# **Daily sound level exposure for preterm infants in the neonatal intensive care unit** Lauren Vicencio, Rohit M. Ananthanarayana, Jana Khudr, Brian B. Monson

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### Introduction

The neonatal intensive care unit (NICU) provides lifesaving care to premature infants. During this vulnerable time of life, infants are exposed to a variety of sounds uncharacteristic of the womb. Within the NICU, high sound pressure levels (SPLs) have the potential to negatively impact preterm infant neurodevelopment. The American Academy of Pediatrics (AAP) has recommended an hourly noise exposure limit for NICUs of less than 45 dBA. Diverse environmental and medical factors, such as bed type and nearby medical devices, have the potential to influence sound level exposure.



Fig 1. Very preterm infant in a crib.

## Aim

This study aimed to examine daily sound level differences by bed type and oxygen (O2) device for premature infants in the NICU.

## Design

#### Population

- 36 very preterm (VPT) infants (born  $\leq$  32 weeks' gestation)
- Level III, open-bay NICU
- Carle Foundation Hospital in Urbana, Illinois

#### Recordings

- LENA audio recording devices
- 16-kHz sampling rate
- Recordings were calibrated to account for microphone gain

## **Design (continued)** Procedure



## Results



 LENA device was mounted to an inside wall of isolette or crib, near the infant's head

• Audio recordings were collected over 24-hour intervals three times per week

• Daily SPL (L<sub>EQ</sub>) was calculated for each 24-hour recording

• Electronic medical record (EMR) data for each infant was documented hourly by NICU nurses

Fig 2. LENA recording device adhered to inside of isolette.

#### Bed type comparison: Crib versus isolette

• Participants with at least three days of recording in both bed types were included in the analysis (n=27)

• A Shapiro-Wilk test indicated that the raw longitudinal data were not normally distributed • When the data were collapsed to compute an average daily exposure for each subject for each bed type, data were normally distributed • An ANOVA of the collapsed data indicated no significant difference between bed types (p=0.709)

• Average daily SPL for crib was 56.3 (SD= 1.6; median= 55.8) and for isolette was 56.1 (SD=1.1; median= 56.0)



## **Results (continued)**

#### O2 device comparison

- Various O2 devices were included: • CPAP = Continuous positive airway
  - pressure
  - HHNC = Heated humidified nasal cannula Mechanical Ventilator

  - Nasal Cannula
- Participants with at least three days of recording from any of the same O2 device were included in the analysis (n=35; total days of recording= 596)
- Days of recording with use of multiple O2 device were excluded
- A Shapiro-Wilk test indicated that the data were not normally distributed
- Preliminary analyses showed that Mechanical Ventilator had the highest mean SPL for O2 devices
  - Room Air (no device) had the highest overall mean SPL

#### O2 Device Type

#### CPAP

#### HHNC

**Mechanical Ventila** 

Nasal Cannula

Room Air (no devic

*Table 1. Mean, standard deviation, and median of SPL for O2 device* 



Fig 3. Mean daily dB SPL by bed type

| е    | Mean dB SPL (SD;<br>median) |
|------|-----------------------------|
|      | 55.8 (1.8; 55.6)            |
|      | 55.5 (2.1; 55.4)            |
| ator | 56.8 (2.5; 56.5)            |
|      | 55.7 (2.4; 55.6)            |
| ce)  | 57.1 (3.1; 57.0)            |
|      |                             |

### Conclusions

- No significant differences in daily SPL exposure were found between crib and isolette for NICU infants
- The results suggest that daily mean SPLs within the NICU exceed the AAP recommendations
- Interestingly, Room Air (no O2 device) had the highest SPLs compared to recordings with an O2 device
  - Inconsistencies in participant EMR data and categorization need to be examined in further analyses
  - Other medical or environmental factors may potentially be contributing to sound exposure in the absence of an O2 device
- Additional statistical analyses are ongoing to assess differences in level for 02 device type
- It is hoped that this line of study will promote interventions designed to decrease potentially hazardous sound levels in the NICU

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