Gravens By Design: What the Ideal NICU Would Look Like

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It is sometimes hard to imagine the ideal NICU – the concept is still evolving, so there is no one available to visit, and even the elements of what could be optimal are evolving. For example, if this exercise were undertaken a few decades ago, it would be difficult to imagine what the digital transformation might permit – and even now, we cannot predict its full potential. Still, the effort seems worthwhile, not only for those who will soon be building a NICU that will have to meet the needs and expectations of its inhabitants for the next 20-30 years but also for those who cannot rebuild soon but could undertake an interim facelift that would be of value to all its constituents.

A NICU should be welcoming to families

This concept has many elements, starting even before one enters the hospital doors. It is usually easy to find the hospital, especially in the digital age, but there are often many places to park and enter the massive complex where most higher-level NICUs are located. Few people will say that finding their way from the street to the NICU is easy; it is hardest for young parents or other family members coming from an outlying community - often at night and almost always under stressful conditions. Proper signage on the street, at the preferred entrance, and through the hallways can greatly facilitate this first encounter. Written directions, both on paper and a hospital website, can also be helpful and allay anxiety even at the start of the journey.

Many hospitals have a foreboding "front door" because of where they are located, how old they are, and their restrictions to entry, but once one reaches the entrance to the NICU, none of these should be factors. The entrance should be well-lit with an attractive color scheme and devoid of stern signage. An individual to welcome and direct families and visitors should always be available. The décor should have more in common with a hotel lobby than an ICU – spacious, relaxing, and, where appropriate, informative. Both signage and artwork should reflect the diversity of cultures served by the NICU and should address parents as members of the care team rather than as visitors.

This paper is not intended to explore the operational aspect of the ideal NICU, but these are immensely important to how families can be made to feel welcome. I have vivid memories of an old NICU in Madrid where several mothers sat in a circle rocking their premature infants while talking and singing together – a stark contrast to most similar NICUs in much wealthier countries I have seen that were largely devoid of parents and dominated by the sights and sounds of technology. The Madrid parents were made to feel welcome not by the physical environment but by the policies of the NICU, and they, in turn, made it more welcoming to every new family.

The NICU should only separate babies from their parents under the most extreme circumstances

There is now abundant evidence of the value of early and extensive intimate contact of a baby with its parents and the safety of single-family rooms. There is no evidence that separating babies from their mothers for extended periods in the first days of life benefits either baby or parent. The ideal NICU would provide space and caregivers for all mothers after their delivery except for those who require highly specialized care. Likewise, accommodation would be provided for fathers or other support persons that will be sufficient for their comfort over extended periods.

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A NICU should present sights and sounds to all inhabitants that are nurturing rather than stressful

There was a point in the early NICU days when audio alarms and bright lights were imperative, but we have known how to minimize these stressors for decades now. Most alarms can be transmitted electronically and visually, a technique learned in every other part of the hospital and adopted in some NICUs as early as the 1980s but has only recently achieved widespread acceptance and is still not a reality for some NICUs. Similarly, there was a time before the advent of transcutaneous oximetry when constant bright lights were needed to assess skin color and perfusion. However, the pendulum swung to a constantly dim environment based on the premise that this was the expected environment *in utero* and, therefore, safer and less stressful for premature infants. This belief has persisted long after it was disproven (1); it is past time for the pendulum to swing back to a middle ground where babies are presented with a circadian rhythm for lighting while still protected from direct light sources.

Adult caregivers and families need appropriate lighting as well. Lighting should be of sufficient intensity and the proper spectrum to provide a circadian and alerting stimulus for caregivers (2) and a welcoming signal to families. In contrast, lighting levels and spectrum at night will minimize melatonin suppression in caregivers while still supporting alertness.

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Daylight and views of the outside world and nature provide a substantial psychological benefit to many adults. However, most NICUs will not have an opportunity to improve access to these features until new construction occurs because of the misguided belief in past years that because babies did not need access to daylight, their caregivers and families did not need it either. The ideal NICU will provide windows in almost all spaces where adults spend extended periods during the day. Even hallways should have a window on at least one end rather than closing off that vista by making an office a little larger or for storage space. In the meantime, attention to the visual environment remains even more important. The walls of NICUs have the potential to be palettes conveying subtle messages through artwork, photos, and stories of NICU grads. Even ceilings and floors have been used creatively to provide additional opportunities for the eye to find the color, whimsy, distraction, and information.

Sound control has been difficult to achieve in many NICUs, even after monitor alarms were tamed. For many NICUs, there are still too many sources of noise and too few sound-absorbing surfaces. There are now alternatives to the hard flooring that transmits and reflects the sound of everything that moves across it, for example. All surfaces should absorb more noise than they generate. HVAC systems were often designed in an era when high airflow was recognized as valuable but not understood as an important source of ambient noise, above which all other desirable sounds such as voices and even monitor alarms must be heard. Design or redesigning these HVAC systems to be quiet and where air can be extensively cleaned and filtered are overdue for many NICUs.

Infection control can be improved in most NICUs

Nosocomial infection continues to be a frustratingly common complication of neonatal intensive care. Something as basic as a handwashing sink is often designed to fail and, even when well-designed, can be misused in a way that contributes to ongoing contamination of NICU surfaces. The ideal NICU will have sinks readily accessible in all patient care and support areas; these sinks should be hands-free, large enough for cleaning hands and forearms, have drains that are offset from the faucets, rims that do not permit objects to be placed on them (and thereby contaminated), splash guards to protect adjacent areas from splatter, quiet paper towel dispensers, and should be handicapped-accessible.

Among new sanitizing techniques being explored, ultraviolet light in the UV-C spectrum has been demonstrated to reduce bacterial and viral presence in circulating air and on certain devices, including hand-held communication devices. There is also increasing evidence that UV-A can be used to reduce contamination of surfaces in occupied spaces (3).

Support spaces should provide respite and support for families and caregivers

In many NICUs, support spaces for caregivers and families are cramped and windowless. These spaces would be large and relaxing in the ideal NICU with abundant daylight and access to an outdoor garden. Likewise, there would be smaller individual spaces that provide privacy and an opportunity to nap, pray, exercise, or do yoga.

The patient care space should be a home away from home for those families who desire it and those babies for whom it is appropriate

This principle comes with qualifiers. Babies whose families rarely interact with them may benefit from being in a shared space with other such babies. A few families prefer being in a space where their baby can be easily seen by caregivers, although this often is based on a misunderstanding of how little we can tell about a baby when we are not directly at the bedside and how much we depend on monitors to provide us information about a baby's status. Most families, though, appreciate a space they can call their own with comfortable seating, a private sleep surface and shower, a refrigerator, and the opportunity to personalize the space with decorations suitable for the baby and the season. Even in a more open setting, parents should have the opportunity for privacy, especially for breastfeeding and skin-to-skin care and space to store their personal belongings.

"To some extent, this is an unreachable goal – walls will get nicked, floors will get stained, equipment will look worn. However, accumulating items in hallways and on counters and signs taped to walls or doors is not inevitable. Instead, it is tolerated mainly by people who get desensitized to its presence and forget that for families in this crucial moment, it announces a lack of attention to details and cleanliness that we would not tolerate in other public venues or indeed in our own homes if we were expecting visitors."

The ideal NICU should look better than the day it opened

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