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Best Practices for Healthcare Lighting Neonatal Intensive Care Unit



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Key Focus Areas









What is the NICU?

- An intensive care unit designed to treat critically ill newborns who require advanced technology and highly trained healthcare professionals
- Common causes for NICU admission are:
 - Preterm (born before 37 weeks)
 - Low birth weight (less than 5.5 lbs)
 - Respiratory distress
 - Infection
 - Birth defects





NICU Levels (in North America)



BASIC CARE

Level I NICUs provide care for healthy, full-term babies. They also stabilize near-term babies to get them ready to be moved to specialized facilities.



ADVANCED CARE

Level II NICUs offer care for babies born at or after 32 weeks and babies who are recovering from more serious health problems.



SPECIALIZED CARE

Level III NICUs care for very sick babies and offer access to a wide range of pediatric specialists and equipment, such as X-rays and ventilation support. The babies in these nurseries are generally born earlier than 32 weeks or have critical illnesses.



HIGHEST LEVEL OF CARE

Level IV NICUs provide the highest level of neonatal care. They have a full range of healthcare providers, including pediatric subspecialists, specialized nurses and equipment to care for very sick babies.



Design Trend: Private NICU



Open Ward





Promoting Health in the NICU

Why are Private Rooms Preferred?

- Lower Light Levels
- Lower Sound Levels
- More Parental Bonding
- Increased Privacy
- More Breastfeeding
- Shorter Stays
- Reduced Exposure to Infection





The Scientific Case for Private NICU

- 2022 Study: Standard care has 2.6X higher risk for infection than "Family Integrated Care"
- 2020 Study: Single Room Design significantly lowers stress levels for mothers
- 2019 Study: Higher overall staff satisfaction with Single Room Design
- 2017 Study: Single Room Design leads to reduction in 7 NICU morbidities (See Appendix 1, right)

Downside: Reduced language skills, and possible reduction of motor skills for the babies, feelings of isolation for parents

Appendix I: Evidence summary of the possible link between neonatal morbidity and single room design

Morbidity	Rationale for effect of single room design	
Necrotising entero- colitis (NEC)	Improved rates of breastfeeding in SR care, and the link between breastmilk and NEC. ^{17,26}	
Intracranial hemor- rhage/periventricular leukomalacia	SR care has been associated with more developmentally appropriate light and sound, and increased parental involvement. ¹³ May decrease apnea, and stabilize cerebral perfusion. ¹³	
Sepsis	Empirical evidence of decreased infection, theoretical support from decreased exposure. ^{13,14}	
Bronchopulmonary dysplasia	RCT level evidence for reduction. May be tied to increased stability resulting in reduced amount and fluctuation in need for inspired oxygen. ^{13,14}	
Neurodevelopment	SR care is more developmentally appropriate (light and sound), enhances maternal-infant non-separation, and facilitates increased parental participation and skin-to-skin contact. Evidence that these factors influence development, and that SR care with high parent involvement improves developmental outcomes measured at 18 months. ²⁰	
Length of stay	Most robust finding across studies has been reduction in length of stay. Potentially the result of increased clinical stability paired with increased parent involvement and resulting confidence in abilities to care for infant. ¹⁴	
Readmission	At least one study found a reduction in readmission, primarily related to a reduction in infections associated with feeding difficulties. This may be explained by increased parental competence associated with SR design. ¹⁴	



Infection in the NICU

Sepsis or infection is the most common reason for neonatal death and poor outcomes. Infections are more common in:

- Premature infants who lack protective antibodies
- Infants with a low birth weight
- Infants with a low <u>APGAR score</u>
- Infants whose mother has certain risk factors

Major NICU Risk





NICU Considerations





- Due to small size of patients, "minor" procedures can pose major challenges
- Immense need for accurate color rendering to identify conditions early (e.g. Cyanosis, NEC)



- Patients' retinas are not fully developed
- Patients need to develop their diurnal (wake/sleep) patterns



- Patients' immune systems are very weak
- Bassinets are mobile and moved regularly – area should be free of hazards



Lighting Needs in the NICU

PROCEDURAL AMBIENT WAYFINDING **Private** (پې ک Open





Procedural Lighting in the NICU



Procedural Lighting in the NICU

The Challenge: Deliver targeted, high-color-rendering illumination for critical procedures on the smallest patients





Procedural Lighting in the Private NICU



Procedural Lighting

Recessed Motorized



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Recessed Non-Motorized







High CRI in Multiple Chromaticities

The difference is **95 CRI** with ultra-high R6, R9, R13 and R15





3 Chromaticities (Color Temperatures)

3500K	Labor/Delivery
Mid-White	NICU
4100K	ICU
Cool White	Cath Lab
5000K	EP Lab
Ultra-Cool White	Hybrid OR



PRO 25: Procedural Lighting in the NICU

Enhanced Visual Acuity

- High color-rendering with Cyanosis Observation Index of 2.7 and CRI of 95+
- Achieves optimal NICU angle of 20°
- Fully dimmable & remote-adjustable

A Safer Environment

- Fully recessed, IP66 rated, with sealed housing
- Sterile and easy to clean with anti-microbial finish

Limproved Patient Comfort

• Dimming to 1% ensures clinicians can use minimum level of light needed to complete their procedural tasks







Spotlight: OU Children's Hospital

- Level IV NICU
- Opened Spring 2022
- 20 Private NICUs
- Procedural lighting: Kirlin INFRALED PRO
- Two fixtures per isolette





Procedural Lighting in the NICU

The Solution: Recessed, high-color-rendering, flexible illumination at proper angles for visual acuity



Recessed Non-Motorized





Spotlight: West Penn Hospital

- Level III NICU featuring natural light & spacious rooms
- Opened April 2019
- 23 Private NICUs, including 3 for multiples (twins, triplets)
- Procedural lighting: Kirlin MRR-07505-3500L
- Two fixtures per isolette





Spotlight: West Penn Hospital

- Level III NICU featuring natural light & spacious rooms
- Opened April 2019
- 23 Private NICUs, including 3 for multiples (twins, triplets)
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- Two fixtures per isolette





Ambient Lighting in the NICU



Circadian Lighting





Ambient Lighting







Spotlight: Children's Hospital Wisconsin

• Level IV NICU

- Phase 2 opened January 2017
- 70 Private NICUs, including several for multiples (twins, triplets)
- Ambient lighting: Kirlin 6" downlight with DALI driver







Spotlight: Children's Hospital Wisconsin

Why DALI?

- Each NICU room features sophisticated audio monitoring
- Small LED lights embedded in the headwall change color to indicate rising noise levels.
- When audio levels reach 55 dB, the LEDs turn amber.
- When noise reaches a critical level of 65 dB, they turn bright red.





More Overnights, More Private Restrooms



CS Mott Children's – Ann Arbor, MI



Children's Hospital of Wisconsin



Wayfinding Lighting in the NICU



Wayfinding in the NICU







NICU Vignettes

Spotlight: New-York Presbyterian

- Level IV NICU with dedicated OR & MRI
- Opened August 2020
- 66 Private NICUs, including several for multiples (twins, triplets)
- Procedural lighting: Kirlin INFRALED PRO
- One fixture per isolette





Spotlight: West Penn Hospital

- 2 Fixed exam lights positioned at each isolette for clinical staff
- Ambient downlights in the family zone for parents to be able to control as needed
- Windows to help babies with circadian rhythm





Spotlight: Good Samaritan







Lighting Needs in the NICU

PROCEDURAL AMBIENT WAYFINDING **Private** INFRALED" PRO Open



A Legacy in Healthcare Lighting









Join Us Every Month, or On Demand!





Questions?

