

Evidence Based Noise Mitigation in the NICU

Susan Bowles, DNP, RNC- NIC,
CNS, NICU
Tri-City Medical Center
Oceanside, CA

Disclosure

- I have nothing to disclose
- All the information in this talk is based on evidence readily available in the Neonatal and General Health Care Professional literature.

Objectives

- Describe how an Evidence Based Practice project was used to effect a practice change
- Discuss the importance of noise mitigation in the NICU environment
- Identify three strategies to use when attempting to mitigate sound in the NICU

Introduction to the Noise Mitigation Program

- Sound is one of the most all encompassing stimuli in the NICU
- Safe sound levels are vital for the healthy development of premature infants.
- Decided to develop an evidenced based project to maintain NICU sound levels at the AAP recommended levels.

What is Evidenced Based Practice (EBP) ?

■ Definition

Evidence-Based Practice (EBP) is a problem solving approach to clinical practice that integrates the conscientious use of **best evidence** in combination with a **clinician's expertise** as well as **patient preferences and values** to make decisions about the type of care that is provided.

Mehyke & Fineout-Overholt, 2006

Why use EBP?

- Takes approximately 17 years to translate research findings into practice.
- Traditional continuing education conferences do not significantly improve clinical performance.
- 3rd party payers are beginning to reimburse only for healthcare practices that are supported by evidence.

What makes EBP so great?

- Clear criteria for appraising the evidence.
- Clear strategies for incorporating evidence into daily practice

Key Steps

1. Ask a relevant clinical question
2. Collect the most pertinent and best evidence
3. Critically appraise all the evidence
4. Integrate all evidence with one's clinical expertise, patient preferences, and values in making a practice decision or change
5. Evaluate the practice decision or change.

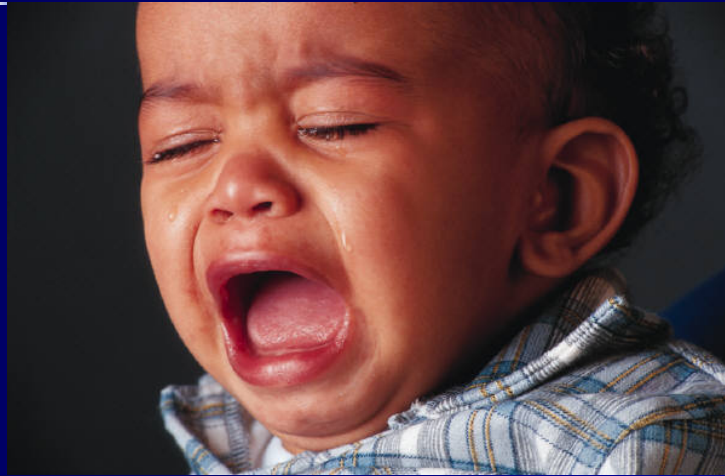
How to ask a relevant clinical question

- Use the PICO question
 - It is a mnemonic used to formulate the elements of a clinical question
 - Asks for specific knowledge to inform clinical decisions and/or actions
 - Different from a background question
 - Asks for general knowledge about a condition, etc
 - P= population/practice
 - I= Intervention
 - C= Comparison
 - O= Outcome(s)

Improving Practice

- Simply implementing EBP does not mean there is improvement in practices, process and outcomes.
- Project needs to be relevant and meaningful.

Why Noise?????



Epidemiology

- In the United States about 12.7% of the births are premature.
- About 52% of these infants will have later neurodevelopmental issues.
- Strategies to reduce morbidity and mortality must be considered to improve outcomes.

Background and Significance

- The control of noise is essential to protect the sleep of the neonate and for healthy auditory development.
- Several studies demonstrate exposure to sound in the NICU can disrupt sleep patterns and alter physiologic and behavioral responses of both term and preterm infants
- The American Academy of Pediatrics recommends that NICUs be monitored for noise. A noise level exceeding 50 decibels is concerning

Question Asked

- In the NICU does a noise mitigation program designed to decrease current measured sound levels result in decibel levels that are in accordance with the American Academy of Pediatrics Policy Statement: Noise a Hazard to the Fetus and Newborn.

Where to start

- What does the literature say
 - Recommended standards
 - Practice guidelines
 - Literature review
- Baseline assessment

Project Plan



- Assess the NICU environment and compare to establish recommendations
- Develop guideline for NICU noise mitigation
- Educational preparation of the staff
- Implementation of protocol
- Evaluation of progress

Assess the environment

- Quiet initiative 2 years earlier had found we were operating at about 62 decibels
- Staff were unclear what that meant and what the impact was on infants in our care.
- Patient satisfaction survey revealed families thought we were too noisy

Next steps

- Developed guidelines for NICU noise mitigation
- Educational preparation of all the staff

Clinical Guideline

- Very simple
- One sheet
- Easy to adopt
 - Or is it??

Auditory System

- Develops second to last
 - Fully functional by 24 weeks
 - Very sensitive
 - Can not habituate



In –utero vs. extrauterine environment

Fetus: Uterus	Preterm: NICU
Fluid conducted	Air Conducted
Low Frequency	All audible frequencies
Quiet to moderately loud	Loud to very loud
Many repetitive patterns	No or few discernable patterns
Signals imbedded in circadian rhythms	No circadian rhythms

Some Definitions

- Noise:
 - Undesirable sound.
- Sound:
 - Vibration in a medium
- *sound has*
 - Intensity (loudness)
 - Frequency (pitch)
 - Periodicity (recurring at intervals, intermittent)
 - Duration (length of time continues)

More Definitions

- Decibel (dB)
 - measurement used to describe the loudness of sound.
- **Leq**-
 - a measure typically used in environmental noise analysis. While not mathematically correct, the term is often used as the “average” sound level that occurred during measurement
- **Lmax**-
 - The highest A-weighted sound level occurring during a noise event.
- Background noise –
 - The noise that generated by equipment, heating, ventilation, air conditioning, plumbing, communication, foot and equipment traffic.

Noise Levels

- In utero
 - Rhythmic, continuous < 72 dB
- In the NICU
 - 60-90 dB peaks to 120 dB

Quality	Peak Intensity dB(A)	Example	Inside Incubator	Effect
Just Audible	10	Heartbeat		
Very Quiet	20 - 30	Whisper		<35 dBA Desired for Sleep
Quiet	40	Average Home		
	50	Light Traffic for Work	Background	<50 dBA Desired
Moderately Loud	60	Normal Conversation	Motor On & Off	Annoyance
	70	Vacuum Cleaner	Bubbling in Ventilator Tubing	
Loud	80	Heavy Traffic Telephone Ringing	Tapping Incubator with Fingers	Hearing Loss with Persistent Exposure
	90	Pneumatic Drill	Closing the Metal Cabinet Doors under the Incubator	
Very Loud	100	Power Mower	Closing Solid Plastic Porthole	
Uncomfortably Loud	120	Boom Box in Car	Dropping the Head of the mattress	Pain and Distress
	140	Jet Plane 30m Overhead		

Common NICU Sounds

- Incubator 58 dB
- Paper ripping 77 dB
- Chairs 86 dB
- Trash Can 80 dB
- Phone Ringing 65dB
- Monitor alarm 78 dB



Sources of Noise and Associated Decibel levels

Within the NICU	Decibel level
Bedside report	50
Bradycardia Alarm	55-88
General Conversation	58-64
Writing on the incubator	59-64
IV pump alarm	61-78
Turning sink on and off	66-76
Opening incubator	67-86
Closing porthole	80-111
Closing isolette cabinet	70-95
Dropping head of mattress	88-117
Placing a bottle on top of incubator	96-117
Banging on incubator to stimulate an apnic infant	130-140

Recommendations

- AAP recommends
 - 45 dB at the bedside
 - A decibel level over 50dB is concerning
 - Transient noise levels should not exceed 65dB



What do the recommendations mean and Why are they important?

- A rise of 10dB corresponds to a doubling of subjective loudness
 - Sound of 80 dB is twice as loud as 70dB which is twice as loud as 60dB
 - 80dB is 4x the loudness of 60dB



So how can we mitigate noise?



- Reduce sound levels in the NICU to recommended standards
 - Building design
 - Equipment choices
 - Policy interventions
- Policy interventions without education and staff buy-in are not successful

Staff Education

- Strategies to reduce noise
 - Respond to alarms within 30 seconds
 - Respond to a crying baby within 30 seconds
 - Conduct conversations away from the bedside
 - Talk in a “movie theater” voice
 - Minimize opening and closing of isolette doors
 - LOWER THE LIGHTS
 - QUIET HOUR
- One on One education with the staff
 - Offered food and CEUs
- Implemented the guideline

Expectations



- The Noise mitigation guidelines
 - The guideline was reviewed with each staff member
 - Use movie theater voices
 - Educate parents

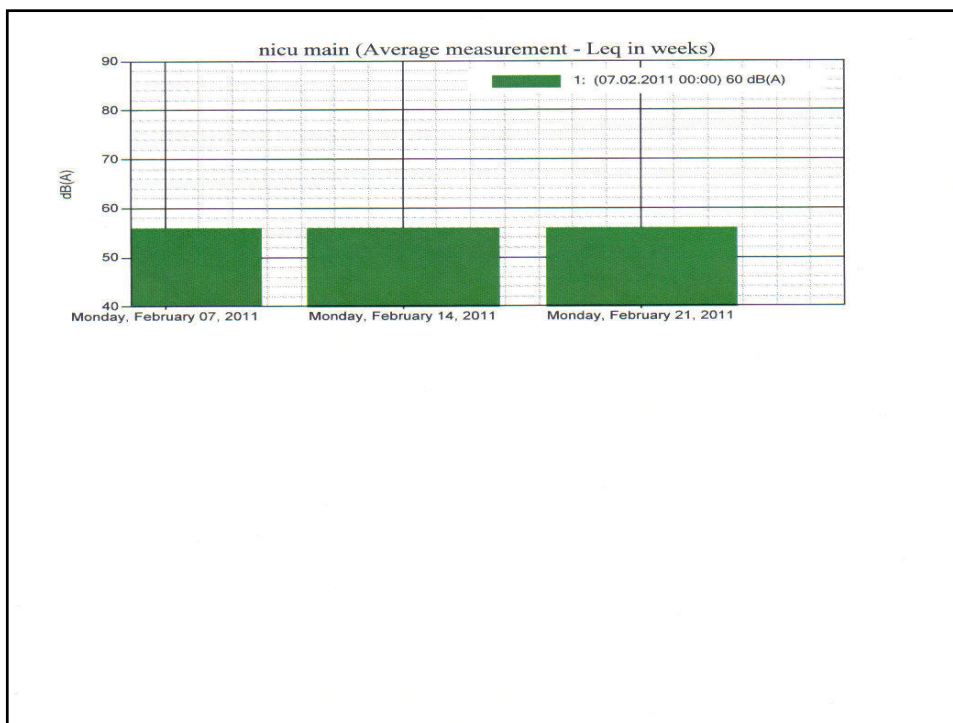
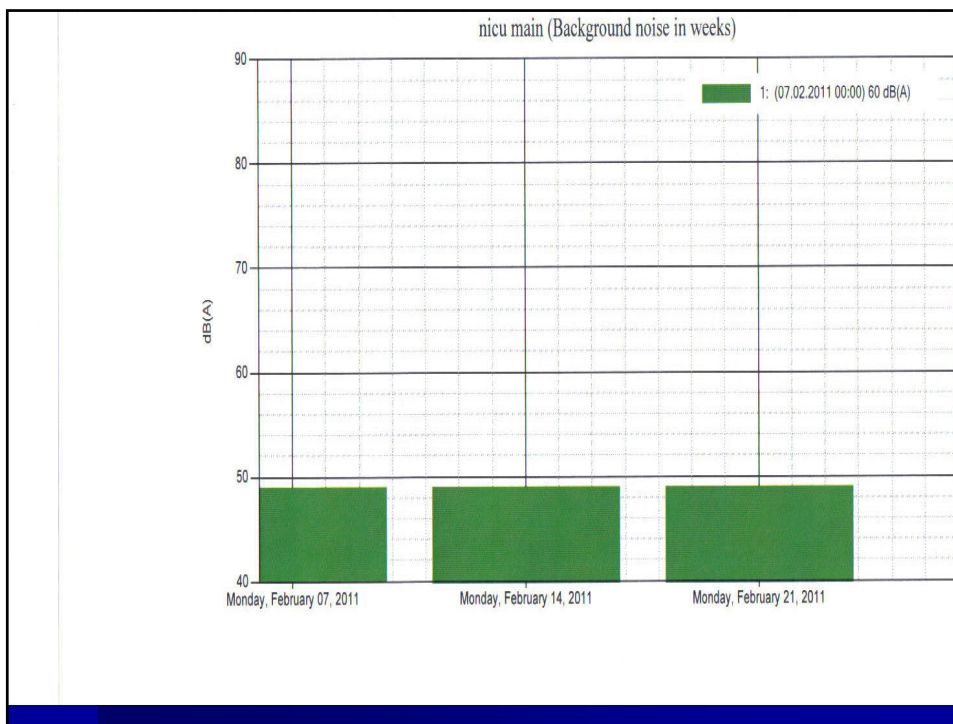
Measured the Noise

- Measured Leq
- Baseline
 - Interesting conversations and findings

Visual Notification of Noise

- Sound Ear with Sound Log

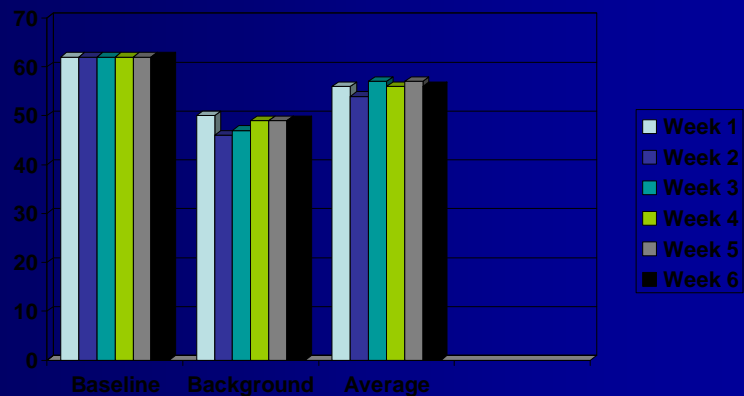




Outcomes

- Reduced the noise level in the NICU
 - Background to 46 decibels (dB)
 - Leq – from 62 dB to 55(dB)
- Implemented quiet time
- Staff buy in

Changes in NICU Noise Levels –One Units Outcomes



Lessons learned



- Possible to decrease noise
- Co-variants did not effect the noise levels
- Staff will buy in if they understand why
- Perception is reality!

Sustaining the Gain

- How do we keep it quiet
 - Keep the program in front of staff
 - We talk about it a lot
 - Unit champions
 - Turning the lights down

Next Steps

- Expand Quiet Time
 - Want to be known as a quiet unit
 - Project is going housewide
- Acoustic ceiling tiles
- Reconfigure the unit
- Install quieter doors

Questions?



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