



## **Perception of patient and visitors on noise pollution in hospitals and need of the real time noise monitoring system**

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### **ABSTRACT**

*Various studies have found that noise is rising in hospitals since the 1960's and it's consistent. Hospitals should have the quietest environment. WHO rules on Community noise expresses that noise in the emergency clinics during night not to surpass 40 dB (A) inside. And during the day and evening the guideline value indoors is 30 dB (A). Noise has many negative impacts physiologically and psychologically not only on patients but on staff too. Still many hospitals have noise more than recommended limits. It has found that patients recover faster in good acoustic conditions as compared to bad acoustic conditions. And it can help to increase the HCAHPS score of the hospitals. To understand the perception of patients and visitors on noise in the hospital and the need of the real time noise monitoring system, a qualitative survey was conducted. The responses we got are from various regions of India. Despite WHO guidelines on noise for the hospitals, our study shows that noise in the hospitals is still rising and it's exceeding the recommended limit. Patient's sleep got hampered during hospital stay, they got irritated due to noise. And it resulted in low patient satisfaction. Noise does not only impact the patient's health, but also it leads to low patient satisfaction and negative perception towards the hospitals. People want hospitals to take necessary actions to reduce the noise like real time noise monitoring systems. By focusing on increasing patient satisfaction score, hospitals can achieve revenue goals.*

**Key Words:** Noise, Patient Satisfaction, Need of real time noise monitoring system

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### **INTRODUCTION**

Clinic workers and directors typically see noise as the hear-able expense of doing business: It's what occurs in a completely working office. Notwithstanding, to outsiders, such as patients and even clinical staff, the experience can be considerably more negative. Indeed, Florence Nightingale recognized commotion as one of the most genuine of all abuses to patients, just as a foe to the mending cycle. In 1859, she composed that anything that causes the patient expectation, tension or desire causes damage, and commotion is essential on the rundown. [1] She likewise composed that noise is that [sound] which harms the patient and, hence, pointless sound is the "cruellest nonattendance of care." [2]

Commotion contamination is fundamentally discovered in the Intensive Care Unit from clinical types of gear like cautions, telephones, entryways opening and shutting, staff exercises and guests. These sources can make emergency clinics extremely noisy. Notwithstanding that there are hard intelligent surfaces and shut beds to one another establishes a horrendous environment where noise bounces around gets intensified. [3]

The fact is that acute patient feels more irritated due to unnecessary noise. [4] It contributes to patients suffering and discomfort. As indicated by patient satisfaction survey, the standard of the medical care experience is usually evaluated consistently with hospitals dynamic environment. The sound of machines and technologies that are overheard through thin walls, curtains and open entryways become the setting during which patients and their families go through their own medical care insight. [5]

King's college London recently published a research article which states that in I.C.U where the patients are under constant observation and need more care and rest- Noise level surpassed 100 dBA. That was much higher than recommended noise level.

Dr Xyrichis from the college recommends that few changes can be made to existing environments at a reasonable cost, these can include:

- Sound-absorbing panels, and
- Noise-warning systems.

Most of the time Hospitals do not realize that the sound has converted to noise and it exceeded the standard limit. Now there is a need that every hospital should have a real time noise monitoring system. This will help monitoring the noise round the clock and notify when noise level exceeds. [6]

The objective of this study is to understand the perception of the patients and visitors on noise pollution in hospitals and to identify whether there is a need for the real time noise monitoring system.

### LITERATURE REVIEW

Studies have found that hospital noise levels have been rising reliably since the 1960s. The ambient noise levels in hospitals rose reliably from 57 dB (A) in 1960 to 72 dB (A) today (2006) during daytime hours, and from 42 dB (A) in 1960 to 60 dB (A) today during evening hours. [7]

A research was conducted in a tertiary care hospital in India and noise level was measured. During morning hours maximum and minimum noise level was (76.7dBA) and (58.34dBA). And during the Evening hour's maximum and minimum noise level was (71.86dBA) and (57.08dBA). And it was exceeding the WHO guidelines on noise limits in the hospitals.

Another study found that, In India, recorded noise levels in an OT were between 65-80dBA during surgery. The average indoor noise levels of three hospitals were found to exceed the standard limits. [8]

Numerous investigations have uncovered that extended exposure to noise pollution may lead to temporary or permanent hearing loss, sleep disruption, vertigo, agitation, weariness, hypertension, gastrointestinal system problems, cardiac arrhythmia, nervous and psychic disorders and so on. In this manner, it is significant that medical services providers ought to give a pleasant environment to the patients since unwanted sound could have a negative impact on patient outcomes.

A study was conducted in 2008 i.e. 'Noise on Intensive Care Unit', and the result was that the noise generated from nurse station were more distracting for patients than other patients and relatives.[9]

In 2000, Press Ganay, found that patients complain multiple times more frequently about noise than about whatever else in a hospital, including food.

A study in Sweden, evaluated the impact of improved room acoustic conditions (by exchanging sound absorbing ceiling tiles and sound reflecting ceiling tiles) of an intensive coronary care unit (ICCU). During good acoustic conditions, pulse amplitudes were normal among patients in acute myocardial infraction and unstable angina pectoris group when contrasted with awful acoustic conditions. Patients felt more satisfied with the care provided by the staff during great acoustic condition. On the contrary, occurrences of rehospitalisation was higher among patients treated during awful acoustic conditions.

### OBJECTIVE

The objective of this study is to identify how the noise in the hospital is affecting the perception of the patients and visitors towards hospital's environment. This study shows, what the reaction of the patients was when they were exposed to noisy environment.

It answers following questions:

1. How was the experience of the patients when the hospital environment was noisy?
2. Whether the noise impacted the inpatients while resting or not?
3. How does visitors felt in such noisy environment?
4. Did it only affect inpatients who are ill and needs quiet environment to heal or the visitors too who were healthy?
5. Is real time noise monitoring system needed to reduce noise?
6. Does patients want hospitals to take actions against noise?

### MATERIAL AND METHODS

Sample size and data collection:

The study is a survey to analyse the perception of patients and visitors on noise in hospitals and need of real time noise monitoring system. To evaluate the perception of patients on noise in the hospitals, a google form was designed which has 14 questions with MCQ options regarding their experience with noise in the hospital.

Simple random sampling was adopted. The survey form was shared with the people from various locations within India. We circulated the form with the help of various social media platforms like- Email, LinkedIn and fellow colleagues. The study was conducted in the period of 28<sup>th</sup> August, 2020 – 20<sup>th</sup> September, 2020. Among 105 responses, the sample size was considered to be 100. The form includes the respondents like, inpatients, outpatients and visitors. So, we can identify how each type responds to noise

in the hospital. And the respondents have visited various hospitals in India. And they answered based on their present or past experience. The responses were used to analyse the perception of patient's perception on noise and whether there is a need of the real time noise monitoring system. The responses were analysed using the response tables made below.

**RESULT**

Almost every person visits hospital once in a life time, be it a patient or a visitor. Out of 100 participants, who've visited the hospital, there were 31(31%) Inpatients, 11(11%) Outpatients, 58(58%) visitors. 87(87%) people think noise in the hospital affects the patient satisfaction in hospitals. 12(12%) people were not sure about this. When we asked the inpatients, if their sleep got hampered due to noise in the hospital, out of 31 people (inpatients) 15(48.3%) said yes and 16(51.6%) said no. Among the people whose sleep got hampered, the reasons were due to the noise that was loud 4 (26.7%), Noise that lasts longer 6(40%), all the above 5 (33.3%).Among the patients whose sleep got hampered, in day time are 8 (53.3%), night time 2(13.3%) and both the times 5(33.3%) who were inpatients.

**Table no. 1**

Age	<input type="radio"/> Below 30	75%(75)
	<input type="radio"/> Between 30-60	22%(22)
	<input type="radio"/> Above 60	3%(3)
Gender	<input type="radio"/> Female	47%(47)
	<input type="radio"/> Male	53%(53)
Have you ever visited a hospital?	<input type="radio"/> Yes	100%(100)
	<input type="radio"/> No	0%(0)
Type of Patient / Visitor	<input type="radio"/> Inpatient	31%(31)
	<input type="radio"/> Outpatient	11%(11)
	<input type="radio"/> Visitor	53%(53)
Do you think noise in hospitals are rising day by day?	<input type="radio"/> Yes	63%(63)
	<input type="radio"/> No	14%(14)
	<input type="radio"/> Maybe	22%(22)
Does the noise stop you getting to sleep during your hospital stay?	<input type="radio"/> Yes	15% (15)(out of 31 inpatients)
	<input type="radio"/> No	16%(16) (out of 31 inpatients)
What's the noise like in the hospital?	<input type="radio"/> Bearable	69%(69)
	<input type="radio"/> Unbearable	29%(29)
At what time noise is more disturbing?	<input type="radio"/> Day	67%(67)
	<input type="radio"/> Night	14%(14)
	<input type="radio"/> All the above	16%(16)
When the noise is more disturbing?	<input type="radio"/> When I want to rest	17%(17)
	<input type="radio"/> When I'm in pain	4%(4)
	<input type="radio"/> While communicating	12%(12)
What type of noise is most annoying?	<input type="radio"/> All the above	8%(8)
	<input type="radio"/> Noise that is loud	26%(26)
	<input type="radio"/> Noise that lasts longer	40%(40)
Do you agree, reduction in noise level inside hospitals will provide better patient recovery?	<input type="radio"/> All the above	30%(30)
	<input type="radio"/> Disagree	21%(21)
Do you think there is a need of the real time noise monitoring system in the hospital which will help them reduce noise level?	<input type="radio"/> Agree	79%(79)
	<input type="radio"/> Yes	87%(87)
	<input type="radio"/> No	2%(2)
Would you feel comfortable to visit such hospitals which has noisy environment?	<input type="radio"/> Maybe	9%(9)
	<input type="radio"/> Yes	2%(2)
Do you think noise in hospital affect the patient satisfaction?	<input type="radio"/> No	40%(40)
	<input type="radio"/> Yes	87%(87)
	<input type="radio"/> Maybe	12%(12)

Table no. 2

Independent variables	Options	Types of Respondents			
		Inpatients (31)	Outpatients (11)	Visitors (58)	Total (100)
1. Do you think noise in hospitals are rising day by day?	Yes	22(35%)	10(15%)	31(49.2%)	63(100%)
	Maybe	9(25%)	1(2.7%)	26(72.2%)	36(100%)
2. Does the noise stop you getting to sleep during your hospital stay?	Yes	14(100%)	NA	NA	14(100%)
	No	17(100%)	NA	NA	17(100%)
3. What's the noise like in the hospital?	Bearable	21(30.4%)	7(10.1%)	41(59.4%)	69(100%)
	Unbearable	10(34%)	4(13.7%)	15(51.7%)	29(100%)
4. At what time noise is more disturbing?	Day	22(32.8%)	6(8.9%)	39(58.2)	67(100%)
	Night	3(21.4%)	4(28.5%)	7(50%)	14(100%)
	All the above	5(31%)	1(6.2%)	10(62.5)	16(100%)
5. When the noise is more disturbing?	Want to rest	14(82.3%)	3(17.6%)	NA	17(100%)
	When in pain	2(50%)	2(50%)	NA	4(100%)
	While communicating	6(50%)	6(50%)	NA	12(100%)
	All the above	8(100%)	0	NA	8(100%)
6. What type of noise is most annoying?	Noise that is loud	9(34.6%)	4(25%)	13(50%)	26(100%)
	Noise that lasts longer	13(32.5%)	3(7.5%)	24(60%)	40(100%)
	All the above	8(26.6%)	3(10%)	19(63.3%)	30(100%)
7. Do you agree, reduction in noise level inside hospitals will provide better patient recovery?	Agree	23(29.1%)	11(13.9%)	45(56.9%)	79(100%)
	Disagree	8(38%)	0	13(61.0%)	21(100%)
8. Do you think there is a need of the real time noise monitoring system in the hospital which will help them reduce noise level?	Yes	30(34.4%)	11(12.6%)	46(52.8%)	87(100%)
	No	1(10%)	0	9(90%)	10(100%)
9. Do you think noise in hospital affect the patient satisfaction?	Yes	30(34.4%)	11(12.6%)	46(52.8%)	87(100%)
	Maybe	1(7.6%)	0	12(92.3%)	13(100%)

Among the 100 people who've visited the hospital, 41 people were patients (Inpatients and outpatients). They felt the noise in the hospital was disturbing. The response we got was, 17 (41.5%) people feel the noise is disturbing when they want to rest, 4(9.8%) when the they are in pain, 12(29.3%) while communicating, 8(19.5%) all the above. Out of 97 people, 67(69.1%) feels the noise is more disturbing at day time, 14(14.4%) at night time and 16(15.5%) at both the times. Out of the people who feel the noise was bearable, Females are 35(77.7%) out of 45 and males are 34(64.5%) out of 53.10(22.3%) females out of 45 and 19(35.5) males out of 53 felt the noise unbearable.21 (67.7%) inpatients out of 31, 7(63.6%) outpatients out of 11 and 41(73.2%) visitors out of 56 felt the noise was bearable. The percentage is higher of the people who says the noise was bearable but we can't deny the fact that noise does affects patients psychologically and physiologically. When the population was asked about what type of noise is most annoying according to them, 26(26.8%) people said noise that is loud, 40(40%) noise that lasts longer, 30(30%) both. When we asked the audience about the reduction in noise will lead to better patient recovery, out of 100, 79(79%) people were agreed with the statement. 9(9%) people were disagreed and 12(12%) were neutral.

## DISCUSSION

The study indicated many factors about perception of patients on noise, how was their experience in hospital and if there is any need for such a system who can monitor noise level continuously and help reducing it. The result we get from the study is that, there are more number of visitors among respondents, who was healthy and still felt the noise irritating and annoying. In our study, the percentage is higher for the disturbing noise is when the patients wants to rest. Hospitals are the places where patients need utmost rest so that they can recover fast. Sleep is fundamental for human wellbeing all in all and helps patients to recover faster. WHO states that, Speech in calm conversation is 100% comprehensible in environmental noise levels up to 35 dB, and can be apprehend clearly with the background levels of 45 dB(A).And according to our study 12(29.3%) people felt the noise disturbing

while communication, which means, that time noise level in the hospital must be more than 45dB (A), which is an exceeded limit according to WHO.

One study was conducted on 'The Effect of Room Acoustics on the Sleep Quality of Healthy Sleepers' and the result was found that slight changes on sound volumes have effects on sleep. The intermittent noise began at a level of  $L_{Amax}$  45 dB (A) which has the capacity to induce waking reactions. Noise-induced awakenings provoked by sound levels who beginning at 30–40 dB (A). The study indicates that patient sleeps was negatively affected by the sound environment. There have been numerous examinations conducted on the number of noise-induced sleep arousals within different sleep stages. Past examinations have additionally figured out which noise sources, such as staff talking and telephone noise, arouse the patients most frequently. Almost 32(76.1%) patients out of 42, had problem regarding sleep. Either their sleep got hampered or they couldn't rest due to the noise. And it affected at both the times i.e. at night and at that time. Which again shows the noise level must have exceeded the standard guidelines of WHO. Noise is increasing in wards and it leads to lack of sleep which is a major issue for many patients worldwide. Also, it's affecting the immune system along with the people's psychological conditions. There is a proof that when patients lack sleep they heal at slower pace and it increases the days of hospitalization.

Perception about RTNMS (Real time noise monitoring system):

As we already know that noise is rising and have to take measures to reduce it. So, we can think of a solution like real time noise monitoring system. When we explained the concept of real time noise monitoring system and asked about the need of the same in the hospital to respondents, 87(87%) people said yes, 2(2%) said no, and 9(9%) were not sure about this. Which shows people want hospitals to adopt such new technologies which can help reduce the noise and the environment become more quiet and pleasant.

Use of Real Time Noise Monitoring System:

Real time noise monitoring system is the device which monitors real time noise in the hospital. Most of the times hospitals don't realize that the noise has exceeded the standard limits. The real time noise monitoring system will monitor the noise and can notify when it exceeds the standard level. So, that required interventions can be taken and noise can reduce.

How it works:

The real time noise monitoring system includes noise monitoring device, which will monitor the noise level continuously of and can be kept in different wards, ICU and OT. The software needs to be developed and installed in the computers of all the departments in the same hospital, where the readings will be displayed. The device will be connected to the computer/ Mobile via IoT gateway. The noise limit will be set and if the noise exceeds the pre-defined limit, the notification will be displayed on the screen so that staff will get to know that noise has increased and in which department and they can take necessary actions to reduce it.

## CONCLUSION

While hospitalization, a patient needs peaceful and quiet environment so that they can rest well and recover faster. But if the hospital environment is noisy then it not only affects the patient physically but also psychologically. Also, it creates a negative impact about the hospital. The study indicated that according to people, the noise is rising day by day. Due to noise Patients had sleeping problems or they couldn't rest in the hospital due to noise which suggests that the noise limit was exceeding standard limits, and it resulted into low patient satisfaction. The reasons were, the noise was loud, persistent at both the times (day and night). And for some it was unbearable too. The noise not only did affect the patients but also visitors who were healthy. People are reluctant to visit the noisy environment. Patients/visitors wanted the hospital environment as quiet as possible.

They want hospitals to implement interventions which will reduce the noise. The respondents were agreeing on implementation of real time noise monitoring system.

According to them it will help the hospitals to identify and reduce the noise, which will gain patient satisfaction. By implementing these mechanisms, it will create a positive impact on patient's mind that hospitals do care about their patients. The more you focus on giving the positive experience to the patients, the more they will prefer your hospital and recommend to others as well. If we could try to increase the patient satisfaction it will be beneficial to the hospitals in terms of revenue generation. Ultimately, hospitals who are providing superior patient experience achieves more revenue goals.

## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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