Noise Reduction in the Neonatal Intensive Care Unit – A Quality Improvement Initiative
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Background: Noise has a deleterious effect on the developing fetus and infant. Current research suggests that ambient noise exposure in growing preterm infants can have short and long term adverse effects, such as physiological instability, hearing loss, poor neurodevelopmental outcome, increased days on oxygen and increased length of stay. Noise levels reported in NICUs range between 50-75dB with peaks of 105dB which far exceeds the AAP recommendations of 45dB.

Aim: To lower the monthly average ambient noise level in our NICU from 62.4 to 56dB (10% decrease from the baseline) from February 2014-January 2015.

Setting: The NICU is an academic level IV unit with an open bay design and 3 rooms with average daily census varying from 10-16 babies in each room. The NICU is a regional perinatal referral center with over 650 admissions and 150 transports per year. Due to the high volume and acuity, the noise levels are significantly elevated, peaking with increased census and the number of providers.

Mechanisms: Potential sources of noise were identified (Table 1). Predominantly the factors contributing to noise level were identified as equipment related and human factors. Lack of awareness of the adverse effects of noise and the culture of loud conversations between the various care providers was perceived to be a big factor in addition to various alarms and other ambient noise stimuli as evidenced by peaks of noise at time of change of shift and troughs during quiet times. Noise also seemed to vary with the time of the day with higher noise levels during the day when there are more care providers denoting a significant human factor.

Drivers of Change: We used the Plan, Do, Study, Act (PDSA cycle) model for improvement of noise levels. Key drivers were identified. (Figure 1) Various interventions were then planned in successive PDSA cycles and implemented accordingly. (Figure 2)

Methods/Measures: Noise level was recorded using Extech SDL600 noise level meter/datalogger. Baseline data was collected in January 2014. Starting February 2014, after implementing the strategies (Figure 2), data was collected continuously. Decibel level readings were recorded every 10 minutes. Averages were calculated monthly for the day and night shifts. Peak noise level was also monitored during this time. Feedback of the results was provided regularly to the staff and displayed on the huddle board.

Data/Results: The baseline average noise level was noted to be 62.4dB and peak noise level was 115dB. Post intervention, there was a gradual decline in both the average and peak noise levels. At the end of 1 year the average noise levels had decreased to 56.0dB (10.1% decline) (Figure 3) and peak noise level decreased to 76dB (Figure 4). During the day shift noise levels decreased from 63.9 to 56.2 (12% decline) as compared to the night shift which showed a decrease from 60.8 to 55.9 (8% decline from baseline) (Figure 5).

Discussion: Raising awareness about the negative effects of noise on preterm infants through targeted education, behavioral modifications and some environmental changes, we were able to decrease the NICU noise level. In order to create culture change there is a need for continuous dialogue between the project champions and the NICU staff.

Team Acknowledgements: Zahava Cohen (ANM), Sue Horan (RN/PCC), Diane Collins (RN/PCC) and the entire NICU staff.
### Outcomes

Lower average monthly ambient noise from 62 to 56dB by January 2015

### Primary Drivers

- Education and increasing awareness of providers/staff in the NICU
- Tackling environmental/equipment related sources of noise
- Behavioral modifications/bringing about change in culture
- Reminders to regulate noise levels

### Interventions/Strategies

- On-going education of all NICU staff
- Providing regular feedback on the progress to the staff
- Discussion of new strategies at the monthly nursing council meetings
- Lowering alarm intensity: Monitors, ventilators, humidifiers and infusion pumps
- Shut off ventilator alarms during suctioning/Use of in-line suction
- Silence the ringers of the phones in the patient rooms
- Relocation of the intercom to an area remote from patient care site
- Turn beepers and cell phones to vibrate
- Fixing the door silencers
- Limiting the number of providers while rounding to one team per room
- Dimming of ambient light except while providing care/Increasing duration of quiet time
- Reducing the use of intercom/overhead paging
- Parental education by the nurses and providers about adverse noise stimulations
- Closing isolette doors/portholes gently
- Not using the isolette as a writing surface
- Posting signs as visual reminders
- Use of Yacker Tracker (traffic lights)
- Assigning a nurse as noise monitor in each room per shift
- Empowering parents to serve as reminders

**Figure 1**: Key Driver Diagram
Figure 2: Timeline of interventions

**PDSA I (Feb-May 2014)**
- Education of NICU staff
- Lowering alarm intensity
- Use of in-line suction on all infants
- Silence the ringers of the phones in the patient rooms
- Relocation of the intercom to an area remote from patient care site
- Turn beepers and cell phones to vibrate
- Fixing the door silencers

**Baseline Data (January 2014)**

**PDSA II (June-Aug 2014)**
- Ongoing education of NICU staff
- Providing regular feedback on the progress to the staff
- Limiting the number of providers while rounding to one team per room
- Dimming of ambient light except while providing care/Increasing duration of quiet time
- Posting signs as visual reminders
- Reducing the use of intercom/overhead paging

**Continuous Noise Level Monitoring**

**PDSA III (Sep-Oct 2014)**
- Ongoing education of NICU staff
- Providing regular feedback on the progress to the staff
- Use of Yacker Tracker (traffic lights)
- Parental education

**PDSA IV (Nov-Dec 2014)**
- Ongoing education of NICU staff
- Providing regular feedback on the progress to the staff
- Assigning a nurse as noise monitor in each room per shift
Figure 3: Average noise levels in the NICU

Figure 4: Peak Noise level in the NICU
**Figure 5:** Distribution of average noise levels-Day versus night

<table>
<thead>
<tr>
<th>Noise source</th>
<th>Intensity, dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical ventilator</td>
<td>60-65</td>
</tr>
<tr>
<td>Mechanical ventilator alarm</td>
<td>70-75</td>
</tr>
<tr>
<td>Infusion pump alarm</td>
<td>65-75</td>
</tr>
<tr>
<td>Pulse oximetry alarm</td>
<td>60-75</td>
</tr>
<tr>
<td>Cardiac monitor</td>
<td>60-65</td>
</tr>
<tr>
<td>Endotracheal suction</td>
<td>50-60</td>
</tr>
<tr>
<td>Tapping/Scribbling on the isolette</td>
<td>80-85</td>
</tr>
<tr>
<td>Closing porthole/door of the isolette</td>
<td>75-80</td>
</tr>
</tbody>
</table>

**Table 1:** Sources of Noise in the NICU