retrieved. Every questionnaire response was tallied and cross-tabulated for analysis. While secondary data was gathered, pertinent literature was consulted. These resources made it easier to gather and examine data on the current topic of interest. Additionally, the measured noise level at work zones was cross-tabulated using data from morning and evening noise measurements. A sound level meter made in accordance with IEC 651 (International Electrotechnical Commission Standard 651) was used to measure the noise. This device measures decibels (dB) of sound pressure. A high-sensitivity microphone, a preamplifier, and electrical circuits that translate sound waves into legible noise levels are all included in the IEC 651 type sound level meter. It enables the device to measure noise in a consistent, precise, and repeatable manner.

3.7 Research Instrument Validity and Reliability

The tool was validated by occupational health and safety experts using face and content validity. Following a thorough analysis, the OHS professional assessed the content validity of the questionnaire and ensured that it measured the appropriate items. The instrument's dependability was ensured by the split-half reliability test for internal consistency. To do this, 10% of the sample size, or respondents who are not part of the population but share characteristics with them, were given the instrument. The Cronbach Alpha reliability coefficient formula was utilized to calculate the reliability of the instrument by cross-tabulating responses from completed questionnaires.

$$\alpha = \left(\frac{k}{k-1}\right)\left(\frac{S_y^2 - S_i^2}{S_y^2}\right) \qquad (3.2)$$

In this formula, S_y^2 represents the variance of the overall response scores, S_i^2 denotes the sum of the variances of each individual questionnaire item, and K refers to the number of response options used in the scale, which in this study is five.

Method of Data Analysis

Data collected from noise level measurement and questionnaire administered was cross tabulated and represented in a bar chart for easy interpretation of findings. Measurements were statistically analysed using noise dose, time weighed average, and analysis of variance test (ANOVA). Data was also analysed in comparison with standard allowable limit by OSHA.

3.0 Data Presentation, Analysis, And Discussion of Findings

Table 3.1: Demographic Description of Construction Workers

Category	Options	PTI	Enerhen	Total	% Response
Gender	Male	64	71	135	89%
	Female	9	8	17	11%
Age	20 - 29years	14	23	37	24%
	30 - 39years	28	31	59	39%
	40 - 49years	17	9	26	17%
	50 - 59years	8	12	20	13%
	60years - Above	6	4	10	7%
Level of Education	Primary	5	12	17	11%
	Secondary	19	25	44	29%
	Tertiary	49	42	91	60%
Years Spent in Industry	< 1years	17	23	40	26%
	1 - 5years	31	25	56	37%
	>5years	25	31	56	37%
Work Category	Labourer	56	47	103	68%
	Supervisors	13	29	42	28%
	Manager	4	3	7	5%

Interpretation: The demographics of construction workers at two construction sites are shown in Table 3.1. Males make up 89% of the population, while females make up 11%. Adults with postsecondary education (60%) between the ages of 30 and 39 make up the construction site. While 68% of workers are laborers, more than 70% of workers have more than 1% of work experience.

S/N	General Awareness	PTI	Enerhen
1	Workers are aware of noise pollution in the work environment	4	4
2	Workers are aware of the effect of noise to their health	3	4
3	Workers are aware of protective gears against noise pollution	4	3
4	Workers and management are aware of noise-generating machines	3	4
5	Workers are aware of noise coping strategies	2	2
	Personal Protective Equipment	**PTI**	**Enerhen**
6	Staff are provided ear protective gears	3	4
7	There is enforcement of the use of ear protective devices	2	2
8	Workers are trained on the use of ear protective devices	3	3
	Noise Pollution	**PTI**	**Enerhen**
9	Noise is always experienced throughout work hours	4	4
10	Noise generating machines are available in workplace	3	3
11	Noise level is of high frequency	4	4
	Workers Health	**PTI**	**Enerhen**
12	Staff have experienced high blood pressure	4	3
13	Staff sometimes experience feelings of fatigue during working hours.	4	4
14	Workers experience sleeplessness.	4	4
15	Workers miss conversation details due to hearing difficulty	3	4
	Management Commitment	**PTI**	**Enerhen**
16	Management carried out actions aimed at noise prevention.	2	2
17	Issues of noise pollution have been addressed in safety meetings.	3	3
18	There are available measures provided by management for mitigating noise.	3	3

5 = Strongly Agree, 4 = Agreed, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree

Table 3.2: Perception on the Effect of Noise on Construction Workers
Source: Field survey 2026

Interpretation: Table 3.2 reveals that workers recorded high awareness of noise(4-agreed), frequent noise exposure (4), and high-frequency noise (4). PPE usage and training recorded low score (2-3) while management commitment to noise reduction actions scored low (2–3).
Average results recorded from noise measurements at PTI construction site across three construction phases (excavation, form work and beam placement) over a period of 7days is below.

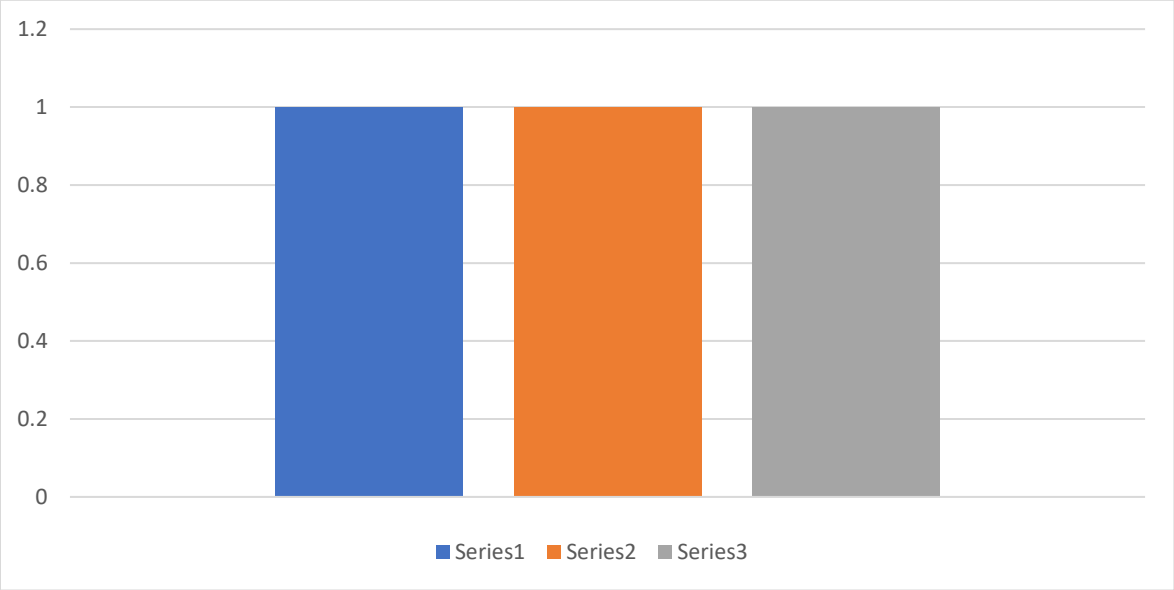

Table 3.3 shows noise level from 73.3-81.9dB for excavation, 79.4-84.1dB for form work and 81.3-90.3dB for beam placement, some of which exceeds the recommended noise exposure limit of 85dB especially during beam placement.

Table 3.4: Statistical Analysis of Noise associated with different Construction Phase at PTI Construction Site

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	73.58	2	36.79	4.47861	0.026386	3.554557
Within Groups	147.8629	18	8.214603			
Total	221.4429	20				

Source: Field survey 2026

Table 3.4 shows from statistical analysis that the p-value (0.02) is less than 0.05. Hence, there is a significant difference between noise levels measured across the different construction phases at PTI construction sites.

3.2 Discussion of Findings

3.2.1 Demography of Respondents

The construction sector is dominated by men, as seen by the workforce's mature age of over 20. This data describes the professional traits of people working on construction sites, highlighting significant variations. The observed distribution demonstrates the suitability of the study's studied population because workers are adults who can give specific details about how noise affects their health and the environment. The results of the survey analytics are consistent with reports by Fiona (2006) that revealed 93% male dominance in the construction business and Nadeem (2019) that found the average age of construction workers to be 30.3±5.317 years. Their work category, years of experience in the construction business, and educational background all support their appropriateness for effectively communicating their views and experiences about noise exposure. Additionally, the demographic statistics show that the majority of employees have relevant on-site experience, indicating that they are familiar with workplace settings, particularly activities that involve a lot of noise. A sizable percentage of respondents are classified as skilled workers, which suggests that they are frequently exposed to machinery and construction items that are known to produce loud noises.

3.2.2 Perception on the Effect of Noise on Construction Workers

According to Table 4.2's findings, construction workers in PTI and Enerhen are highly aware of noise pollution at their workplace (Agree-4). The majority of the subjects (construction workers) in Nadeem's (2019) study were aware of the causes and potential contributing variables of noise in a construction setting, confirming a similar finding. These answers show a high level of knowledge that noise is regularly produced by on-site machinery and happens throughout working hours. The high level of awareness that has been noted extends beyond workers' familiarity with noise-cancelling equipment. This conclusion is supported by a related study by Najaa et al. (2023), which found a positive connection ($r=0.508$, $p=0.004$) between the usage of hearing protection devices and knowledge about noise. However, employees who disagreed showed deficiencies in their knowledge of noise coping mechanisms (2). Although personal protective equipment (PPE) is clearly offered with a positive response of (3-PTI, 4-Enerhen), the enforcement of their use is noticeably weak despite studies by scholars like Ebikabowei and Reginald (2016) showing that workers perceive noise pollution as occurring on construction sites and posing a health risk to both workers and residents. This suggests that adherence or effective protection against occupational noise dangers are not always correlated with the availability of protective measures. Workers surveyed acknowledged the existence of noise, particularly from construction equipment, as Ebikabowei and Reginald (2016) noted in a Yenagoa construction site (Birma et al., 2018).

Regarding health issues, respondents admitted to having symptoms, particularly weariness and trouble communicating, that may be linked to prolonged exposure to loud noises. These findings, which can be linked to the years spent on the building site, indicate that noise is already having quantifiable effects on workers' well-being. These health effects align with those documented by Biibaloo et al. (2024) (health such as hypertension, stroke, hearing loss, and cardiovascular-related events). However, reports of elevated blood pressure seem to be significantly more prevalent among PTI employees than those at Enerhen, which could indicate that the locations differ in terms

of stress levels, equipment kind, or duration of exposure. The observed inadequate enforcement of protective aids is supported by the management's apparent lack of commitment to noise control in both locations. Moderate to poor marks were given to noise reduction initiatives, policy enforcement through safety meetings, and the supply of mitigating measures.

Conclusion, Recommendations, And Implications

This study shows that construction workers at both PTI and Enerhen construction sites have a high degree of awareness of noise pollution in their workplace, with perception scores showing strong agreement that noise is damaging and constantly present. The demographic profile also shows an experienced workforce, with the majority of respondents being in the skilled labor category and having worked in the business for a number of years. These respondents are primarily older than 20. Their replies about noise dangers and related health effects are more credible because of these qualities. However, enforcement of the use of hearing protection devices (HPDs) is still lax, despite the availability of HPDs and sufficient awareness about noise. Fatigue and communication problems are examples of noise-related symptoms that workers reported, which point to new health impacts from ongoing exposure. During multiple construction phases, instrumental noise tests showed recorded values ranging from 73.3–90.3 dB at PTI and 70.8–88.0 dB at Enerhen, above the permissible occupational exposure limit of 85 dB. The highest noise levels were created by tasks like formwork and beam placement, suggesting that machine-intensive procedures have a major role in exposure to hazardous noise. Overall, the results show a significant discrepancy between employees' awareness and the actual application of noise reduction techniques. In order to preserve the health and welfare of construction workers, it is imperative that managerial interventions be enhanced, protective measures be consistently enforced, and workplace noise abatement solutions be improved.

Recommendation

Base on the findings, the following recommendations were made:

i. Site supervisors should ensure mandatory and consistent use of hearing protection devices through regular monitoring, disciplinary measures, and reinforcing safety responsibilities.
ii. Management should introduce noise-dampening equipment to machinery and install temporary barriers to reduce exposure at the source.
iii. Periodic noise measurements should be carried out to identify peak exposure periods and assess compliance with allowable limits.
iv. Workers should be trained not only in the dangers of noise but also on coping strategies, communication techniques, and early reporting of hearing-related symptoms.
v. Management should integrate noise control into safety meetings, provide continuous safety support, and establish policies that protect workers' health.

Contribution to Knowledge

By combining worker perceptions with actual measured noise levels, this study provides fresh baseline data on occupational noise exposure in Nigerian construction contexts.

Furthermore, this research offers a dual perspective that demonstrates that workers' subjective experiences closely match measured noise values ranging from 70.8dB to 90.3dB, which exceed recommended occupational limits, in contrast to previous studies that only looked at environmental readings. This improves knowledge of how noise exposure affects actual on-site health consequences, particularly from various stages of building projects

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