

ASSESSMENT OF AUDITORY AND NON AUDITORY IMPACT OF NOISE USING NOISE EXPOSURE INDICATOR (NEI) IN HOSPITALS

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ABSTRACT-Economic growth in urban centers of country is accompanied by increase in environmental degradation mainly in terms of noise pollution. Noise pollution is degrading the quality of outdoor working environment which have detrimental effect due to long term exposure. In present paper a study was carried out to assess the effect of noise on auditory system. Five hospitals in Lucknow city namely King George Medical College, Veerangana Jhalkaribai Women & Child Hospital, DrShayama Prasad Mukherjee Civil Hospital, Balrampur Hospital & Sahara Hospital are monitored for evaluating noise pollution level (Leq) at outdoor locations of outpatient department (OPD) in day time. Using noise pollution level (Leq), Noise Exposure Indicator (NEI) for these hospitals which is a risk based tool for ranking and assessing occupational noise exposure on people present in that environment is worked out. On the basis of NEI, ranking of hospital was found in order from most severe to least severe as King George Medical College, DrShayama Prasad Mukherjee Civil Hospital, Veerangana Jhalkaribai Women & Child Hospital, Sahara Hospital & Balrampur Hospital. Employees working outside OPD were surveyed and a pure tone audiometry test was conducted for evaluating non auditory impact and auditory impact respectively. Survey revealed the prevalence of non-auditory impact namely annoyance, sleeplessness, stress till first period of 1-2 weeks from timing of starting job and impacts get diminishes with later continuation of job and now employees become susceptible in working in noisy environment. Results of pure tone audiometry revealed absence of noise induced hearing loss (NIHL) but mild hearing loss is observed in King George Medical College due to higher NEI value among the five hospitals.

Keywords : Hospitals, Employee outside OPD, auditory & non auditory impact, sustainable noise mitigation measures.

1. INTRODUCTION

In present scenario of rapid urbanization, environment degradation and maintenance of its quality is major concern for policy makers. Noise pollution in urban environment is emerging as a threat to quality of life impacting the peace of outside working environment. In urban environment hospitals which are categorized under silence zones, are getting noisier. Employees working in these environment are prone to noise affecting their quality of life. Noise Exposure Indicator bring out the numerical way of quantifying occupational risk exposure of noise on employees. NEI prioritises the study area in order to evaluate the effect of exposure of noise on these employees which are studied in terms of auditory and non auditory impact. Auditory and non auditory impact are long term and short term consequences of exposure on ears to noisy environment. In auditory impact hearing loss of employee is examined to check by how much threshold their hearing capacity is being effected working in noisy environment. In non auditory impact, sleeplessness, annoyance and stress of employee is evaluated. So, on these parameters quality of life of employee working in noisy hospitals areas are assessed.

2. LITERATURE REVIEW

Preeti Srivastava et al 2016 studied noise level around ten hospitals of Jaipur city in Rajasthan, India & observed that hospitals were exposed to higher noise level as compared to ambient noise standard level by Central pollution control Board (CPCB). According to CPCB standards, on the basis of noise pollution level, permissible noise level are set for four major zones as classified (Table No. 1).

Table no 1. Standards for noise pollution level by CPCB(2009)

Area code	Category of Area	Limits in	
		Day	Night
I	Industrial area	75	70
C	Commercial area	65	55
R	Residential area	55	45
S	Silence area	50	40

SanjithSaseedharan et.al 2015 worked at ICU of S.L. Raheja Hospital (A Fortis Associate) RahejaRugnalayaMarg, Mahim West, Mumbai.Noise levels in the ICU were found to be higher than the guideline values in accordance with most recent studies.

Ahsan Md. Quamrul et.al 2015 conducted study to determine noise pollution in different zone of the Jamalpursadar municipal area Bangladesh in the year of 2014. The proper utilization of traffic enforcement laws was suggested by most of the respondents, driver and public awareness on noise pollution.

Tim Robinson et.al 2015 study objective was to describe the prevalence of occupational NIHL among woodworkers in Nepal and measure noise levels at workplaces. The woodworking industry represented an important cause of occupational noise-induced hearing loss (NIHL), a significant yet underappreciated problem in many developing countries.They observed that Woodworkers in Nepal were at risk of occupational NIHL. A typical audiogram is shown below which classifies hearing loss with sound perceived at different frequencies.

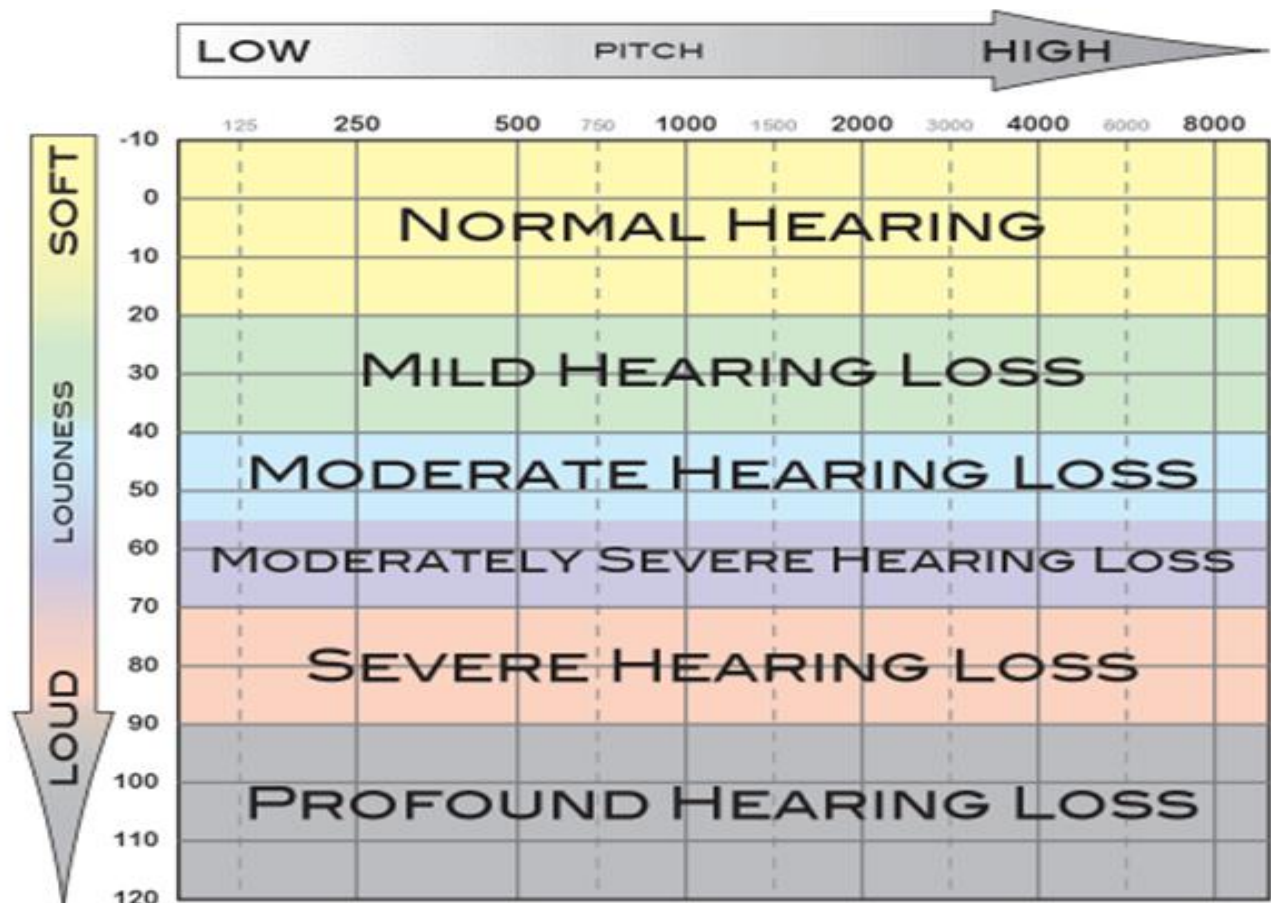


Fig no .1 Audiogram showing range of hearing loss for different noise decibel level.

BhabanandaPhukan et.al 2013 carried out noise level measurement $L_{10}, L_{50}, L_{90}, L_{eq}$ to assess the traffic generated noise in Guwahati University Campus, Assam during the month of April-May 2012 . This study revealed that the noise levels exceeded the prescribed noise standard set by the Central Pollution Control Board, India (CPCB, 1998). The results of the analysis revealed that the maximum equivalent noise level L_{eq} was in the morning during 9-11am and minimum in the midday at 12-2pm. L_{eq} is calculated using the equation

$$L_{eq} = L_{50} + ((L_{10} - L_{90})^2 / 60) \tag{i}$$

Mathias Basner et.al 2013 conducted observational and experimental studies which showed that noise exposure leads to annoyance, disturbs sleep and caused daytime sleepiness, affects patient outcomes and staff performance in hospitals, increases the occurrence of hypertension and cardiovascular disease, and impairs cognitive performance in schoolchildren. In this paper, they stressed on the importance of adequate noise prevention and mitigation strategies for public health.

Colin Tickell et.al 2012 described the application of NEI. Information was presented on recent observations and recommendations of how to take occupational noise management to the next level, where it was the responsibility of an accountable team from hygiene, engineering, maintenance and procurement departments at a workplace. Noise exposure risk ranking combines the number of people exposed and their exposure level.

$$NEI = N_i \cdot C_i \cdot L_i \tag{ii}$$

where L_i is noise exposure $L_{Aeq,8h}$ measured or estimated, dBA, C_i is the NEI coefficient for the range of noise exposure L_i , N_i is the number of employees with exposure L_i .

3. METHODOLOGY

(i). Study area

In Lucknow, capital city of Uttar Pradesh, shown in fig 2. five hospital namely King George Medical College (red), Veerangana Jhalkaribai Women & Child Hospital (black), Dr Shayama Prasad Mukherjee Civil Hospital (purple), Balrampur Hospital (green) & Sahara Hospital (yellow) are shown which are selected for study. In outdoor environment, location outside opd are selected for noise monitoring.

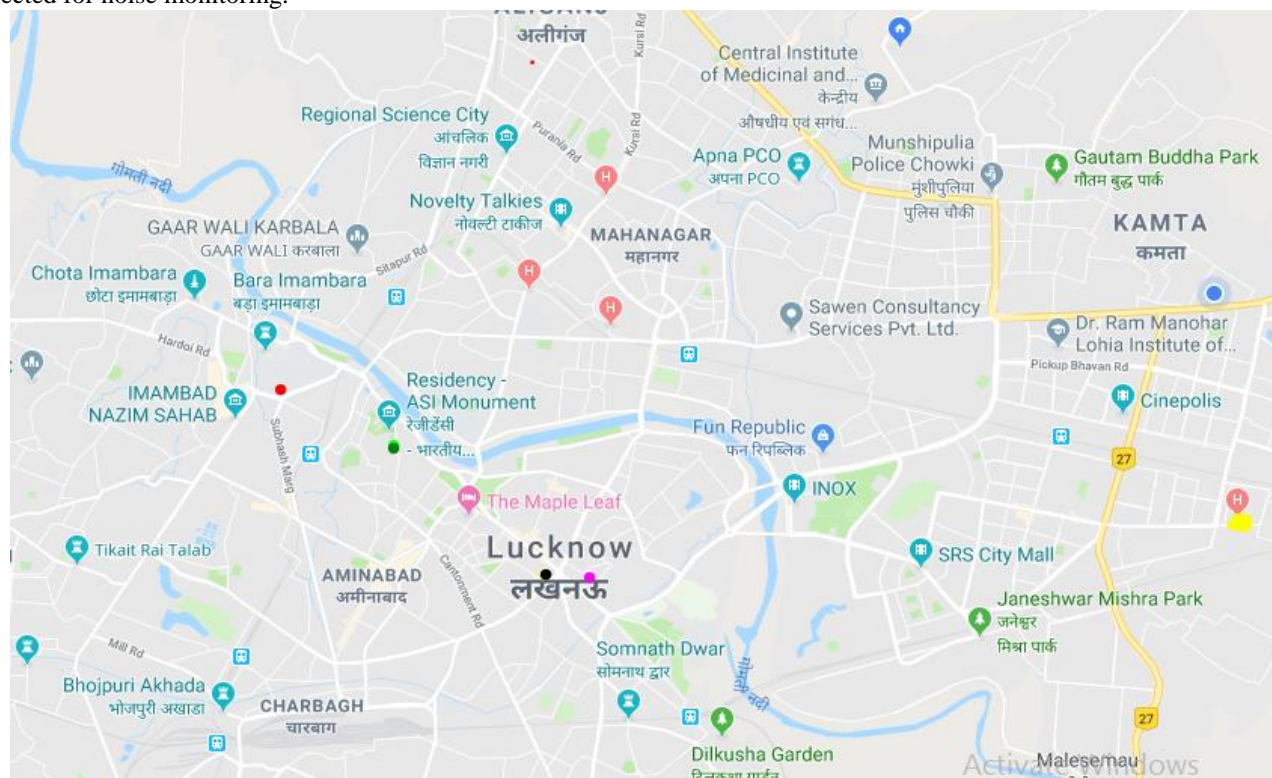


Fig 2. Location of hospitals shown on map of Lucknow.

(ii). Data collection

Noise data in Hospitals are taken using Lutron SL-4010 Sound Level meter in day time from 10:00 am to 2:00 pm which is working hours for general opd. For measuring noise in given environment, following parameter L_{10} , L_{50} , L_{90} , L_{eq} are calculated. Noise Exposure Indicator is calculated using the L_{eq} obtained above for each hospitals. So no of employee exposed is 2. L_{eq} obtained is in the range of 70 dB to 85 dB.

S.No	Name of Hospital	No of Employee outside OPD	Leq(dB)	Risk Ratio	NEI	Ranking
1.	King George Medical College	2	83.98	0.10	16.7	1
2.	Veerangana Jhalkaribai Women & Child Hospital	2	81.72	0.10	16.3	3
3.	Dr. Shayama Prasad Mukherjee Civil Hospital	2	82.99	0.10	16.5	2
4.	Balrampur Hospital	2	72.12	0.05	7.2	5
5.	Sahara Hospital	2	80.57	0.10	16.1	4

Table 2. Ranking and NEI values for five hospitals in Lucknow city.

Therefore, risk ratios used in the equation is 0.05 for 70 to 80 dB range and 0.1 for 80 to 85 dB range. In this way, NEI is worked out for each hospitals and corresponding to following NEI, Hospitals are ranked which is represented in table 2. Employees working outside opd were surveyed and get conducted a Pure Tone Audiometry in ENT department of their respective hospital in which they are employed. Employees participated in the study were in the working age group from 26 to 40 years. In Questionnaire used in the survey, question were taken from WHOQOL-1995, Division of mental health, WHO, Geneva.

4. RESULT AND DISCUSSIONS

Among the following five Hospitals ,King George Medical University is most noisiest hospital with noise level L_{eq} 83.98 dB & NEI 16.7 following with DrShayama Prasad Mukherjee Civil Hospital L_{eq} 82.99 dB & NEI 16.5, VeeranganaJhalkaribai Women & Child Hospital L_{eq} 81.72 dB & NEI 16.3,Sahara Hospital L_{eq} 80.57 dB & NEI 16.1, and at last Balrampur Hospital L_{eq} 72.12 dB & NEI 7.2. NEI result is represented in fig. 3 which summarises the result obtained in the study.

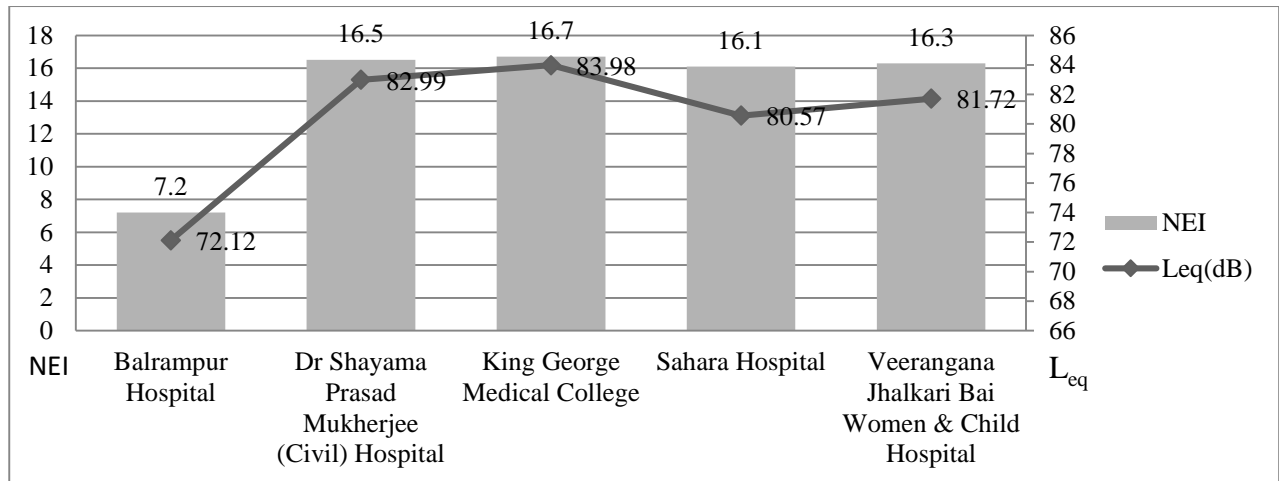


Fig 3. L_{eq} and NEI plotted for five hospitals in Lucknow City

(i). Auditory impact

Series of audiogram obtained in Pure tone audiometry of employees revealed the absence of NIHL among five Hospitals despite of being working in noisy environment though mild hearing loss has been observed at King George Medical College. In Fig.no 4, at 250 Hz, 500 Hz & at 8000 Hz, hearing loss is observed at these frequencies.

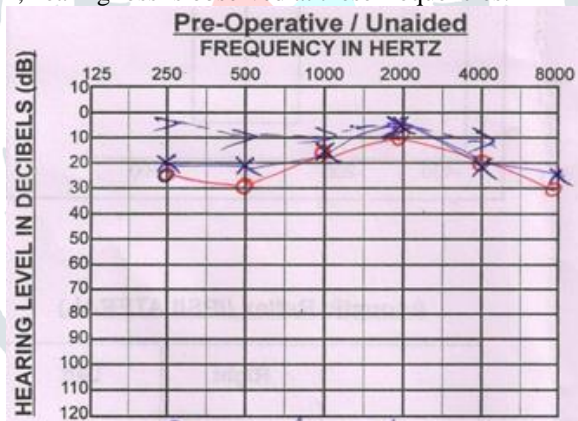


Fig 4. Audiogram of the employee working in King George Medical College.

(ii). Non auditory impact

Survey done in the study revealed that working in noisy environment was leading to annoyance, sleeplessness & stress only in the earlier working period of 1-2 weeks and later with advent in working periods made them habitual and adaptable to work in such noisy environment.



Fig.5 Variation of Degree of Annoyance ,Sleeplessness& Stress with the working period in weeks.

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