



Sound Levels

In the Neonatal Intensive Care Unit

Julia Brown

University of Wyoming, Nursing

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Presentation Content

- Sound Level Guidelines for a NICU
- Pathophysiology of an infants ear
- Affects of High Sound levels to a neonate
- What Contributes to sound in the NICU
- Small Changes
- Single family room versus open ward unit
- Conclusion



Sound Level Guidelines for a NICU

- EPA recommends less than or equal to 45 dB during the day and 35 during the night
- The AAP recommends that hourly levels should remain below 50 dB
 - Levels shouldn't reach 55 dB more than ten percent of the time
 - A one second max should not reach 70 dB ¹³



Sound Level Guidelines for a NICU

Decibel Level	Example of Sound Level
10	Heartbeat
20-30	Whisper
40	Average home
50	Light traffic
60	Normal conversation
70	Vacuum cleaner
80	Heavy traffic and telephone ring
90	Pneumatic drill

Committee on Environmental Health, 1997

- Sound levels in the NICU should remain below the level of a normal conversation... Most NICU's do not adhere to this



Pathophysiology of an Infants Ear

- By 24 weeks the neonate's cochlea is completely developed ⁷
- Hair cells in the cochlea until 26-30 weeks¹⁸
- Mother's womb consist of low frequency noises from which infant is taken from too early to an environment of multiple noises that far exceed recommended value ¹⁸



AFFECTS OF HIGH SOUND LEVELS TO A NEONATE

Affects of High Sound Levels to a Neonate

- Heart Rate
 - Bradycardia or tachycardia with high levels of stimulation or sudden changes in the environment
 - Most reliable indicator ²⁶



Affects of High Sound Levels to a Neonate

- Respiratory Rate
 - Interval between breaths
 - Apnea ²⁶



Affects of High Sound Levels to a Neonate

- Oxygen Saturation
 - Hypoxemia ²⁶
 - Less than 84% sometimes 90%



Affects of High Sound Levels to a Neonate

- Hearing loss
- Sever hearing damage ¹⁸



Affects of High Sound Levels to a Neonate

- Sleep deprivation ¹⁹
- Decrease levels of deep sleep
 - REM periods





WHERE DO SOUND LEVELS ORIGINATE ?

Where Do Sound Levels Originate?

- Respiratory equipment
- Cardiac monitors
- Incubators
- Tube systems
- Pneumatic doors
- Supply cabinets
- Pyxis machines ^{11, 12, 14}

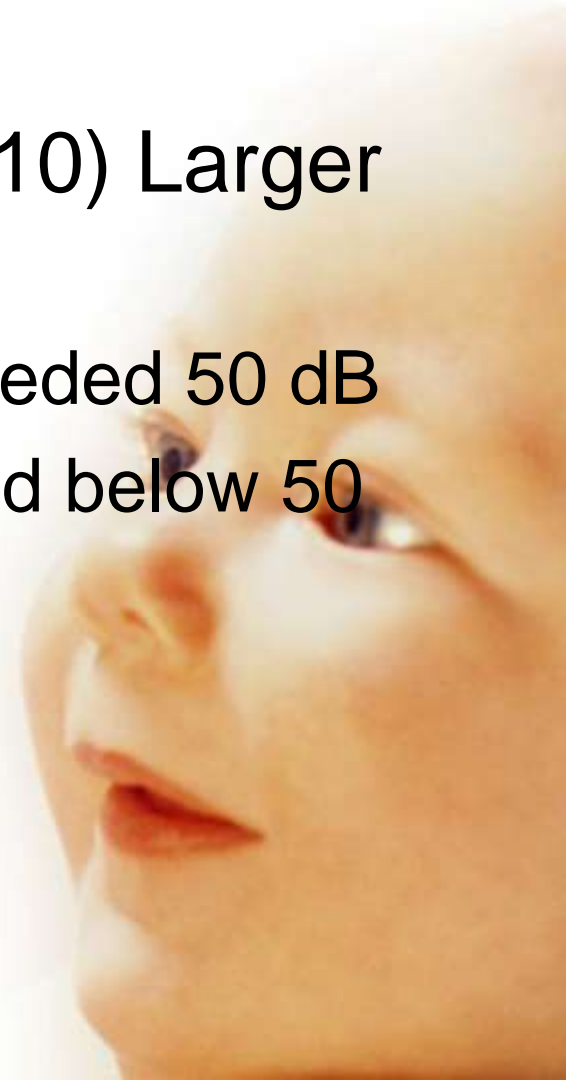


Where Do Sound Levels Originate?

- Contributing Behaviors
 - not closing incubator doors gently
 - top of the incubator as a table surface
 - pagers and phones
 - radios being played
 - hand washing
 - opening medical equipment
 - patient rounds and nursing report
 - invasive procedures
 - babies crying ^{8, 11, 15}

Where Do Sound Levels Originate?

- Berg, Chavez, & Serpanos (2010) Larger tertiary care NICU study
 - 99.99% of levels measured exceeded 50 dB
 - 0.01% of the time levels remained below 50 dB



Average Sound Levels as Heard in an Open Crib

Quiet	47 dB
Talking	49 dB
Radio	53 dB
Sink faucet	57 dB

This table is according to 2005 values (Thomas & Uran, 2007)

Lasky and Williams (2009)

- Incubator and open bed sound levels
 - Giraffe OmniBeds Considerable lower compared to older incubator design
 - CPAP, room air, nasal cannula, mechanical ventilation deliver different sound levels
 - The sound level also varies in an incubator versus an open bed



Sound Levels as Heard in an Isolette

Writing on the top of an isolette hood	62
Incubator alarm	68
Motor on	60
Motor off	38
IV pump alarm	61
Ventilator tube bubbling	61
Finger tapping on hood	65
Closing drawer on incubator	73
Closing porthole to incubator	73
Dropping head of mattress	87

This table is according to 2005 values (Thomas & Uran, 2007)





ENVIRONMENTAL CHANGES TO DECREASE SOUND LEVELS

Environmental Changes to Decrease Sound Levels

- Sound Level Monitors ²²
 - How will this help?



Environmental Changes to Decrease Sound Levels

- Equipment Selection
 - Incubators
 - Changes at the manufacturing level ²⁴



Environmental Changes to Decrease Sound Levels

- 3D pyramidal shaped open cell polyurethane foam ²



Environmental Changes to Decrease Sound Levels

Type of Sound	Isolette	Isolette with the foam panel
Background noise	47	43
Monitor alarm	64	56
Temperature alarm	82	77
Baby crying	79	69
Porthole closing	81	74
Isolette door closing	80	68

This table is according to values by: (Altunku, Akman, Kulekci, Akdas, Bilgen & Ozek, 2009)



Environmental Changes to Decrease Sound Levels

- Infant Earplugs
 - Increase SaO₂
 - Better deep sleep states
 - Better Weight Gain
 - Greater OFC measurements
 - Fewer changes in behavioral states ¹



Environmental Changes to Decrease Sound Levels

- Immediate Changes ^{2, 11, 15, 21}
 - Discontinuing radio and video use
 - Padding drawers and doors
 - Plastic waste bins instead of metal
 - Covering isolette with blankets
 - Rubber shoes on furniture legs
 - Turning alarm speakers down by 50% or 55db
 - positioning them away from the infant





BEHAVIORAL CHANGES TO DECREASE SOUND LEVELS

Behavioral Changes to Decrease Sound Levels

- speaking softly and in low tones
- Soft shoes
- not using incubator top as a table surface
- coordinating care
- careful closing porthole doors
- responding promptly to alarms
- Don't drop the head of the be in the isolette
- limiting the use of personal radios ^{2, 21, 24}



Behavioral Changes to Decrease Sound Levels

- Quiet Hours
 - 2x/day
 - Once a shift ^{11, 15, 23}
- Quiet Zones
 - Medication and feeding areas ¹⁵

Sound generating activities and diagnostic tests are avoided unless necessary ^{15, 23}

Behavioral Changes to Decrease Sound Levels

- Awareness programs ¹¹
 - posters placed around the unit
 - peer monitoring
 - sporadic sound level measurements
 - Helps get the employees actively involved in the change



Behavioral Changes to Decrease Sound Levels

- NAEP (Noise Educational Awareness Program) ¹⁹
 - Education devoted to the entire care team
- Noise Reduction Protocol ²¹
 - Use the environmental and behavioral changes as discussed
 - reported changes from 62-66 dB to 56 dB; that's a change of 6-10 dB

Clinical Implications

- Important developmental care consideration
- Can be avoided
- An unnecessary stressor causing an infant to use energy needed to help them recover

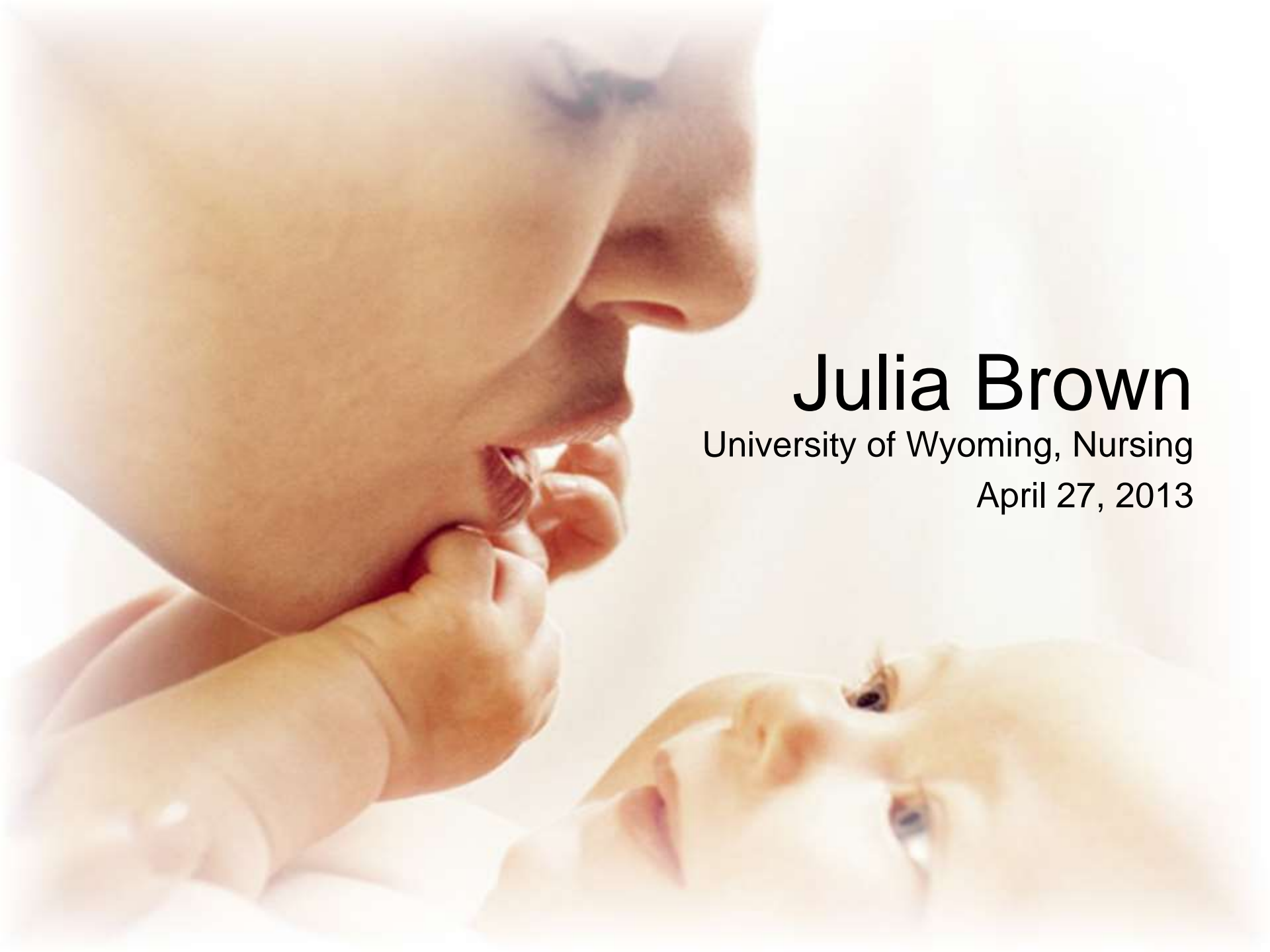


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University of Wyoming, Nursing

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