Sound Control in the NICU

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Introduction

Sound is one of the most pervasive stimuli in the NICU. There is the hum of activity, intermittent alarms, and conversation – sometimes cheerful, usually businesslike, occasionally terse and concerned. For the premature infant, it is qualitatively different, and also perceived quite differently from that experienced in utero since it is transmitted through an air medium, rather than the maternal tissues and the amniotic fluid. Because a substantial degree of auditory development and learning occur during the last trimester, the issue of sound control in the NICU is crucial in efforts to optimize the environment of the preterm infant. Furthermore, excessive, unpleasant sound (“noise”) can interfere with infant sleep, itself an important developmental task of the ill infant, and can induce stress and decrease performance of the babies' caregivers.

The intensity of sound is expressed in decibels (dB) and measured on a semi-logarithmic scale, which means that an increase of about 10 dB represents a doubling of the sound intensity. Frequency is an additional important characteristic of sound; the many permutations of sound intensity and frequency pertinent to the NICU are nicely summarized in a recent article by Gray¹, as part of an entire supplement on the effect of environmental sound on the fetus and newborn.²

The current recommended standard³ calls for NICU sound levels to remain below 50 dB the majority of the time. At this level, infant sleep is usually not disturbed by excessive noise, and staff can communicate and work without the stress of high noise levels.

It is easiest to achieve adequate control of sound in the NICU when the unit is designed and built “from scratch”. Much of the “background” noise in a typical NICU comes from the building itself – audible sound or vibrations from activity outside the hospital and from machinery within the hospital, and sounds generated by airflow through the heating, ventilation, and air conditioning system (HVAC). Without sufficient attention to these sources, the background noise in a NICU, even before any equipment or personnel are brought, in can be greater than 40 dB, but with care
doors or walls, and walls with openings of any significant size are of limited value in reducing sound transmission, whereas full-length, insulated walls are very effective, but can only be used where visual contact is not essential.

Finally, it is important to consider the everyday activities in the NICU that generate sound and find ways to moderate or eliminate them. Monitor alarms, for example, can be transmitted visually, or wirelessly to personal pagers. Intercoms can usually be eliminated by locator systems and/or by supplying each staff member with a wireless phone. Noisy conversations, such as those that occur at the change of shift, can be moved away from the bedside by good floor plans (and sometimes a change in practice or policy); likewise, the noisy traffic of personnel and diagnostic equipment should be carefully planned to avoid affecting the sound level at the babies’ bedsides as much as possible.


What are the best strategies for sound reduction if new construction is not possible?

Many NICUs constructed before the late 1990s are noisy, with typical sound levels well above the recommended standard. New construction is not always feasible, but there are many interventions that can help to reduce the sound level for both infants and caregivers.

First, staff should carefully evaluate where the loudest, most unpleasant sounds are being generated. Most NICUs were built to utilize auditory signals as the primary method of transmitting information (ie, equipment and monitor alarms and general communication [intercom, telephone ringer]). In addition, many usual work activities, such as equipment movement and conversation, generate substantial amounts of sound. Changes in the unit’s practices can yield significant reduction in sound levels without requiring any financial investment, and upgrading monitoring and communications equipment to utilize wireless phones and pagers can also be done without new construction, although there is certainly a substantial cost involved. Minor renovations can also yield considerable benefit in sound reduction; adding acoustical ceiling tile and soft flooring, for instance, is likely to reduce sound levels by several decibels, based on unpublished studies we have done. If infants are usually cared for on radiant warmers in a NICU where sound levels are above 60 dB, placing them in incubators as soon as possible is another strategy to somewhat reduce the ambient sound level they are exposed to.
Is carpet really a good alternative since it is easily soiled and cleaning it requires devices that are themselves very noisy?

When conditions are optimal, carpeting has been shown to work very well in a number of NICUs; we have had carpet in our nursery, for example, for over 15 years. “Optimal conditions” is the key. A high-quality carpet must be chosen; currently available hospital-grade carpeting is remarkably easy to clean, even when blood or other stains occur. Even with the best carpet, though, there must be a commitment on the part of staff to wipe up spills when they occur, and on the part of the hospital housekeeping staff to do “spot cleaning” of an area where a spill occurred within 24 hours. Regular vacuuming of carpet can be done quietly if a central vacuum system or a quiet vacuum sweeper is used (for recommendations on vacuum equipment, see http://www.nd.edu/~kkolberg/Vacuum.htm).

Carpeting is not suitable for all areas of any NICU, so cushioned vinyl flooring, which offers many of the same acoustical benefits as carpet, should be used where carpet is not practical (eg, around sinks, in procedure rooms, in utility rooms, etc.), or in nurseries where cleaning services are not reliable. Concerns about the risk of carpet harboring infectious organisms have been allayed by a number of studies and considerable experience although here again, good cleaning support must be available.
Is it helpful to “add back” certain sounds to the baby's environment – for example, music, or a tape of the parents' voices?

There are no good data to address this question. In utero, a baby is certainly exposed to its mother's voice, although it is perceived through a solid and liquid interface, instead of air. We are uncertain what the intensity of that sound is for the fetus, or precisely how the different interface might affect those wavelengths of sound that are most important to deliver to the developing fetus. It seems likely that too much or too little sound stimulation would be disadvantageous to the baby, but we just don’t know what the proper intensity, wavelength, or type of sound is for an infant at any given gestational age prior to term. Given our current lack of knowledge, it is probably reasonable to allow a baby to be exposed to music or a tape of its parents’ voices from time to time, but this should not be loud (above the sound level in the recommended standard) or continuous, and should be considered optional, not essential, until more studies are available.
Where can we get a good meter to measure sound levels in our NICU?

A Larson Davis 703 dosimeter and/or a Sound Level Meter can be rented from Modal Shop, Cincinnati, Ohio (US), phone: 800-860-4867, www.modalshop.com. The Larson Davis 703 sells for $1,280 with software and does a good job for parameters useful to most nursery situations.

Larson Davis products are of a very good quality and have the advantage of an accessible, knowledgeable support staff that is helpful and patient with relatively inexperienced people learning to use their equipment. Information about Larson Davis products can be obtained from Gordon Dix at 801-375-0177, X-1101.
References


Please see the discussion under "General questions", posts #12 and 14, for a description of a sound control renovation in an existing nursery that seems very innovative!