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A Single-Room NICU-The Next Generation Evolution in the Design of Neonatal Intensive Care Units

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Background

The care of premature and sick neonates has come a long way since Dr. Martin Couney developed a controversial model in the late nineteenth and early twentieth centuries of exhibiting and caring for neonates at various expositions and fairs to raise money for their care. Hard to imagine in today's medical environment under Health Insurance Portability and Accountability Act (HIPAA) regulations. Neonatal Intensive Care Units (NICUs) were developed in the 1960s as the emergence of new technologies such as ventilators for mechanical breathing, fetal monitoring, and amniocentesis required a special environment to care for neonates. Since then, perinatal and neonatal medicine has advanced exponentially, greatly decreasing the mortality rates for infants with low birth weight and abnormalities.

Recent social and demographic trends have contributed to the increase in the number of neonates needing special care. Teenage pregnancies and pregnancies with drug abuse and neglected perinatal care have led to neonates with abnormalities. Fertility medicine techniques of implanting multiple eggs to boost the chances of pregnancy have led to multiple births and low birth weight neonates requiring critical care. There is also evidence of the benefits of family-centered care. Technological advancements in perinatology have affected the design of neonatal intensive care units. Organizations such as the Newborn Individualized Developmental Care and Assessment Program (NIDCAP) focus on educating NICU staff in the skills needed to provide care in a neurodevelopmentally supportive, individualized, and family-centered framework.

NICU, Levels of Care, and Current Standards Defined

The definition of NICU has been a matter of considerable debate. The codes and standards that define the level of care for the newborns include terms such as "special care nursery," "continuing care nursery," and "NICU." The recommended standards for NICU design, endorsed by several neonatal and perinatal organizations, define "newborn intensive care" as "care for medically unstable or critically ill newborns requiring constant nursing, complicated surgical procedures, continual respiratory support, or other intensive interventions." NICU care is expensive and requires the commitment of specialty physicians, staff, and facilities. This has led to the regionalization of NICU locations to serve the entire U.S. population.



Figure 1: An open plan concept at Children's Medical Center of Dallas

Evolution of NICU Configurations

Open plan concept

Early NICU configurations incorporated open plans for up to 30 neonates positioned along a service counter and headwall system. Some designs divided the plan into two or three high-risk and low-risk areas. The intent was to deliver as much care as possible without moving the neonates. Access to the patient area was restricted, keeping viewing corridors on the perimeter. Because a neonate's immune system is fragile, parents were allowed inside on a limited basis and only after scrubbing and gowning.

Open modular plans with cubicle curtains

NICUs of the next generation were designed with modules of six to eight neonates, separated either by cubicle curtains or by walls that allowed staff observation while offering some privacy. The advantage of the modular layout was staffing efficiency, with the ability to close and open modules as needed depending on the census. One or two private rooms were provided for training the parents for transition to home. Parents participated in the care of their babies. However, their accommodations within the care area were minimal and did not offer privacy.

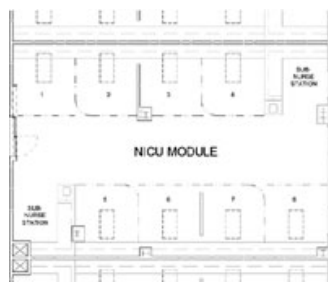


Figure 2: A modular NICU configuration at Baptist Medical Center, Montgomery, Alabama

Pinwheel configuration

The advent of test-tube babies (conceived either through in vitro fertilization [IVF] or gamete intra-fallopian transfer [GIFT]) in the 1980s and advances in reproductive medicine during the 1990s increased the number of multiple births and low-birth-weight babies. During this time, the desire for, and benefits of, family participation in the care of their babies were realized. Infection control issues were addressed with increased filtration and frequency of air changes. The NICU configurations, using pinwheel or other layouts with partitions and headwalls, provided more privacy for the family and the neonates while allowing staff to observe several neonates at a time. Overall space requirements increased due to the need for additional circulation areas and inclusion of family facilities such as lounges, parent teaching areas, breast pump rooms. Parents' sleeping accommodations were in a separate area, either in a dormitory style or with private rooms.

A Case for Individual Private Neonatal Care Rooms

A move toward family-centered care and a more consumer-focused orientation have resulted in the widespread use of individual private rooms for obstetrical services, universal patient rooms, and outpatient surgical preparation and recovery. In the continuing evolution of NICU design, there is a need to address infant and family privacy and flexibility to provide the entire spectrum of care without moving the baby. Individual private rooms provide the best setting for the NICU of the future, with substantial benefits according to many neonatologists, nurses, and support staff.

Compliance with patient and family privacy requirements under HIPAA

The Health Insurance Portability and Accountability Act (HIPAA) passed by Congress in 1996 has a speech privacy rule, "Standards for Privacy of Individually Identifiable Health Information," that went into effect on April 14, 2003. Acoustical and speech privacy at hospitals is a significant issue that needs design consideration. This is especially important for neonates who may potentially develop disabilities. Individual private rooms are the only reasonable way to meet the acoustical privacy requirements under HIPAA. Private rooms also give families the privacy to participate in the care of their neonates on a continual basis.



Figure 3: Mother and family spaces are provided through a modular plan with partial walls at Utah Valley Regional Medical Center, Provo, Utah

Flexible, adequate space to deliver specialized care to each neonate in one place

The intent of single-room NICU design is to maximize efficiency by enabling performance of all care and needed procedures in one room. A single room provides adequate space and flexibility for critical care as well as transitional care, which prepares parents for home care of neonates. The single-room approach reduces costs related to transporting the neonates and increases physician and staff efficiency.

Infection control

The NICU is one of the highest-risk areas for developing infections due to the babies' immature immune systems. Particulate matter tends to move freely in an open space despite best efforts in locating diffusers and exhausts. Isolating neonates from each other and from outside sources of infections has proven to be most effective for infection control in NICUs. A private-room NICU provides the best isolation for neonates.

Complete control over environment

Constant bright lights in an open-plan NICU can be harmful to babies. The NICU needs a variety of lighting levels to regulate neonates' biological rhythms, perform procedures, and ensure the psychological well-being of staff and families. Similarly, control of background noise and temperature for each neonate and family is desirable to suit their individual needs. A single-room NICU provides complete environmental control, with an individual thermostat to regulate temperature, a door to block the noise, an exterior window, and blinds to control lighting levels.

Optimal family involvement in caring for babies on a continual basis

Active participation of parents in the medical care and decision making for their neonates fosters development of the parent-child relationship and helps parents learn to take care of their babies. Parental access to their newborns is recommended on a 24-hour basis. The traditional approach provides facilities for parents to stay overnight adjacent or close to the NICU. Generally, these limited facilities cannot accommodate every parent. Single-room NICUs provide the best setting for family-centered care by providing an area for each family adjacent to the neonate. The increased area for the single room is offset by the elimination of parent sleep rooms within or adjacent to the unit.

Improved clinical outcome and customer satisfaction

Limited experience with single-room NICUs has shown that close participation of parents in their child's care has shortened hospital stays and reduced readmission rates. More data are needed to provide clear evidence of the positive clinical outcome of single-room NICUs. Based on the customer satisfaction with, and success of, single-room maternity care and outpatient surgical care models, there is ample evidence that single-room NICUs will increase customer satisfaction and become the industry norm in the future.

Design Solution

While private rooms offer recognized benefits in terms of family-centered care and comfort, use of single-room NICUs has been limited, largely due to perceptions that they will increase space requirements and decrease staff efficiency. A need exists, therefore, to develop NICU configurations based on the private-room model and using appropriate configurations and communication technology to mitigate the perceived inefficiencies. Below are some strategies to develop single-room NICU designs.

Size and configuration

A single NICU room of 200 square feet provides adequate space for caregivers to deliver critical care while giving the family "a home away from home." A room 9 to 10 feet wide with a flat headwall provides enough space around the infant bed for equipment and caregivers. Keeping the width to a minimum helps to achieve an efficient layout, with rooms around the perimeter that provide windows to each room. Experience has shown that the single-room NICU configuration requires less circulation area than the pinwheel or modular configuration. While the rooms are larger, the space requirements are reduced because no parent sleep rooms are needed. Overall, the single-room design does not increase the total space needs significantly.

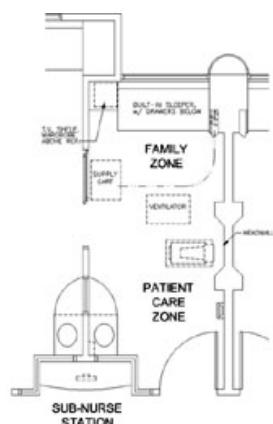


Figure 4: Plan for a 200-square-foot single NICU room at Clarian North Hospital, Indianapolis

Staffing efficiency

The greatest resistance to the single-room NICU is based on the perception that it would require more staff because they could not observe all neonates at all times. It is imperative that the single-room NICU use communication technology to mitigate the perceived need for more staff. Today's advanced monitoring, surveillance, and nurse locator systems immediately notify staff of patient activities and allow access to patient information—even from a remote location. In addition, a nurse work alcove can be provided outside each pair or group of rooms, allowing nurses to interact and work together as a team.

Facilities for family-centered care

One of the important benefits of single-room NICU design is that it allows the parents to participate in the care of their baby in privacy to develop the parent-infant bond throughout the critical care phase. This also prepares the parents to care for their baby at home following discharge. Separate parent sleep rooms are not necessary. However, a family lounge, kitchenette, laundry, and toilets with shower facilities should be provided so that parents can continue some of their routine activities.

Accommodation of multiple neonates

Some private rooms should be designed with a sliding door between two rooms to create a suite accommodating multiple babies and the family. This allows both parents to stay with their children on a continuous basis.

Conclusion

The provision of individual rooms for at least some NICU patients is an idea whose time has come (White 2003). The NICU of the future will be based on family-centered care and the new realities of HIPAA regulations to provide privacy and confidentiality. Clarian North Hospital in Indianapolis, a specialty hospital for women and children, is currently incorporating the single-room NICU into its design. It will provide 24 200-square-foot, single-room NICUs, enhanced with exterior views of nature. All of the rooms will provide distinct family, patient, and caregiver zones allowing the best possible care.

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