

Original Research Article

Assessment of noise pollution level in a tertiary care hospital of Imphal, Manipur

Jalina Laishram*, Khangembam Sonarjit Singh, Tyllibor Syiem, Brogen Singh Akoijam

Department of Community Medicine, Regional Institute of Medical Sciences, Imphal, Manipur, India

Received: 24 August 2023

Accepted: 02 October 2023

*Correspondence:

Dr. Jalina Laishram,

E-mail: Jalinalaishram@yahoo.in

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Noise pollution is a major public health problem. Previous studies reported the presence of noise pollution in various hospital settings around the world. There are few studies conducted on noise pollution in the north eastern part of India especially in Manipur. Therefore, the study was undertaken to assess noise pollution in a tertiary hospital of Manipur for future suggestive measures to reduce noise and associated health impacts.

Methods: An observational study was conducted in a public tertiary care hospital of Imphal, Manipur. Data collection for noise level measurement was done by using a digital sound level meter instrument and mobile sound meter app. The data was analyzed using IBM SPSS for Windows, version 21.0. Armonk, NY.

Results: The highest sound level of 87.6 dB(A) was recorded in the general OPD counter. Among the OPDs, Medicine OPD recorded the highest sound level of 85.2 dB(A). Parking areas recorded an average maximum of 80.5 dB(A). Hospital wards recorded an average maximum sound of 77.4 dB(A).

Conclusions: In this study, the maximum sound level in a week average was found in parking areas of the hospital. Majority of the places around the hospital recorded a noise level which is beyond the recommended CPCB noise level 2000.

Keywords: Central pollution control board 2000, Noise pollution, Tertiary hospital

INTRODUCTION

Noise is defined as unwanted sound. Sound, which pleases the listeners, is music and that which causes pain and annoyance is noise.¹ Noise pollution is generally defined as regular exposure to elevated sound levels that may lead to adverse effects in humans or other living organisms.¹ Noise pollution in hospitals can impact sleep cycle, cardiovascular response, pain management, wound healing and other responses in a patient.² Noise levels have also been shown to alter staff stress level, impact job performance, induce hearing loss at high noise levels, create annoyance and cause an increased rate of burnout.² Thus, noise pollution in hospitals is recognized as a serious health hazard and not just a nuisance.² World Health Organization (WHO) recommends continuous

background noise in hospital rooms to be 35 dB (A), with night time peaks in wards not to exceed 40 dB (A).² Hospitals are intrinsically noisy places with noise emanating from many sources including alarms and monitors, human chatter from workers, patients and visitors, movement of beds and equipment and public address systems.³

Several studies have reported high noise pollution in various hospital settings around the world.²⁻¹³ Environmental noise in hospitals has received attention in the medical literature.⁴ The Environmental Protection Agency recommends that noise levels in the hospital setting should not exceed 45 dBA during the day and 35 dBA at night.⁴ While the International Noise Council and World Health Organization (1999) has recommended that

noise levels in hospital areas should be 35-40 dB(A) in the daytime and 30-40 dB(A) in the evening.⁵ In India recommended value of noise level in hospital is 50 dB at daytime and 40 dB at night time as per CPCB (Central pollution control board), noise rule 2000. In addition, noise pollution has many effects on humans, including hearing loss, emotion effects, impaired communication, physiological and psychological effect.

Although previous studies have reported high noise levels in hospital settings far exceeding permissible limits, little attention has been paid towards mitigating the hazards of noise pollution in hospitals. In addition, very few studies had been conducted till date on noise pollution in tertiary care hospitals of Manipur. Therefore, the study was undertaken to measure the level of noise in some selected areas of the tertiary care hospital and to compare the obtained noise level with the National Standard CPCB 2000.

METHODS

A longitudinal study was conducted between 20th of May to 27th of June 2019 in a tertiary care hospital, Imphal, Manipur.

Sampling

Purposive sampling was used to select the areas of the hospital to be measured.

Study tool

A digital sound level meter instrument (MECO, model 970P) and mobile sound meter app which was downloaded from google play store and calibrated with the digital sound level meter was used for measuring sound level.

The readings of digital sound level meter were labelled in decibel, A-weighted (dBA) units. The instrument records sound ranging from 35 dBA up to 130 dBA with a sensitivity index of ± 1.5 dBA. It had a maximum (MAX), minimum (MIN) and a hold function (HOLD) key for measurement of noise.

Operational definition

Noise pollution in the hospital was defined as a sound level of more than 50 decibel (A) during daytime and more than 40 decibels (A) during night time (CPCB 2000).

Data collection

Several locations/spots, both inside and outside of the hospital were selected for measurement of sound over a period of one week. A total of 3 readings were taken in each spot and each reading was recorded for 5 minutes. Readings from the two devices were recorded in the

proforma. The equipments were kept at about 1.2 meters above the ground or floor level. Tripod stands were used to keep the instruments. The equipments were kept at least 1 meter away from any reflecting surfaces. The timings of measurement were done in the following way: (a) morning- 9.30 am- 10.30 am, (b) forenoon- 11.00 am - 12 pm (noon), (c) evening- 4.30 pm - 5.30 pm, (d) night- 7:30 pm - 8:30 pm.

Statistical analysis

Data collected were checked for consistency and completeness. Data were entered in IBM SPSS version 21.0. Armonk, NY. Descriptive statistics like mean, frequency, range were used to represent the data.

Ethical issues

Ethics approval was obtained from the research ethics board, RIMS, Imphal before the beginning of the study. Permission was also sought from the medical superintendent of the hospital as well as the respective heads of the departments concerned.

RESULTS

A total of 33 spots were selected purposively for measurement of noise level in the study. Among the wards a total number of 14 spots were selected (medicine- 4; surgery- 4; obstetrics and gynecology- 2; paying ward- 1; isolation ward- 1 emergency ward- 1; pediatrics- 1). In this study, a total number of 5 spots were selected from parking places of the hospital (emergency- 1, OT- 1, PMR- 1, forensic- 1, radiotherapy- 1). A total number of seven spots were chosen from the OPD areas (medicine- 1, derma- 1, radiotherapy- 1, PMR- 1, psychiatry- 1, dental- 1, pedodontics- 1). From the registration counters, a total number of 3 areas were selected for the study (general- 1, dental- 1, obstetrics and gynecology- 1). Finally, four areas were selected inside the hospital (emergency corridor- 1, emergency examination room- 1, library- 1, obstetrics and gynecology waiting room- 1).

Table 1 shows the average sound level in a week at different spots of the hospital.

Table 1: Average sound level over one week period at different spots of the hospital.

Hospital areas	One week period sound level in dB(A)		Recommended maximum noise level in silent zones	
	Average maximum	Average minimum	Day time	Night time
Wards	77.4	57.2	50 dBA	40 dBA
Parking	80.5	53		
Registration	76.6	58.0		
OPDs	76.5	54.8		

The average maximum and minimum sound level in the ward areas were 77.4 dB(A) and 57.2 dB(A) respectively. The parking areas were found to have average maximum noise level of 80.5 dB(A) and average minimum noise level of 53 dB(A). In the registration areas, we have found average maximum noise level of 76.6 dB(A) and an average minimum noise level of 58.0 dB(A). In the present study an average maximum sound level of 76.5 dB(A) and average minimum sound level of 54.8 dB(A) were found in OPD areas.

Table 2 shows hospital areas with maximum and minimum sound level over one week period.

Table 2: Hospital areas with maximum and minimum sound level over one week period.

Hospital areas	Maximum dB(A)	Minimum dB(A)
Wards	Paying ward (82.6)	Isolation ward (40.4)
Parking places	Forensic parking (85.9)	PMR parking (39.6)
OPD registration counter	General OPD (87.6)	Dental OPD (28.0)
OPD	Medicine OPD (85.2)	Dental OPD (28.0)

Paying ward recorded maximum sound level whereas the minimum sound level was recorded in isolation ward during one week period of noise measurement among all the ward areas located in the hospital. During one week period of noise measurement among all the parking areas in the hospital, Forensic parking was found to have a maximum noise level and PMR parking was found to be the minimum noise level. Among the OPD registration counters, general OPD registration counter recorded maximum sound level and dental OPD registration counter recorded minimum sound level. Lastly, medicine OPD recorded maximum noise level in the hospital among all the OPD areas whereas dental OPD recorded minimum noise level during one week period of noise measurement.

Figure 1 shows level of noise pollution in and around the tertiary care hospital.

Line chart shows the noise level trend in one week period and it has been observed that the noise level is found to be higher than recommended noise level of CPCB 2000 in the all the selected areas of the hospital throughout the week.

Figure 2 shows noise level in some selected areas of hospital.

Bar diagram shows that the noise level is found to be higher than the permissible noise level of CPCB 2000 in all the selected areas of hospital irrespective of day and night time.

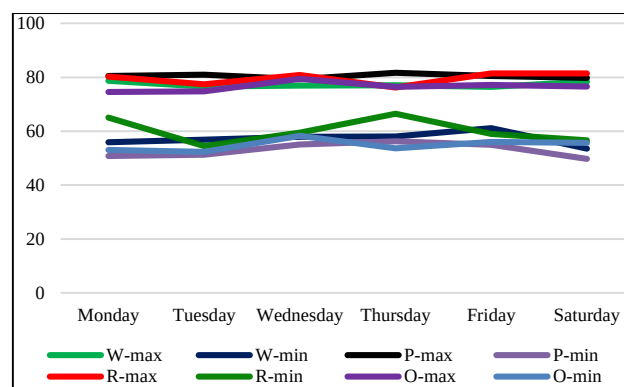


Figure 1: Level of noise pollution in and around of hospital.

*W=wards, P=parking areas, R=registration counter, O=OPD

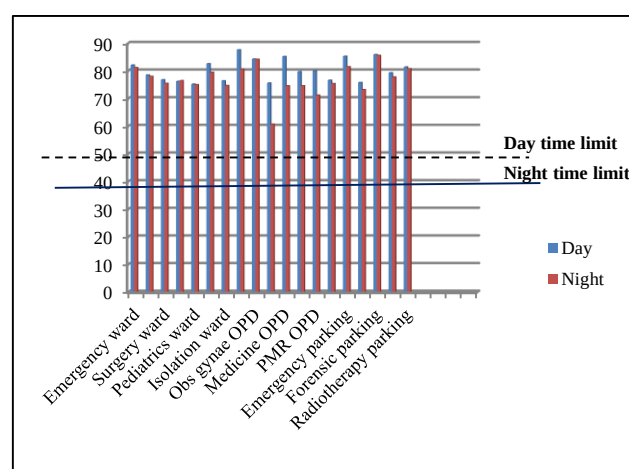


Figure 2: Level of noise pollution in some selected areas of hospital.

DISCUSSION

The findings of this study confirm that excessive noise level is present in different areas of the present hospital. Recorded noise levels were high both in and around the hospital, with an unchanged pattern during one week period of recording. Even though noise levels are expected to decrease during the night time, it was persistently above the permitted values of national standard CPCB 2000.

In this study, the mobile sound meter app calibrated to the digital sound level meter was used for measurement of sound levels. Similar study tool (i.e. Mobile sound meter app) was also used in the studies conducted by Khaiwal et al, Ibekwe et al and Moshi et al.^{2,9,10} The sound levels measured in the wards, OPD registration, OPDs, parking places of the present hospital are found to be higher than the permissible level as given by the national standard CPCB 2000, India and similar findings were found in the studies conducted by Khaiwal et al and Short et al where the measured sound levels exceeded the maximum permissible level as given by the "The Noise Pollution (Regulation and Control) Rules 2000 CPCB".^{2,3}

In our study, the highest sound level was recorded in day time reaching 87.6 dB(A) in the OPD registration counter and similar finding was seen in the study conducted by Short et al where the highest sound level of 90 dB(A) was recorded at day time.³ The reason to this finding may be because of the number of people reaching the hospital is highest during the forenoon and noon hours and also all the departments are opened during this period. The lowest sound level in the current study was found to be 14.4 dB (A) at dental OPD and almost a similar finding was seen in a study conducted by Vinodhkumaradithyaa et al where the lowest recorded noise level was 18 dB (A).⁵ The reason of having lowest sound level in the dental OPD is due to its place of location which is at the far end of the hospital away from the main hospital area.

In the present study, the noise level in the daytime was higher than the noise level in the night time and similar finding was seen in a study conducted by Mousavi et al.⁶ The reason for this finding could be because of visits by patient's family members and their communication inside the different wards of the hospital during daytime.

Moreover, among the spots measured the highest sound level was recorded in the main OPD registration areas. Similar findings were reported by Baqar et al and Mossi et al where the reception area recorded the highest sound levels recorded at noon time.^{7,10} The number of people gathering at these main areas for booking of OPD tickets is seen to be greater compared to any other area in the hospital. Hence, these areas recorded the highest sound levels.

In the present study, the lowest sound level was recorded in the night time of dental OPD. This is similar to a study conducted by Baqar et al where the lowest sound level was also recorded in the night time.⁷ This may be accountable to the fact that apart from the emergency, all the OPDs are non-functional during the night time.

The noise level in the wards of the hospital in the present study was found to be between 57.2 dB(A) and 77.4 dB(A) and a similar finding was observed in a study conducted by Pai et al where the noise level in the wards of a hospital in Taiwan was between 50.3 dB(A) and 68.1 dB(A).¹¹

Factors possibly contributing to the high noise levels were high turnover of patients, overcrowding of wards, communication among healthcare providers, incessant conversations by visitors, crying of babies, screaming of children and emotional outbursts, vehicles (engine noise, horns, bells and public vehicles on adjacent roads), location (adjacent to the main road, decreased breathing space between two buildings and lack of silence zones), environmental factors (low number of trees within the hospital premises) and equipments and appliances (mobile phones, alarms of instruments, power generators present near the wards and noise from old fans, loud speakers used by security guards).¹²

The strength of the study could be the selection of a total of 33 sites including inside and outside of the hospital for continuous monitoring of sound level for a period of one week. Recording the sound level only for a short period in each location could be a limitation of the present study. The other limitation could be the deployment of purposive sampling which makes the study less generalizable.

CONCLUSION

The maximum sound level found at all the spots both in daytime and night time in the tertiary care hospital was found to be above the recommended level, suggestive of noise pollution. Even the minimum sound level, both in daytime and night time, in most of the spots, were higher than the recommended sound in hospital. The highest level of noise was recorded in parking places and then followed by wards, registration counters and OPDs respectively.

Recommendations

Further studies can be done including other private hospitals and tertiary care hospitals of Manipur and compare the noise level with the present findings of the tertiary care hospital. Authorities of the present tertiary care hospital need to set up noise monitoring system and take necessary measures in order to reduce the noise pollution in hospital.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee of RIMS, Imphal

REFERENCES

1. WHO Guidelines for Noise. Central Pollution Control Board. Available from: <https://cpcb.nic.in/who-guidelines-for-noise-quality/>. Accessed on 6 February 2023.
2. Khaiwal R, Singh T, Tripathy JP, Mor S, Munjal S, Patro B, et al. Assessment of noise pollution in and around a sensitive zone in North India and its non-auditory impacts. *Sci Total Environ*. 2016;566:981-7.
3. Short AE, Short KT, Holdgate A, Ahern N, Morris J. Noise levels in an Australian emergency department. *Australas Emerg Nurs J*. 2011;14(1):26-31.
4. Environmental Protection Agency. Information on levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety. Washington, DC: Government Printing Office; 1974.
5. Vinodhkumaradithyaa A, Srinivasan M, Ananthalakshmi I, Kumar DP, Rajasekhar RJ, Daniel T, et al. Noise levels in a tertiary care hospital. *Noise Health*. 2008;10(38):11-3.

6. Mousavi SA, Sohrabi P. A comprehensive evaluation of the level of noise pollution in hospitals of Kermanshah University of Medical Sciences. *Global Nest J*. 2018;20(2):363-7.
7. Baqar M, Arslan M, Abbasi SA, Ashraf U, Khalid A, Zahid H. Noise pollution in the hospital environment of a developing country: A case study of Lahore (Pakistan). *Arch Environ Occup Health*. 2018;73(6):367-74.
8. Charan PD. An assessment of environmental noise pollution in Bikaner city of western Rajasthan, India. *Int J Life Sci Tech*. 2017;10(3):33-7.
9. Ibekwe T, Folorunso D, Ebuta A, Amodu J, Nwegbu M, Mairami Z, et al. Evaluation of the environmental noise levels in Abuja Municipality using mobile phones. *Ann Ibadan Postgrad Med*. 2016;14(2):58-64.
10. Moshi AA, Philimoni KM, Mkoma SL. Noise pollution on wards in Iringa regional hospital, Tanzania. *World Appl Sci J*. 2010;11(5):599-603.
11. Pai JY. A study in hospital noise—a case from Taiwan. *Int J Occup Saf Ergon*. 2007;13(1):83-90.
12. Noise Measurements in the Johns Hopkins Medical Institutions' Pediatric Intensive Care Unit. In: Hunter T, Busch-Vishniac I, West JE, Chivukula RV. *Noise-Con 04. The 2004 National Conference on Noise Control Engineering*. 2004.
13. Al-Zubeera HG, Al-Jawadia AA, Al-Joomardb RA. Noise pollution in mosul medical city center teaching hospitals. *Ann Coll Med Mosul*. 2013;39(1):32-7.

Cite this article as: Laishram J, Singh KS, Syiem T, Akoijam BS. Assessment of noise pollution level in a tertiary care hospital of Imphal, Manipur. *Int J Community Med Public Health* 2023;10:4308-12.