2022

Education for LTACH Nurses on Clinical Monitoring Systems

Deneen Stokes
Walden University

Walden University

College of Nursing

This is to certify that the doctoral study by

Deneen Stokes

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Barbara Niedz, Committee Chairperson, Nursing Faculty
Dr. Francisca Farrar, Committee Member, Nursing Faculty
Dr. Jonas Nguh, University Reviewer, Nursing Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2022

Abstract

Education for LTACH Nurses on Clinical Monitoring Systems

by

Deneen Stokes

MSN, Walden University, 2016

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

Walden University

February 2022

Abstract

Alarm fatigue is a patient safety issue. The gap identified in practice is that nurses did not know how to navigate the monitoring system properly such that improper use of the alarm system was the result, which compromised patient safety. The goal of this project aimed to fill the gap in knowledge and skill among the staff and improve the confidence level among nurses by providing an educational program. The practice-focused question focused on whether knowledge, skills, and confidence would increase among nurses after receiving education on the clinical monitoring system. The model to facilitate organizing and analyzing this project was Rosswurm and Larrabee's model for evidence-based practice. The sources of evidence were data from pretest and posttest surveys completed by seventeen nursing staff after reviewing the self-guided education. The paired *t*-tests were used to determine if a statistically significant improvement concluded with return demonstration competency. The results showed a statistically significant increase in confidence for navigating the clinical monitoring systems (p=.012), The competency demonstrated that the staff knew how to navigate the monitoring system with small amount of coaching. This project contributes to positive social change by increasing nurses' confidence in addressing alarms safely and increasing patient and family satisfaction, which would lead to better scores to support the organization's quality metrics and thereby impact service reimbursements.

Education for LTACH Nurses on Clinical Monitoring Systems

by

Deneen Stokes

MSN, Walden University, 2016

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

Walden University

February 2022

Dedication

This is dedicated to my parents, who I told I wanted to be a doctor when I was in the 11th grade. I just didn't know then that it would be in nursing.

Acknowledgments

I would like to thank and acknowledge the people who have helped me reach this point in my academic career. Mrs. Pugh, from nursing school, who told me to stop thinking like an accountant and start thinking like a nurse. My patients over the years, who showed me there is a lesson in every interaction. My formal and informal mentors who reminded me that if it was easy everyone would do it and they understood the process. My family who always encouraged me near and far. My husband who is my biggest supporter and personal chef, making sure I had delicious food to eat. My cousin, Stephanie, who made sure I took care of my mental health. My grandmother, Grannie Goose, who was always my biggest cheerleader. Dr. Niedz, who pushed me when she knew I could do more and pulled me when I needed help. Lastly, I thank God who showed me that He gives second chances if you trust Him and trust His guidance.

Table of Contents

List of Tables

List of Figures

Section 1: Nature of the Project

Introduction

Alarm fatigue is a prominent patient safety issue. The Joint Commission (TJC) published the National Patient Safety Goals (TJC, 2020) and update them regularly. One goal is to reduce patient harm associated with the clinical alarm system by improving its safety. Alarm fatigue is the phenomenon that occurs when a staff member, often the nurse, is desensitized to alarm signals due to frequent exposure to the alarm signals, which can lead to a delayed or missed response for a patient (Torabizadeh et al., 2017). The primary intervention to reduce alarm fatigue is individualizing the alarms. This practice by the nurse had clarified which alarms triggered by the patient require immediate attention. Reducing alarm fatigue was not the only opportunity to improve patient safety associated with clinical alarm systems. The nurse had to individualize the alarms and address the alarm's cause, whether it is the patient's actual reading or a false reading caused by the system (Cosper et al., 2017).

The long-term acute care hospital (LTACH) that served as the doctoral of nursing practice (DNP) project setting made addressing all clinical alarms a priority, but nurses had reported not knowing how to navigate all aspects of the system. The education on the clinical alarm system was a part of every nurse’s orientation. Yet, it was the only opportunity for training on the clinical alarm system for the duration of their tenure on the unit. Since alarm management education only happens during orientation, there were opportunities that the nurse may forget or not use a feature on the system that will aid in monitoring a patient. This project impacts social change by improving the LTACH

nursing staff members' knowledge, skills, and confidence in managing clinical monitoring to advocate for their patients' care and outcomes accurately and confidently. This project also impacts social change by expanding on team building to improve patient outcomes by strengthening the unit's skill and reducing the risk of harm related to alarm fatigue. Desensitization and alarm fatigue can have serious consequences when a patient's genuine instability is not recognized or addressed despite the alarm (Baker & Rodger, 2020). The project provided a reassuring experience for the patient and their families. For example, one study showed that the reduction of false or nonactionable alarms increased patient satisfaction by improving the patient's overall perception of the quality of their hospital experience in that the staff spent more time providing direct patient care instead of responding to alarms (Whalen et al., 2014)

Problem Statement

Technology best serves the patient when used correctly (Phillips et al., 2020). This project aimed to fill the gap in knowledge and skill among the staff and improved the attitude and confidence level among LTACH nurses with additional education. The meaningful gap-in-practice involved the improper use of the clinical monitoring alarm system in the LTACH setting. Nurses may have heard the alarms but ignored them and may have tuned the alarms out, thereby failing to cancel and resolve the alarm signal. Additionally, they might have cancelled the alarm assuming that the alarm is false without resolving the problem or confirming the validity of the alarm. Improper use of the alarm system was the result and compromised patient safety. The gap identified in

practice was that nurses did not know how to navigate the monitoring system properly in the LTACH to reduce the frequency of nonactionable alarms.

One example demonstrating lack of knowledge and skill with a nurse occurred while she was trying to troubleshoot an alarm. The apnea alarm triggered the respiratory rate alarm of one patient. The manager asked the nurse whether the alarm was real. Her reply indicated that it had been alarming frequently, but the patient is on mechanical ventilation and the ventilator alarm had not triggered at all. The manager who has experience with the monitoring system demonstrated how to properly troubleshoot the system and revealed a respiratory rate detection line. After adjusting the detection line to the level of the patient's breaths, the system recognized the shallow breaths of the patient and no longer triggered an apnea alarm.

This educational project's practice-focused question was: Did knowledge, skills, and confidence in using the current clinical monitoring system increase among LTACH nurses after receiving education on the clinical monitoring system? This doctoral project held significance for the field of nursing practice by expanding opportunities to lead collaborative improvement efforts and enhance knowledge and leadership to improve nursing practice and patient outcomes (Institute of Medicine [IOM], 2010; American Association of Colleges for Nursing [AACN], 2006).

Leading collaborative improvement efforts was a recommendation emerging from a report by the IOM when discussing the future of nursing. This project addressed the knowledge gap inherent at the site and implicit in the IOM goal: assessing, designing, and evaluating practice environments to improve health outcomes, including maximizing use

of health or medical devices and health information technology (IOM, 2006). The additional significance to nursing practice was enhancing knowledge and leadership to improve nursing practice and patient outcomes as reenforced by the Essentials of Doctoral Education for Advanced Nursing Practice prepared by the AACN (2010). Part of the DNP curriculum is to augment the knowledge and leadership of the DNP student. This project addressed the AACN DNP essentials: to develop and evaluate delivery approaches, as well as ensuring accountability for the quality of patient safety for this patient population (AACN, 2010).

Local Practice Problem

The setting for this doctoral project was a LTACH. It was a 19-bed unit that provides around-the-clock physiological monitoring. The patients admitted to the LTACH were mostly received from an intensive care unit. They were too ill to go to other care levels or require other medical interventions like administering multiple intravenous medications and mechanical ventilator weaning. The LTACH admission criteria focused on stability, but patients were still critically ill.

The LTACH received patients in various stages of recovery and frequently from an intensive care unit. Clinical liaisons were on site nurses who review the initial criteria for admission to the LTACH from outside facilities in the surrounding area. The average length of stay at the LTACH was 35 days and any admission had a minimum length of stay of 25 days. The patients were categorized in one or more of the four criteria: ventilatory weaning, respiratory complex, wound care, and medically complex. Once the patient met one or more of the criteria, the clinical liaison reported the potential

admission to the unit medical team, led by the medical director for further consideration. The needs and outcomes were considered by the medical team and the patient was confirmed for admission, pending insurance authorization.

The nursing staff for the LTACH was comprised of registered nurses (RNs) and certified nursing assistants (CNAs). There were 20 full-time RNs, one part-time, five per diem RNs, and five agency nurses. Current hiring measures were in place to add two additional full-time RNs and reduce the RN agency staff to two. There were eight full-time CNAs, one part-time, and no per diem or agency CNAs. The LTACH patient to staff ratios were as follows: four to five patients per RN and eight to 10 patients per CNA. Additional RNs and CNAs that work on the unit were 'float' staff. The float staff were a separate department that work on the LTACH and the rehabilitation units. The float staff consisted of nine full time RNs, three per diem RNs, and 15 CNAs. The last nursing staff to discuss were the nursing clinical coordinators. The nursing clinical coordinators (NCC) were like house supervisors that handle administrative and clinical concerns 24 hours, 7 days a week. The nursing clinical coordinators were RNs with extensive experience on the LTACH or rehabilitation unit and were trained to response to all clinical emergencies. Their contribution is vital when the managers are not available.

The partners-in-health, respiratory therapists, have worked alongside the RNs and CNAs and were housed on the unit. The RNs were the primary staff that handle and respond to the clinical alarm system. The respiratory therapists had a smaller role in addressing clinical alarms. They monitored the respiratory rate and pulse oximetry level, along with the heart rate when giving a breathing treatment or during the ventilator

weaning process. The CNA's role regarding the clinical alarms was to alert the RN when vital sign values were outside of the patients' baseline triggering an alarm or if they heard an alarm to notify a nurse to evaluate the alarm's reason.

It was feasible to accomplish this project in the identified setting because it has the nursing staff and clinical monitoring system. The education on the clinical alarm system was part of every RN and CNA orientation, but it was the only opportunity for training on the clinical alarm system for the duration of their career on the unit. Experienced nurses and new-to practice nurses received education on the clinical monitoring system during orientation to the unit. However, there was no annual competency for the clinical monitoring system.

Purpose Statement

The meaningful gap-in-practice that this doctoral project addressed included improper troubleshooting of the clinical alarm system in the LTACH setting. The gap identified in practice was that the nurses did not know how to navigate the monitoring system properly on the LTACH due to the lack of continuing education on the clinical monitoring system. An example of the need for this doctoral project was for reviewing alarm event history. For example, in my review I identified that a patient had a critical event and the physician had wanted to check the telemetry strips leading up to the event. However, the covering nurse and the charge nurse were not familiar with navigating the monitoring system to review the history. The nurse educator assisted the physician and demonstrated to the two nurses how to review alarm history. This brief training benefited the two nurses, but the rest of the staff did not receive any education on those steps. This

episode and others have conveyed that the need for the staff education was relevant and was a patient safety concern.

This doctoral project's practice-focused question was: Did knowledge, skills, and confidence in using the current clinical monitoring system increase among LTACH nurses after receiving education on the clinical monitoring system? This doctoral project addressed this unit's gap-in-practice by creating the expectation to improve in knowledge and skill by educating the nursing staff on how to effectively navigate and troubleshoot the clinical monitoring system. This project also addressed the nurses' confidence that they would improve patient outcomes and reduce the risk of harm related to alarm fatigue, as well as provide a reassuring experience for the patient and their families. The reduction of false or nonactionable alarms showed an increased patient satisfaction by improving the patient's overall perception of the quality of their hospital experience in that the staff spent more time providing direct patient care instead of responding to alarms (see Whalen et al., 2014).

Nature of the Doctoral Project

The DNP project consisted of a structured educational program to train the nurses on how to navigate the clinical monitoring system. It consisted of education in the form of PowerPoint and hands-on simulation. The instruction covered navigating the clinical monitoring system, evaluating the clinical alarms, taking steps to address an alarm, and troubleshooting. The AACN provided recommendations on reducing clinical alarms. It served as a guide when developing the nursing staff's education and competencies (see Lorenzo Lewis & Oster, 2019).

The strategies to obtain the data on knowledge acquisition included a pretest and a posttest. Beginning with the pretest, to establish baseline knowledge, the participants answered questions regarding their knowledge and level of confidence in navigating the clinical monitoring system, understanding of clinical alarms, steps to take when addressing an alert, and troubleshooting. The education for the nurses covered navigating the clinical monitoring system, along with addressing, managing, and troubleshooting alerts. The posttest covered the same questions, with the anticipation that there will be an improvement in all areas. The education concluded with a simulation to apply the education and evaluate the competence of the nurses with navigating the monitoring system. I included this step because simulation can reflect the efficiency and appropriate skills and allow for immediate feedback from the educator (see Phillips et al., 2020).

A competency checklist was created to determine skills that are demonstrated. The full educational process and competency was added to the new nurse orientation and the annual education for registered nurses. The competency checklist incorporated aspects of the knowledge and skills for navigating the monitoring system and a hands-on/return demonstration during the simulation. The simulation evaluated the nurses' ability to apply the knowledge. One study showed that an educational program taught nurses how to safely navigate and interpret readings that resulted in improved patient outcomes and prevented adverse events (Phillips et al., 2020).

Thus, the purpose of the DNP project provided LTACH nurses with continuing education on the clinical alarm system at the site. Expected outcomes of the project included: LTACH nurses have improved knowledge, skills, and confidence in using the

current clinical monitoring system after participating in an educational process. This doctoral project addressed this unit's gap-in-practice by creating the expectation to improve in knowledge and skill by educating the nursing staff on how to effectively navigate and troubleshoot the clinical monitoring system. This project also addressed the nurses' confidence that will improve patient outcomes and reduce the risk of harm related to alarm fatigue.

Significance

The stakeholders impacted by this project include the patients on the unit, the organization, the staff, and physicians. The patients were impacted by having safer caregivers and reduced risk of adverse events due to user errors during physiological monitoring. Bi et al. (2020) found that after training, the experimental group's alarm fatigue scores were lower indicating that the training was effective, in addition to building their alarm management skills affecting their knowledge and critical thinking. The Patient Safety Authority (PSA) recorded reportable adverse patient events and found that there was an increase in telemetry events from 2014 to 2018 (Kukielka et al., 2019). Thirteen of these reported events had resulted in death (Kukielka et al., 2019).

The organization was impacted by this project by also having safer caregivers and developing a reputation for delivering safer patient care. This unit as a LTACH used LTRAX as a data collection tool to document quality metrics for LTACHs supported by CMS Quality Reporting (LTRAX, n.d.). The Centers for Medicare and Medicaid Services (CMS) supported the LTRAX for reporting standardized patient assessment data and quality measures to improve Medicare beneficiary outcomes (CMS, n.d.). Poor

scores may affect Medicare reimbursement of services provided to the patients. The staff was impacted by knowing that they are improving their ability to care for patients on clinical monitoring systems and demonstrating that they are safer practitioners. The physicians would have increased confidence and trust in the nursing staff that the patients are supported by a more knowledgeable and skilled nursing staff.

The potential contributions of this project to nursing practice included its transferability to other practice units that use clinical monitoring systems. The contribution also validated research that shows increase knowledge and skill with navigating clinical monitoring systems will reduce patient risk for errors related to equipment.

This project had transferability to similar practice areas. Any practice unit that used clinical monitoring systems to maintain an ongoing physiological monitoring for any duration of time would potentially benefit from the project. Examples of other practice units included, but are not limited to, post-anesthesia care unit (PACU), stepdown unit, direct observation unit, and intensive care units. This project would benefit similar practice areas with patients of all ages and through the entire lifespan.

The implications for positive social change that might emerge from the project benefited the staff, patients, and patients' families. The staff benefited from increasing their knowledge, skill, and confidence to be safe caregivers. This project's importance extended from the social environment to building knowledge and confidence in the staff and patient/family satisfaction for quality service (Oliveira et al., 2018). The project benefited the organization for economic and financial implications for with a reduction in

possible harm to patients and adherence to National Patient Safety Guidelines. The Pennsylvania Patient Safety Authority demonstrated that reporting of telemetry related events had increased and the majority of the events were due to user error (see Kukielka et al., 2019).

This project impacted social change by improving the LTACH nursing staff members' knowledge, skills, and confidence in managing clinical monitoring to advocate for their patients' care and outcomes accurately and confidently. This project also impacted social change by expanding on team building to improve patient outcomes by strengthening the unit's skill and reducing the risk of harm related to alarm fatigue. Desensitization and alarm fatigue can have serious consequences when a patient's genuine instability is not recognized or addressed despite the alarm (Baker & Rodger, 2020). The project also provided a reassuring experience for the patient and their families. The reduction of false or nonactionable alarms showed an increased patient satisfaction by improving the patient's overall perception of the quality of their hospital experience in that the staff spent more time providing direct patient care instead of responding to alarms (Whalen et al., 2014)

Summary

Alarm fatigue is a patient safety issue. LTACH nurses can improve their knowledge, skills, and confidence in using the current clinical monitoring system after receiving education on the clinical monitoring system, and thereby reducing alarm fatigue or desensitization. The LTACH made addressing all clinical alarms a priority, but nurses reported not knowing how to navigate all aspects of the system. Since alarm management

education only happens during orientation, there were opportunities that the nurse may forget or not use a feature on the system that will aid in monitoring a patient. An expected result of the project included increased patient satisfaction by improved quality of their hospital experience and overall care. The staff received education on the clinical monitoring system to increase their knowledge and skill, which resulted in their increased confidence.

Section 2: Background and Context

Introduction

The LTACH that served as the DNP project setting made addressing all clinical alarms a priority but nurses reported not knowing how to navigate all aspects of the system. Education on the clinical alarm system was part of every nurse's orientation. Yet, it was the only opportunity for training on the clinical alarm system for their tenure on the unit. This doctoral project's practice-focused question was: Did knowledge, skills, and confidence in using the current clinical monitoring system increase among LTACH nurses after receiving education on the clinical monitoring system? This doctoral project addressed this unit's gap-in-practice by creating the expectation to improve knowledge and skill by educating the nursing staff on navigating and troubleshooting the clinical monitoring system effectively. This project also addressed the nurses' confidence that they will be improving patient outcomes, reducing the risk of harm related to alarm fatigue, and providing a reassuring experience for the patient and their families. The reduction of false or nonactionable alarms showed an increased patient satisfaction by improving the patient's overall perception of the quality of their hospital experience. The staff spent more time providing direct patient care instead of responding to alarms (Whalen et al., 2014).

The background for this project included a review of the evidence-based practice model, by Rosswurm and Larrabee (1999), to guide the project and translate the literature into practice. Some terms used in this project were clarified that may have multiple

meanings. By describing my professional role and relationship to this project, I addressed my relationships to the topic, participants, and institution, as well as any biases.

Concepts, Models, and Theories

Model for Evidence-Based Practice

The use of evidence-based models presents a guide for organizing and translating knowledge into practice (White et al., 2016). Various models or frameworks were beneficial in providing a guide to implementing best practices. The model to facilitate organizing and analyzing this project was Rosswurm and Larrabee's model for evidence-based practice, tested in the acute clinical setting (White et al., 2016). The model guided researchers through the process of using evidence-based practices from literature, integrating the findings into standards of practice (Rosswurm & Larrabee, 1999). Rosswurm and Larrabee's model had six steps:

1. Assess the need for change in practice.
2. Link the problem with interventions and outcomes.
3. Synthesize the best evidence.
4. Design practice change.
5. Implement and evaluate the practice change.
6. Integrate and maintain the practice change.

Step 1 of the model was to assess the need for change in practice and covers identifying the problem, collecting data, and involving the stakeholders (Rosswurm & Larrabee, 1999). The unit's issue was recognized by the nurse manager, who received frequent questions about managing the clinical monitoring system. The nurse manager

found a pattern and spoke to the clinical educator about the unit's needs and noise in the hallway. The nurse educator reinforced alarm management with the nurses by individualizing the patients' alarm parameters, but the information did not reach all nurses. The nurse manager agreed that reinforcement needed to occur but wanted to expand on communication since the educator only reviewed the clinical monitoring system during each nurses' orientation. There had been no direct adverse patient outcomes on the unit, but the alarm noise level was reflected in the patient experience scores.

The first quarter patient survey results showed 15% out of 100% on the environment's quietness, which included noise from talking and alarm signals. In comparison, the first-quarter national average for the same metric was 71%, and the regional average was 70%. There was no distinction in the survey regarding which area produced more noise, staff voice volumes or the alarm signals. Thereby, patients, unit leadership, and the nurses were the stakeholders for this project

Next, Step 2 of the model linked the problem with potential interventions and selecting outcome indicators (Rosswurm & Larrabee, 1999). After identifying that the nurses needed an educational refresh of the monitoring systems, literature supported staff education. The literature was aligned with the goals of education in the doctoral project's practice-focused question: Did knowledge, skills, and confidence in using the current clinical monitoring system increase among LTACH nurses after receiving education on the clinical monitoring system? The expected outcome was an improvement in the nursing staff's knowledge and skill on navigating and troubleshooting the clinical

monitoring system effectively. With the increase in knowledge and skill, the staff confidence was expected to increase also.

Step 3 of the model explained how the literature review will draw on the best practices. The literature review resulted in ten articles that support this project to educate staff on the clinical monitoring systems and found that their outcomes endorsed an increase in appropriate monitoring, improvement in patient safety, and reduction in alarms. Relevant sources of evidence in the literature supported the need to address the knowledge gap addressed in this project. Providing education on reducing nuisance or non-actionable alarms to reduce alarm fatigues allowed the clinician to address the warnings that are true and intervene when appropriate.

Step 4 of the Rosswurm and Larrabee's model for evidence-based practice process was designing a change in a protocol, procedure, or standard (Rosswurm & Larrabee, 1999). This project involved creating a change in protocols for addressing the education of the clinical monitoring system. The unit assessment determined that educational reinforcement was needed for the clinical monitoring system due to the information being only reviewed during each nurses' orientation and receiving feedback from the nurse educator that staff is not familiar with the system's necessary aspects. The project outcomes were defined as improvement in knowledge, skills, and confidence using the monitoring system.

Step 5 of the model was implementing and evaluating the change in practice, which consisted of education explaining the vital areas for navigating the clinical monitoring system and hands-on/return demonstration with simulation to validate the

education. The nurses received a pretest and posttest of the material with the expectation that there will be an improvement in knowledge. After the pretest and posttest, the simulation confirmed with a competency to verify the understanding and application of the education. The confidence evaluation had Likert questions identifying the nurses' confidence in navigating and troubleshooting the monitoring system. According to one study, the expectation was that the nurses will improve in self-confidence to be safer caregivers and demonstrate that other clinicians, patients, and families have confidence in the staff and patient/family satisfaction for quality service (see Oliveira et al., 2018). This step was also the opportunity to identify any modifications to the education or simulation format that would help make the change in protocol successful (Rosswurm & Larrabee, 1999).

The final step in the model was Step 6 covered integrating and maintaining the practice change. This project aimed to improve the knowledge, skills, and confidence in using the current clinical monitoring system increase among LTACH nurses after receiving education on the clinical monitoring system. The other goal was to make this education mandatory during orientation for all new nurses and have an annual competency. For the organization's leadership, ongoing communication of the practice change and data revealing improvement enhanced the stakeholders' confidence in the change's effectiveness and provided the resources to maintain the practice by monitoring the outcomes (see Rosswurm & Larrabee, 1999).

Clinical Alarm Systems

Sendlebach and others (2019) developed a study to evaluate the impact of implementing electronic order sets based on the American Heart Association practice standard for appropriate monitoring. The study included 297 patients, 150 patients in the preintervention group and 147 patients in the post-intervention group, with similar baseline characteristics except for gender. The researchers used a quasi-experimental design to compare the patients who received appropriate electrocardiographic (ECG) monitoring before and after implementing computerized order sets to establish monitoring. The baseline data was collected two years before implementation to avoid contamination of the practice standards' awareness. A clinical team with experience on the unit, electronic medical records, and ECG monitoring developed the order set intervention. The hospitalists and residents received education and applied to general admissions. The results showed an increase in the accurate monitoring from 48% to 61.2%. The most significant increase was among the residents, from 30.8% to 76.5%. As a result, the reduction in ECG monitoring did not adversely affect patient outcomes and reduced the number of false or clinically irrelevant ECG alarms.

Alarm Fatigue

Yeh and colleagues (2019) found interventions to reduce nonactionable alarms in an adult intensive care unit (ICU). This study was conducted at a 24-bed adult medical intensive care unit (MICU) at a 480-bed academic medical center. Their goal was to test whether implementing interventions in an inter-professional team-based approach can effectively reduce unnecessary or nonactionable alarms. This study was a prospective

cohort, pre-and post-design with repeated measures at baseline (preintervention) and post-phase with two interventions. The interventions used for the design were collected from a 22-day baseline period of alarm data. The two phases of interventions changed the default setting on identified arrhythmia alarms and the default setting on specified oxygen saturation alarms. The study results found a reduction in the most frequently generated alarms without compromising patient safety (Yeh et al., 2019). The total number of alerts reduced by 40% over 14 days, with nonactionable alarms decreased by 47% and arrhythmia alarms decreased by 46%.

The cohort study completed by Lewis and Oster (2019) demonstrated that implementing nurse-driven, evidenced-based, and patient-customized monitoring interventions reduced nuisance alarms and decreased the nurses' perceived alarm fatigue. The study included 74 RNs in a 36-bed intensive care unit/step-down unit (ICU/SDU) in a 368-bed, not-for-profit, Magnet-designated acute care facility. The exploratory nonrandomized, pretest and posttest, one-group quasi-experimental study began with 30 days of alarm data collected. The alarm numbers and duration were calculated, in addition to a survey of the nurses' perception of alarm fatigue. The education and intervention implemented were based upon the AACN recommendations for alarm management CEASE, an acronym for Communication, Electrodes, Appropriateness, Setup, and Education. The study results showed a decrease of 30% in auditory alarms and reduced alarm nuisance perception from 68% to 44%.

Baker and Rodger (2020) performed a quantitative survey with anonymous participation at a private long-term acute care facility with 80-beds across 3 locations.

The survey was open to 98 clinical staff; 60 people completed the study. The clinical staff included registered nurses, licensed practical nurses, nursing assistants, and monitor technicians. The survey findings showed a high potential for alarm fatigue and an opportunity to improve patient safety by reducing alarm fatigue. Seventy percent of respondents agreed that no clinical changes were missed. Almost three-quarters, 73% agreed that the current system alerted them to severe changes in patients' condition, while 82% agreed that unit noise levels were too high. There were 35% who agreed that most alarms were due to patient noncompliance.

Simulation as a Training Tool

Bi and colleagues (2020) evaluated the effect of monitoring alarm management training to reduce alarm fatigue, total alarms, and nonactionable alarms. The researcher performed a randomized, single-blind trial at a tertiary A-level hospital that included 93 ICU nurses randomly assigned into an experimental group and a control group. The control group (46 nurses) received regular training on ECG identification, use and maintenance, and infection control management. The experimental group (47 nurses) received alarm management training created from a combination of practice standards published by the American College of Cardiology and the American Association of Critical-Care Nurses. The training included awareness of alarms and alarm management, properly setting up and connecting monitors, troubleshooting nonactionable alarms, and personalized training toward barriers or problems. The trial was over 3 months. Before the intervention, baseline comparisons had no significant differences. The experimental group had statistically significant lower alarm fatigue scores and a lower total number of

alarms and nonactionable alarms than the control group after the trial period. There was no difference between groups of true crisis alarms.

Self-Efficacy/Confidence in Nurses

To provide a guide to educate nurses on using physiological monitors and alarm safety, Phillips et al. (2020) created a guide to improve the knowledge, skills, and attitudes of registered nurses for alarm management. This article is a guide using case studies. The guide is divided into four areas of core competencies: (a) hardware and connectivity; (b) admission, discharge, transfer of patients in the context of physiologic monitors; (c) alarm management; and (d) appropriate monitoring for the patient's condition (Phillips et al., 2020). The article explains that education using different case studies facilitates learning by targeting the learner's ability, competence, and attitude with skills and actions.

A qualitative study arm of mixed methods study conducted by Ruppel and others (2018) used an interpretive descriptive methodological approach. There were 27 nurses who were subjectively selected by the nurse managers and nurse educators from three ICUs in an academic medical center. The study identified four themes from the interviews: alarm culture and context, nurse attributes, motivation to customize, and understanding how to customize the monitors. The study results showed the nurses customized monitor alarms based on level of expertise and comfort and being influenced by the culture on the unit, patient responses to alarms, and their technical understanding of the monitors.

Clarification of Local Terms

Clinical Alarms were signals or alerts from a variety of medical devices, from life-sustaining to less critical equipment designed for physiological monitoring and also alerts designed to indicate equipment malfunction or variation from a normal device condition (Lukasewicz & Mattox, 2015).

Clinical Monitors could be a variety of medical devices, from life-sustaining to less critical equipment designed for physiological monitoring (Lukasewicz & Mattox, 2015).

Alarm Fatigue was the phenomenon that occurs when a staff member has been desensitized to alarm signals due to frequent exposure to the alarm signals, which could lead to a delayed or missed response for a patient (Torabizadeh et al., 2017).

LTACH Facility was defined as a hospital which has an average inpatient length of stay of 25 days or longer which allows patients more time to be weaned from the mechanical ventilation at a slower rate or requiring more time to recover from complex medical conditions and injuries (Baker & Rodger, 2020). These patients were too ill to be transferred to a skilled nursing facility, acute rehabilitation hospital or their home after their hospital stay (GSPP, n.d.).

Relevance to Nursing Practice

A quantitative and observational cohort study completed by de Oliveria and others measured health professionals' response time to alarms and the implications to patient safety (de Oliveira et al., 2018). In a 20-bed adult ICU of a public teaching hospital, the study data and observations were seven hours in one-hour increments over

seven days. Three researchers simultaneously observed the staff on the unit. The study found absence or delay in team response suggesting relevant alarms may be underestimated and may compromise patient safety. Of 103 alarms activated during the seven hours of observation, 66% of the alerts were not addressed, 66.1% of the alarms came from the multi-parameter monitor, and the nursing staff addressed 32% of the warnings. The Hawthorne effect results may have been affected, which may have been affected by the researchers' visual presence.

Chen and others (2016) led a retrospective study of all telemetry orders in medicine and progressive care units at a US-based academic hospital for one year. The three primary reasons for telemetry orders were for angina/acute coronary syndrome (ACS), arrhythmias, and heart failure. They found that 20.2% of patients were monitored for noncardiac reasons, like respiratory conditions, infection, substance abuse, altered mental status, vital signs monitoring, bleeding, and PE/DVT (pulmonary embolism/deep vein thrombosis). Inappropriate telemetry monitoring leads to increased costs, alarm fatigue, and inefficient nursing care. The researcher admitted that they did not assess the ordered telemetry duration since most indications only needed 24-48 hours of monitoring. They also could not exclude the possibility that patients with noncardiac signs had an appropriate reason for being on telemetry.

Turmell and colleagues (2017) led a quality improvement project to describe the impact of evidence-based alarm management strategies in a 580-bed not-for-profit Magnet-recognized hospital. The researchers used preintervention and post-intervention data collection over two years and found the alarm management program's overall results

reduced alarms up to 30%. The project implemented one strategy in one to two units at a time. The data collected for daily electrode change showed a 33% reduction in alarms and 26% reduction in artifact alarms from baseline. The data collected for reducing nonactionable alarms, duplicate alarms, and thresholds' adjustment showed a 33% reduction on one unit (one patient accounted for most of these alarms) and an 84% reduction on the other unit baseline. The data collected for appropriate telemetry use in patients who no longer required monitoring and were taken off promptly averaged six patients removed from monitoring per day. The study calculated that reducing the census of continuously monitored patients could save $136,500 per year and 841 RN hours per year.

The literature's overall themes showed that education to staff on reducing nuisance or non-actionable alarms to reduce alarm fatigue would allow the clinician to address the warnings that are true and intervene when appropriate. The evidence justified that this is a practice problem critical to the nursing profession by developing the nurses' clinical reasoning and appropriately customizing the alarm parameters for increased patient safety, reduced alarm fatigue, building staff confidence, and changing negative attitudes (see Ruppel et al., 2019).

This doctoral project advanced the nursing practice and filled the gap in practice in two ways. First, the project was completed in an LTACH setting. Most of the researched literature discusses alarm management guidelines in an ICU setting, not an LTACH. The other way that the project fills a gap in practice was to address the need for continual education on the clinical monitoring systems. The literature showed that

education was provided to the staff but did not indicate plans to complete the education annually after initial orientation. Bi and others (2020) discussed that the future would include alarm management training for all ICU nurses based on clinical practice guidelines but did not discuss an opportunity for re-education. Another article mentioned that an education/competency packet used in their study would be adapted to the onboarding curriculum for new graduate nurses and experienced nursing staff to the unit (see Lewis & Oster, 2019). The authors expected that emphasizing alarm management upon hire would create a practice culture of patient safety and a quieter work environment (see Lewis & Oster, 2019). One study revealed that the retention of staff receiving ECG education was reduced by 26% eight weeks after the initial training and recommended a reinforcement of the information presented during orientation to ensure safe patient care (see Brooks, 2016).

Local Background and Context

The local evidence on the relevance of the problem and justified the practice-focused question was evidence by the questions from staff and the length of alarms and noise on unit. The problem of multiple and frequent alarms could result in alarm fatigue. This phenomenon could occur when a staff member, often the nurse, was desensitized to alarm signals due to frequent exposure to the alarm signals, which may lead to a delayed or missed response, and for a critically ill patient, it may cause adverse or lastly effects (see Torabizadeh et al., 2017). The institution or organization's role in addressing alarm management for patient safety was providing posters on the unit of the National Patient

Safety Guidelines. The guidelines for alarm management were included with the other in-patient hospital guidelines for patient safety.

The demographics of the patients were aligned with the problem of the project. The LTACH provided around-the-clock physiological monitoring. The patients were received from an ICU to the LTACH because they were too ill to go to other care levels or require other medical interventions like administering multiple intravenous medications and mechanical ventilator weaning. The LTACH patients were stable, but were still critically ill.

The organization's mission was: We create world-class, patient-centered rehabilitation and post-acute care services by defining evidence-based practice and fully integrating care throughout the continuum. The organization's vision was: Partnering to realize life's potential. The work of the rehabilitation unit and the post-acute care services (LTACH) provided patient care based on EBP and worked with the patient through the management of their disease to help them get as close to their baseline before injury or exacerbation of disease as possible.

The Patient Safety Authority recorded reportable adverse patient events and found that there was an increase in telemetry events from 2014 to 2018 (Kukielka et al., 2019). There were 13 of these events which resulted in death (Kukielka et al., 2019). The project also had benefits for economic and financial implications for the organization with a reduction in possible harm to patients and adherence to National Patient Safety Guidelines. One study completed by the Pennsylvania Patient Safety Authority demonstrated that reporting of telemetry related events has increased and the majority of

the events were due to user error (Kukielka et al., 2019). The National Patient Safety Guidelines were presented by the Joint Commission for quality of care and positive impact on health outcomes (TJC, n.d.). The guidelines were developed for different facility types, like hospital, ambulatory, home care, and nursing care centers, to name a few (TJC, 2020). The guidelines were gathered each year about emerging patient safety issues and the guide that led this project was the standard for in-patient hospitals to achieve and maintain continuous standard compliance and operational improvement (TJC, 2020).

Role of the DNP Student

Relationship to Project

Nursing was a second career for me, with my only regret of not being in nursing sooner. Before applying to nursing school, I began taking prerequisites for nursing as my employer outsourced most of my department's work. Nursing had proven to be the perfect career for me: it kept me challenged and engaged, not outsourceable and allowed me to help people. I had often 'played' school with my younger cousins and siblings by making age-relevant lessons and performing science experiments. I began my college career preparing to be an elementary school teacher but now made a full circle opportunity to continue educating all people across the life span: patients, families, staff, and new nurses. This doctoral project allowed me to be the educator I had been groomed to become.

I obtained my Master of Science (MSN) degree in Nurse Education, anticipating teaching nursing students in the academic arena. I was introduced to the nurse educator

where I am currently employed and assisted her with filing and administrative work. She impressed upon me of being a nurse educator and opened my view of nursing education in a facility. My agency assignment expanded into a full-time career with this organization and mainly on this LTACH unit. I have grown as a nurse and nurse leader on the LTACH and understand the unit's needs. As the manager, I acted as a resource on the unit, administratively and clinically. I had received questions about the clinical monitoring systems that was fully upgraded at least once during my tenure. Still, the extent of education on the monitoring system had not been complete or consistent. As nursing staff changes, the introduction to the clinical monitoring system had not been standardized. It had been carried over by nursing staff and only during orientation. There was no additional re-education until someone asked a question, and it was only educated with one or two individuals.

My role in the doctoral project was two-fold. I was the DNP student that provided the education and the manager of the unit. One of my early goals as the manager was to re-vamp the orientation process for the team. This project allowed for one area of that goal to be addressed. In both roles, I wanted the staff to be efficient and knowledgeable about the clinical monitoring system. Another area for improvement was to develop preceptors for orienting new employees to the unit; that goal was not part of this project but is part of my role as the unit's manager. My relationship with the bedside nurses was understood that the education of the clinical monitoring system would continue as an improvement for our area. As a DNP student, I was supported by the nurses because they notice the difference in the unit's environment when the alarms were not alerting. The

nursing staff noticed that their workflow and time management were improved without checking on the patient due to a nonactionable alarm. The organization and nursing leadership for the LTACH had verbally and administratively shown support for my progress as a DNP student and as a manager developing plans to improve the unit's clinical and critical thinking skills. My direct manager had supported adjustments in my schedule to accommodate practicum hours and encouraged my energy around improving the team beginning with the clinical monitoring system. My manager and chief nursing officer were aware of the patient experience metric regarding noise on the unit. They were supportive that alarm management will improve the noise on the unit and patient safety.

Motivations and Biases

My motivation was to strive for a staff that is efficient and knowledgeable about the clinical monitoring system. The National Patient Safety Guidelines drove adherence, and I accepted that I had the authority to influence patient safety improvements on the unit. I was motivated to make sure that all nurses were aware of patient safety through knowledgeable and skilled clinical monitoring. This education made me proactive in avoiding difficult conversations with staff or families that a patient could have been harmed by the lack of knowledge, skill, or confidence attributed to the monitoring system. Overall, my pursuit of completing my DNP program gave me the energy to be a more vigorous advocate for the patients, staff, unit, and organization by understanding principles of practice management and balancing productivity with quality of care, in addition to analyzing the financial aspects of practice change (see AACN, 2006).

My potential bias in completing this doctoral project was as a manager. I strove for patient and staff safety to implement the education on the unit without a project. As a nurse, I strove to advocate for the patient at every opportunity, and alarm fatigue was an opportunity to promote safe patient care through improved monitoring skills with timely and appropriate responses.

Summary

The background for this project included a review of the evidence-based practice model (Rosswurm & Larrabee, 1999). This model guided the project for translating the literature in to practice and educated the staff on the clinical monitoring system. Current literature supported educating the nurse on alarm management, while this project would standardize educating staff during onboarding and annually. My professional role and relationship to this project as the nurse manager for the LTACH had presented some bias, but the bias was toward advocating for the patient, staff, and overall safe patient care on the unit.

Section 3: Collection and Analysis of Evidence

Introduction

This project aimed to fill the gap in knowledge and skill among the staff and improve the confidence levels among LTACH nurses with additional education. The meaningful gap-in-practice involved the improper use of the clinical monitoring alarm system in the LTACH setting. Nurses heard the alarms but may have ignored them or tuned the alarms out, thereby failing to cancel and resolve the alarm signal. Additionally, they might have cancelled the alarm assuming the alarm was false without resolving the problem or confirming the validity of the alarm. Improper use of the alarm system was the result, and compromised patient safety. The gap identified in practice was that nurses did not know how to navigate the monitoring system properly in the LTACH to reduce the frequency of nonactionable alarms. The background for this project included a review of the evidence-based practice model by Rosswurm and Larrabee (1999), which guided the project for translating the literature in to practice and educating the staff on the clinical monitoring system. The current literature supported educating the nurse on alarm management. This section discusses the practice-focused question, sources of evidence supporting this project, and how the evidence guided the method for implementing education for the LTACH nurses

Practice-Focused Question(s)

This practice-focused question for this project was: Did knowledge, skills, and confidence in using the current clinical monitoring system increase among LTACH nurses after receiving education on the clinical monitoring system? The purpose of this

DNP project was to improve the nursing staff knowledge and skill by educating the nursing staff on how to effectively navigate and troubleshoot the clinical monitoring system, as well as increase confidence that they were improving patient outcomes, reducing the risk of harm related to alarm fatigue, and providing a reassuring experience for the patient and their families.

Sources of Evidence

The sources of evidence used in this project were collected from databases search. The findings supported the practice-focused question and this DNP project. This section also describes the sources of evidence that will be collected in the DNP project.

Published Outcomes and Research

The sources of evidence that were collected to meet the purpose of this doctoral project included literature obtained that demonstrated alarm fatigue is a patient safety issue. Walden Library provided resources to support this project by offering access to a variety of databases (Walden University, n.d.). The primary databases used for literature collection were Cumulative Index to Nursing & Allied Health Literature (CINAHL).and MEDLINE. The databases were used to retrieve literature supporting evidence-based practices. The evidence for this project addressed a practice problem critical to the nursing profession by developing the nurses' clinical reasoning to appropriately customize and interpretate alarms for increased patient safety, reduce alarm fatigue, build staff confidence, and change negative views (see Ruppel et al., 2019).

The keywords used for the literature review included *alarm fatigue*, *alarm safety,* and *clinical alarm* (with the Boolean symbol, asterisk, to include keywords *clinical*

alarms, clinical alarm safety, clinical alarm management, clinical alarm system, and *clinical alarm fatigue*). The years searched were 2016 through 2021. The literature review included an exhaustive and comprehensive review of existing theory and research for relevance to project. The literature review concluded with a final review of the articles for relevance.

Evidence Generated for the Doctoral Project

The evidence and data generated for the purpose of the doctoral project included a discussion of the participants, procedures, and protections. A step-by-step description included how this evidence was be collected.

Participants

This project involved all the RNs who work on the unit. The nursing staff that received the clinical monitoring training included the LTACH RNs, float RNs, and the NCCs. The education was required for the LTACH RNs and the float RNs because they had specific patient assignments and were performing direct patient care. The education was optional for the NCCs because they did not have a specific patient assignment and would occasionally perform direct patient care. The NCC's role was mostly supervisory. For the LTACH, there were 20 full-time RNs, one part-time, five per diem RNs, and five agency nurses. There were nine full time float RNs and three per diem float RNs. There were 10 NCCs who also had the option of completing the education and competency. The total number of required participants was 43 registered nurses; the total of optional participants was 10 NCCs.

Procedures

The education and survey for this DNP project was completed over a 3-week period. The nurses completed a pretest before beginning the education to have baseline data. The education consisted of self-guided study via PowerPoint document to explain how to navigate the clinical monitoring system. The curriculum for the project was included in Appendix B. After the PowerPoint review, the nurse was directed to complete a posttest to evaluate confidence and knowledge after reading the self-guided education. After the survey period was completed, the self-guided study was again provided to the nurses to review for 10 days. After the education was reviewed, the nurses were able to participate in a simulation of the material discussed. A competency was provided for two weeks to validate retention of the education with a return demonstration.

This DNP project was an educational project that evaluated knowledge, confidence and skill using a pretest of questions that included:

- Four demographic questions for general background information of the participants (gender, age, years of licensure, and years of LTACH experience).
- Six quantitative questions asking the nurses about confidence in navigating the clinical monitoring system, using a 1-5 Likert scale (strongly agree, agree, neither agree or disagree, disagree, strongly disagree) for scoring.
- Ten quantitative questions on nurses' knowledge in navigating the clinical monitoring system (see Appendix C).

Protections

To maintain the protection of human subjects, the project was guided by the Walden educational manual. The Institutional Review Board (IRB) at the project site was consulted, and an application to the Walden University IRB was sought. The project site's IRB deferred to Walden University's IRB. Additional ways that human subjects were protected included confidentiality and anonymity of pretest and posttest data. Participants were advised using the consent procedure advocated in the educational manual. They had the opportunity to refuse to allow their data to be included in this DNP project. Walden University's ethics approval number for this project was 08-24-21-0453219.

Analysis and Synthesis

The project analysis was performed by compiling the data collected and analyzed from the pretest and the posttest using paired *t*-tests or the non-parametric equivalent to determine if a statistically significant improvement was realized. The project concluded with a presentation of the socio-demographic data of the participants. A comparison of the pretest and posttest results was analyzed to determine if the results are statistically significant.

Summary

LTACH nurses had the opportunity to improve their knowledge, skills, and confidence in using the current clinical monitoring system after receiving education on the clinical monitoring system, and thereby reducing alarm fatigue or desensitization. The staff received education on the clinical monitoring system to increase their knowledge

and skill, which resulted in their increased confidence. One source of evidence was the published literature that had been reviewed and supported this project. The participants were the RNs that provide direct patient care on the LTACH. The procedure for increasing the knowledge, skill, and confidence of the nurses was an educational presentation with a simulation component. The pretest and posttest determined any statistically significant improvements in the knowledge and confidence, while the simulation and return demonstration supported a competency on their skills. The participants were protected under the guidance of the IRB approval.

Section 4: Findings and Recommendations

Introduction

This project aimed to fill the gap in knowledge and skill among the staff and improve the confidence levels among LTACH nurses with additional education. The meaningful gap-in-practice involved the improper use of the clinical monitoring alarm system in the LTACH setting. Nurses heard the alarms but may have ignored them or tuned the alarms out, thereby failing to cancel and resolve the alarm signal. Additionally, they might have cancelled the alarm assuming the alarm was false without resolving the problem or confirming the validity of the alarm. Improper use of the alarm system would be the result and compromising patient safety. The gap identified in practice was that nurses did not know how to navigate the monitoring system properly in the LTACH to reduce the frequency of nonactionable alarms. The current literature supported educating the nurse on alarm management. This practice-focused question for this project was: Did knowledge, skills, and confidence in using the current clinical monitoring system increase among LTACH nurses after receiving education on the clinical monitoring system? The purpose of this DNP project was to improve the nursing staff knowledge and skill by educating the nursing staff on how to effectively navigate and troubleshoot the clinical monitoring system, as well as increase confidence that they would improve patient outcomes, reduce the risk of harm related to alarm fatigue, and provide a reassuring experience for the patient and their families.

The sources of evidence were data from surveys completed by the nursing staff. The evidence was obtained by confidential and anonymous surveys of pretest and posttest data completed by the nursing staff.

The analysis performed for this project was compiling the data collected and analyzed from the pretest and the posttest using the paired *t*-tests to determine if a statistically significant improvement was realized. This section concludes with a presentation of the sociodemographic data of the participants. A comparison of the pretest and posttest results was analyzed to determine if the results are statistically significant.

Findings and Implications

The survey was sent to 43 nurses who care for patients on the LTACH. A total of 17 nurses responded to the survey. The case processing summary revealed that 11 nurses completed the pretest and posttest, 64.7% of the 17 respondents and 25.6% of the 43 nurses eligible to complete the survey. Table 1 listed the demographics of the survey participants. Twelve (70.6%) of the participants identified as female, while one participant did not specify their gender. The most common age group to complete the survey was 30-39 years old with seven participants (41.2%). The participants with 8 or more years as a registered nurse were the most common demographic (29.4%), with 2-4 years of nursing experience as a close second (23%). There were eight (47.1%) participants who had 3 years or more of working on the unit and two (11.8%) participants who worked 1 to 2 years on the unit for a combined rate of 58.9%.

Table 1

Demographics of Participants

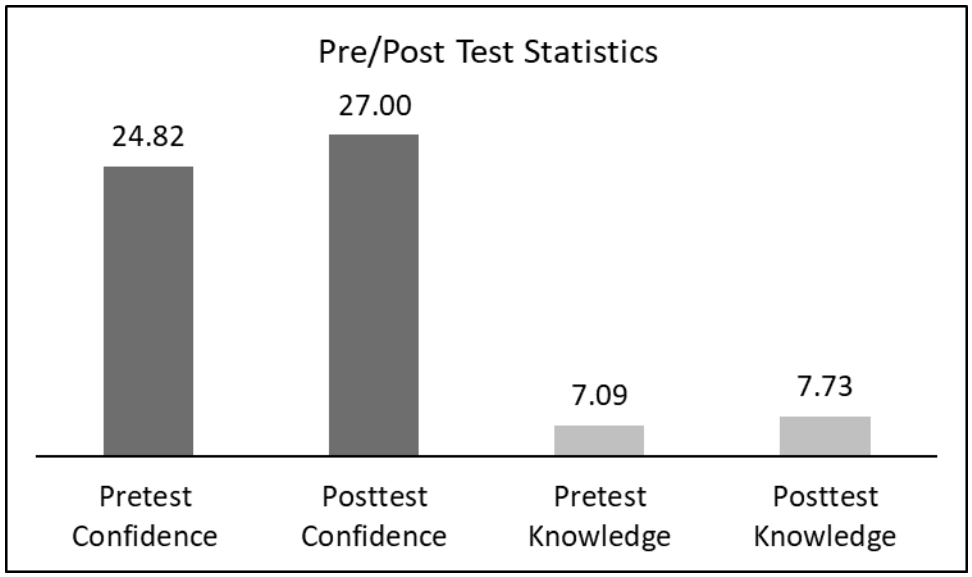
	Absolute Distribution	Relative Distribution (%)
Gender		
Not specified	1	5.9
Female	12	70.6
Male	4	23.5
Total	17	100
Age		
Not specified	1	5.9
20-29 years old	4	23.5
30-39 years old	7	41.2
40-49 years old	3	17.6
50+ years old	2	11.8
Total	17	100
Experience as a RN		
Not specified	1	5.9
< 1 year	3	17.6
2-4 years	4	23.5
5-7 years	1	5.9
8+ years	5	29.4
Total	17	100
Experience on Unit		
Not specified	2	11.8
< 6 months	3	17.6
1-2 years	2	11.8
3+ years	8	47.1
Total	17	100

Note. RN=Registered Nurse.

The case processing summary revealed that only 11 of the 17 participants completed the posttest. The remaining results were collected from the 11 surveys that had pretests and posttests. The findings from the pretest and posttest for the confidence showed a mean increase from the pretest of 24.81 to 27.00 from the posttest uncovering a significant increase in confidence from the participants. The findings from the pretest and posttest for the knowledge questions show a mean increase from 7.09 to 7.73 from the posttest

test revealing a very slight increase in knowledge. Figure 1 represents a graph of the mean of the confidence and the knowledge surveys.

Figure 1 - *Pretest and Posttest Statistics Summary*



These tests determine whether or not the data are normally distributed, which dictates an assumption of the inferential tests that compare means. Since the pretest scores were not normally distributed but the posttest scores were, the nonparametric related samples test (Wilcoxon Signed Ranks) was used to determine statistical significance, as demonstrated in Table 2 and Table 3. The *p* value, the level of significance for the data, was achieved. However, even though the staff had a statistically significant increase in confidence (p=.012), they have not substantially increased the number of correct answers on the knowledge posttest (p=.167).

Table 2

Wilcoxon Signed Ranks Test

Ranks				
		N	Mean Rank	Sum of Ranks
PostConfidTotal - PreConfidTotal	Negative Ranks	1[a]	1.50	1.50
	Positive Ranks	8[b]	5.44	43.50
	Ties	2[c]		
	Total	11		
PostKnowTotal - PreKnowTotal	Negative Ranks	2[d]	2.00	4.00
	Positive Ranks	4[e]	4.25	17.00
	Ties	5[f]		
	Total	11		

Note. a. PostConfidTotal < PreConfidTotal.
b. PostConfidTotal > PreConfidTotal.
c. PostConfidTotal = PreConfidTotal.
d. PostKnowTotal < PreKnowTotal.
e. PostKnowTotal > PreKnowTotal.
f. PostKnowTotal = PreKnowTotal.

Table 3

Test Statistics

	Tests Statistics[a]	
	PostConfidTotal - PreConfidTotal	PostKnowTotal - PreKnowTotal
Z	-2.514[b]	-1.382[b]
Asymp. Sig. (2-tailed)	.012	.167

Note. a. Wilcoxon Signed Ranks Test.
b. Based on negative ranks.

The unanticipated outcome on the for this project was the very slight increase in knowledge. Many of the staff were either new to the unit or received their education to the clinical monitoring system more than three years ago. The impact on this finding

acknowledges that the staff may retain more education from their initial orientation to the clinical monitoring system than assessed. The limitation to this outlook is that the 11 nurses (26% of the eligible participants) who completed the survey may have been more familiar with the clinical monitoring system than the 31 other nurses (74% of the eligible participants) who did not complete the pretest and posttest.

The return demonstration competency was completed after the self-guided study and hands-on simulation. Both were available after the survey period was completed. The education was made available to all the nurses prior to return demonstration competency. Most (95.8%) of the nursing staff completed the competency; one nurse was on a leave of absence. There were observations from the return demonstration that warrant changes in the overall staging of the education. The competency was divided into four areas:

- Hardware and Connectivity
- Admission, Discharge, Leave of Absence
- Managing Monitor Alarms
- Appropriate Monitoring

Competency Area 1 and Competency Area 2 were completed by the staff with 100% accuracy and no assistance to complete. Competency Area 3 was completed with 91% accuracy. In Area 3, all the staff were assisted in finding the detection line for the respiratory rate. This information was covered in the education, but the staff may have not taken advantage of the hands-on simulation. Competency Area 4 was completed with 50% accuracy, but the nurses' accuracy was attributed to the wording of the competency. The question for the best practices for the electrodes and SpO_2 placement led the staff to

refer to steps to take in caring for the patient in the event of abnormal readings were alarming. The validator for the competency verbally asked the questions about what steps needed to be taken prior to placing the electrodes and SpO_2 device on the patient.

From the findings, the staff confidence increased regarding caregiver safety. The implication demonstrated that the staff were confident in addressing alarms in a timely way, comfortable in individualizing alarm parameters, and navigating the clinical monitoring systems. From the staff member's confidence, the implications extend to the patients and patients' family in satisfaction of quality service. With the increase in patient and family satisfaction in the service of the nurse and a reduction of noise on the unit from nonactionable alarms, the data collection tool (LTRAX) completed by the patient or patient's family would report an increase in quality of service by the nursing staff and reduction of noise on the unit. This aspect of the project implies LTRAX scores would increase and support the organization's goal of improving outcomes, thereby impacting service reimbursements.

The implication in terms of systems can be translated to other practice units that provide clinical monitoring for their patients. This project's contribution will validate research that other practice units can reduce patient risk and impact the confidence among the staff and potentially improve quality metrics collected by that unit's organization.

In addition to the financial benefits, this project will impact positive social change by providing a reassuring experience for the patient and their families. The reduction of false or nonactionable alarms may show an increased patient satisfaction by improving

the patient's overall perception of the quality of their hospital experience with staff spent more time providing direct patient care instead of responding to nonactionable alarms.

Recommendations

There are two recommended solutions that will address the gap-in-practice, as informed by the findings discussed above. The first recommendation would be to create an annual competency for the navigating the clinical monitoring system focusing on return demonstration. The competency presented in Appendix B proved to be more telling of the staff's retention and knowledge of the clinical monitoring system than the pretest and posttest. The findings showed that there was no statistically significant improvement in the knowledge of the nurses from their review of the PowerPoint education. The education provided the foundation for what to expect in navigating the clinical monitoring system but failed to allow the student to connect the education with the physical aspect of the monitoring system. The future education for the competency will include a video and voice-over to match the pictures with the actions to help connect the education with the physical aspect of navigating the system.

The other recommendation for the addressing the gap-in-practice is adding the education and competency to the unit's orientation process. If a new nurse is hired or new to working on the unit, their orientation will include a face-to-face education of the monitoring system with their preceptor. This addition to the orientation process will help reinforce what nurses will need to know for addressing clinical alarms during patient care.

Strengths and Limitations of the Project

The strength of the doctoral project was the anonymity of the participants in completing the surveys. Another strength of the project was the *p* value, the level of significance for the data, was achieved. Even though the staff had a statistically significant increase in confidence, they did not show an increase in correct answers on the knowledge posttest. The strength of this project was also the support from the organization's leadership that supports scholarly advancement of its staff and dedication to improving the quality of care on the unit. The project supported a quality improvement of the clinial alarms on the unit. The purpose would compare the data on alarms before and after the completion of the survey and competency. The likelihood of a reduction in clinical alarms is expected with the data supporting an increase in nurses' confidence.

The limitations of the project were the delivery of the project and the connection with the participants. The program used to deliver the survey and education electronically allowed for the nurse to complete the pretest, then advance to the PowerPoint education, and end with being directed to the posttest. The directions were clear for 11 of the participants, but not clear enough for six of the participants to complete the posttest. Due to the anonymity survey, the participant was not able to ask questions on the directions and the researcher was not able to determine which participant did not complete the posttest to inquiry about any technical issues. The connection to the participants as the manager of the unit was reflected as a limitation. There may have been hesitation to participate in the project survey as the project manager is also the acting unit manager. As the nurse manager of the unit, I would have been able to mandate the pretest and posttest,

but that would have compromised my role as the project manager to encourage voluntary participation. Looking back, finding an alternative site that supported patients with clinical monitoring may have been more effective. The project was presented during a time of low morale with the organization and the nurses' morale may have affected their interest in volunteering for any projects or activities outside of their job description, even if it supported improvement on the unit. The return demonstration competency was not voluntary.

The recommendation for future projects to address a similar topic, like navigating clinical devices for patient care, would be to assess the unit for interest in the topic. While patient care is on the nurses' radar, the nurses would have needed more information on how the project could improve patient care and quality metrics, along with the purpose, benefit, and implication of these improvements to increase participation.

Section 5: Dissemination Plan

The plan to disseminate this work to the institution experiencing the problem in practice will include a presentation to the executive leadership, in addition to distributing the final paper to the clinical staff on the unit. I also plan to disseminate the project for the broader nursing profession to the journals for two organizations. The first organization is the AACN whose journal is called *Critical Care Nurse*. It is a bimonthly, peer-reviewed clinical practice journal that provides relevant and useful information concerning the bedside care of critically and acutely ill patients and keeps nurses informed on issues that affect their practice (AACN Publishing, n.d.). I will also submit the project for dissemination through the PSA journal called *Patient Safety*. The journal supports improving the quality of healthcare in Pennsylvania, and beyond, by collecting and analyzing patient safety information, developing solutions to patient safety issues, and sharing this information through education and collaboration (PSA, n.d.). *Patient Safety* is not directed to only nurses, but to the healthcare service.

Analysis of Self

My role as a practitioner, scholar, and project manager during this project showed me that a DNP-prepared nurse must address patient care, quality improvements, and organizational goals, as well, as self-awareness of strengths and weakness from many directions. I see my role as being an advocate for my unit and other nurses. To promote any initiative, I have the ability to draw on my knowledge of research, interdisciplinary collaboration, and ability to critically appraise evidenced-based literature for its application. For my long-term professional goals, I can draw on this experience to be a

mentor for new and experienced nurses, in addition to mentoring managers that would like to pursue quality improvement projects.

When I began my DNP journey through the rigors of the didactic portion of the program, I enjoyed learning about being an advanced practice nursing scholar. I looked forward to the practicum portion but had difficulty finding a location for my project. I finally changed my project idea from a specific population to a more general population. After finding a practicum site and preceptor, the pandemic delayed completing my practicum hours for 6 months. After starting the practicum hours, my preceptor was encouraging and included me in meetings and seminars that expanded my appreciation of his role as a DNP-prepared clinical educator. I had personal challenges that affected my concentration on the writing portion of the project but was encouraged by my doctoral chair and family to complete each step, one at a time.

Summary

The goal of this DNP project aimed to fill the gap in knowledge and skill among the staff and improve the confidence level among LTACH nurses. The practice-focused question was: Did knowledge, skills, and confidence in using the current clinical monitoring system increase among LTACH nurses after receiving education on the clinical monitoring system? The results of showed that there was a very slight increase in knowledge among the nurses. However, the results showed a significant increase in confidence for navigating the clinical monitoring systems. The competency demonstrated that the staff knew how to navigate the monitoring system with small amount of

coaching. Overall, the project validated a need for structured education on the monitoring system for new hires and an annual competency.

References

American Association of Colleges of Nursing. (2006). *The essentials of doctoral education for advanced nursing practice.* http://www.aacn.nche.edu/dnp/Essentials.pdf

American Association of Critical-Care Nurses (AACN) Publishing (n.d.). *AACN publishing*. https://aacnjournals.org/

Baker, K., & Rodger, J. (2020). Assessing causes of alarm fatigue in long-term acute care and its impact on identifying clinical changes in patient conditions. *Informatics in Medicine Unlocked*, *18*(100300), 1-9. https://doi-org /10.1016/j.imu.2020.100300

Bi, J., Yin, X., Li, H., Gao, R., Zhang, Q., Zhong, T., Zan, T., Guan, B., & Li, Z. (2020). Effects of monitor alarm management training on nurses' alarm fatigue: A randomised controlled trial. *Journal of Clinical Nursing*, *29*(21/22), 4203–4216. https://doi-org /10.1111/jocn.15452

Brooks, C. A. (2016). Retention of baseline electrocardiographic knowledge after a blended-learning course. *American Journal of Critical Care*, *25*(1), 61–67. https://doi-org/10.4037/ajcc2016556

Cadet, V. N. (2014). Safe signals. Managing clinical alarm systems for optimal performance. *Health Facilities Management*, *27*(2), 29–32.

Centers for Medicare & Medicaid Services. (n.d.). *Long-term care hospital (LTCH) quality reporting program (QRP).* https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/LTCH-Quality-Reporting

Chen, S., Palchaudhuri, S., Johnson, A., Trost, J., Ponor, I., & Zakaria, S. (2017). Does this patient need telemetry? An analysis of telemetry ordering practices at an academic medical center. *Journal of Evaluation in Clinical Practice*, *23*(4), 741–746. https://doi.org/10.1111/jep.12708

Cosper, P., Zellinger, M., Enebo, A., Jacques, S., Razzano, L., and Neder Flack, M. (2017). Improving clinical alarm management: Guidance and strategies. *Biomedical Instrumentation & Technology*, *51*(2), 109–115. https://doi-org /10.2345/0899-8205-51.2.109

Institute of Medicine. (2010). *Report brief: The future of nursing: Leading change, advancing health*. http://www.nationalacademies.org/hmd/~/media/Files/Report%20Files/2010/The-Future-of-Nursing/Future%20of%20Nursing%202010%20Recommendations.pdf

Kukielka, E., Gipson, K. R., & Jones, R. (2019). A brief analysis of telemetry–related events. *Patient Safety*, *1*(2), 9-9.

Lorenzo Lewis, C., & Oster, C. A. (2019). Research outcomes of implementing CEASE: An innovative, nurse-driven, evidence-based, patient-customized monitoring bundle to decrease alarm fatigue in the intensive care unit/step-down unit. *Dimensions of Critical Care Nursing*, *38*(3), 160–173. https://doi-org/10.1097/DCC.0000000000000357

LTRAX (n.d.) *LTACH outcomes system: Welcome to www.ltrax.com.* https://www.ltrax.com/

Lukasewicz, C. L. & Mattox, E. A. (2015). Understanding clinical alarm safety. *Critical Care Nurse*, *35*(4): 45–57. https://doi.org/10.4037/ccn2015113

Oliveira, A. E. C. de, Machado, A. B., Santos, E. D. D., & Almeida, É. B. de. (2018). Alarm fatigue and the implications for patient safety. *Revista Brasileira de Enfermagem*, *71*(6), 3035–3040. https://doi-org/10.1590/0034-7167-2017-0481

Patient Safety Authority. (n.d.). *Patient safety journal.* https://patientsafetyj.com/index.php/patientsaf

Phillips, J., Sowan, A., Ruppel, H., & Magness, R. (2020). Educational program for physiologic monitor use and alarm systems safety: A toolkit. *Clinical Nurse Specialist: The Journal for Advanced Nursing Practice*, *34*(2), 50–62. https://doi-org/10.1097/NUR.0000000000000507

Rosswurm, M. A., & Larrabee, J. H. (1999). A model for change to evidence-based practice. *Image: Journal of Nursing Scholarship*, *31*(4), 317–322.

Ruppel, H., Funk, M., Whittemore, R., Wung, S. F., Bonafide, C. P., & Powell Kennedy, H. (2019). Critical care nurses' clinical reasoning about physiologic monitor alarm customisation: An interpretive descriptive study. *Journal of Clinical Nursing*, *28*(15–16), 3033–3041. https://doi-org /10.1111/jocn.14866

Sendelbach, S., Sandau, K. E., Smith, L., Kreiger, R., Hanovich, S., & Funk, M. (2019). Implementing practice standards for inpatient electrocardiographic monitoring. *American Journal of Critical Care*, *28*(2), 109–116. https://doi.org/10.4037/ajcc2019699

The Joint Commission (TJC). (2020). *2020 Hospital national patient safety goals.* https://www.jointcommission.org/-/media/tjc/documents/standards/national-patient-safety-goals/2020/simplified_2020-hap-npsgs-eff-july-final.pdf

The Joint Commission. (n.d.). *About our standards.* https://www.jointcommission.org/standards/about-our-standards/

Torabizadeh, C., Yousefinya, A., Zand, F., Rakhshan, M., & Fararooei, M. (2017). A nurses' alarm fatigue questionnaire: development and psychometric properties. *Journal of Clinical Monitoring and Computing*, *31*(6), 1305–1312. https://doi.org/10.1007/s10877-016-9958-x

Turmell, J. W., Coke, L., Catinella, R., Hosford, T., & Majeski, A. (2017). Alarm fatigue. *Journal of Nursing Care Quality*, *32*(1), 47–54. https://doi.org/10.1097/NCQ.0000000000000223

Walden University (n.d.). *My Walden student portal.* https://beta.my.waldenu.edu/#/dashboard

Whalen, D. A., Covelle, P. M., Piepenbrink, J. C., Villanova, K. L., Cuneo, C. L., & Awtry, E. H. (2014). Novel approach to cardiac alarm management on telemetry units. *The Journal of Cardiovascular Nursing*, *29*(5), E13–E22. https://doi-org/10.1097/JCN.0000000000000114

White, K. M., Dudley-Brown, S. & Terhan, M.F. (2016). *Translation of evidence into nursing and health care practice* (2nd ed.) Springer.

Appendix A: Table of Evidence

Article #	Author & Date	Evidence Type	Sample, Sample Size, Setting	Findings that help answer the clinical question	Observable Measures	Limitations	Evidence Level Evidence Quality
1	Phillip et al., 2020	Case Studies	Not applicable	Educational toolkit for physiologic monitor use and alarm safety	Not applicable	Not compared to other toolkits Provided as a guide, no measurable steps	6 Case Series, Case Report
2	Yeh et al., 2019	Prospective, cohort, pre- and post-design with repeated measures at baseline and post-phase I and II interventions	24-bed adult MICU in a 480-bed academic medical center	Using clinical alarm management programs, reduced non-actionable alarms	Total number of alarms reduced by 40% over a 14-day period. Non-actionable alarms decreased by 47%, arrhythmia alarms decreased by 46%	Healthcare workers were aware of the changes before the study period. No intervention-related adverse events were observed because adjustment did not compromise patient safety.	5 Cohort study

						The study focused on modifying default settings.	
3	Lewis & Oster, 2019	Exploratory nonrandomized, pretest and posttest, 1-group quasi-experimental study	74 RNs in a 36-bed ICU/SDU in a 368-bed, not-for-profit, Magnet-designated acute care facility	Implementation of the CEASE bundle helped reduce alarm signals without compromising patient safety. Nurse perception of alarm fatigue was reduced following the implementation of the CEASE bundle.	Total number of alarms decreased by 31%. Low priority Level 1 alarms time decreased 23 seconds. Level 2 time did not change. Level 3 time increased 246 seconds. Adherence to bundle increased 22.4%. RN perceived decreased in nuisance alarm decreased.	No control group for comparison. No randomization. Survey response low. Monitor system underwent software upgrade during the study. Increase in number of monitors displayed and relocation of monitor technician.	5 Cohort study
4	Sendlebach et al., 2019	Preintervention/ postintervention quasi-experimental study	297 patients that used remote monitoring in 627-bed	Implementation of order set was associated with an increase in appropriate monitoring	Increase in appropriate monitoring from 48% to 61.2%.	Staff changes before and after interventions may have completed comparisons.	5 Cohort study

			hospital			Order set was limited to general admission of the CMC staff.	
5	Bi et al., 2020	Randomized, single-blind trial	93 ICU nurses in a tertiary A-level hospital	Study showed association of nurses who received additional education on alarm management scored lower on alarm fatigue and had fewer total alarms and nonactionable alarms	Analysis of the groups showed experimental group with lower alarm fatigue scores and lower total number of alarms and nonactionable alarms than the control group. No difference tween groups of true crisis alarms	Possible omissions or errors in records may have occurred. Communication between the two groups was unavoidable and may have contaminated the control group.	4 Random Control Trial
6	Baker & Rodger, 2020	Quantitative survey, anonymous participation	Private long-term acute care facility with 80-beds across 3 locations. Survey opens 98	Survey findings showed high potential for alarm fatigue and opportunity improve patient safety by reducing alarm fatigue.	70% agreed or responded neutral that clinical changes were not missed. 73% agreed that current system alerted	Small sample size and improvement of survey questions.	5 Cohort study

			clinical staff; 60 responses were received.		them to serious changes in patient condition. 82% agreed that unit noise levels were too high. 35% agreed that most alarms were due to patient noncompliance.		
7	Turmell et al., 2017	Quality improvement project-Preintervention and postintervention data collection over a 2-year period	580-bed non-for-profit Magnet-recognized hospital	Alarm management program reduced alarms up to 30%	For daily electrode change: 33% reduction in alarms and 26% reduction in artifact alarms. For reducing nonactionable alarms: 33% reduction on one unit and 84% reduction on the other unit. For appropriate use of telemetry:	Trialed one strategy at a time on different units. Unknown results on implementing all strategies at one time on one unit. Team members changed during the project.	5 Cohort study

					average actual removal of 6 patients per day.		
8	de Oliveira et al., 2018	Quantitative and Observational study	20-bed adult ICU in a public teaching hospital	Study found absence or delay in response of team suggesting relevant alarms may be underestimated, and may compromise patient safety	Of 103 alarms activated, 66% of the alarms were not addressed. 66.1% of the alarms came from the multi-parameter monitor. 32% of the alarms were addressed by the nursing staff.	Data collected on one location. Results of the study may be affected by the Hawthorne effect.	5 Cohort study
9	Chen et al., 2016	Retrospective study	All telemetry orders in medicine and progressive care units at a US-based academic hospital	20% of patients were monitored for noncardiac reasons. Inappropriate use leads to increased costs, alarm fatigue, and inefficient nursing care	35.3% reasons were for Angina/ACS. 19.7% for arrhythmias, 10.2% for heart failure. 20.2% for noncardiac indications.	Did not assess the duration of the ordered telemetry, since most indications only needed 24-48 hours of monitoring. Cannot exclude possibility that patients with	5 Cohort study

						noncardiac indications had an appropriate reason for being on telemetry	
10	Ruppel et al., 2018	Qualitative study arm of mixed methods study conducted using an interpretive descriptive methodological approach	27 nurses from three ICUs in an academic medical center.	Nurses customized monitor alarms based on level of expertise and comfort, as well as being influenced by the culture on the unit, patient responses to alarms, and their own technical understanding of the monitors	Four themes were identified: alarm culture and context, nurse attributes, motivation to customize, and understanding how to customize the monitors.	Respondents were from one medical center and most had bachelor's degree. Also, the respondents were subjectively selected by the nurse managers and nurse educators	5 Cohort study

Dang, D. & Dearholt, S.L. (2018) Johns Hopkins Evidence-Based Practice: Model and Guidelines 3rd Ed. Sigma Theta Tau International.

Appendix B: Planning Grid for Curriculum

Learning Outcome(s):

Demonstrate competencies in use of clinical monitoring system and alarm management in the following areas

- Hardware and Connectivity
- Admission, Discharge, Leave of Absence
- Managing Monitor Alarms
- Appropriate Monitoring

Nursing Professional Development

Topical Content Outline	Time frame	References	Teaching method/learner engagement and Evaluation method
Pretest, education, and posttest	30 minutes	Completed pretest, then self-guided education, and complete posttest in one sitting. Survey and education available over a 3-week period	PowerPoint, Survey
Education and Simulation	60 minutes	Self-guided study available to refresh, prior to simulation and return demonstration. Hands-on simulation of clinical monitoring system provided.	PowerPoint, Simulation
Return demonstration	15 minutes	Completed during 2-week period	Competency

Appendix C: Evaluation Tools Demographic and Confidence Questionnaire,

Pretest/Posttest, Competency Checklist

Demographic and Confidence Questionnaire
Nurses' Confidence about Navigating Clinical Monitoring System

1. What is your gender?

☐ Male ☐ Female ☐ I prefer not to answer

2. What is your age?

☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60+

3. How long have you been in practice as a registered nurse?

☐ < 1 year ☐ 2-4 ☐ 5-7 ☐ 8-10 ☐ 11-15 ☐ 16+

4. How many years have you worked on the LTACH?

☐ < 3 months ☐ 6-9 months ☐ 1-2 year ☐ 3-4 years ☐ 5+years

		Strongly disagree	Disagree	Neither Agree or Disagree	Agree	Strongly agree
5	I am comfortable with navigating the clinical monitoring system.	1	2	3	4	5
6	I am able to address all clinical alarms in a timely manner.	1	2	3	4	5
7	I know which alarms are low, medium, and high priority.	1	2	3	4	5
8	I am comfortable individualizing my patient(s) alarm parameters.	1	2	3	4	5
9	I am able to complete care for my patients without interruption from frequent alarms.	1	2	3	4	5
10	I am able to troubleshoot non-actionable alarms.	1	2	3	4	5

PRETEST ON CLINICAL MONITORING SYSTEM

Instructions: Please circle the correct answer

Time to complete: estimated 10 minutes

1. The respiratory rate detection line can be accessed at
   a. The bedside monitor
   b. The central monitor
   c. The X2 portable monitor
   d. By placing the monitor on standby

2. The EASI lead placement is more accurate when the
   a. The Joint Commission says it is more accurate
   b. Monitor ECG setup indicates EASI
   c. Monitor ECG setup indicates Standard
   d. The patient has a pacemaker

3. Which lead(s) determines the respiratory rate from ECG
   a. The black and green lead
   b. The brown lead
   c. The red and white leads
   d. None of the leads

4. Where to retrieve/read strips from alarms from 2 days ago
   a. The bedside monitor
   b. The central monitor
   c. The X2 portable monitor
   d. By placing the monitor on standby

5. Where to clear sector on central clinical monitoring station?
   a. Clear the sector only with a physician’s order
   b. Clear the sector at the bedside monitor
   c. Clear the sector at the central monitor
   d. Clear the sector on the X2 portable monitor

6. When to place patient on standby
   a. Every time the nurse enters the room
   b. When administering medication
   c. When patient is off unit for a procedure
   d. When the patient is in the gym

7. When to change parameters on heart rate (HR)
    a. After assessing the patient's baseline
    b. Never change the parameters on the monitor
    c. When the physician orders adjustment the parameters
    d. During a rapid response

8. When to change parameters on respiratory rate (RR)
    a. Never change the parameters on the monitor
    b. When the physician orders adjustment the parameters
    c. During a rapid response
    d. After assessing the patient's baseline

9. What is difference between pulse and heart rate (HR)
    a. The heart rate comes from the $EtCO_2$ lead
    b. The difference is documented in Pennchart
    c. The pulse is from the SpO_2 device
    d. There is no difference

10. How to remove ECG monitoring for a patient
    a. Never remove ECG monitoring unless that patient is discharged
    b. Unplug the ECG cable
    c. Access ECG under Setup and switch to Off
    d. When a rapid response is called on the patient

Registered Nurse Competency
LTACH Specialty Hospital
Year: _____ Name: _____
PLEASE PRINT

Instructions: Evaluator sign and date when it is completed.

LTACH Clinical Monitor Competency
Demonstrate competencies in use of clinical monitoring system and alarm management in the following areas 1. Hardware and Connectivity 2. Admission, Discharge, Leave of Absence 3. Managing Monitor Alarms 4. Appropriate Monitoring

Method of Instruction • (S) Simulation • (P) Packet, self-learning	Method of Evaluation • (R) Return Demonstration • (O) Observation (in clinical setting) • (V) Verbal Review	Method of Instruction	Evaluation Method	Evaluator Initials	Date
Competency Area 1: Hardware and Connectivity					
Identify monitors' major hardware components and connectors (NBP, ECG, SpO_2					
Describe the functions of alarm lamps and front panel color indicators					
Report device malfunctions to service personnel					
Clean and disinfect monitors and monitor accessories per manufacturer guidelines					
Competency Area 2: Admission, Discharge, Leave of Absence					
Admit patient to central and bedside monitors appropriately (Last name, first initial of first name, MRN number, male/female, paced or non-paced status)					
Discharge patient from central and bedside monitors					
Place patient in standby for Leave of Absence (LOA) or off unit procedure from central and bedside monitors					
Edit patient information after admission					
Set monitor to standby mode and resume from standby monitoring					

Method of Instruction • (S) Simulation • (P) Packet, self-learning	Method of Evaluation • (R) Return Demonstration • (O) Observation (in clinical setting) • (V) Verbal Review	Method of Instruction	Evaluation Method	Evaluator Initials	Date
Competency Area 3: Managing Monitor Alarms					
Differentiate different types of waves to manage (e.g., ECG, RR, SpO2)					
Differentiate the priority (e.g., from low to medium to high priority) visual alarm indicators					
Differentiate the priority of alarm messages based on visual alarm indicators					
Adjust respiratory rate detection line					
Change the size of a waveform					
Pause alarms and cancel the pause					
Silence alarms					
Troubleshoot common device issues					
Change alarm limits safely and appropriately (based on current patient status and treatment plan) per unit policy					
Acknowledge alarm messages appropriately					
Customize default settings to patient specific per unit policy					
Competency Area 4: Appropriate Monitoring					
Describe best practices in electrode placement (frequency of changing electrodes, skin preparation) and place electrodes appropriately					
Explain the information displayed in trend windows					
Place electrodes appropriately for Standard and EASI placement					
Select the optimal SpO2 a measurement site					

Staff member _____ Date _____
SIGNATURE

Evaluator _____ Date _____
SIGNATURE