PREDICTORS OF AUDITORY EXPOSURES IN THE NEONATAL INTENSIVE CARE UNIT

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INTRODUCTION

As early as 23 weeks' gestation, the fetal auditory system begins to function. It is thought that the acoustic input that fetuses are exposed to *in utero* is vital for their auditory neurodevelopment. Infants born preterm are at greater risk for auditory dysfunction than full-term infants. High noise levels and other adverse acoustic exposures in the neonatal intensive care unit (NICU) have been reported previously. However, little is known about the factors that may influence the quantity and quality of the auditory exposures that these infants receive in the NICU. To address this, we aim to take examine these contributing factors.

AIM

In this study we sought to examine factors that could lead to adverse acoustic exposures, including respiration device and bed type (crib vs. incubator).

DESIGN

Recordings:

• LENA audio recorders

• 24-hr audio recordings, 16-kHz sampling rate

• Automated classification of durations of different sound categories: speech, electronic sounds, noise, silence

Population:

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

DESIGN (continued)

Methods:

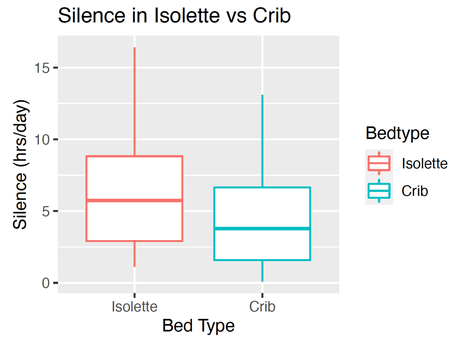
- Audio recordings were collected over 24-hour intervals, 3x per week.
- The LENA was adhered to the inside wall of the infant's incubator or crib (see image below).
- Electronic medical record (EMR) data for each infant were documented on an hourly basis by the NICU nurses.
- LENA automated classification algorithm was utilized to assign labels by sound category
- Thousands of hours of auditory exposures were analyzed, with ~482 hours for each subject.

LENA recording device adhered to inside of incubator.

RESULTS

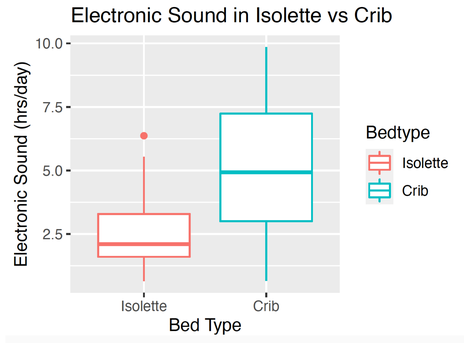
Silence and electronic sound exposure was analyzed on a daily basis. Preliminary analyses indicate:

- No evidence for increased silence exposure for infants in incubators vs. open cribs (p = 0.1).

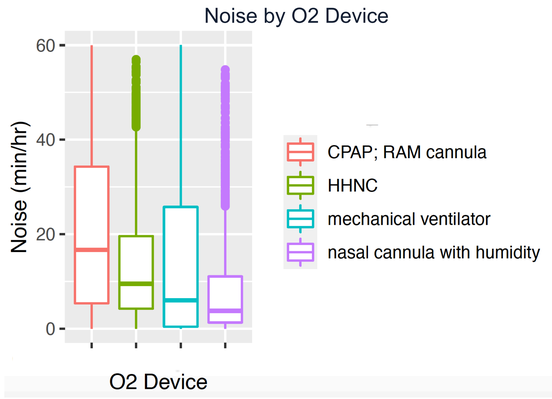


RESULTS (continued)

- Daily speech exposure estimates for infants in open cribs averaged approximately 30 minutes per day.
- Electronic sound exposure (e.g., alarms) is greater for infants in open cribs (p<0.001).



- Noise exposure was analyzed on an hourly basis as a function of O2 device (e.g., CPAP vs. mechanical ventilator) used during respiratory support.
- Noise exposure differed across type of O2 devices.
  - CPAP= Continuous positive airway pressure.
  - HHNC= Heated humidified nasal cannula.
  - CPAP; RAM cannula was the noisiest and most frequently used O2 device.
  - Shapiro-Wilk test indicated that the data is not normally distributed.
  - Kruskal-Wallis rank sum test indicated these differences were significant (p<0.0001).
  - Pairwise comparisons using Wilcoxon rank sum tests indicated significant differences between all devices.



Average noise (in mins/hr) recorded by the LENA device in the presence of each of the following O2 devices

CONCLUSIONS

- Several factors influence auditory exposures in the NICU, including bed type and nearby medical devices.
- Whether these factors can be controlled to mitigate adverse auditory exposures remains to be seen.
- Our results imply that some NICU factors may hinder an infant's access to speech (e.g., due to potential masking by other sound sources).
- 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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