ASSESSMENT OF KNOWLEDGE OF ALARM FATIGUE, PRACTICE TOWARDS ALARMS AND ASSOCIATED FACTORS AMONG NURSES WORKING IN ADULT INTENSIVE CARE UNITS OF FEDERAL GOVERNMENTAL HOSPITALS IN ADDIS ABABA, ETHIOPIA, 2020 G.C.

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This is to certify that the thesis entitled "Assessment of knowledge of alarm fatigue, practice towards alarms and associated factors among nurses working in adult intensive care units of federal government hospitals in Addis Ababa city, Ethiopia'' is submitted in partial fulfillment of the MSc. With specialization in "Emergency and Critical care nursing" to the Graduate Program of the College of Health Sciences of Addis Ababa University and has done by Hana Kebede ID No: GSR 9850/11 under my supervision. Therefore, I recommend that the student has fulfilled the requirements and hence here by can submit the thesis to the Department.

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Declaration I hereby declare that this MSc thesis is my original work and has not been presented for a degree in any other university and all sources of material used for this thesis have been duly acknowledged

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TABLE OF CONTENTS

Contents

LIST OF TABLES

LIST OF FIGURES

ACRONYM AND ABBREVIATIONS

A. A: Addis Ababa

AACN: American Association of Critical Care Nurses

AAU: Addis Ababa University

AJC: The American joint commission

CCN: Critical care nurses

CCU: Critical care unit

CHS: College of health science

CIP: Critically ill patients

FDA: Food and drug administration

HTF: Health care technology foundation

ICU: Intensive Care Unit

KP: Knowledge and Practice

SPSS: Statistical Package for Social Sciences

WHO**:** World Health Organization

ABSTRUCT

Background: Audible clinical alarms have been an essential part of patient monitoring since the 1950s. Alarm fatigue is the desensitization of a clinician to an alarm stimulus that occurs when caregivers are exposed to a great number of repeated alarms. Due to a number of clinical alarms from medical machines within the ICU, there is a high risk of nurses becoming desensitized to the sound of patient alarms**.** Moreover, physiologic alarms may be disabled, silenced, or ignored. These practices can potentially affect the patient care negatively.

Objectives: To assess the nurses' level of knowledge of alarm fatigue, practices towards alarms and associated factors among nurses working in adult ICUs of federal government hospitals in Addis Ababa city, Ethiopia, Jan-Jun 2020 G.C.

Methods: A descriptive cross-sectional quantitative study design was conducted to determine the knowledge of alarm fatigue, practices towards alarms and associated factors among nurses working in Adult ICUs of federal governmental hospitals in Addis Ababa, Ethiopia from Jan -Jun 2020 GC. A total of 162 nurses was recruited by the convienience sampling method. The data were collected by using semi structured, self-administer questioner. SPSS version 25 for Windows was used for data entry and analysis, descriptive statistics and bivariate and multivariate logistic regression were used to analyze the data.

Result: In this study, 42% of participants had poor practice towards alarms and 57.8% have good practice. The majority of, 107 (66%) respondents had good knowledge on alarm fatigue. The majority of nurses 140 (86.4%) answered correctly that Non actionable/nuisance alarms disrupt patient care. Nurses who don’t have in service training on alarm management are 2 times, having a poor practice than those who took in service training (AOR=1.974, 95% CI (1.296, 4.024)).

Conclusion and Recommendation: Although the improvement of nurses' knowledge and practices regarding alarm management will directly or indirectly reduce the harms related to poor alarm management, Nurses have remarkable gaps and alarming skill performance related to alarms. Therefore, periodic on-job and pre-service training regarding alarm management, guidelines as well as protocols should be provided to all ICU nurses. There is also a need for further research to include more settings would be valuable. In addition, there are gaps identified for further research to strengthen findings.

Keywords: Adult ICU, alarm fatigue, practice towards alarms.

1. INTRODUCTION

1.1. Background

In the 1950s, there was a flourishing improvement of innovative medical machines that aid in saving lives and assist critically ill patients. These machines alert the staff by alarm signals when there is an alteration to condition of the patient (1).

Audible clinical alarms have been an essential part of patient monitoring since the 1950s and this clinical alarms are warning signs that notify caregivers when the patient is in, or potentially in, hazardous situations, and needs immediate assistance (2).

Alarm fatigue is defined as the desensitization of a clinician to an alarm stimulus that occurs when caregivers are exposed to a great number of repeated alarms. As a result clinicians become overwhelmed by trying to respond to them. This desensitization can lead to prolonged response times or missing essential alarm sounds which places the patients at risk (3).

Since the clinical alarms summit in 2011, regulatory agencies, hospital management, and medical equipment producers have sought to optimize the use of alarms in an effort to over-come their negative effects on clinicians, patients, and visitors (4).

It is a typical practice in critical care unit to depend on audible clinical alarms to alert the staffs when an intervention is needed. Due to high number of clinical alarms from medical machines within the ICU, there is a potential risk of being fatigued to alarm sounds. And this have a negative impact on ICU nurses responses to alarms. Moreover, physiologic alarms may be disabled, silenced, or ignored. So, these practices create a patient safety concern (5).

In addition, critical care nurses are responsible for identifying and quickly acting upon changes in patients' physiological condition. And they use medical devices, including bedside physiologic monitors to assist them in their practice. Customizing alarm settings in medical devices help the nurses to appropriately follow their patients and decrease the number of non actionable or false alarms (6).

This effective alarm management in an ICU is crucial to assist nursing staff in managing patient safety. If alarm management is ineffective, the aim of ensuring patient safety is compromised (7). More over alarms that are intended to assist and alert nurses to patient needs then becomes a risk to patients care and safety as the patients immediate needs may not be identified (8).

Effective alarm management in an intensive care unit (ICU) can be influenced by various factors the culture of the department, nursing practice and technology. But if a culture is created where staff is reliant on clinical alarms only for patient care, this is potentially a risk to patient safety. Alarm limits should be correctly set and functioning to avoid an adverse event for the patient (9).

Based on the researchers' experience in the ICU setting, the staff presently used in our ICU facilities are generally come with minimal ICU skills or training. The question that needs to be asked is whether or not this therapeutic system is being utilized optimally to ensure that appropriate patient care and management is rendered as per patient needs or are there challenges experienced with managing alarms in an ICU.

1.2. Statement of problem

The effective use of alarms continues to be a challenge in the clinical setting with respect to how they are selected, set up, and responded to. Increasing amount of alarms were considered to be a big problem in critical care medicine but still it remains unsolved. In addition, threats to the patient wellbeing as a result of missing or ignored alarms are still being reported (10).

The first problem of alarms was first brought into attention in 1974 by the Emergency Care Research Institute when the published sentinel event reported an unnoticed alarm on a hypothermia device causes a severe patient burn (11).

The Emergency Care Research Institute found 264 incidents associated with alarms between 2000 and 2006. The Food and Drug Administration discovered 566 alarm related death reports in the United States from 2005 to 2008 (12). TJC reported 98 alarm-related events between January 2009 and June 2012, of the 98 reported events, 80 resulted in death, 13 in permanent loss of function, and 5 in unexpected additional care or extended stay. And this Alarm-associated harms may consist of technical failures as well as alarm fatigue (9,13).

The ECRI considered clinical alarm hazards the number one health technology hazard for years 2012. ECRI Institute's search of the FDA Maude database using an alarm and death revealed 216 deaths involving physiologic monitor alarms In 73 of the cases, alarms sounded, but staff silenced them, did not hear them because the volume was too low, or did not respond for another reason (14).

Study has shown that 72% to 99% of clinical alarms are non actionable or false alarms. This great number of non actionable alarms resulted in alarm fatigue. Alarm fatigue caused by alarm desensitization may result in slower nursing response time, and may cause nurses to ignore the alarm or to turn it off totally (15).

The TJC has been trying to combat alarm fatigue since 2013, because there were numerous reported sentinel events, which led TJC to issue an alert on alarms and then made alarm management a national patient safety goal. In 2019, reducing the harm associated with clinical alarm systems continues to be a

national patient safety goal. The joint commission continues to encourage health care systems to put policies in place to decrease the burden of unnecessary alarms on staff (13,16).

With the nursing shortage being a worldwide problem, to improve nurses' abilities to detect alarm signals of patient deterioration do have global importance (6,17). In a research done in Africa, Nairobi concluded that majority of nurses 81.6% do not fill alarm checklist and need training on the importance of alarm management (18).

As far as my knowledge there are no researches done in Ethiopia related to alarm fatigue and alarm practice. Alarm fatigue of staff in an ICU setting is a potential clinical problem that needs to be identified as the lack of attention and response to valid alarms that require actionable intervention can lead to/cause delayed responses, which may contribute towards patient deterioration and mortality (19).

Alarm fatigue can lead to incorrect alarm setting whereby the threshold limits are adjusted and are not in line with patient needs as per their baseline data. Moreover this area remains relatively unexplored in our setting and this quantitative study will be taken to identify this problem in the ICUs of federal government hospitals in Ethiopia.

1.3. Significance of the study

The study may provide for responsible bodies of ICU units and nurse managers with an in-depth understanding of the nurses' alarm management, which could help to develop appropriate guidelines and procedures by giving strong attention for alarm management strategies in the adult ICU department.

The study can identify the internal and external problems encountered by nurses during their alarm management practices. Awareness of these problems with nurse managers will help them to support their nurses and to communicate with hospital administrators to give emphasis to alarm management strategies.

The study may help to provide recommendations to training institutions to review the curriculum and close the gaps identified therein, ensuring that upon qualification, nurses are well equipped with current knowledge and skills in alarm management.

In addition, the study may help to improve quality of care given to patients and identify the challenges in alarm management to ensure patient safety. It also laid a foundation for research studies which focus more on nurse’s competencies in alarm management practices.

2. LITERATURE REVIEW

Regardless of the many years of concern about alarms and their effective use, including alarm fatigue, alarm management remains a significant challenge in the clinical setting. While new technologies may offer some improvements, these technologies are not yet all readily available, nor are they easily integrated. In the meantime a starting point is to properly understand the current local situation. Recently, literature has called attention to alarms hazards, with a key issue being alarm fatigue. The rationale for the Joint Commission's new NPSG is strong evidence that alarm management is a critical safety. The 2014 national patient safety goal introduced by The Joint Commission, focusing on clinical alarm management and safety, citing the need for improved safety in clinical settings (20,21).

2.1. Knowledge of alarm fatigue

On a study done in Ireland most of the nurses were familiar with the term alarm fatigue (88%). likewise, 84% of the nurses knew the causes of alarm fatigue. on the other hand, only 48% of the nurses knew how to prevent alarm fatigue. Nurses' knowledge of how to prevent alarm fatigue was not found to be associated with years of experience of the nurses.

Most of the nurses (72%) believed that smart alarm technology would be effective at reducing false alarms. Just over half of participants (54%, n = 88) had knowledge of adverse patient events related to clinical alarms

From 71% of critical care nurses who said adverse patient events related to clinical alarms occur in their institution, 37% of them did not know how alarm fatigue can be prevented. 47% of nurses responded that New technology had been established to advance clinical alarm safety in their institution, This was significantly related to nurses' knowledge of alarm fatigue prevention (22).

A study done on Montana State University A majority of respondents confirmed the occurrence of frequent nuisance alarms (84.6%) which disrupt patient care (84.6%), and re- duce trust in alarms causing caregivers to disable alarms (53.8%, neutral: 46.2%). Responses were divergent on the statements about the complexity of hearing, recognizing alarms, and responding to alarms. Participants (46.2%) disagreed that staff were sensitive enough to respond to alarms quickly (9).

2.2. The Practice of alarms

From the top ten health technology hazards for 2015, alarm hazards were one of them as identified by The Emergency Care Research Institute, 2014. The first hazard as listed in this report is, Alarm Hazards: Inadequate Alarm Configuration Policies and Practices. The report related to inappropriate practices with alarm set ups, an example, the failure to reset equipment with the arrival of new patients and inappropriate choice of alarm limits chosen for the patient. 15 Recommendations put forward do highlight training needs for the clinical staff related to how to configure the alarms and ensure it is in line with policy. Training is re-emphasized with regards to orientation and updates (8).

On a study done in Ireland 88% of participants gave fourth highest agreement level for Customizing patient alarm parameters at the start of a shift and was significantly related to nurses' knowledge of preventing alarm fatigue 92%. The 2nd lowest level of agreement 30.9% was properly setting alarm parameters and alerts is overly complex in existing devices, while difficulty setting alarms properly was ranked 8th as an obstacle to effective alarm management. And only 36% of nurses agreed that alarms could not be heard or were missed repeatedly. However, 62% of participants responded that environmental background noise (noise competition) had interfered with alarm recognition, and 50% agreed that, when a number of devices were alarming, there was confusion determining which device was alarming. There was almost common agreement with in the participants in this study that 99% of them responded that alarms should signify alarm priority (22).

According to HTF 2011 survey 1 in 5 US Hospitals reported Clinical Alarm Adverse Events (23). A research done on Plymouth University Shows workload influence the ease with which the location of a sound can be identified, and 'alarm fatigue' in terms of variables which influence people's ability or capability in detecting audible alarms (24).

A research done Alarm Management at the University of Vermont Medical Center shows that in appropriate alarm setting contribute for 45 % of alarms (25).

Alarms also contribute to the desensitization of nurses to devices; in such a way that alarms for "true" events have less probability of calling the attention of the staff. In the study by Korniewicz et al., 77% of the participants agreed, or strongly agreed that "nuisance" alarms interrupt the sequence of care practice (3).

There is a substantial increase in the number of responses from the first to the second survey of health care technology foundation was due to effective publication of the survey by using partner society relationships (26).

A study done by AJCC shows that most of the nurses able to identify the characteristics of a ‘‘nuisance alarm’’, many felt that it was the responsibility of the primary nurse to set appropriate limits and responded to alarms in a timely manner. However, describing it can be seen that inappropriate alarm set-ting figured high in the participant’s responses across all five themes (27—71%).When asked what a ‘‘frequent’’ nuisance alarm would be, 81% of respondents identified a false positive or clinically irrelevant alarm as being the key factor. When compared to defining a nuisance alarm, interestingly, 57% of individuals suggested alarm accuracy and inappropriate alarm setting were major contributing factors. Within those themes the practice of silencing and altering alarm limits, >50% of alarms were as a result of the nurse being absent from the bed-space. This study clearly identified that inappropriate alarm setting was one of the major factors that caused individual annoyance, especially when relative inaction was witnessed in response- ding to the initial alarm. Clearly false-positive alarms are inevitable in this clinical environment because of the ever changing condition of the patient (Korniewicz et al., 2008), for example a ventilated patient coughing will trigger a high pressure alarm and the delusional patient removing monitoring devices (27).

The study results shows that 83% changed alarm parameters when a patient’s vital signs changed and 78% changed parameters at the beginning of their shift (5).

On a study done on Kenyatta National Hospital (KNH) majority of the nurses 78.2% reported that they always act in response to alarms of all durations. Most of the respondents 81.6% did not fill alarm checklists and only 18.4% reported filling alarm checklists. From 55 (100%) of nurses who responded to Reasons why they do not fill alarm checklists, 5.5% reported that there is no alarm checklists in the unit and there are no protocols describing that they have to fill alarm checklists and the rest 94.5% responded other reasons as to why they were not filling alarm cheek list. From all nurses 43% of them said that they Always make sure proper skin preparation before placing electrodes, most of participants (77%) responded that they Always assess the reason of the alarm beep when it alarms, 89.7% of participants responded that they Never ignore alarms each time they beep, 70.1% of them also responded that they Always check and assess the patient’s situation every time the alarm beeps and 71.3% of them said they Always reset the alarm settings of the device each time they accept a new patient (18).

2.3. Factors that influence alarm fatigue

In a research done in Korea shows from the obstacles to effective alarm management of medical appliance alarms, frequent false alarms lead to reduced attention or response to alarms when they occur was ranked 1st and difficulty in setting alarms properly was ranked last (8).

In a study done on Kenyatta national hospital shows the nurses' responses of disabling alarms every time is 81.5% of the age group 25– 35 years, MScN and KRN scored 100%, those that had worked as nurses for more than 10 years scored 79.8%, those who had worked in CCU for more than 10 years scored 85.6%, nurses that are trained scored 80.5%, and nurses that had undergone alarm management training scored 82.5%.

Testing of socio demographic characteristics and the nurses' responses to the action, I assess the cause of the alarm every time, The participants scored in this way in terms of the highest scores age group 36–44 years scores 96.6%, females scored 93.2%, KRN scored 100%, those that had experience as nurses more than 2 years scored 100%, those that had experience in CCU for more than 2 years scored 92.3%, and those that were trained for alarm management scored 100%. There was also found a statistically significant relationship among the nurses' age and their reaction to the action of cheeking the cause of the alarm beep (18).

2.4. Conceptual framework

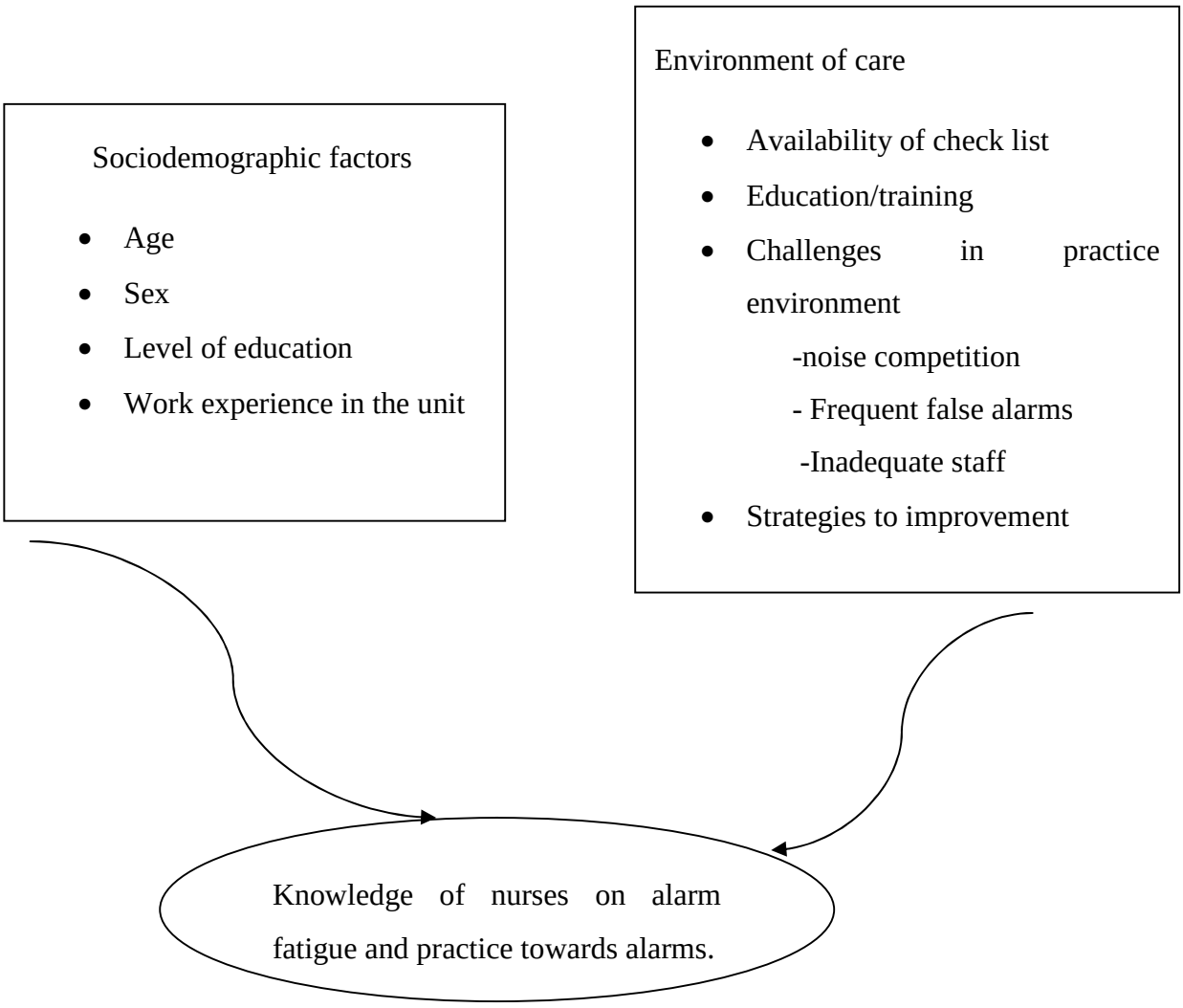

Figure 1 conceptual frame work reflects relationship b/n knowledge of nurses on alarm fatigue and practice towards alarms with the associated factors adapted from different work of literature.

3. OBJECTIVES

3.1. General objective

- To assess knowledge of Alarm Fatigue, Practice towards Alarms and associated factors among nurses working in adult intensive care units of federal governmental hospitals in Addis Ababa, Ethiopia, Jan-Jun 2020 GC.

3.2. Specific objectives

- To assess ICU nurses knowledge alarm fatigue
- To assess the practice of ICU nurses towards alarms
- To identify factors that affect the ICU nurses proper management of clinical alarms

4. METHODOLOGY

4.1. Study area

Addis Ababa is the capital city of Ethiopia, and seat of the African Union and Economic Commission for Africa is at the heartland of Ethiopia, with a population of 3.384,569 of people in an area of 540 square Kilometers. The city comprises 10 sub cities and 116 woredas. The population pyramid is broad based, typical of a developing world. People from different regions of Ethiopia populate the city. The city consists of a total of 79 health facilities including Hospitals; out of which 6 hospitals owned by Addis Ababa Health Bureau, 6 hospitals owned by Federal Ministry of Health (central), 2 ministry of defense and 1 police force hospitals which provide different health services. In addition there are about 26 health center, 9 clinic, and 34 health posts. From the hospitals, 12 of them state run, and more than 40 private(28).

Federal governmental hospitals located in Addis Ababa city excluding those that give special services are Black Lion hospital with 42 nurses, Alert hospital with 30 nurses, St Peter hospital with 20 nurses, St Paulos hospital with 48 nurses and ABET hospital with 39 nurses. The total number of nurses in these federal governmental hospitals is 179.

4.2. Study period

The study was conducted in these ICUs of federal governmental hospitals from Jun -Jan 2020 Addis Ababa, Ethiopia.

4.3. Study design

A cross-sectional study design was conducted from Oct 2019 - Jun 2020 Addis Ababa, Ethiopia.

4.4. Target population

All nurses working in the adult ICUs in Ethiopia.

4.5. Source Population

All nurses working in adult ICUs of Governmental hospitals in Addis Ababa city.

4.6. Study population

All nurses working in adult ICUs of federal governmental hospitals in Addis Ababa city.

4.7. Eligibility Criteria

4.7.1. Inclusion criteria

Nurses who present during the data collection period and enough to give reliable information were included in the study.

4.7.2. Exclusion criteria

- Nurses who are not available during the data collection period.
- All nurses who are employed in managerial positions (head nurses, directors)

4.8. Sample size determination

All the total 179 nurses who are working in Adult ICU of federal governmental hospitals in Addis Ababa city were included in the study. From the total of 179 nurses, 167 were participated in the study, 12 nurses were not found in the hospital during the data collection period. The total amount of questionnaires administered was 167 of which 162 completed questionnaires were received, thus a response rate of 97% was achieved

4.9. Sampling techniques

The sample selection of this study was a non-probability convienience sampling method. There are 6 federal governmental hospitals in A. A, Amanuel hospital was excluded from this study because it gives special service and the rest 5 hospitals were included in this study. Yekatit 12 hospital were used as a pilot study area by simple lottery method to take 5% of participants and the necessary corrections were made to some of the questions of the questionnaires that are not clear to participants.

4.10. Study Variables

4.10.1. Dependent variables

- Knowledge of nurses on alarm fatigue and practice towards alarms.

4.10.2. Independent variables

Sociodemographic factors

- Age
- Sex

- Level of education
- Work experience in the unit

Environment of care

- Availability of alarm cheek list (guideline)
- Education/Training
- Challenges in practice environment
  - -Noise competition
  - - Frequent false alarms
  - -Inadequate staff
- Strategies for improvement

4.11. Data collection procedure

The questioner for data collection was adapted from the Health Technology Foundation 2011 Clinical Alarms Survey and from different up-to-date literatures (18,22). The HFT survey has formerly been used to survey healthcare professionals generally throughout the US in 2005–2006, 2011, and 2016 and also in quite a lot of other studies to evaluate nurses' awareness of alarms. This questioner consists of four main sections. Demographic information, knowledge questions assessing nurses' familiarity with the term alarm fatigue, general statements about nurses recognition of clinical alarms and asks respondents to rate their level of agreement with the statements, and a list of eight questions assessing practice towards alarms are used in this study**.**

4.12. Data Quality Control

In addition to the training given to the data collectors, the questionnaires were pre-tested 4 days before the actual data collection days on 5% nurses who were not selected for the study.

As a result of the pretest necessary corrections was made to some of the questions of the questionnaires. Moreover, during data collection supervisors were checking in the study area, how the data collector is doing his/her task. The principal investigator also closely supervised the activity on a daily basis.

At the end of each data collection day the principal investigator was also checking the completeness of filling questionnaires and whether recorded information makes sense to ensure the quality of data

collected. Besides this, the principal investigator was carefully entering and thoroughly cleaned the data before the commencement of the analysis.

4.13. Data analysis

All questionnaires were checked for completeness of responses/ticks. Data were entered into epi manager data client entry version 4.4.2 win 64 then processed and analyzed using SPSS version 25 for windows statistical program for analysis. Frequency tables and charts were used to present the data. Binary logistic regression was used to estimate the crude odds ratio of all independent variables on knowledge of alarm fatigue and practice towards alarms with p-value of <0.25. And Multiple logistic regression was also be used to estimate the adjusted odds ratio of knowledge and practice to control confounders and predict the final predictor at 95% confidence interval and 0.05 level of significance.

4.14. Data management and methodology

The data consists of self administered questioners taken by the researcher. Researcher transferred questioners to a personal computer to save the backup. The trustworthiness of the findings was assured through member checking, peer debriefing, investigator triangulation before starting the actual rapport with relevant people for the study. Member checking was used to test data interpretation at the end of each person questioners'.

Peer debriefing was used during data analysis and interpretation to obtain trustworthy findings by ensuring that the findings are confirmable by other peers. Report of the study findings was presented to academic staff members of the study hospitals and the relevant peoples to receive their comments to improve its quality.

4.15. Ethical considerations

Ethical approval for the study was obtained from the Addis Ababa University emergency medicine and critical care in the nursing department.

A support letter was taken from the emergency department to the study hospitals for permission to conduct the study. From these hospitals Participants was informed about the voluntary nature of the study and rapport was built before conducting the data collection .Privacy of participants during the data collection was assured by conducting in comfortable private place and by helping their workload other

than alarm management during the data collection time. Participants were also be assured that all their personal information are protected from public and secured by the researcher.

4.16. Dissemination of findings

Main findings, conclusion and recommendations of the study will be presented and reported to responsible bodies. It will be disseminated to AAU Emergency medicine and critical care department, Hospital administrations.

4.17. Operational Definitions

Knowledge: This refers to acquired education or experience, and the theoretical or practical understanding of alarm fatigue. The items in this category, yes or no questions will intend to assess familiarity, causes and prevention of alarm fatigue. Based on this research the percentage scores will be graded as poor, and good to determine the knowledge level. Grading will be classified according to the mean score of the study result.

Practice: This describes the nurses' methods of alarm management. The items in this category, the Likert scale will intend to determine the frequency of performing certain interventions to prevent complications of care. The response categories will be coded as 1 to 4, for questions 1,2,3,7 and 8 the grading of the responses are: Never–1, Sometimes- 2, Often–3 and Always- 4. And for questions 4, 5 and 6 the grading are: Never–4, Sometimes- 3, Often–2 and Always-1.

Alarms: An alarm is an audible sign on medical patient monitoring instruments anticipated to alert the nurses or other health care workers, when there is a patient or device problem. Medical equipment used in an ICU that have alarms are cardiac monitors, ventilators, infusion pumps, oxygen saturation devices etc**.**

Alarm limits: In this study alarm limit refers to the minimum and maximum limits per parameter to be set according to a patient's baseline parameters so that when the patient parameters move outside of these limits an alarm is sounded and the ICU nurses can be alerted to changes in a patient's condition.

Critical care nurses: nurses who are currently working in ICU.

False/Nuisance alarms: A non-actionable alarm due to an artifact resulted in false data which are transmitted and displayed on the patient monitoring devices (19).

Alarm fatigue: Alarm fatigue is the failure to recognize and act in response to true alarms that need bedside clinical intervention due to the high amount of alarms (19).

5. RESULT

This section gives an account of the study findings on nurse's knowledge of alarm fatigue, practice towards alarms and associated factors in adult ICUs of federal governmental hospitals in Addis Ababa. From the total of 179 nurses, 167 were participated in the study, 12 nurses were not found in the hospital during the data collection period. The total amount of questionnaires administered was 167 of which 162 completed questionnaires were received, thus a non response rate was 3%.

5.1. Socio-demographic characteristics of respondents

The following section describes the gender, age, work experience, educational background and in service training of the participants, in order to determine whether some of these characteristics might influence the respondent's knowledge of alarm fatigue and their practice towards alarms. Out of 162 respondents, 95 (58.6%) were females. The majority of the study participants 82 (50.6%) had 2-5 years work experience as a nurse and the mean work experience of the participants was 2.5 years. Regarding to in service training on alarm management, only 83(51.2%) of participants responded that they get adequate in service training. Out of 162 nurses 152 (93.8%) were BSc holders and there were only 5 (3.1%) MSC holder nurses the rest were diploma holder nurses. (Table1)

Table 1. Sociodemographic characteristics of nurses working in federal governmental hospitals in Addis Ababa, Ethiopia, Jan 2020.

VARIABLES	RESPONSE	FREQUENCY(N=162)	PERCENTAGE (%)
SEX	Male	67	41.4
	Female	95	58.6
In service training on alarm management	Yes	83	51.2
	No	79	48.8
Age (Mean=age 30yrs)	Bellow 25 years	16	9.9
	25-35 yrs	119	73.5
	36-44 yrs	26	16.0
	45-55 yrs	1	0.6
Educational status	Diploma	5	3.1
	Degree	152	93.8
	Masters	5	3.1
Work experience as a nurse	Bellow two years	18	11.1
	2-5yrs	82	50.6
	5-10 yrs	49	30.2
	Above 10 yrs	13	8.0
Work experience in ICU	Bellow two years	45	27.8
	2-5yrs	76	46.9
	5-10 yrs	36	22.2
	Above 10 yrs	5	3.1

5.2. Knowledge of study participants on alarm fatigue.

5.2.1. Specific Knowledge of study participants on alarm fatigue.

Among 162 nurses About 102(63%) are not familiar with the term alarm fatigue. Majority 106(65.4%) of respondent said they don't know what causes alarm fatigue and larger part of participants 107(66%) don't know how to prevent alarm fatigue. Among 162 nurses 154(95.1%) of respondents correctly

respond an alarm sound or visual displays should differentiate the priority of an alarm. In addition 149(92%) of respondents correctly respond an alarm sounds and /or visual displays should be distinct based on the parameter (e.g. Heart rate) or source (device type). The majority of nurses 140(86.4%) answered correctly that Non actionable/nuisance alarms disrupt patient care. Among 162 nurses, 145(89.5%) correctly respond Non-actionable/Nuisance alarms reduce trust in alarms and cause caregivers to turn the alarms off at times other than setup or procedural events.

5.2.2. General Knowledge of the study participants' on alarm fatigue

The result revealed that 107(66 %) of respondents scored above the mean and its considered as having a good knowledge of alarm fatigue. And 55 (34%) of study participants scored bellow the mean and they are considered as having a poor knowledge on alarm fatigue.

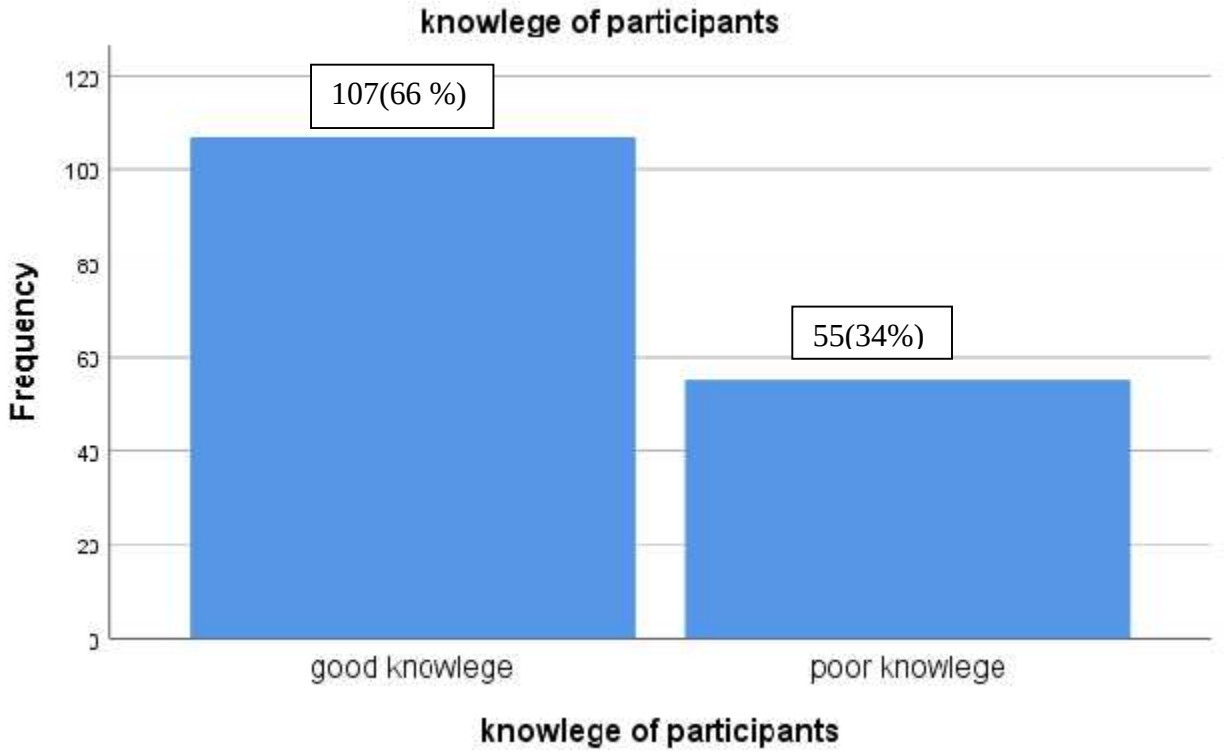

Figure 2. Participant responses for each Knowledge question on alarm fatigue in federal governmental hospitals in Addis Ababa, Ethiopia, Jan 2020.

Table 2. Participant responses for each Knowledge question on alarm fatigue in federal governmental Hospital, Addis Ababa, Ethiopia, Jan, 2020.

S.N	Statements	Yes	%	No	%
1	Are you familiar with the term alarm fatigue?	60	37	102	63
2	Do you know what causes alarm fatigue?	56	34.6	106	65.4
3	Do you know how to prevent alarm fatigue?	55	34	107	66
4	An alarm sounds and/or visual displays should differentiate the priority of the alarm (e.g. Heart rate) or source (device type)	154	95.1	8	4.9
5	An alarm sounds and/or visual displays should be distinct based on the parameter	149	92	13	8
6	Non actionable/nuisance alarms disrupt patient care?	140	86.4	22	13.6
7	Non-actionable/Nuisance alarms reduce trust in alarms and cause caregivers to turn the alarms off at times other than setup or procedural events.	145	89.5	17	10.5

5.3. practices of nurses on management of clinical alarms

5.3.1. Specific practice of participants towards alarm management

From 162 respondents, 54 (33.3%) responded that they always ensure proper skin preparation of patients before placing the electrodes. And only 64 (39.5%) of the participants Always assess the cause of the alarm beep when it alarms. From all study participants only 31 (19.1%) Never ignore alarms every time they beep. And 56 (34.6%) Always check and assess the patient's condition every time the alarm beeps and 59 (36.4%) Always reset the alarm settings of the machine each time they admit a patient.

5.3.2. General practice of participants towards alarm management

This describes the nurses' methods of alarm management, and Likert scale questions were used to assess their practice level, which was intended to determine the frequency of performing certain interventions to prevent complications of care.

The response categories will be coded as 1 to 4, for questions 1,2,3,7 and 8 the grading of the responses are: Never–1, Sometimes- 2, Often–3 and Always- 4. And for questions 4, 5 and 6 the gradings are: Never–4, Sometimes- 3, Often–2 and Always-1. For this Likert scale questions in order to discuss these in a more meaningful way, the categories never and sometimes (1 and 2) was grouped together while Almost and Always (3 and 4) was grouped together. A score of above the mean was interpreted as good practice and score of bellow the mean was interpreted as poor practice.

In this study the result revealed that 93 (57.4 %) of respondents had good practice on alarm management. And 68(42.6%) of participants had poor practice on alarm management.

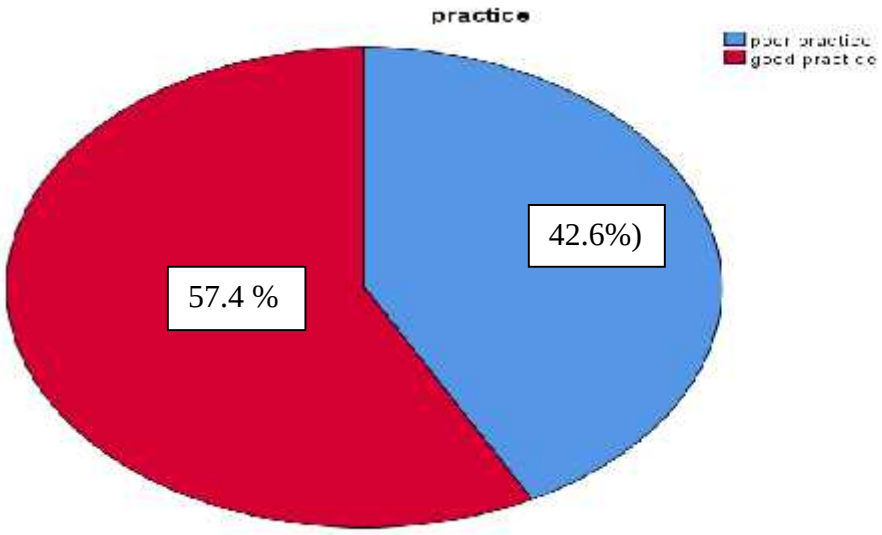

Figure 3. level of practice of participants towards clinical alarms, in federal governmental Hospitals Addis Ababa, Ethiopia, Jan, 2020.

Table 3. participant responses for each practice question on clinical alarms, in federal governmental hospitals Addis Ababa, Ethiopia, Jun, 2020.

Variables	Never	Some time	Often	Always
I ensure proper skin preparation of patients before placing the electrodes	3(1.9%)	27(16.7%)	78(48.1%)	54(33.3%
I change the patients' electrodes daily	7(4.3%)	19(11.7%)	73(45.1%)	63(38.9%)
I assess the cause of the alarm beep when it alarms	2(1.2%)	19(11.7%)	77(47.5%)	64(39.5%)
I disable the alarms every time they beep	18(11.1%)	105(64.8%)	29(17.9%)	9(5.6%)
I reset the alarm limits every time alarms beep	18(11.1%)	108(66.7%)	26(16%)	9(5.6%)
I ignore alarms every time they beep	31(19.1%)	109(67.3%)	14(8.6%)	7(4.3%)
Check and assess the patient's condition every time the alarm beep	2(1.2%)	33(20.4%)	71(43.8%)	56(34.6%)
Reset alarm settings of the machines each time I admit a new patient	8(4.9%)	21(13%)	74(45.7%)	59(36.4%)

For questions 1,2,3,7 and 8 the grading of the responses is as follows: Never–1, Sometimes- 2, Often–3 and Always- 4For questions 4, 5, and 6, Never–4, Sometimes- 3, Often–2 and Always- 1

5.4. Questions on factors of clinical alarms that can affect the knowledge of alarm fatigue and practice of nurses towards alarm management

For this Likert scale questions in order to discuss these in a more meaningful way, the categories strongly agree and agree (1 and 2) were grouped together while disagree and strongly disagree (3 and 4) were also grouped together**.** The majority of the participants 130(80.2%) agreed that properly setting alarm parameters and alerts is overly complex in existing devices and the result shows that almost half of nurses who work in ICUs of federal governmental hospitals hadn't got any on job training concerning alarm management 83(51.2%).The majority of participants 139(85.8%) agreed that frequent false alarms occur frequently. 61(37.6%) of participants agreed that When a number of devices with alarms are used with a patient, it can be confusing to determine which device is in alarm. The majority of the participants 126(77.7%) didn't agree with the question Environmental background noise has interfered with alarm recognition. From 162 nurses 113 (69.7%) didn't agree that There is a requirement in their institution to document that the alarms are set and appropriate for each patient. And also 124 (76.5%) of participants said that Clinical policies and procedures regarding the alarm management are not effectively used in their institution.

Table 4. participant responses on factors of clinical alarms in federal governmental hospitalss, Addis Ababa, Ethiopia, Jun 2020.

Variables	Strongly agree	Agree	Disagree	Strongly disagree
Properly setting alarm parameters and alerts is overly complex in existing devices	48(29.6%)	82(50.6%)	24(14.8%)	8(4.9%)
Frequent false alarms occur frequently	41(25.3%)	98(60.5%)	20(12.3%)	3(1.9%)
There is adequate staff to respond to clinical alarms.	22(13.6%)	50(30.9%)	76(46.9%)	14(8.6%)
When a number of devices with alarms are used with a patient, it can be confusing to determine which device is in alarm	7(4.3%)	54(33.3%)	77(47.5%)	24(14.8%)
Environmental background noise has interfered	9(5.6%)	27(16.7%)	107(66%)	19(11.7%)

with alarm recognition.				
There is a requirement in my institution to document that the alarms are set and appropriate for each patient	12(7.4%)	37(22.8%)	71(43.8%)	42(25.9%)
Clinical policies and procedures regarding the alarm management are effectively used in my facility.	12(7.4%)	26(16%)	94(58%)	30(18.5%)

No	Variables	Yes	No
1	Has your hospital developed clinical alarm improvement initiatives over the past two years?	4(2.5%)	158(97.5%)
2	Is there a check list in your institution for alarm setting?	1(0.6%)	161(99.4%)

5.5. Factors associated with the level of knowledge of alarm fatigue

In the Bivariate logistic regression analysis the factors found to be significantly associated with knowledge of nurses with p-value <0.25 were: work experience, staff shortage and clinical alarm improvement initiatives. From the variables associated with knowledge of nurses in the Bivariate logistic regression; clinical alarm improvement was statistically significant to predict knowledge of nurses in the multivariable logistic regression with p-value of< 0.05. Those nurses who responded that there were no clinical alarm improvement initiatives in their institution are 3 times to have poor knowledge than those who said there is clinical alarm improvement initiatives. (AOR= 3.25, 95% CI (1.271, 8.348)).

Table 5. Bivariate and multivariate analysis of factors associated with knowledge of alarm fatigue among nurses working in federal governmental hospitals, Addis Ababa, Esthiopia 2020.

Variables	Category	Knowledge		P value (<0.25)	COR(95%C.I)	P value (<0.05)	AOR(95%C.I)
		Good	Poor		(Lower, upper)		(Lower, upper)
Sex:	Male	43	24	0.817	0.902(0.375,2.166)		
	Female	64	31				
Age	Bellow 25 years	10	6	1			
	25-35 years	79	40	1			
	36-44 years	18	8	1			
	45-55 years	0	1				
Educational status	Diploma	5	0	0.999			
	Degree	98	54	0.692	1.670(0.133,21.030)		
	MSC	4	1				
Service training	Yes	56	27	0.377	1.402(0.663,2.966)		
	No	51	28				
Work experience as a nurse	Bellow two years	12	6	0.455	0.330(0.018,6.025)		
	2-5 years	55	27	**0.217**	0.263(0.032,2.194)	0.141	0.409(0.124,1.344)
	5-10 years	34	15	**0.135**	0.259(0.044,1.521)	.134	0.384(0.110,1.343)
	Above 10 years	6	7				

Work experience in ICU	Bellow two years	34	11	0.463	0.338(0.019,6.113)		
	2-5 years	46	30	0.896	0.836(0.057,12.236)		
	5-10 years	25	11	0.592	0.512(0.045,5.893)		
	Above 10years	2	3				
Availability of check list	Yes	0	1	1			
	No	107	54				
Noise competition	Yes	24	12	0.439	1.526(0.523,4.452)		
	No	83	43				
Frequent false alarms	Yes	88	51	0.434	0.608(0.175,2.115)		
	No	19	4				
Adequate staff	Yes	46	26	0.193	0.514(0.189,1.399)	0.597	0.833(0.424,1.638)
	No	61	29				
Clinical improvement	Yes	0	4				
	No	107	51	0.023	0.329(0.126,0.859)	**0.014**	3.257(1.271,8.348)

5.6. Factors associated with level of practice of nurses towards alarms

In the bivariate logistic regression analysis the factors found to be statistically associated with the practice of nurses with p-value <0.25 were: work experience, frequent false alarms, service training and sex. From the variables associated with the practice of nurses in the Bivariate logistic regression; service training and sex was statistically significant to predict practice of nurses in the multivariable logistic regression with p-value of< 0.05. Those nurses who don't have in service training on alarm management are 2 times, having a poor practice than those who took in service training. (AOR=1.974, 95% CI (1.296, 4.024)). And Males are less likely to have poor practice by 72% than females.

Table 6. Bivariate and multivariate analysis of factors associated with the practice on alarm management among nurses working in federal governmental hospitals Addis Ababa, Ethiopia 2020.

Variables	Category	Practice		P value(<0.25)	COR(95%C.I) (lower,upper)	P value (<0.05)	AOR(95%C.I) (lower,upper)
		Good	Poor				
sex:	Male	26	40	**0.009**	3.168(1.330,7.548)	0.002	0.274(0.122,0.615)
	Female	67	28				
Age	bellow 25 years	7	9	1.00			
	25-35 years	73	46	1.00			
	36-44 years	12	13	1.00			
	45-55 years	1	0				
Educational status	Diploma	1	4	0.386	0.262(0.013,5.420)		
	Degree	89	62	0.794	0.754(0.090,6.292)		
	MSC	3	2				
Service training	Yes	54	28				
	No	39	40	**0.035**	0.433(0.198,0.944)	0.041	1.974(1.296,4.024)
work experience as a nurse	bellow 2 years	5	12	0.664	0.490(0.020,12.239)		
	2-5 years	51	31	**0.075**	7.066(0..822,60.760)	0.075	7.066(0.822,60.76)

	5-10 years	29	20	0.428	2.065(0.343,12.413)		
	above 10 years	8	5				
work experience in ICU	bellow 2 years	20	24	0.467	0.308(0.013,7.386)		
	2-5 years	44	32	0.295	0.198(0.010,4.117)		
	5-10 years	25	11	0.721	0.599(0.036,9.937)		
	above 10 years	4	1				
Availability of cheek list	Yes	1	0	1.000			
	No	92	68				
Noise competition	Yes	17	19	0.783	0.863(0.302,2.467)		
	No	76	49				
Frequent false alarms	Yes	84	54	**0.122**	0.411(0.133,1.269)	**0.347**	3.548(0.254,49.540)
	No	9	14				
Adequate staff	Yes	31	40	**0.144**	2.071(0.780,5.494)	**0.035**	5.476(1.128,26.582)
	No	62	28				
Clinical improvement	Yes	71	48	0.282	0.618(0.258,1.484)		
	No	22	20				

6. DISCUSSION

This study is trying to find out the level of nurses knowledge of alarm fatigue and practice towards alarms and associated factors for alarm management. Because nurses are primarily responsible for the recognition and management of clinical alarms, knowledge surrounding the concept of alarms is central for the successful management of clinical alarms. The nurse who took part in this study were experienced, with the majority having more than five years work experience in addition, the majority of nurses were BSC qualification. We found, however, that majority 63% of nurses were not familiar with alarm fatigue, a similar study conducted in Ireland, Most nurses (88%, n = 146) stated they were familiar with the term alarm fatigue. This difference in knowledge of alarm fatigue can be due to our training may not include alarm fatigue.

Majority of nurses 130(80.2%) agreed with the statement that properly setting alarm parameters and alerts is overly complex in existing devices. International literature suggests that practitioners are often unaware of the intricacies of monitors and tend to underestimate their knowledge deficits. Even experienced nurses need ongoing education regarding medical device (22).

The participants' response for the question alarms should indicate alarm priorities, are similar to those reported by ICU nurses isolated from HTF surveys conducted in US and study in South Korea. The majority of ICU nurses from these aforementioned studies responded that alarms should indicate alarm priority (23).

Majority of the participants 145 (89.5%) said Non-actionable/Nuisance alarms reduce trust in alarms and couse caregivers to turn the alarms off at times other than setup or procedural events. Similar study conducted in Ireland 81% agreed that non actionable alarms reduce trust in alarms and cause caregivers to turn the alarms off at times other than setup or procedural events (22). This result further suggests that on the job training on alarm fatigue and its prevention is so important, so that it can increase nurse's response to alarms.

In this study, 68(42%) of participants had poor practice and 93(57.4)% have good practice towards alarm management, but on a study done in Kenya 88% of participants have good practice towards alarms this discrepancy may be due to lack of adequate training (8).

From 162 respondents, 54 (33.3%) responded that they Al-ways ensure proper skin preparation of patients before placing electrodes, 64 (39.5%) Always assess the cause of the alarm beep when it alarms, and 59 (36.4%) Always reset the alarm settings of the machine each time they admit a patient, generally the respondents score below 50% in this questions. And this result contradicted with the study done in Kenya, Nairobi where most of the participants score more than 75%. In the view of the fact that alarm practice is important in the management of ICU patients, it was anticipated that the scores of practice would be expected to be high. From these results it was obvious that there were various gaps in the management of clinical alarms and staffs in the ICU need to be sensitized to clinical alarms.

The majority 161 (99.4%) of study participants responded that there is no alarm check list for alarm setting, this result contradicted with the research done in Kenyatta national hospital where only 5.5% of respondents reported that no alarm check lists have been provided in the unit. This difference may show that adequate attention may not given to alarm management. In this study only 49(30.2%) of participants agreed that there is a requirement in their institution to document that alarms are set properly for each patient, This is also contradicted with the study done in Ireland that majority (82%) of the nurses agreed that there is a requirement in their institution to document that alarms are set properly for each patient (22).

There was no association' between nurses' knowledge of how to prevent alarm fatigue and sex, age, Years of Experience, Education Level and work Experience. Only those nurses who responded that there were no clinical alarm improvement initiatives in their institution have 3 times to have poor knowledge than those who said yes. (AOR= 3.25, 95% CI (1.271, 8.348)).

In this study only service training and sex had significant association with the practice of nurses. Those nurses who don't have in service training on alarm management are 2 times to have a poor practice than those who took in service training. (AOR=1.974, 95% CI (1.296, 4.024)).

Males are less likely to have poor practice by 72% than females. (AOR =0.274,95% CI(0.122,0.615).These statistical significant difference between males and females agrees with the results of study done in Kenya that gender and their response to the action of assessing the cause of the alarm beep are strongly associated (p= 0.006) (18).

7. CONCLUSION

The full extent of alarm fatigue has not been properly considered in Ethiopia; in this study there is a gap regarding to nurses knowledge of alarm fatigue. Alarm fatigue has profound consequences for patient safety.(26) Future research should focus on identifying levels of alarm fatigue among critical care nurses and evaluating education and training approaches to manage alarm fatigue. In this study majority of Critical Care Nurses are not familiar with Alarm Fatigue, but the alarm fatigue phenomenon has serious consequences for patient safety with the worst case scenario resulting in death or serious patient harm.

In this study the result revealed that there is a gap regarding proper alarm management, but still the majority of them can manage to respond to alarms correctly. Clinical alarm management in ICU is a vital task in the care of a patient to guarantee patient safety. It is a part that is not well researched and does need additional knowledge. Understanding of the concepts of clinical alarm management and what factors result in poor management of alarms would be important. Alarms on medical instruments do not substitute the nurses skill to handle their patient but is an aid in recognizing possible changes in patient situation as a means of early notice or warning. The wrong use of this medical instrument alarm can be harmful to the patient care. So, continuous in service training, assessment of alarms in ICU and establishment of alarm check list and protocols are essential.

8: LIMITATION OF THE STUDY

8.1 Strength of the study

The strength of this study was the inclusion of nurses from across all federal governmental hospitals in Addis Ababa city who works in adult ICU departments. From 167 participants, 162 of the participants accepted to participate in the study making a response rate of 97%. Also, there was nothing that was done in Ethiopia published about alarm management and low attention was given to this area but this study may give some insight about clinical alarm management.

8.2 Limitation of the study

A small sample size may affect estimations of the parameters and power of the test. This cross sectional study by its nature cannot establish cause and effect relationship. However, findings from this study can show as a current knowledge and practice of alarm management within the study area. Only a self administered questionnaire was used as a tool due to time shortage and it was better to add a checklist for increasing the quality of the data.

9. RECOMMENDATION

9.3.1. For FMOH

Based on the findings of this study, periodic on-job and pre-service training regarding alarm management should be provided to all types of health care givers particularly nurses. Regular supportive supervision by experts is also needed to motivate, refresh to all nurses and to properly manage clinical alarms.

9.3.2. For Education

Alarm management should be included in education training.

9.3.3. For hospital nursing managerial

It is recommended that the hospital nursing management take a leading role in developing guidelines, and have a policy in place for in-service training to orient nurses in this practice.

9.3.4. For further Research

To the researcher's knowledge this study is the first to be done in the country and serves as a baseline study. Further research to include more settings would be valuable. There are gaps identified for further research to strengthen findings. Recommended to implement this study on other hospitals in Ethiopia outside Addis Ababa city.

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ANNEXES

Annex I.: English version information sheet

Title: Assessment of critical care nurses knowledge of Alarm Fatigue, Practice towards Alarms and associated factors among nurses working in adult ICUs of federal government hospitals in Addis Ababa city, Ethiopia.

Principal investigator: Hana Kebede Mekonnen

Name of the institution: Department of Emergency and critical care, School of Emergency medicine, College of Health Sciences, Addis Ababa University.

Introduction of investigator

Greetings! My name is Hana Kebede. I am a master's student in Addis Ababa University, school of Emergency medicine. Currently I am doing a research on Assessment of critical care nurses knowledge of Alarm Fatigue, Practice towards Alarms and associated factors among nurses working at the adult ICUs of federal government hospitals in Addis Ababa city, Ethiopia.

This information sheet is prepared to enable ICU nurses to understand the purpose of the study consciously, ask for further explanation and participate voluntarily. The study involves self-Administer questioner, for nurses y who works in Adult ICU.

Purpose of study: The purpose of this research is to assess critical care nurses knowledge of Alarm Fatigue, Practices towards Alarms and associated factors among nurses working in the adult ICUs of federal government hospitals in Addis Ababa city, Ethiopia. If you agree to take part in this study, you will answer the question for about 10-15 minutes.

Study procedure: Volunteer participants in this study will be given a questionnaire with a few questions regarding their knowledge of alarm fatigue, practice towards alarms and associated factors. In addition, you will be asked to sign on the consent form for your voluntariness. The findings of this study will be shared through the presentation, but your name will not be mentioned in the report.

Possible risks/ discomforts: The study is not associated with any harm. However you might feel uncomfortable in answering the questions when you take your time on it associated with work overload. In case you experience any severe discomfort, please let me know and you will stop the questioner and will be continued if you felt like.

Possible benefits: At the moment, this study will not be of direct benefit to you, but I hope that the findings from this study may help the policy makers to make decisions in designing appropriate programs, strategies and policies that will have advantage indirectly to you and directly to your patients admitted to ICUs.

Data confidentiality: All collected data will be handled so as to protect your confidentiality. No names will be mentioned and the information will be coded. I would like to assure you that all information about you will be protected from the public, and your personal identity will not be mentioned in any report of this study.

All details of your information will be stored and secured in a pass word protected files in the researchers' personal computer.

Voluntary participation and right to leave the research

Participation in this study is voluntary and you have the right to decide whether to participate or not. You also have the right not to participate in this study or withdraw from the study if you wish without any worry.

Payment: There is no payment for study participants since; the research is to be conducted while the participants are attending care in the ICU wards.

Contact for additional information

If you need more clarification about this study, you can call or contact the researcher;

Hana Kebede *Mobile: 0913180422,*

Email: hanamekonnen123@gmail.com

Annex II: Written consent form

The above information sheet describing the study purpose and procedure, benefits and risks, confidentiality issues, voluntary participation and rights to withdraw for the research title "Assessment of knowledge of Alarm Fatigue, Practices towards Alarms and associated factors among nurses working in adult ICUs of federal government hospitals in Addis Ababa city, Ethiopia". Has been read and explained to me. I have been given an opportunity to ask any question for more explanation about the research. I agree to participate as a volunteer.

_____ _____

Date, Name and signature of volunteer

I certify that purpose of the study, the potential benefits and possible risks associated with participating in this study was explained to the above individual.

_____ _____

Date, Name and signature of researcher

Annex III: Semi structured questioners

THANK YOU FOR TAKING YOUR TIME TO HELP WITH THIS QUESTIONNAIRE

SECTION ONE: SOCIO-DEMOGRAPHIC DETAILS (Please tick where applicable).

1.	Sex	A) Male	
		B) Female	

2. Age…….
3. Educational status?

A. Diploma	
B. Degree	
C. MSC(Masters degree)	
D. If other please specify	……

4. Have you had any in service training on alarm management?

A. Yes

B. No

5. How long have you been working as a nurse?

Bellow two years	
2-5 years	
5-10years	
Above 10 years	

6. How long have you been working in ICU?

Bellow two years	
2-5 years	
5-10years	

Above 10 years	

SECTION TWO: QUESTIONS ON KNOWLEDGE OF ALARM FATIGUE AND RECOGNITION OF CLINICAL ALARMS

No	Questions	Yes	No
1	Are you familiar with the term alarm fatigue?		
2	Do you know what causes Alarm Fatigue?		
3	Do you know how to prevent alarm fatigue?		
4	An alarm sounds and/or visual displays should differentiate the priority of the alarm.		
5	An alarm sounds and/or visual displays should be distinct based on the parameter (e.g. Heart rate) or source (device type)		
6	Non-actionable/Nuisance alarms disrupt patient care		
7	Non-actionable/Nuisance alarms reduce trust in alarms and cause caregivers to turn the alarms off at times other than setup or procedural events		

No	Questions	Strongly Agree	Agree	Disagree	Strongly Disagree
1	Properly setting alarm parameters and alerts is overly complex in existing devices				

2	Frequent false alarms occur frequently				
3	When a number of devices with alarms are used with a patient, it can be confusing to determine which device is in alarm				
4	Environmental background noise has interfered with alarm recognition.				
5	There are adequate staffs to respond to clinical alarms				
6	There is a requirement in my institution to document that the alarms are set and appropriate for each patient				
7	Clinical policies and procedures regarding the alarm management are effectively used in my facility.				

No	**Questions**	**Yes**	**No**
1	Has your hospital developed clinical alarm improvement initiatives over the past two years?		
2	Is there a check list in your institution for alarm setting?		

SECTION THREE: QUESTIONS TO ASSESS NURSES PRACTICE TOWARDS ALARMS

No	Questions	Never	Some time	Often	Always
1	I ensure proper skin preparation of patients before placing the electrodes				
2	I change the patients' electrodes daily				
3	I assess the cause of the alarm beep when it alarms				
4	I disable the alarms every time they beep				
5	I reset the alarm limits every time alarms beep				
6	I ignore alarms every time they beep				
7	Check and assess the patient's condition every time the alarm beep				
8	Reset alarm settings of the machines each time I admit a new patient				

Annex IV: Assurance of Principal Investigator

The undersigned agrees to accept responsibility for the scientific, ethical and technical conduct of the research project and for provision of required progress reports as Per terms and conditions of the Research Publications Office in effect at the time of Grant is forwarded as the result of this application.

Name of the student: Hana Kebede

Date._____ Signature _____

Approval of the primary Advisor

Name of the primary advisor: Mr. Asmamaw Abebe

Date._____ Signature _____