RIASE
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FATIGUE ALARM ON PATIENT SAFETY:
SYSTEMATIC REVIEW

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ABSTRACT

Objective: This study aims to analyze scientific articles on alarm fatigue and to understand its influence on patient safety. **Methods**: We have conducted a systematic review by research in the CINAHL, MEDLINE, and MEDICLATINA databases. Using the descriptors in both English and Portuguese, we used the following inclusion criteria for the selection of articles: full original articles or systematic reviews, with publication between 2012 and 2014. **Results**: Prevalence studies are predominantly prospective, with randomized and controlled clinical trials and observational studies. In this review, the included articles are placed between levels 2a and 3, meaning studies with high evidence. Therefore, we obtained four observational studies and five prospective studies. **Conclusion**: Our results show that that alarm fatigue is a reality within intensive care units. Regarding the data produced in this research, we highlight: the sensitivity and specificity of the alarms; the role of health professionals; the strategies for alarm fatigue reduction and increased patient safety.

Descriptors: Clinical Alarms; Alarm Fatigue; Patient Safety.

INTRODUCTION

The existence of monitoring systems has allowed Health Facilities, especially Intensive Care Units, to continuously monitor inpatients and quickly identify changes in their health status[1].

The monitors of these units have alarms for a series of physiological variables, aiming to continuously monitor vital parameters, promote the safety of patients in critical condition, and alert health-care professionals to the possible changes in vital parameters. However, the fact that the number of monitoring variables is continuously increasing can create a false sense of safety and, in this case, become a serious problem for patient safety.

Alarm fatigue is an increasingly present phenomenon in Intensive Care Units, and occurs when a large number of alarms of monitors or other equipment hide clinically significant alarms, which causes the most important alarms to be silenced, ignored, or turned off by health professionals, impairing patient safety[2]. The delayed response time to alarms by health professionals may also indicate the presence of fatigue. Thus, the greater the time for intervention, the greater the risk for the patient[3].

According to the Directorate-General of Health (DGS), patient safety corresponds to reducing the risk of unnecessary healthcare damage to a minimum acceptable. A minimum

acceptable refers to the collective notion, before the current knowledge, of available resources and of the context in which the care was provided as opposed to the risk of non-treatment or another alternative treatment[4].

A high number of medical equipment alarms represents a potential risk for the patient's health and safety, not only by the changes caused by the high levels of audible noise, but also by leading health professionals to a process of insensitivity and reduced alertness and trust in the sense of urgency of the alarms. This phenomenon results in alarm fatigue. The lack of answer to relevant alarms may have serious consequences on the patient's clinical conditions, because changes will not be detected, preventing the adoption of appropriate therapeutic measures[3,5-8]. In this context, it is essential to correctly interpret the alarm signal and understand the profile of clinical relevance for patient safety.

The high incidence of false alarms in the units is related to the fact that monitoring systems present high sensitivity, low specificity, and an excessive number of alarms with low clinical relevance. Authors also show that the lack of standardization in alarm sounds, of appropriate emergency alert, and the visual and auditory inadequacy of variables in the monitor alarms can contribute to the false alarms[3,6-9].

In 1997, the European Committee for Standardization established a classification of alarms in three categories: high priority, indicating an urgent situation (which can immediately lead to a vital problem and requires an immediate response by health professionals); medium priority, indicating a dangerous situation (requires a quick response); and low priority, indicating a dangerous situation (requires attention)[10].

The American organization Emergency Care Research Institute studies means of improving the safety, quality, and cost-effectiveness of care in hospitals. This organization, when analyzing the dangers related to medical devices and patient safety, put the alarms of multiparameter monitors in first place on a list of 10 health technology hazards in the years 2012, 2013, and 2014[11].

There are reports of patient deaths related to monitoring alarms in hospitals in the United States, namely alarms of multiparameter monitors. These data are worrisome and show the importance of research in this area, not only to draw attention to the monitoring standardization, but also to the impairment of patient safety, noting that each parameter has a specificity, sensitivity, and relevance to the situation of each patient[2].

METHODOLOGY

The systematic review is a research method that allows the search, critical appraisal, and synthesis of the available evidence on an investigated topic, and its final product is the current state of knowledge of that topic, the implementation of effective interventions on healthcare, cost reduction, and the identification of gaps that lead to the development of future research[12].

To guide our study, we formulated the following question: how is patient safety impaired by alarm fatigue?

We have conducted this systematic review by searches in the CINAHL, MEDLINE, and MEDICLATINA databases, using the descriptors both in Portuguese and English: Clinical Alarms; Alarm Fatigue; Patient Safety (Alarmes Clínicos; Fadiga dos Alarmes; Segurança do Doente). The inclusion criteria for selecting articles were the following: full original articles or systematic reviews, with publication date between 2012 and 2014, available in the scientific databases, published in Portuguese and/or English. Of a total of 29 articles found, nine fulfilled the inclusion criteria. All articles have addressed the topic of clinical alarms, alarm fatigue, and stimulus-response time of the health team to the alarms. Our research method and results are presented in Figure 1.

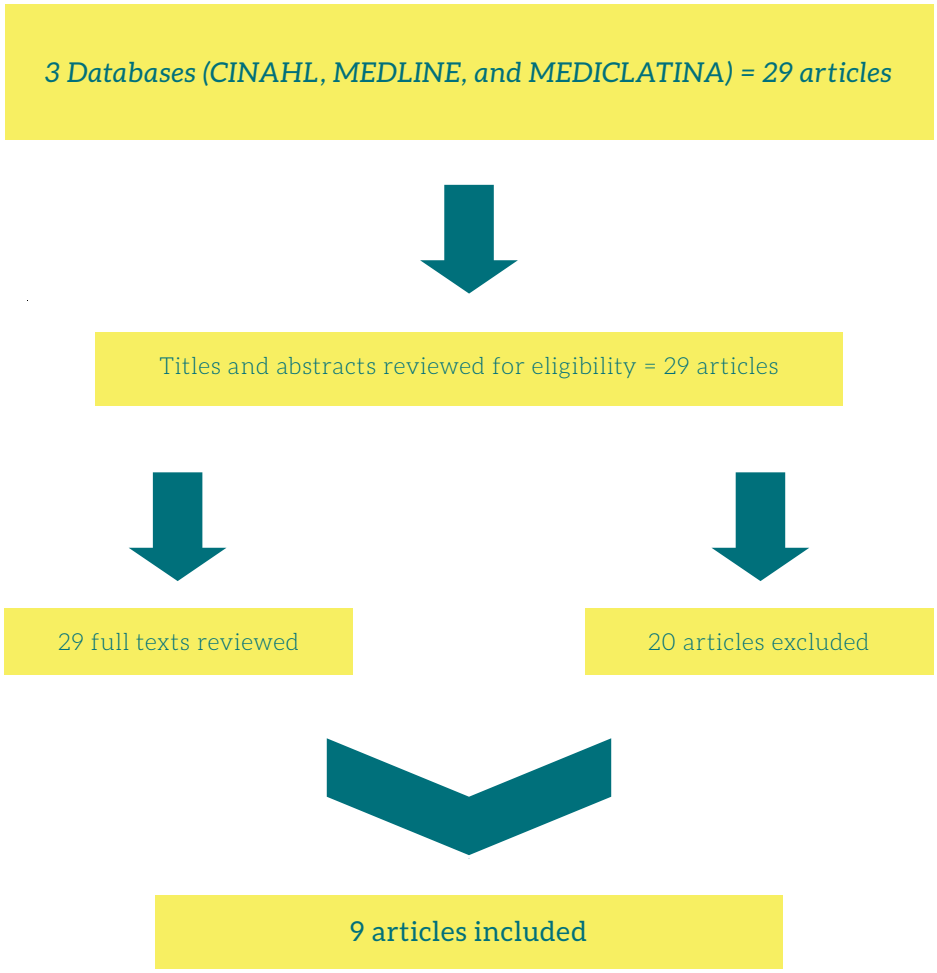

Figure 1 - Results of our search in electronic databases.

Source: Research data, 2015.

After the analysis of the chosen articles, we assessed their quality level, as shown in Table 1.

1 The quality assessment of the studies included in this systematic review was conducted by a modified version of an assessment instrument accepted by the scientific community, in which we used a scale from 0 to 15 that assessed 5 items, each with a score from 0 to 3. The items evaluated were: literature on the presence in the curriculum, study design, participants and their selection, data collection instrument, conclusions and implications.

Table 1 – Adaptation of the table that assesses the quality level of articles according to Bugalho and Carneiro (2004)

Article	1	2	3	4	5	Score	Quality
Atitudes and practices related to chinical alarms (2014)	2	3	1	2	3	11/15	High
The problem of alarm fatigue (2013)	0	1	0	0	2	3/15	Low
Fadiga de alarmes: quando os alarmes se tornam uma ameaça à segurança nos cuidados intensivos (2014)	0	1	0	0	2	3/15	Low
Fadiga dos alarmes em terapia intensiva: descrevendo o fenómeno através da revisão sistemática da literatura (2013)	2	3	0	2	2	9/15	Moderate
Fadiga dos alarmes de equipamentos eletrómedicos em terapia intensiva (2014)	3	3	3	3	2	14/15	High
Fadiga dos alarmes: revisão integrativa (2013)	3	3	1	3	3	13/15	High
Monitor alarm fatigue: an interative review (2012)	1	2	1	0	2	6/15	Moderate
Tempo estimulo-resposta da equipa de saúde aos alarmes de monitorização na terapia intensiva: implicações para a segurança do doente grave (2014)	3	3	3	3	2	14/15	High
Tempo estimulo-resposta aos alarmes de pressão invasiva: implicações para a segurança do paciente crítico (2014)	3	3	3	3	2	14/15	High

Fonte: Dados da pesquisa.

The system of evidence, described by Sackett *et al.*, was used to determine the level of evidence of the studies selected and included in this systematic review[13]. Prevalence studies are predominantly prospective, with randomized and controlled clinical trials and observational studies. According to the aforementioned author, the level of evidence lies between levels 1 and 6, with level 1 showing excellent evidence and level 6, insignificant evidence. In this review, the included articles are placed between levels 2a and 3, meaning that they are studies with high evidence. Therefore, we obtained four observational studies and five prospective studies.

Table 2 – Levels of evidence

Levels	Description
Level 1	Meta-analysis of randomized and controlled clinical trials
Level 2a	Randomized and controlled clinical trials (RCT)
Level 2b	Nonrandomized, noncontrolled, or non-blind clinical trial
Level 3	Observational studies
Level 4	Clinical trials with pretest or posttest
Level 5	Descriptive studies
Level 6	Insignificant evidence

Source: Adapted from evidence according to Sackett *et al.* (2000).

RESULTS

After selecting the articles, they were analyzed considering the objectives and questions of this study. The information collected from the articles were gathered in Table 2. The table was prepared to systematize data, helping their analysis and interpretation.

Tabela 3 - Características dos estudos sobre a fadiga dos alarmes na segurança do doente

Título, ano, revista e autores	Tipo de estudo	Participantes	Instrumento de colheita de dados	Resultados
Atitudes and practices related to chinical alarms[14] (2014) AJCC American Journal of Critical Care Marjorie Funk; RN; PhD; J. Tobey Clark; MSEE; CCE; Thomas J. Bauld; PhD; CCE; Jennifer C. Ott; MSBM and Paul Coss	Estudo On Line com dois inquéritos do ano 2005 a 2011.	Profissionais de saúde 1327 respostas no estudo de 2005 e 4278 respostas em 2011. Maioria dos participantes trabalhava em Hospital de agudos e em UCI's e maioritariamente enfermeiros.	Questionário on-line, onde se dividia em 3 partes. Primeira parte estudo demográfico, segunda parte diz respeito à concordância ou discordância de 9 afirmações acerca dos alarmes, e uma Terceira parte que se refere à inibição do efeito os alarmes para o profissional. Questionário feito em 2005-2006 e um segundo em 2011.	Os falsos alarmes são a grande preocupação, bem como, a padronização dos alarmes. Salienta-se a não definição de parâmetros individualizados para os diferentes doentes, o que faz com que alguns alarmes sejam descredibilizados. Foram accionadas estratégias para melhorar os alarmes, tais como, uma mensagem através dos Mídias, a transmissão de conhecimentos dos próprios profissionais de saúde, a preparação da pele do doente antes de colocar os elétrodos, bem como, monitorizar só os doentes que necessitem de monitorização. Continuam a existir hospitais onde os alarmes são conhecidos pelo seu barulho e não pela sua interpretação ou eficácia.
The problem of Alarm Fatigue[15] (2013) AWHONN Tanya Tanner; Phd; MBA	Revisão Sistemática da Literatura	Estudos observacionais, exploratórios, prospetivos e retrospetivos, artigos de revisão e editorial.	Foram incluídos no estudo 15 publicações com um recorte temporal de 1999 a 2012, em Inglês, com a temática referente a alarmes clínicos, fadiga dos alarmes e segurança doente.	Remete para a importância dos alarmes na segurança do utente. Salienta que a fadiga de alarmes leva a uma resposta mais lenta da equipa de enfermagem, seja a desligar o alarme, seja a ignorá-lo. Um dos estudos refere que a maior parte das mortes que aconteceram foram devidas ao erro humano, ou seja à desconexão proposicional de cabos sonoros dos alarmes. Outra das conclusões a que o estudo descreve é o fato de os sons dos alarmes serem padronizados, o que faz com que o profissional recorra ao primeiro alarme que ouve e ignora o segundo, podendo este ser mais crítico que o primeiro. Nas unidades de neonatologia, a fadiga de alarmes diz respeito aos falsos alarmes, devido a artefactos físicos, como a mobilização do utente, a má colocação dos elétrodos ou mesmo a configuração dos alarmes nos monitores. Uma das sugestões do estudo é que os profissionais obtenham formação em configuração de alarmes para diminuírem o risco de comprometimento da segurança do utente.

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Título, ano, revista e autores	Tipo de estudo	Participantes	Instrumento de colheita de dados	Resultados
Fadiga de alarmes: quando os alarmes se tornam uma ameaça á segurança nos cuidados intensivos[16] (2014) Rev enferm UFPE on line Roberto Carlos Lyra da Silva	Editorial	Artigos de revisão, artigos online e dissertações de mestrado	O autor do editorial recorreu a dissertações de mestrado e artigos de revisão da área da Medicina e da Engenharia Biomédica, assim como a artigos online que abordam a temática da fadiga dos alarmes.	Sugere-se a adoção de estratégias para minimizar os falsos alarmes e a fadiga dos alarmes como medida de segurança dos doentes internados em UCI. As estratégias passam pela gestão e padronização dos alarmes estabelecendo níveis de criticidade para os alarmes. A implementação de protocolos na resposta de atendimento dos alarmes é outra das estratégias propostas.
Fadiga dos alarmes em terapia intensiva: descrevendo o fenómeno através da revisão sistemática da literatura[17] (2013) Journal of Research Fundamental Care On line Adriana Carla Bridi, Roberto Carlos Lyra da Silva, Jorge Leandro do S. Monteiro	Revisão Sistemática da Literatura	Estudos observacionais, exploratórios, prospetivos e retrospetivos, artigos de revisão e editorial.	Foram incluídos no estudo 16 publicações com um recorte temporal de 1993 a 2010, em Português ou Inglês, com a temática referente a alarmes clínicos, fadiga dos alarmes e segurança do paciente.	Esta revisão permitiu elucidar aspetos fundamentais relativos à fadiga dos alarmes e levantar problemas relacionados com os alarmes de monitorização e segurança do doente. Foi possível verificar que a segurança do doente deve ser considerada na aquisição e incorporação de tecnologias nas UCI's, pelo que a qualificação e treino dos profissionais de saúde torna-se indispensável. Todos os alarmes precisam ser valorizados pelos profissionais, pois a avaliação do doente por parte do profissional é fundamental para uma deteção das alterações e para uma atuação atempada.

Tabela 3 - Características dos estudos sobre a fadiga dos alarmes na segurança do doente

Título, ano, revista e autores	Tipo de estudo	Participantes	Instrumento de colheita de dados	Resultados
Fadiga dos alarmes de equipamentos eletromédicos em terapia intensiva[18] (2014) Journal Nurse UFPE on line Fabrício dos Santos, Roberto Carlos Lyra Silva, Pedro Paulo Silva de Argolo Ferrão, Antônio da Silva Ribeiro, Roberta Faitanin Passamani	Estudo descritivo, observacional, de abordagem quantitativa, tipo estudo de caso.	6 doentes internados; 42 profissionais de saúde (12 enfermeiros, 5 médicos, 17 técnicos de enfermagem e 8 fisioterapeutas).	A observação dos dados partiu de uma observação livre, num Centro de Terapia Intensiva, num hospital da rede pública do Rio de Janeiro.	Os seguintes alarmes oximetria de pulso, ECG, PNI, PA, temperatura axilar, FR, PVC, bombas infusoras e ventilador mecânico, foram cronometrados durante 32 h de observação (16h diurnas e 16h noturnas). Todos os alarmes foram desvalorizados à exceção do alarme do ventilador, que foi o único que tive uma resposta em tempo suficiente, considerando-se que são os que mereceram maior atenção por parte dos profissionais de saúde.
Fadiga dos alarmes: revisão sistemática[19] (2013) Journal Nurse UFPE on line Adele Kuckartz Pergher, Roberto Carlos Lyra da Silva	Revisão Sistemática da Literatura	Artigos de revisão, artigos publicados em revistas/jornais e entrevista.	Foram incluídos neste estudo 8 artigos publicados entre 2010 e 2011. Dos 8 artigos, 7 foram publicados nos EUA em revistas da área da Medicina e 1 artigo foi publicado na Alemanha numa revista da área da Engenharia biomédica. Todos os artigos abordavam a temática da fadiga dos alarmes.	Os resultados observados fazem referência a várias soluções para a redução dos alarmes e a consequente fadiga. As estratégias a adotar passam pelo ajuste adequado e individualização dos alarmes para cada doente e a formação dos profissionais, havendo uma necessidade de melhor compreensão, conhecimento, incidência, tempo de resposta e relevância clinica dos alarmes.

Tabela 3 - Características dos estudos sobre a fadiga dos alarmes na segurança do doente

Título, ano, revista e autores	Tipo de estudo	Participantes	Instrumento de colheita de dados	Resultados
Monitor Alarm Fatigue: an Interative Review[5] (2012) Biomédical instrumentation & Technology Maria Cvach	Revisão Sistemática da Literatura	Estudos observacionais, exploratórios, prospetivos e retrospetivos, artigos de revisão.	177 resumos foram revistos, mas apenas foram analisados 72 artigos, sendo a evidência da pesquisa organizada por 5 grandes temas.	Existem estratégias para reduzir a dessensibilização dos alarmes. Os resultados mostram que um aspeto fundamental da gestão dos alarmes é garantir que os profissionais de saúde estejam cientes das condições do mesmo, podendo muitas vezes serem autocorrigidos.
Tempo estímulo-resposta da equipa de saúde aos alarmes de monitorização na terapia intensiva: implicações para a segurança do doente grave[2] (2014) Rev Bras Ter Intensiva Adriana Carla Bridi, Roberto Carlos Lyra da Silva, Carolina Correa Pinto de Farias, Andrezza Serpa Franco, Viviane de Lima Quintas dos Santos	Estudo quantitativo, observacional, descritivo	A observação foi realizada em 5 leitos da Unidade Coronária do Instituto Nacional de Cardiologia no Rio de Janeiro. Foram observados 88 pacientes na totalidade [49 serviço diurno (SD) e 39 serviço noturno (SN)].	A observação neste estudo foi não participativa, ou seja, o pesquisador não se envolveu no contexto a ser observado e não participou como membro da equipa. O estudo foi limitado a 5 leitos da unidade de forma a permitir cronometrar e contar fidedignamente todos os alarmes que soaram. Foram efetuadas 40horas de observação de forma descontinuada, em dias e horários diferentes, entre março e junho de 2012, sendo que 20horas foram no SN, e 20horas no SD. Um tempo de resposta superior a 10 minutos foi considerado um alarme sem resposta.	Num total de 227 alarmes de monitorização, dos quais 106 no SD e 121 no SN, 145 dos alarmes ficaram sem resposta/fatigados, 68 no SD e 77 no SN. A pausa no alarme foi a conduta mais adaptada pela equipa, tanto no SD como SN. O ajuste dos elétrodos foi a segunda conduta mais adotada no SD, sendo que a Frequência Cardíaca foi a validável que mais gerou alarmes. A reposição de sensor foi a segunda conduta que mais adotada no SN. Dos alarmes atendidos, a maioria foram atendidos por Enfermeiros.

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Título, ano, revista e autores	Tipo de estudo	Participantes	Instrumento de colheita de dados	Resultados
Tempo estímulo-resposta aos alarmes de pressão invasiva: implicações para a segurança do paciente crítico[20] (2014) Rev Gaúcha Enfermagem Adele Kuckartz Perghera Roberto Carlos Lyra da Silva	Estudo observacional, descritivo, exploratório, tipo estudo de caso	11 Doentes internados; 37 profissionais de saúde (28 enfermeiros, 5 médicos e 4 fisioterapeutas).	Para a coleta de dados utilizou-se a técnica da observação estruturada, foi realizada numa UTI adulto de um hospital militar localizado no Rio de Janeiro.	Após 60h de observação em turnos diurnos (7h-19h), foram registados 76 alarmes de PA. 21 dos alarmes foram atendidos no tempo médio de resposta, sendo que 55 dos alarmes foram considerados fatigados, ficando mais de 10 min. sem resposta.

Summary of results

The incidence of electromedical equipment alarms is high. We found that the alarms were losing their function of drawing attention to some relevant situation caused by the patient or even by equipment malfunction, becoming a situation that generates stress and fatigue, caused by the idea that most alarms are false. Throughout the study, we verified that health-care professionals mostly let the alarms ringing for a period longer than 10 min., showing that only the fan alarm required their attention, alarming only for short periods of time[8].

We found that all the alarms of electrocardiogram (ECG), peripheral oxygen saturation (SpO2), noninvasive blood pressure (NIBP), blood pressure (BP), axillary temperature (AXT), central venous pressure (CVP), and respiratory rate (RR) led professionals to exhaustion. These data are worrisome regarding patient safety. In this study, alarm fatigue is a phenomenon characterized by the fact that most alarms stayed active for a period of at least 10 minutes with no professional response[8].

In the integrative review carried out by Perghera and Silva, they reported that 227 alarms were registered, resulting in an average of 5.7 alarms/hour. At daytime service, 64.15% of all alarms observed were considered fatigued (10-minute limit). They observed, throughout the study, that the alarms are cumulative in the environment and that the level of noise is negative for both patients and team. Four factors contributed for not promptly turning off an alarm: team too busy to answer them; team deliberately ignoring the alarm; not seeing/hearing the alarm; confusion in identifying which alarm is ringing. The first two are related to staff shortage and the last two, with the physical context and excessive noise of the unit. Concerning the physical context, the authors observed the difficulty in viewing some beds, which hinders hearing the alarm sound. The distance between beds and nursing station impaired the alarm identification, and consequently the professional reaction to turn it off, endangering patient safety. Regarding staff shortage, they identified a nurse/patient ratio below the standards advocated by RDC no. 26, of May 11, 2012[19-20].

Considering the number of inpatients and the time required to mute each alarm, the authors concluded that, if the professionals answered all alarms, it would be virtually impossible to perform routine tasks. Given that the nursing team monitors patients 24 hours a day and most closely relates to the patient monitoring systems and their alarms, they are the professional group most involved in the phenomenon of alarm fatigue.

In the systematic review conducted by Cvach, she concluded that the lack of response due to the excessive number of alarms results in a sensory overload leading to desensitization, with alarms often being referred to as "nuisance." When the alarm is seen as a "disturbance," the caregiver can turn off the alarm or ignore the warning that is intended to make the environment safer[5].

To the author, "the probability of connection" of the caregiver is the response to the alarm based on the truly perceived alarm rate. If an alarm system is perceived as 90% reliable, the response rate will be about 90%, and so on. Nurses answer to alarms for different reasons, not just because the alarm sounds. They adjust the order of their activities by evaluating the urgency of the alarm regarding the patient's condition and have a greater tendency to react to longer alarms, considered rare. As the workload increases, the response to the alarm and performance decrease. Setting the alarms to the real needs of patients ensures that they are valid and provide early warning to potential critical situations[5].

Perghera and Silva, in their integrative review, concluded that all authors analyzed refer to patient safety when there is desensitization in the response to alarms. Strategies to minimize this phenomenon pass through the training of the health teams for monitor handling and through the collaboration with biomedical engineers for setting and standardizing monitor alarms[19].

In that article, there is reference to two cases of death due to the deactivation of monitor alarms, which did not signal an emergency situation. In one of the cases, there was an sensitization to the problem, which led to the creation of a training program and of a best practice committee. The notification of these events emerges as an important factor for reviewing these phenomena and making the adverse event a good example to other institutions[19].

The large number of clinically irrelevant alarms leads to reduced alertness by the team, which can lead to a lack of response to relevant alarms, not offering safety in the patient follow-up[17].

They also reference a study conducted on a semi-intensive unit with 15 beds, in which clinical engineers, nurses, doctors, and administrators gathered. The team's concern with patient safety boosted the existence of the study and led the team to change the alarm systems to face the "alarm fatigue." According to the authors, alarms serve to alert the team about changes in normal or acceptable patterns. However, when alarm fatigue takes place, the team mutes and ignores them, becoming indifferent and thus impairing patient safety. Nurses considered the alarms a nuisance and claimed that answering them interrupted patient care. The high number of false positive sound alarms leads professionals to consider them just as "noise," and not as indicators of a potential emergency situation. Some measures have been adopted in the unit. The Nurses were trained to identify and adjust the limits and levels of alarm parameters according to the patients' clinical condition. The software of monitors was modified to promote better audibility of alarm tones. As a result, there was a 43% reduction of physiological alarms when compared with the database collected before these changes.

The study points out that the frequent false alarms are not only considered a nuisance for patients and team, but also affect the patient's safety and care effectiveness. Sometimes, an alarm can be only a technical defect, such as a bad positioned electrode or interference, but it can also signal a severe arrhythmia. Turning off the alarms is often the solution found by the team, because they cannot control them. In these cases, patient safety is not ensured.

In the study by Bridi *et al.*, more than 60% of the alarms were registered without reply (response time higher than 10 minutes) and less than 20% were answered in 5 minutes. If these alarms signaled a severe arrhythmia or instability, the lack or delay in the team's responses to the alerts would result in serious consequences for the patient, since the changes would not be detected, preventing the adoption of therapeutic measures[2].

The high number of alarms and equipment, besides predisposing to alarm fatigue, creates a stressful environment and impairs the patients' rest, increasing the time of hospitalization and the use of analgesics and anxiolytics. The team can reach a level of alarm fatigue in which, even when consciously hearing the alarms, they can "mentally turn them off" and thus end up not answering them.

The author considers that alarm overload can lead the team to deactivate the monitoring variables, reducing the volume of alarms, disabling them, or inadvertently adjusting the parameters off the appropriate limits for the patient's needs, in an attempt to reduce the alarms.

When professionals adjust the volumes of alarms, they must consider the flow of people in that environment, the physical plant of the unit, the background noise, and the patient profile, making relevant alarms be noticed or preventing high noise from causing discomfort.

FINAL CONSIDERATIONS

Our results show that that alarm fatigue is a reality within intensive care units. Regarding the data produced in this research, we highlight: the sensitivity and specificity of the alarms; the role of health professionals; the strategies for alarm fatigue reduction and increased patient safety.

The technological advancement in the monitoring and life support means of intensive care units may impair patient safety, since the alarms are not properly answered. The high sensitivity (profuse sweating, patient mobility, psycho-motor agitation, cold extremities, nail polish, body hair, patient's objects) and the weak specificity (same rhythms, equal volumes, short parameters intervals) of the alarms contributed to a high incidence of false

alarms and low clinical relevance, which shows an inadequate response on the part of health-care professionals, especially nurses.

We observed that nurses were the professionals that most "answered" alarms, being considered those who most deal with monitoring equipment and alarm systems and, thus, those more involved in the alarm fatigue phenomenon. Regarding the behavior adopted by professionals before the answered alarms, the pause of the alarm can show there was no real evaluation of the problem by professionals.

Thus, developing strategies to correct the action of nurses regarding the alarm response is needed.

One of the strategies consists of an individual parameterization for each patient and each context, in services such as UCIP and Neonatology, where all patients are monitored and have parameterization of several elements of evaluation. There is also the need to create differentiation between the sound and timbre of the alarm. This standardization must come from the professionals themselves, collaborating with companies that produce and sell the monitors to carry out these small changes, which are a benefit to patients in their recovery and treatment effectiveness, substantially increasing their safety. Wireless Technologies, among others, can be viable alternatives to watch the monitoring.

Thus, a fundamental aspect of alarm management is ensuring that health professionals are aware of their conditions, aiming to reduce the symptoms of stress. Another way of reducing noise passes through strategies to the team of health professionals avoid false alarms, adjusting them to the needs of each patient, which ensures their validity, and providing an early warning to potentially critical situations.

The training and qualification of the teams to acquire knowledge and the appropriate handling of monitors, as well as the creation of protocols and daily routines regarding alarm parameterization, becomes essential to patient safety.

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