Performance Improvement

A Patient Safety Solution: A Pre- Post Evaluation of a 24/7 Nurse-led Proactive Rapid Response Program

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ABSTRACT

Background: Rapid Response Systems are patient safety programs that have been implemented around the world to reduce preventable patient harm and failure to rescue.

Problem: There was a high rate of cardiac arrests outside the intensive care unit and an absence of a structured system to identify and rescue patients with signs of clinical deterioration prior to cardiac arrest.

Objectives: To evaluate the impact of a structured 24/7 nurse-led proactive rapid response program on clinical deterioration and cardio-pulmonary arrests.

Methods: This pre-post-evaluation study took place in a 650-bed quaternary academic regional referral center. The study period was between January 2014 and February 2020. A rapid response system redesign was initiated in early 2017, and a 24/7 nurse-led proactive rapid response program was launched in December 2017.

Results: A statistically significant decrease in rates of critical care cardio-pulmonary arrests, non-critical care cardio-pulmonary arrests, rapid response consults, unplanned ICU transfers, and hospital deaths occurred following the implementation of the 24/7 nurse-led proactive rapid response program.

Conclusions: Implementing a structured 24/7 nurse-led rapid response program can decrease cardiopulmonary arrests, unplanned transfers to ICU, and hospital deaths.

Keywords: Rapid Response, Proactive rounding, patient safety

INTRODUCTION

The prevalence of preventable patient harm in healthcare settings has been reported to be as high as one in twenty patients (Panagioti et al, 2019). Of those experiencing preventable harm, as many as twelve percent may experience permanent disability or death (Panagioti et al, 2019). Failure to rescue (FTR) is described as a failure to recognize and respond to a hospitalized patient experiencing complications from a disease process or medical intervention (Burke et al, 2022). Rapid Response Systems (RRS) have evolved as a patient safety solution to reduce preventable harm and FTR (DeVita et al, 2010). Meta-analyses show that RRS are associated with reduced rates of cardiopulmonary arrest and mortality, although findings remain controversial, in part due to heterogeneity of response models and lack of standardized outcome measures (Olsen et al, 2019). A variety of models exist that have different names and responders. Critical care outreach programs, rapid response teams (RRTs), and medical emergency teams (METs) may consist of diverse responders that include physicians, nurses, and respiratory therapists (Burke et al, 2022; DeVita et al, 2010). RRS includes components known as limbs that include the afferent trigger limb (detection), an efferent or response limb, an administrative or governance limb, and an evaluation performance improvement limb (DeVita et al, 2010).

Antecedents to deterioration are often present before clinical deterioration, such as abnormal vital signs. These abnormal physiologic vital sign parameters provide triggers to call for clinical review (the afferent limb) and additional attention by the RRT (efferent response limb). Studies have shown that afferent trigger failure is usually due to incomplete or delayed vital sign checks (Michard et al, 2021). Researchers have investigated the afferent trigger and failure to recognize and respond to clinical deterioration (Al-Moteri et al, 2019). This has led to administrative limbs, such as early warning systems (EWS) that evolved from efforts to identify patients at risk of deterioration early enough for actions to occur (Al-Moteri et al, 2019). Barriers to following EWS algorithms include culture, confidence, past experiences, and the demeanor of response teams. Facilitators to EWS include standardized protocols that allow response teams to assess, triage, intervene, and escalate as the scope of nursing practice allows (Wood, et al, 2019). As EMRs have evolved, so have automated EWS. Paper systems have been replaced by automated aggregate EWS systems and remote surveillance.

Artificial intelligence (AI), machine learning, and continuous monitoring have uncovered opportunities for the prediction and prevention of clinical deterioration. AI represents a valuable tool that can be used to improve patient safety (Bates, et al, 2021). Implementation and adoption of these innovative technologies can improve surveillance, decrease workload, and may reduce the frequency of many types of harm (Bates, et al, 2021). Proactive rounding or a pre-MET tier of RRS that is combined with AI holds promise for safety and staffing solutions. Understanding gaps in processes, clinical practice, escalation protocols, and clinical interventions can be used to target strategies for improvement (Sprogis et al, 2021). Flexible staffing using remote surveillance has been used for consistent and timely patient care review. Collaboration, communication, and trust between remote and on-site teams can offload work from front-facing staff, allowing them to spend more time with patients and families (Paulson et al, 2020).

Building a system of care for patient safety requires an infrastructure with clear leadership, experienced staff, inter-professional trust, collaboration, understanding of nurses' decision-making, perceptions of escalation, and the ability to work around organizational structures to mitigate patient risk (Bingham et al, 2020). Reprimanding hierarchies, alarm fatigue, and lack of integration with other hospital systems create barriers to success (Olsen et al, 2019). RRS are expected to continue evolving with novel developments in monitoring technologies, risk prediction informatics, and human factors engineering (Lyons et al, 2018).

PROBLEM

Before December 2017, our hospital response to deteriorating patients was modeled on the early code response teams, where a nurse from an ICU, would leave their assignment to respond to a rapid response or code blue type event. By 2015, the number, duration, and complexity of rapid response activations became unsustainable using this model, and other options for patient safety solutions were explored.

OBJECTIVE

In this paper, we outline a phased approach to implementing a 24/7 nurse-led rapid response program and its impact on patient outcomes.

METHODS

Design

This was a single-site, pre-post evaluation study. The hospital Institutional Review Board waived the need for study approval.

Setting

The setting for this study was a 650-bed quaternary academic regional referral center with three ICUs, located in the Southern United States.

Intervention

As a first step, the Critical Care Clinical Nurse Specialist performed a gap analysis, literature review, and staff survey. Learnings were then categorized into six key areas of need. The analysis was shared with the Chief Nursing Officer and other leaders. Opportunities to optimize the emergency response, staffing efficiency, and care delivery informed the development of a proactive rapid response program.

Next, a newly formed resuscitation committee was leveraged to provide an infrastructure for the resuscitation program and to engage patient-facing staff into six task forces to drive key initiatives (Table 1). The aim and scope of each group were outlined, and monthly committee reports facilitated shared communication and the escalation of barriers to hospital leadership. Resuscitation awareness increased during 2017 due to taskforce activities. Existing online life-support training was updated, standard operating procedures were developed, and documentation expectations were redefined.

In September 2017, artificial intelligence clinical deterioration alerts were introduced through the electronic health record (EHR), as were portable devices and patient wearable technologies. Inter-professional advanced resuscitation training was initiated in a newly opened simulation center, and goal-directed resuscitation training accompanied the distribution of a new defibrillator fleet.

In December 2017, the 24/7 rapid response nurse (RRN) program was launched. The RRN utilized existing ICU nurses, who were scheduled for a rapid response shift rather than as a bedside nurse in the ICU. A backup staffing system was developed for call-ins and short-falls with support from nursing administration to ensure the RRN resource was

Table 1. Resuscitation Taskforces

Taskforce	Taskforce Aim
Process of Care	To evaluate and make recommendations on emergency response team membership & daily work
Equipment & Supplies	To evaluate and make recommendations on emergency & supply needs
Code Cart/ Regulatory	To evaluate the process for code cart exchange and daily checks
Defibrillator	To review the current state of defibrillators and AEDs and provide recommendations for change
Education & Training	To make recommendations on staff educational gaps, needs & responsibilities in emergencies
Data & Outcomes	To make recommendations on data and documentation to track adherence to processes and outcomes

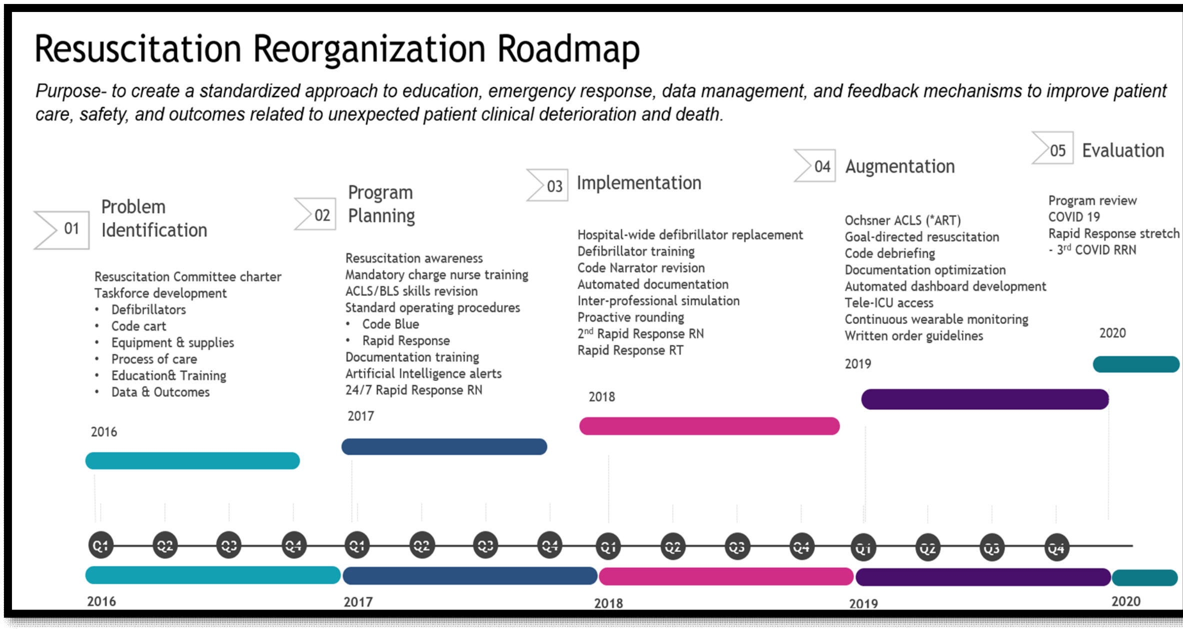
not pulled into ICU staffing. Protocols and written order guidelines ensured nurses practiced within the scope of their licensure, while expediting treatment to clinically deteriorating patients. Table 2 outlines the main tasks of the RRN. The health information technology infrastructure was used as part of the novel care system to provide surveillance, screening, data collection, and case review. Risk stratification, standardized calling criteria, escalation protocols, response pathways, and documentation, including notes, reports, and dashboards, were automated.

The RRNs acted as clinical practice consultants who provided just-in-time expertise to troubleshoot bedside clinical situations. The visibility and recognition of the team were created by branding with red and white shirts, swag, and clinical notes. This allowed staff to quickly identify experts in clinical emergencies and find documentation in the EHR. In 2018, the number of RRN consultations, stroke emergencies, and respiratory events, along with the lack of night coverage, resulted in adding a second RRN and daytime respiratory therapist. By 2019, an Ochsner Advanced Resuscitation Training program was initiated to replace existing emergency education to ensure hands-on team training for all staff. As the rapid response program matured, iterative modifications were made to workflows, metrics, and training.

Timeline

A program timeline diagram can be seen in Figure 1. The pre-implementation period was defined as January 2014 through November 2017, and post-implementation period from December 2017 (date of RRN implementation) to February 2020 (although the number of RRN activities were reported for all of 2020). The study period occurred after the transition to EHR and before the COVID-19 pandemic.

Figure 1. Rapid Response Program Timeline



Evaluation plan

First, we captured the major activities of RRN and placed them into three major categories: event recognitions, event escalation, and event interventions. There were reported annually (2018-2020). Additional measures were chosen that aligned with published literature on failure to rescue and RRS (DeVita, et al 2010; Subbe et al, 2019). Measures included: Monthly counts of critical care codes, non-critical care codes, RRN consults, unplanned ICU transfers, ICU deaths, ICU discharges, hospital deaths, and hospital discharges; average ICU length of stay (LOS), hospital length of stay, and ventilator days per admission.

Then for each metric, a linear model was utilized to carry out a single group interrupted time series analysis. The model contains a binary indicator of period (pre/post-intervention), month (numbered 0 to 73), and period-by-month interaction. Linear combinations of estimated model parameters were constructed to (1) estimate means and linear trends in each period and (2) estimate the differences in means and linear trends between periods. Each metric is summarized with period-specific means and linear trends, differences between periods in means and trends, and p-values from t-tests. All tests were evaluated using a significance level α of 0.05. In addition, a cost saving estimate for 2018 was determined by examining the difference between RRN salary cost and avoided ICU days (calculated by the difference in cost between an ICU bed and non-ICU bed).

Data were entered into the American Heart Association Get with the Guidelines Resuscitation (GWTG-R) database for standardization and benchmarking. In addition to the quality checks in the database, the completeness and accuracy of data were evaluated using manual and electronic data comparisons by the nursing team, telecommunications operators, house supervisors, and quality improvement coordinators. All analyses were performed using SAS 9.4 (*SAS* Institute, Cary NC).

Table 2. Rapid Response Event Categories and Volume from January 2018 through December 2020

Recognize	High-risk Screening	2018	2019	2020
Clinical intuition Vital sign abnormalities Physiologic abnormalities AI/MEWS	Chart Review	9294	17378	24494
	Consults	2635	14067	34097
	AI		1703	2107
	Total	11929	33148	60698
Escalate	**Proactive Rounding**	**2018**	**2019**	**2020**
Call to Primary MD Call to Rapid Response Call MD/RRS/CC Document concern/escalation	Proactive Notes	3215	4719	2972
	Follow up		2122	1439
	Total	3215	6841	4411
Intervene	**Reactive Response**	**2018**	**2019**	**2020**
Order interventions Increase monitoring Order additional testing Document event	Rapids	913	1192	1065
	Transfers into ICU	659	884	948
	Transfers to HLOC	131	322	233
	Code Blue	161	138	141
	Code Stroke	99	158	166
	Floor Intubation	81	73	88
	Total	2044	2767	2641

HLOC = Higher level of care

RESULTS

Table 2 outlines the annual number of RRN activities by recognition, escalation, and intervention. The highest number of events were related to high-risk screening, followed by proactive rounding, and then reactive responses. While all three categories increased annually, the biggest gains were in screening and rounding. Under high-risk screening, the largest increase was in the number RRN consults (range from 2,635 in 2018 to 34,097 for all of 2020). The numbers in table 2 were not controlled for the hospital census.

There was a statistically significant decrease in rates of critical care cardio-pulmonary arrests(codes), non-critical care codes, rapid response consults, unplanned ICU transfers, and hospital deaths occurred following the implementation of the 24/7 nurse-led proactive rapid response program (Table 3), despite a significant increase in the number of hospital discharges. There was also an increase in the ICU length of stay (p<0.001) and ventilator days. Linear trends comparing the pre- and post-implementation periods were non-significant, except for a decrease in the number of ICU discharges post-implementation (Figure 2, Table 4).

Table 3. Average Monthly Hospital Metrics Prior to and Following Implementation of Rapid Response Iintervention

	Mean (95% CI)			
Metric	**Pre**	**Post**	**Post - Pre (95% CI)**	**P-value**
Hospital Discharges	2026 (1988, 2064)	2241 (2191, 2292)	216 (153, 279)	**<0.001**
Critical Care Codes per 1,000 Hospital Discharges	7.6 (6.6, 8.4)	5.3 (4.1, 6.4)	-2.2 (-3.7, -0.8)	**0.003**
Non-Critical Care Codes per 1,000 Hospital Discharges	5.7 (5.0, 6.4)	2.5 (1.6, 3.4)	-3.2 (-4.3, -2.1)	**<0.001**
RRS Consults per 1,000 Hospital Discharges	38.5 (35.8, 41.2)	34.2 (30.6, 37.8)	-4.3 (-8.9, 0.2)	0.058
Unplanned ICU Transfers per 1,000 Hospital Discharges	62.9 (60.3, 65.4)	52.3 (49.0, 55.7)	-10.5 (-14.8, -6.3)	**<0.001**
Deaths per 1,000 Hospital Discharges	37.1 (34.9, 39.3)	33.1 (30.1, 36.0)	-4.0 (-7.7, -0.3)	**0.033**
Hospital Length of Stay	14.5 (13.7, 15.2)	13.5 (12.4, 14.5)	-1.0 (-2.3, 0.3)	0.129
ICU Discharges	531 (521, 542)	586 (572, 600)	54 (37, 72)	**<0.001**
ICU Deaths per 1,000 ICU Discharges	99.9 (94.7, 105.1)	98.4 (91.6, 105.3)	-1.5 (-10.1, 7.1)	0.727
ICU Length of Stay	4.2 (4.1, 4.4)	4.8 (4.6, 5.0)	0.5 (0.3, 0.8)	**<0.001**
Ventilator Days	4.0 (3.6, 4.4)	4.9 (4.4, 5.3)	0.9 (0.3, 1.5)	**0.006**

The cost of the RRN intervention was estimated at $500,000/annually. In 2018, the number of ICU days saved by the early intervention was also estimated at $500,000. Each patient who was upgraded to ICU by the team had an average length of stay of 6 days. This indicated that the program was cost neutral in terms of nursing labor but impacted quality outcomes, staff support, and patient experience.

Figure 2. Visualization of Monthly Means and Linear trends for Pre-post Implementation of a 24/7 Rapid Response Nurse Program

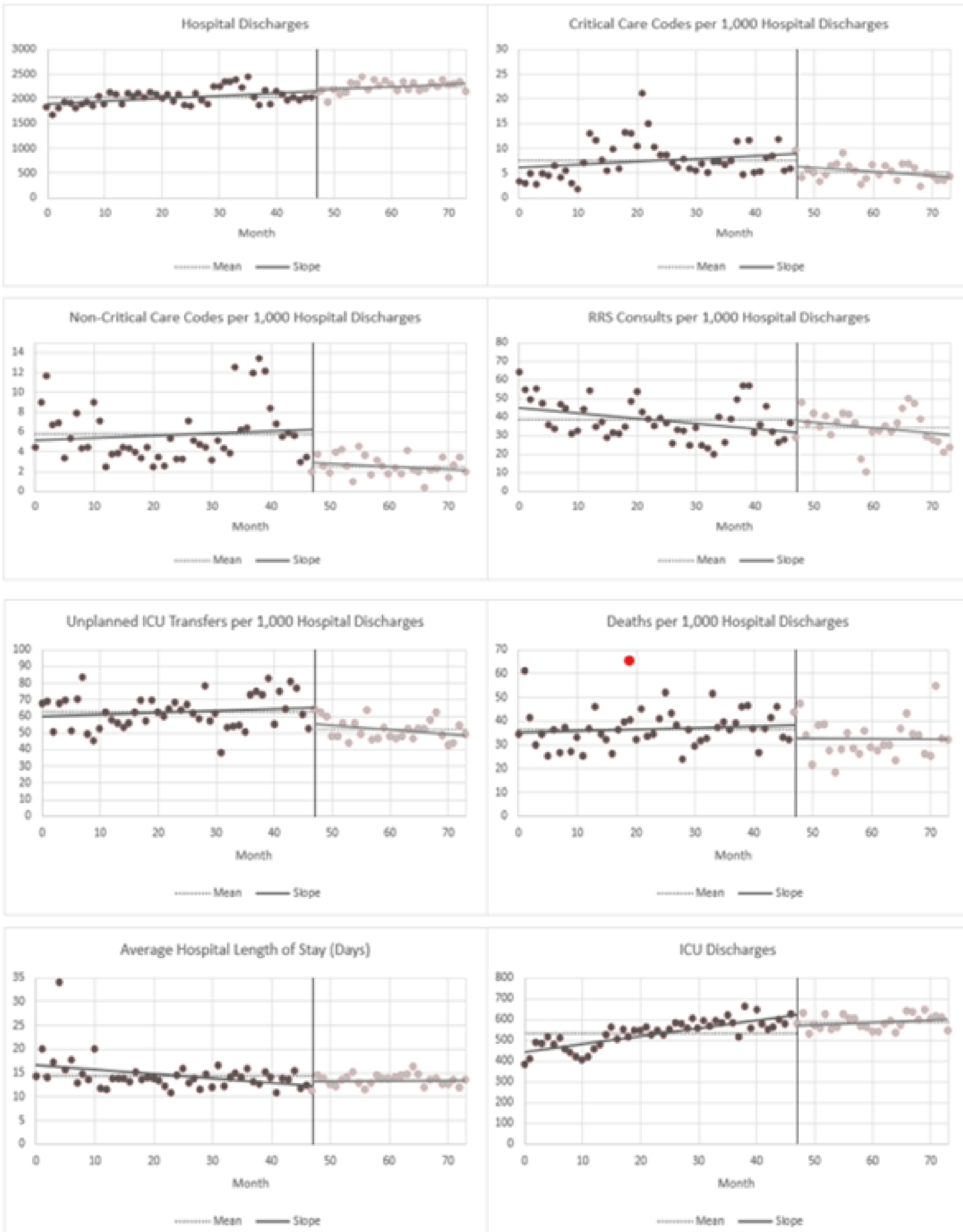
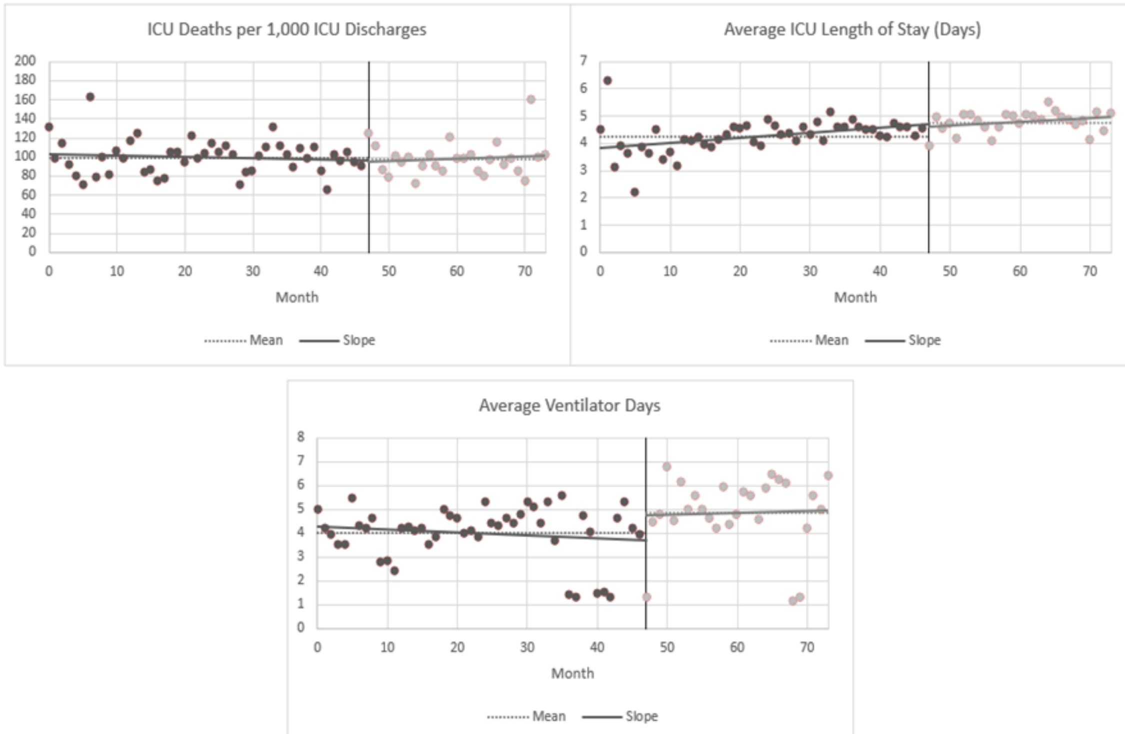


Figure 2 continued. Visualization of Monthly Means and Linear trends for Pre-post Implementation of a 24/7 Rapid Response Nurse Program



** The vertical reference line represents month 47 (December 2017), the beginning of the post-intervention period.

Discussion

The results indicate that clinical deterioration was addressed by proactive interventions, and not simply moving critically ill patients to the ICU just before cardiac arrest. The increase in ICU length of stay and ventilator days is perplexing. One can postulate that there was a potential change in patient acuity and more aggressive care (maybe related to earlier recognition before cardiopulmonary arrest and, therefore, more aggressive therapy based on the patient potential for a good clinical outcome). Although not directly addressed in this study, there is a need for the RRN to be an expert in discussions about end-of-life preferences and written treatment goals.

The 24/7 RRN may help with future staffing solutions in a variety of ways; (1) for on-demand and unpredictable surge staffing to manage high-stakes clinical situations and emergencies, (2) to have a 24/7 expert clinical leader at the point of service who can drive outcomes and mitigate communication and teamwork barriers, and (3) to create novel tiered models of flexible staffing (for example, staffing an RRN to help with multiple units such as 1:100 patients versus needing to increase each nurse assignment in case of an emergency). Prior to the new program, rapid response activities were estimated at 3 to 5 per day.

Table 4. Linear Trends in Monthly Hospital Metrics Before and Following Implementation of a Rapid Response Intervention

Metric	Mean (95% CI)		Post - Pre (95% CI)	P value
	Pre	Post		
Hospital Discharges	5.3 (2.5, 8.1)	5.8 (-0.7, 12.2)	0.4 (-6.6, 7.5)	0.902
Critical Care Codes per 1,000 Hospital Discharges	0.06 (-0.01, 0.12)	-0.08 (-0.23, 0.07)	-0.14 (-0.30, 0.03)	0.100
Non-Critical Care Codes per 1,000 Hospital Discharges	0.02 (-0.03, 0.07)	-0.03 (-0.14, 0.08)	-0.05 (-0.18, 0.07)	0.386
RRS Consults per 1,000 Hospital Discharges	-0.28 (-0.48,-0.08)	-0.29 (-0.75, 0.17)	-0.02 (-0.52, 0.49)	0.951
Unplanned ICU Transfers per 1,000 Hospital Discharges	0.12 (-0.07, 0.30)	-0.24 (-0.67, 0.19)	-0.36 (-0.83, 0.11)	0.131
Deaths per 1,000 Hospital Discharges	0.07 (-0.09, 0.23)	-0.02 (-0.39, 0.36)	-0.09 (-0.50, 0.33)	0.679
Hospital Length of Stay	-0.09 (-0.15,-0.03)	0.004 (-0.13, 0.14)	0.10 (-0.05, 0.24)	0.186
ICU Discharges	3.8 (3.0, 4.6)	1.1 (-0.7, 2.9)	-2.7 (-4.6, -0.7)	**0.008**
ICU Deaths per 1,000 ICU Discharges	-0.13 (-0.52, 0.25)	0.22 (-0.65, 1.10)	0.35 (-0.60, 1.31)	0.465
ICU Length of Stay	0.02 (0.01, 0.03)	0.01 (-0.01, 0.04)	-0.004 (-0.03, 0.02)	0.751
Ventilator Days	-0.12 (-0.04, 0.02)	0.01 (-0.06, 0.07)	0.02 (-0.05, 0.09)	0.582

This reactive approach did not fully identify the need for a dedicated resource. With the renewed interest in codes and AI, there was an opportunity to demonstrate a need for a more proactive approach to clinical deterioration. The nursing team was able to risk-stratify patients through AI and clinical decision support tools. Institutional interest in continuous monitoring also allowed the AI models to be optimized with more data points to further identify at-risk patients. This program evolved as a smart staffing solution that supported frontline clinicians when unscheduled, unexpected critical care was required outside ICU. The RRNs acted as consultants for their colleagues, improved quality of care, participated in the research, and professionally developed. Opportunities to impact other costly interventions such as ventilator days and ICU length of stay were also identified as areas for future research.

Study strengths

The metrics in our study align with the recommended process and outcome metrics suggested by The International Society for Rapid Response Systems (founded in 2012), those contained in the GWTG-R database for resuscitation, and The Joint Commission requirements to improve resuscitation care (Subbe et al, 2019; The Joint Commission, 2022). Our study also included a metric of organizational costs, as few studies have evaluated RRS staffing on quality outcomes (Burke et al, 2022). We were also able to collect data and outcomes over an extended period and quantify and categorize the proactive and reactive RRN work.

Another strength of this study was the use of AI for targeted quality improvement. Electronic surveillance and risk stratification provided a method to identify, triage, and manage clinical deterioration whilst offering alternative staffing models, and innovative coverage solutions. Our program leveraged EHR documentation for data collection, abstraction, and visualization.

Limitations

The limitations of this study are that it was conducted at a single center with an institutional focus on mortality reduction and AI. Our program was fortunate to have an active resuscitation leadership group who dedicated time and energy to the project despite it not being part of their paid positions, as well as engaged RRNs who made the program successful. These limitations may restrict generalizability to other facilities.

CONCLUSIONS

Implementing a structured 24/7 nurse-led rapid response program can decrease cardiopulmonary arrests, unplanned transfers to ICU, and hospital deaths, highlighting opportunities to reduce preventable patient harm and failure to rescue. Key learnings from this study include the need for infrastructure, clinical leadership training, AI and clinical decision support workflows, flexible RRN staffing, and targeted quality improvement strategies. Phased development using existing resources can enhance sustainability and uncover potential for spread to other environments. Implications for practice and further study in the field include investigation of implementation practices using standardized, customizable toolkits and alignment with internationally established outcomes.

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REFERENCES

Al-Moteri M, Plummer V, Cooper S, Symmons M (2019). Clinical deterioration of ward patients in the presence of antecedents: A systematic review and narrative synthesis. *Australian Critical Care* 32(5):411-420. doi: 10.1016/j.aucc.2018.06.004

Bates DW, Levine D, Syrowatka A, Kuznetsova M, Craig KJT, Rui A, Jackson GP, Rhee K (2021). The potential of artificial intelligence to improve patient safety: a scoping review. *NPJ Digital Medicine* 4(1):54. doi: 10.1038/s41746-021-00423-6.

Bingham G, Fossum M, Hughes L, Digby R, Bucknall T (2020). The pre-Medical Emergency Team response: Nurses' decision-making escalating deterioration to treating teams using urgent review criteria. *Journal of Advanced Nursing* 76(8):2171-2181. https://doi.org/10.1111/jan.14433

Burke JR, Downey C, Almoudaris AM (2022). Failure to rescue deteriorating patients: a systematic review of root causes and improvement strategies. *Journal of Patient Safety* 1;18(1):e140-55. doi: 10.1097/PTS.0000000000000720

DeVita MA, Smith GB, Adam SK, Adams-Pizarro I, Buist M, Bellomo R, Bonello R, Cerchiari E, Farlow B, Goldsmith D, Haskell H, Hillman K, Howell M, Hravnak M, Hunt EA, Hvarfner A, Kellett J, Lighthall GK, Lippert A, Lippert FK, Mahroof R, Myers JS, Rosen M, Reynolds S, Rotondi A, Rubulotta F, Winters B (2010). "Identifying the hospitalised patient in crisis"—a consensus conference on the afferent limb of rapid response systems. *Resuscitation* 81(4):375-382. doi: 10.1016/j.resuscitation.2009.12.008.

Lyons PG, Edelson DP, Churpek MM (2018). Rapid response systems. *Resuscitation* 128:191-197. doi: 10.1016/j.resuscitation.2018.05.013

Michard F, Kalkman CJ (2021). Rethinking patient surveillance on hospital wards. *Anesthesiology* 135(3):531-540. doi: 10.1097/ALN.0000000000003843

Olsen SL, Søreide E, Hillman K, Hansen BS (2019). Succeeding with rapid response systems–a never-ending process: A systematic review of how health-care professionals perceive facilitators and barriers within the limbs of the RRS. *Resuscitation* 144:75-90. doi: 10.1016/j.resuscitation.2019.08.034

Panagioti M, Khan K, Keers RN, Abuzour A, Phipps D, Kontopantelis E, Bower P, Campbell S, Haneef R, Avery AJ, Ashcroft DM (2019). Prevalence, severity, and nature of preventable patient harm across medical care settings: systematic review and meta-analysis. *British Medical Journal* 17;366:l4185. doi: 10.1136/bmj.l4185

Paulson SS, Dummett BA, Green J, Scruth E, Reyes V, Escobar GJ (2020). What do we do after the pilot is done? Implementation of a hospital early warning system at scale. *The Joint Commission Journal on Quality and Patient Safety* 46(4):207-216. doi: 10.1016/j.jcjq.2020.01.003

Sprogis SK, Currey J, Jones D, Considine J (2021). Use of the pre-medical emergency team tier of rapid response systems: A scoping Review. *Intensive and Critical Care Nursing* 65:103041. doi: 10.1016/j.iccn.2021.103041.

Subbe CP, Bannard-Smith J, Bunch J, Champunot R, DeVita MA, Durham L, Edelson DP, Gonzalez I, Hancock C, Haniffa R, Hartin J Haskell H, Hogan H, Jones DA, Kalkman CJ, Lighthall GK, Malycha J, Ni MZ, Phillips AV, Rubulotta F, So RK, Welch J (2019). Quality metrics for the evaluation of Rapid Response Systems: Proceedings from the third international consensus conference on Rapid Response Systems. *Resuscitation* 141:1-12.doi: 10.1016/j.resuscitation.2019.05.012

The Joint Commission. Resuscitative Services and Post-resuscitation Care – Understanding the Requirements (2022)**.** What are the key concepts organizations need to understand regarding the new Resuscitative Services requirements? Retrieved May 2022 from https://www.jointcommission.org/standards/standard-faqs/hospital-and-hospital-clinics/provision-of-care-treatment-and-services-pc/000002366/

Wood C, Chaboyer W, Carr P (2019). How do nurses use early warning scoring systems to detect and act on patient deterioration to ensure patient safety? A scoping review. *International Journal of Nursing Studies* 94:166-178. doi: 10.1016/j.ijnurstu.2019.03.01