

Implementation of the National Early Warning Score in a Military Hospital

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Abstract

Problem & Purpose: Unrecognized clinical deterioration leads to poor outcomes including unanticipated intensive care unit (ICU) admission, cardiac arrest and death. Statistics show 59.4% of patients have one abnormal vital sign one to four hours prior to cardiac arrest. The National Early Warning Score (NEWS) assists nurses to identify early clinical decompensation and intervene to prevent poor outcomes. Previous attempts to implement NEWS and a dedicated rapid response nurse (RRN) at a community sized military treatment facility were unsuccessful for improving early recognition of clinical deterioration. Prior to implementation less than 8.3% of patients at moderate risk for clinical decompensation were assessed by the RRN. The purpose of this quality improvement project was to improve early recognition of clinical deterioration by implementing a dual approach that targets both the RRN and ward nurses. Both approaches target patients at moderate to high risk of clinical decompensation to achieve early stabilization or transfer to a higher level of care.

Methods: A standardized communication tool was created and utilized by the RRNs to track and trend patients with a NEWS of three to five and as a reminder to document their assessment in the electronic health record (EHR). Re-education and a workflow diagram for ward nurses was presented during a skills fair to increase assessment and vital sign frequency according to the existing NEWS protocol.

Results: Over 13 weeks, 698 NEWS triggers were analyzed. Of these NEWS greater than or equal to five triggers, 76% (n= 57) were assessed by the RRN using the communication tool. Of the 76%, 84% (n=48), were physically assessed. Increased vital sign and assessment frequency by the ward nurses was highly variable throughout the implementation phase, 6.7-80% and 0-27.2%, respectively.

Conclusions: A standardized communication tool utilized by the RRNs increased RRN adherence to the NEWS protocol, achieving early identification and assessment of patients with a NEWS of three to five. NEWS greater than or equal to five identified patients at greater risk for deterioration and were associated with increased ward nurse adherence to the NEWS protocol. Improved early identification of deterioration may decrease unanticipated intensive care unit (ICU) admissions.

Introduction

Early clinical decompensation is often unrecognized in patients in acute care areas. Research shows that 59.4% of patients have at least one abnormal vital sign one to four hours prior to cardiac arrest with only 22-23% surviving until hospital discharge (Andersen et al., 2016). Furthermore, unrecognized clinical decompensation can lead to unanticipated intensive care unit (ICU) admissions (Smith et al., 2013) and is a strong predictor of mortality (Andersen et al., 2016; Girotra et al., 2012). The National Early Warning Score (NEWS) has proven to be a valid and reliable tool to identify in hospital deterioration and associated mortality (Spangfors et al., 2018).

In early 2018, two sentinel events were the impetus for NEWS implementation at a community sized military treatment facility (MTF). At the time, the NEWS protocol was implemented with two distinct roles: the rapid response nurse (RRN) role and the ward nurse role. The dedicated RRN is responsible for monitoring at risk patients from an electronic health record (EHR) dashboard, physically assessing those at medium and high risk for deterioration as evidenced with NEWS scores ranging from three to five and documenting the assessment. The ward nurse is responsible for increasing vital sign and assessment frequency on patients with increasing NEWS of three to five. Documented RRN compliance with the NEWS protocol was less than 20% and documentation of increased vital sign and assessment frequency was only 9% among ward nursing staff. Barriers to compliance include lack of knowledge of the policy requirements, complacency, lack of workflow implementation in the EHR and high staff turnover.

The purpose of this quality improvement project was to improve early recognition of clinical deterioration of ward patients. Strategies included the implementation of a standardized

communication tool utilizing a computer-based spreadsheet for the RRN to encourage assessment of adult in patients with a NEWS of three to five. The ward nurses were re-educated and provided with feedback to support adherence with increased vital sign and assessment frequency according to the current NEWS protocol. Improving assessment by the RRN and ward nurses will promote early identification of clinical decompensation and may decrease morbidity and mortality.

Literature Review

This review will provide a synthesis of the evidence that supports utilization and compliance with the NEWS and use of a standardized communication tool. The review provides evidence of the reliability and validity of the NEWS to identify early clinical deterioration, predict and prevent poor outcomes such as cardiac arrest, unplanned intensive care unit (ICU) admission or unexpected death. The available evidence also shows improved mortality with accurate scoring based on the calculated NEWS and increased compliance of use when used in conjunction with a standardized communication tool such as the situation, background, assessment, recommendation (SBAR). The level of the evidence was determined using Melnyk and Fineout-Overholt's (2014) rating system. The quality of evidence rating was determined using Newhouse's (2006) evidence rating system (Appendices A and B).

Smith et al., (2016) evaluated the effect of the NEWS protocol on the outcomes of cardiac arrest with cardiopulmonary resuscitation (CPR), unplanned ICU admission or unexpected death and identified a statistically significant improvement in identifying decompensating patients earlier using NEWS than with medical emergency team (MET) criteria. The most important MET criteria were the physiologic parameters which provided an accurate comparison to the NEWS algorithm. The area under the receiver operating curve (AUROC) for cardiac arrest,

unanticipated ICU admission, death and the combined outcome for NEWS were 0.78 (95% Confidence interval [CI], 0.76-0.78), 0.86 (CI 0.85-0.86), 0.91 (CI 0.91-0.92), and 0.88 (CI 0.88-0.88), respectively (Smith et al., 2016). Pimentel et al., (2019) identified a higher positive predictive value for the original NEWS (3.2%) compared to the NEWS2 (2.7%) for affirming the sensitivity for early clinical decompensation of the NEWS algorithm. Smith and colleagues (2016) and Pimentel et al., (2019) provided substantial, level I and IV evidence, respectively for NEWS as a valid and reliable tool and protocol to identify and intervene during early clinical deterioration.

Appropriate use and scoring of the NEWS protocol are the cornerstone of improving in-hospital mortality. Kolic et al., (2015) and Haegdorens et al., (2019) demonstrated a negative correlation between NEWS protocol compliance and mortality. In two studies Haegdorens et al., 2018; Haegdorens et al., 2019 evaluated the situation, background, assessment, recommendation (SBAR) communication format and found that it played a vital role in communicating acuity changes to escalate care. Evidence shows that accurate calculation of the score is vital, but action on the score impacts short and long-term patient outcomes. To examine workload associated with the NEWS Pimentel et al., (2019), evaluated the use of different cut-off scores requiring increased vital sign and assessment frequency, 5 for the NEWS and 7 for the NEWS2 and found decreased staff workload requirements for the higher scores. Haegdorens et al., (2018, 2019), Kolic et al., (2015) and Pimentel et al. (2019) provided vital evidence showing the correlation between NEWS protocol compliance, standardized communication tools and mortality.

The synthesized evidence ranges from level I to VI with quality ranging from A to C. Specifically, the articles identifying improved mortality with increased protocol compliance

utilizing a standardized communication tool are the basis for the proposed practice change. Despite the lack of effect in the initial Haegdorens et al., (2018) study, the remaining research provides a cumulative level of evidence to support the implementation of a standardized communication tool and re-education on the NEWS protocol to increase compliance. The implementation of this practice change is a low risk, high yield endeavor that should promote positive patient outcomes and reduce absolute workload for the staff (Pimentel et al., 2019).

Theoretical Framework

Sister Calista Roy's Adaptation Model (RAM) is an ideal model for the implementation of a practice change especially as it relates to the role of the rapid response nurse and the use of the National Early Warning Score. Roy's adaptation model was created based on the work of a physiologic psychologist, Harry Helson, who created adaptation-level theory. RAM describes how external and internal stimuli lead to three adaptive levels in individuals: integrated, compensatory and compromised (Roy, 2009).

These levels mimic physiological changes that can be identified by the RRN and/or the ward nurse. The integrated level represents a stable patient. The target of this practice change is the compensatory and compromised patients. Compensatory patients have an elevated NEWS of 3-5 requiring increased assessment by the ward nurse and the RRN. The compromised patients have a NEWS of six or greater requiring an RRT evaluation. Compromised patients then utilize cognator or regulator coping processes to maintain their current level or improve their physiologic status. The RAM theorizes there are four modes of adaption: physiological, self-concept, role function and interdependence. Of most interest to this project is the physiological adaptation. RAM also addresses the nurse's role in all of these elements by incorporating the nursing process. The six elements of the nursing process and the central focus of this project are

as follows: assessment of behavior and stimuli, nursing diagnosis, goal setting, intervention and evaluation. Adapting this model for the needs of this quality improvement project, decompensation can be identified at the compensatory or compromised level of adaptation. The ward rounding tool will be used as a communication tool among the RRNs to identify and track the compensating and compromised patients subsequently assisting the nurse in completing the six steps of the nursing process and intervening to decrease further deterioration or progression to a lower level of adaptation.

Methods

The setting for this intervention was a 120-bed, community-sized military treatment facility (MTF). The population consists of active duty, reserve and retired military and their dependent family members. The focus of the intervention included two adult in patient wards caring for medical-surgical patients with and without telemetry. The intervention was driven by one doctorate of nursing practice (DNP) student, a critical care clinical nurse specialist (CNS), a medical/surgical CNS and two RRN champions from the critical care unit.

Structure measures assessed during this implementation include the number of RRNs and ward nurses aware of their responsibilities, the NEWS policy and implementation of a standardized communication tool, named the RRN ward rounding tool found in Appendix D. Inclusion criteria for these three structure measures is any designated RRN or ward nurse working in the two target units. An attestation form acknowledging RRN responsibilities and re-education of the NEWS policy was utilized to capture the number of RRNs trained and as an agreement to adhere to the NEWS protocol. Ward nurses were re-educated on the NEWS protocol during a bi-annual skills fair using a power point and case scenarios. This included increasing vital sign and assessment frequency with increasing NEWS according to the NEWS

protocol. Process measures for the RRNs included assessment by the RRN of patients with NEWS of three to five defined as the number of patients with a documented RRN note over the number of patients with a NEWS of three to five. This process measure was further stratified by NEWS of three to four and NEWS greater than or equal to five. The second RRN process measure includes the number of patients tracked on the RRN ward rounding tool with NEWS greater than or equal to three defined as the number of patients documented on the standardized communication tool over the number of patients with NEWS greater than or equal to three. Stratification of the process measures for increased frequency of vital sign and assessments by the ward nurse were assessed using the same numerator and denominator methods as described above. The outcome of unanticipated ICU admissions was measured by identifying the number of patients with a NEWS greater than or equal to three with unanticipated ICU admissions over the number of patients with NEWS greater than three. A weekly automated reported provided a list of patients with NEWS greater than or equal to three and manual chart audits were conducted to evaluate process measures (Appendix E).

Tactics used to educate RRNs about their responsibilities included review of the NEWS policy and a review of the RRN ward rounding tool during the ICU skills fair one week prior to implementation that included a poster and power point presentation found in Appendix C. This tool was created in a spreadsheet application after undergoing several revisions based on RRN feedback. It was intended to communicate trended NEWS across multiple shifts and to improve assessment and compliance with the NEWS protocol. Ward nurses were re-educated on the NEWS policy during a bi-annual skills fair event. Laminated visual aids of the desired ward nurse workflow including increased vital sign and assessment frequency were posted on both of the interventional wards. Included in this workflow were instructions for documentation of the

focused physical exam findings in the nurse narrative note. This allows the RRN, other ward nurses and providers a clear picture of the change causing an increased score.

Patient confidentiality was maintained by using a password protected spreadsheet document on a password protected computer. Only initials were utilized in the spreadsheet document to differentiate the data points. The RRN ward rounding tool was never exported from the hospital's EHR. Prior to implementation the project was approved by the University of Maryland's Human Resources Protection Office (HRPO) and the Institutional Review Board (IRB) at the military treatment facility and deemed Not Human Subjects Research.

Results

Analysis of the structure and process measures were completed after a 13-week implementation period. Education of the medical/surgical nurses (89%), telemetry ward nurses (78%) and RRNs (83%) was successful but did not reach the desired goal of 100% of nurses educated. Ward nurse adherence to increasing vital sign and assessment frequency was highly variable across times as well as actual NEWS scores. In patients with NEWS 3-4 increased vital sign frequency ranged from 6.9 – 19.3% adherence over 13 weeks (Figure 1), while increased vital sign frequency in patients with NEWS greater than or equal to 5 ranged from 7.6-100% over the same time period (Figure 3). The median value (3.95%) for reassessment of patients with NEWS 3-4 by ward nurses remained low throughout implementation (Figure 2). Reassessment of patients with a NEWS greater than or equal to 5 by the ward nurse initially showed improvement after project implementation from weeks three to five, with a peak performance of 40% at weeks 10 and 11 and a median of 10% (Figure 4). There was no association with increased vital sign or assessment process measures and the re-education provided.

The RRN process measures included increased assessment frequency of patients with NEWS greater than or equal to five and utilization of the RRN ward rounding tool to trend at risk patients and communicate changes to the oncoming shifts. Patients with a NEWS greater than or equal to 5 tracked on the RRN rounding tool remained at or above the median of 75% for six weeks and then decreased around the same time as the second COVID-19 surge (Figure 6). During the implementation phase 84% of patients tracked on the RRN tool were physically assessed by the RRN. Adherence to documentation requirements in the EHR by the RRN remained low ranging from 0 to 33.3% (Figure 5). Unanticipated ICU admission trends showed minimal change, however the frequency was low pre and post-intervention with a median of 5.5% (Figure 7). There was an abrupt increase in week 11 which is consistent with a known surge of COVID-19 patients.

During the intervention, weekly educational in-services and flyers were provided to the RRNs and ward nurses as reminders of the hospital's NEWS protocol requirements. Initially these interventions improved ward nurse adherence to escalation and documentation of increased vital sign and assessment frequency, however these interventions were not effective to sustain the changes. Some barriers to the success of this QI project include unit and hospital culture, high staff turnover, lack of accountability and the global pandemic. Facilitators of this project include engaged ICU leadership and skilled RRNs providing guidance to the ward nurses. Some unexpected benefits of this project include modernizing the RRN workflow with an electronic tracking tool. In addition to assisting with the communication about at-risk patients between RRNs, this tool also quantified the RRN workload, which provided support for the preservation of a dedicated RRN for each shift.

Discussion

The implementation of this project was most successful in achieving identification of those patients at highest risk of deterioration with a NEWS of greater than or equal to five. Consistent with the literature patients with a higher NEWS, greater than or equal to five received a more robust clinical response than those with lower scores (Haegdorens et al., 2019). Ward nurses must use their clinical judgement, according to the NEWS protocol, to determine if patients with scores of three to four require increased monitoring. This is likely why the Haegdorens et al. 2019 study found decreased workload with the lower scores. Communication between the ward nurses and RRNs increased as a result of this intervention. This improved collaboration to escalate care when necessary.

The RRN ward rounding tool was modified several times throughout implementation by the RRN champions to meet the needs of their workflow and patient population. Originally, this communication tool utilized the illness severity, patient summary, action list, synthesis by the receiver, and summary (IPASS) format. This format was altered to work in a spreadsheet application and the final version included the patient's initials, medical record number, initial triggering NEWS score, virtual or physical assessment, a brief description of their condition, a yes/no drop-down box reminder to document a clinical note and the RRNs initials. The RRN ward rounding tool was well adopted and utilized to identify patients at highest risk of clinical decompensation providing increased monitoring or escalation of care as suggested by the NEWS protocol (Royal College of Physicians, 2012).

Unanticipated ICU admission trends remained low throughout the implementation phase. However, in week 11 there was an increase in unanticipated ICU admissions which was likely associated with the COVID-19 patient surge, their illness severity and the lack of a dedicated

RRN. Due to project design, a single reason for the increase cannot be determined. However, it is likely to be multifactorial. Contributing factors could be winter seasonal illness, hiring of contract nurses that are unfamiliar with the NEWS protocol and lack of experienced ward nurses.

One major issue with this project is the utilization of the NEWS and not the NEWS2. The NEWS2 considers the presence of hypercapnic disease which increases the threshold for monitoring and intervention, therefore decreasing NEWS triggers requiring intervention by the ward nurse or RRN. The NEWS was built into this MTFs EHR and due to upcoming EHR changes they are not updating the algorithm to the NEWS2. Retrospective chart reviews of the patients with NEWS greater than or equal to five with chronic and/or hypercapnic diseases showed an initial appropriate response by the ward nurses and RRNs. Further triggers at the same number were less likely to receive the same attention and these patients rarely required escalation of care. The ward nurses and RRNs utilized critical thinking and the NEWS protocol to determine which patients were clinically unstable (Haegdorens et al. 2019).

Generalizability of this QI project is limited due to the small sample size and the specific patient population included. In addition, the structure and process measures utilized in this project are unique to the interventions implemented at this military treatment facility.

Implementation of the RRN ward rounding tool may not be generalizable to other hospitals, but the use of a standardized communication tool to facilitate monitoring of practices of patients at risk for clinical deterioration may be applicable to other sites. It is also possible that this intervention was greatly impacted by the coronavirus pandemic causing a shift in priorities, the re-assignment of a vital RRN champion to another hospital and the loss of a dedicated RRN monitoring ward patients for deterioration.

Conclusion

The NEWS is a valid and reliable tool that has been successfully utilized to identify patients at high risk for clinical decompensation, unanticipated ICU admission, cardiac arrest and death (Smith et al., 2013). In our project, while overall adherence to the NEWS protocol was variable, the implementation of the RRN ward rounding tool was incredibly valuable. This standardized tool increased identification and trending of the patients most at risk for sudden decompensation and also quantified the utility and effectiveness of the dedicated RRN role.

Continued education efforts should be focused on hospital orientation and periodically throughout the year for ward nurses. Accountability is important to improve adherence to the hospital's NEWS policy for both the RRNs and ward nurses and standardized communication tools can help promote the required accountability.

This hospital is working to include the NEWS algorithm in all in-patient care areas in order to spread the NEWS intervention and increase identification of at-risk patients. Future QI projects should focus on increasing vital sign and assessment frequency by the ward nurses on patients with higher NEWS greater than or equal to five, as these patients have the highest risk for sudden decompensation. Implications for future practice include utilizing a dedicated RRN and customized ward rounding tool that is incorporated into the EHR to further increase early identification of decompensating patients and facilitate communication with all healthcare providers.

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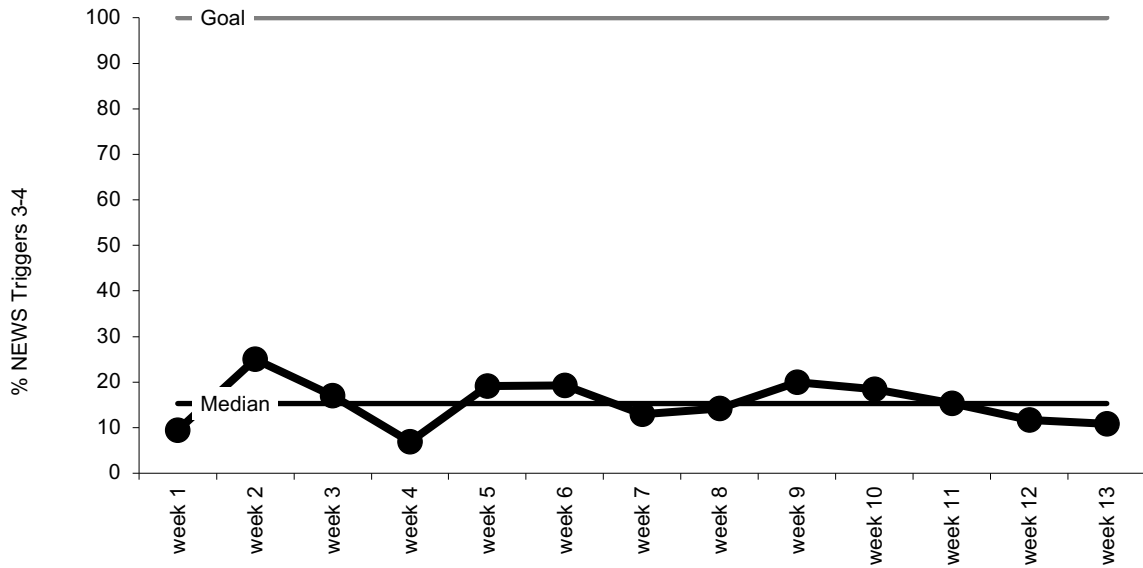
Smith, G., Prytherch, D., Meredith, P., Schmidt, P., & Featherstone, P. (2013). The ability of the National Early Warning Score (NEWS) to discriminate patients at risk of early cardiac arrest, unanticipated intensive care unit admission, and death. *Resuscitation*, 84(4), 465-470. <https://doi.org/10.1016/j.resuscitation.2012.12.016>

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Figure 1

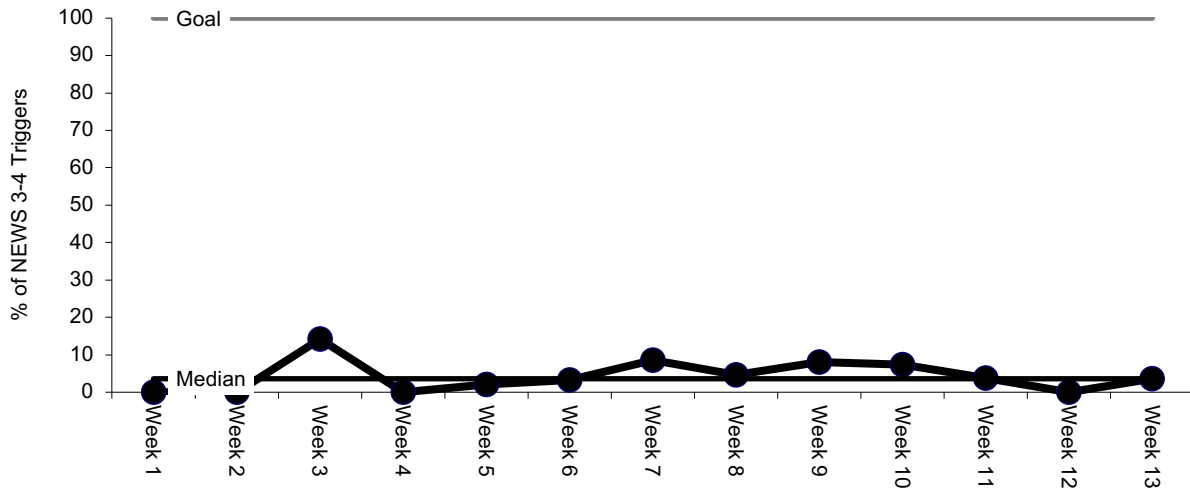
Patients with NEWS 3-4 with increased vital sign frequency by the ward RN



Note. Patients with a NEWS of 3-4 were typically not at high-risk for decompensation, therefore the ward nurses rarely increased vital sign frequency.

Figure 2

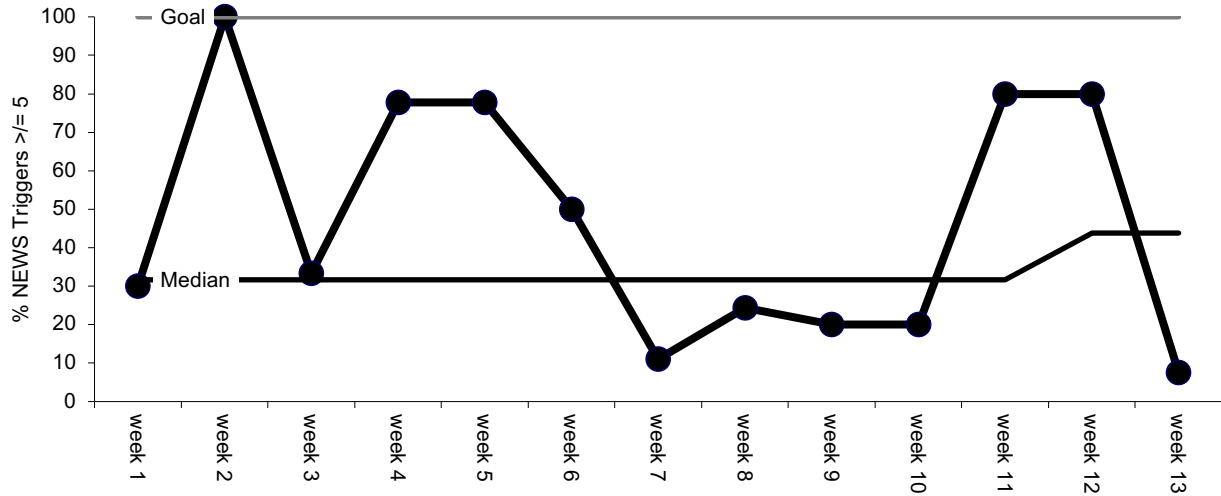
Patients with a NEWS 3-4 with Increased Assessment Frequency by Ward RN



Note. Patients with a NEWS of three to four may require increased assessment, but this is based on the ward nurse’s clinical judgement and the guidance of the hospital’s NEWS protocol.

Figure 3

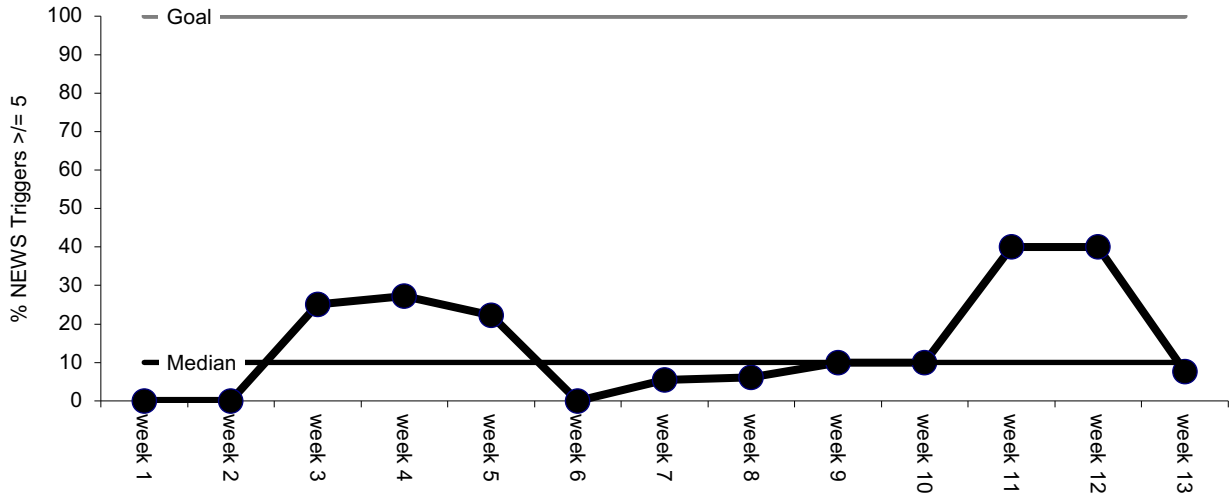
NEWS Greater Than or Equal to 5 with Increased Vital Sign Frequency by Ward Nurse



Notes. There was no correlation with increased vital sign frequency and the re-education intervention for ward nurses. Most patients with a NEWS greater than or equal to five received at least one vital sign recheck.

Figure 4

NEWS Greater Than or Equal to 5 with Increased Assessment Frequency by Ward Nurse



Note. Documentation of reassessment initially increased after re-education of the ward nurses.

As acuity became higher and COVID-19 surged adherence to the policy was poor.

Figure 5

NEWS Greater Than or Equal to 5 with Documented Physical Assessment by RRN

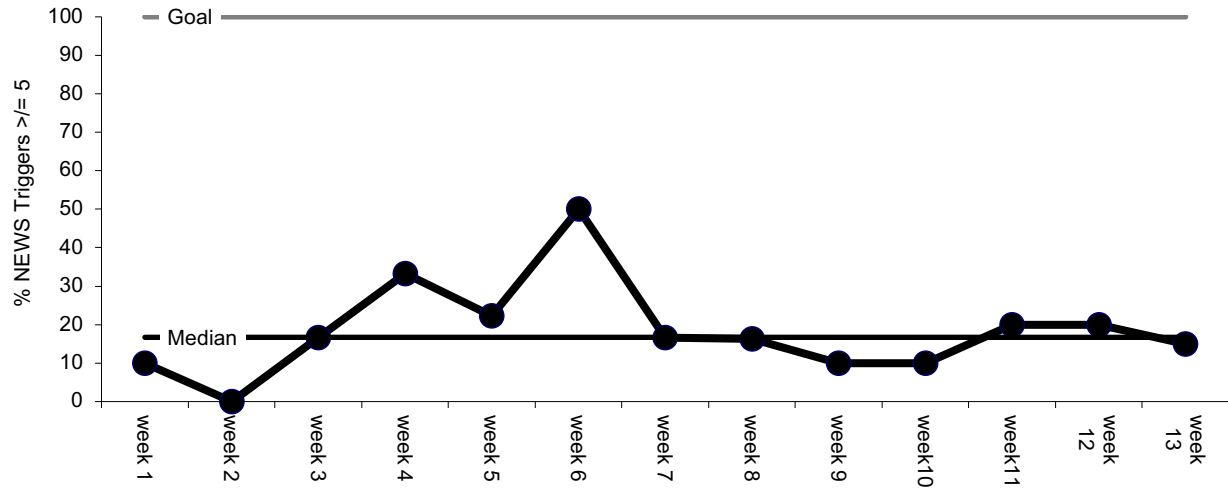
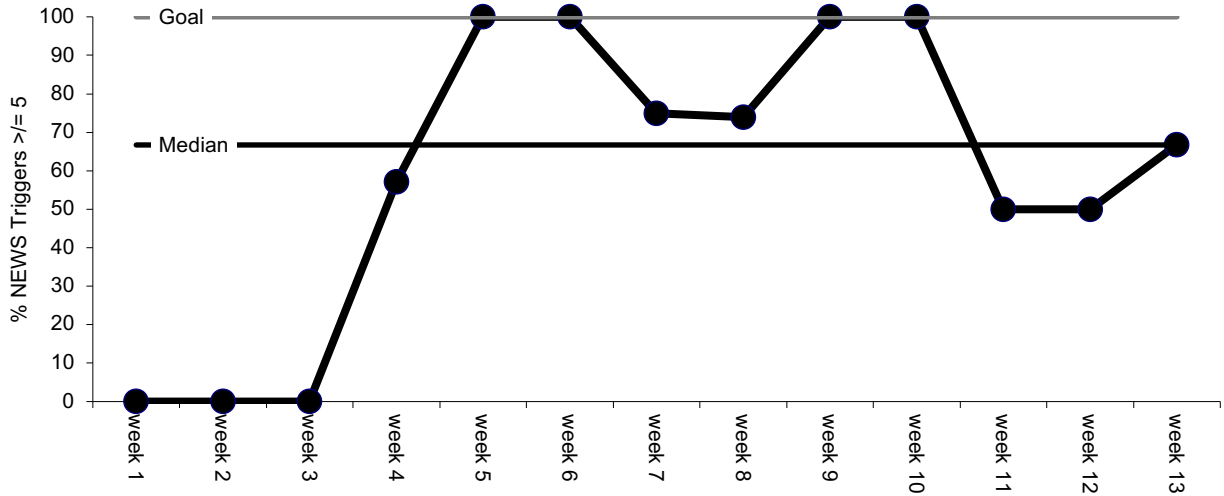


Figure 6

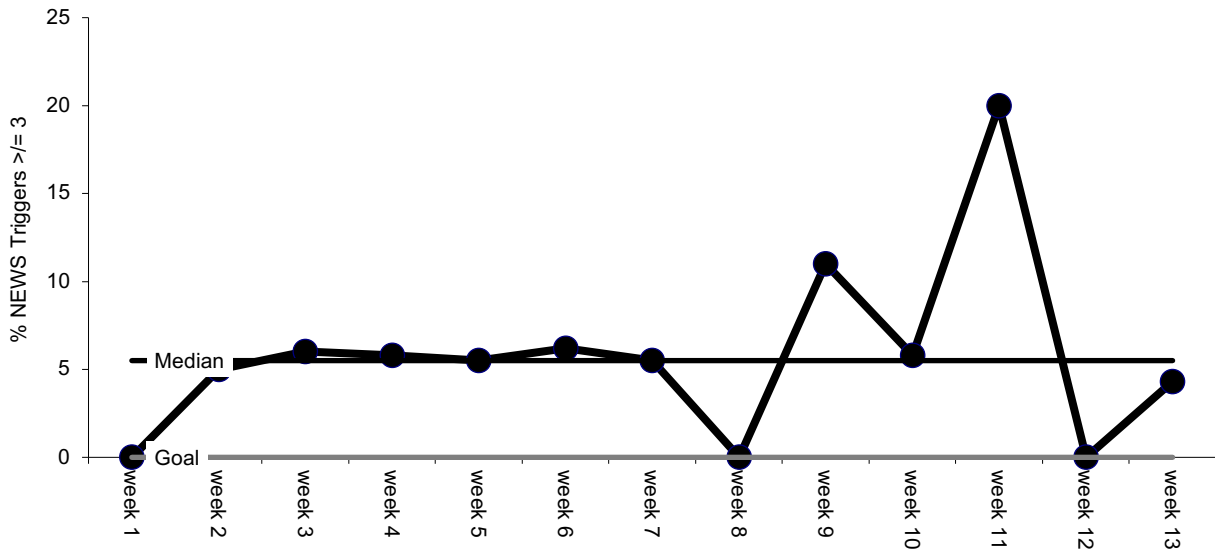
NEWS Greater Than or Equal to 5 Tracked on RRN Ward Rounding Tool



Note. The RRN ward rounding tool was implemented in week 4, compliance with trending patients with elevated NEWS remained high until the COVID-19 surge when the primary RRN champion was reassigned to another hospital.

Figure 7

Patients with NEWS Greater Than or Equal to Three with Unanticipated ICU Admissions



Note. The rate of unanticipated ICU admissions remained steady at 5% until week 9 which was the beginning of the COVID-19 surge.

Appendix A

Evidence Review Table

Citation: Smith, G., Prytherch, D., Jarvis, S., Kovacs, C., Meredith, P., Schmidt, P., & Briggs, J. (2016). A comparison of the ability of the physiologic components of medical emergency team criteria and the U. K. National Early Warning Score to discriminate patients at risk of a range of adverse clinical outcomes. <i>Critical Care Medicine Journal</i> , 44(12), 2171-2181. http://doi.org/f9cbgt					Level IV
Purpose/ Hypothesis	Design	Sample	Intervention	Outcomes	Results
“To compare the ability of medical emergency team criteria and the National Early Warning Score (NEWS) to discriminate cardiac arrest, unanticipated ICU admission and death within 24 hours of a vital sign measurement, and to quantify the associated workload”	Retrospective cohort study	<p>Sampling Technique: Convenience sampling of adult in patients ≥ 16 years old</p> <p># Eligible: 2,606,050 observation sets</p> <p># Accepted: 2,225,725 observation sets</p> <p># Control: N/A</p> <p># Intervention: N/A</p> <p>Power analysis: None</p> <p>Group Homogeneity: Some heterogeneity among the types of care areas the patients were admitted to. Overall, the majority of the data was homogeneous as indicated in Table 1.</p> <p>Forty-seven percent of the vital signs observed were from males and 96.3% had no events during their admission and observed vital signs.</p>	<p>Control: N/A</p> <p>Intervention: None</p> <p>Intervention fidelity: VitalPAC software was utilized to collect the following: date/time of observation set, pulse, systolic and diastolic blood pressure, respiratory rate, temperature, neurologic status using AVPU scale, peripheral oxygen saturation and inspired gas (FiO₂).</p>	<p>DV: Deaths, cardiac arrests, unanticipated intensive care unit (ICU) admission or a combined outcome which means the first of any of the above three outcomes.</p> <p>Measurement tool (reliability), time, procedure: The electronic health record (VitalPAC) was utilized to compile vital sign data over 31 months and entered per patient vital sign set into NEWS and 44 different MET criteria. Dependent variables were measured by conducting chart reviews to determine the disposition of the patient upon discharge from the hospital and to determine if they experienced and</p>	<p>Statistical Procedures(s) and Results: Area under the receiver operating curve (AUROC, 95% CI) for cardiac arrest, unanticipated ICU admission, death and the combined outcome for NEWS were 0.78(0.76-0.78), 0.86(0.85-0.86), 0.91(0.91-0.92), and 0.88(0.88-0.88), respectively. NEWS sensitivity and specificity for each outcome were stratified by the numeric NEWS value. Over 44 MERT criteria were evaluated showing a wide range of sensitivity and specificity. NEWS showed better discrimination than the MET criteria in all the outcomes. Some MET</p>

				unanticipated ICU admission or cardiac arrest. Only one outcome was counted, for example if the patient experienced cardiac arrest and died only the death was counted.	criteria had higher sensitivity than NEWS values >7, all had lower specificity.
Citation: Haegdorens, F., Van Bogaert, P., Roelant, E., De Meester, K., Misselyn, M., Wouters, K., & Monsieurs, K. (2018). The introduction of a rapid response system in acute hospitals: A pragmatic stepped wedge cluster randomized controlled trial. <i>Resuscitation</i> , 129, 127-134. https://doi.org/10.1016/j.resuscitation.2018.04.018					Level II
Purpose/ Hypothesis	Design	Sample	Intervention	Outcomes	Results
“This study aims to investigate the effectiveness of an RRS including a standardized observation and communication protocol using the NEWS and the Situation, Background, Assessment and Recommendation (SBAR) communication method in acute hospitals in Belgium”	Stepped wedge cluster randomized controlled trail (RCT)	<p>Sampling technique: Cluster sampling</p> <p>Eligible participants: 14 hospitals</p> <p>Accepted: 7 hospitals</p> <p>Control: 2 wards per hospital (1 medical, 1 surgical)</p> <p>Intervention: Stepped wedge using 5 time periods of four-month intervals with a total of 7 hospitals and 28 wards were included totaling 13,698 admissions.</p> <p>Power analysis: Six hospitals with 24 participating wards for an 83% statistical power at a significance level of 0.05</p> <p>Group homogeneity: Some heterogeneity was seen in the</p>	<p>Control: Time one was used as an initial control and data collection point for the researchers according to the stepped wedge process.</p> <p>Intervention: A standardized observation with NEWS and SBAR communication was implemented.</p> <p>Treatment fidelity: One week prior to implementing NEWS and SBAR two trainers provided mandatory training lasting four hours for all nurses in the wards. It covered measurement and interpretation of vital signs, clinical</p>	<p>DV: Patient level outcomes - Unexpected death, cardiac arrest with CPR, and unplanned ICU admission.</p> <p>Secondary outcomes: Organizational level outcomes – Total ward mortality in patients without do not resuscitate (DNR) code, and hospital mortality.</p> <p>Measurement tool (reliability), time, procedure: Longitudinal data supplied by the hospitals provided baseline characteristics and date/time stamped crude outcome indicators (mortality, DNR code, resuscitation team calls</p>	<p>Statistical procedures and Results: Pearson’s Chi-squared test was used to compare proportions of NEWS values between the control and intervention group. The Mann-Whitney U test compared the mean rate per 1000 admissions of all primary outcomes between the control and intervention group in each period.</p> <p><u>Unexpected death:</u> control - 1.5/1000, intervention – 0.7/1000</p> <p><u>Cardiac arrest:</u> control- 1.3/1000, intervention- 1.0/1000</p> <p><u>Unplanned ICU admission:</u> control- 6.5/1000, 10.3/1000</p>

		Charlson Comorbidity index (CCI) category, but otherwise the populations were homogenous.	observation, communication skills and practical tips for NEWS and SBAR.	and transfers to the ICU). All crude and primary outcomes are presented per 1000 patient admissions. There were four intervention time points time 1 (T1) to time 4 (T4) spanning four, four-month periods.	No significant difference was noted between groups when adjusting for clusters and controlling for CCI and nursing hours per patient day (NHPPD). No significant effect was found on the primary outcomes likely caused by an underpowered study
Citation: Haegdorens, F., Monsieurs, K., Meester, K., & Bogaert, P. (2019). An intervention including the national early warning score improves patient monitoring practice and reduces mortality: A cluster randomized controlled trial. <i>Journal of Advanced Nursing</i> , 75, 1196-2005. http://doi.org/dmk6					Level IV
Purpose/ Hypothesis	Design	Sample	Intervention	Outcomes	Results
“To investigate the impact of the national early warning score on the frequency and the quality of vital sign registration and to study the association between protocol compliance and patient mortality.”	Post-hoc analysis of data from the RCT listed above (Haegdorens et al., 2018).	Sampling technique: Cluster (original study) Eligible participants: N=60,956 patient admissions Accepted: N=60,956 Intervention: 32,722 Power analysis: Not applicable Group homogeneity: As previously mentioned there was some heterogeneity among the CCI in this patient population.	Control: Time one was used as an initial control and data collection point for the researchers according to the stepped wedge process. Intervention: A standardized observation with NEWS and SBAR communication was implemented. Treatment fidelity: One week prior to implementing NEWS and SBAR two trainers provided mandatory training lasting four hours for all nurses in	Dependent variable: Frequency and quality of vital sign registration. Compliance with NEWS protocol and patient mortality. Secondary outcomes: total ward mortality, ward mortality in patients without DNR code, and hospital mortality. Combined mortality. Measurement tool (reliability), time, procedure: Patient records were used to identify outcome indicators. Mortality	Statistical procedures and Results: Cross-sectional sample of intervention group protocol compliance was 47.7%. Pearson’s correlation coefficient for protocol compliance and combined mortality rate: -0.364 (p=0.080). Adjusted for the CCI and age protocol compliance and combined mortality-β: -0.576(p=0.003) This study showed increased observation in clinically unstable patients. It also showed a negative correlation between compliance

			the wards. It covered measurement and interpretation of vital signs, clinical observation, communication skills and practical tips for NEWS and SBAR.	was defined as all admitted patients who died on the study ward or up to 72hrs after discharge from the ward. Combined mortality is a composite of unexpected death, death within 72hrs after cardiac arrest with CPR or unplanned ICU admission. Compliance is defined as a registered NEWS at least every 12 hours including all six vital signs and supplemental oxygen per patient.	and combined mortality.
Citation: Pimentel, M., Redfern, O., Gerry, S., Collins, G., Malycha, J., Prytherch, D., Schmidt, P., Smith, G., & Watkinson, P. (2019). A comparison of the ability of the National Early Warning Score and the National Early Warning Score 2 to identify patients at risk of in-hospital mortality: A multi-centre database study. <i>Resuscitation</i> , 134, 147-156. https://doi.org/10.1016/j.resuscitation.2018.09.026					Level IV
Purpose/ Hypothesis	Design	Sample	Intervention	Outcomes	Results
“To compare the ability of the National Early Warning Score (NEWS) and the NEWS2 to identify patients at risk of in-hospital mortality and other adverse outcomes.”	Retrospective observational study	Sampling technique: Convenience sampling from 5 hospitals in adult patients ≥ 16 years old Eligible participants: 363,530 admissions With at least one complete vital sign observation Accepted: 251,266 admissions, 6,229,740 vital sign observations	Control: N/A Intervention: N/A Treatment fidelity: Three groups created based on being diagnosed with, at risk for or no T2RF. ICD-10 codes in the patient’s chart were utilized to identify patients with a current diagnosis of T2RF. The same technique was utilized	DV: Patient outcome (primary)-death within 24 hours of an observation set based identified with NEWS and NEWS2. Secondary- cardiac arrest, unanticipated ICU admission, death within 24 hours of an observation set. Measurement tool (reliability), time,	Statistical procedures and Results: <u>Documented T2RF</u> AUROC for predicting inpatient mortality within 24h for the two scoring systems NEWS-0.862(95%CI: 0.848 to 0.875). NEWS2-0.841(0.827-0.855) Positive predictive values (PPV) at a

		<p>Power analysis: Not applicable</p> <p>Group homogeneity: The groups were homogenous except for comorbidity. Patients stratified into the type 2 respiratory failure (T2RF) and at risk for T2RF group scored higher on the Charlson Comorbidity Index (CCI).</p>	<p>to identify patients at risk for T2RF. Patients without any diagnoses or risk for were classified as not at risk and considered to be group 3.</p>	<p>procedure: Outcomes were obtained retrospectively from different clinical information systems including each hospitals' patient administration systems, the ICU clinical information systems, and the hospitals' National Cardiac Arrest Audit. Each vital sign set was analyzed as independently associated with the outcome.</p>	<p>threshold of NEWS 5 - NEWS 2.5% and NEWS2 3.0% <u>At risk for T2RF</u> AUROC for predicting inpatient mortality within 24h for the two scoring systems. NEWS-0.881(0.878 to 0.884), NEWS2 0.860(0.857 to 0.864). PPV at a NEWS of 5-NEWS 3.2%, NEWS2 2.7%.</p> <p>Efficiency curves comparing NEWS to NEWS2. At the suggested cut-offs of 5 and 7 points for patients diagnosed with T2RF it reduced absolute staff workload by approximately 11% and 5% respectively. Also reduces sensitivity to identify early clinical deterioration at 10% and 14% respectively.</p>
<p>Citation: Kolic, I., Crane, S., McCartney, S., Perkins, Z., & Taylor, A. (2015). Factors affecting response to National Early Warning Score (NEWS). <i>Resuscitation</i>, 90, 85-90. http://dx.doi.org/10.1016/j.resuscitation.2015.02.009</p>					<p>Level VI</p>
<p>Purpose/ Hypothesis</p>	<p>Design</p>	<p>Sample</p>	<p>Intervention</p>	<p>Outcomes</p>	<p>Results</p>

<p>“Assess the scoring accuracy and the adequacy of the prescribed clinical responses to NEWS and assess whether responses were affected by time of day, day of week and score severity”</p>	<p>Prospective observational study</p>	<p>Sampling technique: convenience Eligible participants: 370 patients, adult patients ≥ 16 years old on two acute medical wards in a single hospital Accepted: 370 Power analysis: N/A Group homogeneity: Baseline characteristics homogenous across the sample.</p>	<p>Control: N/A Intervention: N/A Treatment fidelity: NEWS scores were manually calculated from documented vital signs on observation charts, time to subsequent observations and the adequacy of clinical responses. Time of day and day of week was noted.</p>	<p>DV: Process measures-scoring error and adequacy of clinical response. Secondary outcomes – patient mortality Measurement tool (reliability), time, procedure: Scoring error was defined as a difference in calculation between the observation score and the NEWS chart score. Adequacy of clinical response is defined as carrying out the prescribed actions dictated by the protocol.</p>	<p>Statistical procedures and Results: <u>Scoring error-</u> 18.9% of patients had an incorrect score <u>Clinical response-</u> 74.1% of patients received an appropriate clinical response based on their NEWS 25.9% did not have an adequate clinical response Weekend admission were more likely to receive an inadequate clinical response (p<0.0001). <u>Mortality-</u> 6% of patients with an adequate clinical response died versus 8.5% who did not receive an adequate clinical response</p>
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Notes. Evidence review supporting the practice change.

Appendix B

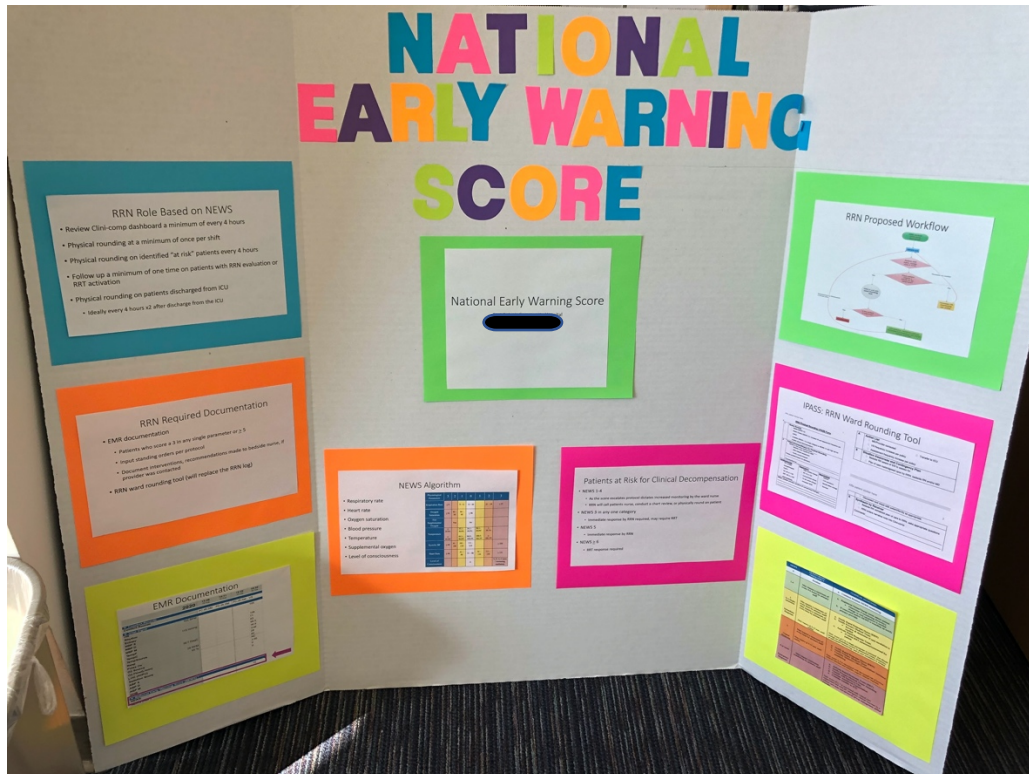
Evidence Synthesis Table

Evidence Based Practice Question (PICO): In the adult in-patient population at a community hospital why are NEWS scores of 3-5 not being assessed?			
Level of Evidence	# of Studies	Summary of Findings	Overall Quality
II	1	Haegdorens et al., (2018) found no significant effect on their primary outcomes of cardiac arrest with CPR, unplanned ICU admission or unexpected death. However, due to changes in their sample size they concluded their study may be underpowered to detect a statistically significant effect. They concluded more research is necessary with adequate power to determine statistical significance.	B, this stepped wedge randomized controlled trial utilized four groups at five different time points starting with each group as a control and in a step-wise fashion adding the intervention to previously controlled groups. Due to the lack of unit blinding results may not be reliable. The measures were appropriate for this study; however, the intervention was not statistically significant for improving the outcomes.
IV	3	Smith et al., (2016) quantified mortality for NEWS values from 3-7 as compared to 44 MET calling criteria. Not surprising the AUROC was 0.88 (95% confidence interval) proving to be a better discriminator of clinical decompensation. Some METS had higher sensitivity than NEWS values greater than or equal to 7, however they also generated a higher workload. Haegdorens et al., (2019) utilized the data from their previous study to prove NEWS compliance decreased mortality($r = -0.364$, $p=0.080$), it also increased vital sign registration among patients at risk. Pimentel et al., (2019) examined the specificity and sensitivity of the NEWS and NEWS2 in patients diagnosed with and at risk for type two respiratory failure for the primary outcome of in-hospital death within 24 hours of an observation. NEWS2 showed no improvement in discrimination over NEWS. PPV was higher for patients with the NEWS2 of 7.	B, this retrospective cohort study utilized a large set of vital signs across the entirety of a patient admission, compiled over 31 months. Although this is not an interventional study the strengths and limitations were clearly described such as DNR patients being included in the vital signs studied as well as this being a single-center study. The results were consistent. B, this post hoc data analysis of the previous stepped wedge cluster RCT more clearly explained the previous data gathered and utilized appropriate statistical methods showing correlations as previously mentioned. A recommendation was made for adoption of NEWS in medical and surgical wards. B, this retrospective observational study was well designed with robust data available. Each vital sign was independently analyzed and contributed to the assigned outcomes. It further supported the utility of the original NEWS algorithm in patients without type two respiratory failure proving it is a valid and reliable tool with consistent sensitivity and specificity values reported.
VI	1	Kolic et al., (2015) assessed appropriate scoring, clinical response to NEWS and the mortality based on the documented clinical response. This single center, prospective observational study showed minimal scoring error (18.9%) and a 75.9% appropriate clinical response based on the NEWS. Although not statistically significant, a clinical significance was identified with an adequate response to increased NEWS showing a decrease in mortality.	C, this prospective observational study provided further evidence that compliance with NEWS has an impact on patient outcomes. Limitations include the prospective observational design and small sample size and snapshot of patient care based on the limited study time. The evidence from this small study adds to the currently available literature on the reliability of NEWS with compliance to the prescribed protocol.

Notes. Synthesis of the evidence utilized for the practice change.

Appendix C

Poster presentation for the Rapid Response Nurses



Note. This poster presentation was utilized during the skills fair with the RRNs. A description of the updated workflow, documentation expectations and policy education were provided.

Appendix D

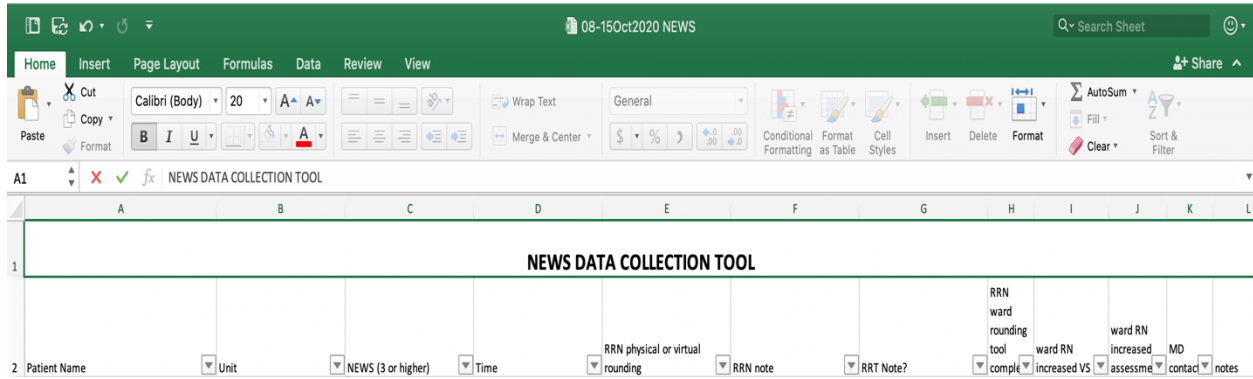
RRN Ward Rounding Tool

On Watch Review Findings																	
Only Document abnormal findings according to NEWS criteria:																	
NEWS of 3 in one category or ≥ 5 MUST have an in-person RRN assessment complete and documented																	
Month: September																	
#	Date	Patient Initials/DoD ID	0800 NEWS	1100 NEWS	1600 NEWS	2000 NEWS	2400 NEWS	0400 NEWS	Ward	Notes	Follow-up	Day Shift Virtual or Physical Rounding	Night Shift Virtual or Physical Rounding	Clinical Note documented day shift?	Clinical Note documented night shift?	Activated RRT Y/N	Rapid Response Nurse
1																	
2																	
3																	
4																	
5																	
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Note. The RRN ward rounding tool is separated by monthly spreadsheets including all the days of the month. Each day represents a 24-hour period from 0700 to 0700.

Appendix E

NEWS Data Collection Tool



Note. The data collection tool includes the patients initials, location, NEWS and time of trigger.

Manual chart audits are required to identify increased vital sign and/or assessment frequency by the ward nurse in addition to an RRN note and if the provider was contacted.

Appendix F

RRN NEWS Education Attestation Form

Please read the following statement carefully and sign below once training has been completed, understood and agreed to.

I have been trained on the NEWS policy, RRN policy and the Ward Rounding Tool. I understand and will adhere to the policy as outlined and complete the Ward Rounding Tool on all patients with a NEWS of 3 to 5.

Printed Name	Date	Signature/Credentials