

Repercussion of noise in the neonatal intensive care unit

Repercussões do ruído na unidade de terapia intensiva neonatal

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Keywords

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Descritores

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Abstract

Objective: To identify repercussion of noise in the neonatal intensive care unit on mothers, newborns and on interactions of neonates with healthcare professional from the mothers' perspective.

Methods: This descriptive cross-sectional study was carried out in the neonatal intensive care unit. The study population was composed by 95 mothers. Data were collected using formularies. The statistical analysis was descriptive.

Results: Mothers' perception of noise in the unit caused repercussion on neonates such as agitation, cry, irritability among other. Mothers' also reported to have headache, agitation and tendency to cry, which led them to touch less and speak softly with their babies.

Conclusion: Repercussions of noise perceived by mothers on themselves and on babies' behavior and physical changes were associated with difficulties of mothers to keep attention and to interact with healthcare professionals.

Resumo

Objetivo: Identificar as repercussões do ruído da unidade de terapia intensiva neonatal sobre as mães, recém-nascidos e interações com o filho e profissionais de saúde, a partir da percepção materna.

Métodos: Estudo descritivo transversal, realizado em unidade de terapia intensiva neonatal. A amostra constitui-se de 95 mães. Um formulário foi utilizado como instrumento de coleta de dados. Para análise dos dados utilizou-se estatística descritiva.

Resultados: Na percepção das mães o ruído da unidade traz repercussões sobre o neonato provocando agitação, choro, irritabilidade entre outros; desencadeia-lhe cefaléia, agitação e vontade de chorar, levando-a tocar menos e falar mais baixo com o filho. Referem dificuldade em manter sua atenção durante a interação com o profissional.

Conclusão: As repercussões do ruído percebidas pela mãe tanto sobre si como para o seu filho, abrangem alterações comportamentais e físicas; associadas à dificuldade materna de manter a atenção ao interagir com o profissional de saúde.

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Introduction

The birth of a premature and/or sick newborn constitutes a crisis for the family because parents have problems to identify in physical and behavior characteristics of the child, differently from what was expected, their previous ideal dream, so causing frustrations.⁽¹⁾ This situation could motive opposite feelings, that is, at one side there is a hope represented by the birth and the other side the symptoms such as depression, anxiety, sadness, fear, insecurity, distress, among other.⁽¹⁻⁵⁾ This situation could difficult the establishment of an affective bonding and affect negatively families dynamics.

The situation could be worse when the newborn is hospitalized in the neonatal intensive care unit (NICU), a restrict and unknown environment that impact and intimidate most of families.⁽⁶⁾ In addition, this environment increases the feeling of vulnerability, impotence, frustration, fault and revolt.⁽²⁻⁴⁾

Due to the high complexity of procedures and technology used in the NICU, this environment conditions include intense sensorial stimulus such as excessive lighting and noise which are incompatible with well-being of neonates, family and professionals.

Currently, the literature in nursing has been emphasizing the need of an ecological environment in the NICU mainly concerning babies exposure to loud noise.⁽⁷⁻¹¹⁾ Noises are loud or confused sounds at frequency physiologically incompatible with human ear that may cause physical lesions, physiological and behavioral changes.⁽¹²⁾ In most of cases noise in the NICU and inside incubators is due to alarms produced by life support devices, flow of medical gas, communication among professionals and during activities of nursing care.⁽¹³⁻¹⁶⁾

Newborns exposed to high sound pressure levels (SPL) could present hypoxia, increase of adrenocorticotrophic hormone and adrenaline release, increased heart rate, systemic vasoconstriction, pupil dilation, elevated blood and intracranial pressure, increased oxygen consumption rates, and energetic expenditure, which in long-term could result in delayed weight gain. Hearing loss due to long exposure to noise among hospitalized newborns in the NICU is a problem widely discussed in the literature.^(7,8)

Among deleterious effects of high SPL for professionals the most common are increased blood pressure, changes in heart rate and muscle tone, headache, hearing loss, low concentration power, irritability, burnout syndrome and job dissatisfaction.^(9,10)

Brazilian studies have been showing high SPL within the unit and inside incubators.^(13,14) However, few studies are published on this topic mainly considering the health service user's perspective. Therefore, because of the importance of an environment that could enable an affective bounding between mother and child after birth, as well as to provide an adequate communication between family and health professional, this study attempted to verify if noise in the NICU could change interaction between the mother and her baby, and also mothers and health professionals.

In this study we aimed to identify repercussions of noise in the neonatal intensive care unit on mothers and newborns and also on their interaction. The interaction between mothers and healthcare professionals was also verified.

In this study the term perception is used as the act to acquire knowledge by sensitive organs. In other words, to notice.⁽¹⁷⁾

Methods

This descriptive cross-sectional study was conducted in two emergency room of the Neonatal Intensive Care Unit (NICU) at an academic hospital in São Paulo, SP, Brazil. The rooms are placed in the eighth floor of the hospital and have four beds exclusive for patients of the public health system enrolled in the hospital's prenatal care program. The unit does not have adequate physical structure to reduce high SPL particularly for presence of many professionals, students and families. The single intervention in this front is called "the sleeping time" that consists in environmental measures such as to reduce lighting and noise, and minimal manipulation of newborns.

Due to the limited space within the unit, parents are allowed to stay inside NICU from 9 a.m. to 9 p.m. In addition, professionals often report neo-

nate clinical conditions and treatment management for families close to the incubator.

To data collection all national and international ethical and legal aspects of research on human subjects were followed.

Independent variables were age, mothers' formal education level, number of visits to the baby in the unit, duration of baby's hospitalization, previous experience of hospitalization of a family member at NICU.

The dependent variable "mothers' perception of noise" was measure according to noise level, repercussion of noise on them and baby, mothers' reactions to the noise, professional management, influence of noise on interaction with her baby and with the multidisciplinary team. Data was collected using interviews and structured forms with open and closed questions.

To validate forms, a pre-test was conducted with mothers who had newborns hospitalized in other neonatal units and who had similar characteristics. In general, interviews lasted for approximately 15 minutes.

The study population was composed of 95 mothers who babies were hospitalized during the period of this study. Inclusion criteria were mothers who child was hospitalized in the NICU and visited their child for at least three days excluding the day of the interview. All mother agreed to participate. The number of visits was defined as three because we believed to be enough for mothers have a perception of the noise in the unit. Mothers who reported hearing loss and psychiatric disturbs were excluded.

For data analysis we used absolute, relative, mean and standard deviation (SD). The analysis of open question was done considering the frequency of answers. Spearman's rank correlation coefficient was used to analyze relation between numbers of days that families visited newborns in the NICU along with variables of mothers' perceptions related to the negative impact of noise on them, on their child, and in the level of care perceived by interactions with the professional.

The receiver operator characteristic curve (ROC) was used to verify if number of days that mother

visited their child in the NICU was different from any of the characteristics evaluated.

This study followed national and international ethical and legal aspects of research on human subjects.

Results

Considering independent variables the sample of this study presented: a) mean age of 28.8, SD of 6.9 years; b) formal education level of 52.6% for complete high school and 30.5% for incomplete high school; c) mean number of visits to newborns was 16.7, SD of 26.8 days; d) duration of newborn's hospitalization was 18.8, SD of 28.3 days; e) those who never been in a NICU before were 93,7%.

Mothers (80%) considered that NICU was noisy. From the total, 25.3% mentioned that NICU had mild noise, 22.1% perceived more or less noisy, 18.9% considered the unit noisy and only 13.7% classified the unit as very noisy.

Regarding discomfort in the environment related to sound, 59.1% of mothers reported that noise disturbed them, 29.6% perceived the environment as noisy but it did not disturb, and 11.3% did not report any discomfort. Mothers' feeling when a high noise in the unit was perceived was agitated (23%), tense (42%) wish to cry (20%) and headache (15%).

Those mothers who most visited the unit perceived a higher discomfort (mean 20.9; SD 35.2 days) (Figure 1).

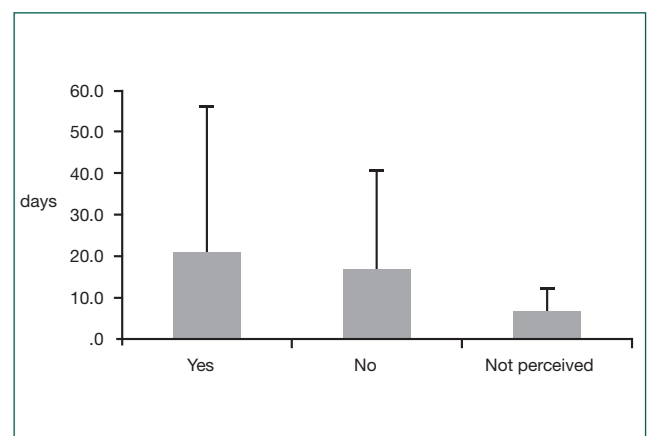


Figure 1. Relation between number of days of visit to the neonate and discomfort caused by the noise to the mothers

A total of 69.7% of participants perceived that repercussion of noise in the NICU on their babies disturbed the child and, among them, 32.1% considered that their baby was very disturbed due to the child agitation, grumbling, crying and movements that seemed that he/she was scary or had fear shown by facial expression of pain. Mothers who most visited their child had higher perception of disturbance that noise caused on their baby (mean of 20.1, SD 34.3 days). (Figure 2)

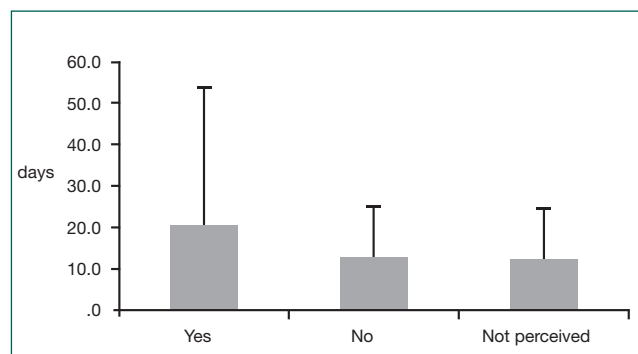


Figure 2. Relation between number of visits to the neonate and the baby's discomfort caused by the noise perceived by the mother

For perception of reactions caused by the noise, 77% of mother reported that even when an elevated noise that disturbed them was in the NICU they stayed in the environment, whereas others (22.9%) reported to leave the place, leaving the child alone. A total of 40 mothers (66.7%) were worried to not make loud sounds when closed to the baby and, among them, 87.5% tried to not make any noise. However, 31 mothers (40.8%) did not mention the same concern.

Almost half of mothers (52.1%) considered that spoke less with their child when the NICU was noisy. A significant portion of moms (45.8%) also reported to speak more softly with babies because of environmental conditions. Related to tactile interaction, less than a half of mothers (47.9%) reported to touch less their child when the environment was noisy.

A total of 66.7% of mother reported that they did not change their tone of voice during communication with health care team even when the NICU had unfavorable acoustic conditions.

ROC had sensibility of 0.96 and specificity of 0.65, it also indicated that mothers who visited their child in the ICU for more than eight days had high probability of not change tone of voice in noisy situation (Figure 3).

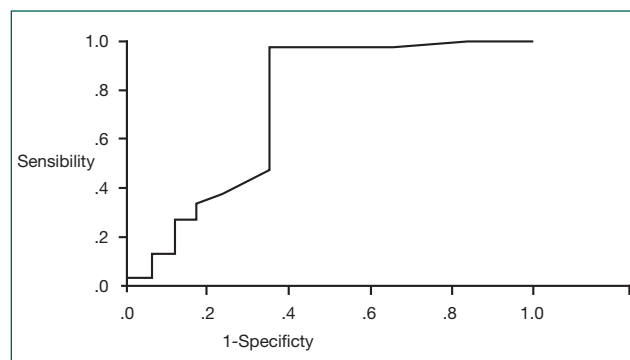


Figure 3. ROC of mothers' perception related to the need of changing their tone of voice during communication with health care professionals

Interestingly, 50% of participants reported that when the environment was noisy they had problems to concentrate on while the professional were explaining something to them. For variables we found that most frequent visits of mother to the newborn in the NICU (mean of 12.9 SD 8.7 days) were associated with high proportion of difficult to concentrate during explications about baby's health status. (Figure 4)

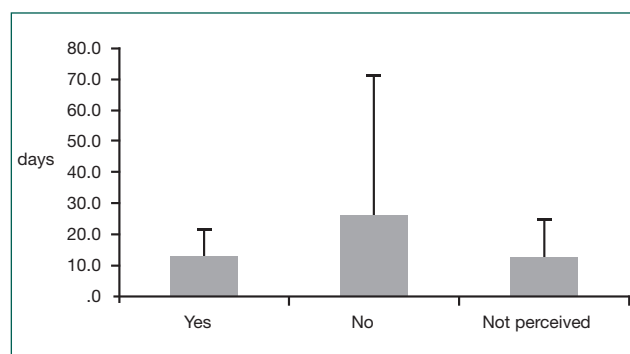


Figure 4. Mothers' perceptions related to care level and interactions with health professional associated with number of visits to the NICU

Discussion

Several studied had reported high level of stress in parents caused by their child hospitalization in the

NICU. This stress is not only because of suffering with newborn's critical health status but also because the NICU is unknown environment that may cause fear on them.^(4,18) Little is known about consequences of noise in parents, how they perceive⁽¹⁹⁾ and understand it. Findings of this study showed that noise in the NICU was a disturbance factor that increased mothers' stress. This study reinforced the importance of noise management in the NICU. In addition, some studies^(13,14) have detected high level of sound pressure, over the levels recommended by regulatory agencies, in the NICU and inside incubators.^(13,14,20,21)

Some authors considered the importance of an adequate environment. Responses of newborns to the first external stimulus are crucial to establish an affective bonding between families and their babies.^(1,2,22)

In this sense, for parents is easier and motivator to interact with their child while perceive a positive response. From stages that goes from deep sleeping and crying, the state of alert inactivity is the better to promote interaction with the baby who at this state is calm, alert, had low motor activity, regular breathing and sensorial systems such as hearing more opened for interactions. This state also help the caregiver to delivery a better care for the baby.^(23,24)

However, more intense environmental stimulation such as excessive lighting and loud noise, could lead the baby to become more alert and with tendency to cry.⁽²⁵⁾ Babies exposed to an excessively noisy environment may lead parents to give less attention to their babies, therefore affecting negatively the interaction and bonding formation with parents.⁽⁵⁾

This study data indicated that most visits to NICU were associated with high perception of noise that disturbed mothers and their baby. For this reason, longer hospitalization could have a negative effect on mother, increase stress, and as a result, reduce interaction between the mother and her child. Another study, however, reported that professionals' perspective was that noise do not affect families,⁽¹⁹⁾ and it suggested a development of strategies by multidisciplinary teams to receive better parents who baby are hospitalized for longer periods, giving emphasizes to an humanized care in order to include families.

According to mothers, the noise also affected communication with health professionals because during professionals' explanations related to babies' clinical status, most of them were unable to be concentrated. The attention for families in the NICU expects that health team promote adequate conditions to communicate with them during hospitalization. Professionals should be open to answer questions and provide information regarding the care delivered, diagnosis, treatment and prognosis of the child. Such actions are crucial to promote a reliable environment.

In this context the family has the chance to report healthcare professionals their feelings, fears and concerns. However, to understand orally communication is a complex process that involves identification and comprehension of words articulated that may lead correct understanding of the message.⁽²⁶⁾ Therefore, the importance of good acoustic conditions in the NICU is justified. In addition, the literature report that even normal hearing people complaint about the difficulties to understand other inside a noisy environment.⁽²⁷⁾ Hence, communication between family and professionals in the NICU with elevated SPL could be impaired and, as a result, many important information are lose, which might cause conflicts between parents and professionals and also promotes a less humanized environment.

Based on mothers' perspective this study revealed one aspect of the ecological environment in the NICU, which indicated the influence of noise in interaction between mother and infant in the first phase of a vital cycle. It is important to highlight that first interactions are vital for parents and can reflect on the quality of interaction with their child in the future. Another important fact is that an environment free of noise stimulates parents to spend more time in the NICU with their child. In addition, to spend a long time during neonates hospitalization is a right for parents provided by the law.

Further studies are encouraged to understand better what consequences a noisy environment could cause to families who child is hospitalized at a NICU.

Considering findings of this study it is suggested that health services should promote educa-

tional programs in order to create a conscience in professionals about the importance of comfortable acoustic environment for care. In addition, other administrative and organizational measures is required such as to establish criteria to purchase new equipments that produce less noise, to promote preventive maintenance and to place sensors in order to create a systematic monitoring of noise. Besides that, other things required are adequate physical structure that could offer more privacy for parents and neonates, a job system based on integrative and individualized care to enable a low concentration of professionals in the same environment, among other. It is understand that in front of this moment that human beings are challenged by sustainability issues, to take care of a microenvironment during initial life phase of newborns deserve more attention of public health administrators.

Conclusion

Findings showed that repercussion of noise perceived by mothers on themselves and on neonates caused physical and emotional changes. It is verified that changes compromised areas related to ability of interactions. This situation could result in a decreasing of affective and sensorial changes between parents and children, therefore it could compromise the bonding and, as a consequence, psychobiology needs.

Other repercussion of noise in the NICU pointed out by mother was the difficult to be concentrated during communication with health professional.

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Collaborations

Grecco GM; Tsunemi MH; Balieiro MMFG; Kakehashi TY and Pinheiro EM contributed to the design of the study, analyzed and interpreted data. They were also responsible to draft the paper, critical review and final approval of proofs.

References

1. Brum EH, Schermann L. [Early relations and infant development: theoretical approach in risk birth situation]. *Ciênc Saúde Coletiva*. 2004; 9(2):457-67. Portuguese.
2. Linhares MB, Carvalho AE, Bordin MB, Chimello JT, Martinez FE, Jorge SM. [Preterm and low birth weight as a risk for the development of children]. *Paidéia (Ribeirão Preto)*. 2000; 10(18): 60-9. Portuguese.
3. Carter JD, Mulder RT, Bartram AF, Darlow BA. Infants in a neonatal intensive care unit: parental response. *Arch Dis Child Fetal Neonatal*. 2005; 90(2): F109-F113.
4. Carvalho JB, Araújo AC, Costa IC, Brito RS, Souza NL. [Social representation of fathers regarding their premature child in the neonatal intensive care unit]. *Rev Bras Enferm*. 2009; 62(5):734-8. Portuguese.
5. Gaíva MA, Ferriani MG. Prematuridade: vivências de crianças e familiares. *Acta Paul Enferm*. 2001; 14(1): 17-27.
6. Gaíva MA, Scochi CG. [Family participation in premature care in neonatal ICU]. *Rev Bras Enferm*. 2005; 58(4):444-8. Portuguese.
7. Bremmer P, Byers JF, Kiehl E. Noise and the premature infant: physiological effects and practice implications. *J Obstet Gynecol Neonatal Nurs*. 2003; 3 (4): 447-54.
8. Krueger C, Wall S, Parker L, Nealis R. Elevated sound levels within a busy NICU. *Neonatal Netw*. 2005; 24(6): 33-7.
9. Tomei F, Tomao E, Baccolo TP, Papaleo B, Alfi P. Vascular effects of noise. *Angiology*. 1992; 43(11):904-12.
10. Carvalho M, Vieira AA. [Medical errors in hospitalized patients]. *J Pediatr (Rio J)*. 2002; 78(4). 261-8. Portuguese.
11. Philbin MK. Planning the acoustic environment of a neonatal intensive care unit. *Clin Perinatol*. 2004; 31(2):331-52.
12. Standley JM. A meta-analysis of the efficacy of music therapy for premature infants. *J Pediatr Nurs*. 2002; 17(2):107-13.
13. Peixoto PV, Araújo MA, Kakehashi TY, Pinheiro EM. [Sound pressure levels in the neonatal intensive care unit]. *Rev Esc Enferm USP*. 2011, 45(6): 1309-14. Portuguese.
14. Peixoto PV, Balbino FS, Chimirri V, Pinheiro EM, Kakehashi TY. Internal noise levels in neonatal intensive care unit incubators. *Acta Paul Enferm*. 2011; 24(3): 359-64.
15. Kakehashi TY, Pinheiro EM, Pizzarro G, Guilherme A. Noise level in neonatal intensive care unit. *Acta Paul Enferm*. 2007; 20(4): 404-9.
16. Ichisato SM, Scochi CG. Ruídos na unidade de cuidado intensivo neonatal durante as passagens de plantão (enfermagem e/ou médica) e visita médica. *Ciênc Cuid Saúde*. 2006, 5 (Supl): 127-33.
17. Hargie OD. Interpersonal communication: a theoretical framework. 3rd ed. London: Routledge; 2006. The handbook of communication skills. p.29-63.
18. Board R. Father stress during a child's critical care hospitalization. *J Pediatr Health Care*. 2004; 18(5): 244-9.
19. Aurelio FS, Tochetto TM. Noise in a neonatal Intensive Care Unit: measurement and perception of professionals and parents. *Rev Paul Pediatr*. 2010; 28 (2):162-9.
20. Associação Brasileira de Normas Técnicas. NBR 10152: Níveis de ruídos para conforto acústico. Rio de Janeiro: ABNT; 2000
21. Associação Brasileira de Normas Técnicas. NBR IEC 60601-2-19: Equipamento eletromédico - parte 2: prescrições particulares para

- segurança de incubadoras de recém-nascido (RN). Rio de Janeiro: ABNT; 1997.
22. Pinheiro EM, Silva MJ, Angelo M, Ribeiro CA. The meaning of interaction between nursing professionals and newborns/families in a hospital setting. *Rev Latinoam Enferm*. 2008; 16(6): 1012-8.
 23. Lagercrantz H, Changeux JP. Basic consciousness of the newborn. *Semin Perinatol*. 2010; 34(3):201-6.
 24. VandenBerg KA. State systems development in high-risk newborns in the neonatal intensive care unit: identification and management of sleep, alertness, and crying. *J Perinat Neonatal Nurs*. 2007; 21(2):130-9.
 25. Trapanotto M, Benini F, Farina M, Gobber D, Magnavita V, Zacchello F. Behavioural and physiological reactivity to noise in the newborn. *J Paediatr Child Health*. 2004; 40(5-6): 275-81.
 26. Calais LL, Russo IC, Borges AC. Performance of elderly in a speech in noise test. *Pró-Fono Rev Atual Cient*. 2008; 20(3):147-52.
 27. Henriques MO, Miranda EC, Costa MJ. Speech recognition thresholds in noisy areas: reference values for normal hearing adults. *Rev Bras Otorrinolaringol*. 2008; 74(2): 188-92.