ISSN: 2318-8413 DOI: 10.18554/refacs.v6i3.3084

REFACS
Revista Família, Ciclos de Vida e Saúde no Contexto Social

Noise control: team perceptions and educational intervention in a Neonatal Intensive Care Unit

Controle do ruído: percepções da equipe e intervenção educativa em Unidade de Terapia Intensiva Neonatal

Control del ruido: Percepciones del Equipo e Intervención Educativa en Unidad de Terapia Intensiva Neonatal

Received: 02/02/2018
Approved: 28/06/2017
Published: 01/08/2018

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This is a hybrid study, with a quantitative and cross-sectional stage, conducted from March to May 2017 through a survey, and a descriptive-narrative qualitative stage, aimed at identifying noise perception in a Neonate Intensive Care Unit at a public teaching hospital, and describing actions of Permanent Health Education (PHE) used for noise control. The main effects the noise was found to have on the team were: irritability (83.3%), headaches (75%) and loss of attention (68.3%). Main sources of noise: monitor and incubator alarms (95%) and conversation in the unit (85%). The formation of a Guiding Group with expertise on the field, meetings in different turns and flexibilization of participation were the initiatives that enabled the implementation of the PHE. A list of suggestions to support the development of the "culture of silence" in the sector was elaborated. Considering the worldwide challenge regarding noise control in these units, it can be inferred that the description of the process and initiatives will enable its replication in similar settings.
Descriptors: Noise monitoring; Intensive care units neonatal; Hospitals teaching.

Estudo híbrido, composto de fase transversal-quantitativa, realizado de março a maio de 2017, através de levantamento e fase descritiva-narrativa de abordagem qualitativa, que teve como objetivo identificar a percepção do ruído de uma Unidade de Terapia Intensiva Neonatal de hospital público de ensino e descrever ações de Educação Permanente em Saúde (EPS) empreendidas para o controle do ruído. Foram identificados como principais efeitos do ruído na equipe: irritabilidade (83,3%), dores de cabeça (75%) e perda de atenção (68,3%). Principais fontes: alarmes de monitores e incubadoras (95%) e conversas na unidade (85%). A formação de Grupo Condutor com expertise, reuniões em diferentes turnos e a flexibilização da participação foram iniciativas viabilizadoras para a implementação da EPS. Foi elaborado um menu de sugestões apoiadoras ao desenvolvimento da "cultura do silêncio" no setor. Mediante o desafio mundial quanto ao controle de ruídos nestas unidades, infere-se que a descrição do processo e das iniciativas favorece sua replicação em cenários semelhantes.
Descritores: Monitoramento do ruído; Unidades de terapia intensiva neonatal; Hospitais de ensino.

Estudio híbrido, compuesto de fase transversal-cuantitativa, realizado de marzo a mayo de 2017, a través de levantamiento y fase descriptiva-narrativa de abordaje cuantitativo, que tuvo como objetivo identificar la percepción del ruido de una Unidad de Terapia Intensiva Neonatal de hospital público de enseñanza y describir acciones de Educación Permanente en Salud (EPS) emprendidas para el control del ruido. Fueron identificados como principales efectos del ruido en el equipo: irritabilidad (83,3%), dolor de cabeza (75%) y pérdida de atención (68,3%). Principales fuentes: alarmas de monitores e incubadoras (95%) y conversaciones en la unidad (85%). La formación de Grupo Conductor con experiencia, reuniones en diferentes turnos y la flexibilización de la participación fueron iniciativas viabilizadoras para la implementación de la EPS. Fue elaborado un menú de sugerencias apoyadoras para el desarrollo de la "cultura del silencio" en el sector. Mediante el desafío mundial en cuanto al control de ruidos en estas unidades, se infiere que la descripción del proceso y de las iniciativas favorece su replicación en escenarios semejantes.
Descriptores: Monitoreo del ruido; Unidades de cuidado intensivo neonatal, Hospitales de enseñanza.

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INTRODUCTION

The Neonate Intensive Care Unit (NICU) is a highly complex hospital environment, where newborns in severe conditions are treated. Some of the current premises of neonate care are the need to minimize the handling of the newborns and put into effect environmental controls to adequately reestablish them, since premature children are under greater risk of developing cognitive, motor and behavioral disorders when compared with babies born at due date[1,2].

The multiprofessional NICU team must be competent in the use of technologies (monitors, incubators, infusion bombs, among others) and works in a stressful environment, due to the instability of the neonates, and their low tolerance of mistakes considering the high risk procedures performed and the excessive noise[3,4]. From this perspective, noise control stands out among the actions the multiprofessional teams that work in the NICU perform[1,2].

The noise in the NICU settings is higher than in most environments. These auditory signals have been understood as disturbances and happen in regular intervals. They frequently cause problems to the newborns, their families and the workers in the unit[1,4] - especially in cases when the inadequate control of noise in these environments may lead to damage to the neonate, be this damage physical, social or psychological. A recent systematic review showed the importance of strategies to monitor the noise in the NICU environment[1].

As a consequence, the existence of this control in the NICU environment has been a preoccupation of teaching hospitals in different places throughout the world[5,6]. Studies found volumes above the recommended security limits, which would be between 35 and 45dB, as exemplified by a North American experience for controlling noise at NICU, which found that, previous to their intervention, mean values were of 57.0 dB (standard deviation ± 0,84)[5]. Measurements in a teaching hospital in Mexico showed an average of 61.8 dB (standard deviation ± 4.4)[7]. In a Canadian hospital, an auditing system measured limits from 45 to 55dB in the NICU of a hospital[6].

When considering Public Teaching Hospitals, the challenges for controlling noise are even greater. First, these are spaces where a high number of people come and go. Traditionally, workers, professors, researchers and students with different levels of education share this space[8].

Also, the organizational culture of these hospital has elements related to their rigid structures and to the centralization of power, resulting in challenges for the development of teamwork and the engaged participation of the workers in the changes[9]. However, these week points result from influences in the scope of the hospital service administration, from factors regarding the macro-structure of the health system itself, and from limitations of the workers regarding their technical qualifications for exercising the job[8,9].

As a consequence, there is no global planning for the hospitalization unit, there are problems in the coordination of the assistance and administrative processes, communication problems, and there are no instruments of participatory management[8,10].

Overcoming these practices tends to positively influence the quality of care and the culture of patient safety in the hospitals as a whole, especially as it values the promotion of interpersonal relations and the motivation and satisfaction of the workers[8,10]. These aspects become relevant as the quality of care takes an increasingly important role in the agenda of the managers, the health professionals and the users, especially regarding discussions which involve the safety of the patient[9].

In the search for propositional ways to deal with clinical and managerial demands from hospitalization units, such as the NICU, the establishment of PHE spaces within the multiprofessional teams has been a strategy to overcome these challenges.

Roughly speaking, the PHE is seen as the production of knowledge in health institutions, started from the reality experienced by the actors involved. Questions raised from the practice of assistance and the

experiences of the teams involved are used as a base to ask, change, and elaborate propositions for participatory interventions that can transform these realities[11].

This study aims at identifying noise perception in a Neonate Intensive Care Unit in a public teaching hospital, and describing actions of Permanent Health Education (PHE) used for noise control.

METHOD

This is a hybrid[12] and exploratory study, made up of two stages: the first was a cross-sectional quantitative study, based on a survey that was performed through a structured self-applicable questionnaire elaborated by the authors; the second was a descriptive and qualitative research, regarding the use of PHE in the unit.

The setting of the study was a NICU with 20 beds in a large public general teaching hospital (332 beds), a macro-regional reference for high-complexity assistance in the Triângulo Sul region of the state of Minas Gerais, Brazil.

The development of the project was motivated by the interest in giving support to the strategic objectives of the hospital, which aims to guarantee quality health care and patient safety through the articulation between teaching-research-extension and assistance. The research was conducted from March to May 2017.

120 questionnaires were delivered (one for each professional in the unit, whichever their professional category was), including the entire multiprofessional team: physicians, resident physicians, nurses (including resident nurses), nursing technicians, physical therapists, psychologists, speech-language therapists, cleaning and support team, clerical staff. The objective was to create a non-probabilistic sample through the maximization of participations.

The participants were advised to give the instrument back in 48 hours. The questions addressed: sociodemographic characterization of participants; how they characterized the noise levels; signals and symptoms they thought could be caused by exposure to excessive noise; and what are the sources of the excessive noise in the NICU. A data bank was created, and descriptive statistical analyses were made according to absolute and relative frequencies. Microsoft Excel® was used for both.

Regarding the second stage, the descriptive technique, documents (meeting minutes) created for the PHE were analyzed so the researchers could identify themes discussed, strategies used, and the engagement of the multiprofessional team in the process. The analysis started from the identification of the process, through a study of the actions of the group (multiprofessional team) and the examination of records, in addition to an effort to understand the phenomenon regarding the situations, events and processes that connect them[13].

Since the PHE was the very theoretical-critical framework for this stage, it can be seen as an educational, active and question-raising practice for education in service, based on work, on the previous knowledge of the workers, on a significant learning process and on the transformation of practice. The theoretical references of the PHE enable the health workers to intervene in their context in a critical, collective and integrative way[11].

The corresponding results were summarily presented in tables. Regarding ethical aspects, Resolution CNS 466/2012 was respected, and the research was approved by the Research Ethics Committee of the Triângulo Mineiro Federal University, under protocol 1.1618.872.

RESULTS

In the first stage of the study, 60 instruments were given back, divided in: nursing technicians (n=22), physicians (n=14), nurses (n=13), physical therapists (n=9) clerical workers (n=2) and one speech-language therapist, meaning that 50% of participants returned the filled form.

Most of them (63.3%) had been working in the NICU from one to five years. Most considered the noise in the unit to be high (55%) or very high (33.3%). Only seven (11.7%) perceived it as normal.

Considering the signs and symptoms presented regarding exposure to excessive noise, the most commonly indicated were: irritability (83.3%), headaches (75%), loss of attention (68.3%) and difficulties to relax mentally (66.7%) (Table 1).

Table 1. Recurring signs and symptoms among workers in the Neonate Intensive Care Unit caused by exposure to inadequate noise. Uberaba, MG, 2017.

Signs and symptoms	none	%
Irritability	50	83.3
Headaches	45	75.0
Loss of attention	41	68.3
Difficulty in relaxing mentally	40	66.7
Alterations in the quality of sleep	31	51.7
Problems in communication with colleagues	31	51.7
Auditive hallucinations	28	46.7
Fatigue	26	43.3
Tensional muscular pain	20	33.3
Auditive losses	19	31.7
Tachycardia	15	25.0
Loss of critical or judging abilities	15	25.0
Depression/anxiety	14	23.3
Higher liberation of stomach acids/gastritis	11	18.3
Arterial hypertension	9	15.0

a Each participant could sign more than one option

The main sources of noise noted were: monitor and incubator alarms (95% in both cases), conversations in the unit (85%), the movement of chairs and tables (83.3%), infusion pumps (80%) and the closing of incubator access doors (76.7%) (Table 2).

Table 2. Sources of excessive noise according to the perception of the workers in the Neonate Intensive Care Unit. Uberaba/MG, 2017.

Sources	none	%
Monitor alarms	57	95.0
Incubator alarm (overheat)	57	95.0
Conversations in the unit	51	85.0
Moving of chairs and tables	50	83.3
Infusion pumps	48	80.0
The closing of incubator doors	46	76.7
Opening and closing of trash cans	43	71.7
Materials placed on top of the incubators	42	70.0
Telephones ringing	39	65.0
Fan	38	63.3
Opening and closing of doors	37	61.7
Syringe pumps	37	61.7
Vacuum	35	58.3
Cellphone use within the unit	34	56.7
Drawers being closed	34	56.7
Noisy footwear	33	55.0
Patients crying	31	51.7
CPAP	30	50.0
Water in the mechanical ventilation circuit	30	50.0
Incubator temperature adjustments	29	48.3
X-ray equipment	28	46.7
Air-conditioning	27	45.0
Incubator access panel being closed	26	43.3
Paper towel holder	25	41.7
Opened faucets	21	35.0
Printer	9	15.0

a Each participant could sign more than one option

Regarding the second stage of the research, according to document analysis, for the development of the PHE, a small group made up of workers from the unit who had expertise in this type of implantation was organized.

The members of this Guiding Group were: The Nursing Technical Chief (TC) and the Medical TC of the unit, a Representative of the Hospital Infection Control Commission (CCIH), a Representative of the Residue Management Unit, two representatives from Clinical Engineering, the TC of the Radiology Sector, the TC of the Enteral Nutrition Sector, the preceptor of the Nursing and Multiprofessional Residence Programs of the Hospital and the Physician in charge of the Medical Residence Program in the Sector.

PHE engagement required meetings to be held in different shifts by the GG members. NICU workers were invited to participate in the meetings through information placed in the bulletin board of the sector, including date, time and objectives of each meeting.

The themes that would be addressed were previously informed, and each meeting was estimated to last about 45 minutes - guaranteeing the routine of assistance would be under control. Below there is a description of the participation of the workers in the meetings conducted in the months of March and May 2017, so that questions could be raised and themes discussed (Chart 1).

Chart 1. Characterization of the meetings for permanent education in health regarding noise control in the Neonate Intensive Care Unit. Uberaba/MG, 2017.

Themes	Objectives	Techniques Used	Categories Participants (n)
How strong is the noise at NICU?	Collectively discussing the results of the survey	Exposure through a dialogue using slide presentation	Nurses (6) Clerical worker (1) Physical therapist (1) Physician (14) Cleaning professional (1) Nursing technicians (38)
How to identify the noise in the NICU?	Identifying, collectively, actions whose change is within the power of the team, so that noise can be better managed.	Exposure through dialogue, using a slide presentation and a suggestion box	Nurses (6) Clerical worker (1) Physical therapist (1) Physician (14) Cleaning professional (1) Nursing technicians (43)

To conduct the meetings, the GG was concerned with valuing teamwork, according to the perspective of the PEH theoretical framework. They tried to communicate clearly, reducing to a minimum the possible misunderstandings; the learning process aimed to eschew the mere transference of knowledge from one person to the other, valuing the idea of learning with the other and not from the other.

With all that, the building of cooperation spaces was sought, favoring the articulation between the members of the team, their knowledge and their actions. Also, the GG sought to offer a support network - so that the meetings would not be tense or competitive.

It is important to highlight that, after the second meeting, the GG took on the responsibility of trying to raise the awareness of all workers regarding the themes discussed. To do so, the members took the responsibility of gathering, in moments other than those of the meetings, suggestions from other workers in the sector on how to overcome the problem.

The suggestions were organized in a list that was the base for the definition of actions in the sector according to the planning of the unit. The suggestions that were under the power of the team, considering how critical to their development financial and organizational decisions or specific knowledge were, were selected for implementation. The list of suggestions was registered in a PEH minute in the sector, and later meetings discussed the elaboration of a schedule to perform the activities, as well as decided who would be responsible for them. The activities were:

a) Raising the awareness of the entire team, including physicians and those on duty on weekends, about the need for noise control in the unit;

b) Raising the awareness of all teams that provide care in the NICU (such as the milk room staff, the kitchen staff and the inter-consultation specialists) and of neonate family members regarding noise control;

c) Advising the team to avoid using noisy footwear in the unit;

d) Advising and raising the awareness of the team about changes needed in their behavior, such as: avoiding to drag chairs, closing cupboard doors and drawers carefully, opening and closing incubator access doors carefully, not putting objects on the incubator, avoiding unrelated conversations, among others;

e) Advising the medical team to promptly answer the phone, especially during the times scheduled for phone contact with parents/relatives;

f) Demanding that cellphones and other electronic communication devices in this environment remain silent, even from the families;

g) Asking for authorization to lower the volume of the alarms of the equipment and to standardize the volume within the NICU;
h) Transferring the printer from the center of the unit to the incubator storage room;
i) Engaging the medical and nursing teams in the implantation of measures to address the uncontrollable cries of babies, trying to use simple measures to comfort them (cherishing, changing position, non-nutritional suction, among others).

DISCUSSION

Discussions on noise control in NICUs have been standing out in literature[13]. Using the Delphi method to identify quality indicators sensible to the actions of nurses in these units, Chinese researchers mentioned noise control as something very important[14].

Being under the excessive noise in these sectors brings negative effects to the workers' health, and can lead to burnout syndrome, as it makes easier for symptoms such as stress, irritability, fatigue and emotional instability to appear among the team of the unit[15].

A research in a public university hospital in Governador Valadares, MG, had similar results to those found here. 235 members of their multiprofessional team identified, as negative effects of exposure to inadequate noise, discomfort when under loud sounds (75.7%), feeling bad at the end of their work shift (35.3%) and difficulties in hearing what others are saying (29.8%)[16]. In a university hospital in Rio de Janeiro, equipment in general was evaluated during the routine work of the multiprofessional team in a NICU, and found to be louder than the safety volumes in all shifts[17].

Regarding the proposals for change considering noise control in the NICU, the need for this environment to be silent stands out[18,19], since the existence of moments of quietness is essential for the development of the neonates being cared for. Therefore, the professionals knew what the essentials for managing noise in these settings are. The challenge for the implantation involves, especially, the organizational culture of the NICU[19-21].

This culture includes the experiences the workers go through in the hospital environment and impacts in the safety of the system being analyzed - especially when its greatest advantages and disadvantages are recognized. The development of aspects related to communication and cooperation within health services is essential for the system to move forward in the improvement of opportunities of attention, and therefore, to better the safety of those being cared and the satisfaction the team has in their work at the NICU[21].

During discussions on how to maintain the culture of silence in the NICU environment during non-emergency situations, the implementation and diffusion of strategies seems essential, including those that favor the recognition of the negative effects of noise on the neonates and on the team.

The entire multiprofessional team must take part in these changes on how to deal with the noise, since, if the changes are restricted to the nursing team, the changes that favor a culture of silence have lower chances of being maintained. As a consequence, all workers in the unit must adhere and the feeling of cooperation must be a part of the initiatives to transform this culture into action[20,21].

From this perspective, in order to bring about changes and engage the team, the process of work in health must be increasingly supported by shared knowledge, so that workers can incorporate changes in the structure of their work. With that, the use of the PEH as a theoretical framework to perform these changes results from questions raised about local reality, which is the base for the construction of collective changes, can help avoiding uncontextualized actions to be designed and leads to initiatives whose execution is based on the field of practice[22,23].

First and foremost, the PEH has been established and guided by free, critical and reflexive thought, and used to transform practices that have been experienced, supporting a personal and professional commitment to transformation[22,23].

The PEH has become an important instrument of change when directed to health,

bringing together the many subjects that integrate care to aid in its improvement. A challenge for the implantation of the PEH in hospitals is the lack of interest from the professionals, the lack of time and the little encouragement received from the management of these institutions[23].

As this research showed, the strategies used, such as the establishment of a GG, the holding of meetings in different, previously scheduled shifts, and the flexibilization of participation, led to initiatives that made the PEH viable, as well as discussion on work practices, and the consequent elaboration of guides to change reality.

The limitation of this study regards the possibilities of generalization of its results, due to the limited feedback of the workers in the first stage and to the fact that the list of suggestions was elaborated according to the reality of one specific NICU. However, the initiatives described above, from the survey of the effects of noise on the team and environment of the NICU, to the implantation of PHE as a strategy to guide changes and record suggestions, can be inferred to have potentially good results in similar settings to the hospital that was analyzed.

CONCLUSION

Faced with the worldwide challenge of noise control in NICU settings and considering the negative effects excessive noise has upon the workers and neonates being cared for, this research collaborates to analyze this problem and proposes solutions to it. In general, the results are innovative when it comes to the PEH references for the operationalization of changes in the unit, considering how much the culture of silence can change.

Despite receiving little feedback in the first stage of the research, which limited the generalization potential of the study, results found were convergent with those of investigations conducted in similar settings.

In addition, these results raised questions that led to shared considerations and to the creation of shared constructions and of the list of initiatives, proposals of the multiprofessional team which were consonant to the PEH theoretical framework. Additionally, the description of the activities in the initiatives favors the replication of this method in similar settings, so that analogous results may be reached.

However, future researches are still needed to verify the actual implantation of the culture of silence in the sector, including whether the list of suggestions will be applied. To do so, this study suggests that an assessment of the noise levels should be performed, mapped according to shifts and sources, before and after the suggestions in the list are implemented.

Other important assessments would be regarding noise perception and its negative effects among the workers, the duration of neonate hospitalization in the NICU, and the satisfaction of the teams and families regarding implemented changes.

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CONTRIBUTIONS

Fabiana Jorge Bueno Galdino Barsam, Larissa Cristina de Sousa Lima contributed in the conception of the study. **Débora de Oliveira Ferreira and Maria Sueli Sueli de Souza Silva** collected the data for the study. **Claudia Rodrigues de Oliveira** took part in the critical review of the article. **Fernanda Carolina Camargo and Cinthia Lorena Silva Barbosa Teixeira** participated in data analysis and in the writing of the article.

How to cite this article (Vancouver)
Barsam FJBG, Teixeira CLSB, Oliveira CR, Lima LCS, Ferreira DO, Silva MSS, et al. Noise control: team perceptions and educational intervention in a Neonate Intensive Care Unit. REFACS [Internet]. 2018 [cited in insert day, month and year of access];6(3): 453-463. Available from: insert access link. DOI: insert DOI link.

How to cite this article (ABNT)
BARSAM, F. J. B. G. et al. Noise control: team perceptions and educational intervention in a Neonate Intensive Care Unit. REFACS, Uberaba, MG, v. 6, n. 3, p. 453-463, 2018. Available from: <insert access link>. Access in: insert day, month and year of access. DOI: insert DOI link.

How to cite this article (APA)
Barsam, F. J. B. G., Teixeira, C. L. S. B., Oliveira, C. R., Lima, L. C. S., Ferreira, D. O. & Silva, M. S. S., et al. (2018). Noise control: team perceptions and educational intervention in a Neonate Intensive Care Unit. REFACS, 6(3), 453-463. Recovered in: insert day, month and year of access from insert access link. DOI: insert DOI link.