Workers' knowledge and perception regarding noise in the Neonatal Unit

CONHECIMENTO E PERCEPÇÃO DOS PROFISSIONAIS A RESPEITO DO RUÍDO NA UNIDADE NEONATAL

CONOCIMIENTO Y PERCEPCIÓN DE LOS PROFESIONALES RESPECTO DEL RUIDO EN LA UNIDAD NEONATAL

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ABSTRACT

The objective of the study was to assess the knowledge and perception of professionals working in a Neonatal Intensive Care Unit (NICU) regarding the repercussions of noise on the neonates, families and workers, prior to the implementation of an educational program. This qualitative descriptive study was conducted in a NICU of a São Paulo hospital with 101 professionals. A questionnaire was used for data collection, and chi-square and Student's t test were used to determine the association between variables. The workers described the NICU as very noisy (44.9%); they noticed the effects of noise during and after their work shift (67.4%) and used strategies to reduce noise. Despite not being familiar with legislation regarding noise in the hospital, the workers identify its repercussions on themselves, the neonates and families. Results indicate the need to teach the staff about legislation and noise prevention, as well as reorganize healthcare practices and Neonatal Intensive Care Unit facilities.

DESCRIPTORS

Intensive Care Units Neonatal
Noise
Infant newborn
Family
Health personnel
Neonatal nursing

RESUMO

O objetivo deste estudo foi verificar o conhecimento e a percepção de profissionais de Unidade de Terapia Intensiva Neonatal (UTIN) sobre as repercussões do ruído ao neonato, família e profissionais, antes da implementação de um programa educativo. Trata-se de uma pesquisa descritiva, quantitativa, realizada em Unidade de Terapia Intensiva Neonatal de um hospital de São Paulo, com 101 profissionais. Foram utilizados: questionário para a coleta de dados, e os testes de Qui-quadrado e t de Student para a associação entre as variáveis. Os profissionais identificaram a UTIN como muito ruidosa (44,9%), perceberam os efeitos desse ruído durante e após a jornada de trabalho (67,4%) e utilizaram estratégias para amenizá-lo. Embora os profissionais desconheçam a legislação sobre o ruído no ambiente hospitalar, identificaram repercussões para si, recém-nascido e família. Os resultados apontaram para a necessidade de orientar a equipe quanto à legislação, prevenção de ruído e reorganização das práticas assistenciais e estrutura física da Unidade de Terapia Intensiva Neonatal.

DESCRITORES

Unidades de Terapia Intensiva Neonatal
Ruído
Recém-nascido
Família
Pessoal de saúde
Enfermagem neonatal

RESUMEN

Se objetivó verificar el conocimiento y percepción de profesionales de Unidad de Terapia Intensiva Neonatal (UTIN) sobre efectos del ruido en el neonato, familia y profesionales, antes de implementar un programa educativo. Investigación descriptiva, cuantitativa, realizada en UTIN de un hospital de São Paulo, con 101 profesionales. Fueron utilizados: cuestionario para recolección de datos y tests de Chi-cuadrado y T de Student para asociación entre las variables. Los profesionales se refirieron a la UTIN como muy ruidosa (44,9%), percibieron los efectos de ese ruido durante y después de la jornada laboral (67,4%) y utilizaron estrategias para neutralizarlo. A pesar de que los profesionales desconozcan la legislación sobre ruidos en ambiente hospitalario, identificaron repercusiones para sí mismos, para el recién nacido y su familia. Los resultados sugieren la necesidad de orientar al equipo respecto de la legislación, prevención de ruidos y reorganización de prácticas asistenciales y estructura física de la UTIN.

DESCRIPTORES

Unidades de Terapia Intensiva Neonatal
Ruido
Recién nacido
Familia
Personal de salud
Enfermería neonatal

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INTRODUCTION

Neonatal Intensive Care Units (NICU) have gone through a process of evolution which has significantly influenced the reduction in the rates of morbidity and mortality among premature babies and newborns with very low birth-weights[1]. The advance in technology has brought equipment which, inevitably, produces noise, which can have repercussions on the health and quality of life of the new-born, her family, and the health care professionals.

A sound or mixture of sounds, with two or more notes, capable of damaging health, safety or public peace is considered to be noise[2].

Exposure to high sound pressure levels can produce physical damage and psychological or behavioral alterations in individuals. In addition to this, the longer the exposure to the noise, the greater the damage[3].

The World Health Organization (WHO) recommends for NICU levels of sound pressure of up to 40 decibel (dB) on the A-weighted (A) scale during the day, with a reduction to 5 to 10 dB(A), at night[4]. The American Academy of Pediatrics suggests that the noise levels should not pass 58 dB(A)[5] in this environment.

The NICU is an environment with various stimuli, including sounds, produced by, among others: the movement of people inside the unit, alarms from life-support machines, water rushing from taps, conversation between health care professionals and family members, and the opening and shutting of the incubators´ hatches, lids of waste-bins and entry doors into the unit[6].

The harm caused by noise to the newborn hospitalized in the NICU may be characterized by: stress, irritability, alterations in circadian rhythm, cardiac and respiratory frequencies, arterial pressure, oxygenation, peristalsis and consumption of glucose, which may delay the recuperation of the hospitalized child[7].

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The long-term effects of noise may be shown in the form of difficulties in hearing, thinking, conversing, reading, writing, spelling or calculating, affecting the child´s social, emotional, intellectual and linguistic development[8].

The deleterious effects of high levels of sound pressure on the health care professionals may be characterized as an increase in arterial pressure, alterations in cardiac rhythm and muscle tone, headache, hearing loss, confusion, low powers of concentration, irritability, burnout and dissatisfaction with work. Health care professionals may also be harmed in the performance of their activities when exposed to high sound pressure levels. The situation may lead them to commit errors and consequently compromise patient safety, as NICU care for newborns in critical situations, who need intensive care and rapid decision-making from the health care professionals working there[9].

The Ministry of Work in Brazil recommends, in Regulatory Standard No. 15 (NR15) about unhealthy work, that a worker´s exposure should not pass a period of eight hours at 85 dB(A); 4 hours at 90 dB(A) and 2 hours at 95 dB(A). Exposure to continuous noise of over 115 dB(A) is not advised for individuals not using appropriate personal protection equipment, or exposure to impact noise over 140 dB(A)[10].

In addition to the patients, health care professionals and support staff, the family of the new-born should also be considered, as they too are present in the NICU, going through a crisis situation due to the illness of one of their members, and experiencing moments which swing from stable to unstable[11].

The routine of the NICU, which is totally different from the family´s routine[9], can increase the suffering caused by the critical condition of the neonate, intensifying some feelings, such as: fear, worry, solitude and guilt, above all when the family is prevented from staying with their baby[12]. The excessive noise of a unit associated with this experience can increase the stress experienced by the family.

Taking all the above into account, and that managing the environment in a Neonatal Intensive Care Unit is a fundamental aspect of the developmental care, and that to achieve the sound pressure levels recommended, the commitment of the multidisciplinary team is necessary, one may ask: what is the knowledge and what are the perceptions of nursing professionals about noise in the Neonatal Intensive Care Unit in a university hospital; and what are the variables which exert influence?

The present study aimed to ascertain the knowledge and perception of the NICU professionals regarding noise and its repercussions on the neonate, their family and the health care professionals.

METHOD

This research is descriptive and quantitative, carried out in an NICU in a teaching hospital in the city of São Paulo. The unit has four rooms with a total of 16 beds, with two rooms dedicated to intensive care (A and B) and the other two to intermediate intensive care (C and D). Each room has an area of approximately 23.80 m^2, a ceiling height of 3.40 m, a floor made from vinyl material, walls of masonry, a ceiling of concrete and glass

windows (with child-proof safety netting) which are kept permanently open, exposing the environment to the noise from the street outside. The rooms are located close to the nursing station, which is where the telephone and stocks of controlled drugs are kept, and is where staff members remain for carrying out certain tasks. Next to the nursing station, there is the corridor, which all health care professionals, students and teaching staff move along or stay in, during clinical discussions and the completion of medical prescriptions.

Preventive maintenance of the unit´s incubators and other equipment is not available, and the environments are not air-conditioned. The newborns parents are present in the NICU on a daily basis, from nine in the morning to nine at night. It must be observed that, generally, the medical and nursing teams' handovers take place beside each incubator, as does the nursing care programmed.

The study´s population was made up of 189 health care professionals, these being: 13 nurses, 44 nursing assistants, 47 doctors, 63 physiotherapists, 3 speech and language therapists, 2 psychologists, 1 clerk and 3 cleaners. It should be emphasized that among these professional there were students and teaching staff.

The sample consisted of 101 professionals, including 28 doctors, 9 nurses, 36 nursing assistants, 3 speech and language therapists, 1 psychologist, 22 physiotherapists, 1 clerk and 1 cleaning assistant, all of whom had provided care to the neonates in rooms A and B or who had been present in the unit during the period of data collection, between May and August 2009.

The data was collected through the application of a questionnaire, elaborated by the researchers based on a bibliographical review, containing both open and closed questions about the following variables: gender, age, profession, level of schooling, length of professional training and of work in the NICU, perceptions about the acoustic characteristics of the neonatal unit and the conduct of the professionals in reducing environmental noise, and the health care professionals´ knowledge about the noise´s socio-political aspects and the psychophysiological consequences of the noise on the neonate, the health care professional and the family.

The data collection instrument was subjected to a pre-test with health care professionals in another neonatal unit which had similar characteristics to the NICU studied. It should be emphasized that the questionnaire used in collecting the data allowed the subjects to leave some questions unanswered, according to the answer they marked. Data collection was carried out by one of the researchers who handed the questionnaire to the respondent and - sometimes – waited for it to be handed back in the area the study was taking place, or returned to pick it up later.

For the analysis of the data, the researchers used the absolute and relative frequencies, the mean and the medians of some variables from the study. In the associations between the variables, the Chi-square test and Student´s t-test were used, with significance fixed at $p < 0.05$.

In identifying the sources of noise, the respondents were asked to list them, placing them in order of importance. The maximum number of sources mentioned was eight, and scores were obtained by attributing to each source mentioned a weighting on a scale of 1 – 8, from least important to most important. The final score was obtained by multiplying the weighting by the frequency.

The project respected the principles of Resolution 196/96, with the approval of the Institution´s Research Ethics Committee (No. 0391/07); authorization was received from the Directorate of Nursing and from the Management of the Neonatal Unit; the Consent Form were signed by those involved in the study.

RESULTS

Of the 101 health care professionals in the NICU studied, 36 (35.6%) were nursing assistants; 28 (27.7%) were doctors; 22 (21.8%) were physiotherapists; 9 (8.9%) were nurses; 3 (3.0%) were speech and language therapists; 1 (1.0%) was a cleaning assistant; 1(1.0%) was a clerk and 1 (1.0%) was a psychologist (Table 1). Regarding level of schooling, 67.0% of the subjects had finished university, followed by 21.0% who had finished high school. As for the other characteristics, the research subjects were on average 32.2 years old, had 7.9 years of professional experience and 5.8 years of experience as professionals in NICU (Table 1).

Regarding how the unit´s acoustic characteristics were perceived, 44 health care professionals (44.9%) considered it to be very noisy; 44 (44.9%) more or less noisy, and only 10 (10.2%) referred to it as a place that was not very noisy.

The professional who found the NICU very noisy (44.9%), had an average of 7.0 years´ work experience in the unit being studied, while those who perceived this environment as not very noisy (10.2%) had worked there for, on average, two years. This data indicates that there is a statistically significant association between health care professionals´ perception of sound pressure levels in the NICU researched and their length of service ($p=0.0013$).

The majority of the subjects (93.8%) perceived some degree of discomfort with the high levels of sound pressure in the NICU, and of these, 26 (26.8%) noted that the noise bothered them a lot; 40 (41.2%) noted that it bothered them more or less; 25 (25.8%) said it bothered them a little; while 5 (5.2%) were not bothered and just 1 (1.0%) health care professional claimed not to have noticed.

Table 1 - Socio-demographic characteristics of health care professionals and support workers at the neonatal intensive care unit - São Paulo, 2009

Profession	f	%
Nursing Assistant	36	35.6
Doctor	28	27.7
Physiotherapist	22	21.8
Nurse	9	8.9
Speech and language therapist	3	3.0
Cleaning assistant	1	1.0
Clerk	1	1.0
Psychologist	1	1.0
Level of schooling		
High school-incomplete	1	1.0
High school-complete	21	21.0
University-incomplete	11	11.0
University-complete	28	28.0
Post-graduate	39	39.0
No answer	1	1.0
Age (years)		
Average (SD)	33.2	8.5
Median (Q1 and Q3)	30	26 – 37
Range	20 to 56	
Time since Graduation (years)		
Average (SD)	7.9	7.3
Median (Q1 and Q3)	6	2 – 11
Range	0.3 to 34	
Length of Service in ITU		
Average (SD)	5.8	6.2
Median (Q1 and Q3)	4	0.4 – 9
Range	0.1 to 26	

Of all the subjects who noted discomfort with the noise in the Neonatal Intensive Care Unit (n=91), 42 (44.2%) affirmed that they always tried not to cause it and 42 (44.2%) reported that they sometimes try to avoid it, adopting various strategies, such as: talking quietly (61.5%); handling the incubator with care (36.5%); responding rapidly to alarms when they go off (25.0%); opening and shutting the doors of the rooms with care (17.7%) and going outside the NICU to talk (14.6%).

The 64 subjects (70.3%) were noticed the noise´s effects on themselves during and after the workday in the Neonatal Intensive Care Unit, while 27 (29.7%) did not. It was ascertained that the effects most frequently noticed were: irritation (26.6%); followed by *memory of the noise* (23.4%), which was identified as a sort of buzzing sound which the health care professionals carry on hearing after they have left the work environment; headache (15.6%); physical tiredness (9.4%); mental tiredness (7.8%); difficulty in concentrating (6.3%) and repercussions on performance of work (6.3%).

It was identified that 63 (72.4%) health care professionals responded that they perceived the effects of the noise during and after the work day, with a median length of service of 5 years and an average of 6.3 years; only 24 subjects (27.6%) did not note the effects, with a median of 1.7 years and an average of 5.3 years. On relating length of service in the NICU with the possible effects which the noise can have on the health care professionals during and after the work day (Figure 1), no statistically significant association was found (p = 0.4821).

Through NR15, the Ministry of Work, in Brazil, recommends that during an eight-hour shift, a worker should be exposed to no more than 85 dB(A). It was observed that 64.4% of the health care professionals responded that they did not know what is called for by NR15. Only 10.9% of the responses corresponded to the recommendation cited, 23 (22.8%) health care professionals mentioned levels of sound pressure below what is called for and the others (2.0%) cited levels above that recommended by NR15.

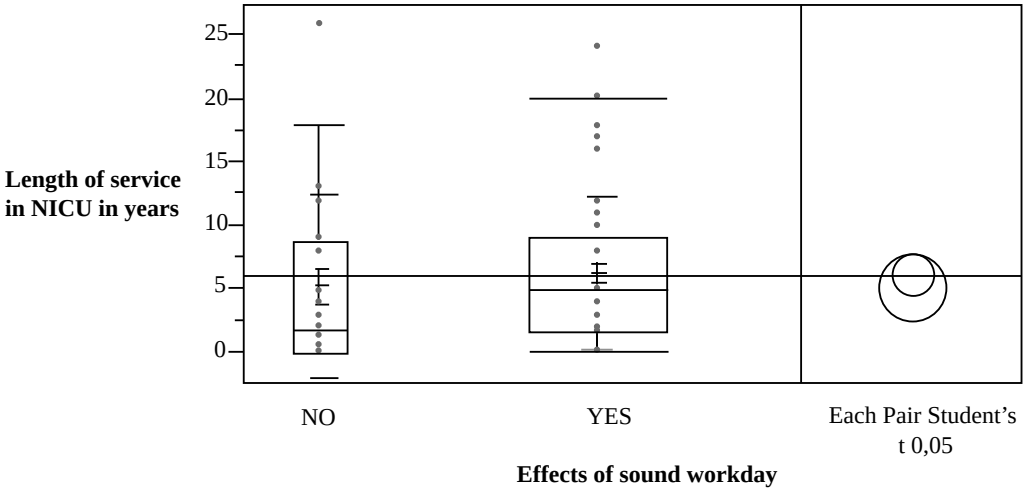

Figure 1 – Relation of the professionals´ length of service in the Neonatal Intensive Care Unit with the effects of noise on the workday - São Paulo, 2009

It was identified that the legislation which deals with levels of sound pressure is unknown by the majority of health care professionals and the support workers, as only 11 (10.9%) of them responded correctly to the question referring to NR15 and 10 (10.0%) correctly about the level of sound pressure called for by the WHO for hospital institutions. As for the NR15 and the WHO recommendation, only 1 (1.0%) physiotherapist and 1 (1.0%) speech and language therapist got both the answers right.

In relation to the perception of the sources of noise, the health care professionals cited as the most important: noises caused by the functioning of the devices and equipment (488 points), the equipment´s alarms (338 points), conversation (250 points), this related to the number of health care professionals (175 points) and to how loud they speak (152 points), opening /shutting the doors of the NICU (90 points), dragging objects/equipment (70 points), opening/shutting the hatch and also external sounds (65 points), putting objects down on top of the incubator (56 points), high heels and the ringing of the telephone, both with 44 points, and others. The health care professionals also mentioned the crying of newborn babies as a source of noise.

It was observed that 73 (73.0%) subjects recognized the effects of environmental noise on the health care professionals´ health, 27 (27.0%) did not, and 1 (1.0%) did not respond to the question. In terms of professional category, the data indicates that all of the nurses recognized the effects of noise on the health care professionals who work in the NICU, followed by 77.8% of the nursing assistants-auxiliaries, 71.4% of the doctors and 54.5% of the physiotherapists.

In this vein, the following deleterious effects of high levels of sound pressure in the NICU on the health of the health care workers were cited: irritability (35.6%), stress (25.7%), distraction (23.8%), headache (8.9%) and some unspecified hearing problems (6.9%).

Regarding awareness of the effects of noise on the family of the newborn hospitalized in the NICU, 23 (63.9%) of the nursing assistants/auxiliaries affirmed that they were aware, followed by 18 (64.3%) of the doctors, 10 (45.4%) of the physiotherapists, 4 (44.4%) of the nurses and 2 (40.0%) of the other professionals. Proportionally, the effects of the noise on the newborn's family most highlighted by the subjects of the study were: irritability (14.9%), stress (11.9%), worry (11.9%), anxiety (10.9%) and insecurity (9.9%); also 10.9% of the health care professionals believe that the noise can give the family the impression that the health team in the NICU does not respect the baby.

The data also showed that 92 (91.1%) health care professionals responded that they are aware of the effects of noise on the newborn, and that 9 (8.9%) did not. In terms of professional categories, it was noted that all of the nurses knew the effects of noise on newborns, as did 33 (91.7%) of the nursing assistants, 27 (96.4%) of the doctors, 18 (81.8%) of the physiotherapists and 5 (83.3%) of the other professionals. Of the consequences of high levels of sound pressure on new-borns, the NICU team identified stress and irritability in equal proportions (24.8%), as well as agitation and sleep disturbances (21.8%), besides alterations in hearing (14.9%), in the clinical evolution (9.9%) and in physiological/metabolic functions (9.9%), among others.

DISCUSSION

Studies have found evidence for high levels of sound pressure in NICU and inside the incubators[6,8,13] and have indicated the deleterious effects on the health of neonates, health care professional and family, although there is still a scarcity of studies in the Brazilian and international Nursing literature on the subject here researched.

Among the existing recommendations for minimizing the levels of sound pressure in the neonatal environment, there are architectural changes[14] and the replacement of equipment, however, these involve high costs and are not always possible to implement at short notice in the units. In this context, the application of low cost measures becomes more important – measures such as the continuing education of the work team regarding the prevention of environmental noise, so as to produce behavioral changes[1,15-16], as 50% of the sources of noise arose from the attitudes of the health team itself[1].

The health care professionals and the support workers in the NICU spend a lot of time exposed to high levels of sound pressure, which makes them susceptible to the deleterious effects that such noise can bring. The data from this research indicates that the health care professionals perceive the NICU as very noisy, creating discomfort and damage to their health, with signs and symptoms persisting after their work day is over – the most cited being irritability and stress. This data agrees with that from another study, in which the health care professionals researched referred to stress, irritability and alterations in hearing, weight and physiological and metabolic functions, including alterations in sleep, producing clinical consequences for the individuals[17]. The National Institute on Deafness and Other Communication Diseases estimates that 10.0% of people aged between 20 and 29 have suffered permanent damage to their hearing, much of which is secondary to exposure to excessive environmental noise[18].

Although health care professionals try not to make noise, the lack of knowledge about the recommended levels of sound pressure and the inexistence of systematic measurements at work make evaluating their efforts difficult, and do not foster the maintenance of permanent pro-active attitudes vis-à-vis an environment which is acoustically-comfortable and also safe for the health of neonates, family members and health care professionals.

Besides irritability and stress, the health care professionals in the present study mention that noise can also cause: headache, distraction, difficulty in caring for the new-born, poor performance, and memory of the noise, among others. In intensive care units, the multidisciplinary team live with other factors which unleash stress, such as: the difficulty of accepting death, the scarcity of material and human resources and the taking of conflicting decisions related to the selection of the patients who are to be attended[19]. Further, it stands out that noise can exacerbate the prejudicial effects on the health of the health care professional in the unit.

The statistical analysis between the length of service of health care professionals and support staff in the Neonatal Intensive Care Unit studied and their perception of the deleterious effects of the noise on their own health, during and after the workday, did not find any significant correlation. However, a study carried out in a general intensive care unit[20] whose objective was to characterize the population of nurses and associate the level of stress, noted that those health care professionals who had graduated more than 11 to 15 years previously presented higher stress scores on the Bianchi Stress Scale.

A quasi-experimental study[15] of the implementation of a noise reduction program in a NICU observed that the change of attitude in health care professionals can vary from individual to individual, being temporary, although health care professionals from other units visiting NICU always observe the *silence* rule in the unit. This study also demonstrated that, for reduction of noise, it is necessary to consider the environmental ecology of the Neonatal Intensive Care Unit as a whole, as when the intensity of the light was reduced, it was observed that the nurses spoke more quietly. Equally, it is necessary to train the health care professionals to detect possible signs in the neonate and family that may be interpreted as adverse effects of the noise.

Loud noise causes psycho-biological effects in the new-born, with alterations in the sleep cycle and wakefulness, immediate changes in vital signs, and inadequate growth and development[13]. This is in addition to the fact that sleep disturbance in the neonate can lead to

> impaired immune function, decreased inspiratory muscle endurance, difficulty in weaning from mechanical ventilation, a possible association with delirium and severe morbidity and impaired secretion of melatonin, the key circadian regulatory hormone[17].

Evidence for sleep disturbance associated with agitation in new-borns was shown in the present study, being the third effect perceived by the health care professionals. Immediate attendance to crying and agitation and to appropriate pain management in neonates should deserve special attention on the part of health care professional to reduce the level of sound pressure inside the incubator.

The neonate´s agitation can raise the level of sound pressure by 20 dB(A)[21]. Although the incubator functions partially as a barrier against the penetration of environmental sounds, it produces sounds associated with its own functioning and with the care given to the child inside it. These sounds reverberate on the hard wall of the canopy, amplifying the noise which hits the neonate[22].

The NICU atmosphere is unfamiliar to most parents. A recent study[11] whose objective was to understand how families perceive their own presence in the Neonatal Intensive Care Unit and their acceptance by the health care professionals, demonstrated that the majority of parents experience moments of tension and great affliction as, normally, they associate hospitalization in this unit with death. Besides this, the environment can contribute to the appearance of feelings of isolation, fear and psychological instability. As the health care professionals in the present study commented, the excessive noise in the NICU can provoke in the parents the impression that the team does not consider the baby´s needs, in addition to making them irritable, stressed, worried, anxious and insecure.

The authors share the belief that parents feel more secure when they participate in the care of their child as partners[11] and are supported in this environment.

Acknowledging the subjective character of the subjects in the study where the perception of noise levels is concerned, and starting from the assumption that it is difficult to quantify the amount of time that the health and support teams spend inside the NICU, investigating how the healthcare professionals' perception of sound levels relates to the length of time they spend in this environment during the workday was considered a limitation on the study – since the multiprofessional team differs both in its activities and in the time it spends in the room providing care to the neonate and her family.

CONCLUSION

The health care professionals who work in the Neonatal Intensive Care Unit identified it as a noisy environment which caused them discomfort, noting that the effects of the noise persist even when the workday is over; they recognize the deleterious effects which the noise can have on the professionals, the neonates and on the families. They adopt, therefore, strategies to reduce the noise in the unit.

Equally, it was ascertained that the majority of the health care professionals are unaware of the recommendations called for, including both those of the Ministry of Work, in Brazil, concerning the level of sound pressure to which a worker may be exposed during an

8-hour shift, and those of the WHO concerning the level of sound pressure permitted during the daytime, in the NICU.

The data indicated the importance of systematic measurement of the level of sound pressure in the NICU, the importance of developing educational programs which encompass the knowledge and involvement of the multidisciplinary team, and above all, the raising of consciousness among the health care professionals concerning the importance of measures which foster better environmental conditions. However, the administrators must remember that behavioral changes alone are not enough, and that planning must include reforms necessary in the unit's physical layout, the acquisition of less noisy equipment, and the implementation of preventive maintenance of the same.

The results of this study are part of wider research which evaluated noise in a NICU, with a view to its reduction through an educational program and which served as support both for training the team and for putting together the practice guidelines for reducing this service´s environmental noise.

REFERENCES

1. Scochi CGS, Riul MJS, Garcia CFD, Barradas LS, Pileggi SO. Cuidado individualizado ao pequeno prematuro: o ambiente sensorial em Unidade de Terapia Intensiva Neonatal. Acta Paul Enferm. 2001;14(1):9-16.
2. Rio de Janeiro. Lei n. 126, de 10 de maio de 1977. Lei do silêncio [Internet]. Rio de Janeiro; 1977 [cited Nov.22nd 2010]. Available at: http://www.amecape.org.br/servicos/som126.htm
3. Grupo Racco Brasil. Declaração de guerra ao ruído. INFOSEG [Internet]. Belo Horizonte; 2010 [cited July 29th 2010]. Available at: http://www.gruporacco.com.br/infoseg/Infoseg_Edicao13_Declaracao_de_guerra_ao_ruido.pdf
4. World Health Organization (WHO). Guidelines for community noise. 4. Guidelines values [Internet]. Geneva; 1999 [cited Aug 2nd 2010]. Available at: http://www.who.int/docstore/peh/noise/Commnoise4.htm
5. American Academy of Pediatrics. Noise: a hazard for the fetus and newborn. Pediatrics. 1997; 100(4):724-7.
6. Ichisato SMT, Scochi CGS. Ruídos na Unidade de Terapia Intensiva Neonatal durante as passagens de plantão (enfermagem e/ou médica) e visita médica. Ciênc Cuidado Saúde. 2006;5 Supl:127-33.
7. Oliveira P, Coimbra D, Mor R. O nível de ruído na Unidade de Terapia Intensiva Neonatal e seus efeitos. Rev CEFAC [Internet]. [cited Aug. 2nd 2010]. Available at: http://www.cefac.br/publicar/arquivos/SP_nivel_de_ruido_na_UTI.pdf
8. Pinheiro EM, Guinsburg R,Nabuco MA, Kakehashi TY. Noise Neonatal Intensive Care Unit and inside the incubator. Rev Latino Am Enferm. 2011;19(5):1214-21.
9. Carvalho WB, Pedreira MLG, Aguiar MAL. Nível de ruídos em uma unidade de cuidados intensivos pediátricos. J Pediatr (Rio J). 2005;81(6):495-8.
10. Brazil. Ministry of Work. Regulatory Standard n. 15. Atividades e Operações Insalubres [Internet]. [cited March 19th 2009]. Available at: http://portal.mte.gov.br/legislacao/norma-regulamentadora-n-15-1.htm
11. Molina RCM, Fonseca EL, Waidman MAP, Marcon SS. The family's perception of its presence at the pediatric and Neonatal Intensive Care Unit. Rev Esc Enferm USP [Internet]. 2009 [cited Dec 15th 2010];43(3):630-8. Available at: http://www.scielo.br/pdf/reeusp/v43n3/en_a19v43n3.pdf
12. Almeida MI, Molina RCM, Vieira TM, Higarashi IH, Marcon SS. O ser mãe de criança com doença crônica: realizando cuidados complexos. Esc Anna Nery Rev Enferm. 2006;10(1):36-46.
13. Darcy AE, Hancock LE, Ware EJ. A descriptive study of noise in the neonatal intensive care unit. Ambient levels and perceptions of contributing factors. Adv Neonatal Care. 2008;8(3):165-75.
14. Brandon DH, Ryan DJ, Barnes AH. Effect of environmental changes on noise in the NICU. Adv Neonatal Care. 2008;8(5 Suppl):S5-10.
15. Philbin MK, Gray L. Changing levels of quiet in an intensive care nursery. J Perinatol. 2002; 22(6):455-60.
16. Miranda ÉJP, Stancato K. Riscos à saúde de equipe de enfermagem em Unidade de Terapia Intensiva: proposta de abordagem integral da saúde. Rev Bras Terapia Intensiva. 2008;20(1):68-76.
17. MacReady N. Simple devices associated with better sleep quality in ICU conditions. Crit Care [Internet]. 2010 [cited April 15th 2010]. Available at: http://www.medscape.com/viewarticle/720309
18. National Institute on Deafness and Other Communication Disorders. Noise and hearing loss [Internet]. [cited March 15th 2008]. Available at: http://www.nidcd.nih.gov/health/hearing/pages/noise.aspx

19. Silva GF, Carvalho MDB, Sanches PJ. Refletindo sobre o cuidado de enfermagem em Unidade de Terapia Intensiva. REME Rem Min Enferm. 2007;11(1):94-8.

20. Guerrer FJL, Bianchi ERF. Caracterização do estresse nos enfermeiros de Unidades de Terapia Intensiva. Rev Esc Enferm USP. 2008;42(2):355-62.

21. Byers JF, Waugh WR, Lowman LB. Sound level exposure of high-risk infant in different environmental conditions. Neonatal Netw. 2006;25(1):25-32.

22. Philbin MK. Planning the acoustic environment of a Neonatal Intensive Care Unit. Clin Perinatol. 2004;31(2):331-52.

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