



## STUDY OF SOUND LEVELS IN NICU: DESCRIPTIVE STUDY

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**ABSTRACT** **Introduction:** The American Academy of Pediatrics (AAP) and the Joint Committee on Infant Hearing (JCIH) have introduced noise as a major physical factor causing pollution in NICUs. The American Academy of Paediatrics recommends that sound levels be lower than 45 dBA in the NICU. They thus suggested that the admittance of infants to these wards might be associated with deafness **Methodology:** This project included conducting sound surveys of naturally occurring noise in the NICU environments. There was no direct neonate involvement. Each part has two sections A and B, the section A is from more sick babies requiring Level 3 NICU care, whereas the section B is for babies requiring Level 2 NICU care. **Results:** The mean numbers of staff present in NICU during Day and Night time is 9 and 6 respectively. For all the infants in section A and section B, monitors were used, infusion pumps were used for all babies in section A and as required in section B. Average ventilated babies/day was 1. **Conclusion:** The sound levels measured in NICU environment and inside incubator in section A and section B, the results show there is no significant difference the level of sound exposure to the babies in each section.

**KEYWORDS :** Sound Levels, NICU, Incubator**INTRODUCTION:**

Recent advances in treatment of preterm babies has increased the survival rate of premature infants. Premature infants spend most of their first months of life in neonatal intensive care units (NICUs). They are exposed to constant, sometimes sudden, and loud noise. Therefore, improvement in quality of life of premature infants with the focus on NICU environment has become one of the research goals.<sup>1</sup>

Gestational age of less than 37 weeks, difficult transition from intrauterine to extra uterine life, physiological limitations, and underdeveloped central nervous system make premature infants vulnerable to negative effects of high level of sound.<sup>2</sup>

Premature infants exposed to high level of sound suffer from fluctuations in heart rate and respiratory rate, decreased arterial oxygen saturation, changes in blood pressure, and impaired weight gain, sleep, and learning. Moreover, high level of sound has negative effects on the primary development of sensory neurons which can disrupt the natural development of the sensory nervous system and cause behavioural, speech, and hearing problems.<sup>3</sup>

Providing a suitable environment for development in the NICU is important because many infants admitted are born prematurely.

The American Academy of Pediatrics (AAP) and the Joint Committee on Infant Hearing (JCIH) have introduced noise as a major physical factor causing pollution in NICUs. The American Academy of Pediatrics recommends that sound levels be lower than 45 dBA in the NICU. They thus suggested that the admittance of infants to these wards might be associated with deafness.<sup>4</sup>

The first step in establishing standard sound levels is measurement. Owing to suitable modern technology and equipment, it is currently possible to measure sound levels.

In India however, little attention is paid to the measurement of sound levels in NICUs. Comparing the measured sound levels in NICUs with standard levels would facilitate the identification of sources of noise and their effects on sound levels. New policies can accordingly be designed to eliminate or mitigate sources of noise and hence reduce sound levels. Reducing sound level in NICUs will in turn shorten the NICU stay of premature infants and support their growth and development.

**METHODOLOGY:**

This project included conducting sound surveys of naturally occurring noise in the NICU environments. There was no direct neonate involvement.

Each part has two sections A and B, the section A is from more sick babies requiring Level 3 NICU care, whereas the section B is for babies requiring Level 2 NICU care.

Our unit is 20 bedded NICU with 15 beds level III and 5 beds level II unit, the study was conducted in level III unit.

**INSTRUMENT USED:**

Sound levels were measured by using a mobile phone with an application SOUND METER which can measure the average and maximum sounds levels over a period of time.

**PROCEDURE:**

**STUDY 1:** studying the sound levels in NICU environment Sound levels are measure during different time of the day and night for a continuous 1 hour. Sound levels average and maximum levels are detected.

**STUDY 2:** studying the sound levels inside the Incubator Sound levels are measure during different time of the day and night for a continuous 1 hour. Sound levels minimum average and maximum levels are detected.

Our unit is located in a corner of a busy road and a college. The sound levels were measured during the various hours of the day [6 hours]. The hours chosen is because that is the period during which the maximum NICU personnel are present in the unit.

The instruments are kept inside the incubator to measure the sound levels inside the incubator and outside the incubator to measure the sound levels in NICU environments simultaneously for an hour.

The instruments measure the average sound exposure, and maximum sound levels during the specific hours of the day

**RESULTS:**

Section A is for the babies requiring Level 3 NICU care and section B for babies requiring level 2 NICU care.

The mean number of babies in our NICU during the study period in section A and section B were 5 and 6 respectively.

The mean numbers of staff present in NICU during Day and Night time is 9 and 6 respectively.

For all the infants in section A and section B, monitors were used, infusion pumps were used for all babies in section A and as required in section B. Average ventilated babies/day was 1.

The sound levels varied from 49db to 91 db during the study period. These levels are higher than the standard AAP recommendations of Leq 45db and Lmax 65db.

The sound levels measured in NICU environment and inside incubator in section A and section B, the results show there is no significant difference the level of sound exposure to the babies in each section.

The sound levels measured in NICU environment and Inside Incubator. The sound level Leq is less Inside the incubator compared to NICU environment in both section A and B. but the sound level Lmax is significantly higher inside the Incubator when compared to NICU environment.

**Table 1: sound levels measured in NICU environment in section A and section B.**

Parameter	Standard	NICU environment	
		Section A (Average)	Section B (Average)
Leq	45	53.45db	53.08db
Lmax	65	83.75db	83.58db

**Table 2: sound levels measured inside the incubator in section A and section B.**

parameter	Standard	Incubator	
		Section A (Average)	Section B (Average)
Leq	45	52.95db	52.63db
Lmax	65	88.29db	88.04db

**Table 3: comparing the sound levels in NICU environment and incubator.**

	Parameters	standard	NICU environment (Average)	Incubator (Average)
Section A	Leq	45	53.45db	52.95db
	Lmax	65	83.75db	88.29db
Section B	Leq	45	53.08db	52.63db
	Lmax	65	83.58db	88.04db

## DISCUSSION:

The sound levels measured in our NICU ranged from 49 db to 91db which is more than the standard recommendation of American academy of paediatrics. Previous similar studies also reported the similar results in other NICU.

The results showed no significant difference between the sound levels in section A where the babies requiring level 3 care were treated and section B where the babies requiring the level 2 care were treated. Previous studies showed difference in sound exposed in various sections because of requirement of more monitors, equipment and nursing personals in level 3 compared to levels 2.

In our study, this difference is not significant because there is no partition between the two sections, and the sound in one section is transmitted to other section. Therefore separation of level of NICU could be an effective method to decrease the sound exposure between the sections.

Ramesh et al could decrease the sound levels of NICU through implementation of sound levels reductions protocols such as separation of rooms with glass and aluminium partition.

Sound levels measured in NICU environment and inside Incubator showed Leq low inside the incubator because of the walls of incubator acting as the shield against external sound. However the sound levels measured inside is still higher than the standard recommendations. Using good quality materials which as not permeable to sound can further decrease the sound levels inside the incubator.<sup>5</sup>

However the Lmax is more inside the incubator compared to NICU environment because the maximum sound produced is from closing the incubator door hard or from accidental hitting on the top of the incubator. Careful nursing training can decrease this sound production.

Sound levels Leq and Lmax are more during the day time than the night time this result is similar to previous studies. This is because of the variation in the number of personnel present during the day hours are more than the night hours

Clinical rounds were the noisiest due to the more number of people present, the highest level of inattention to sources of noise such as alarm of devices and crying of infants. Many previous studies have also reported nurse hand over as one of the noisiest times in the ward.

Krueger et al. considered nurses to have an important effect on noise levels in NICUs. The major source of noise in the hospital is the talking of the personnel. The noise of conversations and alarm of devices are the two main sources of noise in NICUs that can be controlled. Moreover, the inattention of nurses to alarms of devices and the simultaneous noise of more than one device can increase the mean sound level of the environment. Therefore, the quick response of nurses to alarm of devices will decrease the sound levels of the ward. Many studies have performed training programs to increase the knowledge of staff in order to reduce sound levels.<sup>6,7</sup>

Teaching the harmful effects of high sound levels and implementation of a behavior modification program have been reported to decrease sound levels. Many studies have been successful in decreasing sound levels of wards by improving nurse activities such as limiting bedside teaching rounds on infants, reduction of the sound of monitors and alarms, and removing phones from NICU.<sup>8</sup>

Moreover, there was a significant correlation between the number of people present in the ward and sound level. Since the presence of people is associated with noise, implementing regulations to limit the number of people attending a NICU at one time is essential.

During each of our measurements, there was a possibility of falling of metal instruments on the ground. Falling of metal objects on the ground causes a mean noise level to rise and results in the highest level of physiological instability in infants.

## CONCLUSION:

Sound levels measured in NICU environment and inside Incubator showed Leq low inside the incubator because of the walls of incubator acting as the shield against external sound. However the sound levels measured inside is still higher than the standard recommendations.

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