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The Effectiveness of Safety Alarm Implementation among Nurses on Fatigue Alarms in Aceh General Hospital's High Care Unit Room

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ABSTRACT

The safety alarm protocol implementation is one of the standards that need to be applied to reduce the incidence of fatigue alarms. This study aims to know the effect of implementing the safety alarm protocol among nurses on fatigue alarms in Aceh General Hospital's High Care Unit (HCU) Room. This research is quantitative research with a quasi-experiment model. The sample in this study was all nurses in Aceh General Hospital's High Care Unit (HCU) room, with a total of 37 respondents. The research instrument was adopted from the Japanese Occupational Hygiene Association. Data analysis used the Wilcoxon Rank test with a 95% confidence level. This study found that nurses' fatigue alarm scores decreased significantly after 21 days of implementing the safety alarm protocol, from 20 pre-tests to 15 at the post-test (p <0.001). The safety alarm protocol implementation effectively reduces the incidence of fatigue alarm among nurses in Aceh General Hospital's High Care Unit (HCU) room. It means that the safety alarm protocol implementation effectively proved reduces the incidence of fatigue alarms. Hence, the implementation and development of a safety alarm protocol in hospitals are important, especially in intensive care rooms.

Keywords: Alarm Fatigue, Alarm Safety, Nurse, High Care Unit

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BACKGROUND

A work environment in intensive rooms with high pressure, the use of various medical equipment, and patients with complications require nurses to monitor the patient's physiological functions on an ongoing basis using clinical alarms (Wung & Schatz, 2018). To improve patient safety and security, almost all medical equipment in intensive care wards has an alarm to alert nurses to potential dangers among patients to give intervention quickly. Nurses are expected to supervise and respond appropriately to pathological changes in patients and medical equipment (Ebright, Patterson, Chalko, & Render, 2003; Wung & Schatz, 2018).

In 1983, only six types of alarms for one critical patient, but in 2011 there were more than 40 types of clinical alarms (Cho et al., 2016). Many alarms will cause various problems, such as non-optimal use and the potential to cause fatigue alarms. Fatigue alarm occurs when a person's clinical response decreases due to excessive alarms, too many sensory stimuli, and desensitization. Other factors such as excessive workloads, long working hours, and a work environment with high noise levels contribute to desensitization effects associated with fatigue alarms (Cho et al., 2016; Wung & Schatz, 2018).

The research results at John Hopkins Hospital, Baltimore, Maryland, found that 59,000 alarms were alive over 12 days, and 350 alarms were on for each patient per day (HTF, 2011). Wung & Schatz (2018) reports that nearly 90% of the alarms that go off are false or do not provide a severe picture indicating special handling. Another study says that as many as 72% to 99% of clinical alarm signals are false alarms and cause fatigue alarms (Weil, 2009). Baillargeon's study in 2013 also showed that within 2 minutes, there were 52% false alarms, and 70% of them were due to arrhythmias which did not have a significant clinical effect. That condition is the leading cause of fatigue alarm in nurses, with evidence of an average response to turn off the alarm for 7.01 minutes (Baillargeon, 2013).

False alarm contributes as a factor that can cause fatigue alarms to nurses and has the potential to endanger patient safety. One effort to reduce alarm fatigue is with the Alarm Safety Team and implement work protocols using monitors, including equipment preparation, tool settings, patient adjustment, nurses/doctors, and the work environment (Johnson, Hagadorn, & Sink, 2017). Whalen et al. (2014) stated that applying a security protocol using an alarm for two weeks effectively reduces the sound of alarms in one week by 89% and reduces the incidence of code blue by 50%. This, either directly or indirectly, will also reduce the risk of fatigue alarms for nurses on duty because they provide specific responses to the problematic patient's condition based on the sound of the alarm (Whalen et al., 2014).

The observations and interviews by researchers at Aceh General Hospital's High Care Unit room found that hospitals have been facilitated with a monitor device with particular specifications. Aceh General Hospital's High Care Unit room is equipped with various sophisticated monitoring devices and a complex alarm system, and there are 250 alarms live on the hemodynamic monitor for 8 hours. Therefore, this study aims to determine the effect of implementing the safety alarm protocol among nurses on decreasing the fatigue alarm score in Aceh General Hospital's High Care Unit room.

METHOD

Design and Sample

This is quantitative research with a quasi-experimental study, located in Aceh General Hospital's High Care Unit room with a one-group pre-test and post-test design. Data collection and implementation of interventions were carried out for 21 days, starting on

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December 9 - December 28, 2020. The sample in this study was all nurses in Aceh General Hospital's High Care Unit room with 37 respondents.

Research Instrument and Data Analysis

The fatigue alarm instrument uses a questionnaire developed by the Japanese Occupational Hygiene Association (Cho et al., 2016). The interpretation is the greater score, the heavier the fatigue alarm experienced by research respondents. The pre-test and post-test were conducted one week before and after the intervention using the Google form application's help. The safety alarm instrument refers to the American Association of Critical-Care Nurses (AACN) Practice Alert (McGinley, 2013). The data analysis in this study used the Wilcoxon Rank test with a 95% confidence level.

Ethical Consideration

This research has passed the Health Research Ethics Committee (KEPK) RSUDZA and the Faculty of Medicine, Universitas Syiah Kuala, with ethical clearance number: 313/EA/FK-RSUDZA/2020.

RESULTS

Table 1 shows that the average age of respondents was 33 years and was dominated by a female with a percentage of 75.7%. A total of 19 respondents had Ners title, and 67.6% of respondents had never attended training on the use of clinical alarms. Most of the respondents were contract employees of 62.2%, and most of the respondents' tenure of ≥ 2 years was 94.6%. All characteristic data presented in table 1 shows no significant difference between respondents when viewed based on their demographic characteristics (p-value> 0.05).

Table 1. Characteristic Respondent (N=37)

Characteristics	Total (n)	Percentage (%)	p-value
Age			0.087
Mean ± SD	33.73 ± 4.14		
Gender			0.614
Male	9	24.3	
Female	28	75.7	
Education			0.079
D III Nursing	13	35.1	
S1 Nursing	4	10.8	
Ners	19	51.4	
Master of Nursing	1	2.7	
Marital Status			0.685
Single	6	16.2	
Marriage	30	81.1	
Widow/widower	1	2.7	
Clinical alarm training			0.594
Ever	12	32.4	
Never	25	67.6	
Employment status			0.178
Contract	23	62.2	
Civil servants	14	37.8	
Tenure			0.318

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< 2 years	2	5,4
≥ 2 years	35	94.6

Diagram 1 presents fatigue alarm score data based on changes in scores before and after the intervention. The average fatigue alarm score from 25 dropped to 15 after implementing the safety alarm protocol with a score difference of 10. Furthermore, there was an increase of 2.5 points to 17.5 after 21 days of implementing the safety alarm protocol.

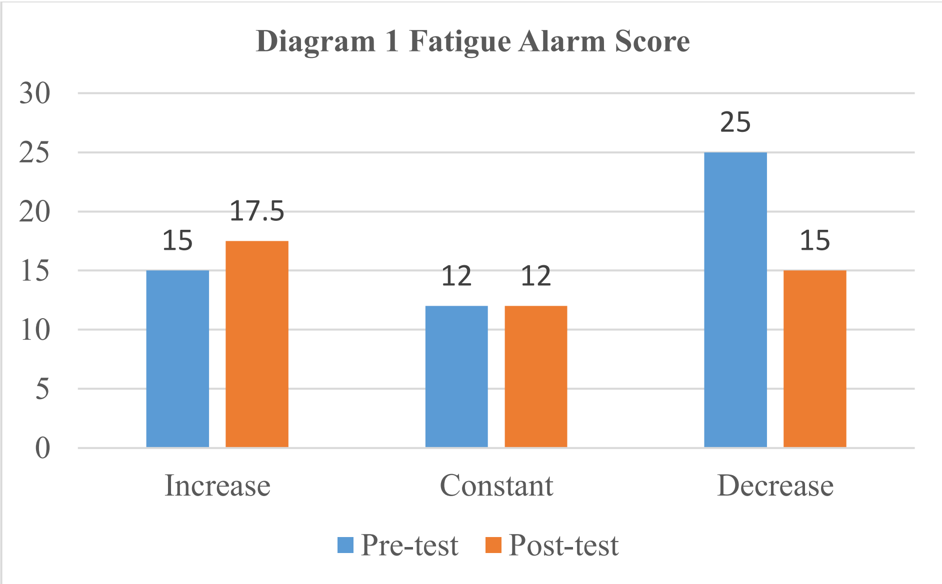

Diagram 2 presents the distribution data of the change in the fatigue alarm score, viz 27 nurses (72.9%) who became research respondents showed a decrease in the fatigue alarm score after implementing the safety alarm protocol for 21 days. However, six respondents experienced an increase in their scores after implementing the safety alarm protocol, and four others showed a fixed value.

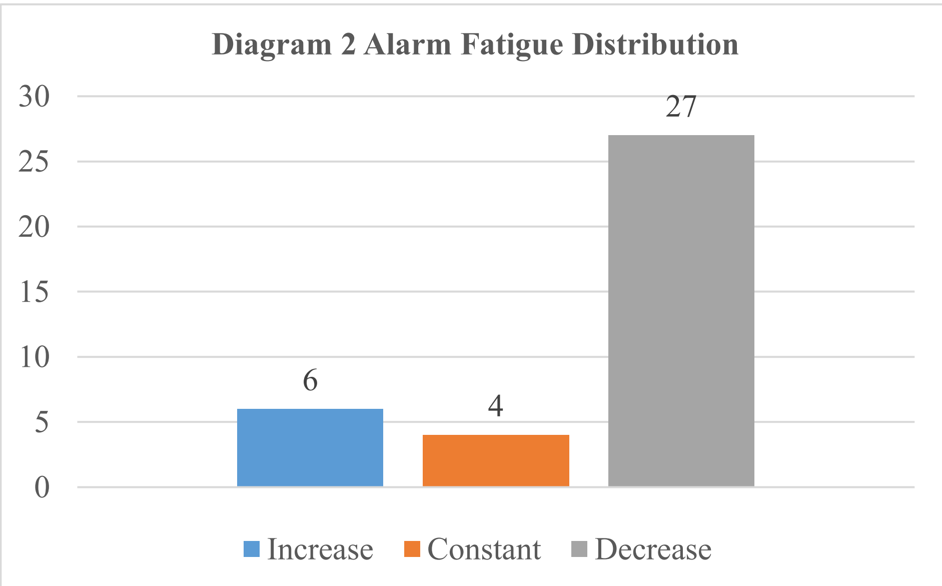

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Table 2 shows the score of fatigue alarm before intervention is 20 with the smallest value of 7 and the largest value of 33. After the intervention for 21 days, the fatigue alarm score has decreased significantly, viz 15 with the smallest value of 7 and the largest value of 21 (p-value <0.05). This means that the safety alarm protocol implementation among nurses effectively reduces fatigue alarms in Aceh General Hospital's High Care Unit room.

Table 2 Fatigue Alarm Score Before and After Implementation of the Safety Alarm Protocol

Fatigue Alarm Score	Median	Min - Max	p-value
Pre-test (n = 37)	20	7 - 33	<0.001
Post-test (n = 37)	15	7 - 21	

DISCUSSION

Nurses in intensive care rooms are a group of nurses who are very vulnerable to fatigue alarms because they are in an area with complex clinical alarms. Healthcare Technology Safety Institute (HTSI) reports that there are 100 - 350 clinical alarms every day on one bed in the ICU room. Depending on the specific characteristics of the alarm system used, health care providers, including nurses, are exposed to 1,000 alarms per shift (AAMI/HTSI Foundation, 2012). Two previous studies reported that 80 - 99% of the alarms that sound do not require particular action (nonactionable alarm). In one study, it was found that 35% of nurses' time was spent responding to clinical alarms (Borowski et al., 2011; Drew et al., 2014). Many alarms that live in one ward can cause desensitization and cause fatigue alarms, and this study result showed a mean value of fatigue alarms of 20 times.

In addition to having an impact on nurses personally, not taking action on alarm signals or delaying reactions can threaten the safety of patients who are receiving treatment. The United States Food and Drug Administration (FDA) reports as many as 500 alarm-related deaths within five years. Based on data on sentinel incidents of The Joint Commission from 2009 to 2012, 80 deaths were reported related to alarms (The Joint Commission, 2013). Excessive alarm exposure poses a triple threat to patient safety. The most apparent threat to patient safety is the desensitization of alarms that cause delays and inadequate clinical responses, such as turning off the alarm without checking the cause of the alarm. Fatigue alarms can lead to prolonged patient care, injury, to death ((Ruskin & Hueske-Kraus, 2015).

As a solution to the problem of alarms in clinical applications, the terms and definitions of alarms must be well understood. Clinical alarms indicate physiological changes in the patient, and technical alarms indicate the biomedicine of the device requiring special attention. The clinical alarm can correctly represent a change in the patient's condition requiring particular action. Also, clinical alarms can be wrong (false clinical alarm) or interfere (nuisance clinical alarm). A clinical alarm nuisance is an actual alarm that does not require particular action. Various factors that cause false and nuisance clinical alarms are improper settings, patient movements, and artifacts due to patient manipulation by health personnel.

In contrast to clinical alarms, technical alarms can arise due to a lack of preparation during use or damage caused to the alarm. A technical alarm can be true, false, and can be ignored. Avoidable alarms can occur when the preparation for the place where the electrodes are attached is not optimal (Ruskin & Hueske-Kraus, 2015).

Implementing a safety alarm protocol for 21 days based on AACN guidelines in this study proved effective in reducing the value of the fatigue alarm that occurred in 37 nurses who worked in the High Care Unit. Fatigue alarm scores decreased by 25% in the study

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respondents from 20 to 15 after 21 days of intervention. Previous studies reported the same thing as the findings in this study, where there was a decrease in the sound of the alarm by up to 47% after changing electrodes every day (McGinley, 2013).

A study conducted by Graham and Cvach (2010) on the management of standardized alarm use has been shown to reduce the number of alarm sounds, thereby reducing the potential for fatigue alarm events in nurses and preventing patient safety problems. As with this study, this study used the same monitoring device as this study in the form of a hemodynamic monitor and pulse oximetry. The study educated nurses to set individual patient alarm limits (customization of monitor alarm parameter limits and levels) and apply the applicable interdisciplinary alarm standards. Researchers in the study concluded that setting the alarm according to patient characteristics was proven to increase the effectiveness of using clinical alarms (Graham & Cvach, 2010).

The decrease in the fatigue alarm score in this study is related to reducing the number of alarm sounds due to the implementation of the safety alarm protocol. A study conducted by Turmell et al. with the application of the AACN safety alarm protocol reported a decrease in alarm sound by 80% to 90%. The adoption of a safety alarm protocol initiated many habitual changes in nursing practice. To consistently run safety alarm protocols requires cultural change and continuous evaluation (Turmell, Coke, Catinella, Hosford, & Majeski, 2017).

However, in this study, not all respondents showed a significant decrease in fatigue alarm scores. A total of 4 respondents showed a constant fatigue alarm score, and six respondents experienced an increase in the score with a mean of 15 before the intervention to 17.5 after the intervention. The increase in scores after the intervention is thought to be related to other factors associated with the incidence of fatigue alarms, such as excessive workload and long working hours. The phenomenon that occurs at the Aceh Government Regional General Hospital is that there are excessive working hours because the nurses exchange shifts outside of the physiological schedule that has been arranged in the room. This will directly have an impact on increasing workload, causing physical and psychological fatigue of nurses. However, this needs to be further proven by a comprehensive evaluation.

The limitations of this study are the small samples, and the coverage of this study is only limited to one room. Another limitation is monitoring, and evaluation by researchers in the implementation of the intervention was not optimal due to the Covid-19 pandemic, which did not allow evaluation of the implementation of the safety alarm protocol on an ongoing basis.

CONCLUSION

Implementing the safety alarm protocol for nurses in Aceh General Hospital's High Care Unit Room reduces the fatigue alarm score. The fatigue alarm score has decreased significantly with p-value = 0.001 <0.05. This means that the safety alarm implementation effectively reduces fatigue alarms in Aceh General Hospital's High Care Unit Room. This conclusion indicates that the implementation and development of safety alarm protocols in hospitals need to be done, especially in intensive care rooms.

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