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## A equipe de enfermagem frente aos acionamentos de alarmes em unidade de terapia intensiva neonatal

The nursing team before alarm triggering in the neonatal intensive care unit

El equipo de enfermería antes de los disparadores de la alarma en la unidad de cuidados intensivos neonatales

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### ABSTRACT

**Objective:** describing and discussing the conduct of nurses before the triggering of the alarms by the electrical equipment. **Methods:** this is a descriptive, exploratory study with a qualitative analysis. **Results:** the professionals present a good qualification, but act in a complex scenario that requires a differentiated staffing sizing and that was not respected, a fact that may have interfered with service alarm triggered. **Conclusion:** given the facts above, it is perceived that the training of nursing professionals and the stimulus to updating knowledge and to the compliance with the technical and operational standards of the profession are presented as well-suited solution to the needs of the individual and the company and/or hospital unit, since the ultimate goal is to provide quality care and safety to the patient.

**Descriptors:** newborn; nursing; alarms; neonatal unit.

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## RESUMO

**Objetivos:** descrever e discutir as condutas dos profissionais de enfermagem diante dos alarmes disparados pelos equipamentos eletromédicos. **Métodos:** trata-se de um estudo descritivo, exploratório e com análise qualitativa. **Resultados:** os profissionais apresentam uma boa qualificação, porém atuam num cenário complexo que exige um dimensionamento de pessoal diferenciado e que não foi respeitado, fato que pode ter interferido no atendimento ao alarme acionado. **Conclusão:** diante dos fatos mencionados, percebe-se que a capacitação dos profissionais de enfermagem e o estímulo à atualização de conhecimentos e ao cumprimento das normas técnicas e operacionais da profissão apresentam-se como solução bem adequada às necessidades do indivíduo e da empresa e/ou unidade hospitalar, visto que o objetivo final é a prestação de uma assistência de qualidade e a segurança do paciente.

**Descritores:** recém-nascido; enfermagem; alarmes; unidade neonatal.

## RESUMEN

**Objetivos:** describir y discutir la conducta de las enfermeras ante las alarmas activadas por el equipo eléctrico. **Métodos:** se realizó un estudio descriptivo, exploratorio, con análisis cualitativo. **Resultados:** los profesionales tienen una buena calificación, pero actúan en un escenario complejo que requiere un dimensionamiento de personal característico y que no se observó, lo que puede haber interferido con alarma de servicio activado. **Conclusión:** teniendo en cuenta los hechos anteriores, se percibe que la capacitación de los profesionales de enfermería y el estímulo a la actualización de conocimientos y al cumplimiento de las normas técnicas y operativas de la profesión se presentan como una solución muy adecuada para las necesidades del individuo y la empresa y/o unidad hospitalaria, ya que el objetivo final es proporcionar una atención de calidad y seguridad al paciente.

**Descritores:** recién-nacido; enfermería; alarmas; unidad neonatal.

## INTRODUCTION

The nursing staff behaviors are of great value to the maintenance of clinical stability of the newborn (NB) assuming so prominent position on the assistance, marked out within the neonatal unit, for scientific aspects of practical-care character directed to a closer care and condition of human existence beyond the physical dimension.<sup>1</sup>

Nevertheless, although we also recognize the importance of the subjective character of dimensions when we take care of these sick neonates, such as sensitivity, spirituality and transcendence, in this article, our concerns are much more focused on the physical dimension of problems, although they may affect, directly or indirectly, other dimensions.

The concern is specifically focused on the problem of alarm signals in the neonatal intensive care environment, in that the incorporation of medical devices aimed at monitoring and advanced life support has been, in recent years, dramatically expanded with technological developments.

Although several studies might indicate that some neonatal intensive care units are already using protocols with

proposals to reduce noxious stimuli to NBs and favoring their cognitive and physiological development,<sup>2-4</sup> little or nothing is known on the impact of alarms of electrical equipment in neonatal care practice.

Searching the impact of alarm signals in increased noise levels and more recently, from the perspective of patient safety in these intensive care units, have been increasingly justified, especially since 2011, when they began to be appointed by the Emergency Care Research Institute (ECRI), as the number ONE in your TOP 10 list of the main dangers in the use of technologies in hospitals. The same projection was made for the year 2013 and also the example of what had happened in 2012.

Investigating the audible alarms triggered by electrical equipment in neonatal intensive care units, is, for nursing, extremely important, as they are the professionals responsible for attending the patient during the 24 hours, which is why we understand these are the very members of the multidisciplinary team that greater concern should present with proper parameterization of neighboring values of monitored variables alarms, to control which alarm signals are triggered unnecessarily inside the unit, or are not interpreted correctly.

Despite the fact that we also recognize that this should be a concern of all members of the team, not only to enable them to provide a less noisy environment, but also to improve the safeguard barriers to patient safety.

So, since we understand that for that the nursing staff needs, as well as specific scientific knowledge related to the use of alarm systems, also the knowledge of how to behave when they are triggered by such equipment in their care environment, propose as a research subject: the behavior of the nursing team in the Neonatal Intensive Care Unit (NICU) on audible alarms triggered by electrical equipment.

The proposed objectives are: To describe and discuss the conduct of nursing professionals on alarms triggered by electrical equipment during service and care to newborns in neonatal intensive care unit.

The difficulties in the search for articles with the theme dealt with, and the scarcity of articles produced by nurses, who treat the problem in question, strengthened our concern with detachment of these professionals in relation to the theme, considering the impacts on their daily care routine.

Although it is not the object of our research, we could not help but point out that the alarms affect not only the RNs, but also the professionals who are in that environment surrounded by noise emitting equipment (beeps).

It is our knowledge and a fact that the equipment bearing the safety systems through audible alarms are essential to alert professionals of changes in the clinical conditions of these patients or even to warn of malfunction from the own electromedical equipment. However, the noise created by these signs of alarm, have increasingly contributed to the increase in noise levels in the NICU.<sup>5-6</sup>

Another serious problem related to the high number of alarm signals triggered by this equipment and additionally the high level of noise in the unit, has been described in the literature as “alarm fatigue”, with serious consequences on patient safety.<sup>7-9</sup>

Fatigue alarms is a world order problem, yet little studied, especially in Latin America, where Brazil, through the laboratory of Economic Evaluation and Health Technology - LAETS, is the pioneer in research of this phenomenon.

Fatigue alarms are a phenomenon in which the alarms fail to draw the attention of professional. Can be characterized by a delay in or lack of response from the team to alarms, due to an excessive number of alarms, resulting in sensory overload and desensitization, with huge repercussions and negative impact on patient safety.<sup>10</sup>

In this perspective, the thought of safety for the patient, it is possible that nurses do not have clarity of the risks of disarming and ignoring or do not have in mind the potential damage that are flagged by the alarms.<sup>11</sup> For example, by disarming the high pressure alarm, the nurse dismissed increased signaled intrathoracic pressure. If it is a recurrent action, it can possibly increase the risk of adverse events such as barotrauma.

When Alarm fatigue occurs, the intensity of noise supported by the diversity of devices used in intensive care units (monitors, mechanical ventilators, incubators and continuous infusion pumps), when used inadvertently and irrationally, turns the alarms into terrible threats to patient safety, since they become ignored by the staff. It installs, then, a false sense of security. Therefore, the nursing staff shall provide appropriate practices when faced with such specific sounds and even view and interpret the events mediated by alarms, turning them into warning tools for risk situations.

Although the alarm serves to alert staff to deviate from a predetermined normal status when fired in large numbers, particularly when inconsistent disguise clinically significant, allowing important alarms to be disabled, silenced or ignored. Therefore, nurses working with the monitors must be educated about monitoring systems, and how to properly adjust the alarm parameters of monitors to meet the specific needs of each patient, and thus prevent alarm fatigue.<sup>12</sup>

## METHODS

This is a descriptive, exploratory research with a qualitative analysis seeking to understand the various situations and relationships in the social life, providing greater familiarity with the theme. Thus, using features such as logging, analysis and correlating phenomena without manipulating them, keeping its nature and characteristics.

The study setting was in a neonatal intensive care unit located in Região dos Lagos, in the city of Cabo Frio-RJ. The study subjects were nurses and nursing technicians working in this sector, containing in each team a nurse and three nursing technicians with scale 24x72 hours per week.

The data collection method occurred in April 2013 through the implementation of non-participant observation with the use of an observation script. This study complied with the ethical precepts of the Law 196-96 using the free and informed consent. We also inform that the study was submitted to and approved by the Ethics and Research Committee (CEP) of the University Veiga de Almeida (UVA) under the CAAE number: 12277813.5.0000.5291.

Data analysis was performed using thematic analysis Bardin<sup>13</sup> understood as a set of methodological tools that applies to diverse discourses with the citation of subjects and further discussion of the results.

## RESULTS

Table 1 shows the nursing staff of the NICU researched; these are scaled in four teams with a nurse and three nursing technicians within twenty-four hours.

**Table 01:** characterization of the team members of the Neonatal Intensive Care Unit.

Nome	Profissão	Experiência	Curso Específico	Pós-Graduação
<i>Alfa A</i>	ENF	3 Anos	Sim	Neonatologia
<i>Beta B</i>	ENF	1 Ano	Sim	Neonatologia/ Pediatria
<i>Gama C</i>	ENF	8 Anos	Sim	Neonatologia
<i>Delta D</i>	ENF	8 Anos	Sim	Neonatologia
<i>Alfa A1</i>	TE	3 Anos	Não	
<i>Alfa A2</i>	TE	2 Anos	Não	
<i>Alfa A3</i>	TE	3 Anos	Não	
<i>Beta B1</i>	TE	7 Anos	Não	
<i>Beta B2</i>	TE	5 Anos	Não	
<i>Beta B3</i>	TE	5 Anos	Não	
<i>Gama C1</i>	TE	15 Anos	Não	
<i>Gama C2</i>	TE	3 Anos	Não	
<i>Gama C3</i>	TE	3 Anos	Não	
<i>Delta D1</i>	TE	15 Anos	Não	
<i>Delta D2</i>	TE	5 Anos	Não	
<i>Delta D3</i>	TE	5 Anos	Não	

ENF- enfermeiro; TE- técnico de enfermagem.

We stress the time of professional experience in this industry, as well as their respective qualifications. Note that if the evaluated professionals present considerable professional experience in the NICU sector.

Here, in Table 1, the number of beds occupied in the four-day period in April of 2013, period of data collection, with a load factor of eight beds in the first two days and nine beds in the other, in a neonatal unit with a total of eleven beds. The neonatal sector is highly complex, requiring rigor in its service range with respect to the corresponding quantitative nursing professionals to the number of available beds.

**Frame 01:** occupancy rate of beds.

Período	Equipe	Leitos ocupados
Dia 01	Alfa A	8
Dia 02	Beta B	8
Dia 03	Gama C	9
Dia 04	Delta D	9

It is known that the congestion is not only related to the volume of unit activities, but also the level of complexity of care the newborn requires. Therefore, we find that, in relation to Table 1 and Frame 1 the number of workers is reduced from the occupancy rate of the studied NICU. According to COFEN Resolution – nº 293/2004, “the design and the adequacy of the quantitative and qualitative nursing professionals should be based on relative characteristics”. The resolution also calls for the percentage of total nursing staff, according to the classification system of the patient, for intensive care, 52-56% should be nurses and other nursing technicians.<sup>14</sup>

**Table 2:** describes the behavior of professionals facing the triggering of alarms and, also, their attitudes in the occurrences of the same.

Tabela 2 - Atitude do profissional frente o acionamento dos alarmes

Atitudes	Bic	Monitor	Incubadora	Ventilador mecânico
Ignorado	4x	4x	1x	1x
Silenciado	2x	4x	3x	---
Observado	---	2x	---	1x
Solucionado	2x	1x	---	2x

x - número de observações do evento.

The triggering of an alarm informs some kind of complication involving the patient or their monitoring system. We found that the nurses had no aptitude in the resolution and knowledge in the alarm system. The attitudes of professionals have become every day and resolved only by malice/experience of labor activity. The most critical situations involving newborns had different position of the work before the issuing of alarms with prompt action in most cases.

## DISCUSSION

The conduct of nursing is a great challenge in daily practice in the NICU, since the goal is to offer assistance that involves the best technology, knowledge, procedures and equipment which requires specialization of our practice, to meet the needs of patients.<sup>2</sup> It is also essential to offer a qualified service with the addition of expertise in neonatal area.

To provide integral care to newborns it is necessary that the nursing professionals understand the instruments of their daily work and use them on benefit of a qualified assistance. We stress that nurses and nursing technicians are the professionals responsible for the direct care and, therefore, are those that normally identify abnormalities in newborns and signals of the unit’s equipment.<sup>14</sup>

According to information from the coordination of the study unit, there is the provision of training for nursing professionals, regarding the operation of equipment. This statement leads us to question what information is discussed and passed on to professional training at the time and if there is evaluation of the training process of its employees, as some did not respond or did not solve the due form the alarm of a problem.

Having knowledge of the changes alarmed by the devices is essential for directing actions and care for nursing safely and efficiently. Training and continuous education are meant to assist the integration of instruments to the practice of our profession, which has the patient’s health in its entirety as working object.<sup>15</sup> Both should be treated in the hospital company or unit as a highly relevant activity, should be planned and monitored by supervisors and to reduce the gaps in information and to favor the uptake of knowledge.

Thinking of quality of service in assisting the RN, the nursing dimension is critical for assistance, with the proposal of preventing negligent actions before alarm triggering. Taking into consideration the factors that interfere in the actions and evidenced in research, we emphasize the workload associated with the reduced number of professionals per bed, thus producing disinterest for issuing audible alarm and difficulties in solving it.

However, the professional disturbing factors, which we noticed in the unit, were the frequent cries of newborns, the sound of the alarm’s noise, the physical and mental fatigue of staff, inadequate time intervals for having meals, inadequate proportion of professional per patient and confinement.

Stress is the reaction that the body and the mind present when there is some difficulty or exciting situation that motivate them to action.<sup>16</sup> The attitude of nursing staff regarding alarms triggering inside the unit was one of the relevant factors, as it is a cause of stress for nurses inflicting deficit in generating interest, initiative and problem-solving.

The level of sound of conversations between employees was 61,4 dB (decibels), fan alarms and pulse oximeters reached 111,5 dB. It is worth mentioning that the permitted levels and recommended by the Brazilian Association of Technical Standards (ABNT) NBR 10152/1987 is 35-45 dB (A) as acceptable levels for different hospital settings.<sup>4,6</sup>

The levels indicated by super-stimulant environment that is the NICU generate discomfort for both NBs, as for the professionals involved; which can trigger disinterest from professionals in the events to which the alarms are triggered. We observed alarms emitting only the visual alerts, the



volume decreasing and the neglecting of audible alerts on certain devices according to the severity of the NB's condition.

Acoustic alarms issued in the unit are essential to alert health professionals about the changes in the clinical conditions of the patients or malfunction of the devices themselves becoming a key icon in the NICU.<sup>6</sup> In this regard, nursing plays a key role in the exercise of surveillance in the NICU, since the amount of staff to maintain caution in their entirety as well as preventing work stress and discouragement factor of professionals. This emphasis and responsibility assigned to Nursing is due to the fact they are present in the 24 hours on duty with the client paying the minimum care that enable the best comfort and quality of life for the individual.

In the NICU, the newborn is subjected to noises that are produced by ventilators, incubators, monitors, alarms, secretion cleaners, venting, O<sub>2</sub> and compressed air, phones and dialogues established between work and family that can compromise the well-being of the baby and affect its development.<sup>4</sup>

We evaluate the programming mode of the NICU equipment during the period of data collection. We saw everyday the programming of silent mode on the oximetry/saturation monitors. However, the other devices (mechanical ventilators, infusion pumps and incubators) issued audible alarms with no change in programming.

The programming of the equipment and its alarm systems shall be in accordance with physiological parameters of NBs, including heart rate, respiratory rate, oxygen saturation, noninvasive pressure (NIBP) and body temperature. The unit of the studied nursing professionals has adopted behaviors such as disabling audible alarms of the monitors, and the improper configuration of machinery in some situations: silencing the noise from some appliances and ignoring the issue of alarms of some appliances.

In clinically stable newborns monitored in the unit, we realized the program of pulse oximetry monitors in silent mode. This attitude may pose risks to the NB's recovery, exposing it to adverse situations, which makes us question whether professionals involved maintain domain of settings and control the parameters of alarms. Therefore, the nursing staff through prompt and appropriate action to the shooting of the alarms, and the resolution thereof, should prevent potentially dangerous situations for NBs.<sup>17</sup>

Many are the noises generated by the equipment in the NICU, and among them there is the occurrence of alarms. These are then to be considered usual sounds inside the unit, leading, routinely, to reduced attention or appreciation of these occurrences by the staff.<sup>18</sup>

In this context, attitudes observed by professionals in Table 2 were: skipped infusion pump alarms when warned before the end of the infusion of drugs and the end of it; in incubators indicating heat loss after procedures and handling together with newborns, resulting in temperature drop; oximetry monitors emitted light signals, they were

silenced; mechanical ventilator in only once in continuous positive airway pressure mode (CPAP) nasal indicating device disconnection (nasal prongs) the NB's nostrils.

Alarms are programmed by the team in muted mode denoting higher incidence in monitors followed by Business Incubation Centre (BIC) and hatcheries; observed by the nursing professional in the gravest situations of NBs ventilators and monitors, due to their complexity; solved by the teams in the issue of alarms: the Bic with the replacement or exchange of drugs in cases of obstruction performed check of venous access - peripheral puncture/PICC (Peripherally Inserted Central Catheters), monitors when signaled to disconnect the oximeters or diverted attention to more serious as poor breathing pattern; fans when indicated changes in inspiratory and expiratory pressure levels, and excess of tracheobronchial secretions in the NB's airways.

An alarm is triggered when the threshold parameters are exceeded, so to maximize the relevance of alarms, these parameters must be set specifically for the individual needs of each patient. The training of nurses for customization or individualization of alarm parameters is essential, as well as its adherence to good monitoring practices, and solving common problems in monitors. Thus, the relationship with manufacturers, representatives, as well as the clinical engineering of the hospital should be close when we think of improving the usability of EMA.

The attitudes adopted by nursing professionals rely on the lack of attention to the alarms, improper patient care, wrong alarm setting or disabling and neglect of it, posing risks to newborns assisted and leaving them susceptible to iatrogenies.

Because it is a complex sector, the NICU has high numbers of iatrogenic events, as is common the need for rapid interventions without detailed analysis of medical records, medical history and physical examination.<sup>19</sup>

In this context, it is believed that nurses should participate more actively in the monitoring of alarms. It is believed that it may develop preventive actions in the search for its causes, correcting them before there is damage to the patient.<sup>11</sup>

is necessary to intervene in the nursing team incorporating new parameterization knowledge of this equipment so that it can act effectively and solve problems before the event of audible alarms, taking into account not only the position of the professional, but also their knowledge to be improved.

The adoption of a careful planning of care that respects the principles established by the nursing profession and endorsed by some theorists of Nursing such as Wanda Aguiar Horta, Dorothea Oren, among others, shows up as a major industry initiative to try to solve this problem.

## CONCLUSION

Once Analyzed the nursing staff behaviors facing the event of alarms in the NICU, we find that professionals did

not show resoluteness against most occurrences involving newborns.

Despite the relevance and importance, this receives little attention from the scientific productions, including intensive care and neonatal research. There is the need to create care protocols in order to induce direct answers from nursing professionals and shorten the time of action before the supervision of monitored NBs equipped with technology involving issuing alarms.

The importance of alarms in the neonatal intensive care environment is essential, with continuous training of everyday situations and their technical-assistance solutions developed by nursing professionals in order to minimize errors and complications for the neonates.

Thus, it is seen that the training of nurses and the encouragement of updating knowledge and compliance with the technical and operational standards of the profession, are presented as well-suited solution to the needs of the individual and the company and / or hospital since the ultimate goal is to provide quality care.

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