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Revisiting Sound in the NICU: Implications for the Developmental Timing, Amount and Type of Sound

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The purpose of this short communication is to invite nurses to revisit the implications for exposure to sound in the preterm infant. Since 1997, the US Environmental Protection Agency has warned that a sound level exceeding 45 dB is best avoided in the Neonatal Intensive Care Unit [1]. More recently, the seventh edition of the recommended standards for ICU design states that, "the combination of continuous background sound and operational sound shall not exceed an hourly Leq of 45 dB and an hourly L10 of 50 dB, both A-weighted slow response in infant rooms and adult sleep areas. Transient sounds or Lmax shall not exceed 65 dB, A-weighted, slow response in these rooms/areas" [2]. The Leq measures a steady (dBA) sound level across a 30 second time period, while the L_{10} is a measure of the decibel level exceeded for 10% of the hour. The Lmax is the highest decibel level measured for at least $1/20^{th}$ of a second during the hour [3,4].

Unfortunately, it has been found repetitively that the sound levels in Neonatal Intensive Care Units (NICU) continue to remain above recommended decibel levels. In 2005, Krueger et al. [5] found that the overall average hourly Leq mean in the NICU was 60.44 dB with a range of 55-68 dB, the L_{10} had a mean of 59.26 dB and the Lmax average was 78.39 with a range of 69-93 dB. More recently, Chow and Stellhass [6] found that the average NICU sound level during the day had a mean of 56.1 ± 2.6 dB with a peak noise level of 85.8 ± 0.7 dB. Night shift had a similar mean of 54.7 ± 4.2 dB; p=0.06 with a peak noise level of 85.0 ± 1.3 dB; p<0.001.

As technology advances, more and more infants are exposed to altered auditory stimulation at still younger ages and during a time period when the auditory system is reaching structural and functional maturity (from 25 weeks' gestation to 5 to 6 months of age). For example, premature infants are placed in incubators, which are a source of increased decibel levels in the NICU, especially when the incubator doors are closed and the fans turned on [7]. Further, infants requiring respiratory support experience still higher sound levels associated with the ventilator equipment [8]. For the fetus, the time period prior to birth is when different processes become tuned to receive qualitatively different signals of specific frequencies and intensities from outside auditory stimulation [9]. In utero, the fetus hears primarily through bone conduction and through fluid while preterm infants (born <37 weeks of gestation) must hear primarily through air conduction.

The effect of these consistently elevated sound levels in the NICUs on preterm infants is staggering. Elevated sound levels have been shown to cause immediate physiological changes, such as an increase in heart rate, blood pressure and respiratory rates, and a decrease in oxygen saturation [10]. Long term, elevated sound levels can potentially result in hearing loss and delays in language development [11].

Not all sound exposure within the NICU however should be considered noise or non-beneficial. A mother's voice, either spoken or sung, has been shown to be beneficial for late preterm hospitalized infants [12-14]. Moreover, live maternal voice resulted in significant decreases in critical events and increases in oxygen saturation [15].

In conclusion, nurses are well positioned to inform researchers and practitioners involved in the care of the preterm infant. It is therefore imperative that nurses revisit sound in the NICU by not only considering decibel levels but, the developmental timing, amount and type of auditory stimulation [16,17].

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