HOURLY SOUND LEVEL EXPOSURE FOR PRETERM INFANTS IN THE NEONATAL INTENSIVE CARE UNIT

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INTRODUCTION

The fetal auditory system begins to function as early as 23 weeks' gestation. When an infant is born prematurely, they transition from the mother's womb to the neonatal intensive care unit (NICU), experiencing a rapid change in their physical and acoustical environment.

Studies suggest that preterm infants are at greater risk for auditory dysfunction than full-term infants. While it is unknown whether this increased risk is due to medical factors associated with preterm birth or environmental factors associated with the NICU, high noise levels and other adverse acoustic exposures have been reported in the NICU.

AIM

To better understand the NICU auditory experience, we sought to examine hourly sound pressure level (SPL) exposure for preterm infants.

DESIGN

Recordings:

- LENA audio recorders
- 24-hr audio recordings, 16-kHz sampling rate
- Hourly L_{EQ} (SPL) calculated from raw recordings

Population:

- 27 very preterm (VPT) infants (born ≤ 32 weeks' gestation) during NICU stay at the Carle Foundation Hospital in Urbana, Illinois.

DESIGN (continued)

Methods:

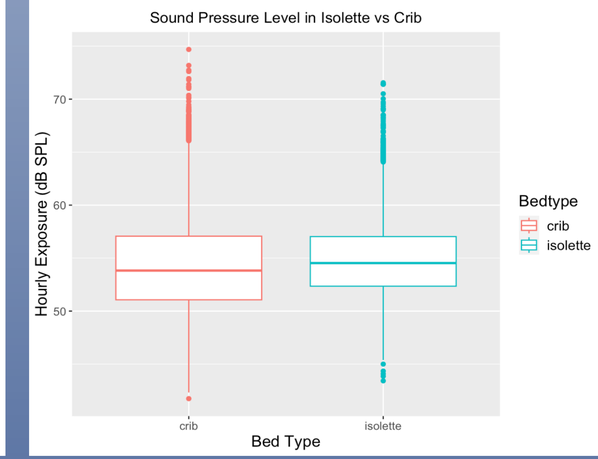
- The LENA was adhered to the inside wall of the infant's incubator/isolette or crib (see image).
- Audio recordings were collected over 24-hour intervals, 3x per week.
- A calibration process involving calculating RMS value and determining a calibration factor for each LENA device was used to estimate SPL
- Electronic medical record (EMR) data for each infant were documented on an hourly basis by the NICU nurses.

LENA recording device adhered to inside of incubator/isolette.

RESULTS

Sound pressure levels and bed type were analyzed on an hourly basis. Preliminary analyses indicate:

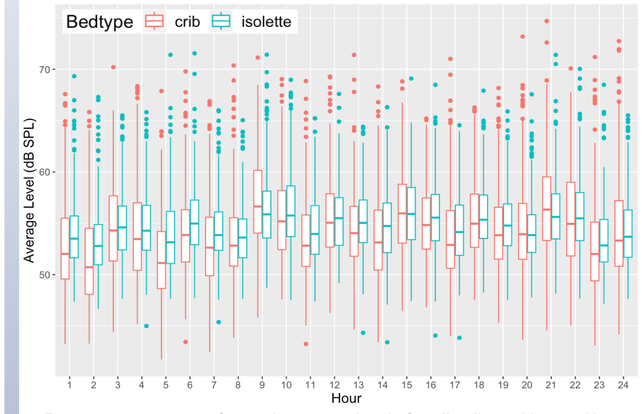
- A difference of 0.7 dB was observed between incubator (54.7 dB SPL) and crib (54 dB SPL)



RESULTS (continued)

- Hourly SPL range: 41.7 – 74.7 dB SPL
- Variation within 24-hr recording: 1.8 – 28.3 dB

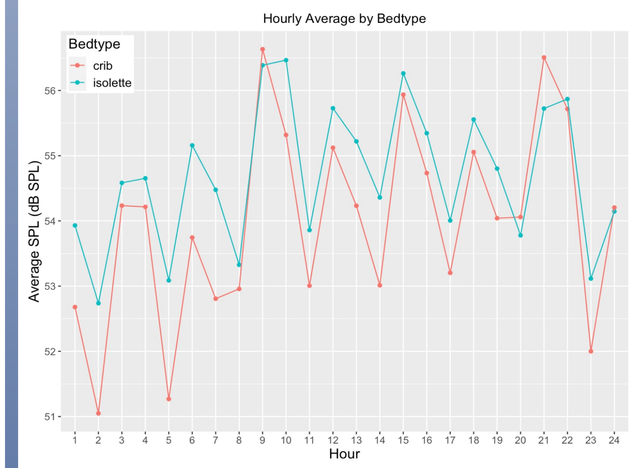
Sound pressure levels across the 24-hour time period:



Raw measurements of sound pressure levels for all collected hours. Hour number indicates prior 60 min to that hour (e.g., hour 1 = 12:00-1:00 AM).

Anecdotal observations of data include:

- While no strong trend is apparent, hours 9 and 21 (8-9 AM/PM) seem to have noticeably greater SPL
- Hour 2 (1-2 AM) appears to have the lowest SPL in both bed types, with level being lower in the crib.
- Levels follow an oscillatory pattern that peaks every three hours throughout the 24-hr period
- The variation of SPL throughout the day seems to be greater in the crib than the incubator.



Hourly average of sound pressure levels for each bed type (incubator vs crib) averaged across all subjects

CONCLUSIONS

- Preliminary analyses suggest that there is little difference in SPL exposure between incubator and crib.
- Our data imply that there may be greater variation in SPL in the crib than in the incubator.
- Whether these factors can be controlled to mitigate adverse auditory exposures remains to be seen.
- Statistical analyses are ongoing to test the observed trends.
- It is hoped that this line of study will lead to interventions designed to prevent audiological impairments associated with preterm birth and NICU environmental exposures.

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