

# *Sshhh.... "I am growing"- Implementation of quiet hours in the NICU*

For continued existence and survival, preterm infants depend on the Neonatal Intensive Care Unit (NICU). The NICU is a sophisticated and technology-driven environment, and preterm infants experience enormous stress in an NICU environment.

NICU that is required by the preterm infants for their continued existence and which actually helps them to survive, may end up being an inappropriate milieu; given the presence of overwhelming stimuli, most potent among them being the continuous presence of noise, caused by the sophisticated machinery and gadgets that may adversely affect the physiological stability, recovery, growth as well as the development of the preterm infants

## *Fetal development*

Early auditory development- Development of the auditory system begins as early as 3–6 weeks of gestation age (GA). By 25 weeks GA, the structural aspects necessary for audition are intact, and the fetus can already perceive and respond to low-frequency sounds passing through amniotic fluid. The neurosensory pathways of the auditory system are known to develop later in gestation, eliciting brainstem and cortical auditory evoked responses at around 28 weeks GA. Many of the sounds that are audible in the womb are generated internally by the mother's respiration, digestion, heart rhythms and physical

movements. Fetuses, however, can also respond to sounds outside of the womb.

Hepper and Shahidullah examined the development of fetal responsiveness to pure tones at various frequencies. They found that at 19 weeks GA, the fetuses could only respond to the 500-Hz tone; whereas, at 27 weeks GA, almost all fetuses responded to both the 250 and 500-Hz tones.

Responsiveness to higher frequencies (1000 and 3000 Hz) was not observed until 33 weeks GA. Although this study was based on indirect measurements of hearing, it revealed that fetal responsiveness to sounds begins at the lower frequencies first and is followed by the higher frequencies later in development.

Thus, frequencies heard within the womb parallel the course of frequency development within the cochlea, making the womb an optimal and protective environment for auditory maturation.

## *The transition from the womb to the NICU environment*

The well-structured course of auditory development is severely interrupted when a preterm infant enters the noisy world of the Neonatal Intensive Care Unit (NICU). First, the hearing experience in the NICU, where sounds are transmitted through air, is very different from the transmission of sounds through the amniotic fluid in the womb. In addition, the type of sounds and levels of noise typically present in the NICU are very different from those present in utero, putting preterm infants at risk for exposure to sound frequencies that they are not yet ready to process.

## *Noise exposure in the NICU*

Investigators globally have repeatedly monitored the background noise in the

ambience of the NICU. Regardless of the recommendations by various committees and researchers in collaboration, investigators have found that the noise levels in NICUs have exceeded the recommendations.

Noise sources in the NICU are numerous consisting of the equipment used to provide intensive care, care giving routines and behaviours of staff, which can be structurally predetermined by the layout, design, and specific functionality of the area, eg air-conditioning, door mechanisms, location of staff desks, travel paths.

### Examples of Recorded Noise Levels in NICU

Event	Loudness
Telephone ringing	80 db
Dash Alarms (set at 70%)	70 dB at 1 metre distance
Closing incubators doors	100-135 dB
Bubbling in ventilator circuit	62-87dB
Tapping incubator with fingers	80 dB
Talking around the bedside (normal level)	60 dB

### Effects of noise on preterm infants

This vulnerable population of newborns is especially sensitive to noise, because their ability to self-regulate and filter noxious stimuli is extremely limited. It has therefore been suggested that excessive exposure to loud noise during the neonatal period can heighten the risk for sensory deficits and developmental disabilities.

Long, Lucey and Philip (1980) assessed the impact of sudden loud NICU noise ranging from 70–75 dBA on two preterm infants of 34–35 weeks of gestational age. The source of

this sudden loud noise was doors closing, diaper pails and staff conversation in the NICU whose ambient noise levels ranged between 60 - 65 dB during the measurement period. The authors reported that sudden loud noise resulted in physiological changes **like decrease in oxygen saturation, increase in heart rate (HR), increase in respiratory rate (RR), increase in intracranial pressure, and sleep deprivation in the preterm infants.**

Lotas (1992) in a review asserted a vast difference between the environment of the uterus and the NICU environment. The authors reported that the ambience of NICU has **potential to cause hearing loss, difficulty in processing auditory inputs, disrupts sleep and the physiological systems in infants**

Philbin and Gray (2004) proposed in a review that, “The traditional NICU includes an acoustic environment consisting of random and competing auditory signals that frequently challenge the immature, developing listener i.e., the preterm infant.”The authors argued the unpredictable or chaotic acoustic environment of NICU **may contribute to atypical attention abilities in children born preterm.**

A cohort study followed up Extremely Low Birth Weight (ELBW) infants and found that these infants were exposed to noise ranging in the level of 50–60 dBA, when cared for in the incubators. The authors found that eleven among the thirty ELBW infants followed up, **exhibited increased HR to noise (Williams, Sanderson, Lai, Selwyn, and Lasky 2009).**

Wachman and Lahav (2011) in a review suggested that loud transient NICU noise causes immediate physiological changes in the various systems of preterm infants. Additionally, the authors postulated that hearing loss very often occurs in preterm infants, who spend extended periods in the

NICU, making them more vulnerable to high levels of noise

### *Provide care that supports the development*

#### *Recommended levels of noise in the NICU- Healing environment*

Blackburn (1998) stated the goal for a NICU environment is to meet the physiological and neurobehavioral needs of each infant to aid in emerging organization, growth and development.

Noise level in the NICU plays an important role in staff communication, family interactions, and infant development. The American Academy of Paediatrics recommends that sound levels be lower than 45 dBA in the NICU, based on a report from the US Environmental Protection Agency.

Staff education should be encouraged including: - increased awareness of human sources of noise, silence the alarms immediately during care, and speak softly during conversations.

There was also an increased awareness of noise-generating behaviours such as hand washing, opening disposable equipment, and opening and closing entry doors. Minor unit-design modifications included using plastic garbage cans and turning off the unit intercom.

#### *Family centred care*

Mothers should be encouraged to talk to a infant in soft voice. Ambient noise should be low enough for an infant to distinguish the maternal voice to optimize the auditory development

*Additional support*, in a study, zahar and de Traversay demonstrated benefits of noise

reduction by the use of earmuffs. Earmuffs were placed over the premature infants ears to reduce noise intensity in the NICU while physiologic and behavioural responses were measured. When infants wore the earmuffs they had significantly higher mean oxygen saturation levels and less fluctuations in oxygen saturation.

### *Conclusion*

*To start up the change in your NICU, start implementing a quiet hour: the last hour of each shift may be designated as quiet hour.*