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Measuring peak daytime noise levels at outpatient and inpatient departments in a medical college and noise related complaints in personnel posted in these departments

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Abstract

Introduction: In a sensitive environment like a healthcare facility, acoustic comfort is not merely a luxury but a clinical necessity. Noise induces annoyance and increases the probability of medical errors. To devise effective reduction strategies and optimize workforce deployment, site-specific data is essential.

Objectives: To find out the level of noise in different areas of NRS Medical College during a pre-specified time interval of a working day, the noise sensitivity of posted staff and noise-related health problems among them.

Methods: It was an observational descriptive study in cross sectional design done in Nil Ratan Sircar Medical College and hospital during 24th February 2025 to 5th March 2025. A total enumeration of different hospital areas was performed and areas with restricted entry like operation theatres were excluded. The Noise Tracker app was used to record average sound levels of continuous 5 mins (at 11 am & 12 pm). Staff posted at respective areas were selected purposively and consenting participants were interviewed with a predesigned schedule containing questions regarding background characteristics, presence of perceived noise-related health problems and Noise Sensitivity. Comparison between categorical variables between groups was done using Chi-square tests. The study was undertaken following proper approvals and oral informed consent.

Results: The OPD areas show a median noise level of 71 dB (Range: 60 dB - 80 dB). The IPD areas exhibit a median of ~63 dB (52 dB - 74 dB). More than half (55.6% at 11am & 69.4% at 12 noon) of the wards were above recommended noise level of 65dB at both time points. The commonest age group among participants was 20-30 years (40.4%), 66% were females, 51.1% were staff nurses. Self-reported headaches were slightly higher in participants exposed to less noisy areas and annoyance showed no significant association with noise. Median noise sensitivity score of staff was 17 (15-20). A significant number of staff with high noise sensitivity were posted at relatively noisy wards.

Conclusion: The findings of the present study emphasize the need for routine noise monitoring, administrative regulation, and low-cost preventive interventions to improve the acoustic environment of hospitals.

INTRODUCTION

Noise is frequently defined as unwanted sound or a combination of sounds that may adversely affect individuals, resulting in physiological damage or psychological harm.¹ In the sensitive environment of a healthcare facility, acoustic comfort is not merely a luxury but a clinical necessity. The World Health Organization (WHO) outlines key health risks from environmental noise exposure, including annoyance, sleep disturbance, cognitive impairment, and cardiovascular disease.² These effects are supported by systematic reviews in the WHO Environmental Noise Guidelines for the European Region (2018).³

The severity of these effects is largely dictated by the intensity of the sound. Noise levels exceeding

Keywords: Noise level at Hospital, Noise Sensitivity, NRS Medical College, Kolkata



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65 decibels (dB) are classified as noise pollution, while levels above 75 dB are considered harmful and those surpassing 120 dB can cause physical pain.^{4,5} Despite WHO 1995 recommendations that background noise should not exceed 35 dB during the day, technology development has pushed average hospital noise levels from 57 dB in 1960 to 72 dB by 2005.⁶

Recent studies across India highlight a troubling trend in clinical settings. An observational study in a public tertiary care hospital in Imphal, Manipur, indicated that noise levels in hospital wards and Outpatient Departments (OPD) significantly exceeded the recommendations set by the Central Pollution Control Board (CPCB).⁷ Annoyance is a known adverse effect of noise exposure.⁸ Internationally, Andrade et al. observed that hospital noise exposure correlates with slower patient recovery rates, decreased productivity among healthcare workers, and a higher probability of medical errors. For staff, excessive noise is an unseen cause of annoyance, mental stress, fatigue, and burnout.⁹ However, very few studies have attempted to explore the hospital soundscape and the annoyance among staff related to it.

Most noise sources within hospitals are controllable and preventable through the application of technical, engineering, and management principles. However, to devise effective reduction strategies and optimize workforce deployment, site-specific data is essential.

MATERIALS AND METHODS

Study type and design: The present study is a descriptive study with cross-sectional design

Study Setting: Various IPDs and OPDs of Nil Ratan Sircar Medical College and Hospital

Study Period: The study was conducted from 24th February 2025 to 5th March 2025

Study Population: IPDs and OPDs of NRS Medical College and Hospital; available staff posted in the each selected IPD/OPDs

Exclusion Criteria:

1. Operation Theatres and wards where data could not be recorded due to restrictions
2. Staff not consenting to interview

Sample size and sampling technique: Total enumeration of all the wards was done and convenience sampling was used to select staff posted in the different wards.

Study Tools:

1. An android-based application to measure the sound level (as per the CPCB norms of India), named Noise Tracker, CSIR-NEERI, Nagpur.
2. A predesigned and pretested schedule containing questions regarding background characteristics of the staff, presence of perceived noise related health problems and Noise Sensitivity Scale Short Form [5 Items, each recorded on a scale from 1 (strongly disagree) to 6 (strongly agree); Score range: 5-30; More score denotes more noise sensitivity] was used for data

collection

Study variables

- Area/ward in the hospital
- Noise level (Leq) at 11 a.m
- Noise level (Leq) at 12 noon
- Designation of posted staff
- Age of posted staff
- Gender of posted staff
- Duration of posting
- Presence of noise related health problems in staff
- Noise sensitivity

Method of data collection

After obtaining necessary permissions from the principal and all concerned heads of the departments, the researchers were divided into small teams for each hospital area. The Noise Tracker app was used to record average sound levels of continuous 5 mins (at 11 am & 12 pm) standing at middle of OPD or IPD. Staff responses were entered into MS-Excel sheet to prepare the master chart.

Statistical analysis

Data were cleaned by removing incomplete responses and arranged for analysis. Categorical variables were presented using frequency and percentages. Median and Inter-quartile ranges for non-normally distributed data. Box and whisker plots were made for graphical representation of the data. Comparison between categorical variables between groups was done using Chi-square tests. A p-value of <0.05 was considered statistically significant.

Ethical considerations: The study was undertaken following approvals from the hospital authorities oral informed consent from the staff members included in the study.

RESULT

The boxplots illustrate the distribution of average noise levels across Outpatient Departments (OPDs) and Inpatient Departments (IPDs). The OPD areas show a median noise level of approximately 71 dB, with a range extending from roughly 60 dB to over 80 dB. In contrast, the IPD areas exhibit a slightly lower median of approximately 63 dB, though significant variability exists, with levels ranging from 52 dB to nearly 74 dB. (**Figure 1**). More than half (55.6% at 11am & 69.4% at 12 noon) of the wards are above recommended noise level of 65dB at both time points. But more wards are above recommended noise level at 12 noon than at 11am. (**Table 1**). The commonest age group among participants was 20-30 years (40.4%), 66% were females, more than half (51.1%) were staff nurses. Most of the participants had a duration of posting of ≤ 12 years (43.6%). (**Table 2**). headaches were slightly higher in participants exposed to < 65 dB of noise.





($\chi^2=29.716$, $p<0.001$). However, annoyance/irritation showed no significant difference between groups ($\chi^2=0.1766$, $p=0.6744$). (Table 3). Median noise sensitivity score of staff was 17 (IQR: 15-20). It was noted a significant number of staff with high noise sensitivity score were also posted at relatively noisy wards. (Figure 2).

DISCUSSION

Our current study demonstrates the peak daytime ambient noise levels in both the outpatient and the inpatient departments at Nil Ratan Sircar Medical College and Hospital and how it far exceeds the WHO recommended limits for hospital environments of noise-sensitive zones in hospitals (35-45 dB(A)).¹⁰ Our study results are consistent with earlier studies which reported a similar scenario for other hospitals where an increasing patient load, extensive human interaction and growing dependence on more advanced medical equipment has collectively raised the ambient noise levels.¹¹

Our study had outpatient departments (OPDs) recording higher peak daytime noise levels compared to inpatient wards. Similar patterns were documented in tertiary care hospitals from Manipur, South India, Iran, and Nigeria, where OPD waiting areas, registration counters, and emergency units consistently emerged as the noisiest locations.^{12,13,14,15} A possible explanation for the higher noise levels in OPDs could possibly be due to overcrowding, high patient turnover, multiple attendants, frequent announcements, and continuous movement of people and equipment. In spite of inpatient wards being relatively quieter, the recorded noise levels still exceeded permissible limits, consistent with earlier ward and ICU-based studies.

The daytime noise levels observed in our present study ranged from around 60 dB to over 80 dB which are comparable to those reported in previous hospital-based assessments, where average daytime Leq values commonly ranged between 60-75 dB(A), with occasional peaks exceeding 85 dB(A).¹⁶ Such levels fall into the category of noisy hospitals and are associated with adverse effects on patient comfort, communication, and recovery.¹⁷ A noise survey across inpatient wards in the United Kingdom showed noise levels ranging from 41 to 61 dB L_{Aeq},¹⁸ in comparison, our inpatient noise levels ranged from 52 dB to nearly 74 dB. A difference of over 10 dB in peak noise levels points towards a problem of overcrowding in wards that exist in resource-limited setups like those that exist in developing nations like India.

An important aspect of this study is the assessment of noise-related complaints among healthcare personnel. While one of our study participants reported to have been diagnosed with hearing defects, a considerable proportion of them also complained of symptoms such as headache, irritability, difficulty concentrating, fatigue, and sleep disturbance. A statistically significant positive co-relation was found between staff exposed to noise levels >65 dB and those getting frequent headaches. These findings are consistent with occupational health literature demonstrating how chronic exposure to elevated noise levels can lead to psychological stress, reduced work efficiency, impaired communication, and burnout.^{19,20,21}

Evidence from previous studies indicates that hospital noise is modifiable.²² Behavioral interventions such as staff sensitization, regulation

of visitor movement, minimizing unnecessary conversations, and optimizing alarm use have been shown to reduce ambient noise levels.²³ Structural measures including acoustic treatment and sound-absorbing materials have also demonstrated effectiveness.²⁴ Given that OPDs consistently exhibit the highest noise levels, these areas should be prioritized for targeted noise-control strategies

An important limitation to our study remains the fact that most of our questionnaire provides us with a very subjective angle. Hence attributing any occupational hazard directly to increased ambient noise becomes difficult to prove. Regardless, this coexistence of objectively high noise levels and subjective discomfort highlights hospital noise as a significant occupational health concern.

CONCLUSION

In general, however, most of the hospital premises including both the outpatient and inpatient departments suffer from elevated noise levels far exceeding the WHO recommendation with outpatient areas being more affected. A statistically significant portion of staff workers suffered from frequent headaches owing to the ambient noise levels. Whether these headaches are a result of the noise or other factors including the stress of working in certain high demanding wards, will need more detailed research. However, the findings of the present study underscore the need for routine noise monitoring, administrative regulation, and low-cost preventive interventions to improve the acoustic environment of hospitals and promote safer patient care.

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CONFLICT OF INTEREST

None Declared

FUNDING

Not declared



Table 1: Distribution of study areas according to recommended noise level at two time points of observation (n= 36)

Time	Wards above RNL [#] Frequency (%)	Wards Below RNL [#] Frequency (%)	Total
11 am	20 (55.6)	16 (44.4)	36(100)
12 noon	25 (69.4)	11 (30.6)	36(100)

#RNL-Recommended Noise Level

Table 2: Baseline characteristics of the interviewer staff (n=94)

Variable	Levels	Number	Percentage
Age groups	20-30	38	40.4
	31-40	32	34
	41-50	12	12.8
	>50	12	12.8
Sex	Female	63	66
	Male	31	33
Designation	Staff nurse	48	51.1
	Security Staff	25	26.6
	Clerk	13	13.8
	Ward boy	8	8.5
Duration of posting	≤12	41	43.6
	13-60	36	38.3
	>60	17	18.1
Total		94	100

Table 3. Distribution of staff according to presence of frequent headaches and noise level at posted area (n=94)

Sound levels	No N (%)	Yes N (%)	Total N (%)	Chi square test	p value
Do you have frequent headaches?					
< 65 dB	19 (59.4)	13 (40.6)	32 (100)	29.716	<0.001*
≥ 65 dB	42 (67.7)	20(32.3)	62 (100)		
Do you feel annoyed/irritated frequently?					
< 65 dB	19 (59.4)	13 (40.6)	32 (100)	0.1766	0.674
≥ 65 dB	34 (54.8)	28 (45.2)	62 (100)		

*Statistically significant

Figure 1: Boxplot showing average noise levels in OPDs and IPDs of study area (n=36)

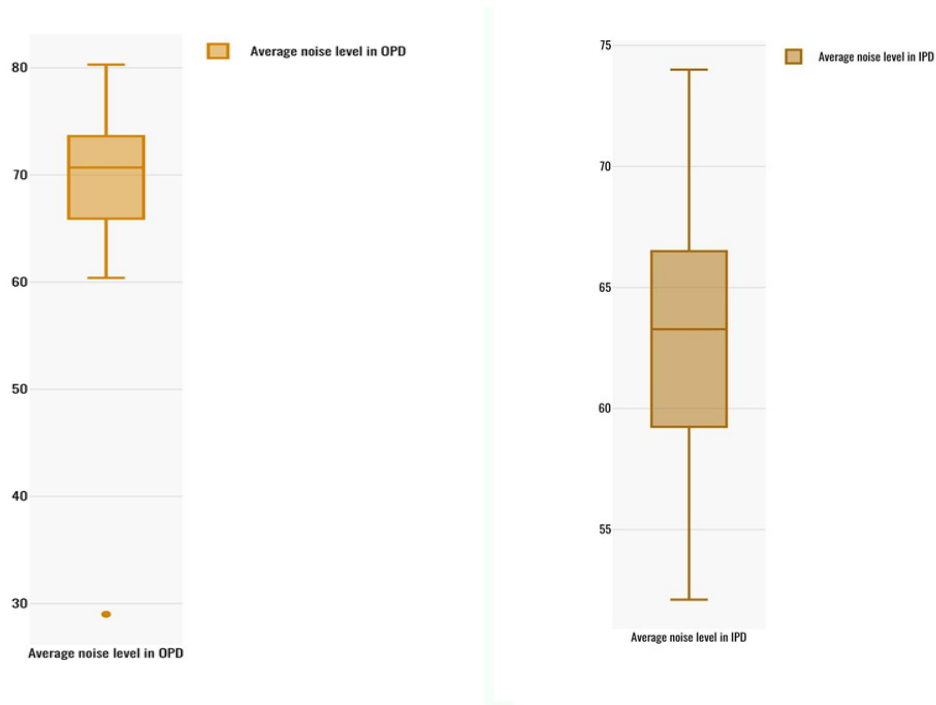
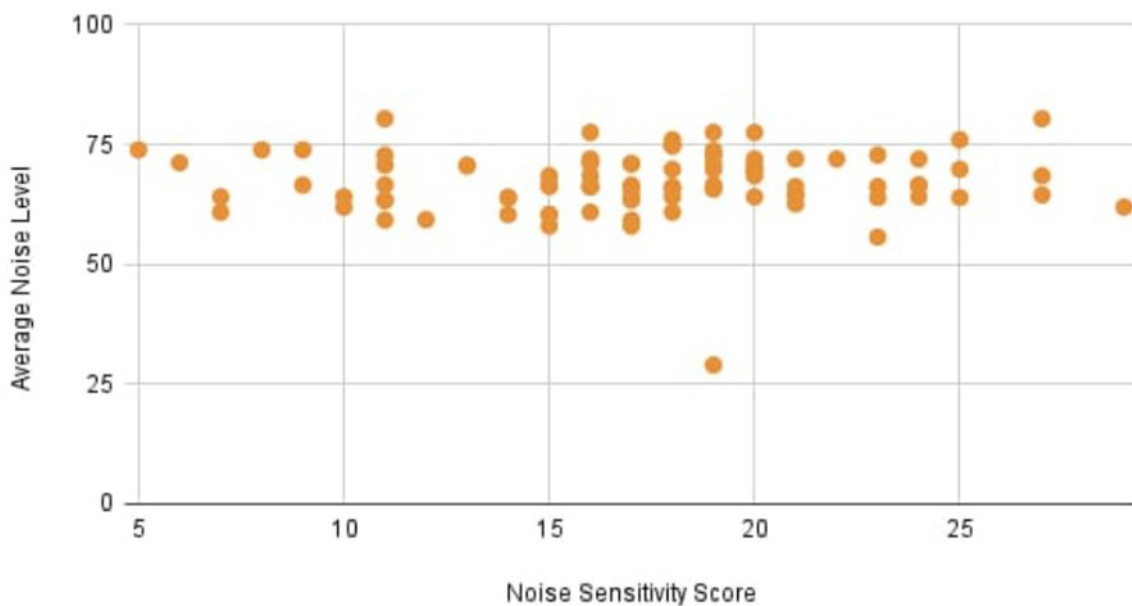


Figure 2. Scatterplot showing distribution of noise and noise sensitivity of posted staff across various studied areas of the hospital (n=94)

Average Noise Level vs. Noise Sensitivity Score





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