

Alarm Fatigue among Nurses Working in Critical Care Setting in a Tertiary Hospital, Nepal

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ABSTRACT

Background

Alarm fatigue is a well-recognized patient safety concern in critical care settings. It occurs when nurses become overwhelmed by the total number of alarm signals which can result in alarm desensitization and eventually contributes to missing of serious and important changes in a patient's condition, thus failing to respond properly.

Objective

To find out alarm fatigue and its associated factors among nurses working in critical care setting.

Method

A cross-sectional study design with convenient sampling technique was used to select 56 nurses working at different critical care settings in Dhulikhel Hospital. A self-constructed semi structured questionnaire and nurses alarm fatigue questionnaire was used for the survey. Frequency, percentage, mean and standard deviation were used for descriptive statistics whereas Independent t-test and One-way ANOVA were used for inferential statistics.

Result

The result shows that more than half of the nurses were less than 25 years, single and more than two-third of the participants worked in Adult Intensive Care Unit. Out of total obtainable score 44, the overall mean score of the Alarm Fatigue was 28.03 ± 12.813 . The result showed that there was no significant difference between alarm fatigue and selected socio-demographic and work related characteristics.

Conclusion

The alarm fatigue among nurses working in critical care settings was found to be higher in this study. Since alarm fatigue is directly related to patients' safety, the effective management of medical device alarms can reduce alarm fatigue and prevent potentially dangerous outcomes.

KEY WORDS

Alarm fatigue, Critical care settings, Nurses

INTRODUCTION

Alarms are found on most medical devices which sound every hour of every day to inform medical personnel of changes that occur in life parameters as well as of any failures of equipment.^{1,2} In intensive care units, the monitor devices aid doctors and nurses hugely in taking instantaneous actions.³ False alarms, inappropriate alarms-setting ranges, and the overuse of patient monitors are very common and they disrupt rest, impede concentration and cognition, disrupt sleep, interferes with communication and increases the risk of accidents.^{4,5}

Alarm fatigue occurs when nurses become overwhelmed by the sheer number of alarm signals, which can result in alarm desensitization the nurses may deactivate variables that need to be monitored, lower the volume, silence, disable alarms or unconsciously adjust their parameters beyond the limits appropriate for the patients' needs in an attempt to decrease the number of alarms.⁶ Such changes may contribute to missing serious and important changes in a patient's condition, thus failing to respond properly.^{5,6}

Various studies concluded that bed to alarm ratio, purpose and length of alarm conditions, staffing levels, high-risk patient ratio, the unit layout and background noises are the contributing factors for alarm fatigue.^{7,8} Alarm fatigue results in lack of response of health care providers due to excessive numbers of alarms, which lead to desensitization and sensory overload which directly affects patients' safety and satisfaction.^{9,10} However, in Nepal, alarm fatigue is truly a new concept. So, this study aims to assess the alarm fatigue among nurses working in critical care settings along with its associated factors.

METHODS

This was a single center, cross-sectional survey conducted among the nurses working at critical care settings in Dhulikhel Hospital from July to September 2021. Convenient sampling technique was used for data collection and all the nurses working in critical care settings willing to participate were enrolled in the study. Sample size was 56. Socio-demographic and work related data was collected using a self-constructed semi structured questionnaire developed by principle investigator and the alarm fatigue was evaluated using the Nurses' Alarm fatigue questionnaire that was developed by Torabizadeh et al.¹¹ Permission was taken from the authors to use the instrument. The questionnaire consists of 13 items scored on a five-point Likert scales: never, rarely, occasionally, usually, and always. Each item on the questionnaire is scored from 0 ("never") to 4 ("always"), (except items 2 and 9 which are scored reversely). The scores of items are summed to give an overall score. The content validity index of the questionnaire is 0.92. The Cronbach's Alpha coefficient for

the overall scale of the Alarm fatigue questionnaire is 0.91.

Permission for the study was taken from the director of Nursing and Midwifery program Kathmandu University School of Medical Sciences (KUSMS), and ethical clearance was taken from Institutional Review Committee (IRC-KUSMS) with Approval no 57/2021. Data was collected using online based questionnaire (Google form) and the response rate was 80%. Percentages, frequency, mean and standard deviation was calculated. Independent t-test and one way ANOVA was used for inferential statistics.

RESULTS

A total of 56 nurses working at critical care settings were enrolled in this study from online survey. More than half of the respondents were less than 25 years, and three-fourth of them were single. Majority of the respondents had done PCL Nursing and about three-fourth of them were working in Adult intensive care unit. Most of the respondents had working experience in nursing as well as critical care setting for 1-5 years. About one-third of the respondents had never heard about Alarm fatigue whereas only about one-tenth of them had training/in-service education on alarm fatigue. In most of the critical care setting both the nurses and doctors are responsible for the alarm limit setting and about two fifth of them had experienced adverse patients events related to clinical alarm problems (Table 1).

The overall mean of alarm fatigue among nurses was 28.03 ± 12.813 . The participants scored highest for "I turn off the alarms at the beginning of every shift", "I pay more attention to the alarms in certain shifts" and "Generally, I hear a certain amount of noise in the ward" whereas the statements "I react differently to the low-volume (yellow) and high-volume (red) alarms of the ventilator" and "At visiting hours, I pay less attention to the alarms of the equipment" composite the lowest score (Table 2).

The result showed that there was no significant difference between alarm fatigue and selected sociodemographic and work-related characteristics table 1.

DISCUSSION

The aim of the study was to find out the alarm fatigue and its associated factors among nurses working in critical care settings. Since alarm fatigue is directly related to patients' safety, the effective management of medical device alarms can reduce alarm fatigue and prevent potentially dangerous outcomes. The alarm fatigue among nurses working in critical care settings was found to be higher in this study.

In this study, the overall mean score of alarm fatigue among nurses was 28.03 ± 12.813 which is consistent with a study in Lebanon among the clinicians where the mean was found

Table 1. Alarm fatigue according to respondents' characteristics

Characteristics	Frequency (%)	Alarm fatigue scale Mean±SD	P value
Age in completed years			
< 25years	32±57.1	28.11±12.734	0.95
≥ 25years	24±42.9	27.98±12.708	
Marital status			
Single	42±75.0	27.97±12.383	0.95
Married	14±25.0	28.23±14.001	
Educational level			
PCL nursing	48±85.7	28±12.734	0.778
Bachelor level in nursing	8±14.3	28.27±12.03	
Current working area			
Adult ICU	40±71.4	25.03±13.044	0.562
Pediatric ICU	7±12.5	23.01±13.456	
Anesthesia (Operation theatre)	9±16.1	24.21±12.171	
Working experience in nursing profession			
< 1 year	2±3.6	28±7.07	0.958
1-5 year	40±71.4	28.23±12.841	
> 5 years	14±25.0	27.53±12.868	

Working experience in Critical Care area

< 1 year	11±19.6	26.96±11.527	0.655
1-5 year	36±64.3	28.65±12.904	
> 5 years	9±16.1	26.89±12.641	

Ever heard about alarm fatigue

No	18±32.1	27.54±12.923	0.7
Yes	37±66.1	28.28±12.704	

Training/in-service education on alarm management

No	52±92.9	27.84±12.822	0.149
Yes	4±7.1	30.5±11.359	

Responsible for alarm limit setting in your unit

Doctors	2±3.6	28±7.07	0.463
Nurses	8±14.3	30.28±12.986	
Both	46±82.1	27.65±12.748	

Ever experienced adverse patient events related to the clinical alarm problems

No	24±42.9	28.97±12.704	0.246
Yes	9±16.1	28.91±13.312	
Unsure	23±41.1	26.76±12.294	

Table 2. Alarm fatigue among nurses

Statement	Always	Usually	Occasionally	Rarely	Never	Cumulative mean (SD)
I regularly readjust the limits of alarms based on the clinical symptoms of patients.	1± 1.8	10± 17.9	17± 30.4	19± 33.9	9± 16.1	2.45± 1.033
I turn off the alarms at the beginning of every shift.	1± 1.8	5± 8.9	8± 14.3	4± 7.1	38± 67.9	3.30± 1.127
Generally, I hear a certain amount of noise in the ward.	10± 17.9	31± 55.4	13± 23.2	2± 3.6	0	2.88± 0.740
I believe much of the noise in the ward is from the alarms of the monitoring equipment.	13± 23.2	27± 48.2	11± 19.6	5± 8.9	0	2.86± 0.883
I pay more attention to the alarms in certain shifts	31± 55.4	21± 37.5	4± 7.1	0	0	3.48± 0.632
In some shifts the heavy workload in the ward prevents my quick response to alarms.	4± 7.1	22± 39.3	15± 26.8	12± 21.4	3± 5.4	2.21± 1.039
When alarms go off repeatedly, I become indifferent to them.	3± 5.4	14± 25	19± 33.9	15± 26.8	5± 8.9	1.91± 1.059
Alarm sounds make me nervous.	4± 7.1	4± 7.1	28± 50	17± 30.4	3± 5.4	1.80± 0.923
I react differently to the low-volume (yellow) and high-volume (red) alarms of the ventilator.	23± 41.1	21± 37.5	8± 14.3	1± 1.8	3± 5.4	0.82± 0.765
When I'm upset and nervous, I'm more responsive to alarm sounds.	12± 21.4	14± 25	9± 16.1	15± 26.8	6± 10.7	2.20± 1.341
When alarms go off repeatedly and continuously, I lose my patience.	2± 3.6	12± 21.4	20± 35.7	13± 23.2	9± 16.1	1.73± 1.087
Alarm sounds prevent me from focusing on my professional duties.	5± 8.9	13± 23.2	11± 19.6	20± 35.7	7± 12.5	1.80± 1.197
At visiting hours, I pay less attention to the alarms of the equipment.	1± 1.8	3± 5.4	5± 8.9	10± 17.9	37± (66.1)	0.59± 0.987
Overall Mean						28.03± 12.813

to be $30.57 \pm SD=7.89$ and is much more higher as compared to a study conducted in Iran among ICU nurses where mean of the alarm fatigue was 19.08 ± 6.26 .^{5,12} This difference may be due to the different in settings, infrastructure and protocols of critical care settings. The alarm fatigue is a domain of mental health that is very crucial to health related quality of life of the healthcare providers. In the long-term, fatigue can also affect staff health and morale, with effects on cardiovascular outcomes, depression, leading to stress and even “burn-out”.¹⁴

According to this study’s findings the participants score for the statements “I pay more attention to the alarms in certain shifts”, I turn off the alarms at the beginning of every shift (which was a negative response question) and “Generally, I hear a certain amount of noise in the ward” composite the highest scores which is in contrary to the findings of a study in Lebanon where the statements “Alarm sounds make me nervous”, I believe much of the noise in the ward is from the alarms of the monitoring equipment” composite the highest scores.⁵ This difference may be because of different settings and protocol used in the hospital.

Our study found no statistically significant relationship between the level of education and the alarm fatigue. In contrary a study in Iran concluded that nurses with higher levels of education are more likely to experience alarm fatigue and also a study in Lebanon shows that the mean alarm fatigue score was higher in nurses with higher levels of education.^{5,12} But a study among nurses working in intensive care unit shows that higher education is negatively correlated with alarm fatigue.¹³ Perhaps the reason for this difference is the type and environment of the study.

In our study no statistically significant association was found between marital status and working experiences but a study done in china among intensive care unit nurses revealed that the unmarried nurses and long working years are negatively correlated with the alarm fatigue.¹³ This contradictory findings may be due to the different settings and working environment. This study revealed that there is no significant difference between the training related

to Alarm management and the alarm fatigue which is in contrast with studies done in Iran and Lebanon where alarm fatigue in nurses who were trained in working with ventilators and alarm settings was significantly less than other nurses.^{5,12} This discrepancy may be because in the present study only very few numbers of the participants were trained in alarm management.

A study in Lebanon revealed that the clinicians who declared that nurses are responsible for alarm limit settings showed lower scores of AF than others subgroups whereas in the current study these was no significant difference between who sets the alarm and the alarm fatigue.⁵ This difference may be because in this study in most of the cases the nurses and doctors jointly set the alarm limit.

Alarm fatigue is a complex and uncontrollable cognitive process. It is the result of changes in human cognition and attention to adapt to the surrounding environment.¹³ Alarm fatigue in nurses can be reduced by the development of different alarm sounds for different situations, joint monitoring (screen), easy access to technical support, personnel support, more humane working hours and alarm management protocols.^{5,13}

The sample size is relatively small and the results are limited to critical care settings of a single hospital. Therefore, the findings may not represent all the nurses working in critical care settings.

CONCLUSION

The alarm fatigue among nurses working in critical care settings was found to be higher in this study. Since alarm fatigue is directly related to patients’ safety, the effective management of medical device alarms can reduce alarm fatigue and prevent potentially dangerous outcomes. Moreover, this study used only alarm fatigue questionnaire to identify to identify alarm fatigue among nurses. In addition to this alarm fatigue questionnaire, observational assessment can add stronger evidence of alarm fatigue among nurses.

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