Evidence to Practice: The NICU Environment

November 12th, 2025

Vermont Oxford Network

1

2025 VON Grand Rounds Date: 11/12/2025

Planners: Roger Soll MD; Denise Zayack RN, MPH

Speaker(s): Roger Soll MD, Danielle Ehret MD, John A F Zupancic, M.D., Sc.D, Robert D. White, MD

Purpose Statement/Goal of this Activity: The 2025 VON Grand Rounds webinar series will provide evidence reviews, a summary of the current practice guidelines, a synthesis of the application of evidence in real work practice settings and will be supported by discussion and question and answer opportunities with expert faculty

The following have relevant financial relationships with ineligible companies (all have been mitigated):
All other speakers/planners/CMIE reviewers do not have ay relevant financial relationships.

This activity did not receive any support for ineligible companies (grants or in-kind).

All recommendations involving clinical medicine made during this talk were based on evidence that is accepted within the profession of medicine as adequate justification for their indication and contradictions in the care of patients.

In support of improving patient care, this activity has been planned and implemented by The Robert Larner College of Medicine at the University of Vermont and Vermont Oxford Network. The University of Vermont is jointly accredited by the Accreditation Council for Continuing Medical Education (ACCME), the Accreditation Council for Pharmacy Education (ACPE), and the American Nurses Credentialling Center (ANCC), to provide continuing education for the healthcare team.

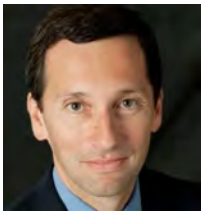
The University of Vermont designates this live activity for a maximum of 1.0 *AMA PRA Category 1 Credit(s)™*. Physicians should claim only the credit commensurate with the extend of their participation in the activity.

This program has been reviewed and is acceptable for up to 1.0 Nursing Contact Hours.

This activity was planned by and for the healthcare team, and learners will receive 1 Interprofessional Continuing Education (IPCE) credit for learning and change.

2

Moderators



John A F Zupancic, M.D., Sc.D
Associate Professor of Pediatrics
Beth Israel Deaconess Medical Center
Pediatrics

Danielle Ehret, MD, MPH
Asfaw Yemiru Green and Gold Professor,
University of Vermont
Chief Medical Officer, Director, Global Health,
Vermont Oxford Network

3

Discussants

Roger F. Soll, MD
H. Wallace Professor of Neonatology,
University of Vermont
Coordinating Editor, Cochrane Neonatal
Director, VON Institute for Evidence Based
Practice, Vermont Oxford Network

Robert D. White, MD.
Director, Regional Newborn Program, Beacon
Children's Hospital; Adjunct Professor,
University of Notre Dame, Chair, Committee to
Establish Recommended Standards for Newborn
ICU Design

4

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5

Evidence to Practice: Environment

Disclosures

Danielle Ehret MD, MPH is the Director of Global Health and Chief Medical Officer at Vermont Oxford Network (VON) and receives salary support to UVM for non-clinical time dedicated to her leadership roles.

Roger F. Soll, MD is the H. Wallace Professor of Neonatology at the Larner College of Medicine at the University of Vermont, Vice President of the Vermont Oxford Network, Director of the VON Institute for Evidence Based Practice, and Coordinating Editor of Cochrane Neonatal.

Robert D. White, MD. Is Director, Regional Newborn Program, Beacon Children's Hospital; Adjunct Professor, University of Notre Dame, Chair, Committee to Establish Recommended Standards for Newborn ICU Design, employee of Pediatrix Medical Group.

John Zupancic MD, ScD is Associate Professor of Pediatrics at Harvard Medical School and Associate Chief of Neonatology at Beth Israel Deaconess Medical Center.

6

How to Participate in Today's Webinar

- Chat questions and comments to "Everyone" during the presentations and discussion.
- Use Poll Everywhere to answer questions posed during the session. Please do not respond to polls in the Chat.

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7

Three ways to use Poll Everywhere

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Go to "pollev.com/vtoxford"

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Text "vtoxford" to 22333, then send your response.

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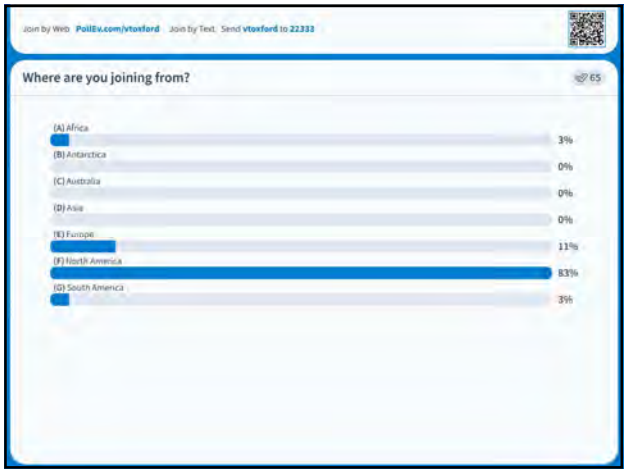

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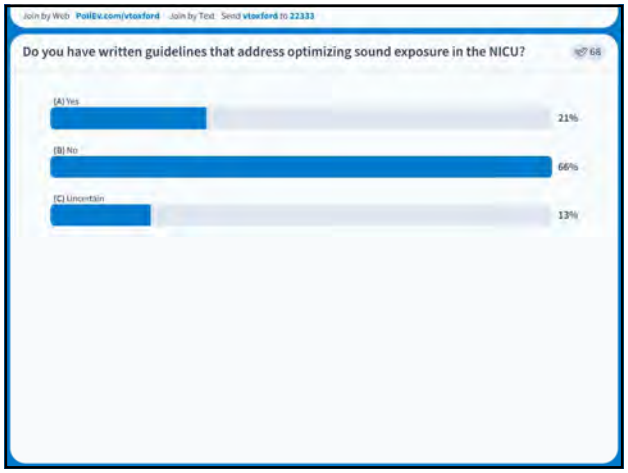

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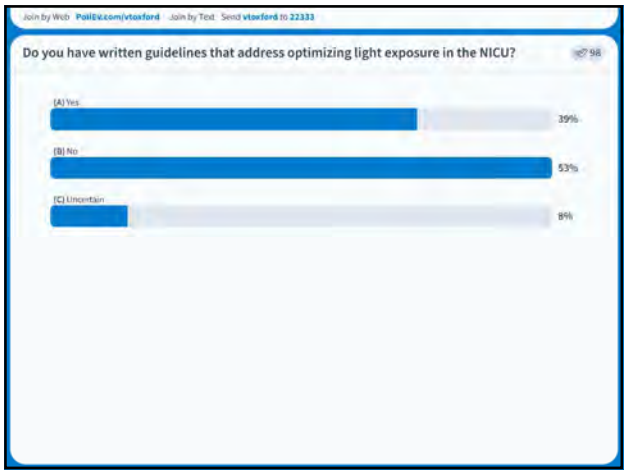


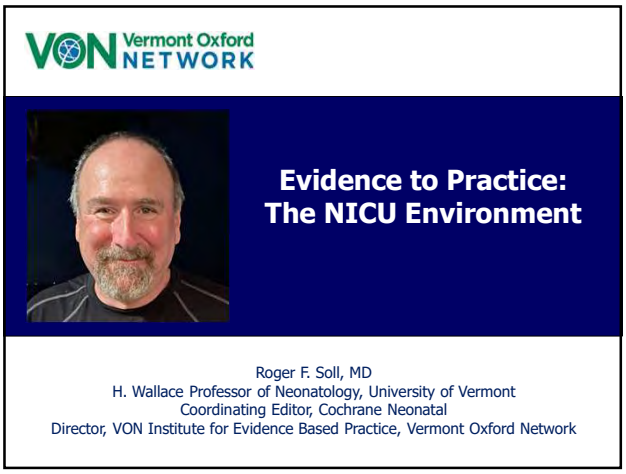
11

Cochrane Neonatal

The NICU Environment

We will review the evidence from randomized trials and meta-analyses and discuss the different approaches that teams around the world are using regarding the NICU environment of critically ill preterm infants

12



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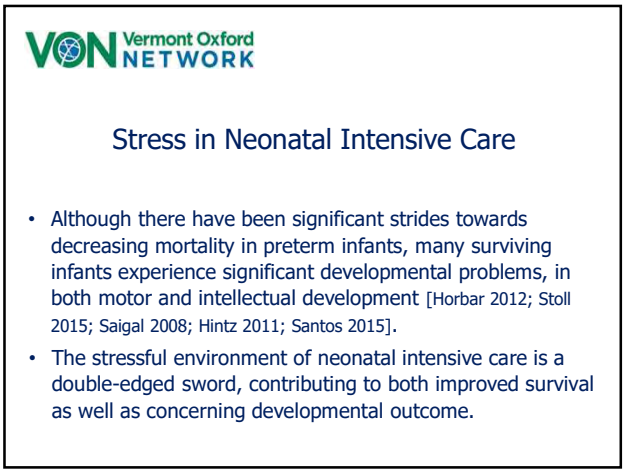

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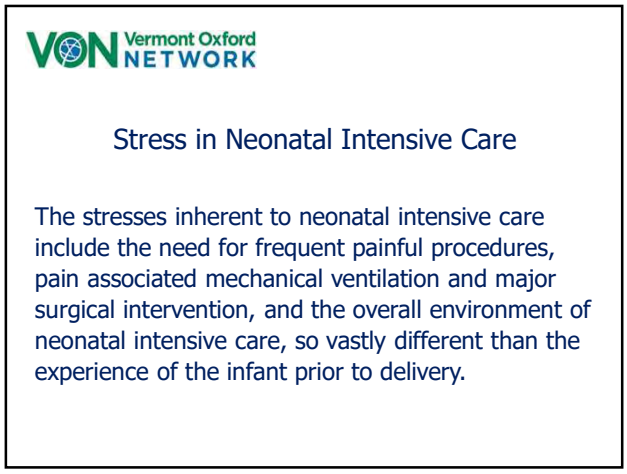

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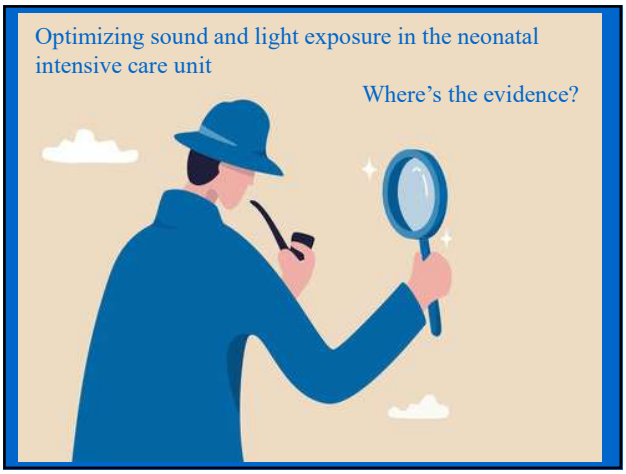

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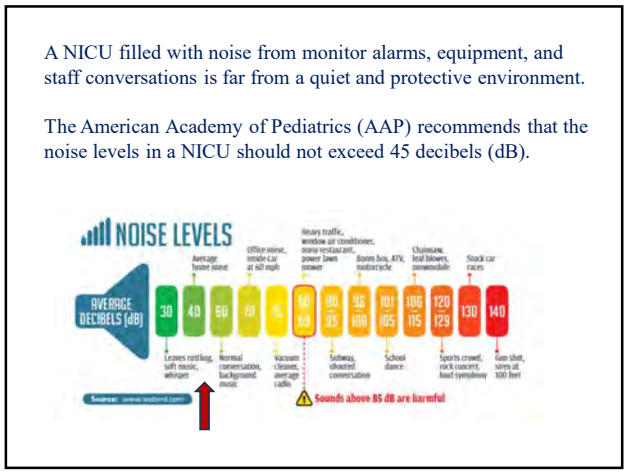

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19

Advances in Neonatal Care

Elevated Sound Levels in the Neonatal Intensive Care Unit: What Is Causing the Problem?

Mayhew, Kelli J. MScN, RN; Lawrence, Sarah L. MD, FRCPC (Pediatrics); Squires, Janet E. PhD, RN; Harrison, Denise PhD, RN.

Advances in Neonatal Care 22(6):p E207-E216, December 2022. | DOI: 10.1097/ANC.0000000000000996

20

Advances in Neonatal Care

Elevated Sound Levels in the Neonatal Intensive Care Unit: What Is Causing the Problem?

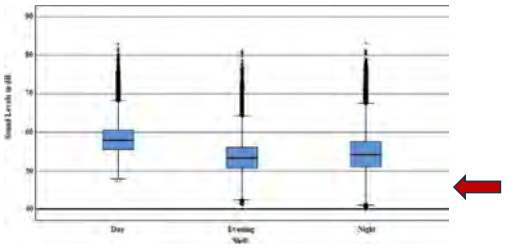
Purpose: To measure sound levels in a level III NICU and to describe contributing environmental factors.

Methods: Descriptive quantitative study. Sound levels were measured using a portable sound meter in an open-bay level III NICU. Contributing environmental factors were recorded and analyzed.

Mayhew, and colleagues. Elevated Sound Levels in the Neonatal Intensive Care Unit: What Is Causing the Problem?. Advances in Neonatal Care 22(6):p E207-E216, December 2022. | DOI: 10.1097/ANC.0000000000000996

21

Elevated Sound Levels in the Neonatal Intensive Care Unit: What Is Causing the Problem?



Boxplots showing the distribution of sound level measurements during the 3 shifts (days, evenings, and nights). IQR indicates interquartile range. Data reported as medians and IQR.

Mayhew, and colleagues. Elevated Sound Levels in the Neonatal Intensive Care Unit: What Is Causing the Problem?. Advances in Neonatal Care 22(6):p E207-E216, December 2022. | DOI: 10.1097/ANC.0000000000000996

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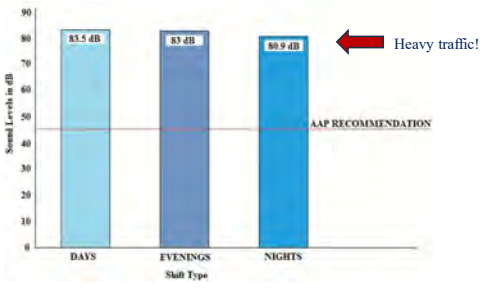
Elevated Sound Levels in the Neonatal Intensive Care Unit: What Is Causing the Problem?



Sound levels. Horizontal red line in the middle of graph depicts AAP recommendation of maximum sound level of 45 dB.

Mayhew, and colleagues. Elevated Sound Levels in the Neonatal Intensive Care Unit: What Is Causing the Problem?. Advances in Neonatal Care 22(6):p E207-E216, December 2022. | DOI: 10.1097/ANC.0000000000000996

23

Advances in Neonatal Care

Elevated Sound Levels in the Neonatal Intensive Care Unit: What Is Causing the Problem?

Multiple linear regression findings demonstrated significant factors associated with elevated sound levels including number of neonates, number of people, number of alarms, acuity level, and shift type. Observational data explain 14.5% of elevated sound levels.

Implications for Practice: An understanding of baseline sound levels and contributing environmental factors is the first step in developing strategies to mitigate excessive noise in the NICU.

Mayhew, and colleagues. Elevated Sound Levels in the Neonatal Intensive Care Unit: What Is Causing the Problem?. Advances in Neonatal Care 22(6):p E207-E216, December 2022. | DOI: 10.1097/ANC.0000000000000996

24

Cochrane Neonatal

Noise or sound management in the neonatal intensive care unit for preterm or very low birth weight infants.

Sibrecht G, Wróblewska-Seniuk K, Bruschettini M.

Cochrane Database of Systematic Reviews 2024, Issue 5. Art. No.: CD010333. DOI: 10.1002/14651858.CD010333.pub4.

25

Noise or sound management in the neonatal intensive care unit for preterm or very low birth weight infants

Infants in the neonatal intensive care unit (NICU) are subjected to different types of stress, including sounds of high intensity. The sound levels in NICUs often exceed the maximum acceptable level recommended by the American Academy of Pediatrics, which is 45 decibels (dB).

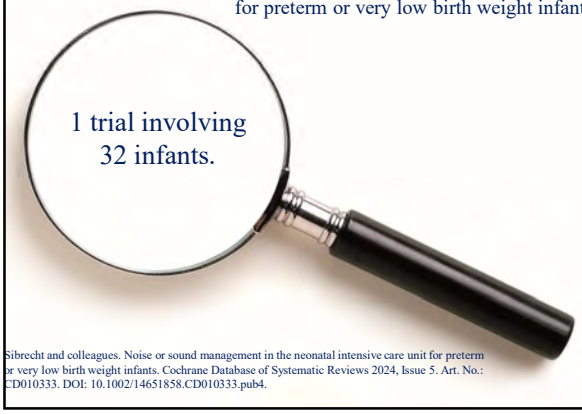
Hearing impairment is diagnosed in 2% to 10% of preterm infants compared to only 0.1% of the general pediatric population.

Bringing sound levels under 45 dB can be achieved by lowering the sound levels in an entire unit; by treating the infant in a section of a NICU, in a 'private' room, or in incubators in which the sound levels are controlled; or by reducing sound levels at the individual level using earmuffs or earplugs.

By lowering sound levels, the resulting stress can be diminished, thereby promoting growth and reducing adverse neonatal outcomes.

26

Noise or sound management in the neonatal intensive care unit for preterm or very low birth weight infants.



27

Noise or sound management in the neonatal intensive care unit for preterm or very low birth weight infants

Main results

We included one RCT, which enrolled 34 newborn infants randomized to the use of silicone earplugs versus no earplugs for hearing protection.

It was a single-center study conducted at the University of Texas Medical School in Houston, Texas, USA.

Earplugs were positioned at the time of randomization and worn continuously until the infants were 35 weeks' postmenstrual age (PMA) or discharged (whichever came first).

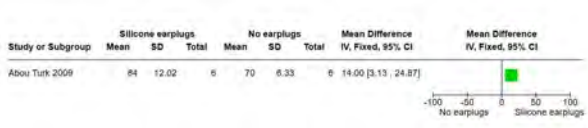
Newborns in the control group received standard care.

28

Noise or sound management in the neonatal intensive care unit for preterm or very low birth weight infants

Comparison 1: Silicone earplugs versus no earplugs for preterm infants in a NICU

Mental Developmental Index (Bayley II) at 18 to 22 months' corrected age



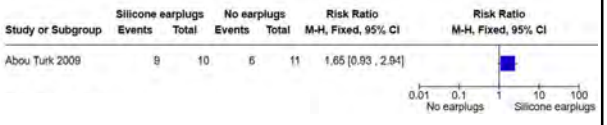
MD 14.00, 95% CI 3.13 to 24.87)

29

Noise or sound management in the neonatal intensive care unit for preterm or very low birth weight infants

Comparison 1: Silicone earplugs versus no earplugs for preterm infants in a NICU

Normal auditory functioning at discharge (measured using automated auditory brainstem response)



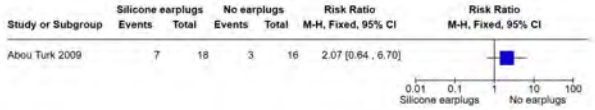
RR 1.65, 95% CI 0.93 to 2.94

30

Noise or sound management in the neonatal intensive care unit for preterm or very low birth weight infants

Comparison 1: Silicone earplugs versus no earplugs for preterm infants in a NICU

All-cause mortality during hospital stay



RR 2.07, 95% CI 0.64 to 6.70

Sibrecht and colleagues. Noise or sound management in the neonatal intensive care unit for preterm or very low birth weight infants. Cochrane Database of Systematic Reviews 2024, Issue 5. Art. No.: CD010333. DOI: 10.1002/14651858.CD010333.pub4.

31

Noise or sound management in the neonatal intensive care unit for preterm or very low birth weight infants

The evidence is very uncertain about the effects of silicone earplugs on the following outcomes.

- Weight (kg) at 18 to 22 months' corrected age (MD 0.31, 95% CI -1.53 to 2.16)
- Height (cm) at 18 to 22 months' corrected age (MD 2.70, 95% CI -3.13 to 8.53)
- Days of assisted ventilation (MD -1.44, 95% CI -23.29 to 20.41)
- Days of initial hospitalization (MD 1.36, 95% CI -31.03 to 33.75)

For all outcomes, we judged the certainty of evidence as very low.

Sibrecht and colleagues. Noise or sound management in the neonatal intensive care unit for preterm or very low birth weight infants. Cochrane Database of Systematic Reviews 2024, Issue 5. Art. No.: CD010333. DOI: 10.1002/14651858.CD010333.pub4.

32

Noise or sound management in the neonatal intensive care unit for preterm or very low birth weight infants

Authors' conclusions

No studies evaluated interventions to reduce sound levels below 45 dB across the whole neonatal unit or in a room within it.

We found only one study that evaluated the benefits of sound reduction in the neonatal intensive care unit for hearing protection in preterm infants.

The study compared the use of silicone earplugs versus no earplugs in newborns of very low birth weight (less than 1500 g).

Considering the very small sample size, imprecise results, and high risk of attrition bias, the evidence based on this research is very uncertain and no conclusions can be drawn.

Sibrecht and colleagues. Noise or sound management in the neonatal intensive care unit for preterm or very low birth weight infants. Cochrane Database of Systematic Reviews 2024, Issue 5. Art. No.: CD010333. DOI: 10.1002/14651858.CD010333.pub4.

33

WJCP World Journal of Clinical Pediatrics

Quieting the neonatal intensive care unit: A quality improvement initiative.

Rangaswamy DR, Kamble N, Veeramachaneni A.

World J Clin Pediatr. 2024 Sep 9;13(3):96018. doi: 10.5409/wjcp.v13.i3.96018.

34

Quieting the neonatal intensive care unit: A quality improvement initiative.

AIM: To measure the sound levels in a NICU and reduce ambient sound levels by at least 10% from baseline.

METHODS: A quasi-experimental quality improvement project was conducted over 4 month in a 20-bed level 3 NICU in a tertiary care medical college.

Baseline noise levels were recorded continuously using a sound level meter.

The interventions included targeted education, environmental modifications, and organizational changes, and were implemented through three rapid Plan-Do-Study-Act (PDSA) cycles.

Weekly feedback and monitoring were conducted, and statistical process control charts were used for analysis.

Rangaswamy and colleagues. Quieting the neonatal intensive care unit: A quality improvement initiative. World J Clin Pediatr. 2024 Sep 9;13(3):96018. doi: 10.5409/wjcp.v13.i3.96018.

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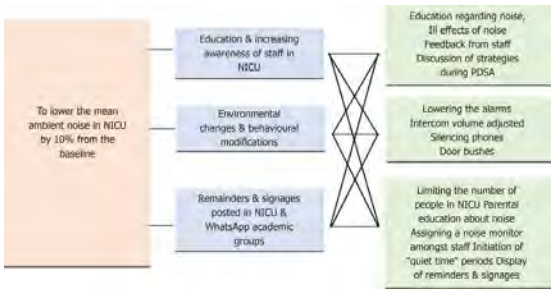
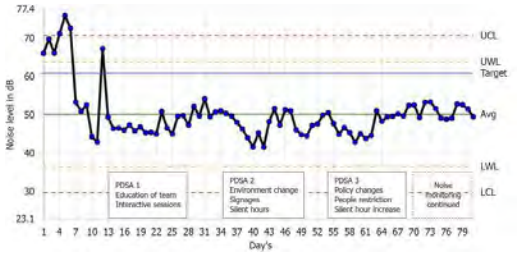
Quieting the neonatal intensive care unit: A quality improvement initiative.



Rangaswamy and colleagues. Quieting the neonatal intensive care unit: A quality improvement initiative. World J Clin Pediatr. 2024 Sep 9;13(3):96018. doi: 10.5409/wjcp.v13.i3.96018.

36

Quieting the neonatal intensive care unit: A quality improvement initiative.



The overall reduction in noise levels was 25% from baseline.

Rangaswamy and colleagues. Quieting the neonatal intensive care unit: A quality improvement initiative. World J Clin Pediatr. 2024 Sep 9;13(3):96018. doi: 10.5409/wjcp.v13.i3.96018.

37

The road to sensory deprivation in the NICU is paved with good intentions: defining an optimal environment of care.

White and colleagues. The road to sensory deprivation in the NICU is paved with good intentions: defining an optimal environment of care. J Perinatol. 2025 Jan;45(1):1-2. doi: 10.1038/s41372-024-02204-x.

38

The Journal of Pediatrics

Auditory Exposure in the Neonatal Intensive Care Unit: Room Type and Other Predictors.

Pineda R, Durant P, Mathur A, Inder T, Wallendorf M, Schlaggar BL.

J Pediatr. 2017 Apr;183:56-66.e3. doi: 10.1016/j.jpeds.2016.12.072.

39

Auditory Exposure in the Neonatal Intensive Care Unit: Room Type and Other Predictors.

Objective: To quantify early auditory exposures in the neonatal intensive care unit (NICU) and evaluate how these are related to medical and environmental factors. We hypothesized that there would be less auditory exposure in the NICU private room, compared with the open ward.

Study design: Preterm infants born at ≤ 28 weeks gestation (33 in the open ward, 25 in private rooms) had auditory exposure quantified at birth, 30 and 34 weeks postmenstrual age (PMA), and term equivalent age using the Language Environmental Acquisition device.

Results: Meaningful language ($P < .0001$), the number of adult words ($P < .0001$), and electronic noise ($P < .0001$) increased across PMA. Silence increased ($P = .0007$) and noise decreased ($P < .0001$) across PMA.

There was more silence in the private room ($P = .02$) than the open ward, with an average of 1.9 hours more silence in a 16-hour period.

There was an interaction between PMA and room type for distant words ($P = .01$) and average decibels ($P = .04$), indicating that changes in auditory exposure across PMA were different for infants in private rooms compared with infants in the open ward.

Conclusions: Understanding the NICU auditory environment paves the way for interventions that reduce high levels of adverse sound and enhance positive forms of auditory exposure, such as language.

Pineda and colleagues. Auditory Exposure in the Neonatal Intensive Care Unit: Room Type and Other Predictors. J Pediatr. 2017 Apr;183:56-66.e3. doi: 10.1016/j.jpeds.2016.12.072.

40

The Journal of Pediatrics

A risk of sensory deprivation in the neonatal intensive care unit.

Jobe AH.

J Pediatr. 2014 Jun;164(6):1265-7. doi: 10.1016/j.jpeds.2014.01.072.

41

Sound Exposures in the NICU

There is extensive literature describing the excessive sound exposures for infants in the NICU, with recommendations from the American Academy of Pediatrics for limiting these exposures. Modern isolettes and ventilators are quieter than in the past, but the amount of continuous white noise can be substantial and a hazard.

However, sound exposure is critical for the development of normal speech. The fetal environment is not quiet, although high frequency sounds are filtered out. The human fetus can hear and respond to sounds by 23-24 weeks, and the development of the auditory cortex is critically dependent on the auditory environment from early gestation.

Deprivation of maternal sounds will interfere with the development of the fetal auditory cortex and interfere with speech and language acquisition.

The amount of speech-related brain activity after birth increases with more fetal exposure to speech. Surprisingly, language exposure in utero initiates the fetus to the phonic characteristics of its native language.

Jobe AH. A risk of sensory deprivation in the neonatal intensive care unit. J Pediatr. 2014 Jun;164(6):1265-7. doi: 10.1016/j.jpeds.2014.01.072.

42

Sound Exposures in the NICU

….However, following very preterm birth, exposure to adult language—maternal or from the NICU staff—was found to be a small percent of the sound exposure.

The appropriate emphasis on sound abatement in the new or renovated NICU should be on background noise, alarm noise, and other non-human noises that can startle and disrupt sleep of the preterm.

However, the focus on noise abatement has morphed into a goal of silence in the NICU with exclusion of staff talk and lively discussions on work rounds.

The result may be a severe limitation of the exposure of the vulnerable developing auditory cortex to human voices and sounds that are necessary for language development.

This delay in language development for infants in single rooms is just what was observed by Pineda and colleagues. In contrast, the open ward better reflects the fetal environment with human sounds and activities.

Jobe AH. A risk of sensory deprivation in the neonatal intensive care unit. J Pediatr. 2014 Jun;164(6):1265-7. doi: 10.1016/j.jpeds.2014.01.072.

43

44

The NEW ENGLAND JOURNAL of MEDICINE

Effect of bright light in the hospital nursery on the incidence of retinopathy of prematurity.

Glass P, Avery GB, Subramanian KN, Keys MP, Sostek AM, Friendly DS.

N Engl J Med. 1985 Aug 15;313(7):401-4. doi: 10.1056/NEJM198508153130701.

45

The NEW ENGLAND JOURNAL of MEDICINE

Effect of bright light in the hospital nursery on the incidence of retinopathy of prematurity.

We prospectively investigated the effect of exposure to light in two intensive care nurseries by comparing the incidence of retinopathy of prematurity among 74 infants from the standard bright nursery environment (median light level, 60 foot-candles [ftc]) with the incidence among 154 infants of similar birth weight for whom the light levels were reduced (median, 25 ftc).

There was a higher incidence of retinopathy of prematurity in the group of infants who had been exposed to the brighter nursery lights, particularly in those with birth weights below 1000 g (86 per cent vs. 54 per cent, $P < 0.01$ by chi-square test).

We conclude that the high level of ambient illumination commonly found in the hospital nursery may be one factor contributing to retinopathy of prematurity and that safety standards with regard to current lighting practices should be reassessed.

Glass and colleagues. Effect of bright light in the hospital nursery on the incidence of retinopathy of prematurity. N Engl J Med. 1985 Aug 15;313(7):401-4. doi: 10.1056/NEJM198508153130701.

46


The Washington Post

Bright Lights Tied To Babies' Blindness
Hospital Nurseries Urged to Lower Intensity

The bright lights of intensive care nurseries may contribute to more than 500 premature infants becoming blind each year, according to researchers at two Washington hospitals whose findings were published today in the New England Journal of Medicine.

47

The NEW ENGLAND JOURNAL of MEDICINE

…an editorial in the New England Journal advises hospitals to modify newborn nurseries by lowering the lights or installing equipment that automatically cycles lights off and on.

48

The JOURNAL of PEDIATRICS

A risk of sensory deprivation in the neonatal intensive care unit.

Jobe AH.

J Pediatr. 2014 Jun;164(6):1265-7. doi: 10.1016/j.jpeds.2014.01.072.

49

Light Exposures in the NICU

Although the fetus is in a dark environment in utero, the fetus has a circadian rhythm entrained by maternal hormones. The circadian regulator in the brain—the hypothalamic superchiasmatic nuclei—of the very preterm baboon equivalent to about 24-week preterm infants, responds to light with increased metabolism and gene expression.

Preterm infants cared for in dimly lighted rooms or day-night lighted rooms develop circadian sleep patterns independent of cycled light. Nevertheless, development of the visual system requires visual experiences. Sight deprivation interrupts visual development, and environmental enrichment fosters brain plasticity.

Circadian rhythms regulate more than sleep cycles, and there is minimal research to explore other potential effects of light on the preterm infant.

Accepting that the fetus has a circadian rhythm and the dark-exposed preterm infant does not, the conservative approach to exposure of the preterm infant to light would be cycling of dim light sufficient for care at night to brighter light during the day. The covering of the isolettes with blankets continuously seems to be questionable because visual development requires light exposure. The biology suggests that judicious light exposure is appropriate until more is known about the effects of light on the preterm infant.

Jobe AH. A risk of sensory deprivation in the neonatal intensive care unit. J Pediatr. 2014 Jun;164(6):1265-7. doi: 10.1016/j.jpeds.2014.01.072.

50

Cochrane Neonatal

Cycled light in the intensive care unit for preterm and low birth weight infants.

Morag and colleagues.

Cochrane Database of Systematic Reviews 2024, Issue 12. Art. No.: CD006982. DOI: 10.1002/14651858.CD006982.pub5

51

Cycled light in the intensive care unit for preterm and low birth weight infants.

Morag and colleagues. Cycled light in the intensive care unit for preterm and low birth weight infants. Cochrane Database of Systematic Reviews 2024, Issue 12. Art. No.: CD006982. DOI: 10.1002/14651858.CD006982.pub5.

52

Cycled light in the intensive care unit for preterm and low birth weight infants.

Preterm and low birth weight infants are at an early stage of development, and do not receive adequate maternal circadian signals.

They are often cared for over prolonged periods of hospitalization in neonatal intensive care units (NICU), where environmental circadian stimuli are lacking. Exposure to artificial light–dark cycles may stimulate the development of the circadian system and improve clinical outcomes.

However, it remains uncertain whether cycled light (CL) is preferable to near darkness (ND) or continuous bright light (CBL) in fostering development and maturation, and reducing adverse neonatal health outcomes.

Morag and colleagues. Cycled light in the intensive care unit for preterm and low birth weight infants. Cochrane Database of Systematic Reviews 2024, Issue 12. Art. No.: CD006982. DOI: 10.1002/14651858.CD006982.pub5.

53

Cycled light in the intensive care unit for preterm and low birth weight infants.

Objectives

To evaluate the benefits and harms of cycled light (CL) in preterm and low birth weight infants compared to near darkness (ND) or continuous bright light (CBL).

Selection criteria

We included randomized controlled trials (RCTs) or quasi-RCTs in preterm infants (< 37 weeks' postmenstrual age (PMA)), or those with a low birth weight (< 2500 g), admitted and cared for in an NICU or a step-down unit, comparing CL with ND or CBL.

Morag and colleagues. Cycled light in the intensive care unit for preterm and low birth weight infants. Cochrane Database of Systematic Reviews 2024, Issue 12. Art. No.: CD006982. DOI: 10.1002/14651858.CD006982.pub5.

54

Cycled light in the intensive care unit for preterm and low birth weight infants.

Main results

We included 20 studies with 1633 infants.

Data for meta-analysis were available for 11 studies (1126 infants).

One study with multiple arms was included in both comparisons.

We rated the overall risk of bias at the study level as high or unclear for all 20 studies that had one or several unclear or high risk of bias judgements across the domains.

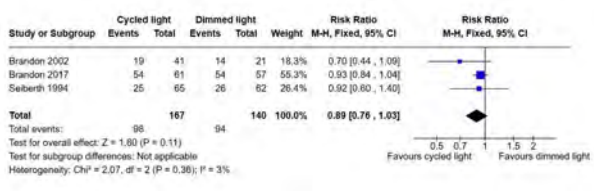
Morag and colleagues. Cycled light in the intensive care unit for preterm and low birth weight infants. Cochrane Database of Systematic Reviews 2024, Issue 12. Art. No.: CD006982. DOI: 10.1002/14651858.CD006982.pub5.

55

Cycled light in the intensive care unit for preterm and low birth weight infants.

Comparison 1: Cycled light versus dimmed light or near darkness (3 studies)

Any retinopathy



RR 0.89, 95% CI 0.76 to 1.03; 3 studies, 307 infants; very low-certainty evidence

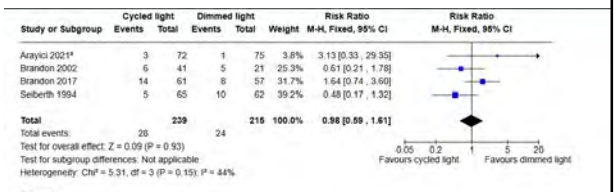
Morag and colleagues. Cycled light in the intensive care unit for preterm and low birth weight infants. Cochrane Database of Systematic Reviews 2024, Issue 12. Art. No.: CD006982. DOI: 10.1002/14651858.CD006982.pub5.

56

Cycled light in the intensive care unit for preterm and low birth weight infants.

Comparison 1: Cycled light versus dimmed light or near darkness (4 studies)

Severe retinopathy



RR 0.98, 95% CI 0.59 to 1.61; 4 studies, 454 infants; very low-certainty evidence).

Morag and colleagues. Cycled light in the intensive care unit for preterm and low birth weight infants. Cochrane Database of Systematic Reviews 2024, Issue 12. Art. No.: CD006982. DOI: 10.1002/14651858.CD006982.pub5.

57

Cycled light in the intensive care unit for preterm and low birth weight infants.

Comparison 1: Cycled light versus dimmed light or near darkness (10 studies)

The evidence is very uncertain about the effect of cycled light compared to dimmed light (reduction of illumination levels) or near darkness on weight at three months (MD 24.79, 95% CI -262.33 to 311.91; 2 studies, 187 infants; very low-certainty evidence), and weight at six months (MD 202, 95% CI -109.68 to 513.68; 1 study, 147 infants; very low-certainty evidence).

Cycled light compared to dimmed light or near darkness may have little to no effect on the duration of initial hospitalization (MD -3.04, 95% CI -7.86 to 1.78; 5 studies, 550 infants; very low-certainty evidence), but the evidence is very uncertain.

The studies did not report any data for major neurodevelopmental disability.

No data are available for adverse effects; it is uncertain if the absence of adverse effects is because none occurred, or because they were not identified and recorded.

Morag and colleagues. Cycled light in the intensive care unit for preterm and low birth weight infants. Cochrane Database of Systematic Reviews 2024, Issue 12. Art. No.: CD006982. DOI: 10.1002/14651858.CD006982.pub5.

58

Cycled light in the intensive care unit for preterm and low birth weight infants.

Comparison 2: Cycled light versus continuous bright light (11 studies)

No data are available on the following primary outcomes, as no studies reported them: growth at three and six months' corrected age, major neurodevelopmental disability, and adverse effects.

It is uncertain if the absence of adverse effects is because none occurred or because they were not identified and recorded. No data are available on retinopathy of prematurity, as no studies reported it.

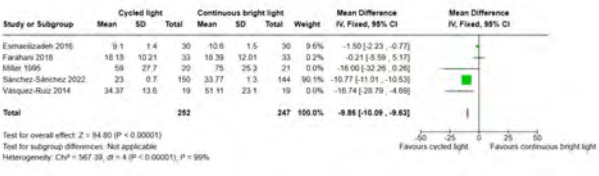
Morag and colleagues. Cycled light in the intensive care unit for preterm and low birth weight infants. Cochrane Database of Systematic Reviews 2024, Issue 12. Art. No.: CD006982. DOI: 10.1002/14651858.CD006982.pub5.

59

Cycled light in the intensive care unit for preterm and low birth weight infants.

Comparison 2: Cycled light versus continuous bright light (5 studies)

Duration of initial hospitalization



Cycled light compared to continuous bright light may reduce the duration of initial hospitalization, but the evidence is very uncertain (MD -9.86, 95% CI -10.09 to -9.63; 5 studies, 499 infants; very low-certainty evidence).

Morag and colleagues. Cycled light in the intensive care unit for preterm and low birth weight infants. Cochrane Database of Systematic Reviews 2024, Issue 12. Art. No.: CD006982. DOI: 10.1002/14651858.CD006982.pub5.

60

Cycled light in the intensive care unit for preterm and low birth weight infants.

Authors' conclusions

Despite identifying 20 studies, we remain uncertain about the effect of cycled light compared to ND or CBL on all outcomes of interest in this review. In addition, a few critical outcomes were not reported by any of the included studies.

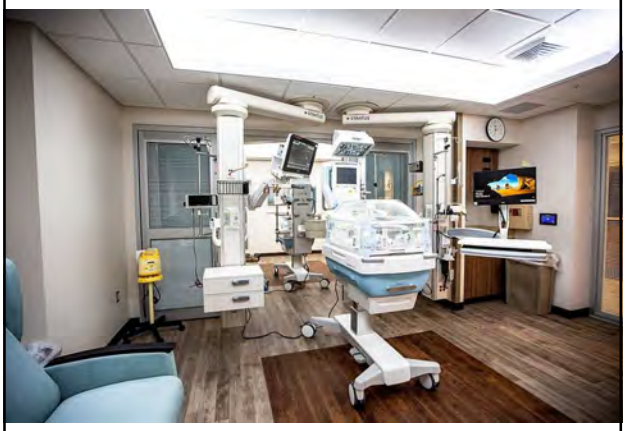
The evidence remains uncertain about whether CL is the right choice in the NICU. The physician should always weigh the benefits and risks, based on the effects of the different options in the specific setting.

Morag and colleagues. Cycled light in the intensive care unit for preterm and low birth weight infants. Cochrane Database of Systematic Reviews 2024, Issue 12. Art. No.: CD006982. DOI: 10.1002/14651858.CD006982.pub5.

61

Skating on thin ice?

62



63

64

VON Vermont Oxford NETWORK

Discussants

Robert D. White, MD.
Director, Regional Newborn Program,
Beacon Children's Hospital
Adjunct Professor, University of Notre Dame,
Chair, Committee to Establish Recommended Standards
for Newborn ICU Design

65

Disclosure

I am an employee of Pediatrix Medical Group but have no other conflicts of interest to disclose

66

NICU Priorities

- Treat illness
- Optimize development
- Support family growth – set each family up for optimal outcome
- Optimize caregivers' abilities to provide the best care while maintaining their physical, mental, and emotional health

The best outcomes require both optimal care and optimal design

67

A Little History….

- 1970s – intense focus on treating illness; NICUs were bright, noisy, crowded, with little family access
- Gradual progress on improving family access and the overall environment of care, while also finding success in supporting increasingly more immature babies with longer NICU stays
- But we still have not arrived at – or even fully identified – the optimal environment of care for babies, families and caregivers

68

A New Focus

Instead of just focusing on ***neuroprotection,***
we should also seek to provide ***neuropromotion.***

- **Neuroprotection –** understood as minimizing stress
  - In the context of today's talk, by minimizing light and sound levels
- **Neuropromotion –** <u>starts</u> with minimizing stress but then seeks to avoid sensory deprivation by offering nurturing stimuli – as well-described by Dr. Jobe in Roger's overview

69

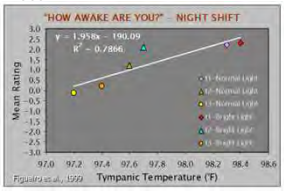
Lighting – what does "just right" look like?

- Babies are obviously our primary constituency, but adults, both parents and caregivers, are important too.
- Roger has reviewed the Cochrane summaries with respect to babies; my take is that at 32 weeks and above cycled lighting is not harmful, may be beneficial for babies, and provides a subliminal message that babies can receive interaction rather than needing to be asleep and unstimulated 24/7.
- Caregivers benefit from access to higher light levels away from the bedside.

70

Night Lighting for Caregivers in the NICU

- Bright light exposure at night increases body temperature and feelings of wakefulness



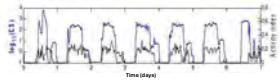
Sponsor: Memorial Hospital, South Bend, IN
Swedish National Energy Administration

71

Light and activity for seven days

(Data from Rea, et al – RPI)

- Day shift nurse



- Rotating shift nurse

72

Lighting – Design Implications

- Baby's bedside
  - No direct lighting into baby's bed except for task lighting
  - Ambient lighting – capable of providing circadian cycling
- Recommended Standard: "Ambient lighting levels in infant spaces shall be adjustable through a range of at least 10 to no more than 600 lux (approximately 1 to 60 foot candles)….
- "Accurate color rendering is essential to NICU care…."
- "No direct view of the electric light source or sun shall be permitted in the infant space …."

73

Lighting – the Big Picture

- Babies – design the baby's care space so that ambient, task, and circadian lighting are optimized
- Caregivers – design work areas to meet caregivers' needs, including those who work night shifts
- Families – provide family area lighting at the bedside that meets their needs; provide daylighting in the patient room wherever possible
- General – lighting sends subliminal messages – it can be intense and harsh, or soft and soothing – don't leave this up to engineers!
- Stay tuned – I expect that eventually Cochrane Reviews will establish the benefit of circadian cycled lighting for babies, so an optimal design should allow for that capability

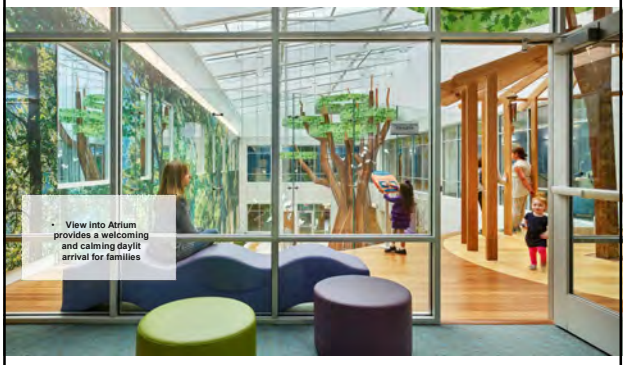
74

75

Sound – Design Considerations

- Working principle – minimize the negative, accentuate the positive
  - Noise is not good for anyone; nurturing sounds (e.g., music, most conversation) are good for everyone
- Sound absorbing surfaces – ceilings, walls, floors, hallways, furnishings
- Use technology to get alarms away from the bedside
- Control extraneous sources of noise – sinks, towel dispensers, trash
- ***Make space for parents***
  - More space = better dissipation of noise
  - More family presence = more provision of nurturing voice, music

76



77

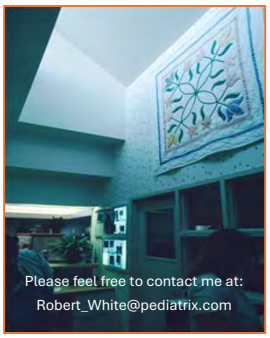
Design Takeaways

- Good design can improve the physical and mental health of babies, families and caregivers; good lighting and sound management are significant ways this can be accomplished
- Families are crucial stakeholders – lighting and sound management must be planned with them in mind => include them on the design team!
- Caregivers have important biological responses to lighting and sound, for better or worse – their needs must also be considered at every stage of design
- NICUs were once the source of excessive light and noise, but the solution is not to simply limit them whenever possible – there is a "sweet spot" that optimizes nurture while minimizing stressors

78

We shape our buildings and afterwards our buildings shape us."

-Winston Churchill (former premie)



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Open discussion

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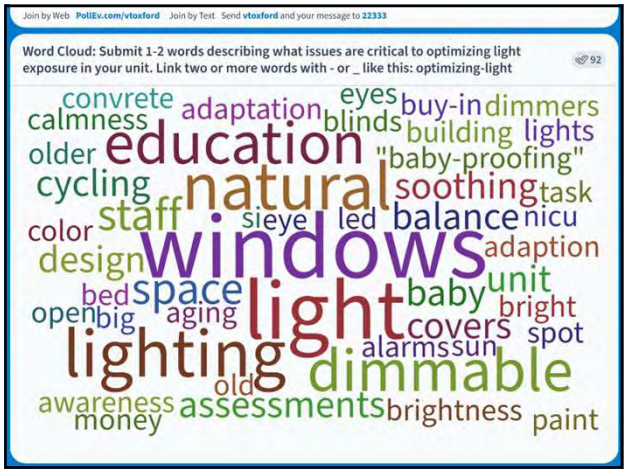

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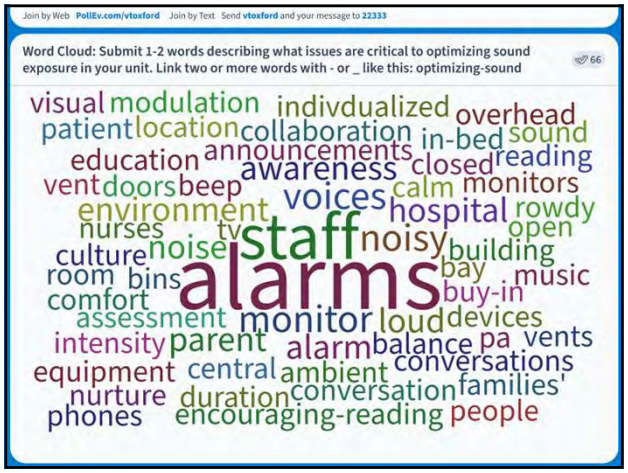


82

Quality Improvement Strategies

Possible take aways?

Light Management:

- Adjustable Lighting: Install lighting systems that are adjustable and can be dimmed to reduce light exposure during certain hours.
- Mimic Natural Cycles: Gradually decrease and dim lights during the night shift to promote healthy sleep patterns, with dim white light (e.g., 30 lux) for the later hours.
- Avoid Excessive Brightness: Reduce exposure to bright white light (e.g., 200-300 lux at the eye) to prevent negative impacts on sleep and physiological well-being

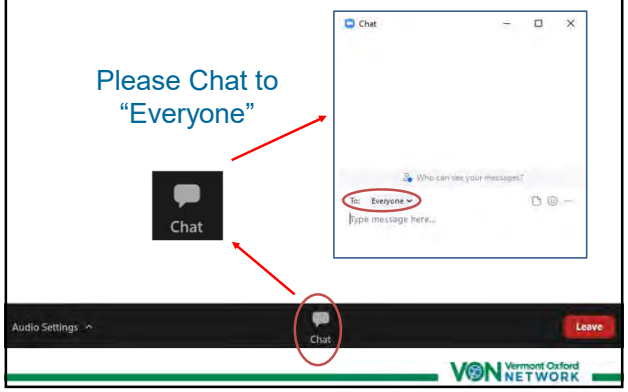
Sound Optimization:

- Monitoring: Implement structured monitoring of noise levels to identify primary sources, such as equipment and human activity.
- Interventions: Use quality improvement processes to reduce noise through strategies like double-counting at infant bedside, limiting noise from equipment, and creating quiet zones.
- Auditory Buffering: Utilize physical and environmental modifications to buffer infants from excessive noise, aiming for background levels to not exceed 45 dB as recommended by the AAP.

83

Questions? Comments? Ideas to Share?

Please Chat to "Everyone"



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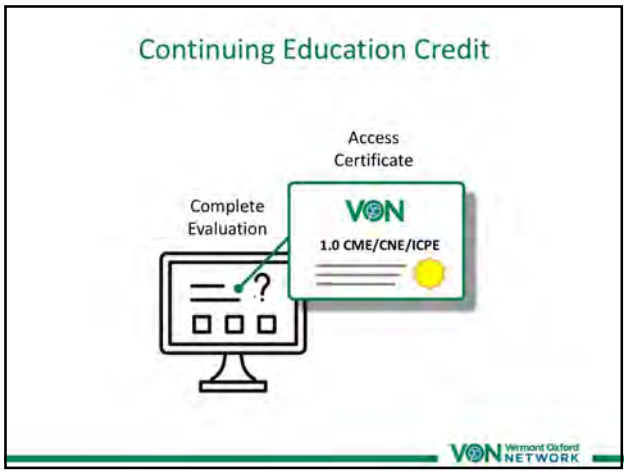
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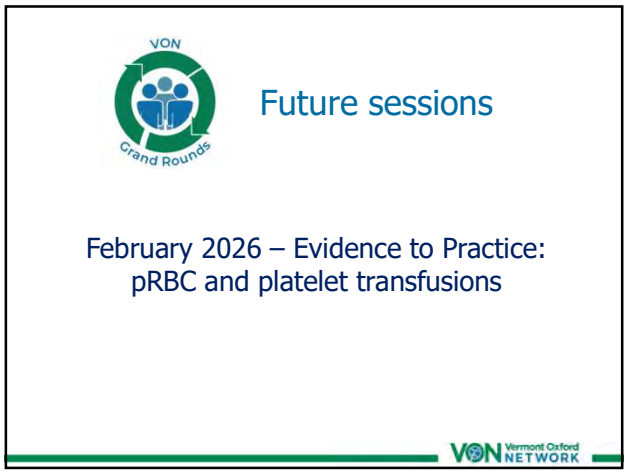
VON Grand Rounds
Future sessions
February 2026 – Evidence to Practice: pRBC and platelet transfusions
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86


NICQ
All Care is Brain Care
All Care is Brain Care
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87