Reducing Early Warning System Unreported Events in an Acute Care Setting Using Education and a Communication Tool

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Dedication

I dedicate this DNP QI Project paper to my mother, Luciana Margarita Pennington de Ocampo. My mother has always been a role model throughout my life. She encouraged and acknowledged my accomplishments with celebration. My mother never settled for less and took what little she had to convert into something significant, but she always depended on the Lord and Savior. At 87 years old, my mother continues to serve as an example of how to relate to life's changing events. My accomplishments reflect my mother's accomplishments throughout her life. Thank you, Mom.

Acknowledgments

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Abstract

The inability of the healthcare team to identify and report Early Warning System (EWS) patient events can result in further patient deterioration and delays in providing needed care. The purpose of this DNP Quality Improvement (QI) project was to initiate a QI solution using evidence-based practice (EBP) to address unreported EWS patient events on inpatient medical and surgical units at one healthcare institution. This DNP project instituted education and re-education of staff on EWS and utilized an EWS Communication Tool (ECT) to reduce unreported EWS scores >4 or a score of >2 for a single EWS parameter thereby improving EWS response times and positively influencing patient outcomes. The data collected involved reported and unreported EWS patient events representing pre- and post- QI implementation. Using Social Cognitive Theory (SCT) as a framework and the Model for Improvement, the DNP student provided the medical/surgical staff EWS education, re-education, and the ECT. Data collected revealed that some EWS parameters were more frequently missed than others. Analysis also revealed a significant association between travel nurses in the post-QI implementation period and unreported EWS events. Both factors can be considered when planning future education. A positive finding was the increase in reporting for an EWS score of three in the post-implementation period. Continued implementation of the QI project's interventions can help sustain this and other encouraging findings.

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Project Overview

Introduction

The Early Warning System (EWS) is an evidence-based scoring system that uses vital signs (VS) and nursing assessments to detect changes in a patient's physical parameters (Conway-Habes et al., 2017). Research shows that when patients have multiple physical parameters with small physiological changes, it can indicate possible deterioration in their overall physical condition (Parrish et al., 2017). Parrish et al. (2017) found that small physiological changes related to VS, oxygen requirements, and mental status in patients could predict a patient's deterioration and, over a span of time, if these VS changes are ignored, could lead to a Rapid Response Team (RRT) response, Code Blue Team (CBT) response, or fatality.

A patient's VS, oxygen requirements, and mental status are represented numerically by EWS scores. The EWS assigns a range for each physiologic parameter representing the patient’s VS, oxygen, and mental status. Each physiological range is assigned a score from zero to three (see Appendix E). A score of three assigned for a single parameter, such as a VS, oxygen requirement, or mental status, would indicate the need for intervention by the healthcare team at the patient’s bedside. Additionally, a patient's physiological parameters resulting in a combined EWS score greater than four would also require a healthcare team response to the patient's bedside (Parrish et al., 2017). The goal of the bedside intervention, when EWS scores prompt, is to escalate care to prevent further physiological deterioration (Conway-Habes et al., 2017). This goal of early intervention by the healthcare team has been shown to reduce unplanned advanced critical care interventions such as an RRT or a CBT response (Flenady et al., 2020).

When EWS scores are adequately assessed, and prompt response initiated, patients are more likely to have positive outcomes (Danesh et al., 2019; Parrish et al., 2017). Studies show that implementation of EWS can reduce RRT activations (Parrish et al., 2017), and when combined with additional surveillance by a designated response team, CBT responses and unplanned Intensive Care Unit (ICU) transfers were lowered (Danesh et al., 2019). Furthermore, it has been found that electronic communication of EWS scores and critical VS values directly to designated critical care nurses led to earlier activation of EWS (Heller et al., 2020; Huff et al., 2019; Lang et al., 2019).

However, literature shows that often there are delays or failures in the documentation and notification of VS, causing delays or failures in activating the EWS system (Redfern et al., 2019). Delays or failures in VS documentation are attributed to a lack of adequate staffing or understanding of critical VS values (Kellett & Sebat, 2017; Redfern et al., 2019). Reduced compliance with EWS and incomplete documentation can also reduce EWS's effectiveness to improve patient outcomes. In a study addressing the quality of recorded EWS scores that used VS measurements, only 62 percent had complete documentation for EWS analysis (Eddahchouri et al., 2021). Furthermore, Eddahchouri et al. (2021) found that delays in VS documentation lasted up to nine hours. These delays in VS documentation led to missed opportunities to detect clinical deterioration and activation of EWS. The delays in EWS detection and activation conflict with the benefits of EWS, thereby allowing patient deterioration to progress and adversely impact patient status. EWS depends on timely and accurate assessment of physical parameters and early activation by healthcare staff to benefit patients.

Patient status depends on surveillance from healthcare providers and VS and

EWS are tools used to warn of physiological deterioration (Kellett & Sebat, 2017). Studies show that combining wireless VS machines that automatically document VS in the electronic health record (EHR) and calculate EWS scores, along with an electronic alert system to notify EWS nurses can lead to increased surveillance of patients and earlier intervention (Heller et al., 2020; Huff et al., 2019; Wong et al., 2017). Advanced technology such as electronic or automated communication of vital signs and EWS scores to healthcare providers can improve early activation of the EWS response (Huff et al., 2019; Lang et al., 2019). In addition, studies show that providing education, training, and re-education of nurses and ancillary staff on EWS and use of an EWS Communication Tool (ECT), can influence timely activation of an EWS response leading to positive outcomes for patients (Al-Kalaldeh et al., 2019; Jensen et al., 2018).

Problem Statement

EWS scores rely on VS measures and are used for earlier identification of patients with deteriorating conditions (Eddahchouri et al., 2021). Studies show that errors in how VS and EWS scores are documented or interpreted can result in delays in patient care (Kellett & Sebat, 2017). These delays in care can lead to further patient deterioration resulting in unplanned ICU admissions, RRT or Code Blue activations, and even fatalities (Danesh et al., 2019). Therefore, process revisions and improvements, including Wireless Electronic Alarm Alerts (WEAA) that go directly to EWS personnel, can be an essential step to help prevent delays and improve timely care for deteriorating patients (Heller et al., 2020). In addition, EWS education, re-education, and the use of the ECT are interventions that can reduce failures to activate an EWS response (Al-Kalaldeh et al., 2019; Jensen et al., 2018).

Purpose of the Project

The purpose of this Doctor of Nursing Practice (DNP) Quality Improvement (QI) project was to initiate QI solutions using evidence-based practice (EBP) to address delays to activate an EWS response on inpatient medical and surgical units at one healthcare institution. The QI solutions involved revisions to the current process for alerting the EWS team of physical parameters and EWS scores that may indicate deterioration. Key accomplishments of this project were education and re-education of staff on EWS and the ECT to improve timely response to EWS scores >4 or a score of >2 for a single EWS parameter. Studies indicate that WEAA provides the EWS team with an opportunity for quicker response times that lead to positive patient outcomes. However, this QI project did not implement this solution due to time and financial constraints.

Clinical Question

The clinical question was described using a mnemonic derived from the elements of a population, intervention, comparison, outcome, and time (PICOT).

On a medical and surgical unit for adult in-patients (P) where there have been failed or delayed activation of EWS responses, do process changes with systematic implementation of WEAA for EWS parameters sent to EWS nurses, EWS education and re-education on EWS and VS, and a communication tool addressing EWS decision and activation (I) when compared to the current practice (C), reduce unreported combined EWS scores >4 or a score >2 for one single EWS parameter (O) over a two month period (T).

Succinct Synthesis/Analysis of Supporting/Related Literature

Search Strategies

The Cumulative Index of Nursing and Allied Health Literature (CINAHL) Full-Text, Medical Literature Analysis and Retrieval System Online (MEDLINE), and PubMed databases were accessed to search articles. The database searches were limited to articles published by 2017. The search terms applied to the database searches are as follows "early warning system," "early warning system delay," "early warning system failure," "failure to rescue vital signs," "failure to rescue prevention," "monitoring EWS," and "timely vital signs." A total of 10,139 articles resulted from the search terms used in the combined databases. Of those, 7,398 were determined to be duplicate articles and were eliminated.

The remaining 2,617 articles were screened by reading titles, abstracts, and conclusions. Those involving research that addressed maternity patients, patients under 18 years of age, settings outside a hospital or specialty clinic, or a specific disease or treatment were excluded, as were articles in a foreign language. In addition, articles irrelevant to the topic, such as global temperature and early warning signs (Chevalier & Grenouillet, 2018), were excluded from the literature review. In total, applying the exclusion criteria led to 2,523 articles being removed. The remaining 94 articles were read and evaluated for research addressing EWS QI interventions to increase timely EWS activation, such as electronic alarm alerts, education, training, and using communication tools. There were 28 articles excluded because the QI interventions, continuous monitoring combined with EWS or continuous VS wearable devices, were deemed unfeasible for implementation at the project site.

Ultimately, 14 articles remained for this synthesis of the literature. In addition, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram (see Appendix A), a visual depiction of the literature search, and a Table of Evidence, both in the appendices, provide additional means of understanding the literature synthesis (see Appendix B).

Synthesis

This literature review uncovered QI interventions that address delays to activate an EWS response by nurses and ancillary medical personnel. Research articles studying timely VS and EWS alert interventions were reviewed to identify solutions that could be implemented.

Background

Early Warning System (EWS)

EWS depends on timely, accurate, and consistent VS measurement to generate an EWS score (Le Lagadec & Dwyer, 2017). EWS is based on EBP research to predict and prevent patient deterioration. Patient deterioration resulting in critical care interventions within 48 hours from a critical VS can be preventable using EWS (Downey et al., 2017). Patients benefit from accurate VS measurements and timely activation of elevated EWS scores because they can prevent further physiological deterioration (Le Lagadec & Dwyer, 2017). VS taken accurately, consistently, and followed with a proper clinical assessment provides patients and healthcare providers valuable information (Kellett & Sebat, 2017).

Failure to Rescue

Failures in responding to a patient’s VS or EWS score, and delayed discovery of these events, can lead to delays in the proper healthcare response reducing the effectiveness of EWS (O’Neill et al., 2021). Failure to rescue research addressed events where healthcare providers often miss patient physiologic indicators that signal patient deterioration (Burke et al., 2022; Shah et al., 2018). Physiological indicators include patients’ VS as predictors of patient deterioration. VS that are ignored, not recorded accurately, or that lack prompt reporting when warranted are not unique to a particular healthcare system (Credland et al., 2018; Eddahchouri et al., 2021; Flenady et al., 2020; Lee et al., 2020). When indicated, failure to address VS or EWS scores can lead to further patient deterioration. These failures may result in a RRT, CBT, unplanned ICU admission, or fatality (Gielen et al., 2021; Treacy & Caroline Stayt, 2019). When frontline healthcare clinicians fail to react or report VS or EWS scores, the discovery of failed responses is often a result of secondary surveillance of the EHR (Ye et al., 2019). This secondary surveillance, instead of in-time recognition with EWS activation has been found to delay patient care (McGrath et al., 2019).

EWS Quality Improvement Project

Three themes noted in the literature for QI interventions had positive outcomes. These three themes were initially considered realistic from both a time and monetary perspective for implementation in this DNP QI project. The first theme was instituting WEAA to notify healthcare providers such as EWS nurses (Heller et al., 2020). The second theme was education and re-education of healthcare providers on EWS, VS, and activating an EWS response (Samim et al., 2020). The last theme noted in the literature review was communication tools promoting EWS activation by guiding healthcare providers on appropriate EWS interventions and assessments (Credland et al., 2018; Kangas et al., 2021; Mau et al., 2019). As a result of the literature review, the QI project's interventions included education for new staff, re-education on EWS for current staff, and a communication tool to guide staff on necessary EWS assessments and interventions. Although WEAA was supported in the literature review this solution was not implemented due to time and financial constraints.

It is also important to mention that the literature review indicated other interventions not selected for this project. First, the literature supported continuous electronic VS monitoring of patients and EWS scores. Studies showed favorable outcomes with reduced delays in EWS activation, but it was determined that this level of monitoring was not a feasible QI intervention for this DNP QI project (Leenen et al., 2020; Weenk et al., 2017; Youssef Ali Amer et al., 2020). In addition, research showed patients wearing continuous VS monitoring devices on medical and surgical floors was an effective method to alert healthcare providers of the patients' critical physiological changes. This method too, was determined not feasible for implementation in this DNP QI project (Downey et al., 2020; Leenen et al., 2021; Weenk et al., 2019; Weller et al., 2018).

EWS/Vital Signs Wireless Electronic Alarm Alerts

The QI project interventions considered a WEAA solution whereby an alert is generated electronically when critical VS and/or EWS scores warrant and sent directly to the EHR and the EWS nurses. With this solution, the concerning VS or EWS-generated data is wirelessly and automatically transmitted directly from the Electronic Wireless

Vital Sign Machines (EWVSM) to the EWS nurses. This QI intervention would quickly notify EWS nurses to respond to a patient's critical VS or EWS score (Ashbeck et al., 2021).

The literature review indicated several other solutions that used technology to improve EWS and are shared here to support WEAA as an effective intervention. A study by Mau et al. (2019) embedded the EHR with EWS parameters and enhanced tools to assist nurses and ancillary staff in identifying risk of clinical deterioration. Mau et al. (2019) found that the technology enhancements decreased the time patients spent in clinical deterioration by communicating acute physiological patient status promptly, thus allowing for immediate interventions by staff.

Heller et al. (2020) studied an automated EWS scoring system with paging functionality on two post-surgical units. The study described that there were increased EWS notifications through paging to charge nurses, primary team physicians and Medical Emergency Team (MET) physicians who provided improved deterioration detection. In addition, the automated EWS scoring system sent out pages to staff and allowed for prompt bedside therapeutic solutions, resulting in fewer MET and ICU interventions (Heller et al., 2020).

Another study referenced in support of WEAA was by Huff et al. (2019), which initiated an electronic VS alert system based on EWS at a 172-bed community hospital involving three nursing units. The goal was to improve the frequency and documentation of VS and clinical outcomes. Huff et al. (2019) found that the electronic VS alert system improved the identification of patient's clinical deterioration at early stages.

A study by Safavi et al. (2021) implemented a surveillance software program to remotely monitor otolaryngology and ophthalmology patients continually and automatically in a 24-bed general surgical care unit. The surveillance software monitored patients' physiological data based on VS and lab results from the EHR. The surveillance software transmits a page to the surgical and remote critical care anesthesiology teams when a patient's physiological deterioration is found. Due to the loss of on-site anesthesia support during the unit's night shift, the surveillance software of the study allowed for remote surveillance of patients in the surgical care unit. The remote surveillance software allowed for increased monitoring of surgical patients without an increase in staffing (Safavi et al., 2021).

After the literature review, it was clear that studies support using electronic alarm alerts to indicate critical changes to VS and EWS scores to help improve early recognition of patient deterioration. This QI project considered the benefits of WEAA and intended to use the institution’s EWVSM to generate alerts directly to the EWS nurses. The goal of using the EWVSM to alert the EWS nurses was to reduce patients' time in clinical deterioration (Mau et al., 2019). A WEAA provides healthcare providers timely results on VS and/or an EWS score and allows healthcare providers to decide the appropriate intervention in a timelier manner (Heller et al., 2020; Huff et al., 2019; Safavi et al., 2021). While the WEAA solution generating critical vital signs and EWS scores wirelessly from the EWVSM directly to the EWS nurses could have benefited communication and activation of EWS, time and financial constraints prevented this intervention from being implemented during the project period. The possibility of WEAA implementation for the agency will be addressed in the future.

EWS Education, Re-Education, and Training

Understanding the significance of VS results and how they relate to EWS scores is essential for patient care staff (Saab et al., 2017). Literature supported the use of education, re-education, and training on EWS to improve timely identification and response. Therefore, education of new staff, travel nurses, and re-education of staff on EWS was utilized as an intervention in this DNP QI project.

A pilot study by Ashbeck et al. (2021) found that on a 27-bed unit, initial education when EWS was implemented resulted in improved communication between nurses and physicians. The study concluded that nurses felt empowered to page physicians about their patient's clinical deterioration because of EWS implementation (Ashbeck et al., 2021).

Mau et al. (2019) conducted a study involving three medical/surgical units and a cardiac telemetry unit using EWS to determine if education and enhanced tools developed to support EWS resulted in quicker stabilization of clinical deterioration in medical/surgical nursing units. The study revealed that education on EWS helped to address lack of reporting critical vital signs and EWS scores to EWS staff (Mau et al., 2019).

Flenady et al. (2020) found that intra- and interprofessional training and education at an institution impacted how nurses and physicians interacted clinically in using EWS to determine patient acuity. The study explored sociocultural factors through semi-structured interviews with 30 acute care clinicians to understand clinical compliance with the EWS system. They found that intra- and interprofessional training promoted staff behavior supporting EWS use (Flenady et al., 2020).

Saab et al. (2017) systematically reviewed 11 articles that addressed ten studies on EWS education and its effect on nurses' knowledge, confidence, and clinical performance. The systematic review indicated that EWS educational programs improved how nurses calculated EWS scores. Four studies indicated an improvement in recording VS after various educational programs. Two studies showed improved nurses' confidence levels after a 4-week e-learning module. However, several studies in the review did not result in a statistically significant improvement in nurses' ability to detect clinical deterioration and escalation of care after education or training. The systematic review indicated that the studies' sample sizes may have influenced results.

Foley and Dowling (2019) aimed to describe how nurses use the EWS in an acute medical ward along with compliance. The researchers used a qualitative study design and interviewed nine nurses and two healthcare assistants who staffed a 15-bed short-stay hospital unit. Their study found that education, training, behavioral changes, and the use of electronic devices could help overcome barriers to use and compliance with EWS. Understanding barriers to introducing EWS can help healthcare institutions and those implementing QI project interventions to increase the likelihood that EWS will be effective (Foley & Dowling, 2019).

Other studies determined that continued education and training for nurses and ancillary staff was an effective means to improve the use of an EWS (Al-Kalaldeh et al., 2019; Jensen et al., 2019). For example, Al-Kalaldeh et al. (2019) studied the benefits of an education program to improve the detection of patient deterioration using EWS in an emergency department. Of the 232 participants, 118 completed the EWS educational program, while 114 did not receive the education intervention. The study concluded that the educational intervention improved the nurses' self-efficacy in EWS early detection of patients' deterioration. In a qualitative study, Jensen et al. (2019) examined 296 nurses' perceptions and reactions to EWS implementation at a Norway hospital. As part of EWS implementation, each nurse completed EWS education with 4 hours of training and seminars. The study revealed that education resulted in nurses having a strong commitment to patient safety and their role to identify early signs of patient deterioration.

Reviewed studies, provided adequate evidence to support the use of education and re-education to reduce EWS response times and were therefore, chosen as QI interventions for this DNP project. The EWS education, re-education, and training of the medical/surgical staff for this DNP project included a review of EWS assessments, VS, EWS scores, and how to intervene. The QI educational intervention provided nurses and ancillary staff additional guidance on activating an EWS response, thus allowing EWS nurses to respond quicker to an event. In addition, education of new and re-education of current staff focused on reporting EWS events involving a score of three for a single EWS parameter which had been identified as an opportunity for improvement at the DNP project site.

A Written Tool to Improve EWS Communication

Research showed that another QI measure to address delays in reporting a critical vital sign or EWS score is making readily available a written reference tool that provides healthcare persons with guidance on EWS (Burger et al., 2017). Burger et al. (2017) created a written communication tool that could be referenced to enhance the decisions made by healthcare providers using the EWS system. Their study involved 25 participants composed of nurses and doctors and sought to validate the communication tool developed. Having a written tool on EWS parameters and the EWS score communicates to the healthcare providers the requirements for EWS activation. The communication tool was a quick reference guide to help staff make decisions based on VS and EWS scores that indicate patient deterioration (Burger et al., 2017). Burger et al. (2017) found that the communication tool helped staff identify changes in physiological parameters so that an early response to patients' clinical deterioration was initiated.

After reviewing the literature, the DNP student decided that the DNP QI project would use an ECT to guide staff on EWS scoring and how to intervene when an EWS event occurs. The ECT aimed to assist staff in making decisions for timely EWS activation and thereby generate a quick response by EWS nurses. In the planning phase, the DNP project designed the ECT to place emphasis on an EWS score of three for a single VS parameter due to delays by staff to activate an EWS response related to this specific scoring situation.

Conclusion

Studies show that WEAA to EWS nurses are effective in addressing clinical staff's delays to act on critical VS or EWS scores (Heller et al., 2020; Huff et al., 2019; Mau et al., 2019; Safavi et al., 2021). Studies also found that education and re-education of healthcare providers on VS, EWS, and EWS scores is an effective QI intervention addressing EWS compliance (Al-Kalaldeh et al., 2019; Flenady et al., 2020; Foley & Dowling, 2019; Jensen et al., 2018; Saab et al., 2017). Lastly, research articles supported using an ECT (Burger et al., 2017). While determined effective, the WEAA intervention will be considered as a solution in the future since time and financial constraints prevented implementation during the DNP project period. Therefore, the remaining three interventions were chosen as solutions for this DNP QI project to help reduce delays in reporting an EWS event.

Conceptual/Theoretical Framework & QI/EBP Model

Social Cognitive Theory

Social Cognitive Theory (SCT) is the theoretical framework selected for this DNP project to improve EWS response times. SCT informs how people, their behaviors, and the environment play a role when changing health behaviors. SCT has three main factors that influence whether a change in health behavior occurs: self-efficacy, goals, and outcome expectations (National Cancer Institute [NCI], 2005). Self-efficacy is an individual's confidence in overcoming challenges and barriers (Aliakbari et al., 2020). As SCT directs, setting goals and taking small steps towards those goals allows the individual to increase their self-efficacy (Smith et al., 2020). Furthermore, understanding the benefits of observing others' behaviors and their outcomes and recognizing one's self-progress toward positive outcomes can reinforce modified behaviors (Aliakbari et al., 2020; NCI, 2005).

First Factor

The DNP student used the factors and concepts of SCT as a guide when planning and implementing the quality improvement initiative to improve timely response to EWS scores. First, with self-efficacy, it is necessary for leadership, patient care staff, and EWS nurses to have confidence in their ability to effect positive change on the current delays noted with responses to EWS scores. The DNP student helped build the staff and nurses' confidence by sharing articles and data showing similar issues with EWS response times at other institutions and how the planned interventions for this QI project were effective at addressing the delays.

Second Factor

A second factor, goal setting, prompted the DNP student to plan small goals, since taking incremental steps could aid in reaching the overall goal. The overall goal of the QI project was to improve timely EWS activation and reduce delays in EWS responses. One incremental goal for this quality improvement project included preparing a teaching plan considering the staff's current knowledge of the EWS. Another incremental goal was how EWS scores relate to the prognosis of a patient's deterioration if not addressed by activation of a response. Focusing on the EWS score of three for a single EWS parameter which warrants activation was addressed during the re-education of staff and a factor in the design of the ECT. This was necessary because it had been noted these activations were regularly missed at the project site. The ECT also guided a combined EWS score greater than four. Another incremental goal was establishing buy-in from administrators and staff for the QI project's implementation. The last incremental goal was to review the current EWS response process at the project site and determine if additional changes were needed to improve timely responses.

In total these goals allowed administration and staff to consider the need for improvements, understand the proposed changes in the current system, and help them see the benefit of making behavior changes or supporting staff behavior changes. Completing these smaller goals helped the DNP student move toward achieving the overarching goal to improve timely EWS responses and reduce delays in EWS activations.

Third Factor

The last SCT factor is termed outcome expectancies which in this DNP project is when staff understand and/or experience through observation or their own action that the behavior change of activating EWS, and the resulting timely response can positively influence their patient's status. For example, EWS nurses who respond in a timely manner to EWS scores or critical values, model the desired behavior for other staff members while also reinforcing this behavior themselves. This behavior, in turn, will provide other nurses, ancillary staff, and EWS nurses motivation to act quickly when a patient's EWS score, or critical vital sign needs immediate evaluation.

SCT Concepts

In addition to these factors, SCT integrates six concepts: reciprocal determinism, behavioral capability, expectations, self-efficacy, observational learning, and reinforcement. Each will be further explained though self-efficacy was addressed as a factor above and therefore will not also be addressed here as a concept. First, reciprocal determinism is the interaction of behavior in adjusting to an environment (Schunk & DiBenedetto, 2020). The individual either adjusts the setting to align with the individual's conduct or makes behavior changes to align with the environment. In this project, reciprocal determinism is seen when staff makes behavior changes to align with the desired environment by implementing actions that increase timely EWS activation (NCI, 2005).

Behavioral capability, the second SCT concept, addresses using learning and skills training to increase knowledge related to changing health behaviors (Aliakbari et al., 2020; NCI, 2005). An example of behavioral capability concerning this quality improvement project is providing nurses and ancillary staff with re-education on EWS activation. This re-education leads to an improved understanding of the EWS, how EWS scores relate to the prognosis of a patient's deterioration and the need for timely responses.

The SCT concept of expectations in behavior is based on outcome expectations; for example, individual A witnessed another individual B receiving a positive comment from a colleague for performing an activity which resulted in individual A also acting with the expectation of receiving a positive comment from others (Schunk & DiBenedetto, 2020).

The fifth SCT concept is observational learning, where the desired behavior is modeled and observed by others, encouraging their adoption of the behavior (NCI, 2005). An example of observational learning with this DNP project would be when staff and/or nurses are observed activating the EWS response promptly, encouraging their colleagues to do the same. The last SCT concept is reinforcements which explain the role of how incentives can encourage or promote positive behavior change (Aliakbari et al., 2020).

The Model for Improvement

The Model for Improvement developed by Associates in Process Improvement was chosen as the quality improvement model to help guide this project. The model uses three questions to address improvement projects (1) What are we trying to accomplish, (2) How will we know that a change is an improvement, (3) What changes can we make that will result in improvement (Moran et al., 2020).

When considering the first question in The Model for Improvement, what are we trying to accomplish, the DNP project strives to improve timely responses for EWS scores >4 or three for one single EWS parameter. Because improving timely responses is the goal for this project, all work, time, and effort were directly related to accomplishing it. Using the Model for Improvement helped the DNP student keep this goal at the forefront of their mind throughout the planning, implementation, and evaluation stages.

The second question, how will we know that a change is an improvement, was answered by comparing EWS notification events during the pre-implementation period of October 1 to November 30, 2021, with the post-implementation period of October 1 to November 30, 2022. The comparison of data from these two phases, one before and one after implementing the solution, was the means for determining if the QI implementations led to an improvement in reporting EWS events.

The Model for Improvement's third and final question, what changes can we make to improve, began with a literature review to identify EBP solutions. Reviewing possible solutions that were realistic and feasible for this institution guided final decision-making choices for interventions that were implemented in this DNP project. In addition, the Model for Improvement's last question also provided guidance after project implementation to adjust or identify new changes to ensure positive outcomes are achieved and/or maintained. In summary, applying the Model for Improvement with its three overarching questions to this QI project helped the DNP student identify and keep in mind critical aspects, including identifying the goal, evaluating the change, and selecting solutions that lead to improvement.

Project Design

Methodology

This DNP project used current literature and a QI design to implement changes to improve EWS activation and timely response at one government medical facility. Studies show that the three QI interventions selected, education on EWS, a process change instituting WEAA for EWS scores, and incorporation of a communication tool can be used to address delays and failures to activate EWS responses (Al-Kalaldeh et al., 2019; Burger et al., 2017; Huff et al., 2019; Jensen et al., 2018; Mau et al., 2019). To measure the effectiveness of these interventions, the project site's EWS Database (ED) was accessed to collect data on EWS events. The ED, housed within Microsoft's Access (MA) database program, provided records of EWS-related events, including associated EHR documentation, patient EWS scores, and the EWS nurses' response times. Quantitative EWS data prior to implementation of the QI measures was collected and compared to data collected post-implementation to determine if QI interventions helped improve reporting of EWS events and timely response by EWS nurses.

Participants

The population for the QI project includes patients over 17 years of age who are US military veterans admitted to one of the project site's three medical/surgical units. Excluded participants were pediatric or maternity patients and/or those admitted to units other than the medical/surgical units. The sample size of participants was 264 individuals. The project also involved medical/surgical unit staff, including nurses and ancillary staff, unit education specialist, clinical nurse leaders, and EWS nurses responsible for responding to EWS needs on the medical/surgical units. The number of healthcare staff involved in the project was a total of 24 people.

Setting

The setting for the QI project was one government medical facility which has three medical/surgical units, each located on separate floors. The patient capacity for each unit is up to 35 patients though the combined three medical/surgical floors are currently limited to 50 patients because of isolation restrictions related to the Covid-19 Pandemic. The patient population is primarily divided by one unit focused on surgical patients and the other two units on medical patients, but each unit can have both types of patients. Each medical/surgical unit is staffed by nurses, ancillary technicians, unit clerks, education specialist, clinical nurse leader, and unit managers. Staffing on each medical/surgical unit consists of three to five nurses, one unit clerk, and three to four ancillary technicians. Each unit has additional staffing Monday-Friday from 07:30 a.m. to 4:00 p.m. day shift, which includes one educational specialist, a day shift clinical nurse leader, an evening shift clinical nurse leader, two assistant nurse managers, and one unit manager. Monitoring and providing EWS support for the combined medical/surgical units are the EWS nurses, which consist of one nurse per 12-hour shift each day and night.

Tool

This QI project used a table created in Excel to gather data from the ED (see Appendix C). Patient's gender, age, race, and diagnosis stored in the institution's EHR were collected without patient identifiers. Data was collected for each EWS event present in the ED during the prescribed pre and post implementation periods. In the Excel table, data collected for each EWS event included the EWS response time, the EWS score, associated VS, and nursing assessments such as Level of Consciousness (LOC), oxygen use, and pulse oximetry readings. Each EWS event involved data collected for the pre-implementation and post-implementation periods. During the post-implementation period, travel nurses were added to the medical/surgical units to supplement staffing, and this data was collected as well. The Excel file was then converted to the International Business Machines (IBM) Statistical Package for the Social Sciences (SPSS) file.

Intervention

This DNP project aimed to implement EBP changes to improve reporting of patients' EWS scores that warranted intervention. Three initiatives were planned: one focused on improving the current EWS process, a second on EWS education and re-education of staff and nurses and the last use of an ECT.

A significant change to the current EWS process at the project site was implementing WEAA to notify EWS nurses. Unfortunately, implementing the WEAA solution was not feasible during the DNP project due to time and financial constraints. The WEAA solution is planned once there is approval by the collaborating institution and the manufacturer of the VS machines. The DNP student in the future, will coordinate with the manufacturer of the VS machines and the project site's Biomedical Engineering department, to facilitate the implementation of the WEAA solution. Upon WEAA implementation, when a patient's vital signs and EWS assessments are added to the project site's VS machines, any VS and EWS scores indicating patient physiological deterioration will be automatically detected and electronically transmitted wirelessly to the EWS nurse.

The first QI intervention implemented, was initiated in September 2022, and focused on re-educating current nurses and staff who utilize the EWS and initial education for those who had not previously been educated on EWS at the project site. Studies have identified re-education and training for staff on EWS as an effective QI initiative (Al-Kalaldeh et al., 2019; Foley & Dowling, 2019; Jensen et al., 2018; Saab et al., 2017). One education specialist and two clinical nurse leaders were available to re-educate groups of staff on their assigned units during day and evening shifts along with the DNP student. A total of four-morning teaching events and four-evening teaching events were performed for the QI project and staff were given an opportunity to ask questions as well. The DNP student also conducted teachings to reach staff that did not attend the planned teaching events. In these instances, the DNP student used a one-on-one teaching approach which allowed other staff on the units not involved to continue delivering healthcare to patients without interruption.

A teaching plan developed by the DNP student, was used to ensure consistency with the education. The teaching plan was based on a ten-item outline (see Appendix F). The ten items were:

1. The purpose of the EWS.
2. VS and the EWS scoring to evaluate patient acuity.
3. The benefits of EWS to patients, healthcare teams, and institutions.
4. Activating an EWS response promptly improves patient outcomes.
5. Failure to activate an EWS response.
6. Evidence-based research in support of EWS.
7. How to use the EWS Communication Tool.

8. Instructions and use of the electronic wireless VS machines.
9. Documentation of EWS findings in the EHR.
10. EWS nurses' surveillance and electronic wireless alarm alerts.

Another QI intervention was the addition of an ECT (see Appendix E). The ECT served as a resource for the medical/surgical staff in providing the proper EWS course of action to prevent further patient deterioration. The ECT was individualized for this project site, which highlighted that an EWS score of three for a single EWS parameter necessitated EWS activation. This focus of the ECT was necessary to address a lack of activating an EWS response by staff in this specific scoring situation. The ECT also addressed EWS parameters and EWS scores, resulting in an EWS score greater than four with recommendations for activating an EWS response. The final ECT revision guided the staff on EWS activation parameters and proper steps to activate an EWS response (Foley & Dowling, 2019; McCabe et al., 2019).

Data collection procedures

The DNP student gathered EWS activation and response time data from the ED. De-identified data for each EWS event were collected for the pre-and post-implementation periods. Data in the ED for each EWS event was collected for the pre-implementation period between September 2021 to November 2021. Data was then collected for the post-implementation period, which spanned September 2022 to November 2022 and reflected the QI interventions. In each period, data collected consisted of the date and time of the EWS event, the patient's gender, age, race, diagnosis, the time of EWS activation, non-activation of the EWS, and the EWS nurse's response time. During the post-implementation period, travel nurses were added to the medical/surgical units to supplement staffing, and this data was collected as well. The pre-and post-implementation data gathered from the ED was transferred to the EWS Data Analysis Excel file to run statistical comparisons between pre-implementation and post-implementation for the QI project. From there, the EWS Data Analysis Excel file was converted to an SPSS data format to run additional statistical analysis.

Institutional System Analysis (SWOT)

The DNP student performed an analysis of strengths, weakness, opportunities, and threats (SWOT) in preparation for the QI project using a SWOT analysis table (see Appendix G). SWOT was performed to provide information about the institution that would be useful with initiating and maintaining the QI project’s interventions.

Strengths

Strengths for this QI project included support for the change, current technology, and staff knowledge. Regarding support for the QI change, one of the project's strengths is that EWS nurses were motivated to resolve the concerning rise noted in the non-activation of the EWS and in reducing EWS nurses' response times to EWS patient events. Through EWS nurses' group emails, EWS nurses have voiced concerns about the frequent occurrence of non-activation of the EWS system. An additional concern is a delay in the care of patients by the EWS nurses due to the delay or non-activation of the EWS. Therefore, EWS nurses wanted to see a change in the current trend. Another strength is the government medical facility's use of EWVSM, which record the patient's VS directly via wireless technology into the patient's EHR. Wireless recording of VS is a strength because this functionality allows for quick documentation into the EHR.

Furthermore, these enhanced EWVSM can automatically calculate the EWS score for patients. This functionality will allow the project site in the future to initiate WEAA by simply upgrading software on the current system. Another strength of this project is that nurses and ancillary staff have some knowledge of the EHR, EWVSM, and EWS because they have previously received training on the technologies and processes. Therefore, it was expected that there would not be a steep learning curve associated with the QI project's education interventions.

Weakness

The major weaknesses with implementation of this QI project were threefold, the DNP student's lack of experience, budgetary concerns, and time constraints. The DNP student facilitated the implementation of this QI project but lacked experience and knowledge, having never done so before. Budgetary concerns were a weakness because high monetary costs were associated with implementing WEAA. This WEAA intervention meant administrators needed to be on board with funding WEAA. Even with their support, the situation was complicated because the fiscal budget for 2023 was already in place. The DNP student was unfamiliar with how administrators at the government medical facility initiate funding for projects after a fiscal budget is in place and is aware that initiating new spending may be time-consuming. Another weakness was that time was limited due to the constraints of the DNP curriculum, which complicates initiating a system-wide change like the implementation of WEAA.

Opportunities

Opportunities were that other healthcare agencies may acquire knowledge afforded by this QI project to help address their institution's concerns with timely activation of EWS responses. As a result of the QI interventions, the project helped patients on the medical/surgical units receive a timely EWS response and the full benefit of an EWS's activation. In addition, the QI project may benefit the government medical facility by reducing costs related to unplanned ICU admissions, RRTs, and CBTs, which literature shows can occur with delayed responses (Lang et al., 2019; Wu et al., 2021; Ye et al., 2019).

Threats

A threat to the project was the cost of software and equipment upgrades for the EWVSM. Due to budget constraints, it was difficult for the institution to provide funding for the upgrades for the EWVSM. An additional threat was that patient information could be placed at risk related to the software and equipment upgrades required for the WEAA.

Implementation Timeline

The Salisbury University (SU) IRB approval was initiated and received during Spring 2022 (see Appendix J). The institution's approval, which deemed IRB unnecessary, was received in the Summer of 2022. An addendum was submitted for revisions to the EWS communication tool, with subsequent SU IRB approval received in August 2022. During a meeting with personnel from the project site and the manufacturer of the EWVSM in September 2022, both parties determined that WEAA was not feasible at this time. The meetings resulted in the implementation of the WEAA to be considered for the future. The education, re-education, and training for EWS and the ECT were implemented in mid-September 2022. Pre-implementation data from the ED covering October 1 to November 30, 2021, was collected during October 2022. Post-implementation data was collected at the end of November 2022. Aside from WEAA not being implemented as part of the DNP project, the other interventions and data collection occurred as planned without any major delays.

IRB and Institution Approval

The SU IRB application was submitted and approved during the Spring 2022 semester. A SU IRB addendum for changes made to the ECT was submitted in August 2022 and received approval that same month. Additional revisions to the data collection methods, such as the inclusion of VS data associated with EWS scores and the addition of travel nurses' role in EWS events, were submitted to SU IRB in October 2022 and November 2022 and received approvals in both respective months.

The Institution's Site Authorization letter for the DNP QI project was initiated by the DNP student and requested through the institution's Nurse Research Coordinator in February 2022. After a literature review and Executive Summary were presented to the institution's Nurse Research Coordinator, the project was recommended for approval to the Director of Nursing Education, Research, Practice, Outcomes, and Recruitment. In January 2022, the Director generated a Site Authorization Letter for the DNP student to proceed with the QI project (See Appendix D). The institution's Nurse Research Coordinator and the DNP student submitted the institution's IRB application and was notified that IRB approval was not needed (see Appendix I).

Project Implementation

Discussion on Project Implementation

The objective of the DNP QI project was to improve reporting of EWS events. The DNP QI project implemented education for new staff and travel nurses and re-education for current staff which focused on improving reporting EWS events and activation of a response. Additionally, all staff received education for the new EWS communication tool (ECT) which was developed as part of the DNP QI project. The EWS communication tool (ECT) was designed to increase staff awareness of and guide when an EWS score warranted activation.

Barriers and Facilitators

The DNP student evaluated the implementation of this project and in doing so identified barriers that challenged and facilitating factors that aided this DNP QI project. Barriers and facilitating factors exist in the implementation of any project (Morris et al., 2021). This section will address three facilitating factors and three barriers that came into play during implementation.

Facilitating Factors

The three facilitating factors that aided implementation of the project were the planning that went into the education intervention, the staff's eagerness to learn and the DNP student's commitment to educating staff. First, regarding planning, the DNP student considered when the medical/surgical unit's staff would be available for re-education on EWS and the ECT. The DNP student also recognized the need to reach night shift staff as part of the DNP QI interventions. It was determined that the periods before change of shift, at 6:00 am and 5:00 pm, would be most conducive to the group teaching events. This plan facilitated efficient implementation of the education intervention. Additionally, it was recognized that having a set outline which addressed the educational objectives would help with consistency of the information provided to staff.

The second facilitating factor was the staff's eagerness to learn. It was noted that the staff was genuinely engaged in the information being presented. Evidence of the staff's eagerness to learn was indicated by their being attentive and the questions they asked throughout the teaching events.

The third facilitating factor was the DNP student's commitment to educating the staff. For those staff who did not attend a group teaching event, the DNP student held individual one-on-one teaching sessions. While this approach may not be sustainable long-term, it was feasible for the initial implementation.

Barriers

Upon reflection of the DNP project, there were three barriers that came into play during implementation and each of these will be individually addressed here. One barrier was the delivery error of the ECT causing it to arrive a week late after initially being sent to the wrong address. As a result, there was a one-week delay in the EWS re-education intervention because it relied on the ECT being available so its use could be explained. Once the error was discovered, the DNP student was able to utilize communication skills and facilitate timely resolution of proper delivery of the ECT preventing further delays.

Another barrier was the lack of established relationships with night shift staff as the DNP student and night shift staff were unfamiliar with each other. This unfamiliarity was a barrier that was noted when presenting the re-education on EWS and the ECT because there were not any pre-established relationships which could have helped facilitate these sessions. While the DNP student depended on principles of interprofessional collaboration and communication throughout the whole of the project, it was determined that these skills were especially important with night shift staff (Schentrup et al., 2019).

The DNP student's lack of familiarity with the institution's procedures and funding of QI projects was a barrier to WEAA implementation. The WEAA implementation was a primary DNP QI intervention that proved promising through research evidence to improve reporting of EWS events. The meetings between the institution and the manufacturer of the EWVSM initially were supportive with moving forward. However, it was later determined that funding and time constraints meant that implementation of WEAA would be delayed and is planned for future implementation.

Summative Evaluation of Implementation Process

It is known that institutions have opportunities to improve reporting of EWS scores that warrant intervention which can benefit patient outcomes (Samim et al., 2020). The QI project implemented EWS education, re-education, and use of an ECT to improve reporting for combined EWS scores > 4 or a score > 2 for one single EWS parameter by staff on the medical/surgical unit at one healthcare institution. Improved reporting by staff was meant to decrease the number of EWS events where patients with critical scores are discovered through secondary surveillance of EHR by the EWS nurses.

The time given for EWS education, re-education, and the introduction to the ECT for the DNP QI project implementations involved four daily morning and evening sessions. The DNP student was the key person in providing the educational sessions with minor assistance from the educational specialist and the clinical nurse leaders. The staff responded well to the educational sessions when the educational specialist and the clinical nurse leaders participated with the educational sessions. The educational specialist and the clinical nurse leaders often provide training and teaching events for the staff. Having them during the EWS education, re-education, and ECT presentations added incentive for the staff to participate during the presentations. The teaching sessions assisted with upholding the institution's policy of an EWS intervention by educating staff that the healthcare team is expected to respond within one hour after an EWS event is activated. Furthermore, during re-education on EWS and the ECT, it was noted that the staff were engaged and receptive. This was evidenced by their being attentive and asking questions throughout the teaching events. It was also a positive sign when the education specialist wanted copies of the ECT to help educate future new staff.

The DNP student considered the frequent events involving failure to report an EWS response where there was an EWS score of three for a single EWS parameter when designing the ECT. Therefore, a primary focus of the tool was highlighting the need to report the EWS score of three for a single EWS parameter. The ECT also drew attention to a combined EWS score greater than four. Together, EWS education and the ECT were designed to increase staff awareness and guide staff when an EWS score warranted activation. Also, in designing the ECT, the DNP student considered the material it would be printed on and where it would be placed. The ECT was printed and then laminated and was placed on each EWVSM on the medical/surgical units. The staff appreciated the size and durability of the laminated ECT by verbalizing that ECT was well made and useful where it was located.

Data collection for the DNP QI project compared a similar period a year prior to implementation of the DNP QI interventions. The data collection pre-implementation timeframe was October 1 to November 30, 2021, and post-implementation was October 1 to November 30, 2022. In the pre-implementation period, there were 170 reported EWS events and 36 events that were not reported. Following implementation of the QI solutions, the DNP student found there were 94 reported EWS events and 19 events that were not reported. This means there were fewer unreported EWS events after implementation of the QI interventions. Fewer unreported EWS events helped decrease the delay of EWS nurses’ responses and helped patients receive EWS interventions per the agency policy of an EWS response to the bedside within one hour.

A major setback to improve reporting of EWS events was the inability to implement WEAA as part of the QI project. This inability related to the institution’s timeline to implement a project of this scale and the time constraints of the DNP student’s project courses. In addition to timing, the institution’s funding for the WEAA project required institutional approval and agreement on cost by both the manufacturer of EWVSM and the institution. WEAA would have generated an alert to the EWS nurses as soon as a patient’s VS is taken on the EWVSM that warranted intervention. This solution for the QI project would have been an additional intervention to improve reporting of EWS events and the accelerated response time by EWS nurses.

An unreported EWS patient event can cause a delay in care by staff, providers, and EWS nurses to address the event within the prescribed one-hour response period identified in the institution’s policy. Due to the presence of unreported events, EWS nurses must then rely on finding events that warranted EWS activation through secondary surveillance of the EHR. The primary priority of EWS nurses is attending to patients with elevated EWS scores on the medical/surgical units. The need for second surveillance to discover unreported EWS patient events can delay the responses by EWS nurses up to several hours. Depending on when the EWS nurse performs secondary surveillance of the EHR and discovers an unreported EWS event, determines how delayed the EWS response for that patient is. The DNP QI interventions benefited patients by reducing unreported EWS events by staff. In addition, there was a decrease in total reported EWS events after the QI interventions compared to the previous year for the same period. The decrease in reported EWS events could possibly reflect improved staff awareness of patients' physiological status meaning that staff are identifying deterioration even before EWS scores warrant intervention.

Having more time and funding, the DNP student would have taken further steps to implement WEAA. Implementing the WEAA in the future is another intervention that can help improve reporting of EWS events and reduce delays in responding to an EWS event. Through WEAA, EWS nurses are alerted directly to a patient's EWS score and VS, allowing immediate response to a patient's condition. Further coordination between the institution and the manufacturer, can provide the project site with WEAA abilities leading to improvements in EWS responses.

The sustainability of the QI project's interventions, and future implementation of the WEAA should be considered. The sustainability of any improvements with EWS related to the DNP QI project will require ongoing education on EWS and the ECT. Staggard scheduling is suggested as a means of educating, for example, planning twice a year teaching events to ensure that education of newly hired staff, and travel nurses and re-education of current staff is done on a systematic basis. The education and re-education on EWS and the ECT could be a responsibility shared between the medical/surgical unit's education specialist, clinical nurse leaders, and the EWS nurses. The reprinting of the ECT as part of the sustainability of the QI project would be best assigned to the EWS nurses because the EWS nurses already have experience in reprinting materials for the EWS and storing the educational material associated with EWS.

Analysis and Discussion of Findings

Analysis

The medical/surgical staff documents EWS patient events in the EHR. The EWVSM updates the EHR with vital signs and the associated EWS parameter score. When there is an EWS patient event, EWS nurses document in the EHR and the ED the care delivered by the healthcare team because of activation. In addition, EWS nurses document in the EHR and the ED unreported EWS patient events when these have been discovered through secondary surveillance. Therefore, the EHR and ED were sources of data used for collection in this DNP QI project.

The data representing EWS patient events for pre and post implementation were collected through a retrospective review of the ED. Pre-implementation records of EWS patient events in the ED were reviewed from October 1 to November 30, 2021. Post-implementation records of EWS patient events were reviewed in the ED from October 1 to November 30, 2022. These dates were selected to compare the same period but different years to minimize outliers from the data collected. Both the pre-and post-implementation EWS patient events were treated as independent samples from each other since the EWS events involved different patients during separate periods. Each EWS event represents a patient’s physiological changes associated with an EWS parameter and score. For statistical analysis, total EWS patient events from the ED included both reported and unreported EWS patient events. The dependent variable of this QI project was the failed reporting of EWS patient events' relationship with the DNP QI intervention.

There was a total of 264 EWS patient events recorded in the ED using Microsoft's Access (MA), with 170 EWS patient events in the pre- implementation period and 94 in the post-implementation period. The data collected from MA was then transferred to Microsoft Excel (ME) to generate a data format acceptable for SPSS. The ME file was then transferred to SPSS and converted to an SPSS data file. Each EWS event in SPSS was then compared with the institution's EHR to verify accuracy and was updated in SPSS without patient identifiers.

Descriptive Statistics

There are three levels of measurement that can be applied to a variable in SPSS, nominal, ordinal, and scale (Windle & Throckmorton, 2007). Characteristics of the variables of the QI project are presented with the level of measurement identified.

The patient's gender was captured for EWS events and presented in Table 1. Of the 170 events in the pre-implementation period, 92.4% were males (n=157) and 7.6% were females (n=13). Of the 94 events during the post-implementation period, 97.9% were males (n=92) and 2.1% were females (n=2). The variable for gender was classified as nominal in SPSS.

Table 1

DNP QI Project Gender for Pre- and Post-Implementation

Pre-	***Gender***		***Frequency***	***Percent***
	Male		157	92.4
	Female		13	7.6
		Total	170	100.0
Post-	***Gender***		***Frequency***	***Percent***
	Male		92	97.9
	Female		2	2.1
		Total	94	100.0

Patient ages for the pre-implementation period ranged from 37 to 90 years, with a mean of 68.4 years and a mode of 66. Patient ages for the post-implementation ranged from 46 to 95 years, with a mean of 71.9 years and a mode of 75. The variable for age was classified as scale data in SPSS.

When reviewing EWS events, the patient's race was categorized as White, Black, Hispanic, Asian, and Pacific Islander and presented in Table 2. The race demographics for pre-implementation were 51.8% White (*n*=88), 47.6% Black (*n*=81), and 0.4% Pacific Islander (*n*=1). The race demographics for post-implementation patients were 39.4% White (*n*=37) and 60.6% Black (*n*=57). The variable for race was classified as nominal in SPSS.

Table 2

DNP QI Project Race for Pre- and Post-Implementation

Pre-	***Race***	***Frequency***	***Percent***
	White	88	51.8
	Black	81	47.6
	Pacific Islander	1	0.6
	Total	170	100.0
Post-	***Race***	***Frequency***	***Percent***
	White	37	39.4
	Black	57	60.6
	Total	94	100.0

Demographics for the pre- and post-implementation periods were similar with there being more males than females and similar mean ages. These demographics also align with the usual population at the institution. There was a difference noted with race demographics as the pre-implementation period included more white patients and fewer black patients than the post-implementation period.

Descriptive percentages of reported and unreported EWS events for pre- and post-implementation were compared and presented in Table 3. Of the 170 events during the pre-implementation period, 78.8% (*n*=134) were reported, and 21.2% (*n*=36) were not reported. Of the 94 events during the post-implementation period, 79.8% (*n*=75) were reported, and 20.2% (*n*=19) were not reported. Therefore, in both periods, there were more reported than unreported EWS events.

Table 3

EWS Patient Events for Pre- and Post-Implementation

Pre-	***EWS Events***	***Frequency***	***Percent***
	Reported EWS	134	78.8
	Unreported EWS	36	21.2
	Total	170	100.0
Post-	***EW Events***	***Frequency***	***Percent***
	Reported EWS	75	79.8
	Unreported EWS	19	20.2
		94	100.0

Data collected included the actual EWS scores where reporting of a patient event was warranted. The total score for each EWS patient event and the associated EWS parameter scores were analyzed and measured as ordinal in SPSS. The QI project focused on decreasing all unreported events with particular emphasis on EWS patient events that warranted activation.

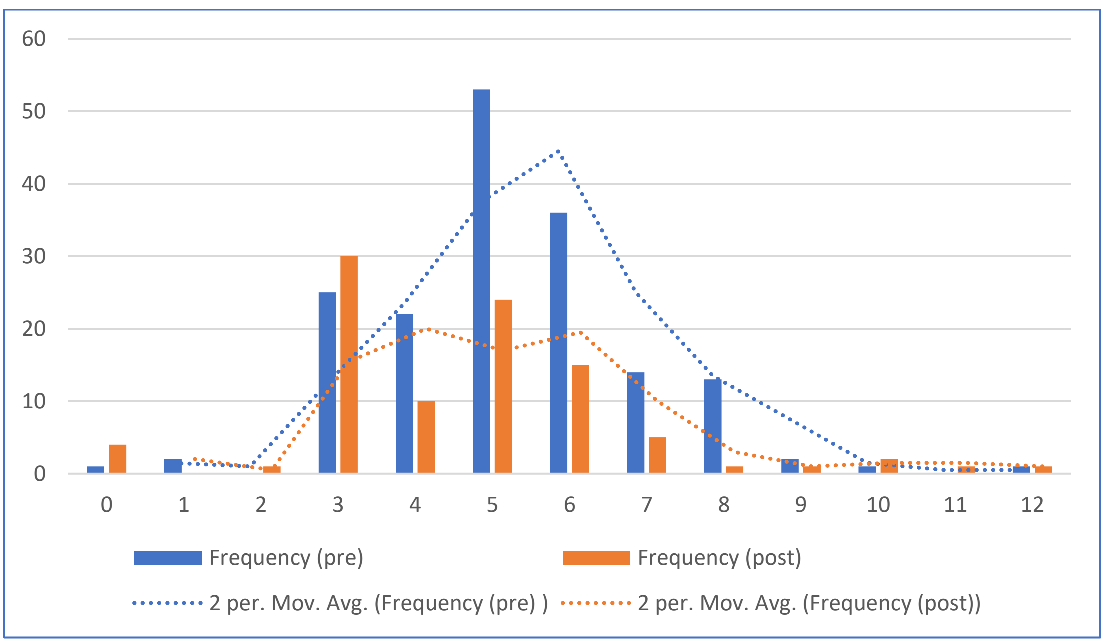
When considering the frequency of activated EWS events' scores, differences were noted between the pre- and post-implementation periods. As seen in Table 4, the EWS activation score of three in the pre-implementation period occurred 25 times, or 14.7% of events, and in the post-implementation period the score of three occurred 30 times, or 31.9% of events; therefore, the score of three activated twice as many EWS events when the QI changes were being implemented. Additionally, the EWS activation scores of 4, 5, 6, 7, and 8 decreased indicating a shift toward the lower score of three to recognize and activate an EWS event (Figure 1).

Table 4

EWS Score for Activated Events Pre- and Post-Implementation

EWS Scores	***Frequency (pre)***	***Percent***	***Frequency (post)***	***Percent***
0	1	.6	4	4.3
1	2	1.2	0	0
2	0	0	1	1.1
3	25	14.7	30	31.9
4	22	12.9	10	10.6
5	53	31.2	24	25.5
6	36	21.2	15	16.0
7	14	8.2	5	5.3
8	13	7.6	1	1.1
9	2	1.2	1	1.1
10	1	.6	2	2.1
11	0	0	1	1.1
12	1	.6	1	1.1
Total	170	100.0	94	100.0

Figure 1
EWS Score Frequency Pre- vs. Post-Implementation



Data for EWS scores were also separated by those reported and those not reported in the pre- and post-implementation periods. Again, reviewing the score of three for activation of events as a particular interest in the DNP project, it was found that 44% (*n*=11) of events in the pre-implementation period and 70% (*n*=21) of events in the pos-implementation period were activated with this score (Table 5). Therefore, the score of three activated 26% more events after QI changes were implemented.

Table 5

EWS Score for Reported and Unreported Events

Score	Reported (Pre)	Reported (Post)	Unreported (Pre)	Unrepor (Post
0	1	4	0	0
1	2	0	0	0
2	0	1	0	9
3	***11***	***21***	14	5
4	15	5	7	3
5	44	21	9	1
6	33	14	3	1
7	12	5	2	0
8	12	1	1	0
9	2	1	0	0
10	1	2	0	0
11	0	0	0	1
12	1	0	0	0
TOTAL	**134**	**75**	**36**	**19**

Each of the seven EWS parameters could be scored from zero to three, and each EWS patient event's total score depended on the parameter(s) identified for the event. When reviewing EWS events for both samples (n=264), the three largest means occurred for oxygen saturation (Sat) at 1.18, Systolic Blood Pressure (SBP) at 1.10, and Oxygen at 0.99 as see in Table 6.

Table 6

EWS Score Parameters for All EWS Events

	n	Mean	Std. Deviation	Minimum
EWS Temperature Score	264	.14	.405	0
EWS Heart Rate Score	264	.97	1.031	0
EWS Respiratory Score	264	.52	.983	0
EWS SBP Score	264	1.10	1.272	0
EWS Sat Score	264	1.18	1.209	0
EWS Oxygen Score	264	.99	1.002	0
EWS LOC Score	264	.08	.483	0

The DNP student stratified the reported and unreported events for both samples (*n*=264) per the seven parameters to evaluate the difference between pre-and post-implementation scores as provided in Table 7. Using a Kruskal-Wallis test for ordinal data, the mean rank for Sat score was 130.37 for reported events versus 140.6 for unreported events, and the mean rank for SPB was 131.29 for reported events versus 137.1 for unreported events. Of note, the Sat and SBP scores were the most frequently included parameters in the overall EWS scores for both reported and unreported events.

Table 7

Kruskal-Wallis Test for EWS Events (n=264)

	EWS Events	*n*	Mean Rank
EWS Temperature Score	Reported EWS Events	209	134.52
	Unreported EWS Events	55	124.81
	Total	264	
EWS Heart Rate Score	Reported EWS Events	209	137.07
	Unreported EWS Events	55	115.13
	Total	264	
EWS Respiratory Score	Reported EWS Events	209	136.42
	Unreported EWS Events	55	117.61
	Total	264	

EWS SBP Score	Reported EWS Events	209	131.29
	Unreported EWS Events	55	137.10
	Total	264	
EWS Sat Score	Reported EWS Events	209	130.37
	Unreported EWS Events	55	140.60
	Total	264	
EWS Oxygen Score	Reported EWS Events	209	141.60
	Unreported EWS Events	55	97.94
	Total	264	
EWS LOC Score	Reported EWS Events	209	132.16
	Unreported EWS Events	55	133.80
	Total	264	

The differences of time of an unreported EWS event occurred and the time a EWS nurse responded was compared to pre-implementation and post-implementation periods. The pre-implementation minimum time an EWS nurse responded to an unreported EWS event was 13 minutes. The maximum time an EWS nurse responded to an unreported EWS event was six hours and 30 minutes. Of the 36 unreported EWS events in the pre-implementation period, the average response time by an EWS nurse was two hours and 25 minutes or 145 minutes.

During post-implementation of the DNP QI project the minimum time EWS nurses responded to an unreported EWS event was four minutes and the maximum time an EWS nurse responded to an unreported EWS event was four hours and 46 minutes. There was a total of 19 unreported events in the post-implementation period and the average response time by an EWS nurse was one hour and 42 minutes or 102 minutes. Therefore, the average response time decreased by 43 minutes.

Inferential Statistics

Data analysis included statistical tests to determine if correlations existed among several variables. The results of these tests and their implications are provided in this section.

Race

The percentage of White and Black patients with EWS events was similar in the pre-implementation sample but different for the post-implementation sample. A chi-squared test was performed to determine if a relationship existed between race and EWS scores. Race was not found to be statistically significant X^2 (20, n = 170) = 15.35, p = .756 which was anticipated.

The percentage of White and Black patients with EWS events differed in the post-QI intervention. The chi-squared test again found no statistical significance between EWS scores and race, X^2 (10, N = 94) = 13.28, p = .208. This means that even though there were a larger representation of the Black race in the post-QI intervention sample, it did not reach statistical significance.

Travel Nurses

In the post-implementation period, a total of 94 EWS patient events occurred, 75 reported and 19 unreported. When analyzing these events, it was determined that seven of the 19, or 36.7%, involved a travel nurse. A chi-squared test found this staffing factor to be statistically significant X^2 (1, n = 94) = 29.86, $p < .001$, meaning that travel nurses at the institution were associated with unreported EWS events (Table 8).

Table 8

Chi-Square for Reported and Not Reported EWS Events Post-Implementation

		EWS Reported	EWS Unreported	Total
Travel Nurse	Travel Nurse Assigned	0	7	7
	Regular Staff Assigned	75	12	87
Total		75	19	94

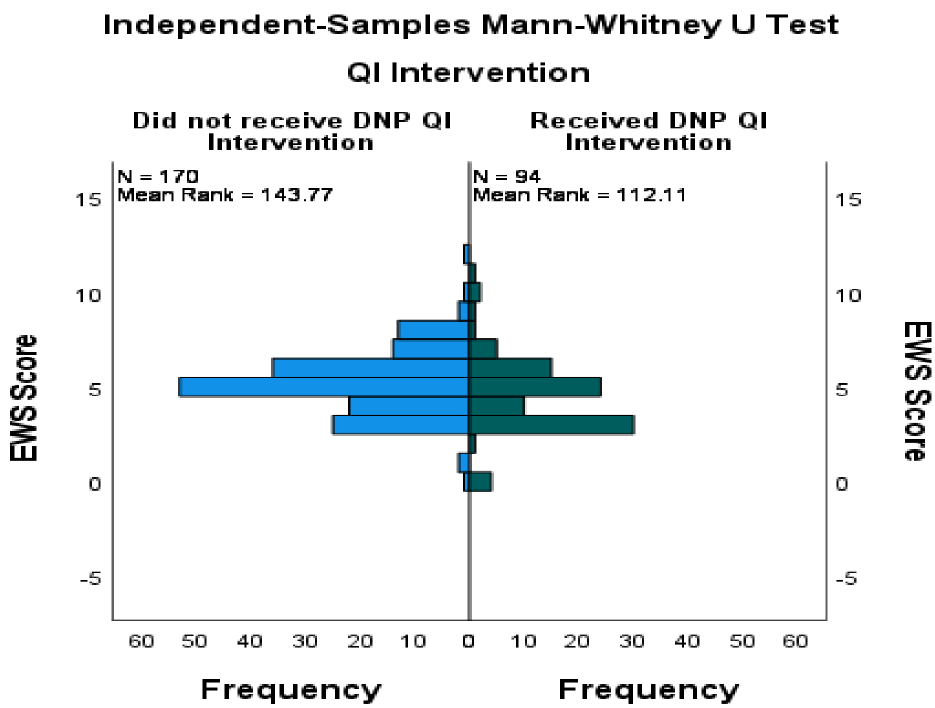
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	29.855[a]	1	<.001
Continuity Correction	24.749	1	<.001
Likelihood Ratio	24.820	1	<.001
Fisher's Exact Test			
Linear-by-Linear Association	29.537	1	<.001
N of Valid Cases	94		

Scores & Time

The DNP project's objectives aimed to improve reporting of EWS patient events when scores were warranted and to evaluate response times to those events. The institution’s sample of patients representing pre- and post-implementation EWS events and the mean scores were compared using a Mann-Whitney U Test for independent samples (Figure 2). The null hypothesis that the distribution of EWS scores is the same across categories of the QI interventions was rejected ($p < .001$). Therefore, reporting of EWS events at different activation scores was found between the samples and shifted to a lower score, below seven and more at the score of three, as discussed earlier. This shift supports a positive impact from the QI interventions to activate EWS events.

Figure 2

Relationship between Pre- and Post-Implementation means for EWS Scores



The pre- and post-implementation EWS events ($n = 264$) and the time for EWS nurses to respond to the events were also analyzed (Table 9). A Pearson's correlation test was performed in SPSS to determine if there was a relationship between the time a patient's EWS parameter occurred and the time the EWS nurse responded to the patient. The relationship between the patients' EWS parameter event and the time for response was found to be statistically significant, r (53) = .64, $p < .001$.

Table 9

Pearson's Correlation: Time between EWS Event and Response

		EWS Event Time	EWS RN Response time
EWS Event Time	Pearson Correlation		.644**
	Sig. (2-tailed)		<.001
	N		55
EWS RN Response time	Pearson Correlation	.644**	
	Sig. (2-tailed)	<.001	
	N	55	

**. Correlation is significant at the 0.01 level (2-tailed).

An independent-samples t-test was performed on the difference of time between an EWS nurse's response to an unreported EWS event for pre- and post-implementation. There was a statistically significant difference between pre-implementation (M = 2:25, SD = 1:31) and post-implementation (M = 1:42, SD = 1:17) in response times by EWS nurses $t(53) = 1.7$, $p = 0.04$.

Discussion

Surveillance of a patient's physiological status is the responsibility of healthcare providers and the healthcare institution. EWS provides a means for healthcare institutions to identify even minor physiological changes that warrant intervention by healthcare personnel to prevent further deterioration in a patient's status. EWS scores based on a patient's physiological changes in their VS, mental status, oxygen dependence, and oxygen saturation to alert healthcare providers of impending deterioration. Further patient deterioration can ensue when there are delays in reporting physiological changes that warrant intervention. EWS events recorded at the project site are either reported by staff and healthcare providers or are discovered through secondary surveillance of the EHR by EWS nurses.

The institution uses EWVSM to update patients' VS and EWS scores directly to the EHR upon a patient's VS being taken by the staff. How often staff takes a patients' VS throughout their shift is based on the healthcare providers' orders. When staff does not report critical EWS scores and VS, they are discovered by EWS nurses during secondary surveillance of the EHR. The frequent surveillance of the EHR every four hours by EWS nurses provides a final, albeit less than ideal, solution to address patients' physiological changes that, if left unnoticed, could lead to further physiological deterioration. Ideally, staff are aware of a patient's physiological changes that warrant intervention and report the EWS event promptly versus it being later discovered by EWS nurses through EHR secondary surveillance.

The pre-and post-implementation samples represented patients needing intervention because of their EWS scores. In both the pre- and post-implementation periods, there were significantly more men, over 90%, than females. The average age was approximately 70 years for both the pre-and post-implementation periods. There was a difference in race, with White being predominate for the pre-implementation and Black for the post-implementation period. Overall, the demographics for patients with EWS events in the pre- and post-implementation periods were similar to the patient population demographics at the project site.

The QI project's interventions aimed to minimize unreported EWS patient events that result in delays in the delivery of an EWS response. Post-implementation data indicated a reduction in both reported and unreported EWS patient events. In addition, total events between the pre-intervention and post-intervention show a significant reduction from 170 in the pre-implementation period to 94 in the post-implementation period. The reduced EWS events during post-implementation may possibly reflect positive outcomes of earlier identification of patient needs from EWS education, re-education, and the ECT implementation.

A point of concern was that EWS nurses at the project site often found EWS patient events through secondary surveillance of the EHR and then activated the EWS response for these unreported events. EWS nurses activating EWS responses were categorized as unreported EWS patient events, and there were 36 pre- and 19 post-implementations. This means there were 17 fewer patients in the post-implementation period who received a delayed EWS response. The decrease in the total number of unreported EWS events in the post-implementation period may be due to increased confidence and awareness of staff to report EWS patient events. However, this change in reported EWS events may also relate to the fact that there was an overall reduction in EWS patient events. In the pre-implementation period, there were 170 events, and this dropped to 97 events in the post-implementation period. Regardless, the lower number of unreported EWS events in the post-implementation period does indicate an overall positive change for patient care.

The total EWS score for EWS patient events in the pre- and post-implementation periods ranged from zero to 12. The data for each total EWS score was identified by reported and unreported EWS patient events for pre- and post-implementation. The DNP QI intervention objectives were to reduce unreported EWS patient events and improve staff recognition of an EWS patient score of three for a single parameter. A frequency descriptive analysis was performed for each pre- and post-implementation total EWS patient score. Comparison between pre- and post-implementation for EWS event scores indicated a reduction for each EWS event score post-implementation except for the EWS score of three. This possibly indicates that EWS education, re-education, and the ECT helped staff increase awareness to each EWS event's score and EWS events involving a score of three for a single parameter.

When considering frequency of specific scores between the pre- and post-implementation periods, the score of three is of interest because it was recognized that there was an opportunity at this project site for improved reporting if a single parameter scored a three. The frequency for an EWS score of three was 25 (14.7%) in the pre-implementation period and 30 (31.9%) in the post-implementation period. Although there was an increased frequency for the total EWS score of three in the post-implementation period, comparisons between reported and unreported EWS patient events provide further information. The data shows that there were 11 reported and 14 unreported EWS events with a score of three in the pre-implementation period. However, the total EWS patient score of three for the post-implementation for reported events was 21, and nine for unreported events. When you look at these numbers as percentages, you find that in the pre-implementation period, 44% (*n*=11) were reported and this was increased in the post-implementation period to 70% (n=21). This indicates a positive change with more EWS patient events for a score of three being reported and that the medical/surgical staff reported the EWS patient score of three more often after implementation of QI solutions and reduced unreported EWS patient events when there was an EWS score of three for a single parameter. It could be concluded then that these positive outcomes are due to increased confidence and awareness of staff in addressing an EWS patient score of three; thereby, initiating response for less severe patient events.

Inferential statistics included the Independent-Samples Mann-Whitney U test to compare means for EWS scores and the DNP QI intervention. The null hypothesis was that the distribution of EWS scores is the same across categories of the QI Intervention and was rejected, $p < .001$. The DNP QI interventions reflected a change in the means of the EWS scores from two independent samples taken from the institution's population.

The chi-square test for differences in race and the EWS scores for pre- and post-implementation did not indicate statistical significance. However, there was a noted frequency difference between race for White and Black from the population samples for pre- and post-implementation. Further research could provide additional analysis opportunities as to the effect of the DNP QI interventions on EWS events specific to a patient's race.

A chi-square test was done between travel nurses and reported or unreported EWS events. The chi-square test indicated a statistical significance, $p = < .001$, and seven EWS events associated with travel nurses were unreported. The travel nurses were not a staffing solution during the pre-implementation period but were during post-implementation. This change might indicate that travel nurses did not receive adequate education during the DNP QI intervention.

Descriptive statistics revealed the time difference from when an unreported EWS event occurs and the time an EWS nurse responds to the unreported EWS event. The pre-implementation difference in time related to an EWS nurse's response to an unreported EWS event resulted in longer time intervals for minimum, maximum, and average time compared to the time an EWS nurse responded to an unreported EWS event post-implementation. In addition, a Pearson's correlation was performed to determine the relationship between the time of an EWS patient event occurs and the time of an EWS nurse's response. The events addressed were events occurring pre- and post-implementation, and the relationship was statistically significant, r (53) = .64, $p < .001$.

Additionally, an independent-samples t-test was performed on unreported EWS events and the time difference of an EWS nurse's response between pre- and post-implementation. There was a significant difference between the means $p = 0.04$ and the mean response time for pre-implementation which was two hours and 25 minutes. For post-implementation the mean response time of EWS nurses to an unreported EWS event was one hour and 42 minutes. This indicates that the DNP QI interventions resulted in a significant decrease in delayed responses to unreported EWS events by the EWS nurses between the pre- and post-implementation periods.

Further analysis of the time variable an EWS nurse responds to reported and unreported EWS events should be considered in the future to compare with the EWS nurse response times from this DNP QI intervention. The additional analysis would provide further information related to this DNP QI intervention and similar studies on differences in time between an EWS patient event and an EWS nurse's response time.

The statistical analysis of the DNP QI project indicates that the reporting of EWS patient events improved. In addition, there was an improvement in reporting the EWS score of three for a single parameter. The results of the DNP QI project's data are a resource for further education on EWS and the ECT towards sustainability of the positive outcomes. The medical/surgical education specialist, clinical nurse leaders, and EWS nurses can use the results of the DNP QI project to provide further evidence for staff to continue these practice changes.

Other possible explanations exist for the outcomes related to EWS patient events following the QI interventions. EWS nurses document EWS patient events in the ED as they occur. One explanation for the decrease in total EWS patient events following the QI interventions is possible infrequent documentation of EWS patient events in the ED by EWS nurses. Another explanation for the decrease in total EWS patient events is that the patient acuity throughout the medical and surgical units was low during the post-implementation period. Another consideration for the lower reporting of EWS patient events following QI implementation is that the patient census on the medical and surgical units were low during the months in the post-implementation period. These alternate explanations require further data collection and analysis to understand their effects.

The limitations of the DNP QI project were the DNP student's lack of experience in initiating a QI project. Additionally, the institution's EHR documentation of EWS patient events is difficult to data mine and required the use of the ED to gather most of the DNP QI project's data. It was also necessary to compare data with the institution's EHR to verify accuracy. The DNP QI project was unable to implement the WEAA due to funding limitations, coordination between the institution's administration and the manufacturer of the EWVSM, and the time constraints of the DNP student's semester. Another limitation to consider is that the DNP QI project was planned, implemented, and evaluated during a pandemic affecting the institution's census and acuity of patients.

Recommendations

Economic Considerations

Implementation of WEAA is still a future consideration as this part of the DNP project could not be implemented. The WEAA implementation would require funding to upgrade the software of the current EWVSM, and for the purchase of an additional server, compatible cellular phones, and monitor screens. The cost of the WEAA implementation will depend on negotiations between the manufacturer and the institution though it is recognized that this is a project that would have to be added to the institution’s fiscal budget. Although the WEAA implementation was not included in the resulting QI project, its implementation continues to be a future goal for the DNP student.

Additional economic considerations relate to those interventions that were implemented as part of the DNP project including continuing education and printing of the ECT. The institution’s budget will need funding to cover costs of continued EWS education, re-education, and training. It is suggested that education be offered twice yearly and there are cost implications particularly for staff time if they are attending teaching sessions outside of their scheduled shifts. Lastly, while minimal, there are ongoing costs associated with the printing and laminating of ECTs as the current ECTs become worn and/or when additional VS machines are purchased and need an ECT attached.

Implications for Practice

The process inherent in the DNP curriculum methodically prepared the DNP student to implement QI interventions at the project’s institution (Melnyk & Fineout-Overholt, 2019). Implementing EBP changes as part of this project provided the DNP student a foundation to reflect and build upon when considering, participating in, and leading future care healthcare delivery changes. Efforts in preparing and implementing the QI project helped the DNP students establish the skills needed to lead a project of this magnitude and motivated the DNP student to help others who want to implement EBP changes.

As a result of project planning and implementation, the DNP student was able to achieve DNP Essentials I, II, IV, VI (American Association of Colleges of Nursing [AACN], 2016). DNP Essential I, which requires the student to utilize scientific underpinnings for practice, was met through reviewing literature to better understand the problem and identify feasible QI interventions (AACN, 2016). The DNP student used technology, which is part of DNP Essential IV, to improve care delivery concerning EWS when accessing databases and utilizing EWVSM capabilities. Understanding the institution’s procedures for implementing a QI project helped the DNP student gain experience and skills that will benefit patient care outcomes and achieved DNP Essentials II which includes being able to understand organizational policy in providing quality care (AACN, 2016). The DNP student gained additional skills in reviewing the literature to gather research evidence to support the DNP QI interventions and consider relevant findings post-implementation as part of DNP Essentials III which requires the student to interpret findings from the DNP QI project (AACN, 2016). Finally, DNP Essential VI, which is focused on interprofessional collaboration, was met as part of the DNP project as the student worked alongside the medical/surgical staff, administrators, and EWS colleagues while planning and implementing the QI interventions. The DNP student found collaborating with administrators to obtain their buy-in as simultaneously challenging and rewarding and a good learning opportunity. Additionally, implementing the QI project provided opportunities for the DNP student to motivate others in the institution to change care delivery based on EBP which will likely result in future collaborations (Beeber et al., 2019). Ultimately, the DNP student appreciated the guidelines of the DNP Essentials in providing standards for education and identifying the role of a nurse prepared at the DNP level (Morris et al., 2021).

Process and Outcome Recommendations

The DNP student reviewed the results of the DNP QI project and considered alternative process changes that could further improve outcomes and/or aid with sustainability. The following are recommendations based on this DNP QI project which had the goal to improve reporting of EWS patient events.

Nursing care documentation is a useful source of data when it is readily available for analysis (Shah & Khan, 2020). A data mining recommendation is developing and improving data collection methods directly through the institution's EHR associated with EWS patient events. Currently, VS are automatically uploaded to the EHR from the EWVSM. From there, staff nurses document an EWS note in the EHR and manually calculate an EWS score based on assessment data and VS results. Improving how EWS events are documented in the EHR would improve data mining for EBP research and implementation. For example, EWS data gathered directly from the EHR rather than the ED would decrease data mining time spent in gathering data and allow other disciplines to make use of the data generated (Shah & Khan, 2020). In addition, using the EHR directly to gather EWS data could improve mining methods resulting in additional information to help reduce unreported EWS patient events.

WEAA was not implemented during the QI project due to funding, administrative coordination, and time constraints. However, the literature review indicates that WEAA can improve reporting of critical EWS scores (Heller et al., 2020; Huff et al., 2019; Safavi et al., 2021). The WEAA implementation relies directly on reporting critical VS and EWS scores to the institution's EHR and the EWS nurses. Immediate reporting of critical VS and EWS scores directly to EWS nurses because of WEAA implementation would allow patients to be evaluated more promptly. Providing the institution with WEAA capabilities is a consideration for the future, and the DNP student plans to assist with its implementation.

During implementation of the QI project, the DNP student provided EWS education, re-education, and information on the ECT. Therefore, a recommendation in planning the educational sessions is to consider performing a pre- and post-questionnaire based on a Likert scale to evaluate the staff member's understanding of the education and also provide staff an opportunity to share input and suggestions regarding EWS and the ECT. The Likert scale would provide data that could potentially further improve outcomes related to the reporting of EWS patient events.

Dissemination Plan

This DNP QI project will be presented to committee members and the Salisbury University faculty on April 24, 2023. Upon final DNP approval by the faculty project chair, the DNP student will submit the final DNP paper for archiving through Salisbury University. The DNP student will submit manuscripts next year on quality improvement in nursing practice and journals related to QI interventions involving healthcare delivery. The journals considered are The American Journal of Nursing, The Journal of Clinical

Nursing, and The International Journal of Nursing Studies Advances. Findings from the doctoral project will also be shared with the institution's central organizational office of nursing service for presentation consideration at organizational conferences. The DNP student also plans to present the results of the DNP QI project to the institution's nursing department and during future educational sessions on EWS and the ECT.

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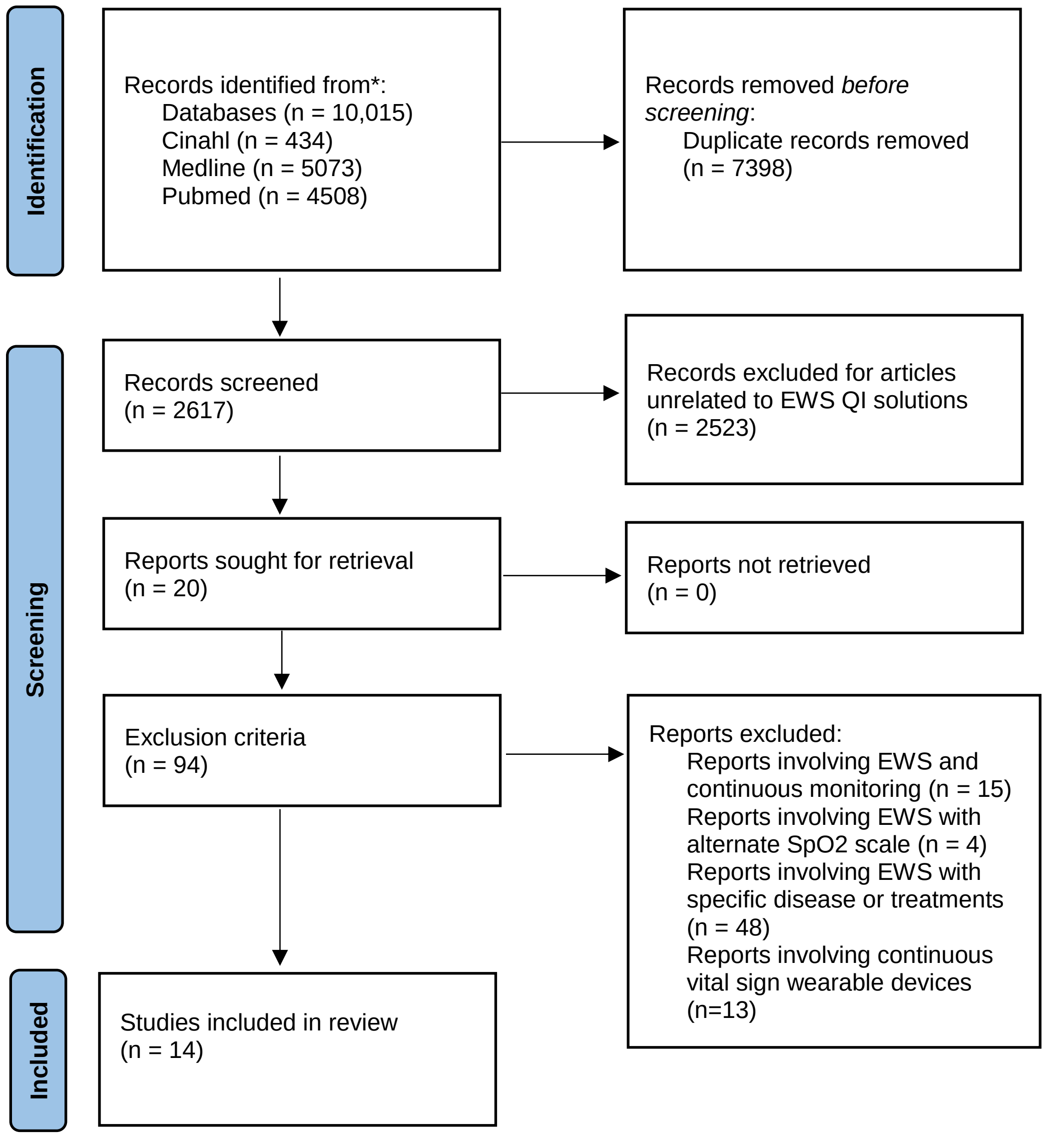
Appendix A

Prisma Diagram



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For more information, visit: http://www.prisma-statement.org/

Appendix B

Table of Evidence

Citation	Conceptual Framework	Design/ Purpose	Sample/ Setting	Measurement of Major Variables	Study Findings	Appraisal of Worth to Practice	Strength & Quality of Evidence
Inpatient Education and Telephone Follow-up							
Al-Kalaldeh, M., Suleiman, K., Abu-Shahroor, L., & Al-Mawajdah, H. (2019). The impact of introducing the Modified Early Warning Score "MEWS" on emergency nurses' perceived role and self-efficacy: A quasi-	Bandura	Introduction of MEWS to nurses in the ED working at different health care centers in Jordan. Quasi-experimental study	A control group and intervention group each contained at least 4 hospitals. Nurses working in the ED were the target population with at least one year experience and bedside care. The intervention	Descriptive statistics were used for demographics. Fishers' Exact Test and t-test were used to examine variations in demographics between the intervention and control groups. A total of 232 volunteers participated in the study in the	Firstly, the assessment of self-efficacy scores between the intervention and control groups at pre-test phase showed that nurses in the control group scored higher in the self-efficacy scale compared to the intervention group ($p < 0.001$).	This study supported the effectiveness of introducing an educational training program concerned with MEWS for ED nurses. ED nurses who participated in the intervention group	Level 2 B (JHNEBP)

experimental study.			group received the study program on EWS.	pre-test phase and were divided into intervention (118 = 59.9%) and control (114 = 49.1%) groups.	self-efficacy scores increased significantly across the study phases among the intervention group from moderate to high level, leading to a statistically significant difference at $p < 0.001$. When Bonferroni Post Hoc statistic test for multiple comparisons was performed, there were statistical differences in the self-efficacy scores between pre-test and both post- test and follow-up phases ($p < 0.001$, and $p <$	exhibited prominent changes in their self-efficacy and perceived role after receiving the study program. It was also evident that those nurses who received the MEWS educational program maintained their attained self-efficacy and perceived role levels evidenced by subsequent scores after receiving the program.	

					0.001, respectively).		
Ashbeck, R., Stellpflug, C., Ihrke, E., Marsh, S., Fraune, M., Brummel, A., & Holst, C. (2021). Development of a standardized system to detect and treat early patient deterioration.	Not identified	Quality improvement project to improve communication and collaboration along with three objectives: Implementation of an EWS Development of a graded response system when EWS scores escalate Rounding with residents, nurses, and respiratory therapist during the evening and night shifts	27-bed pilot unit of general medical patient population with a pulmonary subspecialty at a 2207-bed academic medical center	Post-intervention data and pre-electronic health record (EHR) data was collected. Staff use of modified early warning score (MEWS) was collected via paper forms. Outcome data such as intervention intensity, RRT activations, and transfers to higher level of care were collected from the EHR. Mortality data was reviewed. Data on evening and night rounding	MEWS score of 3 or more events average 3 per day out of a 27-bed unit. Average MEW scores greater than 4.2 resulted in a transfer to higher care. RRT activation decreased by 20% over one year. Before the QIP, 3.5 patients per month required RRT interventions. Pager volumes increased possibly related to resident notification of MEWS. There was an improvement in	Positive outcomes for patients, residents, and nurses. Nurses were able to page residents based on MEWS and graded response from assessments.	Level 2C (JHNEBP)

				by residents was collected. Qualitative and quantitative communication data was collected from electronic surveys. Quantitative data from pager volumes was collected.	communication amongst staff.		
Burger, D., Jordan, S., & Kyriacos, U. (2017). Validation of a modified early warning score-linked situation-background-assessment-recommendation communication tool: A mixed methods study.	None identified	A mixed methods design was used for development of the communication tool and MEWS. The purpose of the study is a communication tool incorporating MEWS and vital signs to report early	18 participants composed of physicians, surgeons, and nurses at Cape Town hospital	49 items on the communication tool were evaluated and revision suggestions made by participants. Items on the communication tool were used when agreement of greater or equal to 70% was achieved	Inter-rater reliability for the items on the communication tool was 82.2% for 37 of 45 items.	The communication tool based on MEWS is appropriate for paraprofessional staff. The communication tool allows for early detection and rescue deteriorating patients	Level 2C (JHNEBP)

		signs of clinical deterioration		from participants.			
Credland, N., Dyson, J., & Johnson, M. J. (2018). What are the patterns of compliance with early warning track and trigger tools: A narrative review.	None identified	A narrative review was used to explore patterns of compliance with early warning track and trigger tools	Review included papers using a quantitative design, but a qualitative approach was taken to synthesize the findings. 7 out of 27 papers were selected	Three themes were identified: early warning score calculation accuracy, monitoring frequency, and clinical response.	Poor compliance was identified in all three themes.	Outcomes improve when staff calculate EWS scores accurately, monitor per protocols, and escalate according to clinical assessments.	Level 1 A (JHNEBP)
Foley, C., & Dowling, M. (2019). How do nurses use the early warning score in their practice? A case study from an acute medical unit.	None identified	A holistic single descriptive case study design. Using mixed methods approach for both qualitative and quantitative data. Study to describe how nurse use the EWS.	15 bed acute medical short stay ward. Nine nurses and two healthcare assistants (HCA) participated in the study.	Document analysis of EWS charts. Interviews and observations focusing on EWS practice. Three themes were identified: protocol adherence vs. clinical judgement, parameter	Protocol adherence vs. clinical judgement: nurses valued EWS but nurses would often hesitate when decision-making conflicted with their intuition and knowledge. Parameter adjustment and escalation:	Nurses' clinical judgement would conflict with EWS escalation protocols. Modifications to EWS parameters was not considered or appropriate. Education	Level 2 B (JHNEBP)

				adjustment and escalation, and culture.	Changes on EWS parameters were only allowed by senior medical personnel. Changes were made when requested by nurses. Culture: EWS was a viewed by nurses as a task rather than a tool. There was not a set frequency for EWS monitoring.	and training are needed to identify patient deterioration. The potential implementati on of an electronic data capture that automates the score, tracks and triggers deterioration and automatically alerts a medical emergency response team, should also be explored.	
Heller, A. R., Mees, S. T., Lauterwald, B., Reeps, C., Koch, T., & Weitz, J.	None identified	Study to evaluate effect of an automated MEWS-based early warning	2 surgical wards with a total of 56 beds received the automated MEWS-based	Frequency of measurements was based on a patient’s condition. Measurements	A total of 3827 patients were acquired from the 2 surgical wards. Cardiopulmonar	Patient deterioration often identified and detected by automated	Level 2 B (JHNEBP)

(2020). Detection of deteriorating patients on surgical wards outside the icu by an automated mews-based early warning system with paging functionality		system with paging functionality (IntelliVue Guardian Solution, Philips, Hamburg, Germany)	early warning system with paging functionality.	related to MEWS were wirelessly transmitted to a central server. Dashboard of all patients displayed continuous physiological parameters related to MEWS at the nurses' station and attending surgeons' rooms. Notifications by text message to custom DECT phones provided patient room and bed numbers with current MEWS score and the	y causes were mainly identified as MEWS calls. Cardiac arrests dropped from 5.3 to 2.1 per 1000 admissions during the intervention period. Risk related MEWS paging to ward attending surgeons increased with a drop in CPR calls. There was a reduction in unplanned ICU admissions of 3.6% to 3.0%.	MEWS monitor alerts than by staff observation. Automated MEWS reduces incidence of FTR events.	

				time a changed took place.			
Huff, S., Stephens, K., Whiteman, K., Swanson-Biearman, B., & Mori, C. (2019). Implementation of a vital sign alert system to improve outcomes.	Iowa model of EBP	Goal of QI project: Improve frequency and documentation of VS, develop an electronic vital sign alert (VSA) system based on NEWS system that included a sepsis screening process, and improve clinical outcomes by an increased number of RRT activation and reduced CBT and unplanned ICU admissions. Improve sepsis bundle compliance	172-bed community hospital. 2 medical/surgical units with a total of 44 beds and a progressive care unit of 29 beds. Care was delivered by hospitalists, nurses, and patient care assistants.	A vital signs alert (VSA) was developed based on EWS score parameters. When vital signs were entered, the data also populated a separate screen dedicated to systemic inflammatory response syndrome (SIRS). Both the VSA and the sepsis screen displayed on a patient's chart. Compliance to the VSA system by nurses was determined by	All nurses completed the mandatory education on the VSA and sepsis screen. RRT activations went down after 245 charts were audited. Mortality decreased by 23% for admissions to the ICU within 24 hours since the VSA implementation. 21% more cases of sepsis were identified from the sepsis screening tool and VSA implementation. 62% of nurses indicated through a	A VSA and concurrent sepsis screen can improve length of stay and mortality for patients with respiratory failure or sepsis. The VSA and concurrent sepsis screen is a cost-effective tool to improve patient outcomes.	Level 3 B (JHNEBP)

		and evaluate nurse satisfaction with the VSA.		an anonymous survey.	survey that VSA helped in identifying patients at risk for sepsis. 51% of nurses indicated that VSA also supported a nurse's intuition about a patient's condition.		
Jensen, J. K., Skår, R., & Tveit, B. (2019). Introducing the national early warning score—A qualitative study of hospital nurses' perceptions and reactions.		A qualitative case study with observations	Eight units involving medical, surgical, and rheumatology wards at a state-funded hospital in Norway. Participants were nurses with at least a 3 year bachelor's degree with ages ranging from 20s-50s.	4-hour training programs to introduce NEWS, consisting of group seminars and simulation sessions. The program covered four themes: how to use NEWS, using the new charts, calculating a score and responding based on a	Four tensions emerged as themes in the analysis of the nurses' perceptions and reactions to the introduction of NEWS based on the different elements in their work context. These themes were identified as follows: tension between using standardized	During the professional training in the simulation sessions, the nurses became more aware of the importance of vital sign measurement s.	Level 3 B (JHNEBP)

				score combined with vital sign physiology.	tools and relying on clinical judgement, tension in the hospital ward's community of practice, tension related to rules and compliance and tension related to NEWS and the division of labor.		
Lang, A., Simmonds, M., Pinchin, J., Sharples, S., Dunn, L., Clarke, S., Bennett, O., Wood, S., & Swinscoe, C. (2019). The Impact of an Electronic Patient Bedside Observation and Handover	None identified	The study set out to identify improvement and deterioration when introducing new technology in the workplace. The study interviewed and performed direct observation of	The study was conducted at a large teaching hospital in the United Kingdom. 6000 nurses, doctors, healthcare assistants, and allied health professionals were provided personal	Observations involved 23 pre-deployment and 64 post-deployment observation sessions. Interviews for a total of 40 participants was conducted. All interviews were post-deployment.	For nurses: Increase use of smartphones was observed. Observation locations increased from the office to the nurse's station. Doctors: Smartphone use increased. Doctors spent less time in the office location	Electronically generating an EWS score from vital signs and transmitting the data wirelessly to healthcare providers via handheld device such as a smartphone improves	Level 3 B (JHNEBP)

System on Clinical Practice: Mixed-Methods Evaluation.		staff on pre- and post-deployment of mobile devices with integrated EWS software. The electronic observations (eObs) and electronic handover (eHandover) software on mobile devices allowed staff to react to key patient data.	mobile devices and training.	Impact evaluation was based on a longitudinal analysis of unplanned critical care admissions.	and more time in the nurse's station. Interview data revealed a large positive response from nurses related to the eObs. 10% reduction in unplanned ICU admissions after implementation. eObs improved detection and response to deteriorating patients and real-time communication of EWS of patient information via handheld devices. The mobile solution reduced EWS-related patient safety incidents	real-time patient acuity assessments. This capability also addresses staff delays in activation of an EWS response.	

					and allowed doctors and nurses to spend more time with patients at the bedside.		
Mau, K. A., Fink, S., Hicks, B., Brookhouse, A., Flannery, A. M., & Siedlecki, S. L. (2019). Advanced technology leads to earlier intervention for clinical deterioration on medical/surgical units.	None identified	Retrospective review of electronic medical records (EMR) used data in a comparative design. The study aims: To determine if there is a difference in time (hours) patients spend with at-risk EWS scores post-implementation of an EMR-enhanced EWS when compared to pre-	A 157-bed community hospital. Three medical/surgical units and one cardiac telemetry unit. Adult patients 18 years or older without do not resuscitate or comfort care orders.	Demographic patient data was collected from the EMR. EWS scoring tool used to apply to extracted vital signs from the EMR. Hours patient spent with moderate or high EWS scores was measured for pre-implementation and compared to post-implementation.	The two groups held similar patient demographic data. During both study periods, staff mix remained stable.	A decrease amount of time patients spent with moderate or high risk EWS scores was indicated after implementation of an EWS moderate or high-risk alert within the EMR. The study indicated a benefit of implementing innovative tools that enhance and assist nurses. Reassessment	Level 3 B (JHNEBP)

		implementation. To determine if there is a difference in time (minutes) until re-assessment of vital signs following a EWS risk alert post-implementation of an EMR-enhanced EWS when compared to pre-implementation.				of EWS scores after activation of an EWS response also benefited from the implementation with timely re-evaluation.	
Pullinger, R., Wilson, S., Way, R., Santos, M., Wong, D., Clifton, D., Birks, J., & Tarassenko, L. (2017). Implementing	None identified	Study to determine feasibility of implementing an electronic observation chart with automated EWS calculation	Study was conducted in the emergency department of a tertiary referral and major trauma center. All patients over the age of	Two study stages: stage one EWS calculation was manually calculated and recorded on paper. Stage two EWS was	Retrospective analysis observations on EWS shows stage 2 an increase frequency in EWS observation of higher scores.	Electronic observation charting system based on EWS was modified from a ward application to the ED with improved	Level 3 B (JHNEBP)

an electronic observation and early warning score chart in the emergency department: A feasibility study.			16 years were recruited for the study.	automatically calculated and recorded on handheld electronic devices with prompts for further evaluation. Electronic observation charts were also available on bedside electronic tablets and central stations. In addition, patient bedside monitors updated electronic observation charts with patient vitals every 30 seconds.	Suggesting more attention was paid to high-acuity patients.	observation and interventions for moderate and high EWS scores.	
Saab, M. M., McCarthy, B.,	None identified	Systematic review	Randomized controlled	The search strategy	Evidence from this review	This systematic	Level 3 A (JHNEBP)

Andrews, T., Savage, E., Drummond, F. J., Walshe, N., Forde, M., Breen, D., Henn, P., Drennan, J., & Hegarty, J. (2017). The effect of adult Early Warning Systems education on nurses' knowledge, confidence and clinical clinical performance: A systematic review.		The aim of the systematic review was to determine the effect of adult EWS education on nurses' knowledge, confidence and clinical performance.	trials (RCTs), non-RCTs and pre- and post-test studies considered for inclusion met the following criteria: (1) involved adult patients (i.e. over 18 years of age); (2) comprised programs relating to the education and/or training of nurses about the use of EWS/track and trigger systems; (3) compared the effect of educational programs to baseline and/or control conditions; (4) addressed	yielded 3,598 titles and abstracts. Duplicates were deleted (n = 294) and irrelevant records were excluded based on title and abstract screening (n = 3,304). Following a full-text review of 267 articles, 256 full-text articles were excluded as they focused on budget impact analyses of EWS, evaluations of the implementation of EWS and effectiveness	suggests that EWS educational programs succeeded in increasing nurses' knowledge, confidence and clinical performance with regard to calculation of EWS and documentation of vital signs, at least in the short term.	review supports using education and training for improving outcomes related to EWS accuracy and documentation.	

			nurses' knowledge, confidence, an clinical performance in terms of vital-sign recording, early warning score calculation and/or response to clinical deterioration; (5) published between January 2011 and November 2015 and (6) published in English.	and validation of EWS systems. Reference list checks did not yield any new articles. There-fore, a total of 10 studies in 11 papers met the review eligibility criteria and were included in this review			
Wu, C.-L., Kuo, C.-T., Shih, S.-J., Chen, J.-C., Lo, Y.-C., Yu, H.-H., Huang, M.-D., Sheu, W. H.-H., & Liu, S.-A.	None identified	Study conducted to evaluate effectiveness of implementing an electronic version NEWS (E-NEWS) to	This study was conducted at a 1500-bed veterans' hospital in Taiwan. The inclusion criteria were as follows: (1)	Vital signs were upload in real-time to the EMR. The E-NEWS was developed to calculate the EWS scores	E-NEWS system provided hourly EWS scores allowing care teams awareness of clinical deterioration.	E-NEWS system provided good communicati on of EWS scores to healthcare staff reducing	Level 3 B (JHNEBP)

(2021). Implementation of an Electronic National Early Warning System to Decrease Clinical Deterioration in Hospitalized Patients at a Tertiary Medical Center.		predict clinical deterioration	patients who were hospitalized in ordinary wards and (2) were ≥20 years old. The exclusion criteria included (1) hospitalization for less than one day (≤24 h), (2) direct admission to ICU, and (3) patients who had been intubated before admission.	upon vital sign uploads. A dashboard was created allowing healthcare providers to visualization patient status based on EWS. EWS scores requiring intervention were sent to in-charge attending physicians via a text message to cellphones. If EWS scores increased, then notification is sent to on-duty ward physicians by the in-charge nurse.		unplanned ICU admissions.	
Ye, C., Wang, O., Liu, M., Zheng, L., Xia,	Not identified	Build and prospectively (pro) validate	Patients admitted to two acute	DV: Risk of death at least 24-48 hours	EWS model alerted clinicians to	EWS model can be applied in	Level 3 B (JHNEBP

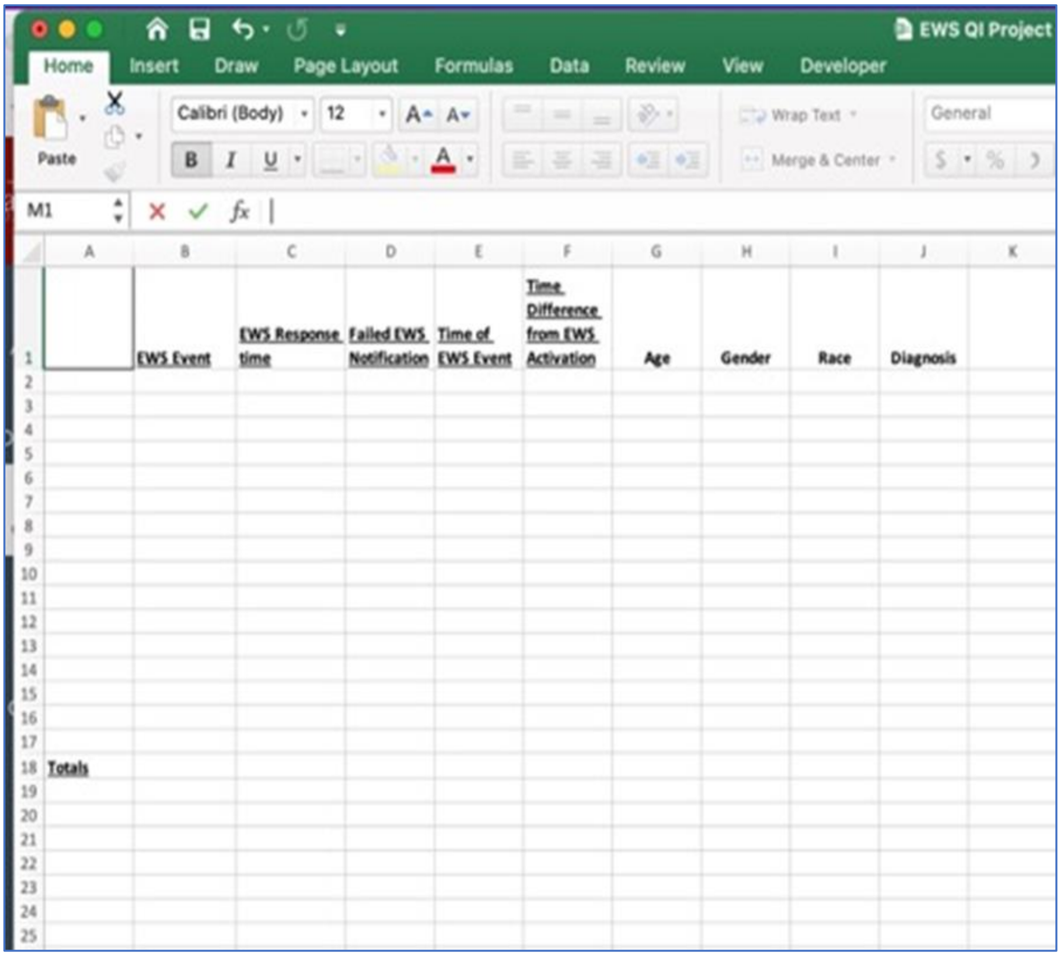
M., Hao, S., Jin, B., Jin, H., Zhu, C., Huang, C. J., Gao, P., Ellrodt, G., Brennan, D., Stearns, F., Sylvester, K. G., Widen, E., McElhinney, D. B., & Ling, X. (2019). A real-time early warning system for monitoring inpatient mortality risk: Prospective study using electronic medical record data.		an EMR-based inpatient mortality EWS. Retrospective (retro) review also.	hospitals medical-surgical and ICU units (n= 42,484 retro & 11,762 pro) with review of 24 hours prior to death and 24-hour intervals (retro group) and 24-hour intervals during hospitalization (pro group).	before the event=EWS score of high, intermediate, or low risk. IV: Post admission clinical information & static historical medical variables used. Analysis: EMR data. Kaplan-Meier method and compared their hazard ratios (HRs) using Cox regression.	40% (40/99) of highest risk encounters 24-48 hours before death (c-stat=0.884) & another 17% within 48-72 hours. Model could notify providers up to 1.7 days (40.8 hours) prior to death and did so in 13.3% of high-risk patients (13/255). EWS can impact decisions regarding care as 31 of 99 high-risk patients survived.	real time to all hospitalized patients and automatically send alerts to providers or RRT for high-risk patients to expedite interventions and reduce risk of death, regardless of DNR status. Consideration of patients' social determinants could impact the mortality model.	

List of Abbreviations:

Early Warning System (EWS), Vital Signs (VS), Rapid Response Team (RRT), Code Blue Team (CBT), Intensive Care Unit (ICU), Electronic Health Record (EHR), Quality Improvement (QI), Failure to Rescue (FTR), Code Blue (CB), Evidence-Based Practice (EBP), Electronic Wireless Vital Sign Machines (EWVSMEVM), Social Cognitive Theory (SCT), Doctor of Nursing Practice (DNP), Level of Consciousness (LOC), Information Technology (IT), Specific, Measurable, Achievable, Realistic, and Timely (SMART), Strengths, Weakness, Opportunities, and Threats (SWOT), Quality Improvement Project (QIP), Respiratory Therapist (RT), Health Information System (HIS), Nurse Information System (NIS), Adverse Event (AE), Vital Sign Alert (VSA), Modified Early Warning Score (MEWS), Johns Hopkins Nursing Evidence-Based Practice (JHNEBP), Healthcare Assistants (HCA), Medical Emergency Teams (MET), Systemic Inflammatory Response Syndrome (SIRS), observations (eObs), handover (eHandover), electronic medical records (EMR), Randomized controlled trials (RCT), remote surveillance software program (RSSP), dependent variable (DV), independent variable (IV), do not resuscitate (DNR), quality improvement project (QIP), wireless electronic alarm alerts (WEAA), Institutional Review Board (IRB), Salisbury University (SU), EWS Database (ED), Microsoft Access (MA), Microsoft Excel (ME), International Business Machines (IBM), Statistical Package for the Social Sciences (SPSS)

Appendix C

EWS Data Analysis Tool



Appendix D

Institution Site Authorization Letter

Site Authorization Letter

January 14, 2022

Dear

After reviewing the proposed quality improvement project, "Early Warning System Activation" presented by . I have granted authorization for to conduct the quality improvement project at

I understand the purpose of this quantitative quality improvement (QI) project is to develop an evidence-based inititave to improve Early Warning System (EWS) activation. Mr. , will be precepted by

Thank you.

Appendix E

EWS Communication Tool

EWS SCORE	EWS RESPONSE	
3	EWS score of 3 for ANY one EWS parameter such as: ♥ Heart rate (≤ 40) or (≥ 131) ♥ Low temperature (≤ 95) ♥ Respiratory rate (≤ 8) or (≥ 25) ♥ Low oxygen saturation (≤ 91) ♥ Systolic blood pressure (≤ 90) or (≥ 220) ♥ Level of consciousness (from baseline) for example: an unresponsive patient to voice or pain **Notify Primary Nurse, EWS Nurse, Primary Team, Charge Nurse, and Clinical Nurse Leader**	
5 OR GREATER	**Notify Primary Nurse, EWS Nurse, Primary Team, Charge Nurse, and Clinical Nurse Leader**	
EXAMPLES OF EWS SCORES GREATER THAN 5	EWS combined scores of 5 or 6 for example: Heart rate EWS score = 2, Pulse Ox EWS score =2, Respiratory Rate EWS score =2 **Total EWS score = 6** Another example: O2 EWS score = 2, Pulse Ox EWS score =2, Temperature EWS score =1 **Total EWS score =5**	EWS combined score of 7 or greater for example: Heart rate EWS score = 2, Pulse Ox EWS score = 2, O2 EWS score = 2, Respiratory Rate EWS score = 2 **Total EWS score = 8**

Appendix F

Educational Outline

1. Purpose of the Early Warning System (EWS)
2. Vital signs and the EWS scoring to evaluate patient acuity
3. Benefits of EWS to patients, healthcare team, and organization
4. Activating an EWS response in a timely manner improves patient outcomes
5. Failure to activate an EWS response
6. Evidence-based research in support of EWS
7. How to use the EWS Clinical Response Tool
8. Instructions and use of the electronic wireless vital sign machines
9. Documentation of EWS findings in the electronic health record (EHR)
10. EWS nurses' surveillance and electronic wireless EWS alarm alerts

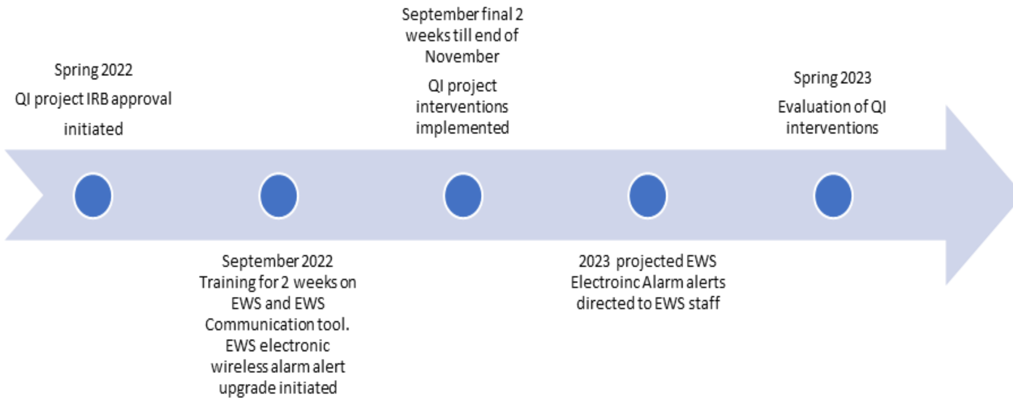
Appendix G

SWOT Table

Strengths	**Weakness**
• Agency support for change • Current technology and equipment • Staff knowledge of EWS • Vital signs automatically update EHR	• DNP student’s lack of experience with establishing a QI project • Cost of electronic alarm alerts • Unfamiliarity with government funding of projects • Time delays due to institution’s bureaucracy
Opportunities	**Threats**
• QI project will help other facilities • Patients receive timely EWS responses • Reduce further patient deterioration • Reduce cost for unplanned ICU, RRTs, and CBTs	• Cost of software and equipment upgrades • Budget constraints prevent QI project • Patient information security is lost • QI project does not improve EWS response and activation

Appendix H

Timeline



Appendix I

Institution Site IRB Approval (Redacted)

NOT HUMAN RESEARCH DETERMINATION

Date: July 27, 2022

To:
RE: HP-00102611
Name: Process Changes to Improve Early Warning System (EWS) Activation and Reduce Response Times

This letter is to acknowledge that the IRB reviewed the information provided and has determined that the submission does not require IRB review. This determination has been made with the understanding that the proposed project does not involve a systematic investigation designed to develop or contribute to generalizable knowledge **OR** a human participant (see definitions below).

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities are human subject research in which the organization is engaged, please submit a new request to the IRB for a determination.

Appendix J

SU IRB Approval

Salisbury University
Institutional Review Board
Committee on Human Research
Phone: (410) 548-3549
Fax: (410) 677-0052
Email:humanresearch@salisbury.edu

IRB Research Protocol Approval Notification

Date: 6/15/2022

To: N. Hall
RE: Protocol #31
Type of Submission: Expedited
Type of IRB Review: Expedited
Protocol is scheduled to begin 8/2022 end 5/2023

Approval for this project is valid from 6/15/2022 to 5/31/2023.

This letter serves to notify Dr. Nicole Hall and Dirk Pennington that the Salisbury University (SU) Institutional Review Board (IRB) approved the above referenced protocol entitled, Process Changes to Improve Early Warning System (EWS) Activation and Reduce Response Times on June 15, 2022.

Pursuant to Federal regulations 21 CFR 56.109, the IRB has determined that this protocol qualifies for Expedited review.

Federal regulation 45 CFR 46.103 (b)(4)(iii) requires Primary Investigators (PI), except when a subject is in immediate danger, to assure any change to an approved protocol is not initiated prior to IRB review and approval. Additionally, the PI must also inform the IRB of unanticipated problems involving risks to participants.

These same federal regulations require continuing review of research be conducted by the IRB at intervals appropriate to the degree of risk. Your research is scheduled to begin 8/2022 and end 5/2023. It is the PI's responsibility to submit continuing review reports in a timely manner (at least 3 weeks prior to scheduled end date on the protocol approval).

The SU IRB is organized and operated according to guidelines of the United States Office for Human Research Protections and the United States Code of Federal Regulations and under Federal Wide Assurance No. FWA00020237.

If you have any questions about this review or questions, concerns, and/or suggestions regarding this process, please do not hesitate to contact the Office of Graduate Studies and Research at 410-548-3549 or humanresearch@salisbury.edu.