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Perspectives on the NICU Environment

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Life experiences have a way of changing people - personally and professionally. Our way of thinking - our 'perspective' - evolves from mechanical interpretations to intuitive perceptions, and in the process, we discover new meaning and significance.

Scott Radcliff's family experience in the Neonatal Intensive Care Unit (NICU) will forever influence his career in the planning and design of healthcare environments. Over the course of 63 days in the NICU, he developed a different, intimate understanding of the spaces.

As high-stress, high-performance areas, Neonatal Intensive Care Units must support the care of premature and critically ill newborns, as well as accommodate family and caregivers. With multiple parties in a confined area, challenges of space and privacy, in addition to other factors can contribute to frustrated parties. In an environment where every action is urgent, reducing environmental stressors is imperative.

A successful NICU design enables observation, encourages communication, and allows privacy. It also mimics a safe, nurturing haven, much like a mother's womb. A designer must know and understand each end user when creating a space plan. The wrong lighting level could disrupt an infant's circadian rhythm. Lack of privacy might deter parent/child bonding. Poorly placed equipment can delay a critical action. Each user has individual needs, yet fulfilling them is a delicate balance.

How can a designer juggle multiple expectations and needs? Where does one begin the design process? Through a series of observations and considerations, this article explores architectural considerations for future NICU facilities reinforced from Mr. Radcliff's personal experience.

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Perspectives on the NICU Environment

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Life experiences have a way of changing us – personally and professionally. Our way of thinking – our perspective – evolves from mechanical interpretations to intuitive perceptions, and in the process, we discover new meaning and significance.

That said, my family's experience in the Neonatal Intensive Care Unit (NICU) will forever influence my career in the planning and design of healthcare environments. During the 63 days in the NICU, I developed a new understanding of these spaces.

NICUs are high-stress, high-performance areas. Centers for premature and critically ill newborns, NICUs must also accommodate family and caregivers. With multiple parties in a confined area, issues of space and privacy, in addition to other factors, can contribute to mounting frustration. In an environment where every action is urgent, reducing environmental stressors is imperative.

A successful NICU design enables observation, encourages communication and allows privacy. It also mimics a safe, nurturing haven, much like a mother's womb. A designer must know and understand each end user when creating a space plan. The wrong lighting level could disrupt an infant's circadian rhythm. Lack of privacy might deter parent-child bonding. Poorly placed equipment can delay a critical action. Each user has individual needs, yet fulfilling them is a delicate balance.

How can a designer juggle multiple expectations along with the latest technologies? Where does one begin the design process? This article explores architectural considerations reinforced through personal experience. It is a compilation of observations and suggestions for NICU facilities of the future.

Our Story

My wife, Shannon, was six months pregnant with my second daughter when we were out of town for my grandmother's funeral. Before the weekend was over, Shannon went into pre-term labor, and I found myself standing outside an operating room while my wife was being prepped for a Cesarean section. I did not know if either of them would survive. Both of them did, however, we still had a long journey ahead of us – after all, Hannah

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was born at 26 weeks (full-term babies are born at 40 weeks), weighing 2 lbs. 1 ounce at birth and dropping to 1 lb. 10 ounces after only one week. The three of us spent a total of 63 consecutive days in a NICU, 300 miles away from home, doing everything that we possibly could to help our daughter survive.



Hannah Radcliff – six hours old

Lessons Learned: Planning and Design

My wife and I learned many life lessons during the 63 days we spent in the NICU. Additionally, I now have a unique perspective of how hospital designs affect patients, families and caregivers. The remainder of this discussion will be centered on the practical planning and design of NICUs.

Provide the Right Space

Patient: *As you enter the world of a NICU, your focus is tuned into the incubator where your baby is laying. This is the sole purpose of the space – to keep that baby alive and give it the best chance of survival.*

- *Position the incubator to support interaction between the baby, caregivers and family.*
- *Enhance observation of the incubator from various points within the room.*

Equipment: *There is a tremendous amount of life support equipment that is required to keep these babies alive. Knowing what equipment will be used is critical to planning the space. Hannah lived in an incubator for 75% of her stay and a small crib the rest of the time. She was intubated on a ventilator for a day, was on a Continuous Positive Airway Pressure (CPAP) machine for five weeks to regulate breathing and develop lung function, hooked up to*

a vitals monitor for the duration of her stay, and periodically required a nasal cannula. Knowledge of the space requirements for each of these pieces of equipment must be considered.

- ***Plan each patient station for a worst-case scenario.***
- ***Diagram all equipment so that spaces accommodate activities and equipment.***

Family: Each parent had complete access to the nursery, along with two additional visitors, for a total of four people.

- ***Determine space around the incubator by considering the maximum number of visitors and plan accordingly.***
- ***Enable the family to actively participate in care of the newborn.***
- ***Give consideration to overnight accommodations for parents, as well as times for bonding with the baby.***

Caregivers: There will be times when two caregivers and all four family members are in the same space at the same time.

- ***Provide enough space so that nurses have access to both sides of the incubator in case of an emergency.***
- ***Promote easy access to hand washing locations, supplies, linens and charting locations.***
- ***Distribute medical gas and electrical outlets within easy-to-reach locations which are not obstructed by equipment.***
- ***Incorporate staff respite areas.***

Rounds: Every morning, the neonatologist, along with a multidisciplinary team of four to 20 people, makes rounds in the nursery. The group stops at each station and discusses the care plan for each neonate.

- ***Establish adequate space for this multidisciplinary team.***
- ***Accommodate interaction between the family and care team.***
- ***Consider how documentation will occur during this period.***

Understand Parents' Perspective of Time

It may seem strange, but when faced with a crisis, time seems to stop. At that moment in time, nothing else matters. As you walk down that hall for the 90th time, it seems like Groundhog Day, and time does not start again until your baby is out of the NICU. Time is measured by events; days are marked by a nightly ritual of arriving at the NICU and discovering how much weight your baby has gained (or lost).

Anything that takes time away from getting to see your baby is a stressor and is not desirable. Travel distances from parking, elevator trips and security were all perceived as obstacles from seeing our daughter.

- ***Minimize travel distances and unnecessary barriers from parking to nursery.***
- ***Create efficiencies regarding location and proximity between departments.***

Reduce Environmental Stressors

The hospital – and especially the NICU – is a stressful environment. Very few people expect or desire to spend any time – let alone two months of their lives – in a NICU. For many, the experience can last even longer, and many NICU parents describe this experience as "being thrown onto a roller coaster ride." There are moments of relief and joy which can change quickly to fear and anxiety. My wife and I found ourselves asking, "When will this nightmare end? When will my child start breathing again? You mean that I need to make this life-and-death decision in the next 30 seconds?"

NICU nurses are experts in developmental care for the baby and family-centered care for the parents. They play a primary role, and can decrease the parent's stress level by providing information, education and support.

Facility design can hinder or enable efforts to provide family-centered care. A facility can contribute to reduced stress levels, and several suggestions on providing positive distractions and reducing environmental stressors in the NICU are discussed in this article.

Provide Privacy

There is a delicate balance between sound and visual privacy in the NICU. Privacy is important, because critical bonding occurs between parents and baby during this time. Evidence shows that a developmental technique called "kangaroo care" improves the physiologic response. Chest-to-chest contact keeps the baby warm, boosts the baby's immune system and increases respiration. This is a time of intimate bonding that deserves the utmost respect and privacy.

Visual privacy can be as simple as hanging a cubicle curtain around the baby's station or as complex as private patient rooms. While a curtain provides little sound privacy versus a private room, the private room also brings with it a potential to create isolation rather than privacy, which should be taken into consideration when designing this space.

Provide Educational Opportunities

Literature, books and links to internet sites can provide the right information at the right time. Provide a specific location where parents can access information beyond conversations with doctors and caregivers.

Provide Internet Access

Internet access was critical in reducing our stress levels. We provided daily updates to our family and friends via an online service. This enabled us to communicate Hannah's progress to multiple parties at one time, which allowed us to return our focus to her care. In addition to communication, the internet provided a temporary escape as we watched the latest episodes of Grey's Anatomy on ABC.com.

Caregiver Support

Caregivers in the NICU are truly gifted and remarkable people. Twelve hours from the time my wife was admitted, we were told that one of the nurse practitioners who would be caring for our baby after birth was on her way down to our room. We waited 12 hours for her, and we could not understand why it took such a significant amount of time for this visit – that is, until after our NICU stay. The caregivers must prioritize their time minute by minute. If an emergency comes up, they must drop everything they are working on and address the emergency.

When the nurse practitioner finally arrived in my wife's room, she explained the challenges that our baby would face. She also took us on a tour of the NICU where we would live for the next 63 days. This consult was just one of many responsibilities of the nurse practitioner during her 24-hour shifts.

The Staff

The NICU is a high-stress, high-performance space. Caregivers must perform to the best of their ability under extremely difficult circumstances. Their role means life or death for neonates – from delivery to discharge.

It is the designer's role to eliminate barriers and enable caregivers to perform at their very best. Based upon my observations of caregivers' roles and activities, I have developed the following list which I believe should be understood, addressed and when applicable, incorporated into each NICU design.

Parents: Role/Activities - Primary caregivers, ultimate decision makers and integral part of the care team

- Families may be a single parent, mother and father, grandparent, all of the above, or not present at all.

Neonatologists: Role - Primary Decision Maker for Care Plan Activities - Leads interdisciplinary "rounds" to develop the care plan

- Interacts with parents; explains care plans
- Provides on-call consultation for emergencies

Nurse Practitioners: Role - Intermediate Decision Make Activities - Develops care plan recommendations for neonatologists

- Supervises nurses
- Provides intermittent care and on-call consultation for emergencies

Nurses: Role - Implementation of the Care Plan Activities - Provides continual care and emotional support for families and co-workers

- Observes neonate
- Feeds neonate and changes diapers
- Administers medication and checks IVs
- Does charting and provides details during rounds
- Discusses baby's care plan

Respiratory Therapists: Role - Monitors and addresses

pulmonary issues

Activities - Provides continual care

- **Adjusts pulmonary equipment**
- **Fulfills nursing responsibilities during staff shortages**

Social Workers: Role - Addresses/Discusses family needs

Activities - Participates in rounds

- **Meets with families**
- **Provides emotional support**

Housekeeping: Role - Support

Activities - Stocks linens

- **Removes soiled linens**
- **Disposes of trash**

The Right Space...in the Right Location...with the Right

Amenities: Ward vs. Private Rooms

What spaces do caregivers need? NICU guidelines describe required spaces, but designing a NICU does more than understand prerequisites. Sensitivity and understanding of a caregiver's work process is paramount to eliminating environmental barriers and enabling the staff to provide excellent care.

Keeping spaces oriented in the right locations is a delicate balance. Three primary, yet conflicting priorities in the NICU environment are observation, communication and privacy. Nurses must be able to observe a neonate's vital signs, see the baby's color when an alarm goes off and communicate with others in case of emergencies. Observation and communication traditionally suggests an open ward design.

Families often desire and need more privacy and reduced noise levels than a ward design allows, which has led many hospitals and designers down the path of private NICU designs. However, the more privacy a family is given, the greater chance that observation and communication can be compromised. Modern telemetry and monitoring capabilities are amenities that are bridging the gap between privacy and observation. As this technology improves and caregivers become more comfortable with it, families will experience a greater amount of privacy.

The balance between observation, communication and privacy depends upon how space requirements are assembled in the plan. The designer should have a good feel for individual elements in order to create a delicate balance.

A general understanding of functional and adjacency requirements, as well as suggestions for amenities are listed. Each recommendation provides a level of support to the caregiver.

Neonate Station: Large enough to accommodate incubator, multiple family members and caregivers on either side of the incubator

- **Accommodates up to 20 caregivers during rounds**
- **Ranges from 100% private, to pods, or a completely open**

ward

- **Supplies which are conveniently located for each station**
- **Accessible hand-washing sink**
- **Developmental Care calls for environmental factors which include: 1) Light levels, which mimic the daylight cycle to reinforce circadian rhythms; and 2) Privacy for kangaroo care ("skin-to-skin" contact with parents to keep neonate warm, develop immune system, and bond with parents during a time when bonding normally occurs within the womb).**

- **Music therapy and reduced noise levels**
- **Locate all controls for easy accessibility**

Control Desk: Check in for families

- **Security for babies**
- **Accommodates the unit secretary workstation**

Nurse Station: Charting (paper and/or computer)

- **Discussions about care**
- **Access to meds and supplies**
- **Hand-washing sink**
- **Phones with a light or soft ring tone to limit excess noise**

Storage: Medication (Pyxis)

- **Formula and breast milk**
- **Bottles and feeding supplies**
- **Equipment**

Procedure Room: Used for circumcision and other minor procedures

Family Amenities: Easy parking and access to the NICU

- **Restrooms located close to the NICU**
- **Overnight accommodations for family**
- **Consult Room**

Additional Spaces: On-call rooms

- **Offices**
- **Staff retreats**
- **Staff lockers and lounges**

Putting It All In Perspective

As my daughter approaches her second birthday, my perspective continues to grow and develop along with her. Her life has breathed new life into my designs, and I am grateful for both.

Aultman Hospital - 2010 Project

As part of Aultman 2010 – a project completed by Ohio healthcare designer, Hasenstab Architects – single-room NICUs were developed, exemplifying many of the concepts discussed in this article, including:

- **Level III classification, which cares for the tiniest and most high-risk newborns**
- **25 private NICU rooms, each 160-SF**
- **Spaces can be made into suites for multiple birth families**
- **Customized features such as lighting and heating**
- **Reduced noise level (to approximately 50 decibels) with**

fully carpeted areas, special ceiling tiles and unique unit layout with all staff "noise making" activities behind closed doors

- **Four nurse stations which serve six to seven babies each**
- **Family sleep room**
- **Family area which features a home-away-from-home atmosphere with refrigerator, microwave, coffee maker, fireplace, computer stations and children's play area**
- **Families have access to a clothing washer and dryer**



Aultman Hospital photo by Scott Pease Photography

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