



Perception of the multidisciplinary team about noise in neonatal intermediate care units*

Percepção da equipe multiprofissional sobre ruído em unidade de cuidado intermediário neonatal

Percepción del equipo multiprofesional sobre el ruido en una unidad de cuidado intermedio neonatal

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ABSTRACT

Objective: To describe the perception of the multidisciplinary team on ambient noise in a neonatal intermediate care unit. **Methods:** Descriptive study with qualitative design. Open-ended interviews were conducted with 43 professionals working in the neonatal intermediate care unit. The taped interviews were transcribed and underwent thematic analysis. **Results:** Four thematic topics arose: how the team perceived the noise in the unit; what generated noise in the unit; the effects of noise on babies, workers, relatives and associates; and, how to reduce noise in the unit. **Conclusion:** The staff was knowledgeable about the noise in the unit, pointing out possibilities and limitations for its reduction. **Keywords:** Noise/adverse effects; Perception; Infant, newborn; Child health services, Patient care team; Nurseries, hospital

RESUMO

Objetivo: Descrever a percepção da equipe multiprofissional sobre ruído ambiente em uma unidade de cuidado intermediário neonatal. **Métodos:** Estudo descritivo com delineamento qualitativo. Realizaram-se entrevistas abertas com 43 profissionais que atuavam na unidade de cuidado intermediário neonatal. As entrevistas gravadas foram transcritas e realizou-se a análise temática. **Resultados:** Aprenderam-se quatro núcleos temáticos: Como a equipe percebe o ruído na unidade; O que gera ruído na unidade; Os efeitos do ruído nos bebês, trabalhadores, familiares e acompanhantes; Como reduzir o ruído na unidade. **Conclusão:** A equipe tem conhecimento sobre o ruído na unidade, apontando possibilidades e limitações para sua redução. **Descritores:** Ruído/efeitos adversos; Percepção; Recém-nascido; Serviços de saúde da criança; Equipe de assistência ao paciente; Berçários hospitalares

RESUMEN

Objetivo: Describir la percepción del equipo multiprofesional sobre el ruido del ambiente en una unidad de cuidado intermedio neonatal. **Métodos:** Se trata de un estudio descriptivo con abordaje cualitativo. Se realizaron entrevistas abiertas con 43 profesionales que trabajaban en una unidad de cuidado intermedio neonatal. Las entrevistas grabadas fueron transcritas realizándose el análisis temático. **Resultados:** Se elaboraron cuatro núcleos temáticos: Cómo percibe el equipo el ruido en la unidad; Qué genera ruido en la unidad; Los efectos del ruido en los bebés, trabajadores, familiares y acompañantes; Cómo reducir el ruido en la unidad. **Conclusión:** El equipo tiene conocimiento sobre el ruido en la unidad, apuntando posibilidades y limitaciones para su reducción. **Descritores:** Ruido/efectos adversos; Percepción; Recien-nacido; Servicios de salud del niño; Grupo de atención al paciente; Salas cuna en hospital

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INTRODUCTION

In the field of neonatology, the implementation of important technological advances combined with improvements in neonatal intensive care units (NICUs) has led to the increased survival of smaller and more premature newborns. However, units that provide specialized care are located in environments with excessive stimulation. An elevated noise level is one type of stimulation that can have an iatrogenic effect on the neonatal developmental process⁽¹⁾. Noise management has been the subject of investigations and interventions as a component of neonatal developmental care⁽²⁾.

The World Health Organization (WHO) recommends that the equivalent continuous sound pressure level (L_{eq}) inside hospitals should be no greater than 30 dBA, with a maximum sound pressure level (L_{max}) of 40 dBA⁽³⁾. The North American standard of the Committee to Establish Recommended Standards for Newborn ICU Design⁽⁴⁾ established that the usual noise level should not exceed L_{eq} 45 dBA and L_{max} 65 dBA. This standard is recommended for both the NICU and for the neonatal intermediate care unit (NIMCU). To investigate the abovementioned parameters, this study utilized the A-weighted decibel (dBA) unit, which most closely matches the perception of sound by the human ear, with an emphasis on low and high frequencies from 1 to 6.3 kHz⁽⁵⁾. L_{eq} describes the average sound energy level measured in dBA at a given time, while L_{max} represents the highest sound pressure level recorded during a given time period⁽⁶⁾.

Several studies have found intense levels of continuous noise in NICUs, ranging from 55.22 to 83 dBA⁽⁷⁻¹²⁾. Based on the acoustic comfort norm in Brazil, indoor hospital environment (e.g., apartments, nursing homes, nurseries and surgical centers) sound levels have been established between 35 and 45 dBA, which are considered as the desirable and acceptable limits, respectively⁽¹³⁾. In the city of São Paulo (São Paulo State [SP]), intense sound pressure levels were recorded in the NICU of a public university hospital, with L_{eq} between 49.9 and 88.3 dBA and impact noise up to 114.1 dBC⁽¹⁴⁾.

Concerns regarding the environmental noise issue in neonatal units and an interest in developing strategies to reduce this noise have motivated researchers to study health professionals' perceptions of such noise, especially considering that caregivers are an important noise source. From this perspective, the present study is justified, as it represents a preliminary step to support the establishment of a participatory program to reduce noise in NIMCUs.

The aim of this study was to describe healthcare professionals', assistants' and clerks' perceptions of the background noise in a NIMCU located in the city of Ribeirão Preto (SP). It should be noted that the workers involved in this study are characterized as a multidisciplinary team comprising healthcare professionals and hospital staff.

MATERIALS AND METHODS

This study utilized a qualitative descriptive design and was conducted in the NIMCU of a public university hospital in Ribeirão Preto (SP), which is a tertiary center for perinatal care.

The NIMCU staff was included in the study because they are active participants in the process of changing the noise levels of the unit. The inclusion criteria were workers who were consistently present in the neonatal unit and who were permanent employees, regardless of their schedules. Professionals who occasionally worked in the unit (i.e., they were requested for a consultation or for an examination to support a diagnosis or therapy) were excluded from the study.

This study included a total of 44 subjects (6 nurses, 20 technicians/nursing assistants, 1 medical professor, 4 physicians, 3 residents, 1 psychologist, 2 speech therapists, 1 social worker, 4 assistants and 2 clerks) who were active from December 2008 to June 2009 and worked 24-hour shifts.

For data collection, the same interviewer conducted open interviews with all subjects. The interviews were conducted during working hours (when workers were on duty) and were recorded with the permission of the participants after they signed a consent form. A structured script with the following questions guided the interviews:

"Do you think this unit is noisy? Why?"

"What are the sources of loud noise? What makes these noises? What causes noise in this unit?"

"Talk about the effects of background noise exposure on newborns, their caregivers and professionals working in the unit."

"How can we reduce the background noise? How can we implement a program to reduce background noise in this neonatal unit?"

The taped interviews were first fully transcribed; then, a thematic analysis was conducted to identify the core interview themes whose presence or frequency was relevant to the analysis⁽¹⁵⁾. The subjects were identified according to the interview sequence (i1, i2... i43) to preserve anonymity.

The study was approved by the Hospital Research Ethics Committee with the authorization of the department heads (Case No. 12.189/2007).

RESULTS

The statements from the subjects were grouped into four core themes: how the team perceives the noise in the NIMCU; what generates noise in the NIMCU; the effects of noise on babies, workers and family caregivers; and how to reduce noise in the NIMCU.

How the team perceives the noise in the NIMCU

The majority of respondents reported perceiving excess background noise:

I find it very noisy (in the NIMCU). i6 i7 i9 i16 i24 i25 i26 i34 i29 i35

In contrast, some respondents felt that the NIMCU was a little noisy, especially during intense time periods:

... some episodes of increased noise happen, but not routinely. i12

However, a respondent who did not spend long periods of time in the NIMCU did not consider the unit to be noisy.

What generates noise in the NIMCU

The noise sources mentioned by the respondents included human sources, equipment and the physical structure of the NIMCU.

Regarding the human sources, respondents cited the large number of people who passed through the unit (students, staff, caregivers and others) and the conversations and dynamics of the unit because it is part of a teaching hospital.

...when you have a student, doctor conducting medical visits /.../ the conversation itself I think is the most serious problem /.../ there are the students, the teachers, the children, the workers, the mothers, and from 16:00 to 17:00, there are the grandparents and parents; then the noise is terrible. i1

Crying children are another noise source in the NIMCU, especially in the nursery where 18 neonates are distributed into three spaces divided by laminated counters.

...because this is also a sitting room (the bigger ward)..., children cry all at the same time; sometimes, if one is awake, she/he will cry and wake up the others ... i26

Equipment in use was also identified as a source of noise:

...there is the pulse oximeter (POX), alarms that beep, /.../ from the incubator /.../ from the infusion pumps... i26

...the air conditioning was turned on... when the door was closed. i6

...the incubator itself when you put something on top. i16

The use of radios and telephones inside or outside the NIMCU was also reported. Elements of the physical structure and related factors mentioned by the respondents included equipment management and the physical environment, such as the opening and closing of doors; the closing of the waste disposal cover; sink faucets; the dragging of chairs, cabinets and drawers; and falling objects.

Outside noises that can be heard inside the NIMCU were also reported:

...sometimes, with the construction of the hospital (Children's Hospital building nearby) /.../ the machine noise ... i22

The large number of beds in the NIMCU also leads to noise amplification:

...the physical space; I think the unit is small for the number of beds /.../ a chaotic environment /.../ the fact that the nursery is large, and any small sound fills the entire room... i37

The effects of noise on babies, workers, families and companions

The respondents cited physiological, behavioral and emotional effects of noise on newborns.

Some of the physiological effects that the professionals noted include tachycardia, tachypnea, fatigue, oxygen saturation drops, feeding disruptions, weight loss, hypertension, temperature fluctuations, breathing difficulties, complications in therapeutic processes and infections.

Alterations of heartbeat... also oxygen saturation decreases. i17

...during feeding time, when given milk, they cry and choke... i4

The behavioral manifestations related to noise noted by respondents included disorganization, crying, a heightened Moro/startle reflex, changes in sleep and wakefulness, stress, irritability, restlessness, discomfort, nervousness and anxiety:

...(the noise) completely disrupts the RN... i2

...when you have acute noise, you notice that the child becomes frightened and jumps inside the incubator ... i15

It is known that long-term exposure to noise can lead to developmental changes, concentration difficulties, hyperactivity and impaired hearing. The respondents mentioned these consequences:

...the neurological system will be affected. i16

...if it (the noise) is very intense in the long term... it is associated with hearing loss... i15

Only one subject reported no perception of any effect on newborns.

Most respondents, especially the nursing professionals who spend longer periods of time in the NIMCU, stated that the noise causes stress and fatigue and compromises their performance:

It also affects my behavior; I become stressed, restless... just makes me nervous./.../ it interferes... then you will have to do a procedure already agitated, and sometimes, you do not succeed because of this. i5

Some respondents also mentioned physiological changes in themselves, such as pain, nausea and cardiac/gastric/blood pressure changes:

...the days when the noise is intense, my head hurts... i3

...my stomach hurts, burns, my gastritis becomes exacerbated. i8

Only a few respondents reported having adapted to the background noise.

Respondents also reported the stressful effects of noise on the visiting family members of NIMCU babies:

Some people stay for 5 minutes and then leave because of all of the noise. I even tell them, "stay a little longer dad, you can stay from 16:00 to 17:00 (visiting hours)." However, he says, "no, I have to go, I cannot listen to this (machine)." i1

Some workers reported that the mothers are stressed and even notice changes in the child:

... the days that the background is more (noisy), I've heard several times, "It is too noisy here today; this is annoying me, is disturbing me. Look at how my baby is (irritated)." i39

The workers also noted the emotional effects on the visiting family members, such as serious faces (emotionless), silence (stillness), sadness, complaints and fright:

...sometimes, there are mothers who say, "Wow! Turn this machine off, I cannot stand it anymore..."; they complain that they leave with 'swollen' ears. i19

Conversely, some respondents were not aware of the effects of noise on the parents who spend long periods of time in the hospital visiting their child in the NIMCU:

No, I never heard any mother report (losses), especially because I think they do not know that the noise is not good for the babies, right? i10

How to reduce noise levels in the NIMCU

The strategies for reducing noise levels that were highlighted by the respondents were related to human noise sources and family awareness using continual education, fewer conversations, careful management of equipment and materials and control of the flow of people:

...We have to be careful when closing it (the incubator). /.../ We try to set it (the POX) just right so that it does not make too much noise... Sometimes we go and turn them down (the equipment) /.../ I advise the mothers and others to speak more softly. /.../ Sometimes we lower the volume of the phone. i4

Modifying aspects of people's behavior at work was also noted as a strategy to reduce noise, particularly due to the sensitivity of children:

...with a newborn, we have to understand that they are very sensitive, they are very fragile. i18

Strategies related to equipment modifications included installing acoustically treated walls, utilizing materials for noise reduction, performing equipment maintenance and repair, undergoing training in equipment use and reducing the volume of equipment alarms.

Changes in the physical aspects of the structure of the unit were also mentioned, such as the construction of rooms suitable for visits, a reduction in the number of beds and the improvement of space distribution/restructuring.

DISCUSSION

Few studies have addressed strategies to improve the NIMCU environment in relation to the physical structure, equipment, lighting and noise in the unit⁽¹⁶⁻²¹⁾. It is essential that healthcare professionals become aware of the noise levels in neonatal units so that strategies can be proposed and developed to reduce the noise level⁽²⁰⁻²²⁾, as evidenced by the reports of most respondents.

The noise sources identified by the NIMCU health-care workers are in accordance with those identified in the literature, including human, physical and technological sources. Excess equipment and workers in the NIMCU contribute to a noisier environment^(14,16).

The survey administered in the NIMCU in the present study revealed that the most significant noise source was the opening and closing of the waste container cover (average L_{eq} 59.3 dBA) and that the nursery's open door allowed outside noise from the anteroom to enter the nursery, especially due to the opening and closing of the neonatal unit access door (57.3 dBA). Conversations among professionals during shift changes and medical visits constituted a source of intense noise, generating an L_{eq} of up to 63.8 dBA⁽²⁰⁾.

Furthermore, the noise measured inside the incubators during the care of the premature infants indicated that the main sources of loud noise ($L_{max} > 65$ dBA) were the conversations in the NIMCU near the incubators, the use of the counters (doors and drawers), the infants' own sounds, the opening and closing of doors and the movement of chairs in the unit⁽²³⁾.

Intense noise levels may have physiological effects on the infants⁽²⁴⁾ and may contribute to changes in cerebral blood flow^(9,24). Other effects, especially when the noise level is high, are related to an alarmed state and are characterized by the arousal of the subcortical system, the autonomic nervous system, somatic reflexes, the hormonal system and the respiratory system⁽²⁵⁾. Noise can also contribute to the onset of sleep disorders^(9,26).

The responses related to the effects of noise on infants in this study are similar to the responses given by nurses in a study conducted in Philadelphia (USA), who reported changes in the sleep/wake cycle, immediate changes in vital signs and impaired growth and development in newborns⁽²⁷⁾.

The reaction of premature newborns to noises while receiving care in the NIMCU was measured in a prospective observational study of 20 premature infants. The infants were exposed to an L_{max} greater than 65 dBA, and their physiological and behavioral responses were recorded on film and compared before and after the intense noise. After exposure to the intense noise, 63.2% of infants demonstrated the cochlear-palpebral reflex, 20% demonstrated a startle response, 42.1% showed facial expressions, 55% had changes in bodily activities and 60% had changes in sleep and wakefulness patterns, with statistically significant differences between these reactions before and after noise exposure⁽²³⁾.

The WHO considers 55 dBA to be the threshold for auditory stress⁽³⁾. Premature babies can react to auditory stress with responses that indicate pain. The sensation of pain may be present in some premature babies, requiring greater amounts of pain medication⁽⁹⁾. Hearing loss, which has

also been reported in premature infants, may be related to acoustic trauma to the cochlear cells, among other causes⁽²⁸⁾.

The main effects of noise exposure on the workers' health include irreversible sensorineural hearing loss; physiological changes in heart rate and blood pressure; sleep disturbances; and digestive, vestibular, neurological and various behavioral disturbances such as irritation, fatigue, decreased productivity, noise intolerance, anguish, anxiety, depression and stress⁽²⁴⁾. These findings are similar to the findings of this study⁽²⁹⁾. Some healthcare professionals appear to adapt to intense noise levels in hospitals, especially in the ICU⁽³⁰⁾; however, this intense noise has been shown to affect the ability of other professionals to concentrate on patient care⁽³¹⁾, possibly leading to distractions and errors, which in turn threaten the safety of infants⁽¹⁴⁾. Respondents in this study also noted these effects of noise in their daily lives.

In general, it was evident that the respondents perceived the negative effects of noise in the NIMCU. This finding has not been reported in similar studies in which, regardless of their level of training, employees showed a significant knowledge deficit with regard to the impact of excessive noise exposure in the hospital environment⁽²¹⁾.

In a study conducted in Philadelphia, nurses reported that the main noise sources are the alarms of the NIMCU monitors. The professionals interviewed in our study also made the same observation. Other noise sources included invasive procedures, the presence of families, visits by doctors, nursing shift changes, crying, respirator alarms and ringing phones. To reduce sound pressure levels (SPLs), respondents suggested reducing the alarm volumes of infusion pumps and respirators, even prior to procedures⁽²⁷⁾.

One NIMCU worker also cited the development of awareness programs for healthcare professionals as a strategy to reduce SPLs⁽²⁷⁾. Other respondents suggested the implementation of care and intervention protocols oriented towards healthcare workers and visitors to the neonatal unit and comprising strategies for noise control combined with more humane care⁽¹⁷⁾.

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Awareness strategies have been reported in the literature as a health education initiative that can affect individual and collective awareness of the responsibilities and rights of the population and can encourage popular participation^(20,32). In this context, educational strategies that involve the exchange of experiences and knowledge in multidisciplinary teams are encouraged because of their potential to create a healthy environment in the NIMCU.

Interdisciplinary and intersectoral interventions are required to reduce and control elevated noise levels, including the development of a set of actions aimed at reducing noise due to the physical infrastructure as well as to technological and human noise sources (e.g., professionals and family members). Several of these actions were noted by the respondents in this study and are mentioned in the literature^(16,20).

Sharing the responsibilities among staff and institutional leaders is crucial to the success of noise reduction initiatives, which require continual education, changes in the work place and the implementation of strategies to evaluate the improvement in noise control⁽²⁰⁾.

FINAL CONSIDERATIONS

The results from this study promote reflection; contribute new knowledge that is relevant to noise problems; and suggest methods with which to improve the well-being of healthcare professionals, staff, infants and family members that move through and work in neonatal units.

In this study, nearly all of the respondents agreed that the unit is noisy and that this high noise level negatively affects or will affect the health of workers, neonates and their visiting family members.

The perception that noise may compromise infants' ear health in the long term is relevant, signaling the need for preventive measures aimed at NIMCU workers to reduce background noise. This result supports the development of another participatory intervention study, which is currently in progress.

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