2018

Evaluating the Impact of an Early Warning Scoring System in a Community Hospital Setting

Christine Conner
Walden University

Walden University

College of Health Sciences

This is to certify that the doctoral study by

Christine Conner

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

Review Committee
Dr. Eric Anderson, Committee Chairperson, Nursing Faculty
Dr. Tracy Wright, Committee Member, Nursing Faculty
Dr. Mary Rodgers, University Reviewer, Nursing Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
2018

Abstract

Evaluating the Impact of an Early Warning Scoring System in a Community Hospital Setting

by

Christine Conner

MSN, Seton Hall University, 1998

BSN, Jersey City State College, 1985

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

Walden University

February 2018

Abstract

Failure to recognize and respond to early signs of deterioration in hospitalized patients can have significant implications associated with delays in treatment. This lack of recognition was the impetus for rapid response teams in the United States and the recommendation by the Institute of Healthcare Improvement for use of early warning scores. This project was designed to evaluate the pilot implementation of an early warning score on 2 units in a community hospital in the Northeast. The practice-focused question was used to explore how patient outcomes changed following implementation of an early warning score (EWS) compared to patient outcomes associated with a rapid response team alone. The translating evidence into practice model informed this project. Supporting evidence from existing hospital data was collected for rapid response, code blue, and mortality. Analysis using the chi-square test of homogeneity compared post-implementation with baseline data. The findings indicated the differences between the proportions were not statistically significant, indicating the metrics did not change appreciably following the implementation of the early warning score. While the evaluation analytics of this pilot did not demonstrate significant change in the outcome measures post-implementation, the results may be useful for the facility when performing a future evaluation of the EWS. It is possible that the results of the 2 units were not representative of the facility, and it is therefore recommended to repeat the evaluation using data from the entire facility for a longer period. Increasing the capacity for early recognition in decline has implications for social change through improvement in safety and quality of health care for all hospitalized patients.

Evaluating the Impact of an Early Warning Scoring System in a Community Hospital Setting

by

Christine Conner

MSN, Seton Hall University, 1998

BSN, Jersey City State College, 1985

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

Walden University

February 2018

Dedication

I would like to dedicate this doctoral capstone to my family who has been my source of strength during this journey. First to my husband Jim and daughter Kaitlyn who have been there with unwavering love, support and encouragement every step of the way--this would not have been possible without both of you. To my parents who valued learning and instilled in me the principles of perseverance and determination --although you are gone, your influence is present every day. Finally, for my sister Heather, who left this world one year ago --you were always my biggest cheerleader, and I only wish you were here to share this accomplishment with. I know you are watching. I did it!

Acknowledgments

I would like to first acknowledge my family of friends who have been so supportive and understanding of the commitment necessary for me to complete this doctoral degree. Thank you for providing the humor and the balance when I needed it. Thanks to the faculty, especially Dr. Stoerm Anderson for his mentorship and guidance throughout the doctoral capstone process. I would like to recognize my professional colleagues and preceptor for their invaluable assistance with this project. A special note of gratitude is reserved for my colleague and friend Sharon. Thank you for taking the journey with me. Your intellect is only surpassed by your caring spirit. It was a pleasure learning from you and with you.

.

Table of Contents

List of Tables

Section 1: Nature of the Project

Introduction

Failure to recognize and respond to early signs and symptoms of deterioration in hospitalized patients can have significant implications associated with delays in treatment and subsequent increases in morbidity and mortality. This lack of recognition was the impetus for implementation of rapid response or medical emergency teams in the United States per recommendation of the Institute for Healthcare Improvement (IHI), as an initiative of their 100,000 Lives Campaign (Berwick, Calkins, McCannon & Hackbarth, 2006). A rapid response team (RRT) is a designated group of clinical personnel with expertise in managing critically ill patients who are deployed to the bedside to assist with management of patients in decline. The team may be deployed using a ramp up model, where one member of the team does the initial evaluation, and based on the presentation, may call additional members to the bedside; or a ramp down model where the entire team responds and members who are not essential to the case are dismissed. The purpose of the rapid response team is to deploy and intervene prior to a serious adverse event, such as a cardiac arrest. Fundamental to this initiative was establishing a specific means to enable recognition and response to deterioration in a timely manner. Encouraged by the initial campaign, the subsequent 5 Million Lives Campaign recommended employing an early warning score (EWS) as a complementary method to rapid response teams in an effort to achieve timelier identification of changes in patient condition (5 Million Lives, 2008). Clinical changes may often be subtle, and may be inadvertently overlooked. Clinicians use EWSs to evaluate trends in physiologic parameters, which may show signs

of decline prior to changes in the physical presentation of the patient. Numeric values are assigned to deviations from normal in multiple parameters including vital signs, level of consciousness, and the need for supplemental oxygen, and an aggregate score is then assigned. The clinicians then use an algorithm of actions relative to the scoring for guidance with next steps. Appraisal of the aggregate scores may reveal trends indicative of early decline and alert the clinician, facilitating earlier recognition and initiation of appropriate management even before clinical symptoms trigger a call to the rapid response team.

Despite a very robust rapid response program, this organization where I conducted this project determined instances where delays in recognition of decline have occurred. As part of a strategic initiative focused on improving care quality for hospitalized patients, implementation of a EWS was planned for the healthcare system. This evidence-based implementation was planned for roll-out across all seven campuses in a standardized manner after a pilot was completed. In this DNP capstone project, I evaluated the implementation of the EWS on two pilot units in one community hospital campus in the Northeast region of the United States. I analyzed metrics post implementation of the early warning system and compared them with existing data prior to the initiative to evaluate if the EWS improved clinicians' abilities to recognize early decline and the associated outcome measures, compared with the outcome measures of the rapid response team process alone. Successful implementation may influence the nurse's ability to recognize and intervene sooner in the hospitalized patient experiencing decline, and have implications for reduction in associated morbidity and mortality. In its

2000 report *To Err is Human: Building a Safer Health System*, the Institute of Medicine defined an error as "the failure of a planned action to be completed as intended or the use of a wrong plan to achieve an aim" (Kohn, Corrigan, & Donaldson, p.4). Failure to recognize can therefore be considered a preventable medical error. Improving the capacity for early recognition in decline has widespread implications for improvement in patient safety and quality of health care for all patients.

Problem Statement

In this project, I addressed the delay in recognition of early decline in hospitalized patients. Several studies have demonstrated that 70-84% of patients exhibit signs of decline as early as 6-8 hours prior to experiencing a cardiac arrest (Buist, Bernard, Nguyen, Moore, & Anderson, 2004; Franklin & Mathew, 1994; Schein, Hazday, Pena, Ruben, & Sprung, 1990). Subtle changes in condition may not be recognized by the novice nurse because of inexperience or lack of knowledge. Conversely, in the more experienced nurse, issues such as lean staffing and competing demands may compromise the ability to remain focused and discern the deterioration in a timely manner. The facility's Department of Quality and Outcomes identified concerns regarding potential delays in recognition of early decline in patients with sepsis/severe sepsis, and similar concerns were noted across the hospital system in general. This is not unique to this system, as evidenced by the Centers for Medicare and Medicaid (CMS) instituting a core measure in 2015 specifically focused on management of severe sepsis/septic shock using 3-hour and 6-hour bundles of care. Additionally, the facility's review of rapid response

call data indicated opportunities for earlier intervention in patients with diagnoses other than sepsis, reinforcing the need for improvement in this area.

The Purpose Statement and Project

The purpose of this scholarly project was to evaluate the outcomes of the implementation of a EWS as compared with the outcomes of the standard of care of rapid response without a EWS for response and treatment of decline. The practice-focused question was: How have patient outcomes changed following implementation of an early warning score compared to the outcomes of the standard of care of a rapid response team without a EWS? Short-term outcomes I measured include the number of cardiopulmonary arrest calls and the number of rapid response calls. I will evaluate mortality as a long-term outcome at a later time based on historical data because there was insufficient data in terms of number of deaths to show any significant difference in the short term.

Nature of Doctoral Project

In this scholarly project, I used existing baseline data collected by the hospital prior to the initiation of the EWS, and compared them with similar data post implementation. Sources of evidence were obtained from a hospital administrator who provided me access to the data in aggregate form only. The data was gleaned by hospital personnel from the code blue resuscitation audits and hospital operator logs, which track emergency calls for both cardiopulmonary arrest and pre-arrest rapid response team calls. I also obtained mortality statistics from the administrator. This was all data that the

facility currently collected. By comparing the data, I sought to determine any changes in the outcome measures previously discussed with the implementation of a EWS.

Significance

Failure to rescue or delayed recognition of decline contributes to increased mortality and may be a direct contributor to unnecessary harm and deaths (IHI, n.d.). Despite the IHI recommendation for instituting early warning scores as an adjunct to rapid response teams over 10 years ago, lack of adoption of this practice is common. If improvements in health care safety and quality are to be realized, redesigned workflows and processes are crucial (IOM, 2001). Delays in recognition cause patient harm and increased severity of illness, and have serious resource and financial implications including, but not limited to, increased length of stay, increased length of ICU stay, and unplanned ICU admissions. Contributions to improvement in patient safety can have significance both locally, and more broadly, outside the hospital facility. Knowledge gained from this project may be used locally to implement similar warning systems outside of the inpatient medical-surgical areas, such as in critical care, maternal child health, and the emergency department, further contributing to ongoing quality and safety efforts for prompt recognition of decline in the community hospital setting. Dissemination of the knowledge on a more global level is possible given that patient harm occurring in hospitals is a societal problem requiring the attention of those who can positively impact the issue. Scholarship of application via translation of knowledge into practice is a vital function of the DNP graduate. Promotion of safety and elimination of

health disparities is incumbent on DNP prepared nurses because their educational competencies prepare them for this challenge (AACN, 2006).

Summary

The potential positive impact of improving the recognition of early decline in hospitalized patients has implications for overall health care safety and quality. Redesigning processes resulting in averting patient harm through prompt recognition and intervention can have direct bearing on morbidity and mortality. The early warning system implementation is one such process that can make contributions to safety and improve health care for all hospitalized patients.

Section 2: Background and Context

Introduction

Failure to recognize and respond to decline in a hospitalized patient's condition may be associated with delayed treatment, and increased morbidity and mortality. Rapid response teams are deployed in response to patient decline to assist with medical management. In some cases, despite the rapid response team mechanism, researchers determined that clinicians could have identified subtle deterioration sooner. Clinicians use a EWS to evaluate physiologic trends in patient vital signs, use of supplemental oxygen, and level of consciousness, and assign a numeric value to those parameters that deviate from normal. The farther away from normal the parameter is, the higher the number attached to that factor. Appraisal of the aggregate scores may reveal trends indicative of early decline, facilitating quicker recognition and prompt treatment.

The problem my project site addressed with this quality improvement initiative was the delay in recognition of early decline in hospitalized patients. The problem I addressed in this DNP project was the lack of formal systematic evaluation of the outcomes related to the quality improvement initiative. Therefore the purpose of this scholarly project was to evaluate the outcomes of the implementation of a EWS as compared with the outcomes of the standard of care of rapid response without EWS for treatment of decline. The practice-focused question was: How have patient outcomes changed following implementation of an early warning score compared to the outcomes of the rapid response team without a EWS?

Concepts, Models, and Theories

The model I selected for framing this project was the Johns Hopkins Quality and Safety Research Group's translating evidence into practice model (Pronovost, Berenholtz, & Needham, 2008). This four-step model is intended for planning, implementation, and evaluation of large-scale programs in health care systems. The stages include summarizing the evidence, identifying local barriers to implementation, measuring performance, and ensuring that all patients receive the interventions (Pronovost, Berenholz, & Needham, 2008). This translational model has relevance for use with the EWS program because it will be implemented throughout the hospital facility and will involve multiple disciplines coming together for a singular purpose of improving patient safety and quality of care. It has been used in other safety-focused initiatives, including implementation of recommended best practices to avert patient harm for central line associated bloodstream infections (Pronovost et al., 2006), and acute lung injury in mechanically ventilated patients (Pronovost, Murphy, & Needham, 2010).

Relevance to Nursing Practice

Failure to recognize deterioration in a hospitalized patient has obvious implications specific to associated morbidity and mortality. Researchers identified that delays in recognition of decline in patient condition do occur. In an effort to avert this preventable patient harm, the IHI recommended rapid response teams to respond to instances of decline as part of the 100,000 Lives campaign (Berwick, Calkins, McCannon, & Hackbarth, 2006; IHI, n.d.). Researchers note failure to recognize subtle signs of decline by clinicians despite rapid response team program implementation in

hospitals. The absence of timely recognition may be attributed to a lack of knowledge or experience of the nurse, competing patient care demands, unit staffing or resources, communication breakdown, or hesitancy/failure to summon the rapid response team (Subbe & Welch, 2013). Further recommendations from IHI included continuation of rapid response team deployment as part of the aim to prevent medically attributed harm (McCannon, Hackbarth, & Griffin, 2007). Rapid response teams are usually deployed in response to a change in a single patient parameter being monitored, such as a drop in blood pressure or an increase in heart rate. Studies have shown that 70-84% of patients experience changes in physiologic parameters and behavior indicative of decline 6-8 hours preceding a cardiopulmonary arrest event (Schein, Hazday, Pena, Ruben, & Sprung, 1990; Buist, Bernard, Nguyen, Moore, & Anderson, 2004). Buist et al (2004) also noted the association between six deviations in clinical parameters and an increased risk of mortality. Additionally, the number of abnormal parameters a patient had correlated with higher mortality risk. Of interest were the neurological and respiratory parameter deviations. Despite occurring less often, they were associated with the highest risk for mortality. These changes are often the most subtle to detect. Nurses spend the greatest amount of time with a hospitalized patient, and yet are unable in all cases to recognize and respond to subtleties in clinical deterioration. The suggestion by the IHI to augment the process with synergistic use of an early warning score acknowledges the potential inefficiencies inherent in a single parameter method, promoting aggregate evaluation of multiple parameters and improvement in early recognition of decline

(McNeill & Bryden, 2013). This suggestion aligns with my aims in this project to prevent unintended harm and promote patient safety.

In 2008, hospitals were required, via a Joint Commission national patient safety goal, to have a method to enable staff in obtaining assistance from trained individuals when deterioration in patient condition occurs. Most hospitals chose to put a rapid response or a medical emergency team mechanism in place. This has been the standard of care for intervening in cases of patient decline since that time. The method of implementation has been left to the organizations and is dependent on the unique resources of each facility. Therefore, the number and composition of the responders varies accordingly. Some teams follow a ramp up model in which a single responder goes to the bedside and evaluates the patient. If needed that responder can call and ramp up with additional responders from multiple disciplines. Conversely, the ramp down model is where a team, normally comprised of a physician, a critical care nurse and a respiratory therapist respond to initially evaluate the patient, and those not needed for that case are dismissed based on the specific patient condition. Other models involve a single resource registered nurse (RN) or advance practice nurse (APN) who round in a proactive manner, evaluating patients for whom the primary nurse may have a concern, in order to intervene before a rapid response call is necessitated. Still others have paired a EWS with a rapid response team, with the aim of identifying early decline. The EWS, as I have discussed, is a numeric score assigned to a patient based on assessment of multiple physiologic parameters. The parameters often include vital signs, use of supplemental oxygen, and level of consciousness. A numeric score is assigned to the normal range for

that particular physiologic parameter. Deviations are assigned a number depending on how far out of range they fall. The assessments are done with specified frequency such as every 4 hours on admission, post operatively, and with a change in level of care. After a certain score is maintained for a prescribed period, such as 24 hours, the frequency may be decreased per patient condition. These scores are trended, and the nurse alerted to a decline that he/she may not have noted immediately if the trend is slight. The score can be either numeric or be color coded in a similar way to a traffic light with green meaning minimal or no concern, yellow meaning intervention is necessary to avert a critical event, and red meaning the rapid response team must be implemented immediately. This track and trigger system contains ranges within the score that prompt explicit actions by the nurse according to a specific algorithm. For example, a score of four or below indicates a low risk, and the nurse should continue monitoring the patient. A score of 5-7 is indicative of moderate risk for early decline, and the nurse is directed to call the physician for additional orders if he/she does not have applicable PRN orders. A score of 8 or above is an automatic trigger for the rapid response team to come to the bedside and evaluate and assist in the management the patient. The scores provide a general guideline for the nurse, and he/she may call at any time there is a worry or concern about a patient. Unfortunately, missed opportunities in early recognition of patient decline may still occur, and changes in practice often take time to assimilate. Despite the recommendation to institute a EWS in addition to a facility's existing response plan, many facilities have not yet done so. Variability in the literature may contribute to this hesitancy to put EWSs in place.

In this project, I aimed to add to knowledge about EWSs by comparing specific metrics collected previously by the facility regarding the rapid response team and evaluating any changes noted after implementation of the EWS in addition to the rapid response team. I hoped that the implementation of the EWS would provide a method by which nurses would better recognize and respond to patient decline, which would address the gap in practice and be realized in improved outcomes.

Local Background and Context

I established the relevance of this problem to the project facility before initiating the project. A small number of cases in which earlier recognition and intervention was merited were identified though facility review of clinical documentation, and the clinical presentation to the rapid response or code blue teams. Failure to recognize or rescue occurrences were not frequent, however even one was indicative of an existing opportunity for improved care quality. Rapid response and code blue data indicated that despite a very robust RRT program, cardiac arrests in this population had not decreased significantly, thus providing impetus for the EWS program.

The site for this project was an acute care, not-for-profit, Magnet-designated, community hospital, with a business-affiliated rehabilitation unit and gym, and with a total of 316 beds. The RRT deployed to both the acute care facility, the rehabilitation inpatient unit, and the gym area which sees both inpatients and outpatients. The majority of the patients admitted were over the age of 65, with the CMS as their primary payer. The facility is therefore accountable for compliance with all CMS core measures. The

hospital is part of a very large 13 hospital health care system that had undergone a very recent merger.

Role of the DNP Student

As a DNP student in the facility, I had a support role as the planning and implementation of this EWS program unfolded. The focus of my capstone project was to evaluate the pilot program once it had been implemented to evaluate how patient outcomes changed as compared with the outcomes of the previous standard of care which was the RRT without the EWS. In completing my practicum hours, I was able to observe the planning stages of this effort, including the preparation of staff education materials, and attend organizational meetings where details of this program were discussed. I also had the opportunity to interact with quality and outcomes personnel to obtain information on care quality and reporting. As a critical care APN, I have had an interest in rapid response since its inception over 10 years ago. With the lines between critical care and the medical/surgical units becoming blurred, I had an interest in providing the necessary support mechanisms to staff nurses at the point of care, enabling them to better care for their patients who just a few years ago may have been cared for in an ICU setting. In order to do this well, recognition of actual or potential biases was necessary. My extensive background in the care of critically ill patients as both a bedside caregiver and a clinical nurse specialist (CNS) could have been a benefit, as well as a bias when evaluating cases of decline outside of the ICU. I balanced this by spending time on the medical units gaining perspective on what caregiving was like in that very dynamic setting. I am also an employee of the institution, so it was important that I separated my

student role from my professional role as an educator. Having a familiarity with the layout of the facility and the people was helpful. However, in order to be recognized as a student, I focused my practicum hours outside of the units I normally worked on as a CNS, and I clarified my role as a DNP student when participating in meetings. This provided me with the ability to bring ideas and discussions to the table regarding the recognized gaps in practice, and reinforced the clinical need for the EWS project. The established relationships fostered a sense of trust in the methods necessary to perform a thorough evaluation of the EWS.

Summary

The facility decision to move forward with a pilot program implementation and evaluation involved a thorough review of the background and context of the problem, and consideration of the recommended alternatives. In this case, the administrators supported this important initiative designed to promote patient safety and the relevance to nurses providing care to these patients. The translating evidence into practice model was applicable and provided the framework for the project. Employing a process such as the EWS for identification of early decline may have had ramifications for identified changes in outcome measures such as number of rapid response calls, number of code blue calls, representative of morbidity, and a longer-term measure of mortality.

Section 3: Collection and Analysis of Evidence

Introduction

In this project, I addressed the delay in recognition of early decline in hospitalized patients. The IHI has suggested that facilities implement EWSs to assist with earlier detection of decline in the hospitalized patient population via a track and trigger method, evaluating multiple patient parameters and assigning a physiologic score. This track and trigger system contains ranges within the score that prompt certain actions by the nurse according to a specific algorithm. The purpose of this capstone project was to evaluate the outcomes of the implementation of a EWS pilot as compared with the standard of care for treatment of decline on select patient outcome measures.

Practice-Focused Question

I conducted this project is a community hospital setting where, in some cases, subtle deterioration could have been identified even earlier despite the RRT mechanism. This identification of instances of failure to recognize provided the impetus for the plan to implement a pilot of the EWS. The facility selected two inpatient units for this pilot initiative. One was a geriatric acute care of the elderly (ACE) medical unit and one was a stroke/telemetry unit.

Despite IHI suggestions for their use, many facilities have not instituted use of a EWS. The identified gap in practice related to the actual or potential delays in recognition of early decline concerns patient safety and quality. If deterioration can be identified sooner, then prompt treatment can be initiated more readily and improvements in patient outcomes may be realized. In this project, I sought to evaluate if changes in

patient outcomes occurred after the initiation of the pilot EWS. The practice-focused question was: How have patient outcomes changed following implementation of an early warning score compared to the outcomes of the standard of care of a rapid response team without a EWS?

I used the following definition of terms throughout the project:

Rapid response team: A designated group of clinical personnel with expertise in managing critically ill patients who are deployed to the bedside to assist with management of patients in decline.

Early warning score: A numeric scoring system based on patient physiologic parameters such as vital signs, oxygen use, and level of consciousness. Deviations from normal are assigned a numeric value and an aggregate score is assigned which may indicate a change in patient condition.

Hospitalist: A primary care physician who assumes the care for a hospitalized patient without a primary care physician (PCP), or for whom the PCP is not a member of the medical staff at that facility. The private physician assumes care post-discharge. Duties of hospitalists include medical management of these hospitalized patients, and leading and managing the team during rapid response and code blue calls.

Code blue: A cardiac or respiratory arrest requiring resuscitation efforts.

Sources of Evidence

To address the practice-focused question, I gathered supporting evidence from existing archival facility data collected for rapid response and code blue events, and from mortality statistics which were also routinely reported for patient outcome measures.

These data were be obtained from a facility administrator in aggregate form, with no identifiable patient information accessible. I obtained and evaluated these data, comparing the metrics collected pre-EWS implementation to those collected post-EWS implementation to evaluate for changes. Because the facility implementation of this pilot was very recent, no formal evaluation had been completed. This DNP project served as the evaluation of the pilot initiative.

Published Outcomes and Research

I conducted an extensive review of the literature during the initial stage of this project. Once I identified the literature for use, I rated it for level of evidence using the American Association of Critical Care Nurses (AACN) levels of evidence (Peterson et al, 2014). An organized and systematic review process was used to ascertain applicable literature for use in this project. I used several databases to identify relevant information for the EWS project. These databases included CINAHL Plus, Medline, Cochrane, Joanna Briggs, Google Scholar, and ProQuest Nursing, and Allied Health Source. I used these multiple databases in an effort to acquire the most recent information and assure the topic was studied in a comprehensive manner. Search terms and combinations of search terms utilized included: *early warning, early warning score, early warning system, early warning scoring system, modified early warning score, failure to recognize,* and *failure to rescue*. The literature I identified was extensive on these topics, so limitations were placed on the search to ensure relevance. I limited the scope of the review to materials published 2009-2016 and initially focused on peer reviewed materials including systematic reviews and integrative reviews. Additional individual articles were then

identified as pertinent. I further limited the search by including only English language articles, and focused on the adult medical population.

Archival and Operational Data

In consideration of the comparative design of this project, it was necessary to obtain data for measures specific to the rapid response team and code blue team call activity. This was pre-existing and ongoing data that had been routinely collected as part of the facility plan for evaluation of program quality and outcomes measures for rapid response and resuscitation. Specific data points collected by the facility were the date and time of the call, the unit, the reason for the call, resuscitation status (whether the patient had a do not resuscitate [DNR] status), proximity to admission through the emergency department if applicable, the length of the call in minutes, transfers to higher level of care, and survival to discharge. Once the program was implemented on the pilot units, data on the EWS score was also collected. The overall number of rapid response and code blue calls were tracked, including the units the resuscitations occurred on, to evaluate if the arrests were occurring inside critical care as expected versus outside of the critical care areas. Once the EWS was in effect, evaluation of the calls triggered as a result of scoring an 8 or above provided insight into medical management and timeliness of assessment and interventions. Archival baseline data was available and was relevant to the project as it formed the basis of the comparative measures, with the exception of the EWS scores, which were not performed or collected prior to the program implementation. These data were collected by the facility representative through chart

review methods using an auditing process and the review of operator logs of the individual calls.

The overall validity of the data appeared strong because it was collected in the same manner month to month and was used in reports to the code blue resuscitation committee, critical care committee, and the Quality and Safety Council. A limitation inherent in the data was that the documentation on the rapid response and code blue documentation sheets was manual and as such may have had missing data elements. Additionally, as reported by the facility, on occasion the operator may have inadvertently failed to log a rapid response call. Missing data elements were identified by the reviewer when data collection was in progress, when a rapid response documentation sheet was found that did not match the operator log, it was reconciled. Additional statistical data regarding mortality was collected by the facility, and this data was accessible through reports generated to the department of quality and outcomes and administration. The specific metrics I evaluated for this project were the number of cardiopulmonary arrest calls and the number of rapid response calls for short-term outcome evaluation, and mortality for long-term evaluation. I evaluated these data by comparing the metrics collected prior to the EWS implementation to those collected post-EWS implementation to evaluate if any changes occurred. The facility rapid response, code blue, and mortality data were obtained through a nursing administrator who had authorized the access to this data in aggregate form. The outcomes chosen in the number of rapid response calls and the number of code blue calls represented the best available metrics to evaluate the change in care pre- and post-EWS implementation. I will compare mortality data at a

later time. I did not compare short-term mortality because of the very small number of mortalities historically reported for the two pilot units. The low number on both of the units precluded sufficient statistical power when evaluated in the short term. Any change in mortality rates evaluated over time could potentially be influenced by factors beyond the EWS pilot. This is a potential limitation in the long-term evaluation of mortality.

Evidence Generated for the Doctoral Project

Participants and Procedures

I was the only person involved in collecting and analyzing the secondary data for this project. The facility provided the baseline data as previously collected through their existing data collection methods. After the pilot implementation, the ongoing data collection continued as was previously done, with the exception of the added measure of the early warning score. I obtained the number of rapid response calls, code blue calls, and mortality data from the facility administrator in aggregate form. At no time was individual patient data accessible or necessary for this project. I compared 5 months of post-implementation data to the baseline data to see if any changes were noted on the pilot units involved in the EWS implementation.

Protections

First and foremost, in compliance with human subjects protection protocols, I did not begin data collection until completing IRB submission for both Walden University and the health facility involved, and receiving notification that approval had been granted from both (Appendix A). Additionally, compliance with HIPAA privacy regulations was assured because no individual patient information was necessary or accessible for this

project. The data was collected as usual by the facility. I received data from the administrator on the number of rapid response calls, number of code blue calls, and mortality in aggregate form.

Analysis and Synthesis

I compared the data pre- and post-implementation and evaluated them for any specific changes. Specific data points were collected on the number of rapid response calls, number of code blue calls, and mortality. Analysis involved 5 months of data acquired post-implementation of the EWS pilot on the two units, which I compared with similar data from the same 5-month period during the year prior to the implementation of the EWS pilot. I used a chi-square test of homogeneity to identify any difference between the proportions of cardiac arrests, rapid response calls, and mortality pre- and post-EWS implementation. In this case the independent variable was the EWS. The dependent variables were the number of cardiac arrests, the number of rapid response calls, and the number of mortalities. This test is designed to evaluate if a difference exists between the proportions of two independent groups on a dichotomous independent variable (Laerd Statistics, 2016). The null hypothesis stated there was no difference in the proportion of rapid response calls pre- and post-implementation of the EWS. The second null hypothesis stated there was no difference in the proportion of cardiac arrests pre- and post-implementation of the EWS. The last null hypothesis stated there was no difference in the mortality pre- and post-implementation of the EWS. The alternate hypotheses stated there were differences in the data points pre- and post-EWS. The timeframe I selected for the baseline data was November 1, 2015 through March 31,

2016. This was compared with the post-implementation data from November 1, 2016 through March 31, 2017.

Summary

Failure to recognize early decline in a patient may lead to serious sequelae. Implementation of a EWS in addition to the RRT may alert the nurse to subtle changes in patient condition that may warrant prompt intervention to avert an emergent event. Using appropriate data collection methods and statistical analyses enabled me to accurately compare pre- and post-EWS implementation data to evaluate if any differences were present on the pilot units. This information gained may be used to support wider implementation of the EWS across the facility, and to other system sites if successful.

Section 4: Findings and Recommendations

Introduction

This capstone project was an evaluation of a pilot implementation of a EWS on two units in a community hospital. Despite the presence of a RRT that deployed to instances of patient decline, a facility administrator noted an opportunity for improvement and wanted to employ the EWS to potentially improve timeliness in recognition of deterioration. The EWS was used in conjunction with the Rapid Response Team (RRT) program on two inpatient units. This scoring system assessed patient parameters, assigning an aggregate score that was used to evaluate the individual risk of decline. I anticipated that the number of rapid response calls would initially increase, and the number of code blue (resuscitation) calls would decrease. The purpose of this DNP project was to evaluate if there was any change in rapid response calls, code blue calls, and mortality post-EWS implementation as compared with pre-implementation baseline measurement with the RRT alone. The mortality on both pilot units was historically low, so this metric would best be evaluated long term as opposed to the 5-month period. The timeframe for the baseline data was November 2015 to March 2016. I used the same timeframe 1 year later (November 2016 to March 2017) as a comparative post-EWS implementation. The practice-focused question was: How have patient outcomes changed following implementation of an early warning system compared to the outcomes for the standard of care of a rapid response team without a EWS?

I obtained the sources of evidence for this project from existing data from the hospital for rapid response and code blue calls that were reported in aggregate along

with admission data and mortalities for both of the pilot units to provide context. Data analysis was completed using IBM SPSS Statistics Version 23. I used the chi-square test of homogeneity (test of two proportions) to determine if there was a statistically significant difference in the proportions before and after implementation of the EWS. The level of significance was established using an alpha of .05 ($p < .05$).

Because of the small number of code blue calls, I used a Fisher's exact test to address cell counts with frequencies that were less than five.

Findings and Implications

The data supplied by the facility contact was presented in aggregate form from two different periods containing 5 months of baseline data and 5 months of post-implementation data for the 5-month period of time 1 year later. I compared pre-EWS and post-EWS data for individual months from November through March, as well as for all 5 months in total.

Descriptive Statistics

Rapid response data for unit 5S for the month of November showed a total of 238 admitted patients, with 95 admits in November 2015 and 143 admits during November 2016. There were 10 RRT calls on the unit pre-EWS, compared with 12 calls post-EWS. The proportion of patients with an RRT call pre-EWS was .105 (10.5%) as compared to a post-implementation proportion of .084 (8.4%). This was a difference in proportions of .021 (2.1% decrease), $p = .578$. Table 1 indicates the difference between the two proportions was not statistically significant ($X^2 = .310$; $df = 1$; $p = .578$).

Table 1

Chi- Square Results for 5S RRT Calls for November

	Value	*df*	Asymptotic significance
Pearson chi-square	.310[a]	1	.578
N of valid cases	238		

[a] Zero cells have an expected count less than 5.

Rapid response data for 5S for December noted 227 total admitted patients, with 99 admits in December 2015 and 128 in December 2016. Six calls occurred pre-EWS compared with 17 during the post-EWS period. The proportion of patients with a call pre-EWS was .061 (6.1%) compared with a post-implementation proportion of .133 (13.3%). This was a difference in proportions of .072 (7.2% increase), $p = .074$. Table 2 indicates the difference between the two proportions was not statistically significant ($X^2 = 3.196$; $df = 1$; $p = .074$).

Table 2

Chi-Square Results for 5S RRT Calls for December

	Value	*df*	Asymptotic significance
Pearson chi-square	3.196[a]	1	.074
N of valid cases	227		

[a] Zero cells have an expected count less than 5.

The number of admissions in January was 255 with 113 admits pre-EWS and 142 post-EWS. Twelve RRT calls occurred pre-EWS versus nine post-implementation. The proportion of patients with an RRT call pre-EWS was .106 (10.6%), and the post-EWS

proportion was .063 (6.3%). This was a difference of .043 (4.3% decrease), $p = .217$. Table 3 indicates the difference between the two proportions was not statistically significant ($X^2 = 1.526$; $df = 1$; $p = .217$).

Table 3

Chi-Square Results for 5S RRT Calls for January

	Value	*df*	Asymptotic significance
Pearson chi-square	1.526[a]	1	.217
N of valid cases	255		

[a] Zero cells have an expected count less than 5.

February had similar data with a total of 211 admitted patients (100 pre-EWS and 111 post-EWS). Pre-EWS calls numbered 12 as compared with 10 post-EWS calls. The proportion of patients with a call pre-EWS was .12 (12%) and the post implementation was .09 (9%). This was a difference in proportions of .03 (3% decrease), $p = .478$. Table 4 indicates the difference between the two proportions was not statistically significant with ($X^2 = .504$; $df = 1$; $p = .478$).

Table 4

Chi-Square Results for 5S RRT Calls for February

	Value	*df*	Asymptotic significance
Pearson chi-square	.504[a]	1	.478
N of valid cases	211		

[a] Zero cells have an expected count less than 5.

March saw total admission of 252 patients with 115 pre-EWS and 137 post. Eight calls occurred pre-EWS and 14 post-implementation. The proportion of patients with a call pre-EWS was .07 (7%) compared with a post-EWS proportion of .102 (10.2%). This was a difference in proportions of .032 (3.2% increase), $p = .361$. Table 5 indicates the difference between the two proportions was not statistically significant ($X^2 = .835$; $df = 1$; $p = .361$).

Table 5

Chi-Square Results for 5S RRT for March

	Value	*df*	Asymptotic significance
Pearson chi-square	.835[a]	1	.361
N of valid cases	252		

[a] Zero cells have an expected count less than 5.

Rapid response data for unit 4N proved to be very similar overall. The month of November saw a total of 327 admitted patients, with 156 admits in November 2015 and 171 admits during the same month in 2016. Seven RRT calls occurred on the unit pre-EWS compared with 15 calls post-EWS. The proportion of patients with an RRT call pre-EWS was .045 (4.5%) as compared to the post implementation proportion of .088 (8.8%). This was a difference in proportions of .035 (3.5% increase), $p = .122$. Table 6 indicates the difference between the two proportions was not statistically significant ($X^2 = 2.387$; $df = 1$; $p = .122$).

Table 6

Chi-Square Results for 4N RRT Calls for November

	Value	*df*	Asymptotic significance
Pearson chi-square	2.387[a]	1	.122
N of valid cases	327		

[a] Zero cells have an expected count less than 5.

Rapid response data for 4N for December noted 391 total admitted patients with 191 admits in December 2015 and 200 in December 2016. Fourteen calls occurred pre-EWS compared with ten during the post EWS period. The proportion of patients with a call pre-EWS was .073 (7.3%) compared with the post implementation proportion of .05 (5%). This was a difference in proportions of .023 (2.3% decrease), $p = .337$. Table 7 demonstrates the difference between the two proportions was not statistically significant ($X^2 = .920$; $df = 1$; $p = .337$).

Table 7

Chi-Square Results for 4N RRT Calls for December

	Value	*df*	Asymptotic significance
Pearson chi-square	.920[a]	1	.337
N of valid cases	391		

[a] Zero cells have an expected count less than 5.

The number of admissions in January was 376 with 191 admits pre-EWS and 185 post-EWS. Fourteen RRT calls occurred pre-EWS versus 13 thirteen post-implementation. The proportion of patients with an RRT call pre-EWS was .073 (7.3%)

and the proportion of patients with a call post-EWS was .070 (7%). This was a difference of .003 (.3% decrease), $p = .909$. The difference between the two proportions shown in Table 8 was not statistically significant ($X^2 = .013$; $df = 1$; $p = .909$).

Table 8

Chi-Square Results for 4N RRT Calls for January

	Value	*df*	Asymptotic significance
Pearson chi-square	.013[a]	1	.909
N of valid cases	376		

[a] Zero cells have an expected count less than 5.

February had comparable data with a total of 377 admissions (188 pre-EWS and 189 post-EWS). Pre-EWS calls totaled 12 as compared with 14 post-EWS calls. The proportion of patients with a call pre-EWS was .064 (6.4%) and the proportion of patients with calls post implementation was .074 (7.4%). This was a difference in proportions of .01 (1% increase), $p = .695$. The difference between the two proportions shown in Table 9 was not statistically significant ($X^2 = .154$; $df = 1$; $p = .695$).

Table 9

Chi-Square Results for 4N RRT Calls for February

	Value	*df*	Asymptotic significance
Pearson chi-square	.154[a]	1	.695
N of valid cases	377		

[a] Zero cells have an expected count less than 5.

March saw a total of 392 patients with 178 admitted pre-EWS and 214 post-EWS. Ten RRT calls occurred pre-EWS and 12 post- implementation. The proportion of patients was the same pre and post-EWS at .056 (5.6%), $p = .996$. The lack of difference between the two proportions was not statistically significant as shown in Table 10 ($X^2 = .000$; $df = 1$; $p = .996$).

Table 10

Chi-Square Results for 4N RRT Calls for March

	Value	*df*	Asymptotic significance
Pearson chi-square	.000[a]	1	.996
N of valid cases	392		

[a] Zero cells have an expected count less than 5.

Code blue calls for both of the pilot units were few in number and expected frequencies in several of the cells were less than five, which necessitated the use of Fisher's exact test for accurate statistical analysis. As previously noted for unit 5S, the month of November saw a total of 238 admitted patients, with 95 admits in 2015 and 143 admits during 2016. Two code blue calls occurred on the unit pre-EWS and zero calls occurred post-EWS. The proportion of patients with a code blue call pre-EWS was .021 (2.1%) as compared to the post implementation proportion of .000 (0%). This was a difference in proportions of .021 (2.1% decrease), $p = .158$. Table 11 indicates the difference between the two proportions was not statistically significant.

Table 11

Chi-Square Results for 5S Code Blue Calls for November

	Value	*df*	Asymptotic significance
Pearson chi-square	3.036[a]	1	.081
N of valid cases	238		
Fisher's exact test	.158		

[a] Two cells have an expected count less than 5.

Code blue data for unit 5S for December revealed 227 total admitted patients with 99 in December 2015 and 128 in December 2016. One call occurred pre-EWS compared with two in the post- EWS period. The proportion of patients with a code blue call pre-EWS was .010 (1%) compared with post- implementation proportion of .015 (1.5%). This was a difference in proportions of .005 (.5% increase), $p = 1.000$. Table 12 indicates the difference between the two proportions was not statistically significant.

Table 12

Chi-Square Results for 5S Code Blue Calls for December

	Value	*df*	Asymptotic significance
Pearson chi-square	.131[a]	1	.718
N of valid cases	227		
Fisher's exact test	1.000		

[a] Two cells have an expected count less than 5.

The number of admissions in January totaled 255 with 113 admits pre-EWS and 142 post-EWS. Zero code blue calls occurred pre-EWS versus four post-implementation.

The proportion of patients with a code blue call pre-EWS was .000 (0%) and the proportion of patients with a call post-EWS was .028 (2.8%). This was a difference of .028 (2.8% increase), $p = .132$. Table 13 indicates the difference between the two proportions was not statistically significant.

Table 13

Chi-Square Results for 5S Code Blue Calls for January

	Value	*df*	Asymptotic significance
Pearson chi-square	3.234[a]	1	.072
N of valid cases	255		
Fisher's exact test	.132		

[a] Two cells have an expected count less than 5.

February had a total of 211 admitted patients with 100 admits pre-EWS and 111 post-EWS. One pre-EWS code blue call occurred as compared with zero post-EWS. The proportion of patients with a call pre-EWS was .01 (1%) and the proportion of patients with a call post implementation was .000 (0%). This was a difference in proportions of .01 (1% decrease), $p = .474$. The difference between the two proportions shown in Table 14 was not statistically significant.

Table 14

Chi-Square Results for 5S Code Blue Calls for February

	Value	*df*	Asymptotic significance
Pearson chi-square	1.115[a]	1	.291
N of valid cases	211		
Fisher's exact test	.474		

[a] Two cells have an expected count less than 5.

In March a total of 252 patients were admitted to unit 5S with 115 pre-EWS and 137 post-EWS. One code blue call occurred pre-EWS and zero post implementation. The proportion of patients with a call pre-EWS was .008 (.8%) compared with the proportion of .000 (0%) post-EWS. This was a difference of .008 (.8% decrease), p = .456. The difference between the two proportions shown in Table 15 was not statistically significant.

Table 15

Chi-Square Results for 5S Code Blue Calls for March

	Value	*df*	Asymptotic significance
Pearson chi-square	1.196[a]	1	.274
N of valid cases	252		
Fisher's exact test	.456		

[a] Two cells have an expected count less than 5.

Code blue data for unit 4N appeared to be analogous. November admissions totaled 327 with 156 admits in 2015 and 171 admits during 2016. One code blue call was noted both pre/post-EWS. The proportion of patients with an RRT call pre-EWS and post-EWS was exactly the same with .006 (.6%), $p = 1.000$. Table 16 indicates the lack of difference between the two proportions was not statistically significant.

Table 16

Chi-Square Results for 4N Code Blue Calls for November

	Value	*df*	Asymptotic significance
Pearson chi-square	.004[a]	1	.948
N of valid cases	327		
Fisher's exact test	1.000		

[a] Two cells have an expected count less than 5.

Code blue data for unit 4N for December recorded 391 admitted patients with 191 admits in December 2015 and 200 in December 2016. Zero calls occurred pre-EWS compared with one during the post EWS period. The proportion of patients with a call pre- EWS was .000 (0%) compared with the proportion of patients with a call post implementation of .005 (.5%). This was a difference in proportions of .005 (.5% increase), $p = 1.000$. Table 17 indicates the difference between the two proportions was not statistically significant.

Table 17

Chi-Square Results for 4N Code Blue Calls for December

	Value	*df*	Asymptotic significance
Pearson chi-square	.957[a]	1	.328
N of valid cases	391		
Fisher's exact test	1.000		

[a] Two cells have an expected count less than 5.

January saw 376 admissions with 191 pre-EWS and 185 post-EWS. No calls occurred pre-EWS versus two post-implementation. The proportion of patients with a code blue call pre-EWS was .000 (0%) and the proportion of patients with calls post-EWS was .010 (1%). This was a difference of .010 (1% increase), $p = .241$. Table 18 indicates the difference between the two proportions was not statistically significant.

Table 18

Chi-Square Results for 4N Code Blue Calls for January

	Value	*df*	Asymptotic significance
Pearson chi-square	2.076[a]	1	.150
N of valid cases	376		
Fisher's exact test	.241		

[a] Two cells have an expected count less than 5.

February recorded similar data with a total of 377 admissions (188 pre-EWS and 189 post-EWS). Pre-EWS calls totaled one as compared with zero post-EWS. The

proportion of patients with a call pre-EWS was .005 (.5%) and the proportion of patients with a call post-implementation was .000 (0%). This was a difference in proportions of .5 (.5% decrease), $p = .499$. Table 19 indicates the difference between the two proportions was not statistically significant.

Table 19

Chi-Square Results for 4N Code Blue Calls for February

	Value	*df*	Asymptotic significance
Pearson chi-square	1.008[a]	1	.315
N of valid cases	377		
Fisher's exact test	.499		

[a] Two cells have an expected count less than 5.

Admissions in March numbered 392 patients with 178 admitted pre-EWS and 214 post-EWS. One code blue call occurred both pre-EWS and post- implementation. The proportion of patients with a call was .005 (.5%) pre-EWS and the proportion of patients with a call post-EWS was .004 (.4%). This was a difference of .001 (.1% decrease), $p = 1.000$. Table 20 indicates the difference between the two proportions was not statistically significant.

Table 20

Chi-Square Results for 4N Code Blue Calls for March

	Value	*df*	Asymptotic significance
Pearson chi-square	.017[a]	1	.896
N of valid cases	392		
Fisher's exact test	1.000		

[a] Two cells have an expected count less than 5.

In addition to evaluating the data for rapid response and code blue calls on an individual basis for the five separate months, the data was also evaluated in cumulative manner for the five months in total to identify any differences in proportions. Admissions to unit 5S during that time period totaled 1183 with 522 pre-EWS and 661 post-EWS. The number of RRT calls prior to the EWS pilot was 48 and post-EWS they increased to 62. The proportion of patients with an RRT call pre-EWS was .092 (9.2%), and the proportion of patients with a call post EWS was .094 (9.4%). This was a difference of .002 (.2% increase). Table 21 shows this difference was not statistically significant ($X^2 = .012$; $df = 1$; $p = .914$).

Table 21

Chi-Square Results for 5S RRT November to March

	Value	*df*	Asymptotic significance
Pearson chi-square	.012[a]	1	.914
N of valid cases	1183		

[a] Zero cells have an expected count less than 5.

The number of patients admitted to unit 4N during those five months was 1863 with 904 pre-EWS and 959 post-EWS. Fifty seven out of the 904 patients had a RRT call before the pilot and 64 out of the 959 had a call after the implementation. The proportion of patients with a call pre-EWS was .063 (6.3%), and the proportion of patients with a call post EWS was .067 (6.7%). This was a difference of .004 (.4% increase) which was not statistically significant (X^2 = .104; *df* = 1; *p* = .747) as shown in Table 22.

Table 22

Chi-Square Results for 4N RRT November to March

	Value	*df*	Asymptotic significance
Pearson chi-square	.104[a]	1	.747
N of valid cases	1863		

[a] Zero cells have an expected count less than 5.

As discussed previously, unit 5S had 1183 patients admitted between November and March with 522 pre-EWS and 661 post-EWS. Five code blue calls occurred prior to

the pilot, and six occurred after the implementation. The proportion of patients experiencing a code blue event before the EWS was .01 (1%), versus .009 (.9%) after the EWS began, a difference of .001 (.1% decrease), $p = 1.000$. Table 23 indicates this was not statistically significant.

Table 23

Chi-Square Results for 5S Code Blue November to March

	Value	*df*	Asymptotic Significance
Pearson chi-square	.008[a]	1	.929
N of valid cases	1183		
Fisher's exact test	1.000		

[a] One cell has an expected count less than 5.

Lastly, unit 4N admitted 1863 patients during that five month period with 904 before the pilot and 959 after implementation of the EWS. Three code blue calls occurred pre-EWS and five calls post-EWS. The proportion of patients with a code blue call was .003 (.3%) pre-EWS and the proportion of patients with a call post-EWS was .005 (.5%). This was a difference of .002 (.2% increase), $p = .727$. Table 24 indicates this was not statistically significant.

Table 24

Chi-Square Results for 4N Code Blue November to March

	Value	*df*	Asymptotic significance
Pearson chi-square	.391[a]	1	.532
N of valid cases	1863		
Fisher's exact test	.727		

[a] Two cells have an expected count less than 5.

I conducted the individual and cumulative chi-square tests of homogeneity to compare the proportions of rapid response and code blue calls relative to admissions on the two pilot units before and after the implementation of the EWS. I analyzed this data and sought to determine if the use of the EWS would significantly change patient outcomes after implementation as measured by the number of rapid response calls, number of code blue calls, and mortalities. I anticipated that the number of rapid response calls for scores greater than 8 would increase based on the use of the EWS, which provided a frequent structured method of evaluation based on aggregate physiological parameters. With this increased frequency of surveillance and potential for earlier identification and intervention for those in the moderate scoring range (4-7), I was thought that the number of code blue resuscitation calls would decrease. Based on these

metrics, I thought that the potential for a decrease in the mortality rates for these units was probable.

The rapid response data from units 5S and 4N were analyzed using the chi- square for homogeneity to compare the proportions of RRT calls within the context of the number of patients admitted to the units monthly from November to March. On 5S, 2 out of the 5 months had a slight increase in the proportion of calls noted; otherwise the proportions in the other 3 months actually decreased. This was also the case for 4N, although the months with a noted increase were completely different, therefore no trends in the months were identified. Despite the small increases, none were statistically significant with $p > .05$ (see Tables 1-10). Additionally I completed a comparison of the two proportions for 5S for the cumulative total of the 5 months. Despite small increases in the proportion of calls, these were not statistically significant with $p > .05$ (see Tables 21 and 22). Therefore I could not reject the null hypothesis. My expectation of a significant change in the number of RRT calls after the introduction of the early warning score was not realized. One of the reasons for this may have been that the staff was using the early warning score as they were educated to do. In using the scoring, they may have determined that their patient was scoring in the moderate risk range of 5-7. The expected actions associated with a score in that range was to either use appropriate prn orders they already had for the patient, or to call the physician to obtain appropriate orders, which would have been implemented in an effort to prevent further decline. If the staff intervened in this manner for those scoring in the moderate risk range, it is feasible that the patients would not have progressed in their decline to the point of scoring an 8 or

above, which would have been a trigger to call the RRT. Since I obtained no specific data about the actual EWS scores on the patients, this is speculative, but may explain the blunted increase in the RRT calls for these two units.

I analyzed the code blue data for 5S and 4N using the chi- square for homogeneity to compare the proportions of code blue calls within the context of the number of patients admitted to the units monthly from November to March. Some cells contained less than 5 cases, therefore I used Fisher's exact test for accuracy in the analysis. On 5S, 3 out of the 5 months showed a slight decrease in the proportion of code blue calls during November, February, and March, with December and January experiencing a slight increase. The proportion of code calls on 4N decreased slightly as well for February and March, remained unchanged for November, and actually increased slightly in a similar manner as 5S for December and January. Despite the slight decreases in calls for the months noted, none were significant, with $p > .05$ (see Tables 11-20). The number of code blue calls in January on 5S quadrupled from a baseline of zero in 2016 to four calls in 2017. Similarly, 4N doubled their number of calls during this period from a baseline of zero in 2016 to two in 2017. This was not in accordance with the normally low number of code calls on the pilot units. However, when evaluated in terms of the admissions, the increase was not statistically significant. The 5-month aggregate data for 5S and 4N for RRT calls revealed a small increase in the proportion of calls one year to the other; however, this was not statistically significant in either case. Looking at the code blue calls for both 5S and 4N for the cumulative 5-month period, a slight increase was noted on 4N and a slight decrease on 5S, however neither were statistically

significant. At the conclusion of the evaluation of the EWS pilot, the differences between any of the independent binomial proportions were not statistically significant ($p > .05$), indicating that the frequencies of rapid response calls and code blue calls on the two pilot units did not change significantly following the implementation of the EWS (see Tables 23 and 24). Therefore I failed to reject the null hypotheses and could not accept the alternate hypotheses. The primary limitation noted in this evaluation was that it encompassed only 2 pilot units in one community hospital instead of the originally planned evaluation of a full-facility implementation. Delays in the implementation timeline beyond what was anticipated by the hospital system resulted from necessary refinement of the EWS documentation build in the electronic medical record and technology issues impacting the planned vital sign acquisition on tablets at the point of care. This led facility administrators to suggest bringing it live as a pilot on two units for the purposes of interim evaluation given those constraints. While collecting the data from the pilot units was helpful for this capstone, I had anticipated additional data from multiple units, which would have provided a more robust comparison.

The findings of this capstone study have potential benefit to individual patient safety based on the slight increase in the proportions of RRT calls and slight decrease in proportions of code blue calls. The trends may be more significant if a larger sample is obtained for evaluation, and may support additional implementation in other units. This has benefit not only for one individual, but also for all patients in a hospital community. Institutions can benefit from improved patient safety and a potential decrease in the overall mortality rate. Mortality rates are publicly reported, and consumers of healthcare

may make their decisions for care based on the safety profile and outcome data of a particular facility or hospital system. From a quality standpoint, healthcare facilities want to provide patient care using best practices that enhance and promote safety. Finally, incorporating the use of innovation and employing the use of technology and/or processes for the purpose of improving safety has broader significance to society as a whole. Knowledge gained in the use of a risk assessment method designed to mitigate further decline and possibly preempt patient harm has potential to improve outcomes for society as a whole.

Recommendations

While my analysis of this pilot project did not demonstrate a significant change in the outcome measures of the two units after implementation of the EWS, the results may be useful for the facility when performing additional evaluative processes. It is possible that the results of the two selected units was not representative of the entire facility, and I therefore recommend repeating the evaluation using data from the entire facility over a longer period. This would allow for a more complete assimilation of the new scoring process, adjusted workflows, and knowledge of the tablet technology by the staff prior to evaluation. It would also provide a more comprehensive evaluation when comparing outcomes with other facilities in the hospital system once the complete rollout occurs. If the results of repeated study are unchanged, then it would be incumbent on the facility to consider other potential factors that may influence delay in recognition of decline in the hospital setting. Including the staff more actively in the project may have also yielded additional qualitative data with the use of surveys or focus groups for a more complete

mixed methods evaluation, and should be considered in future study. Additional considerations for study would be the use of a modified EWS in specialty areas such as maternity and pediatrics.

Strengths and Limitations

As part of the capstone evaluation, strengths and limitations should be acknowledged that may have been associated with the project results as reported. One strength of this project is that it was relatively uncomplicated in terms of process and could easily lend itself to replication. Another strength is that much of the data was already collected by the facility, was accessible, and would not compromise nursing time on the units involved. Limitations include that I completed the evaluation on only two units in a single community facility in the Northeastern United States. Thus, findings may not be representative of other types of facilities or areas of the state or country. Another limitation is the length of time for data collection and the timeframe after implementation. Only 5 months of data were obtained for analysis post-implementation. One full year would have been ideal. Given these limitations, the findings indicate the need for additional study with a larger pool of data. Additionally, the implementation of the pilot EWS occurred in September 2016 after 1 month of education. Allowing 1 month for the learning curve for the staff with the new processes and workflow in October, I collected data for November 2016 through March 2017 for analysis. Normally at least 3 months of a new practice should elapse prior to undertaking an evaluative process. The facility also had a color-coded system for capacity and throughput that it used on a daily basis. Red status indicated reaching capacity and a

significant number of holding patients in the emergency department (ED). A more recent "super red" status indicated full capacity, with use of halls beds and an increasing number of holding patients in the ED. It would be of interest to evaluate the number of days at red or super red status to see what, if any, impact that would have had in terms of the data and the level of care that patients were admitted to. Additional quantitative outcome measures such as transfers to higher levels of care in the evaluation may contribute to the robustness of subsequent studies. Lastly, the small number of historical and actual mortalities on each of the pilot units precluded meaningful analysis in the allotted 5 month period. Mortality would be better evaluated long term at the end of a year from implementation. This is a metric of interest because the true effectiveness of the EWS is best evaluated in terms of lives saved.

Section 5: Dissemination Plan

Development of a well-developed strategy for the dissemination of any DNP capstone result is crucial for translation of research into practice. Consistent with DNP Essential III (AACN, 2006), this project culminates with the evaluation and dissemination of findings to improve nursing practice. The goal of this quality improvement project was to evaluate the implementation of a EWS in terms of specific patient outcomes. The impetus for projects such as this is to promote, enhance, or sustain those processes which improve care and outcomes for all patients. Given that charge, communicating the results adds to what is known about evaluation of EWSs in a community hospital and allows for potential replication of the project in similar settings. The first point of dissemination of these results will be the stakeholders at the facility where I implemented the project. The findings may be of interest to the nursing staff who were active participants in the pilot implementation of scoring process of patients in their care. Given the limitations in the number of clinical units and the limited time frame, opportunities for future study should be encouraged and may be more representative of the facility as a whole. I will also provide findings to the nursing administrators who were responsible for the endorsement of the two unit pilot project implementation when the delays in the full facility go-live occurred. The use of an executive summary may be of use here. The evaluation may provide direction for the next phase of the EWS program, inform about limitations given the setting and timeframe, and offer recommendation for future evaluation and reporting efforts. The facility research council offers another forum for dissemination of findings, as it

stipulates that a final report must be given either through a written or verbal presentation once the project or study has concluded. Opportunities for sharing the results externally to other nursing colleagues began with the submission and acceptance of a poster presentation at the system nursing research day (Appendix B). This annual event combined a research conference with the opportunity to highlight the work of nurses using the professional poster format. Given the lack of statistical significance, a journal submission would likely not be accepted for publication. However, if future evaluative processes demonstrate significance, then it would be another format for dissemination to nursing professionals, as would presentations to my professional organization.

Analysis of Self

This DNP journey has included many opportunities for self-reflection, which have permitted me to evaluate the integration of new knowledge and the acquisition of necessary competencies that have contributed to my professional growth. Given my role as a critical care clinical nurse specialist, this topic was of obvious interest. Processes that support or improve patient safety are of benefit to all patients in the hospital setting. Nursing practice changes should be driven by compelling evidence and demonstrated through quality outcomes. This capstone project allowed me the opportunity to examine what was recommended in terms of use of a EWS, and evaluate the value in clinical practice. Identifying opportunities for study that may benefit both patients and nursing colleagues is an important role for the advanced practice nurse. Employing leadership skills and knowledge beyond the individual patient with a shift toward a more complex organizational viewpoint is an outcome of the program of study for the DNP. This ability

to more comprehensively evaluate clinical programs, considering outcome metrics, resources, fiscal responsibility, and short and long term goals, has provided me with tools to better advocate for best practices in an evolving healthcare environment.

In my role as a scholar, I have expanded my knowledge of how to critically appraise literature, execute a program evaluation, and use quantitative methods to identify statistical significance. A lesson I learned as a scholar is that not everything chosen for study will result in statistical significance to support the selected practice, as was the case with this project. Additionally, I began the evaluation of the project a little over a month after the new process was in place. I have learned it is best to have a program or process in place for at least 3 months prior to beginning any evaluation. As a result of the program and capstone process, I can better support the replication of studies in general, and can identify why replication may help support or refute practice, especially given this project's limitations. From a project management standpoint, the skills gained were associated with creation and modification of the timeline, involving the stakeholders in the facility, and identifying barriers and facilitators in the processes. Having experience with short-term quality improvement projects prior to this one was of some benefit to me. I did not anticipate that this project would have taken as long as it did to complete, and the results would not demonstrate statistical significance in support of the EWS. The facility rolled out the EWS process to all inpatient units in the facility with the exception of the specialty units as part of their strategic initiative for patient safety in June 2017. I would have liked to repeat the evaluation of the EWS in terms of the entire facility for a more prolonged period to see if the additional data would

demonstrate a different outcome. This evaluation will not be possible because the facility also implemented a resource nurse program on the night shift, which began in August 2017. This nurse rounds proactively, based partly on the trends of the early warning scores to prevent further decline in patient condition. It has been very well received by the staff and has led to an actual decrease in the number of rapid response calls due to the proactive focus. This new program would make it difficult to attribute any changes in the results solely to the EWS. The project had several challenges, the first of which was the delay in the full implementation of the EWS. If the facility administrators had not approved a pilot version of the project implementation, I would have had to begin again with a new capstone topic. The delays were frustrating as the timeline for the original implementation was a year prior to the actual event, which is why I had decided on this project. The insights gained during this was to ensure a full program implementation is in place prior to beginning an evaluative process, and to persevere despite the extent of the delays. Lastly and most importantly, I feel confident that this project is just the beginning of my opportunities for additional study, whether it be on this topic or other clinical questions that arise in my practice, as learning in nursing should be continuous.

Summary

To conclude, this capstone was an evaluation of a pilot implementation of a EWS on two units in a community hospital. Five months of baseline data on the two units with RRT only was collected and compared to 5 months of data 1 year later post implementation of the EWS with RRT. The outcome metrics I measured were the proportion of rapid response calls, proportion of code blue calls, and mortality evaluated

in the context of admissions. The findings indicated the proportion of rapid response calls and code blue calls on the two pilot units did not change significantly following the implementation and use of the EWS. Based on these findings, the facility should re-evaluate the program in terms of the full facility roll-out. The opportunity for collection and analysis of additional data for program evaluation is recommended to see if any changes can be identified that may prove to be statistically significant. Mortality on both of the units was historically very low and would thus be best evaluated long term at the end of a year post-implementation, which would be the ultimate indicator of program success.

References

5 Million Lives Campaign. (2008). *Getting started kit: Rapid response teams*. Retrieved from http://www.ihi.org/resources/Pages/Tools/HowtoGuideDeployRapid ResponseTeams.aspx

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

Alam, N., Hobbelink, EL., van Tienhoven, A.J., van de Ven, P.M., Jansma, E.P., & Nanayakkara, P.W. (2014). The impact of the use of the early warning score (EWS) on patient outcomes: A systematic review. *Resuscitation*; *85*(5), 587-594. doi:10.1016/j.resuscitation.2014.01.013

Berwick, D.M., Calkins, D.R., McCannon, C.J., & Hackbarth, A.D. (2006). The 100,000 lives campaign: Setting a goal and a deadline for improving health care quality. *JAMA, 295*(3), 324-327. Retrieved from http://jama.jamanetwork.com 4/3/2016

Buist, M., Bernard, S., Nguyen, T. V., Moore, G., & Anderson, J. (2004). Association between clinically abnormal observations and subsequent in-hospital mortality: A prospective study. *Resuscitation*, *62*(2), 137-141. doi:10.1016/j.resuscitation.2004 .03.005

Franklin, C., & Mathew, J. (1994). Developing strategies to prevent inhospital cardiac arrest: Analyzing responses of physicians and nurses in the hours before the event. *Critical Care Medicine*, *22*(2), 244-247. Retrieved from https://journals.lww.com/ccmjournal/pages/default.aspx

Institute for Healthcare Improvement (IHI). (n.d.). Rapid response teams. Retrieved from http://www.ihi.org/Topics/RapidResponseTeams/Pages/default.aspx

Institute of Medicine (2001). *Crossing the quality chasm: A new health system for the 21st century*. Retrieved from the National Academies website: http://nationalacademies.org/HMD/Reports/2001/Crossing-the-Quality-Chasm-A-New-Health-System-for-the-21st-Century.aspx

Kohn, L.T., Corrigan, J.M., & Donaldson, M.S. (2000). *To err is human: Building a safer health system*. Retrieved from National Academies website: http://www.nationalacademies.org/hmd/Reports/1999/To-Err-is-Human-Building-A-Safer-Health-System.aspx

Laerd Statistics (2016). *Statistical tutorials and software guides.* Retrieved from https://statistics.laerd.com

McCannon, C.J., Hackbarth, A.D., & Griffin, F.A. (2007) Miles to go: An introduction to the 5 Million Lives Campaign. *Joint Commission Journal on Quality and Patient Safety, 33*(8), 477-484. Retrieved from http://www.ihi.org/resources/Pages /Publications/MilestoGoIntro5MillionLivesCampaign.aspx

McNeill, G., & Bryden, D. (2013). Do either early warning systems or emergency response teams improve hospital patient survival? A systematic review. *Resuscitation*, *84*(12), 1652-1667. doi:10.1016/j.resuscitation.2013.08.006

Peterson, M.H., Barnason, S., Donnelly, B., Hill, K., Miley, H., Riggs, L., . . . Whiteman, K. (2014). Choosing the best evidence to guide clinical practice: Application of

AACN levels of evidence. *Critical Care Nurse*, *34*(2), 58-68. doi:10.4037 /ccn2014411

Pronovost, P.J., Berenholtz, S.M., & Needham, D. M. (2008). Translating evidence into practice: A model for large scale knowledge translation. *British Medical Journal*, *337*, 963-5. Retrieved from http://journals.bmj.com/

Pronovost, P.J., Murphy, D.J., & Needham, D.M. (2010). The science of translating research into practice in intensive care. *American Journal of Respiratory and Critical Care Medicine, 182*(12), 1463-1464. doi:10.1164/rccm.201008-1255ED

Schein, R. M., Hazday, N., Pena, M., Ruben, B. H., & Sprung, C. L. (1990). Clinical antecedents to in-hospital cardiopulmonary arrest. *Chest Journal*, *98*(6), 1388-1392. Retrieved from http://www.chestnet.org/Publications/CHEST-Publications/CHEST-Journal

Subbe, C.P., & Welch, J.R. (2013). Failure to rescue: Using rapid response systems to improve care of the deteriorating patient in hospital. *Clinical Risk, 19*(1), 6-11. doi:10.1177/1356262213486451

Appendix A: IRB Approval

Walden IRB approval number 07-20-17-0451799

Appendix B: Poster for Dissemination