

NICU LIGHTING DESIGN

responding to the diverse lighting needs of NICU users

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SRG is redesigning a NICU (Neonatal Intensive Care Unit) for a major healthcare provider in the Portland, OR metro area. This is an intensive care unit for babies born prematurely and up to 6 months of age. The space is in an existing hospital and has previously been used as an NICU. For the last several years it was being used as overflow office space, but now is being remodeled and re-commissioned as an NICU. The healthcare provider who owns the hospital recently realized that this could be a value-added service for their business model.

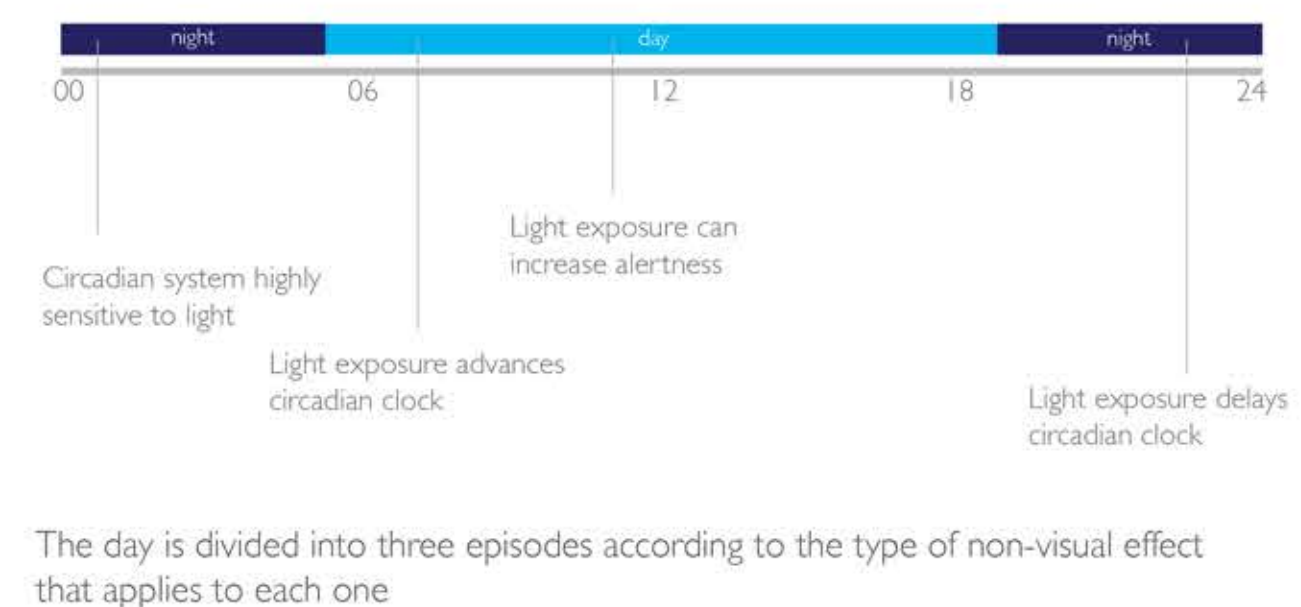
This paper focuses on two factors that affect the design of the NICU project. First, it researches circadian day/night cycle lighting for the spaces serving the infant patients, their families, and the hospital staff. Second, it researches and model possible daylighting strategies for the space along with any supplemental electric lighting as required. Research has shown that babies should not be in direct contact with any light source so as to develop best in a dark space. However, the parents need daylight or daylight simulation that stimulates a natural circadian rhythm. This paper provides iterations exploring different techniques based on our research and models of the iterations which then are compared to reach a conclusion.

Unlike pediatric and adult patient care rooms which do require exterior windows for daylight and views, NICU rooms do not have the same requirement. Currently, there are no specific applicable codes requiring natural daylight within the NICU patient rooms other than a general reference of "access to natural light". However, in the last few years, codes have changed to recommend natural light as a way of speeding up recovery and creating a more inviting space for visitors as well as patients. The existing NICU unit, has little available natural light to patient care areas and no natural light to staff work areas. Of the 15 existing NICU patient rooms only six have exterior windows. The challenges in developing a life cycle model of a complex dynamic system with a long service life are explored and the implications for future designs are discussed.

Adult Eyes/Circadian Rhythm

When humans are indoors for long periods of time and without access to the sunlight of the outside world, they start to suffer. This is because human bodies are in-tune to sunlight in a cycle called the circadian rhythm. The human body (particularly eyes) are clued into the sun (or lack of sun) and creates Melatonin which triggers various biological processes based on what time of day it is (morning, afternoon, evening, or night). One of the more obvious and easily felt processes that gets disrupted if humans are not following the 24 hours cycle of the sun is sleep. Jet-lag is a common example of how sleep gets disrupted when humans tamper with the cycle their body is used to. Research shows that not only is sleep disrupted, but that because humans are also putting stress on other body processes and thus setting us up for diseases such as Seasonal Affective Disorder (SAD), Diabetes, Hypertension, Obesity, and Cancer.

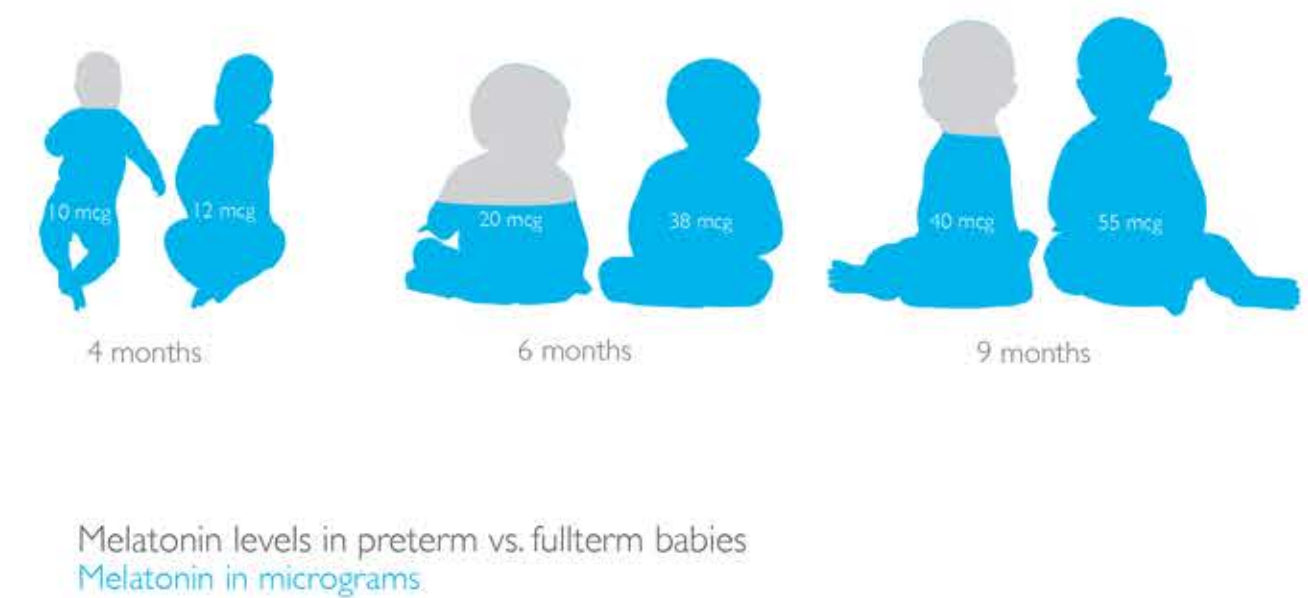
Our research has shown ongoing proof that humans need direct access to sunlight, it comes to reason that we need to design our hospitals so that the workers, patients, and their visitors have adequate access to sunlight at the appropriate times of day. The research project investigates an existing NICU (Neonatal Intensive Care Unit) hospital facility in the Pacific Northwest that has several patient rooms without windows and practically no window access to the the nursing staff areas. The researchers are proposing adding solar fiber-optics to these various spaces that are lacking window access. We would also be providing electrical lighting that will be timed based on the circadian rhythm cycle.



Baby's Eyes/Circadian Rhythms

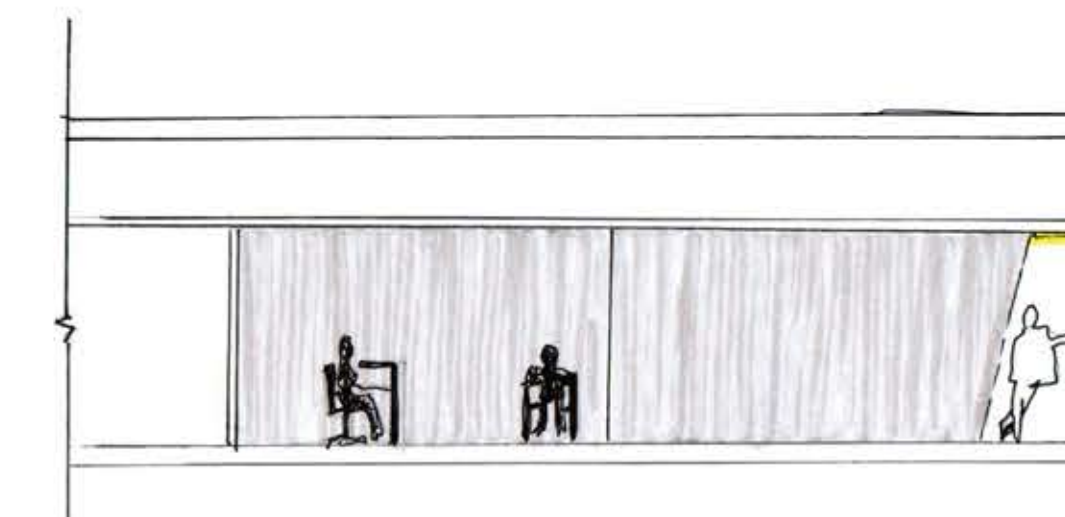
As with any human intervention, good intentions sometimes create new issues. Because we are actually dealing with spaces that are for the preterm infant, they need to delve further into the physiology of this age group. So the question is - how would daylight effect a prematurely born baby? The researchers have found from several interviews and readings the following: "The eye develops in near total darkness - requires it. Further, the immature eye of even 36-or-so week infants has an underdeveloped ability to accommodate to light. A reasonable rule of thumb when designing a space that has to work for many infants is to make near darkness possible for the infant at any time with an ability to add light of variable levels for observation and care." M. Kathleen Philbin, RN, PhD "...Circadian rhythms are present in the womb and affected by the maternal melatonin but outside the womb the brain can establish them not before 3 months of age and for preterms it means corrected age. This is a validated confirmation to Heidi's recommendation on dimming of lighting in NICUs rather than establishing circadian rhythms of lighting before the brain is ready to collect the environmental input." Dr. Sari Goldstein.

The hospitals must be very careful when introducing the sunlight to the patient rooms. The designers, therefore, are only placing any new solar fiber-optic units over the area where the parent/visitor and not directly over the baby's bed. It is now the practice in NICU's that the baby's beds are covered with a thick blanket, which should be expected in this facility. Thus minimizing the impact on the baby's eyes, and help with the visitor and hospital worker.

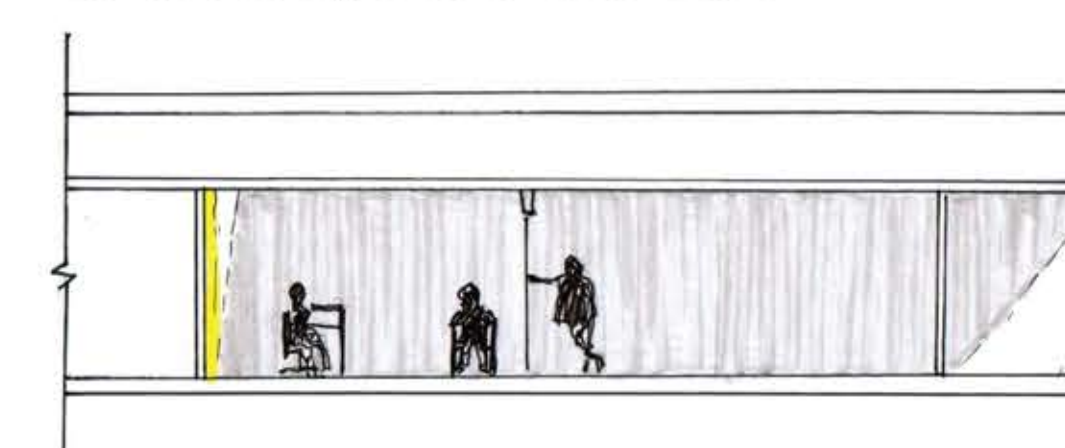


The feedback the researchers got from the Portland Healthcare Facility regarding was that the above design moves were too expensive. The researchers will suggest individual moves that could be made to improve the existing conditions, giving the healthcare facilities the option to chose what moves to implement.

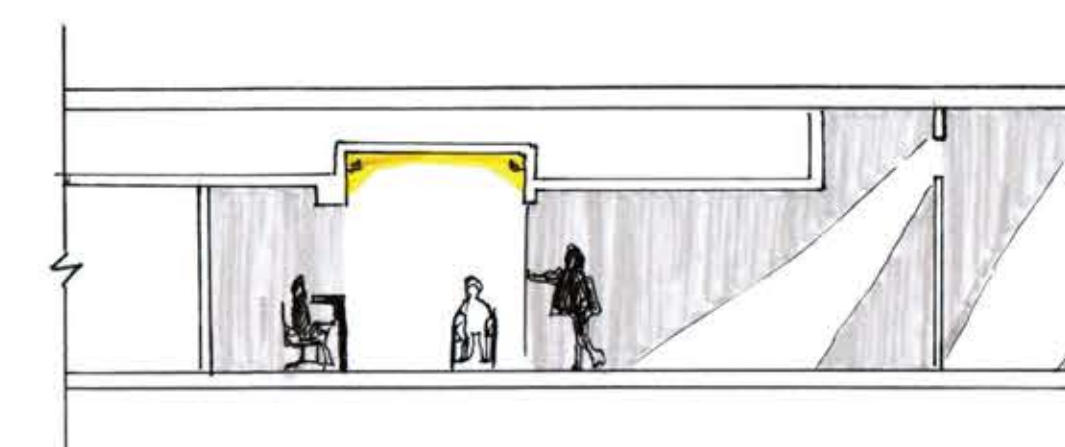
- Wall wash behind the nurses stations.
- Raise the hallway ceilings.
- Controllable task lighting for nurses' desks.
- Fiber optics but only for rooms with no windows.
- Color change for hallway and desk area.



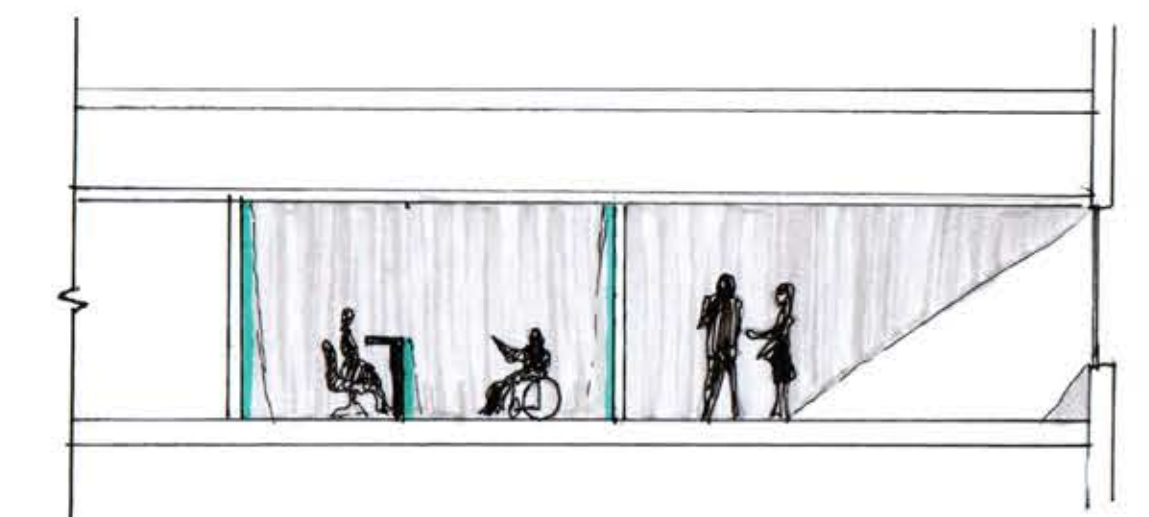
fiber optics but only for rooms with no windows



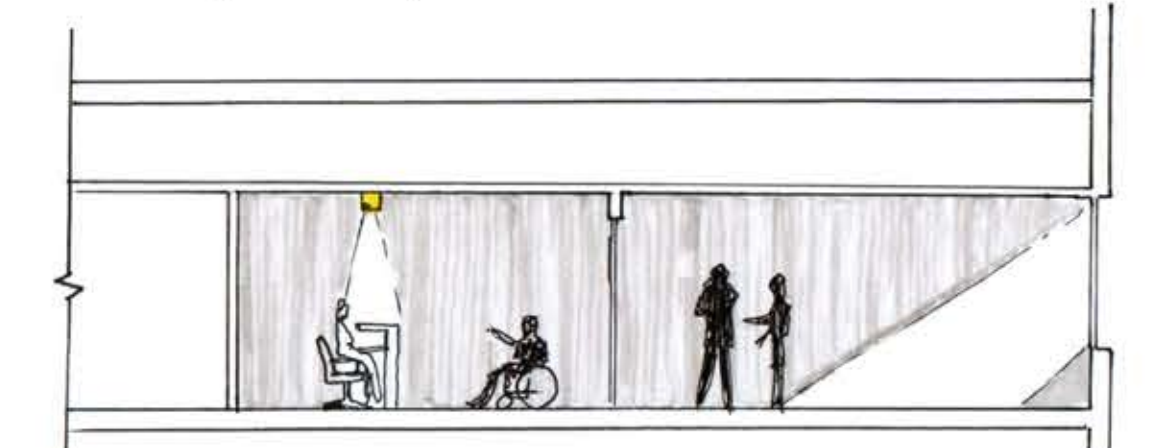
wall wash behind the nurses stations



raise the hallway ceilings



color change for hallway and desk area



controllable task lighting for nurses' desks



raise the hallway ceilings - AGI 32 sample rendering

