



Research Article

Volume 8 Issue 1 - September 2019
DOI: 10.19080/AJPN.2019.08.555783

Acad J Ped Neonatol

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Levels of Sound Pressure in The Neonatal Intensive Care Unit: Professionals Views



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Submission: July 09, 2019; **Published:** September 09, 2019

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Abstract

Aim: To evaluate the perception of professionals about noise in a neonatal intensive care unit and to measure sound pressure levels.

Methods: In the first stage of the research the measurement of sound pressure levels (SPL) in the neonatal unit was performed. This measurement was performed during the workday of the professionals. And in the second stage an interview was conducted with the professionals about their perception of the sound pressure levels in the unit.

Results: The analysis showed that the sound pressure levels are above those recommended in all work shift, however the afternoon shift seems to be the noisiest. The intensive care unit was noisier than the conventional intermediate care unit ($p = 0.00$). When questioned, 72.2% of respondents perceive that the neonatal unit is an environment with intense noises, with morning being the noisiest period (88.9% of responses). Among the sources of noise, the conversations among professionals were the most cited (50.0%), followed by alarms from the devices (42.6%).

Conclusion: The sound pressure levels verified in our neonatal unit were higher than recommended and this was noticed by the professionals who circulate there.

Keywords: Intensive care units; Noise; Monitoring

Abbreviations: NICU: Neonatal Intensive Care Unit; WHO: World Health Organization; SPL: Sound Pressure Levels

Introduction

The technological advance made it possible to increase the survival rates of newborns treated in Neonatal Intensive Care Units. However, such features as mechanical ventilators, infusion pumps, monitors, incubators and alarms, produce high levels of sound pressure (NPS), making the environment noisy. In addition to these there are the noises produced by the human being, for example, conversations and laughter of employees, not careful handling of furniture, such as dragging chairs, closing cabinets, drawers and garbage covers [1-4].

The World Health Organization (WHO) recommends that, in the hospital environment, the Leq (equivalent pressure level) and the L_FMax (maximum sound pressure level) are between 30 and 40 dBA and that, during the night period, reduction of between five and ten percent of the noise level in the unit [5].

Studies show that high levels of sound pressure cause damage to the development of the newborn, such as hypoxia; increased intracranial pressure and blood pressure; apnea; bradycardia; increased oxygen consumption and heart rate, resulting in increased caloric intake [6-9].

Research shows that continuous and excessive noise levels can cause physiological and psychological effects on the health care team, such as high blood pressure, changes in heart rate and muscle tone, headache, hearing loss, confusion, low concentration and irritability, compromising the caregiver's quality of life and may cause Burnout Syndrome and thus compromise patient safety [10-12].

In an attempt to minimize noise levels in neonatal units, some researchers have proposed different strategies, but for to

be effective, it is necessary to raise awareness of the problem [8,13-15]. Therefore, it is important to know the professionals' perception about noise in a neonatal intensive care unit

Materials and Methods

This is a cross-sectional study carried out in a tertiary referral hospital of the public network of Rio de Janeiro, RJ, after approval by the Research Ethics Committee of the Institution (approval number 1.827.9 / CAAE 43368315.2.0000.5269) and the application of the Informed Consent Form.

The neonatal unit is divided into intensive care unit, neonatal intermediate care unit and kangaroo unit. The units has approximately 107.79 and 70.81m², both of rectangular shape with a height of 2.80m. The format of both is rectangular. Both units feature high strength flooring, concrete walls without acoustic treatment, glass windows with solar control film that remain closed all the time. The units have automatic glass doors, air-conditioned environments of Split type, a sink located centrally to the two rooms and sinks located near the incubators, not coated with anti-noise material. The group of 2 or 4 incubators are separated by formica shelves (Figure 1).

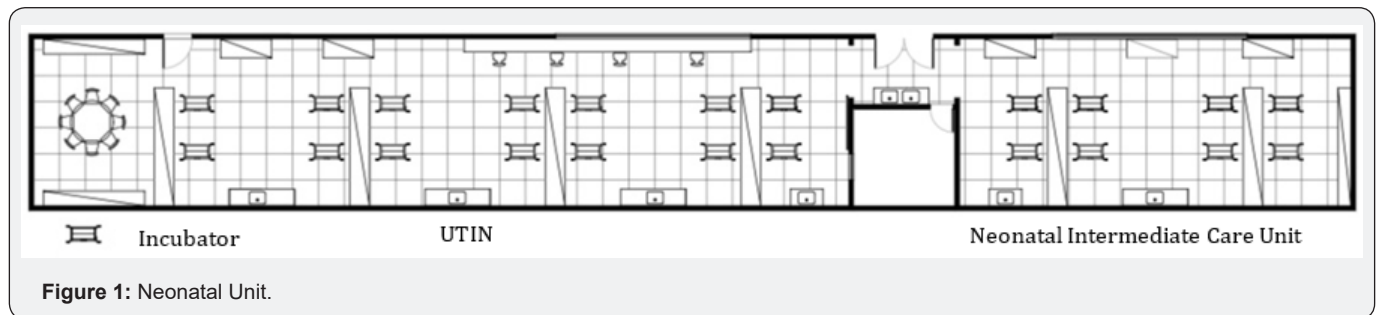


Figure 1: Neonatal Unit.

The Intensive Care Unit has capacity for 12 beds and the Intermediate Care Unit for 8 beds. They are restricted access areas, where only the health staff, cleaning staff, few administrative staff and the parents of newborns circulate. The only exception is on Wednesdays where grandparents are allowed in.

The nursing station is inside the units, where there are telephones and the employees remain when they are not in direct care with the newborns.

The team that operates in the sector is multi-professional, being composed of nurses, nursing technicians, physicians, physiotherapists, speech pathologists, psychologists, occupational therapists and social workers, the nursing team being the most quantitative. The hospital has medical, nursing and multi-professional residency programs, so there are professionals every year, and training is needed throughout the year.

The research participants were health professionals working in the Neonatal Unit. The inclusion criteria was: a) professional providers of direct care to the newborn;

b) professionals who circulate in the NICU, even if they do not provide direct assistance to the newborn.

The procedures used to develop the research were divided into two stages. In the first stage of the research the measurement of the sound pressure levels (SPL) in the selected sectors was carried out. This measurement was performed during the workday of the professionals. And in the second stage the interview was carried out.

Measurement of sound pressure levels was performed only in the NICU and Intermediate Care Unit. No measurement was performed on the kangaroo unit because it is a unit without

technological devices supporting life, therefore, with less possibility of noise.

To measure sound pressure levels the SoundEar[®] device was used, which is a dosimeter with feedback display capable of collecting 256 measurement values every five minutes. The square root of each measured value is then calculated and divided by 256. The mean value is then stored in the SoundLog[®] (which is a small box that couples to the SoundEar[®], which has the capacity to store 8191 measurements, which equals to about 4 weeks of uninterrupted recording.

The frequency range of the device is 20 to 16,000Hz (human audible range), with an accuracy of +/- 1 dB (A) and a dynamic area of 48 dB (A).

The data stored in SoundEar[®] has been exported to the specific software (SoundLog v.1.3.4). The sound pressure levels were summarized graphically using time series plots.

In the interview stage a questionnaire was made up of closed and open questions.

The database was built in the Epi-Info environment, and all statistical analyzes were performed in the SPSS statistical package, version 13. The data of the descriptive analysis are presented in the form of distribution (percentages) to characterize the variables.

Results

The study population was characterized by 54 professionals: 14 physicians, 15 nurses, 14 nursing technicians, 1 physiotherapist, 1 speech pathologist, 1 psychologist, 1 nutritionist, 1 social worker, 1 occupational therapist, 1 cleaning assistant and 4 administrative staff. It is noteworthy that among these professionals there were

students (residents of medicine and nursing). It is noteworthy that it was not possible to reach all professionals because some workers showed lack of interest in participating in the research.

A total of 13,393 records of sound pressure levels in the neonatal unit were analyzed in the 4-month period. The bed occupancy

rate was 100% for a total of 20 beds. The analysis showed that the sound pressure levels are above those recommended by the WHO in all the shifts, however the afternoon shift seems to be the noisiest. The NICU was noisier than the Intermediate Care Unit ($p = 0.00$) (Tables 1 & 2).

Table 1: Levels of sound pressure in the Neonatal Unit.

Shift		dB
Dawn	mean \pm SD	56,94 \pm 4,8
	median	56,50
	Mín - Max	52- 72
Morning	mean \pm SD	58,84 \pm 5,2
	median	59
	Mín - Max	50 - 73
Afternoon	mean \pm SD	59,02 \pm 5,1
	median	59
	Mín - Max	52 - 74
Night	mean \pm SD	58,3 \pm 5,22
	median	59
	Mín - Max	52- 75

Table 2: Levels of sound pressure according to period and unit.

Shift	Unit	N		dB
Dawn	NICU		mean \pm SD	58,01 \pm 4,7
		1944	median	59
			Mín - max	52 - 72
	Intermediate unit		mean \pm SD	55,57 \pm 4,7
		1512	median	52
			Mín - max	52 - 71
Morning	NICU		mean \pm SD	60,68 \pm 4,7
		1803	median	61
			Mín- Max	50 - 73
	Intermediate unit		mean \pm SD	56,64 \pm 5,1
		1400	median	56
			Mín - Max	52
Afternoon	NICU		mean \pm SD	60,53 \pm 4,6
		1834	median	61
			Mín - Max	52 - 72
	Intermediate unit		mean \pm SD	56,78 \pm 5,1
		1404	median	56
			Mín - Max	52 - 74
Night	NICU		mean \pm DP	60,13 \pm 4,7
		1944	median	60
			Mínimo	52
			Maximo	73
	Intermediate unit		mean \pm DP	56,04 \pm 4,9
		1402	median	52
			Mín - Max	52 - 75

A total of 54 volunteers, 48 women and 6 men, with a mean age of 32 ± 6.8 years, including medical staff (25.9%), nursing staff (51.8%), multi-professional team (11.1% %), administrative staff (7.4%) and cleaning staff (1.8%) participated the research. These professionals stay in the neonatal unit for a median of time of 12 hours (min: 1 - max: 24).

72.2% of respondents perceived that the neonatal unit is an environment with intense noises, with the morning being the noisiest period (88.9% of responses). The perception of these professionals about the noise level is shown in Table 3.

Table 3: Perception about the noise level.

Professional Category	Loud Noise	Moderate Noise
Medical Team	71,4%	28,6%
Nursing Team	78,5%	21,5%
Multiprofessional Team	100%	0,0%
Administrative Team	25,0%	75,0%
Cleaning staff	0,0%	100%

According to the interviewees, the existing noise in the neonatal unit is a result of the sum of noise generated by equipment with those generated by professionals (70.4% of the answers).

The conversations of professionals were the sources of noise most cited (50.0%), followed by alarms of the devices (42.6%). Other sources were cited: bathing and aspiration of patients, shaking of newborns, handling of equipment, many people hanging around, inefficient equipment, newborn admission, telephone ringing, and unit cleaning.

Among the interviewees, 57.4% believe that their behavior in the neonatal unit generates noise, while 31.4% say they believe their behavior is not noise-generating. 11.1% of them don't know if noise is produced. It is important to note that among the professionals who answered that their behavior can generate noise, 93.5% believe that the most harmful is the conversation in the unit.

When questioned, 94.4% of the interviewees said that it would be possible to reduce the noise level in the neonatal unit. Only 5.6% of respondents do not believe in noise reduction. The interviewees point out as the main tool for noise reduction is the management and training of the team. Concerning the effects of noise for the newborn, the interviewees indicated physiological and behavioral manifestations. The physiological effects pointed out by the professionals were: tachycardia and saturation fall. Among the behavioral manifestations resulting from noise, stress, irritation, agitation, annoyance, nervousness and anxiety were highlighted. Only one subject reported no perceived effect on neonates.

Professionals reported that unit noise causes stress (74% of responses), irritability, hearing changes, difficulty concentrating, fatigue and anxiety

Discussion

Published studies show that Neonatal Intensive Care Units have high levels of sound pressure, due to the characteristic itself, that is, due to the existing technological devices. Such studies indicate that the human element is also a source of noise [1-4].

Nevertheless, regulatory agencies recommend the maximum sound pressure levels for these environments [5,16,17], which are often exceeded, according to studies using decibelimeters and dosimeters [3,18-20].

In the present study, it was also observed levels of sound pressure above the recommended level, especially in the intensive care unit, which was already expected, since in this unit are the most serious newborns who need more equipment, moreover, has the highest number of beds and, consequently, the highest number of professionals in circulation.

It is interesting to note that 72.2% of respondents are aware that the neonatal unit is an environment with intense noises, with the morning being the noisiest period (88.9% of the responses) and that the conversations between the professionals are one of the main sources of noise (50% of responses).

It is noteworthy that although the professionals pointed to the morning shift as the noisiest, records showed that the noisiest shift was that of the afternoon. Such perception can be because in the morning shift there are more people circulating and it is the time where the baths take place, gastric tube changes, baby weighing and medical round. However, it was observed that the shift where the conversations between the professionals happened most of the time was the afternoon.

Although professionals have a very realistic perception of noise and its sources, as well as the impact of noise on the health of newborns and the professionals themselves, their behavior is not modified. Among the interviewees, 94.4% believe that it is possible to reduce the noise level in the neonatal unit and point out the management and training of the team as the main tool for noise reduction. A review on noise in the neonatal unit, Casavant et al [21] recommends the implementation of interventions with close attention to initial and continuing training of staff with involvement and appropriation of the topic.

Conclusion

The sound pressure levels verified in the neonatal unit studied were higher than recommended and this was noticed by the professionals that circulate there.

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DOI: [10.19080/AJPN.2019.07.555783](https://doi.org/10.19080/AJPN.2019.07.555783)

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