

Flooring choices for newborn ICUs

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Floors are a major element of newborn intensive care unit (NICU) construction. They provide visual cues, sound control, and with certain materials, some degree of physical comfort for workers. Flooring materials may entail a significant cost for installation and upkeep and can have substantial ecological impact, both in the choice of the flooring itself, as well as the substances used to clean it. In this article the important aspects to consider for each factor are explored and recommendations are offered for appropriate choices in various NICU areas.

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Introduction

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Important aspects when evaluating flooring

Durability

Current NICU designs have predominantly utilized the ‘ward’ concept with several patients in the same room. This leads to high traffic in at least some parts of the room and makes replacing flooring material a challenge, since these rooms are rarely empty under normal operating conditions. Highly durable flooring is crucial in this setting since replacement is likely to cause significant disruption to patient care. In the single-family room designs that are becoming increasingly popular, traffic tends to be less concentrated and individual rooms can be more readily taken out of service so durability becomes less of an issue, but the optimal flooring is still one that will retain an attractive

appearance throughout the typical 15- to 25-year life span of an NICU.

Cleaning

Infection control is crucial in the NICU, so a flooring material for patient care areas that can be easily cleaned is essential.¹ Because the patients in an NICU are also vulnerable to adverse reactions to noise and fumes generated by cleaning activities, it is important to consider how those factors will be affected by the choice of a flooring material. There are also significant differences in the environmental and economic impact of cleaning various types of flooring that should be considered to be even more important than their initial cost and environmental impact. For all these reasons, those individuals who will be responsible for maintaining the flooring over its life span should be integrally involved in the selection process.²

Appearance

All typical floorings used in the NICU can be installed in attractive colors and patterns. Some have a more ‘institutional’ look than others, but this can be allayed by the use of wall finishes and furnishings that may offset the ‘sterile’ feeling conveyed by an NICU that consists entirely of industrial materials chosen primarily on the basis of their durability and cost rather than aesthetics. Stain resistance is an important aspect for flooring that will be used where spills of blood, iodine-containing compounds, or other such materials are common. Flooring materials can also play an important role in assisting visitors with way finding by incorporating colors, symbols, and other devices along with appropriate signage.

Comfort and sound control

Flooring materials can have a noticeable impact on the comfort of caregivers who may be standing or walking for most of an 8- to 12-h shift. Those materials that have some ‘cushioning’ effect are considered more desirable by staff. When considering comfort of the caregivers, it is also important to choose flooring materials that do not have a highly reflective surface (low-glare).³

The same resiliency that provides a cushioning effect in some types of flooring tends to confer sound reduction capability as well. Although sound absorption is negligible with all commonly used flooring materials, the noise generated by impacts (for example,

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dropped items, rolling equipment and high-heeled shoes) can be reduced by resilient flooring.

Environmental impact

Choosing materials that minimize the impact on the environment is of growing interest and importance.⁴⁻⁷ The optimal flooring material is one that is made from nontoxic renewable material, manufactured close to where it is used, using a manufacturing process that does not generate toxic materials or use large amounts of energy, and that can be cleaned with nontoxic substances. A resource will be available soon for the manufacturers to report the sustainable properties of their products.⁸ The experience of the Kaiser Permanente Group of Hospitals in choosing flooring materials for their system has recently been chronicled and is instructive, both in the materials used and in the salutary effect that specifying nontoxic materials had on the flooring industry.⁹

Safety

The ideal hospital flooring should be slip-resistant and able to absorb some degree of impact if a fall does occur. These qualities are most evident for carpet, wood and rubber flooring, although improvements have been made in vinyl flooring in recent years to improve slip-resistance, and use of a resilient subfloor rather than concrete is helpful as well. Stone, ceramic tile and concrete flooring materials are less desirable and should be used in areas of minimal traffic, if at all.

Typical products: how do they meet these needs?

Linoleum

Linoleum products have become more popular recently because they are inexpensive and their environmental impact is lower than that of vinyl products. In higher traffic areas, linoleum needs frequent cleaning and waxing to maintain a good appearance, however, and it is not as durable or safe as most other flooring products.

Vinyl

This was the product of choice for hospital floors for many years, but usage has become less common in recent years, largely because toxic substances are often released during its manufacture and care, and perhaps even during everyday use.¹⁰ A clean vinyl floor can be very attractive, but in high-traffic and high-noise areas, its need for frequent maintenance, lack of comfort and absence of acoustical value are significant disadvantages. The industry has begun to address the concerns about environmental impact, so careful search can yield acceptable products for certain parts of the NICU that use recycled materials which do not need to be waxed and are slip-resistant.

Cushioned vinyl

Vinyl floor coverings with a resilient undersurface present the same environmental concerns as hard vinyl flooring, and additionally

may retain depressions (dents) for a period of time where heavy equipment has rested for long periods. While they are more comfortable to walk and stand on and have some acoustical value compared to hard vinyl, the disadvantages make this type of flooring less desirable than other types in any area of the NICU.

Carpet

Carpeting has definite advantages as a flooring material, but also significant downsides. It is attractive and less institutional-looking than most other flooring materials, is comfortable to walk or stand on, and reduces noise generation from traffic moving across it. On the other hand, it is high-maintenance, requiring daily vacuuming and immediate cleaning of spills, as well as regular deep cleaning with substances that may release unpleasant fumes for 24 h or longer, and the typical life span is less than 10 years in high-traffic areas. NICU carpet should be hospital-grade with heat-welded or chemically welded seams and an impermeable backing that is latex and polyvinyl chloride-free, and should be fully recyclable. Maintenance expectations should be clearly articulated with the hospital's housekeeping department in advance of specifying this product. Further information on choice of vacuum cleaners specifically related to their use in the NICU is available.¹¹

Rubber

Rubber flooring is the most rapidly growing choice in newly constructed NICUs due to its ease of cleaning and highly durable nature. Choices of colors and other features are rapidly increasing in this segment, and although the initial cost of installation is high, its other features (comfort, acoustical qualities, resistance to staining, recyclable and low emissions) easily outweigh the up-front economic factor for most patient care area uses. Most current rubber flooring products for hospital use are latex-free, and should either use recycled materials or be fully recyclable.

Others

There is a large number of other flooring choices that have not been often utilized so far in NICU settings, but may be worthy of consideration for new construction in at least some areas of the NICU. These include epoxy, laminates, wood, stone/granite/marble, concrete, porcelain and ceramic tile, and resilient urethane.

Recommendations based on area of use

Patient care areas

Key features include infection control, sound control, comfort, aesthetics, ease of maintenance with low emissions and durability. Rubber is the best-available option for these considerations at the moment, but resilient urethane flooring (Stonhard) and other new products may soon offer comparable or superior alternatives.

US suppliers of hospital-grade rubber flooring include ECOsurfaces, Estrie, Flexco, Mondo and Nora. Large NICUs that have had rubber

Table 1 Summary of flooring considerations

Flooring type	Initial cost	Durability	Comfort/sound control	Environmental impact	Maintenance cost	Suggested use in NICU
Linoleum	Low	Medium	Poor	Good	Medium	Supply areas
Vinyl	Low	Medium	Poor	Fair	Medium	Supply areas
Cushioned vinyl	Low	Medium	Fair	Fair	Medium	None
Carpet	Medium	Low	Good	Good	High	Public areas
Rubber	High	High	Good	Very good	Low	Patient care areas

Abbreviation: NICU, newborn intensive care unit.

flooring installed include the Monroe Carell NICU at Vanderbilt and the Winnie Palmer NICU in Orlando.

Public areas

If sufficient housekeeping support is available, carpet is an excellent choice for at least some public areas because of its aesthetic value. Wood laminate is another option worth considering because of its noninstitutional look, but as with carpet, maintenance challenges must be addressed before this choice is made. For public areas where sound control and low emissions of cleaning fluids are important considerations and carpet or wood are not chosen, rubber flooring is a better alternative than vinyl.

Support areas

In these areas, acoustical and aesthetic considerations become less important, leaving cost as a primary consideration; linoleum or a carefully selected vinyl product are suitable choices (Table 1).

Summary

Too often, the choice of flooring for an NICU is based on the sole considerations of initial cost and ease of maintenance. When all pertinent aspects of flooring performance are considered, however, the true picture of the economic, human and environmental impact of each option can be properly evaluated. The choices that result from this more careful analysis may have a higher initial

cost or require more upkeep, but can offer aesthetic, ergonomic and sensory benefits to those who will live and work in the area for many years after.

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