Southern California CSU DNP Consortium

California State University, Fullerton
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NATIONAL EARLY WARNING SCORES (NEWS): A QUALITY IMPROVEMENT PROJECT

A DOCTORAL PROJECT

Submitted in Partial Fulfillment of the Requirements

For the degree of

DOCTOR OF NURSING PRACTICE

By

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ABSTRACT

Research suggests that a patient suffering from a cardiac and/or respiratory arrest usually exhibits physiological deviations, such as changes in vital signs and/or mental status, at least eight hours prior to the need for more intensive care (Stenhouse, Coates, Tivey, Allsop, & Parker, 2000). Numerous early warning score (EWS) tools are available for use in acute care settings to alert nurses to the need for early intervention to prevent continuing decline and mortality. The National Early Warning Scores (NEWS) is a tool used to predict clinical deterioration based on physiologic measurements. A specific score is given to each physiological measurement and aggregated scores from six parameters and the use of oxygen are used to create a composite score to predict the magnitude of decline.

A prospective quantitative study was conducted in six medical/surgical units in a Level I trauma center, over a 30-day period of time, in order to validate the effectiveness of NEWS in predicting clinical deterioration. Three thousand one hundred and fifty-four patient recordings revealed that 138 patients scored NEWS ≥5, or a 3 in a single parameter and received interventions to prevent further clinical deterioration. Of the 138 NEWS positive patients, 22 were transferred to a higher level of care, whereas 68 patients stayed on the medical/surgical unit. Their NEWS returned to acceptable levels after therapies. Project findings indicate that NEWS supports clinical decision-making

processes as it allows for a single measure of an extreme physiologic value or an aggregate score to activate interventions to prevent clinical deterioration.

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DEDICATION

I dedicate this project to my parents, Viswanatha Warrier and Ambika Devi, who have provided encouragement, love, support, and guidance throughout my life. Without your unconditional love, prayers, and mentorship, I would not be the person I am today. Thank you for being the best parents in the world. I also like to dedicate this project to my in-laws, Govind and Sarojini Warrier, for giving me an opportunity to chase my dream in this country and always believing in me. To my father-in-law, I believe you are watching over me each day and blessing me for my successes. Thank you all from the bottom of my heart. I love each and every one of you very much.

BACKGROUND

Problem Statement

Research suggests that patients transferred from medical/surgical wards to intensive care units experience higher mortality rates when compared to patients admitted from emergency or operating rooms (Stenhouse, Coates, Tivey, Allsop, & Parker, 2000). One reason for the higher mortality rates may be the failure of the nursing staff to identify a significant clinical deterioration in their patients' conditions. Research also suggests that patients suffering from a cardiac and/or respiratory arrest usually exhibit physiological deviations, such as changes in vital signs and/or mental status, at least eight hours prior to their need for more intensive care (Stenhouse et al., 2000).

Numerous recent international reports have advocated the use of early warning scores (EWS) in different practice settings in acute care hospitals for the effective identification and early intervention for patients who present with or develop acute illness (Royal College of Physicians, 2015). There are several bedside tools available for nurses to help identify patients experiencing deterioration, including the National Early Warning Scores (NEWS) tool. NEWS focuses on a simple scoring system in which physiological measurements are assigned a predetermined score, which is then applied to a patient's physiological measurements when they present to the triage or emergency room, and/or are admitted in the hospital. Six simple physiological parameters form the basis of the scoring system: respiratory rate, oxygen saturation, temperature, systolic blood pressure, pulse rate, and level of consciousness. A specific NEWS score is designated to each physiological measurement and the aggregated score from all six parameters and the use of oxygen will predict the magnitude of variation from the norm (Royal College of

Physicians, 2015). The aggregated score, based on physiological changes and the use of oxygen, help to identify patients at high-risk for developing a catastrophic life-threatening event. By identifying at-risk patients, nurses can initiate early interventions or take steps to transfer these patients to units with a higher level of care without activating a Rapid Response Team (RRT) or Code Blue alert.

The National Early Warning Scores (NEWS) quality improvement project, proposed by the author, took place at a Level I trauma center in southern California. This medical center has an inpatient capacity of 546 patients per day and has had a RRT since 2010. When hospital administrators reported that RRT calls from medical/surgical floors were increasing, the patient safety officer for the hospital reviewed the RRT activations and observed that many patients exhibited physiological changes in their clinical condition at least two to three hours prior to the activation. In addition, nursing staff reported using clinical judgment occasionally to initiate an intervention in response to a patient's physiological change(s) that did not meet the RRT activation protocol per hospital policy. Furthermore, any delay in initiating an intervention for patients who did not meet the required RRT activation protocol at the time yet displayed signs and/or symptoms of distress could result in poor clinical outcomes. Waiting for an RRT activation score, when it was evident that the patient needed prompt medical intervention to avert further deterioration, was also placing patients at risk. Thus, to achieve better patient outcomes, the team decided to revise the existing RRT protocol to also include NEWS scoring criteria for early identification and initiation of immediate intervention prior to reaching a RRT and/or Code Blue activation status.

During the initial stage of planning the introduction of an early warning scoring system in the medical center a team evaluated several tools that predict early warning scores in inpatient medical/surgical units. After the evaluation of several tools the team selected NEWS, which had evidence supporting its effectiveness in discriminating risk of acute mortality as well as its appropriate use for the defined patient population in the proposed units. Furthermore, at the recommended trigger level for a clinical alert, NEWS is more sensitive than other early warning systems and has been found to provide an enhanced level of surveillance to detect clinical deterioration.

The proposed project site is a medical center with three primary medical surgical units, two step-down/progressive care units with eight medical/surgical ward beds, and six medical/surgical ward beds dedicated to obstetrics/gynecology (OB/GYN) patients. The total daily average census of inpatients in these units is 136. Based on the results of a prior pilot study conducted in the project's medical center involving one of three primary medical/surgical units, nurses using the NEWS tool in the medical center's medical/surgical units could potentially identify approximately 504 patients per year who required a higher level of care based on their NEWS scores. With the medical center's current mortality rate of approximately 2% per year, this author hopes to see a significant reduction in *failure to rescue* events, which can lead to cardiopulmonary arrest and/or death. The term failure to rescue refers to a death or permanent disability after a treatable complication (Agency for Healthcare and Research Quality [AHRQ], 2014). Failure to rescue events provides a measure of the inability to initiate an intervention by medical providers during adverse events that occurred when patients are under their care. Failure to rescue events may also reflect the quality of monitoring associated with the

effectiveness of an intervention engaged once early signs of deterioration and/or complications are recognized (AHRQ, 2014).

The Clinical Professional Development (CPD) Department at the hospital began the process of developing, implementing, and evaluating a simple scoring tool to identify worrisome change(s) in a patient's physiological parameters. The author of this project initiated a pilot study that evaluated data from 813 patients whose NEWS scores were collected during 24-hour timeframes throughout the month of February 2014. In this pilot study 40 patients met the NEWS scoring criteria to initiate immediate communication between the medical provider and the nurse. The provider was required to conduct an immediate face-to-face patient assessment, which resulted in the transfer of 14 patients to another unit for higher level of care. Twenty-six patients remained in the unit with additional bedside interventions (e.g., administration of oxygen, a beta-blocker and/or a bolus of fluids). Hospital administrators estimated that if the NEWS project had continued, nursing staff could have potentially identified approximately 168 patients per year who were at-risk for clinical deterioration by using the NEWS assessment tool. This short pilot study, conducted on one unit, provided support that the NEWS tool was a valuable resource (Figure 1). Utilization of this tool facilitated early interventions that resulted in the prevention of RRT and/or Code Blue activation (Appendix C). Because of this positive result, the hospital administration and the author of this project considered a second, more robust phase two pilot study.

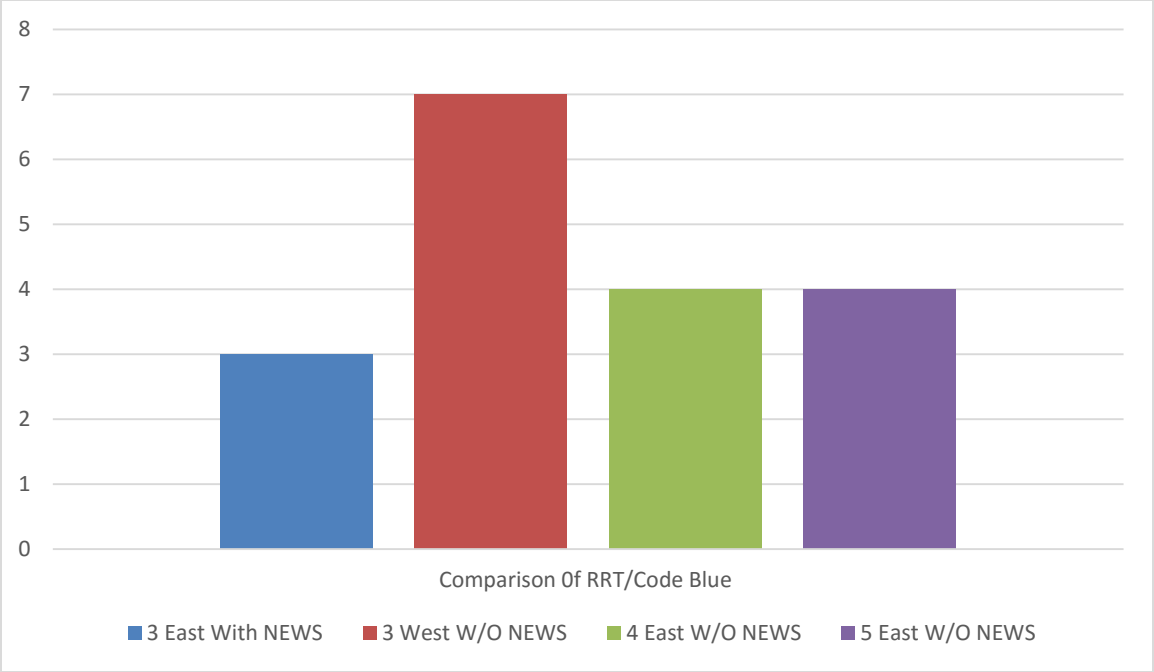

Figure 1. February 2014 RRT/Code Blue activation with and without NEWS.

Purpose Statement

The goal of this project was to improve early identification of patient deterioration so that nurses could initiate immediate interventions ensuring the appropriate use of RRT and/or Code Blue teams. The specific purposes of this project were to implement the NEWS tool on six medical/surgical units and evaluate tool's effectiveness. The objectives of this project were to:

a. Decrease RRT and/or Code Blue calls by early identification of clinical deterioration

b. Provide prompt interventions before situations became life threatening and required a RRT or Code Blue intervention

c. Reduce nonessential RRT activations

d. Implement the use of the tool in six units and compare the results of a prior pilot study conducted during a 26-day timeframe in February 2014 using the tool (NEWS) in one unit to the results of the November 2015 study.

Conceptual Framework

The conceptual framework selected for the National Early Warning Scores (NEWS) project was the Plan-Do-Study-Act (PDSA) model. Moen and Norman (2010; 2013) described the process of combining two quality improvement frameworks in their article, "The Foundation and History of the PDSA Cycle" that eventually became the framework used in this project. The PDSA cycle focuses on real-time changes and is action-oriented (Institute for Innovation and Improvement, 2008). The PDSA model guides a process change and identifies a measurable outcome (Institute for Healthcare Improvement, 2015a).

Best and Newhauser (2006) explained the origin of the PDSA cycle and how the name changed from the Shewhart cycle to the Deming Wheel or the Deming Cycle. The PDSA cycle has two parts. First, clinicians were asked three fundamental questions:

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 an improvement?

The second part of PDSA follows a four-stage cycle, Plan-Do-Study-Act (Taylor et al., 2013). This model is a simple, straightforward, and powerful tool for quality improvement projects.

The first phase of the PDSA cycle is the "Plan." During this phase, the project coordinator identifies methods to improve the situation or secure a desired outcome (U.S.

Department of Health and Human Services Health Resources and Service Administration, 2011; AHRQ, 2013). As part of the planning process for this project, the author conducted a literature review of evidence-based practices to support the project. To ensure success of the Quality Improvement (QI) project, the author identified stakeholders who were essential for the project success. The team members included (a) the inpatient medical director, (b) chief attending physician, (c) chief nursing officer, (d) clinical directors, (e) nurse managers, (f) charge nurses, (g) nursing representatives from each unit, (h) clinical nurse specialists (CNS), (i) clinical nurse educators (CNE), and (j) the respective attending physicians from the units.

The second phase of the PDSA cycle is the "Do" stage. In this phase, the author presented and implemented the proposed plan with the help of team members. Team members for the project presentation included (a) attending physicians, (b) interns/residents, (c) nurse managers, (d) CNSs, (e) CNEs, (f) charge nurses, and (g) unit staff representatives. The staff received education on the NEWS scoring tool, scoring criteria, action alert, and protocol. Due to glitches in the roll out of the Electronic Health Record (EHR) system, the facility decided to use a paper format for recording NEWS to avoid delay in the process of implementation. At this time of this study the author continues to work with information technology to activate the NEWS system in the EHR and the implementation of the NEWS EHR software alert system is scheduled to be activated in late 2016 only after all Department of Health Service (DHS) hospitals go live with their EHR system. Upon establishment of the NEWS tool in the hospital's EHR, the author has been assigned to provide in-services to the staff regarding the use and documentation of NEWS tool electronically. During this phase, the author has been

assigned to follow up with staff and to review how vital signs and NEWS data are recorded in the EHR documentation form as well as documentation of any intervention(s) implemented based on NEWS, and/or any RRT or Code Blue calls initiated during the implementation period. This EHR phase may include needed modification to the protocol.

The third phase of the PDSA is the "Study" phase. In this phase, the author has analyzed one-month of data to determine the outcomes from this project. She has summarized the findings to identify strengths and weaknesses associated with the implementation of the NEWS project. During this phase, she also has analyzed (a) the total number of patients who received a NEWS alert, (b) their demographic data, (c) number of patients who required intervention(s) based on their NEWS alert, and (d) the number of RRT or Code Blue calls activated during the study phase. The author has reviewed all NEWS activated events and has assessed if staff failed to monitor the patient appropriately per NEWS criteria or if the NEWS was not sensitive to the change in the patient's condition.

"Act" is the final phase of the PDSA cycle. Information obtained from the implementation period has helped determine an action or a decision to implement, modify, and/or the need to withdraw the tool. A review of the results has provided direction for revisions in the tool. While the data collection is done for now, the author has committed to providing hospital and nursing stakeholders with project results on a quarterly basis for another year.

The goals of this project were (a) to improve early identification of clinical deterioration based on physiological measurement(s), (b) to initiate appropriate

intervention(s) based on the patient's NEWS, and (c) to improve patient outcomes. The PDSA framework fits well with this NEWS project because it promotes flexibility to adapt changes within the cycles and allows for simple evaluation of practice changes. Figure 2 provides a visual representation of the PDSA Quality Improvement Model using the NEWS assessment tool.

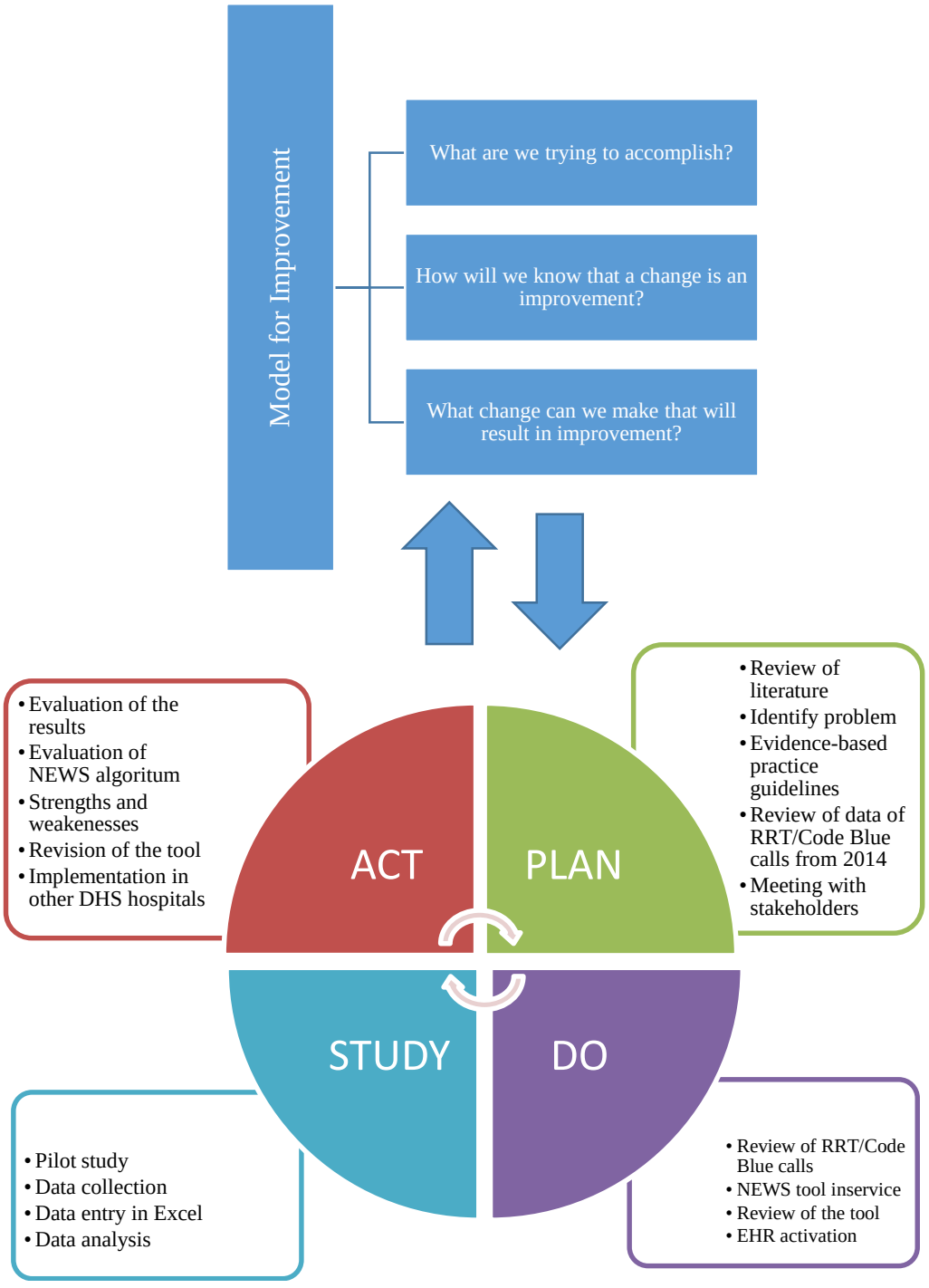

Figure 2. PDSA model for Improvement using a NEWS model. Adapted from NHS Institute for Innovation and Improvement. Retrieved from www.ihi.org/resources/pages/ Healthimprove/ default.aspx

REVIEW OF LITERATURE

Patient physiology can change unpredictably and dynamically over the course of hospitalization. Every admitted patient in the hospital is at risk of developing an acute physiological deterioration. National Early Warning Scores (NEWS) and Modified Early Warning Scores (MEWS) are simple, physiological scoring tools that assist nursing staff in identifying a change in clinical conditions in an acute care hospital (Capan, Ivy, Wilson & Huddleston, 2015; Gardner-Thorpe, Love, Wrightson, Walsh, & Keeling, 2006).

The purpose of this literature review is to identify and review evidence-based articles that examine the efficacy, specificity, sensitivity, validity and reliability of the NEWS tool in different settings. In addition, the literature review identifies the cut-off points for activating the warning system, appropriate intervention(s) based on the scores, and the clinical decision-making capability of nursing staff when the patient is experiencing distress without a NEWS alert score. The author used the Cumulative Index to Nursing and Allied Health (CINAHL), Oxford Journals, PubMed, Medical Subject Heading (MeSH), MedLine, Cochrane Library, and Google Scholar in the literature search for this project. The databases were accessed through the Parlow Library at Harbor-UCLA Medical Center in Torrance, California, and the Pollak Library at California State University, Fullerton. The research librarian and the author developed the search criteria that included the following terms: national early warning scores, modified early warning scores, early warning scores, medical/surgical units, emergency room, intensive care units, admission criteria, physiological scoring system, physiological changes, physiological deterioration, acute vital sign changes, early warning system,

early recognition, and evidence-based practice. The research librarian at Harbor-UCLA Medical Center also assisted in securing full-text articles.

Articles included were peer-reviewed, written in English, and published between 2005 and 2015. Two articles published in 2000 were also included in the literature review as exceptions because these articles extensively explain the origin, modification, and application of the NEWS tool using valid outcome measures.

Patients who develop an acute clinical deterioration often exhibit preceding abnormalities in vital signs. Various hospitals in the United Kingdom have been using 33 different types of early warning scoring systems and NEWS has shown better outcomes among all (Kolic, Crane, McCartney, Perkins, & Taylor, 2015). Kolic et al. conducted a prospective observational study of 370 adult patients admitted to an acute medical ward in London District Medical Hospital. The results from this study showed that the correct use of early warning scores could improve patient outcomes related to interventions in response to clinical deterioration. The study also showed the trend toward increased mortality in people who had an incorrect scoring and response. The inadequate use and incorrect scoring were more evident on weekends and night shifts. Further investigation of the data showed that the discrepancy of scoring and difference in clinical care was due to lack of proper staffing. This study emphasized the fact that the incorrect calculation of NEWS scores had significant implications for patient care and safety.

Many countries have adapted some form of an early warning scoring system in their hospitals to recognize early deterioration. The measured scores are based on a predetermined set of subjectively agreed upon normal vital signs. The sum of the allocated points determines the severity of illness and the recommended interventions.

However, the published studies did not describe the escalation protocol of EWS (Jarvis et al., 2015). The researchers focused on the risk of cardiopulmonary arrest, unanticipated intensive care unit admissions, and death of patients who received a NEWS score of three, four, and five. The authors observed the vital signs data within 24 hours after receiving the NEWS scores. There were a total of 142,282 patients who received an aggregate NEWS value of three or four and 36,207 patients who received a score of three in a single parameter. The results from this study evidenced that an aggregated NEWS of either three or four with a single component score of three had significantly lower risk of adverse outcomes than a score of five or higher, and these patients required more observation and escalation of care.

Patients exhibit physiological deterioration through notable changes in vital signs that a healthcare provider can identify through routinely collected vital signs. A delay in recognition and response to acute physiological deterioration can be due to the complexity of the care delivery process and the fragmented nature of health care. The research supports that EWS-based systems can predict clinical deterioration in patients and can then result in recommended appropriate interventions, such as an activation of a rapid response team or an emergent clinical decision (Capan et al., 2015). The authors conducted a retrospective study using patient care data extracted from electronic medical records. The sample size of this study included 55,385 adult patients admitted in a general ward from January 2011 to December 2012. The study focused on the fact of heterogeneity in both patients and the provider. An acute physiological deterioration reflected the heterogeneity of the patients as to their diagnosis, reason for admission, and the clinical outcomes. Most of the existing EWS protocols did not address the

heterogeneity of the patients and providers using the tool. The results of this study suggested the importance of an individualized approach when treating a patient with an acute physiological deterioration. An early warning score based on dynamic and stochastic models may support data-driven clinical decision-making by enhancing the ability to capture changes in a patient's condition over time in a patient-centered manner.

Healthcare providers may use the MEWS as a risk-prediction tool, which identifies early signs of clinical deterioration. Two retrospective MEWS studies focused on the documentation of vital signs among patients who were noted to be at risk to experience a critical event 48- hours prior to the actual emergency intervention. The researchers measured the patients' risk of developing any one or more of the following: (a) cardiopulmonary arrest, (b) an unplanned intensive care unit admission, (c) unexpected death, and/or (d) emergency surgery (Ludikhuiz, Smorenburg, De Roij, & De Jonge, 2012; Niegsch, Fabritius, & Anhoj, 2013). The researchers concluded that the MEWS tool could serve as a guide for early detection of deteriorating vital signs in patients who may go on to experience cardiopulmonary arrest and/or unplanned intensive care unit admission. However, there was no relevant evidence to suggest that the MEWS tool was effective in identifying patients who required emergency surgery.

Several studies identified the significance of implementing a track and trigger system that enabled nurses and health providers to use signs and symptoms to categorize the level of care needed by patients (Gardner-Thorpe et al., 2006; Ludikhuiz et al., 2012; Niegsch et al., 2013; Romero-Brufau et al., 2014; Yu et al., 2014). This is important to note as in most acute care hospitals nurses record vital signs of patients in medical/surgical floors only once or twice per day. It was suggested that a track and

trigger system like MEWS will help nurses screen patients to determine who will require closer monitoring of vital signs and, if necessary, an intervention (Fullerton, Price, Silvey, Brace, & Perkins, 2012; Yu et al., 2013). Furthermore, there is a preponderance of evidence about the usefulness of the MEWS tool in medical/surgical settings (Gardner-Thorpe et al., 2006).

The findings of Ludikhuiz et al. (2012) and Niegsch et al. (2013) suggests that heart rate, blood pressure, and temperature are the most frequently documented vital signs. Respiratory rate, mental status, and urine output were documented only 30% of the time in their review. Therefore, those measures were not included in the MEWS. In addition, their research indicated that because nurses did not alert physicians in a timely fashion concerning a patient situation with high MEWS scores, no one intervened to take the necessary relevant action based on the patient's deteriorating condition, which resulted in failure to rescue events.

A thorough assessment is the key for a provider to determine the necessity of a patient's admission to an inpatient unit from the emergency room or triage. However, oftentimes the emergency room or triage providers lack the crucial clinical assessment skills to determine the level of care needed for each patient (Cameron et al., 2015). Immediate intervention may not be the most effective solution for all emergency or triage patients. A physiological scoring tool, such as MEWS, can help providers evaluate the severity of a patient's clinical condition and use that information for their clinical decision-making. The physiological parameters used in past MEWS-related studies were (a) blood pressure, (b) heart rate, respiratory rate, (c) mental status (i.e., alert, responds to verbal stimuli, painful stimuli, unresponsive), and (d) urine output (Burch, Tarr, &

Morroni, 2008; Cameron et al., 2015; Ebrahamian et al., 2014). Two separate studies demonstrated the importance of introducing an individualized care plan for patients presenting in the Emergency Department who live alone by measuring demographic characteristics and social isolation in addition to MEWS scoring (Cameron et al., 2015; Ebrahamian, Seydin, Jamshidi-Orak, & Masoumi, 2014). A consistent theme throughout the multiple studies emphasized that a simple clinical scoring tool such as MEWS, NEWS, EWS, or Psychosocial Modified Early Warning Scores (PMEWS) provided a calculation of a patient's physiological scores and assistance in evaluating the probability of admission at the time of triage.

Patients transferred from an intensive care unit (ICU) to a medical/surgical unit are at risk for developing cardiac arrest, overwhelming infections, sepsis, and/or shock (De Meester et al., 2013). Studies point out the increased mortality rates among patients in medical/surgical wards transferred there from ICU (De Meester et al., 2013; Hammond et al., 2012). Due to premature transfers from the ICU to the medical/surgical ward, the discharged patient often returns for further care and/or emergency readmission to the ICU. To decrease unplanned readmissions after transfer from the ICU, De Meester et al. (2012) and Hammond et al. (2013) introduced MEWS tools to assist nurses in monitoring the patient's physiological measurements for 48-hours after ICU discharge. The purpose of introducing the MEWS tool was to provide frequent close monitoring of vital signs so that a provider was able to evaluate patients immediately and initiate interventions.

EWS and MEWS, which describe the same tool, measure the physiological deterioration of patients in an acute care setting. The study by Capan et al. (2015) focused on the EWS score as a determinant factor to activate RRT. The researchers

employed an EHR model called the Markovian model to identify patient-centered EWS scores used in activating RRTs. The authors of this article did not find any published studies related to the use of personalized EHR and EWS to activate RRTs. However, Capan and fellow researchers (2015) found that there was a significant technological advantage in using an EHR as it allowed the provider to look at real-time physiological measurements resulting in the ability to make immediate decisions.

Overall, the studies analyzed in the review of literature conducted for this doctoral project support the use of a physiological scoring tool like MEWS, EWS, NEWS, or PMEWS to evaluate a patient's clinical condition and determine the need for intervention. Findings of these studies also suggest that acute care hospitals should develop a clinically valid protocol which can incorporate the NEWS to improve patient outcomes. Such a protocol may prove to be a valuable guide in caring for patients in the following situations: (a) direct admission from an emergency room to an inpatient unit; (b) transfer from an ICU to a medical/surgical ward; (c) transfer from a medical/surgical ward to ICU or a step-down unit; and/or (d) a discharge from emergency room/triage to home.

METHODS

This project involved the implementation of an adapted NEWS tool to detect early clinical deterioration in patients admitted to six medical/surgical units. The following section describes the procedures and methods used for this project. The purpose of this prospective project was to examine the effectiveness of the NEWS tool in identifying clinical deterioration of medical/surgical patients in order to optimize early interventions prior to the need for RRT/Code Blue activations. In addition, outcome data from this project (e.g., RRT/Code Blue activations) were compared with the pilot data from 2014.

Setting and Sample

The settings for this QI project were six adult inpatient medical/surgical units that provide non-monitored patient care in a Level I trauma center within a southern California academic medical center. These non-monitored patient care areas are inpatient units that provide patient care without using continuous cardiac electronic monitoring devices. The patients hospitalized in the six adult inpatient medical/surgical units were admitted from the (a) emergency room, (b) progressive care units, (c) intensive care units and/or (d) as scheduled admissions. All patients who met the inclusion criteria were potential subjects in this project. In addition, the patients whose NEWS required an intervention, such as healthcare provider alert, RRT and/or Code Blue activations, were automatically included as subjects for this QI project. Patients who experienced an RRT and/or Code Blue activations not generated by a NEWS score were included as an additional cohort of subjects evaluated for other potential clinical conditions that did not exhibit a warning sign.

Inclusion Criteria

The inclusion criteria was:

- Age 18 years or older
- Hospitalized on one of the six designated units involved in this project (medical, surgical, orthopedic, oncology, OB/GYN, and/or neurological units)
- Diagnosed with one or more, but not limited to, the following conditions: (a) chronic obstructive pulmonary disease; (b) chronic asthma; (c) history of hypertension; (d) preexisting cardiac dysrhythmia, (e) surgical intervention(s), (f) cancer diagnosis, or (g) any medical/surgical condition that required an inpatient admission in one of the identified project units.

Exclusion Criteria

Patients were excluded under these conditions:

- Under 18 years of age
- Pregnancy
- Repeated scores for unchanged conditions that do not need to be reported per provider exclusion criteria
- Receiving active palliative/comfort care

Measures

The instrument used to collect data for this project was the NEWS tool as developed by the project setting. This bedside assessment tool was adapted from the original bedside tool developed in the United Kingdom by Conwy and Denbighshire National Health Service (IHS, 2014). The six criteria included in the NEWS tool were: (a) respiratory rate, (b) oxygen saturation, (c) temperature, (d) systolic blood pressure, (e)

heart rate, and (f) level of consciousness. Each physiological parameter received a score from zero to three and the total score was summed (IHS, 2014). A review of studies suggested that the NEWS tool had a sensitivity of 75%, and a specificity of 83% (Gardner-Thorpe et al., 2006).

An interdisciplinary group of healthcare providers from the medical center sponsoring this project reviewed and evaluated various tools for identification of the appropriate early warning scoring system. MEWS and NEWS were identified during this period as appropriate tools for the study's patient population. After further assessment of MEWS and NEWS tools by the author and CPD, it was decided to use the Royal College of Physicians (RCP) NEWS tool, which is based solely on a patient's vital signs. Both tools use the six aforementioned physiological measurements. The main difference between NEWS and MEWS is that NEWS gives a score for patient oxygen use and MEWS includes urine output in the aggregated score. The author conducted a needs assessment survey using both tools, which found the staff identified the NEWS instrument as more appropriate for the patient population in the selected project wards. The group based their decisions on a review of literature and the results from the prior pilot study in one unit. The Ysbyty Glan Clwyd (YGC) MEWS tool did not include a complete set of criteria specifying a time frame to notify providers of early signs of patient clinical deterioration because urine output may require a longer time for reporting. The group believed that when reporting vital signs, the use of oxygen is also an important factor to predict a patient's clinical condition. Therefore, it was included as a variable with the other physiologic parameters in this NEWS project. In addition, the copyright for using the NEWS tool is exclusively given to users by the RCP without any

restrictions except acknowledgement of RCP NHS Trust for developing the tool (Royal College of Physicians, 2015).

The physiological measurements of the NEWS tool have a scoring range of 0 to 3 allocated to each measurement except supplemental oxygen (IHI, 2007). The supplemental oxygen has only two scores 0 and 2 (0 = no oxygen and 2 = use of oxygen). The seven measurements in NEWS scoring criteria are (a) respiratory rate, (b) oxygen saturation, (c) supplemental oxygen, (d) temperature, (e) systolic blood pressure, (f) heart rate, and (g) level of consciousness (Appendix A, Appendix B).

When the nursing staff used this tool, the patients' vital signs were recorded in the EHR and scored manually in the NEWS documentation form M1114 used for this study (Appendix A). The NEWS manual documentation form was color-coded to provide visual alertness to initiate an immediate appropriate intervention. In addition, laminated color-coded charts with the NEWS alert scores were posted in each unit. Color-coded charts assisted in processing important information such as alerts. If the vital sign fell in a yellow zone and/or red zone of the chart, it prompted the nurse to assign a NEWS alert. In addition to the yellow and red score alerts, the hospital decided to include a pink score alert for sepsis identification; however, that variable was not investigated by the author as part of this study.

Procedures

Acceptance from the key stakeholders is necessary for any project. As a part of project planning and implementation, the author arranged a meeting in July 2015 with the following leadership representatives from the medical center's administration:

a. Chief nursing officer

b. Clinic nursing director

c. Nurse managers of medical/surgical units

d. Clinical nurse specialists/clinical nurse educators in the units

e. Attending physicians of medicine, surgery and neurology

f. Inpatient medical director

g. Chief of Department of Medicine.

During the meeting, the author discussed the following: (a) purpose of the prior pilot study, its results, and the rationale for the expansion to other medical/surgical units; and (b) history and purpose of this study involving the NEWS.

The author requested permission to implement NEWS in the remaining six adult inpatient medical/surgical units in order to collect additional data and examine its ability to detect early signs of clinical deterioration. After obtaining administrative approval, the author organized a follow-up meeting during the first week of August 2015. The following administrative representatives attended that meeting: (a) the clinical nursing director, (b) inpatient medical director, (c) chief of medicine, (d) unit nurse managers, (e) CNS/CNEs, and (f) charge nurses. The attending physicians from different services came to a consensus, determined different patient clinical /diagnosis criteria for activating the NEWS protocol, and excluded others. The nursing clinical director, author, and the attending physicians contacted the physician-training personnel for provider education plans.

The author obtained Institutional Review Board (IRB) approval from California State University, Long Beach, and Los Angeles BioMed to conduct the study in the hospital. All the IRB rules and regulations were maintained throughout the study to

protect the confidentiality of patients' handwritten and EHR information required for the data collection process.

A PowerPoint presentation was developed for the required in-service sessions in the oncology, OB/GYN, neurology, medical/surgical, and orthopedic units and reviewed by the inpatient medical director, chief of medicine, attending physician, and CNS and CNE of the respective units participating in this project. The intention for the PowerPoint review by other personnel was to obtain expert advice as to the relevancy of its content and ease of understanding. The CNS and CNE of these units have master's degrees in nursing with extensive bedside experience. Following the approval of the PowerPoint presentation by the experts, unit-specific in-service education sessions were conducted from October 19, 2015, to October 30, 2015. The author and the team scheduled six 30-minute educational sessions to train all of the staff from the medical/surgical units about the use of the NEWS prior to its implementation. Approximately 430 nursing staff attended the in-service training, achieving the target goal of 95% attendance by the time of implementation. The inpatient medical director, chief of medicine, and physician training coordinator arranged the medical provider education through emails, screen savers, and memos. The author placed laminated posters in the units explaining the project (Appendix A). The NEWS implementation was underway in all six medical/surgical units on November 10, 2015, and data collection began the same day for one month to evaluate the efficacy of the tool.

Patients had their vital signs routinely recorded every four hours in their EHR. A specifically designed NEWS template developed for this project was embedded in the EHR. However, during the testing period the author and team realized that the template in

the EHR system was missing two components from the original tool. The information technology department required a six-month period to resolve the issue because of the need to prioritize EHR implementation in other DHS hospitals. Therefore, the EHR NEWS alert software program could not be used. The author had to meet with DHS administration to request a revision of the tool adapted in the EHR as a part of normal procedure. After the NEWS presentation to DHS administration, the DHS QI Department decided to implement this project in other DHS hospitals within their EHR as a part of a DHS-wide quality improvement project to improve patient care. This decision by DHS further delayed the EHR implementation of the revised NEWS computer program in the project hospital, creating the new anticipated date of documentation for NEWS through EHR as June 15, 2016. The inpatient medical director and clinical director of the medical/surgical service in the project hospital decided to implement the project using paper documentation to prevent any further delay in implementing the proposed project starting date. As part of the approval process, the author presented the NEWS documentation form to the forms committee, pharmacy & therapeutic committee, executive leadership committee, and nursing leadership committee. All respective committees approved the form and the paper documentation of NEWS initiated.

Registered nurses, licensed vocational nurses, and nursing attendants entered the vital signs data into the EHR system and then manually documented the same information on the NEWS documentation form. The author conducting this project and/or the designee collected the NEWS documentation form from all six units daily. The charge nurses and the nurse managers instructed the staff to place the NEWS documentation form at the end of the evening shift into provided envelopes with the title

"NEWS Data Collection: November 10, 2015 to December 9, 2015." The author randomly checked the EHR vital signs documentation with the handwritten NEWS scores to validate the accuracy of entry. The author retrieved all NEWS data forms from the units and screened all the scores to ensure that the staff followed inclusion and exclusion criteria. All patients who received a NEWS alert, patients with NEWS scores of five or greater, and/or a score of three in any single parameter, were included as subjects in this project. In addition, patients who had an RRT/Code Blue activation without a NEWS alert were also included in the study to identify the reason for the activation.

In addition, the author extracted the following information from the EHR or unit data summary forms:

a. Daily NEWS alert incidents in each unit and their classification (i.e., provider only alert or RRT/Code Blue activation)
b. Patient information (demographic and diagnosis related data)
c. Type of intervention(s) based on pre-determined cut-off scores
d. All RRT/Code Blue activations during the data collection period
e. All RRT/Code Blue activations from November 10, 2014, to December 9, 2014
f. All RRT/Code Blue data from February 2014 during the first phase of NEWS pilot study in one unit.

The data abstraction form included the following information: (a) date of data collection, (b) a patient identification code, (c) demographic information (race, age, and gender), (d) diagnosis, (e) routine vital signs collected within the past 24 hours with the corresponding NEWS scores (every four hours), (f) total NEWS alert scores, (g) level of

care (moved to higher level of care and/or remained on unit), and (h) type of intervention(s).

To confirm the reliability of the data, the unit charge nurse created a separate record listings all NEWS activation calls, interventions, and status of the patient after the NEWS initiation. This file was maintained in the unit as a part of the daily unit-debriefing folder listing patients' whereabouts. Once the author collected the NEWS activation lists from the charge nurses, she reviewed (a) all NEWS activations, (b) patients' total NEWS, (c) scores assigned to the various physiological parameters, (d) reason for initiation, and (e) the intervention(s) provided for the patient(s) from the nurse's and/or medical provider's EHR documentation. Furthermore, the author obtained the number of RRT/Code Blue calls unrelated to NEWS alert activations from the pilot units during the implementation period.

Aims

The aims of this study and the analysis plan were as follows:

a. Compare the number of RRT/Code Blue calls in six medical/surgical units during similar time frames but one year apart to investigate what effect NEWS implementation had on these outcomes of interest (November 10, 2014, to December 9, 2014, and November 10, 2015, to December 9, 2015, as well as for the entire month of December in 2014 and 2015);
b. Compare the number of RRT/Code Blue activations based on NEWS score to those RRT/Code Blue activations based on nursing judgment;
c. Describe the relationship of demographic and/or clinical factors with RRT/Code Blue activations;

d. Describe what, if any, interventions were given to patients who were transferred to a higher level of care and those given to patients who remained in the unit based on NEWS composite score of 5 or greater or 3 in any single parameter;
e. Describe the clinical condition/diagnosis(es) of patients who received a NEWS of 5 or greater or 3 in any single parameter;
f. Identify the number of missed interventions in patients with a NEWS scores of 5 or greater or 3 in any single parameter.

Data Analysis

The statistical program used to analyze the data was Statistical Package for the Social Sciences (SPSS). Measures of central tendency were used to describe baseline characteristics of the patient population. The effect of the clinical and demographic variables on the measured outcome was analyzed through appropriate inferential and descriptive statistical testing based on the level of measurement used. In addition, the author provided frequency counts for the following:

a. Patients who received a NEWS score of 5 to 6 or 3 in any single physiological parameter;
b. Patients who received NEWS score of seven or higher;
c. Patients who received intervention(s) in the unit based on NEWS score;
d. Patients who were transferred to a higher level of care based on NEWS score;
e. RRT/Code Blue calls initiated based on clinical judgment and without a NEWS alert.

RESULTS

The purpose of the study was to evaluate the effectiveness of the NEWS as a screening tool to detect early signs of clinical deterioration in patients hospitalized on medical/surgical units in a Level 1 trauma center in southern California. One month of NEWS data provided evidence for the aims of the study. Patient demographics, NEWS measurements, and types of interventions for scores of 5 or greater or 3 in any single parameter are reported. In addition, the author presents a comparison of RRT and Code Blue alerts from 2014 and 2015 on these units.

A total of 3,154 patients participated in the study and more than 113,000 separate NEWS data collection points were collected. Patients were assessed at six time-points (0200, 0600, 1000, 1400, 1800, and 2200) and even variables were measured (i.e., respiratory rate, oxygen saturation, use of oxygen, temperature, systolic blood pressure, heart rate, and level of consciousness). The data were entered into the NEWS rubric and a score of 0, 1, 2, or 3 was given for each of these seven variable. Data cleaning revealed that results were only available for 90.3% of all anticipated data collection points (102,473 out of 113,536). Possible reasons for missing information from the data set were (a) time of admission (e.g., admitted at 1000), (b) discharge, or (c) the patient was undergoing a procedure and/or surgery during one or more of the six time-points. Eight-tenths of a percent of patients refused vital signs, which resulted in missing data. A chart review revealed that these individuals were long-term patients with a stable health condition who remained on the medical/surgical units due to lack of housing. The percentage of missing data is satisfactory because patients have acceptable reasons for missing data points. See Table 1.

Table 1. *Summary of Missing Data across Six Measures by Cause, Aggregate Data from Six Time-Points (N = 3,154 patients)*

	Respiratory Rate	Oxygen Saturation	Oxygen Supply
Data			
Available	17096 (90.3%)	17073 (90.2%)	17124 (90.5%)
Unavailable	1826 (9.7%)	1847 (9.8%)	1799 (9.5%)
Reason Unavailable			
Missing	1417 (7.5%)	1418 (7.5%)	1422 (7.5%)
*D/C (555)	167 (0.9%)	167 (0.9%)	167 (0.9%)
*No V/S (666)	7 (0.0%)	7 (0.0%)	8 (0.0%)
Refused (777)	133 (0.7%)	153 (0.8%)	99 (0.5%)
*OR (888)	12 (0.1%)	12 (0.1%)	12 (0.1%)
Off Unit (999)	90 (0.5%)	90 (0.5%)	91 (0.5%)

Note. *D/C = discharge; *V/S = vital signs; *OR = operating room.

Table 1 – continued.

	Temperature	Systolic Blood Pressure	Heart Rate	Level of Consciousness
Data				
Available	17058 (90.1%)	17056 (90.1%)	17066 (90.2%)	17180 (90.8%)
Unavailable	1866 (9.9%)	1867 (9.9%)	1858 (9.8%)	1780 (9.2%)
Reason Unavailable				
Missing	1430 (7.6%)	1424 (7.5%)	1426 (7.5%)	1416 (7.5%)
*D/C (555)	167 (0.9%)	167 (0.9%)	165 (0.9%)	164 (0.9%)
*No V/S (666)	5 (0.0%)	14 (0.1%)	5 (0.0%)	0 (0.0%)
Refused (777)	162 (0.9%)	160 (0.8%)	160 (0.8%)	56 (0.3%)
*OR (888)	12 (0.1%)	12 (0.1%)	12 (0.1%)	11 (0.1%)
Off Unit (999)	90 (0.5%)	90 (0.5%)	90 (0.5%)	90 (0.5%)

Note. *D/C = discharge; *V/S = vital signs; *OR = operating room.

The first aim of the study was to compare the number of RRT, RRT/Code Blue activations in the medical/surgical units in 2015 (NEWS implementation) with those of 2014 data (pre-NEWS) from the same units (Appendix C). Chi-square tests calculated the categorical values of patients days (x1,000) with total number of RRT calls (Table 2) during November 2014 and November 2015. The total number of RRT/Code Blue calls during November 2014 and November 2015 are represented in Table 3. The author also analyzed RRT alerts during December 2014 and December 2015 and combined RRT and Code Blue alerts in Tables 4 and 5, respectively. None of the comparison data was statistically significant. Figure 3 provides another visual representation of this data by presenting the differences in RRT, and RRT/Code Blue calls from 2014 to 2015.

Table 2

Comparison of RRT Activation in November 2014 (pre-NEWS) and November 2015(NEWS)

	November 2014	November 2015	Marginal Row Totals
RRT	11 (9.08) [0.41]	5 (6.92) [0.53]	16
Patient days (x1,000)	10 (11.92) [0.31]	11 (9.08) [0.41]	21
Marginal Column Totals	21	16	37 (Grand total)

Note. $X^2 = 1.6521$. The *p*-value is .198672. This result is *not* significant at $*p < .05$.

Table 3

Comparison of RRT/Code Blue Activations in November 2014 (pre-NEWS) and November 2015(NEWS)

	November 2014	November 2015	Marginal Row Totals
RRT/Code Blue	11 (9.39) [0.27]	6 (7.61) [0.34]	17
Patient days (x1,000)	10 (11.92) [0.31]	11 (9.08) [0.41]	21
Marginal Column Totals	21	17	38 (Grand total)

Note. $X^2 = 1.1094$. The *p*-value is .292. This result is *not* significant at $*p < .05$.

Table 4

Comparison of RRT Activations in December 2014 (pre-NEWS) and December 2015(NEWS)

	December 2014	December 2015	Marginal Row Totals
RRT	7 (6.7) [0.01]	6 (6.3) [0.01]	13
Patient days (x1,000)	10 (10.3) [0.01]	10 (9.7) [0.01]	20
Marginal Column Totals	17	16	33 (Grand total)

Note. The Chi-square statistic is 0.0467. The p-value is .828975. This result is not significant at $*p < .05$.

Table 5

Comparison of RRT/Code Blue Activations in December 2014 (pre-NEWS) and December 2015(NEWS)

	December 2014	December 2015	Marginal Row Totals
RRT/Code Blue	9 (8.44) [0.04]	7 (7.56) [0.04]	16
Patient days (x1,000)	10 (10.56) [0.03]	10 (9.44) [0.03]	20
Marginal Column Totals	19	17	36 (Grand total)

Note. The Chi-square statistic is 0.1393. The *p*-value is .708959. This result is *not* significant at *$p < .05$.

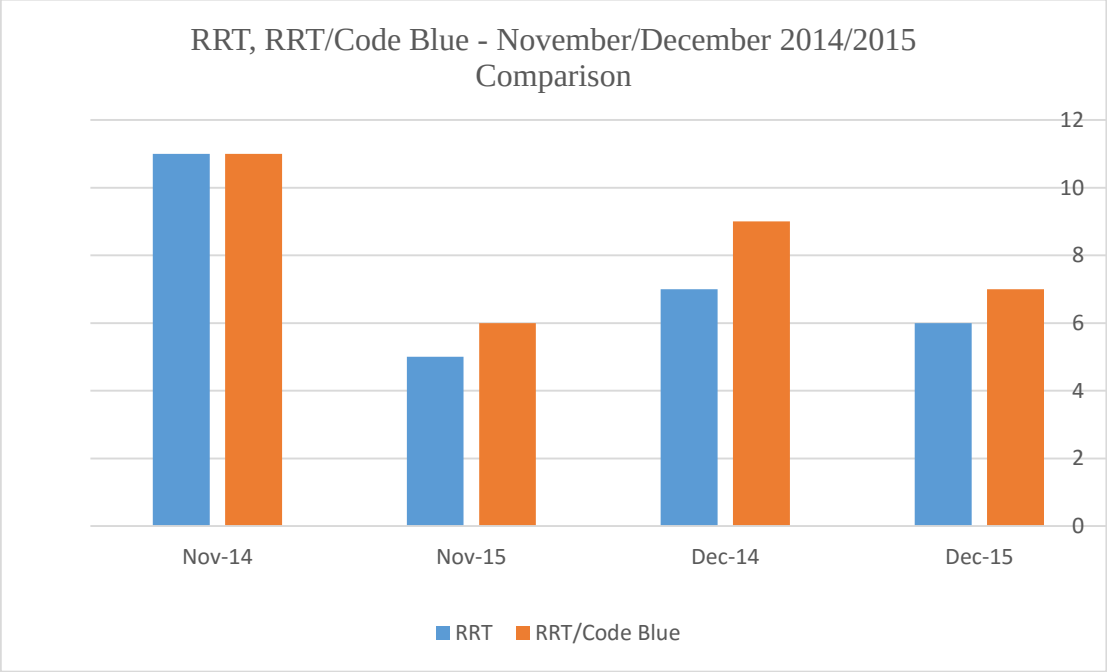

Figure 3. Comparison of RRT and RRT/Code Blue activations in November and December 2014/2015.

Although no statistical difference was found between 2014 and 2015 RRT and RRT/Code Blue calls, the number of RRT calls (x1, 000 patient days) declined from 11 to 5. This downward trend suggests the efficacy of the NEWS tool at identifying patients experiencing clinical deterioration and preventing further clinical decline. In addition, the numbers are small which affects the sensitivity of the statistical testing.

The second aim of the study was to compare the number of RRT/Code Blue activations based on NEWS score to those RRT/Code Blue activations based on nursing judgment. Table 6 demonstrates that there were 18 occasions that patients received scores of 7 or greater, the RRT activation criteria for NEWS. There were two instances of missed interventions as noted in chart review.

The total number of RRT calls during the data collection period was 91, and 19 calls were originated from the pilot medical/surgical units (Appendix C). In addition to RRT activation, there were two Code Blue calls initiated from the pilot units. This result indicates that nurses used their clinical judgment on at least one occasion in alerting RRT and on two occasions for Code Blue activations. The results show that 94.7% of the time nurses used NEWS scores as a tool to initiate RRT and 5.3% of the time they used clinical judgment. Nurses used their clinical judgment 100% of the time when they had to initiate a Code Blue.

Table 6

Intervention Rate by NEWS Score Category

Score	Time	Total Sample	n (valid %) Intervention Employed*	Intervention Missed
0-4	1	2634	9 (0.3)	n/a
	2	2672	5 (0.2)	
	3	2785	9 (0.3)	
	4	2861	5 (0.2)	
	5	2980	20 (0.7)	
	6	2990	16 (0.5)	
5-6, or 3 in any single parameter	1	32	18 (56.3)	14 (43.8)
	2	19	11 (57.9)	8 (42.1)
	3	18	10 (55.6)	8 (44.4)
	4	14	8 (57.1)	6 (42.9)
	5	13	8 (61.5)	5 (38.5)
	6	26	19 (73.1)	7 (26.9)
7+	1	1	1 (100)	0
	2	2	2 (100)	0
	3	5	4 (80.0)	1 (20.0)
	4	1	1 (100)	0
	5	5	4 (80.0)	1 (20.0)
	6	4	4 (100)	0

Note. * Dataset indicate "intervention employed" and "intervention missed". Data set remains unclear whether patients with "missed intervention" indicated actually received no intervention or, if instead, the data were simply missing.

The third aim of the project was to investigate the demographic and/or clinical factors associated with RRT/Code Blue activation during the 2015 project. Table 7 provides the frequency, mean, standard deviation and NEWS categorized by composite score (i.e., 0-4, 5-6 or 3 in any single parameter, and over 7) based on age, gender and race. There were 3,154 patients included in the initial data set. However, after data cleaning, the author excluded patients who did not have six time-points with a complete set of NEWS criteria (i.e., the seven parameters to be measured). The final data set

included 2,667 patients who had a complete set of NEWS measurements with aggregated scores. There were 1,611 males and 1,056 females with a mean age of 52.89 years (SD=15.27). Race/ethnicity demonstrated that majority of the patients were Hispanic (48.4%), which was followed by Black/African American (23.4%). White/Caucasians were 18.2% of the data set, followed by Asians (9.2%).

Table 7 also demonstrates aggregated scoring results by gender, age range, and race. In this data set there was only one patient who met all the six data time-points with complete NEWS physiological measurements indicating a score of 7 or greater and having only one subject in this category prevented a proper comparison of all three scoring criteria. All other patients who received a score of 7 or greater were transferred to a higher level of care immediately following identification to receive further interventions. Thus, data was analyzed only in patients with scores of 0-4 and 5-6 or 3 in any single parameter. There were two key findings. NEWS measurements tended to increase with age. Although this was not statistically significant, it may be clinically relevant. The patients with 5-6 or 3 in any single parameter tended to be older (mean age 57.53 years versus 52.83 years, p=0.08). In this project, NEWS measurements differed by race (p=.05). A post hoc analysis to examine specifics related to this finding was not preformed. The author attempted to examine the effect of comorbidity on NEWS activation. However, the analysis was inconclusive.

Table 7

Demographic Characteristics of 2015 Sample by NEWS Score

		NEWS Score			
	Overall	0-4	5-6 (or 3 in any parameter)	7+	*p**
N	2667	2634	32	1	
		Mean (SD)			
Age, in years	52.89 (15.27)	52.83 (15.28)	57.53 (14.14)	73.00 (n/a)	.08
		Frequency (valid %)			
Gender					.40
Male	1611 (60.4)	1594 (60.5)	17 (53.1)	0 (0)	
Female	1056 (39.6)	1040 (39.5)	15 (46.9)	1 (100)	
Race					.05
Asian	245 (9.2)	240 (9.1)	5 (15.6)	0 (0)	
Black/African American	625 (23.4)	618 (23.5)	7 (21.9)	0 (0)	
Hawaiian/Pacific Islander	5 (0.2)	5 (0.2)	0 (0)	0 (0)	
Hispanic	1292 (48.4)	1279 (48.6)	13 (40.6)	0 (0)	
Native American	6 (0.2)	5 (0.2)	1 (3.1)	0 (0)	
White	486 (18.2)	479 (18.2)	6 (18.8)	1 (100)	
Other	4 (0.1)	4 (0.2)	0 (0)	0 (0)	
Unknown	4 (0.1)	4 (0.2)	0 (0)	0 (0)	

Note. * Due to the limited sample size of NEWS Scores of 7+ formal comparisons via hypothesis testing included only the first two groups. * Presented for Independent Samples t-tests and Chi-Square tests of Independence.

The fourth aim of the study was to look at the number of patients who were transferred to a higher level of care and patients who remained in the unit based on NEWS of 5 or greater or 3 in any single parameter. The NEWS scoring criteria had specific instructions and recommended actions for each range of scores. Scores fell either in a green zone (0-4), yellow zone (5-6 or 3 in any single parameter), and red zone (7 or greater). Tables 8, 9, and 10 demonstrate (a) the intervention rate by the NEWS category, (b) number of patients transferred to the higher level of care, and (c) number of patients who remained in the unit after receiving an intervention. A total of 122 patients received a score of 5-6 or 3 in any single parameter (Table 8). Seventy-four patients received some type of intervention, 63 remained in the unit, and 11 patients were transferred to a higher level of care. Eighteen patients received a score of 7 or greater and 5 patients remained in the unit after an intervention was employed (Table 9). Eleven patients transferred to a higher level of care either based on the NEWS score or after the initiation of an RRT. Five patients who remained in the unit with a NEWS value of 7 or greater were excluded from the study during the data collection period. Two patients who had a score of 7 or greater was excluded because their unchanged NEWS was associated with their clinical diagnosis (i.e., asymptomatic atrial fibrillation, chronic pulmonary obstructive disease, benign hypertension). Furthermore, the provider assessed these two patients prior to excluding them from the study. Two other patients were transferred to palliative care service during the data collection period. One patient had a consistent score of 7 or greater, and the provider wrote orders with specific criteria for RRT activation.

Table 10 addresses the 12 patients who had NEWS measurements at all six time points and subsequently needed to be transferred to a higher level of care. This table does not include four patients who received a 7 or greater NEWS and remained in the unit and were later excluded from the study (two patients with unchanged NEWS value and two patients with active palliative care service). However, the author did keep one patient who had a consistent, unchanged NEWS value due to his clinical condition (s/p lobectomy; small cell lung cancer; interstitial lung disease) in the study even though the patient meets the exclusion criteria. The provider ordered specific NEWS value for RRT activation, but the staff were instructed to initiate RRT whenever a change in the patient's clinical condition was noted. Interestingly, data also indicated that nine patients were transferred to a higher level of care based on the NEWS scores category of 0-4 (Table 10). Further investigation of the documentation in this category revealed that these patients may have been potential sepsis patients and that sepsis screening was not within the scope of this project. Analysis suggests that the provider and the nurses initiated appropriate interventions 64.29% of the time based on NEWS criteria.

Table 8

Intervention Rate by NEWS Score Category

Score	Time	n (valid %) Total Sample	Intervention Employed*	Intervention Missed
0-4	1	2634	9 (0.3)	n/a
	2	2672	5 (0.2)	
	3	2785	9 (0.3)	
	4	2861	5 (0.2)	
	5	2980	20 (0.7)	
	6	2990	16 (0.5)	
5-6, or 3 in any single parameter	1	32	18 (56.3)	14 (43.8)
	2	19	11 (57.9)	8 (42.1)
	3	18	10 (55.6)	8 (44.4)
	4	14	8 (57.1)	6 (42.9)
	5	13	8 (61.5)	5 (38.5)
	6	26	19 (73.1)	7 (26.9)
7+	1	1	1 (100)	0
	2	2	2 (100)	0
	3	5	4 (80.0)	1 (20.0)
	4	1	1 (100)	0
	5	5	4 (80.0)	1 (20.0)
	6	4	4 (100)	0

Note. * Data set did not indicate “no intervention” so it remains unclear whether patients with no intervention indicated actually received no intervention or, if instead, the intervention data were simply missing.

Table 9

Number of Patients Who remained in Unit After Receiving Intervention

		Intervention Employed	Stayed in Unit
Score	Time	N	n (valid %)
0-4	1	9	7 (77.8)
	2	5	5 (100)
	3	9	9 (100)
	4	5	4 (80.0)
	5	20	17 (85.0)
	6	16	10 (62.5)
5-6, or 3 in any single parameter	1	18	16 (88.9)
	2	11	10 (90.9)
	3	10	8 (80.0)
	4	8	6 (75.0)
	5	8	7 (87.5)
	6	19	16 (84.2)
7+	1	1	0 (0)
	2	2	1 (50.0)
	3	4	2 (50.0)
	4	1	1 (100)
	5	4	0 (0)
	6	4	1 (25.0)

Table 10

Number of Patients Transferred to a Higher Level of Care by NEWS Score

Score (Time 1)	Total Sample	*n (valid %) Transferred to higher level of care
0-4	2,634	9 (0.3)
5-6, or 3 in any single parameter	32	2 (6.3)
7+	1	1 (100)

Note. *Patients met complete NEWS score at all 6 time-points.

In order to evaluate the efficacy of interventions for patients who remained in a unit, repeated measures ANOVA tracked NEWS values across a 24-hour time period. This test revealed at least one statistically significant change in the NEWS score over time ($F(5,15)=12.30$, $p < .001$, $\eta_p^2 = .80$). Specifically, statistically significant ($p < 0.05$) reductions were seen between baseline and 8-24 hours (Table 9). In other words, patients who stayed in the unit after their intervention showed NEWS scores that decreased significantly over time, especially from baseline alert time to 8 hours post intervention (Figure 4).

The fifth aim of the study was to examine the diagnoses of the patient(s) who received a reportable NEWS score (5 or greater or a 3 in any single parameter). Clinical diagnoses of all 3,154 patients were available; however, multiple comorbidities made the analysis inconclusive.

The final aim of the project was to identify the number of patients who missed an intervention with NEWS of 5 or greater or 3 in any single parameter. A total of 122 patients received a score of 5-6 or 3 in any single parameter, and 48 patients had missed intervention(s) in one of the six time-points of vital signs measurement. The majority of these 48 patients missed intervention(s) during the 0200 vital signs time-period, followed by 0600, 1000, and 2200. Missing interventions resulted from: (a) no real-time documentation of NEWS on the written documentation form; (b) incomplete EHR documentation of interventions; (c) unchanged NEWS scores; (d) provider notification missing from the EHR system; and (e) confusion about provider notification of NEWS scores versus notification of a sepsis criteria (further explained in the discussion section of this project). Additional explanations are included in the discussion section.

Eighteen patients out of the total sample received a NEWS score of 7 or greater. Sixteen patients received appropriate interventions as described in the NEWS scoring criteria and two patients had missed interventions. For both patients, the EHR had documentation explaining the reason for not activating RRT; therefore, these two patients were assessed and appropriate decision-making occurred. The patients who did not receive an intervention(s) for a score of 7 or greater had medical diagnoses (e.g., status post lobectomy, atrial fibrillation, and COPD) associated with altered vital signs, and the rationale for not escalating the level of care was documented by the provider in the EHR. This section of the paper presents the results of this QI project. Although no statistical difference in the number of RRTs or RRTs and Code Blues resulted from the implementation of the NEWS, the trend analysis is encouraging. As noted, the small sample size of NEWS activations may influence the sensitivity of statistical testing and contribute to Type II errors.

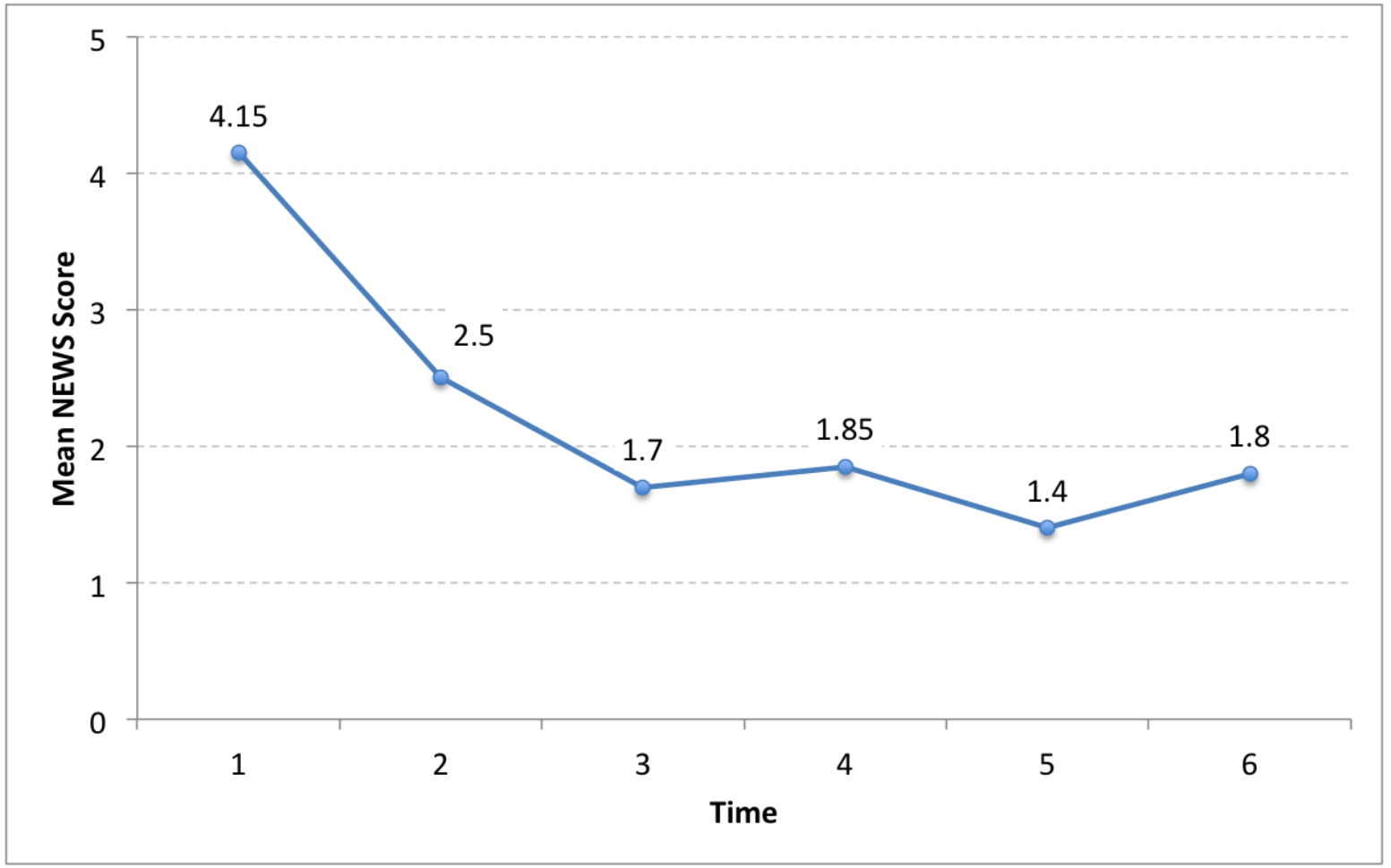

Figure 4. Mean NEWS scores at post-intervention timeframes for patients remaining in unit.

DISCUSSION

Implementing the NEWS in six medical/surgical units was a major milestone for the study hospital. The primary aim of this project was to examine the efficacy of the NEWS for identifying patients at risk for clinical deterioration in pilot units. A secondary aim was to decrease the number of RRT/Code Blue activations through early identification of clinical deterioration. Almost 2% of the patients experienced some type of clinical deterioration in their physiological measurements during the period of this project. By identifying clinical deterioration early, the hospital hopes to influence mortality and failure to rescue rates. The author plans on analyzing the impact of NEWS on the mortality rates in the future.

RRT/Code Blue activations decreased in 2015 after NEWS implementation (November 2014/2015 = 11/5 and December 2014/2015 = 9/7). Although this was not a statistically significant, the small sample size may have resulted in a Type II error. Nevertheless, the decrease of RRT/Code Blue activations is clinically significant and suggests the effectiveness of the NEWS tool. A study by Kolic et al. (2015) suggests the use of early warning scores improves patient outcomes. In this doctoral project study, patients who received timely intervention(s) after a reportable NEWS event, had decreased scores and remained in the unit without experiencing further clinical deterioration.

Ninety-one RRT activations occurred during the pilot period throughout the project hospital and 17 of the 91activations occurred within the six medical/surgical units. Further investigation revealed that during the same 2015 project time frame, nurses used clinical judgment in initiating 74 RRT/Code Blue activations for patients in

non-study units within the project hospital setting. In the pilot units, nurses used NEWS criteria for 16 RRT activations and clinical judgment for one patient. These activations in the non-project units were not initiated based on the use of the NEWS tool as the staff nurses did not have access to it; however, they were appropriate interventions based on sound nursing clinical decision-making skills. The review of literature also supports the use of a "track and trigger" system in the hospital to empower the nursing staff to make appropriate clinical decisions (Gardner-Thorpe, 2006; Yu et al., 2014; Ludikhuiz et al., 2012; Niegsch et al., 2013). The project findings also revealed a few unreported high NEWS scores. It was problematic for the author to identify a proxy NEWS scores for patients who experienced clinical deterioration due to unreported physiological measurements prior to RRT/Code Blue activation. Additionally, the NEWS documentation tool was introduced in the hospital during a below average census that typically occurs during the November and December holiday season. This could be a contributing factor resulting in fewer RRT/Code Blue activations.

The study's demographic data analysis demonstrated that there were no significant differences in NEWS scores based on patients' gender and clinical diagnosis. However, there was a relationship noted between older patients and high NEWS scores as well as a statistical significance difference in race/ethnicity ($p=.05$) and high NEWS scores. The literature supports the finding that demographic characteristics and social isolation may lead to high NEWS. However, the literature does not specify definitions for age range, gender, and ethnicity as was also the case in this project (Cameron et al., 2015; Ebrahamian et al., 2014).

One of the weaknesses of the project was that the initial pilot implementation of NEWS occurred in one unit of the project hospital in February 2014. The findings of this pilot study demonstrated that the use of NEWS could potentially result in significant improvement in reducing the number of missed opportunities to identify clinical deterioration in patients in medical/surgical units. However, it took almost 21 months to implement NEWS in other units because of a hospital-wide EHR implementation plan that put a temporary hold on all projects. The initial lack of sustainability after the November 2014 results were presented may have had a negative effect on the 2015 project. The withdrawal of the tool from the pilot unit may have misled the staff to conclude that the 2014 pilot study was unsuccessful.

This study demonstrated that missed interventions for high NEWS scores were concentrated at two time-points (0200 and 0600). A possible explanation for missing necessary interventions during these periods may have been due to the unavailability of a provider during the night shift. After data collection was completed, the author talked to the chief of medicine and the chief nursing officer about this issue. The on-call provider and the hospitalist answer all emergency calls during the night shift, and NEWS scores may have been a low priority during these times. In addition, healthcare providers may have only reacted to the established response systems (RRTs or Code Blues) in the hospital for any drastic patient deterioration. Lack of provider availability during the night shift was reported to be a potential threat to patients experiencing clinical deterioration. One study cited in the review of the literature found that inadequate staffing could lead to potential errors and delay of interventions (Kolic et. al., 2015). To address this issue of provider available, the decision was made to have nurses notify the

RRT nurse (but not as an RRT alert per se) in addition to the provider. If the medical provider was not available, the RRT nurse would come to evaluate the situation and render a clinical decision to escalate treatment or transfer to a higher level care.

The staff from each of the project's six units identified probable reasons for not notifying the provider of high NEWS scores. It was found that some nurses sensed the clinical situation was "under control" and "being taken care of" on the ward. In other instances nursing attendants did not complete or report high NEWS scores/vital signs in a timely manner and for this reason neither the nurse nor provider was notified in a timely fashion. Some other possible causes of missed interventions include: (a) failure to document the patient's NEWS in real-time, (b) missed paper documentation, (c) an unchanged NEWS value, and (d) the inappropriate inclusion of patients in data collection who met the exclusion criteria. The greatest compliance with the effective use of the NEWS tool occurred during the day-time-points (1000, 1400, and 1800).

One anticipated challenge was the nurse's timely documentation of a NEWS call and healthcare provider acceptance of the call. NEWS protocol has specific guidelines for providers to follow when one of their patients receive a reportable NEWS value. Even though there is a protocol established for a timely assessment of the patient by a medical provider, this was not always confirmed in the EHR as to the exact time the provider saw the patient after nurse notification. At a future point in time, the physician leader for this project will collect data on the provider acknowledgement, assessment, and documentation. In addition, increased success for this project may have possibly been enhanced if sepsis identification had not been included as another scoring requirement along with the NEWS.

With over 500 nursing staff and 250 providers involved across six medical/surgical units, implementing the use of the NEWS tool was a massive undertaking. Although still in its early stage of a DHS-wide roll out of the NEWS as a standard of nursing care, the inpatient director, chief of medicine, clinical nursing director, and all team members were essential to the successful implementation of this project. In any DHS hospital, there are numerous barriers to be identified, evaluated, and overcome with effective strategies and methods.

The two foremost barriers in this project were (a) the implementation of a system wide EHR at the same time that the 2015 project was undertaken and (b) the inability of the staff to document NEWS scores electronically. The duplicate task of double documentation (paper scoring of NEWS and entry of data in the EHR) of vital signs delayed the real-time documentation and notification. The author also investigated the unreported high scores in all six units. Further inquiry demonstrated the need to have computer ability to retrieve provider notification acknowledgements as part of the EHR. The staff stated that they were documenting high NEWS scores through the electronic provider notification functionality; however, that acknowledgement of a high score automatically cleared from the electronic record once the provider opened the notification. Therefore, this feature in the system further restricted the author from validating any staff notification to establish reliability of provider notification. To correct this problem, this issue was communicated to the information technology team, and it will be resolved when NEWS functionality is implemented electronically in June 2016.

The discussion of results demonstrates that the fundamental strength of this QI project hinges on the nurses' direct clinical assessments and interventions provided for

patients whenever there was concern. Furthermore, an additional strength of this project was its prospective quantitative nature and the comprehensiveness of data collection from the six medical/surgical units during a one-month period. This study may assist the healthcare team in highlighting specific areas of patient care that necessitate attention before implementation of the NEWS protocol at all DHS hospitals.

However, clinical deterioration, no matter how small, represents a clinically significant event for the patient, family, and the healthcare provider. Further education, timely notification, and intervention will help identify more patients being treated in medical/surgical units who are at risk for clinical deterioration and subsequent failure to rescue.

LIMITATIONS

The author suggests caution in interpreting and applying the results from this project. Ten percent of physiological measurements were missing from the total data set and could not be included in the analysis. Nonetheless, some missing data are expected due to patient discharge, new admissions, procedures, diagnostic tests, and so forth. Unfortunately, the nursing staff failed to document the reason for missing data on multiple occasions. To overcome the limitation of missed data collection, the team decided to include a mandatory documentation field in the EHR when the NEWS goes live in the hospital EHR in June 2016. This mandatory field has the compulsory documentation function, and the charting will not be saved unless staff complete the required documentation.

Another factor was the unavailability of the NEWS tool in the EHR. The duplicate work of documentation was not well received by the nursing staff during this project and that issue contributed to some discrepancies of documentation. In addition, during the process of implementation, the medical administration added sepsis criteria to the NEWS tool for hospital core measures, leading to staff confusion and inaccurate reporting about differentiating a sepsis alert from a clinical deterioration alert. Some nursing staff thought that this tool was only for sepsis notification, so the NEWS activation criteria were not followed in several instances. This misperception is being resolved. There is a new electronic sepsis alert system (St. John's Sepsis Alert) being piloting in two units and this system will replace the sepsis criteria in NEWS.

The aspect of provider education was an additional limitation in the project. Nursing education was provided to 95% of nursing staff; in contrast, medical providers

received their education through emails and memos. Additionally, there was no follow-up to confirm the acknowledgment of the training material. The lack of efficient provider education delayed some interventions because providers were unaware of the NEWS protocol. The provider training coordinator disseminated the information through emails and memos; however, many interns and residents were unaware of the NEWS tool and its scoring system, which caused delayed interventions. Nursing attendants who came to the unit from a floating pool did not follow the protocol of documentation and timely reporting due to lack of education. This drawback was resolved recently by providing additional provider and nursing attendant education. NEWS tool education is now included in the new employee nursing orientation and residency program training in order to provide this information before they can begin their additional training on the units.

Finally, motivation to use the tool from the beginning of the project's implementation was a pervasive limitation. The nursing staff did not embrace the idea of double documentation, which required both simultaneous electronic and manual documentation of the same information. The author did not have any control over the EHR documentation process during this project because the DHS decided on a large-scale EHR NEWS implementation throughout the DHS system. Until that time, a handwritten NEWS form was to be used at the project hospital. The DHS decided to implement NEWS in other DHS hospitals only after the EHR program was constructed. An EHR NEWS documentation system unquestionably would increase compliance in the future as it is a more efficient reporting method than manual documentation. This limitation will have been resolved once NEWS has gone live electronically throughout the DHS System in June 2016.

CONCLUSION

This prospective study of the NEWS QI project supports the literature findings related to the accurate use of the NEWS tool and the scoring system to identify patients experiencing clinical deterioration to improve their clinical outcome. This QI project also demonstrates the value of using the PDSA framework, allowing real time feedback and addressing issues, including implementation strategies. The structured method of PDSA framework will provide a guideline to use NEWS tool to achieve a prompt and substantial improvement in patient care. NEWS is an appropriate choice from the bedside providers' (nurses and physicians) perspective because the components of the scores are readily available. NEWS also provides an added realistic view of the clinical decision-making process because the score includes a single physiological measure of extreme value in addition to the aggregate scores that activate interventions. Future studies in this project's scope are necessary in order to evaluate (a) the real-time efficacy of the tool, (b) timely notification, and (c) immediate interventions when the tool is implemented electronically both at the project site and throughout the other DHS hospital facilities in the Los Angeles area

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APPENDIX A

NATIONAL WARNING SCORES (NEWS) DOCUMENTATION FORM

Department of Nursing

National Early Warning Score (NEWS)

- **Write the NEWS score in the appropriate column when taking V/S Q4H. If any physiological parameter has a score ≥2 please notify the RN.**
- **RN to activate the RRT if the NEWS score is ≥7. Follow the legend on the back of this form for appropriate interventions.**
- **If any two pink boxes checked in your NEWS score column, this is "<u>Sepsis Until Proven Otherwise</u> or SUPO". Notify the provider <u>immediately</u> to initiate the Sepsis order set!**
- **Please circle the appropriate scores with each vital signs.**

NEWS KEY	**0**	**1**	**2**	**3**	***DATE:***			***UNIT:***			***BED:***
PHYSIOLOGICAL PARAMETERS					**NEWS SCORE**	**0200**	**0600**	**1000**	**1400**	**1800**	**2200**
RESPIRATORY RATE					≥25*	3	3	3	3	3	3	3
					21-24*	2	2	2	2	2	2	2
					12-20	0	0	0	0	0	0	0
					9-11	1	1	1	1	1	1	1
					≤8	3	3	3	3	3	3	3
OXYGEN SATURATION					≤91	3	3	3	3	3	3	3
					92-93	2	2	2	2	2	2	2
					94-95	1	1	1	1	1	1	1
					≥96	0	0	0	0	0	0	0
SUPPLEMENTAL OXYGEN					YES	2	2	2	2	2	2	2
					NO	0	0	0	0	0	0	0

TEMPERATURE	≤35.0 C*	3	3	3	3	3	3	3
	35.1-36.0 C*	1	1	1	1	1	1	1
	36.1-38.0 C	0	0	0	0	0	0	0
	38.1-39 C*	1	1	1	1	1	1	1
	≥39.1 C*	3	3	3	3	3	3	3
SYSTOLIC BLOOD PRESSURE	≤90*	3	3	3	3	3	3	3
	91-100	2	2	2	2	2	2	2
	101-110	1	1	1	1	1	1	1
	111-219	0	0	0	0	0	0	0
	≥220	3	3	3	3	3	3	3
HEART RATE	≤40	3	3	3	3	3	3	3
	41-50	1	1	1	1	1	1	1
	51-90	0	0	0	0	0	0	0
	91-110*	1	1	1	1	1	1	1
	111-130*	2	2	2	2	2	2	2
	≥131*	3	3	3	3	3	3	3
LEVEL OF CONSCIOUSNESS	Alert	0	0	0	0	0	0	0
	V, P, U	3	3	3	3	3	3	3
TOTAL NEWS SCORE								
Staff Initials								

Legend: V = Responds to: Verbal stimuli; P= Painful stimuli; U = Unresponsive.

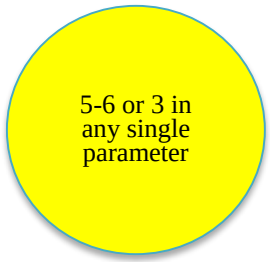
Green = 0-4

Yellow = 5-6 or 3 in any single parameter

Red = 7 or more

Patient Identification

CLINICAL RESPONSE/ ACTIONS TAKEN BASED ON NEWS

NEW SCORE	ACTIONS
	• **Continue to monitor at a minimum of every 4 hours** • **Registered nurse must assess the patient and decide if increased frequency of monitoring and/or escalation of clinical care is required** • **If the patient has two or more pink boxes checked on your NEWS score, notify the provider immediately for possible activation of sepsis protocol. The Sepsis order set in ORCHID should be utilized immediately to order fluids (30 ml/kg), blood cultures, appropriate antibiotics, and a lactic acid measurement.**
	• **Increase frequency of monitoring to a minimum of q2 hours** • **Registered nurse to inform the provider and patient flow coordinator** • **Urgent assessment by a provider** • **Consider transfer to higher level as appropriate** • **If the patient has two or more pink boxes checked on your NEWS score, notify the provider immediately for possible activation of sepsis protocol. The Sepsis order set in ORCHID should be utilized immediately to order fluids (30 ml/kg), blood cultures, appropriate antibiotics, and a lactic acid measurement.**
	• **Registered nurse to activate the Rapid Response Team.**

KEY CONCEPTS

- NEWS should not be used in children (<18 years old) or women who are pregnant.
- **NEWS is not a substitute for competent clinical judgment.**
- Concern about a patient's condition always overrides the NEWS score if the health care provider considers it necessary to escalate care.
- Repeat scores for unchanged conditions do not need to be reported to provider for an urgent assessment. However, if an increase in score is obtained, proceed as indicated above.
- If two or more pink boxes are checked on the NEWS score, consider the patient "Sepsis Until Proven Otherwise or SUPO" and notify the provider immediately for activation of Orchid sepsis protocol.

APPENDIX B

NATIONAL EARLY WARNING SCORES (NEWS) MEASUREMENTS

National Early Warning Scores (NEWS)

National Early Warning Scores (NEWS)							
Score	**3**	**2**	**1**	**0**	**1**	**2**	**3**
Respiratory rate	**≥25**	**21-24**	**N/A**	**12-20**	**9-11**		**≤8**
Oxygen Saturation	**≤91**	**92-93**	**94-95**	**≥96**			
Supplemental oxygen		**Yes**		**No**			
Temperature	**≤35.0 C**	**N/A**	**35.1-36.0C**	**36.1-38.0 C**	**38.1-39.0 C**		**≥39.1 C**
Systolic Blood Pressure	**≤90**	**91-100**	**101-110**	**111-219**			**≥220**
Heart Rate	**≤40**		**41-50**	**51-90**	**91=110**	**111-130**	**≥131**
Level of Consciousness				**Alert**			**V,P,U**
Total Score							

APPENDIX C

RRT/CODE BLUE ACTIVATIONS IN FEBRUARY 2014, NOVEMBER 2014, DECEMBER 2014, NOVEMBER 2015, AND DECEMBER 2015

RRT/Code Blue Activations in November 2014

Approximate inpatient census is 10, 321 patient days (November 2014)

Code Blue/Medical Rapid Response/Surgical Rapid Response Report for November 2014

*Units	A	B	C	D	E	F	Total
Code Blue	None	None	None	None	None	None	0
Medical Rapid Response	3	1	1	1	1	0	7
Surgical Rapid Response	0	2	1	1	0	0	4

*Units de-identified.

Total Number of Code Blue Activation for Entire Hospital in November 2014 = 9

Total Number of Medical Rapid Response Activations for Entire Hospital in November 2014 = 32

Total Number of Surgical Rapid Response Activations for Entire Hospital in November 2014 = 5

RRT/Code Blue Activations in December 2014

Approximate inpatient census is 9,500 patient days (December 2014)

Code Blue/Medical Rapid Response/Surgical Rapid Response Report for December 2014

*Units	A	B	C	D	E	F	Total
Code Blue	None	1	None	1	None	None	2
Medical Rapid Response	None	None	None	2	None	None	2
Surgical Rapid Response	1	1	1	1	1	0	5

*Units de-identified.

Total Number of Code Blue Activation for Entire Hospital in December 2014 = 15

Total Number of Medical Rapid Response Activation for Entire Hospital in December 2014 = 2

Total number of Surgical Rapid Response Activation for Entire Hospital in December 2014 = 5

RRT/Code Blue Activations in November 2015

Approximate inpatient census is 11,140 patient days (November 2015)

Code Blue/Medical Rapid Response/Surgical Rapid Response Report for November 2015

*Units	A	B	C	D	E	F	Total
Code Blue	0	0	1	0	0	0	1
Medical Rapid Response	2	0	0	1	1	0	4
Surgical Rapid Response	0	0	1	0	0	0	1

*Units de-identified.

Total Number of Code Blue Activation for Entire Hospital in November 2015 = 31

Total Number of Medical Rapid Response Calls for Entire Hospital in November 2015 = 48

Total Number of Surgical Rapid Response calls for Entire Hospital in November 2015 = 8

RRT/Code Blue Activations in December 2015

Approximate inpatient census is 9,974 patient days (December 2015)

Code Blue/Medical Rapid Response/Surgical Rapid Response Report for December 2015

*Units	A	B	C	D	E	F	Total
Code Blue	0	0	0	0	1	0	1
Medical Rapid Response	1	0	1	1	1	0	4
Surgical Rapid Response	2	0	0	0	0	0	2

*Units de-identified.

Total Number of Code Blue Activations for Entire Hospital in December 2015 = 20

Total Number of Medical Rapid Response Activations for Entire Hospital in December 2015 = 32

Total Number of Surgical Rapid Response Activations for Entire Hospital in December 2015 = 3

RRT/Code Blue Activations in February 2014

Approximate inpatient census is 10,245 patient days (February 2014)

Code Blue/Medical Rapid Response/Surgical Rapid Response Report for February 2014

*Units	A With NEWS	B No NEWS	C No NEWS	D No NEWS	E No NEWS	F No NEWS	Total
Code Blue	0	0	0	0	0	0	0
Medical Rapid Response	2	1	3	3	0	1	10
Surgical Rapid Response	1	6	1	1	0	0	9

Total Number of Code Blue Activations for Entire Hospital in February 2014 = 4

Total Number of Rapid Response Activations for Entire Hospital in February 2014 = 20

Total Number of Surgical Rapid Response Activations for Entire Hospital in February 2014 = 13

RRT, RRT/Code Blue Activations from Medical/Surgical Units in November 2014, 2015, and December 2014 and 2015

	Nov. 2014	Nov 2015
Pre news RRT	11	5
Patient days (X1000)	10.321	11.14

	Nov. 2014	Nov 2015
Pre news RRT and code Blue	11	6*
Patient days (X1000)	10.321	11.14

*One patient code blue from M/S.

	Dec. 2014	Dec 2015
Pre news RRT	7	6
Patient days (X1000)	9.5	9.97

	Dec. 2014	Dec 2015
Pre news RRT and code Blue	9	7*
Patient days (X1000)	9.5	9.97

*One patient code blue from M/S.