Improving Failure to Rescue Outcomes: A Rapid Response Team Program Review

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Abstract

Title Improving Failure to Rescue Outcomes: A Rapid Response Team Program Review

Background/Significance The average annual incidence of in-hospital cardiac arrests from 2008-2017 was approximately 292,000, an increase of 81,000 since previous data was obtained for the years 2003-2007 (Holmberg et al., 2019). Early identification of patient decline and initiation of a Rapid Response Team (RRT) are necessary for improved patient outcomes, decreased length of stay, and decreased mortality (AHRQ, 2018; Andersen et al., 2019; Burke et al., 2022; IHI, 2022). According to the AHRQ (2019), complications of medical care are unavoidable, and it is the responsibility of the health care system to quickly identify and treat those complications.

Methods A literature search was performed for articles published from January 2017 to July 2022 utilizing CINAHL and PubMed. Articles identified training and education, team composition, sociocultural/leadership, and outcome data to improve RRT outcomes. Utilizing Havelock's Phases of Change model, a proposal to improve RRT performance was developed.

Conclusion Ineffective RRT performance contributes to poor patient outcomes and increased mortality. Program evaluation of an RRT identified gaps and contributory factors which provided the basis for change. Existing resources and processes were used to help ensure sustainability. Upon successful implementation, an updated policy, comprehensive education plan, outcome data measures, and ongoing monitoring plan were in place to monitor progress toward improving RRT outcomes.

Improving Failure to Rescue Outcomes: A Rapid Response Team Program Review

Rapid response teams (RRT) are specialized, multidisciplinary critical care teams activated to assemble at a patient's bedside when a decline in condition is identified (Avis et al., 2016). Although team participants vary by institution, they often include a nurse, physician, and respiratory therapist (Hall et al, 2020). When needed, the team is activated and can immediately assess, diagnose, treat, and determine if the patient can be stabilized or requires transfer to a higher level of care such as the intensive care unit (ICU; Hall et al., 2020). Although RRTs are common in many hospitals in the United States, team composition, roles, training, and education vary and challenges and barriers to effective team dynamics remain (Burrell et al., 2020). This paper aims to explore evidence-based interventions of rapid response teams to ensure best practice measures are included in hospital policy and practice.

Background

The average annual incidence of in-hospital cardiac arrests from 2008-2017 was approximately 292,000, an increase of 81,000 since previous data was obtained for the years 2003-2007 (Holmberg et al., 2019). The Institute for Healthcare Improvement (IHI) identified failure to rescue (FTR) as a significant contributory factor to in-hospital mortality and began to recommend the implementation of rapid response teams in 2004 (IHI, 2022). In 2008, the Joint Commission (JC) added a National Patient Safety Goal requiring a process for specially trained staff to assist when a patient's condition deteriorates (Agency for Healthcare Research and Quality [AHRQ], 2018).

Early identification of patient decline and initiation of RRT are necessary for improved patient outcomes, decreased length of stay, and decreased mortality (AHRQ, 2018; Andersen et al., 2019; Burke et al., 2022; IHI, 2022). Physiologic changes indicative of deterioration leading to cardiac arrest can be detected up to six hours prior to the event (Andersen et al., 2019; Avis et al., 2016;

Mitchell et al., 2019). RRT are composed of staff members specialized in managing the care of critically ill patients, bringing critical care expertise to the bedside quickly when a decline is identified (Mitchell et al, 2019).

Significance

According to the AHRQ (2019), complications of medical care are unavoidable, and it is the responsibility of the health care system to quickly identify and treat those complications. An RRT activation quickly allows the team to manage the complication and/or get the patient to the appropriate level of care before it progresses to cardiac arrest. Clinical deterioration prior to in-hospital cardiac arrest is common and considered preventable or avoidable with appropriate monitoring such as telemetry and/or trending of vital signs (Anderson et al., 2019). Hospitals that employ mechanisms to monitor and recognize deteriorating patients (e.g., education, monitoring, recognition of decline) as well as initiate timely interventions are more likely to prevent cardiac arrest (Andersen et al., 2019; IHI, 2022a). In the event of a witnessed cardiac arrest in the hospital in which early intervention (resuscitative measures) were implemented, the likelihood of survival to discharge was 25% in 2017, up from 20% in 2007 (Anderson et al., 2019).

In acute care, the two most common complications associated with increased mortality from failure to rescue are hypoxia and hypotension, at 51% and 17% respectively (IHI, 2022). Approximately half of all in-hospital cardiac arrests occur on general inpatient units and are considered potentially avoidable. (Andersen et al., 2019). The goal of the RRT is to bring critical care expertise to the bedside to manage and stabilize an unstable patient (Mitchell et al., 2019).

In a medium size midwestern hospital, a program evaluation of the RRT was performed and a gap analysis completed (see Appendix A). The clinical facility recently built a new hospital campus and consolidated two hospitals into one. An additional building attached to the hospital includes

outpatient care services such as a cancer center, endoscopy, magnetic resonance imaging, and outpatient infusion. RRT staff include one or two intensive care unit (ICU) nurses, one respiratory therapist, one ICU intensivist, a nursing supervisor, and a member of security. At times, an emergency department (ED) nurse and ED technician would also respond. The facility had an RRT policy in place that needed to be updated as two hospital campuses merged and outpatient care services were added. There was no dedicated group of RRT nurse responders with responding team members having an assignment in their respective units when a rapid response was activated. Data collection for RRT included total number of activations, symptoms requiring RRT intervention, and patient disposition.

Data regarding RRT was provided by the 2021 chairperson for the code blue committee. In 2021 there were a total of 316 RRT activations. The top four complications requiring RRT activation were acute mental status change (16%) followed by dyspnea (15%), hypotension (14%), and tachycardia (10%). Data regarding disposition identified 53% of the patients remained in their room, 22% of the patients were transferred to the ICU, and 2% resulted in a code blue activation. There were inconsistencies in data metrics reported as the numbers did not match up with total RRT activation suggesting data collection could be improved. Additional factors contributing to effective performance during an RRT can be found in the fishbone diagram in Appendix B.

Problem Statement

This midwestern hospital has not been achieving effective RRT response due to multiple contributing factors. This project will use evidence-based strategies to improve RRT response and outcomes. The Donabedian model will be used to guide the theoretical framework of the project. It is a three-step model of improvement that focuses on structure, process, and outcomes with each component influencing the next (Jones & Roussel, 2020). Utilizing this model to create effective

structure and processes in this midwestern hospital can lead to positive patient outcomes within the system (Moore et al., 2015).

Search Strategy

A literature search was performed on July 7, 2022, using the Cumulative Index of Nursing and Allied Health Literature (CINAHL) and PubMed. A university librarian assisted with the literature search terms. Search terms included “Rapid response team” OR “RRT” and train* OR effic* and NOT pediatric*. The search was limited to articles that were published in English, after 2017, and research focused. A total of 589 articles were identified. After removing duplicates, 527 articles remained for title and abstract review. Articles were included for the adult population in an acute care facility. Articles were excluded for wrong study design, or wrong study population leaving 41 articles for full review. During full article review, an additional 29 were identified as meeting exclusion criteria for wrong study design, wrong study population, or no text available. See Appendix C for preferred reporting items for systematic reviews and meta-analysis (PRISMA) diagram.

Literature Synthesis

A literature synthesis identified systematic reviews, narrative synthesis, meta-analysis, semi-structured interviews, electronic and internet surveys, and organizational interventions. Relevant articles were reviewed utilizing a critique table to identify design/purpose, sample/setting, results, level of evidence, strengths/weaknesses, and relevance to problem (see Appendix D). Level of evidence was evaluated with studies ranging from level V-VII (see Appendix E). An interventions table was developed to identify common themes (see Appendix F). Common themes were identified with the top four in more than half of the articles reviewed (seven or more) including training and education, team composition, sociocultural/leadership, and outcome data. Additional themes identified in less than half of the articles reviewed (six or less) include dedicated RRT nurse,

debriefing, bedside nurse activation of RRT, institutional policies, proactive rounding of at-risk patients, and collaborative resource for bedside nurses.

Education and Training

Hospitals that employ mechanisms to monitor, recognize deteriorating patients, and intervene promptly are more likely to prevent cardiac arrest (Andersen et al., 2019; IHI, 2022a). Education and training of both the bedside nurses and RRT staff to recognize deterioration and properly intervene are essential.

Floor nurses

Bedside nurses are the ones most likely to identify patient decline and need to understand the activation criteria (Avis et al., 2016; Hall et al., 2020; Moreira et al., 2018; Tanguay & Bartel, 2017; Winterbotton & Webre, 2021). Education and training of RRT activation should begin in orientation and be continuously reinforced (Avis et al., 2016). The role of the RRT and the activating nurse is shared with the goal of preventing deterioration or progression to cardiac arrest. The RRT does not assume care of the patient but rather provides an additional service to the patient. Roles should be clearly defined with the bedside nurse taking an active role as they have firsthand knowledge of what led to the decline/RRT activation and will continue to care for the patient once the team leaves or assist with the transfer to a higher level of care (Avis et al., 2016; IHI, 2022a).

Bedside staff may miss early indicators of decline and delay the activation of the RRT which can lead to potentially negative outcomes (Avis et al. 2016; Winterbottom & Webre, 2021). Simulation training can be a useful tool for practicing and educating staff in a safe environment in which constructive feedback can be given (Avis et al. 2016; Le Guen & Costa-Pinto, 2021; Tanguay & Bartel, 2017).

RRT team

The RRT functions as a resource to the organization with the goal of bringing critical care services to the bedside of a critically ill or deteriorating patient. The team should participate in regularly scheduled simulation training to improve performance and team dynamics (Avis et al. 2016; Le Guen & Costa-Pinto, 2021; Tanguay & Bartel, 2017; Winterbotton & Webre, 2021) Winterbottom & Webre (2021) expand beyond simulation to include didactic and evidence-based teamwork principles as well as skills-based competency validation.

In addition to responding to RRT activations, the team serves as a clinical resource and can be used to provide education during and after an activation. Effective communication skills, the projection of teamwork, and willingness to help are important in building collaborative relationships between the RRT and hospital staff (IHI, 2022a; Le Guen & Costa-Pinto, 2021; Tanguay & Bartel, 2017).

Team composition

A multidisciplinary approach should be taken when determining team composition (Avis et al., 2016; Hall et al., 2020; Le Guen & Costa-Pinto, 2021). Team members should be experienced in critical care given the goal of an RRT is to bring critical care resources to the bedside (Hall et al., 2020; IHI, 2022a; Mitchell et al., 2019; Tanguay & Bartel, 2017; Winterbottom & Webre, 2021). Team composition will vary facility to facility with common team members including an intensive care nurse, respiratory therapist, and physician (Dukes et al., 2019; Hall et al, 2020; IHI, 2022a; Moreira et al., 2018). Organizations that have established a dedicated RRT nurse offer additional benefits to the organization such as proactive rounding of at-risk patients, education and support for nurses, and the building of a supportive, collaborative team (Avis et al., 2016; Dukes et al., 2019; Mitchell et al., 2019; Tanguay & Bartel, 2017; Winterbottom & Webre, 2021)

Sociocultural/Leadership

Sociocultural influences and leadership contribute to team effectiveness and timely RRT activation which ultimately impacts outcomes. RRT are most effective when the staff have support from the leadership team to eliminate barriers and demonstrate a commitment to the program (Avis et al., 2016; Dukes et al, 2019; IHI, 2022a). When immediate help is needed at the bedside to evaluate a patient in need, nurses need to feel empowered to activate the RRT without fear of retaliation or intimidation by the response team (Avis et al, 2016; Dukes et al, 2019). Hierarchies between nurses and physicians should be eliminated and the clinical judgement of the bedside nurse in activating an RRT valued (Avis et al., 2016; Hall et al., 2020; Moreira et al., 2018). The responding team should value the bedside nurse assessment and arrive with a service driven mindset, focusing on the patient in need (Tanguay & Bartel, 2017; IHI, 2022a) When supported in the decision to activate an RRT, staff are more likely to activate them (Avis et al., 2016; Moreira et al, 2018)

Outcome data

Outcome data should be collected to identify trends, barriers, and opportunities for improvement and shared with appropriate stakeholders monthly (IHI, 2022a; Tanguay & Bartel, 2017; Winterbottom & Webre, 2021). The following outcomes can be measured to evaluate efficiency of RRT:

- Time from activation to initiation of treatment (Hall et al., 2020; Tanguay & Bartel, 2017)
- Information on reason for activation, location, time, and disposition (Avis et al., 2016; Hall et al., 2020; Tanguay & Bartel, 2017)
- Barriers such as delayed recognition of decline, response team failure, and communication failures (Avis et al., 2016; Subbe et al., 20190
- Time to transfer to higher level of care if indicated (Olsen et al., 2019; Tanguay & Bartel, 2017)

- Decrease in cardiac arrest and code blue outside ICU (IHI, 2022a; Tanguay & Bartel, 2017; Winterbottom & Webre, 2021)
- Codes per 1000 discharges or risk adjusted mortality index (IHI, 2022a; Scubbe et al., 2019; Winterbottom & Webre, 2021)

Review of data and auding of records can identify opportunities for additional education and process improvement.

Change Theory

Havelock's Phases of Change was used to guide the program evaluation project. This change theory uses a six-step linear process which emphasizes planning to ensure success. Havelock's phases include building a relationship, diagnosing a problem, acquiring resources, choosing the solution, gaining acceptance, and maintenance/separation (Udod & Wagner, 2018).

Methods

Project Site and Population

The RRT project took place at a midwestern tertiary teaching hospital. The hospital is a Level III Trauma Center and Primary Stroke Center with 240 acute care beds, 51-bed ED, with 30-bed ICU. The hospital is in a community with a 2021 population estimate of 112, 684 (United States Census Bureau, 2022).

Building a Relationship

- Chief Nursing Officer (CNO): Existing relationship already in place between the DNP student and CNO who was fully supportive of the RRT project review. CNO support was needed to help drive change and overcome barriers presented by nursing leadership and nursing staff.

- Quality Review Specialist (QRS): Existing relationship already in place between the DNP student and QRS that oversees RRT data collection. QRS is responsible for data collection and reporting at monthly committee meetings.
- Clinical Education: Existing relationship already in place between the DNP student and the clinical education team. The clinical education team is responsible for the education and training of nursing staff upon hire, annually, and as directed by the department manager and/or CNO as educational needs are identified. Many of the ongoing education and training initiatives of this project are dependent upon the clinical education team for sustainability.
- Nursing staff: Existing relationship already in place between the DNP student and many nursing staff within the hospital. Bedside nursing staff are responsible for monitoring and identifying changes in condition requiring RRT activation and critical care nursing staff are involved as members of the RRT.
- Intensivist: Existing relationship already in place between the DNP student and intensivist from previous clinical rotation. Intensivist responds to RRT and is considered the team leader.

Diagnosing the Problem

A program review identified categories that lead to ineffective RRT response (see Fishbone Diagram Appendix B). Broad categories including people, policy, education, process, equipment, location and practice were identified as potential contributory factors to ineffective response.

Acquiring Resources

The primary resources required to implement the project were people and time. No new equipment was needed to implement the project. This DNP student was the project lead and coordinated the policy revision and development of education. Staff education and training was done utilizing existing resources including:

- New hire clinical orientation classes
- New hire skills checklists
- Annual competency validation
- Monthly mock codes

No additional tasks were added to the clinical education team as the DNP student updated all required materials and checklists. Discussions were incorporated into existing weekly and monthly clinical education team department meetings. RRT education was integrated into existing methods of education and training already in place. Monthly mock code simulation activities were already in place and modified to include RRT training. Specialty educators will oversee new hire orientation for RRT members within their respective departments to ensure new hire RRT orientation specific to their role as a responder is provided. QRS currently collects and reports RRT data and only the content of the data collected will be changing.

Choosing the Solution

Policy Revision

The RRT policy was reviewed during monthly code blue committee meetings with input on proposed changes received by all members. Updates were made and submitted back to the committee for review and approval. The updated policy was forwarded to the policy review committee for final review and approval. Once approved, changes will be communicated to hospital leaders by email from the service line directors who will disseminate the information to their respective departments.

Nursing Education

Education and training for bedside nurses and nurses responsible for responding to RRT was developed and implemented. Appropriate stakeholders within the clinical education department

responsible for providing new hire and ongoing education were included to provide input. Education and training specific to RRT members was developed and implemented in collaboration with the ICU and ED educators, managers, director, and experienced RRT members.

Quality Data Collection

Quality data collection items were reviewed with the code blue chairperson who developed the initial RRT data collection tool. Evidence-based interventions were reviewed with the code blue committee and incorporated into the data collection and reporting tool used by the QRS. Data regarding RRT activation is being reported monthly at code blue committee meetings with dedicated agenda time and information on failure to rescue is being reported at monthly mortality meetings.

Timeline

Project implementation will begin with policy revision and education/training in October of 2022. Quality improvement data collection will begin November of 2022. Evaluation of quality improvement data and project sustainability will be completed through January 2023. See Appendix G for full project timeline.

Gaining Acceptance

Facilitators and Barriers

There were many strengths and opportunities within the organization to support this initiative. The leadership team was committed to improving quality patient care and decreasing potentially preventable cardiac arrest. The hospital opened March 2022 with new equipment and designed to facilitate staff movement throughout the facility. There was an engaged clinical education department which includes many specialty educators including obstetrics, surgery, ED, and ICU. That allowed many resources to assist with initial and ongoing RRT education and simulation training. The hospital is part of a larger health system with many hospitals both in Michigan and Ohio with an expanded

network of resources and RRT policies. This Doctor of Nursing Practice (DNP) student was the program review project lead which decreased resources needed from the hospital. The DNP student brought resources and contacts from other health systems to provide information on RRT policies and procedures from other organizations. See Appendix H for a strengths, weaknesses, opportunities, and threats (SWOT) analysis.

Weaknesses and threats have the potential to create barriers when implementing change. The hospital has had significant staffing challenges and often operated at a critical staffing level. The American Hospital Association (AHA; 2022) recognizes a critical shortage of staff to meet current healthcare demands. Staff burn out and pandemic related stress contributed to an increased turnover rate which compounded hospital staffing challenges (AHA, 2022). Managers are at times reluctant to require staff to attend mandatory education in lieu of maintaining work-life balance for staff that are mandated to work overtime. Critical staffing and competing priorities have resulted in frequent cancellations of code blue committee meetings to review data for challenges and opportunities. In addition to bedside nursing staff turnover, there were leadership changes at the manager, director, and chief nursing officer levels which brought additional challenges. Other leaders within the organization assume additional responsibilities and become overwhelmed and burdened with additional tasks. Maintaining day to day operational tasks becomes the priority with mandatory education often not considered a priority. Threats to the organization are minimal as it relates to this project and can be attributed to the ongoing effects of coronavirus disease of 2019 (COVID-19) and now the emergence of a new global threat, monkeypox (Centers for Disease Control and Prevention [CDC], 2022).

Ethical Considerations

The project was submitted to both the Michigan State University's and hospital's Internal Review Board (IRB) prior to implementation. All information was de-identified and no personal

health information was collected.

Maintenance and Separation

Evaluation/Outcomes

Outcomes for the program review include an updated RRT policy which included evidence-based interventions. Development and implementation of an RRT training program for both bedside nurses and staff that respond on the RRT. Quality metrics for data collection were developed utilizing evidence-based guidelines in collaboration with the quality team and code blue committee. Standing agenda time was secured for both the code blue and mortality committee meetings to review outcome data.

Sustainability Plan

The facility had an RRT in place so the sustainability plan will focus on maintaining education and training as well as reporting and follow up of data. The education department conducts new hire orientation, annual education, and is responsible for mock code drills with RRT education integrated into each of those areas. Clinical educators for ED and ICU will oversee the orientation and training of RRT members new to their role and assist with simulation activities. Skills checklists for new hires were updated to include RRT education to ensure ongoing training of new hires at the department level continues to take place. Data reporting of RRT information was taking place and additional evidence-based metrics were incorporated and reported monthly at code blue and mortality committees.

The overall goal for this project was to evaluate the RRT program to ensure evidence-based interventions were included in hospital policy and practice.

Discussion

This project has the potential to improve RRT response based on the gap analysis and interventions specific to the institution. As data is collected, additional contributory factors and/or barriers should be investigated for evidence-based interventions as appropriate. Ongoing success of the project is dependent upon continued follow up and review of the data. Meetings to review RRT outcome data are often cancelled so alternative means to convey this information to the leadership team may need to be identified.

It is difficult to generalize the results of this program evaluation to other hospitals and RRT programs. The findings and interventions are unique to the clinical site based on the gap analysis, SWOT analysis, existing policies, executive leadership support, education department involvement, RRT composition, and quality data support services. A facility needing to improve RRT response would need to have a program evaluation of their respective program. Although there may be common gaps identified, the underlying cause and solution may not be the same so this set of interventions will not apply.

Conclusion

Ineffective RRT performance can contribute to poor patient outcomes and increased mortality. Program evaluation of an RRT can identify gaps and contributory factors which provide the basis for change. Utilizing Havelock's Phases of Change model, a proposal to improve RRT performance was developed and implemented. Existing resources and processes were used to help ensure sustainability. Upon successful implementation, an updated policy, comprehensive education plan, outcome data measures, and ongoing monitoring plan was put in place to monitor progress toward improving RRT outcomes.

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Appendix A

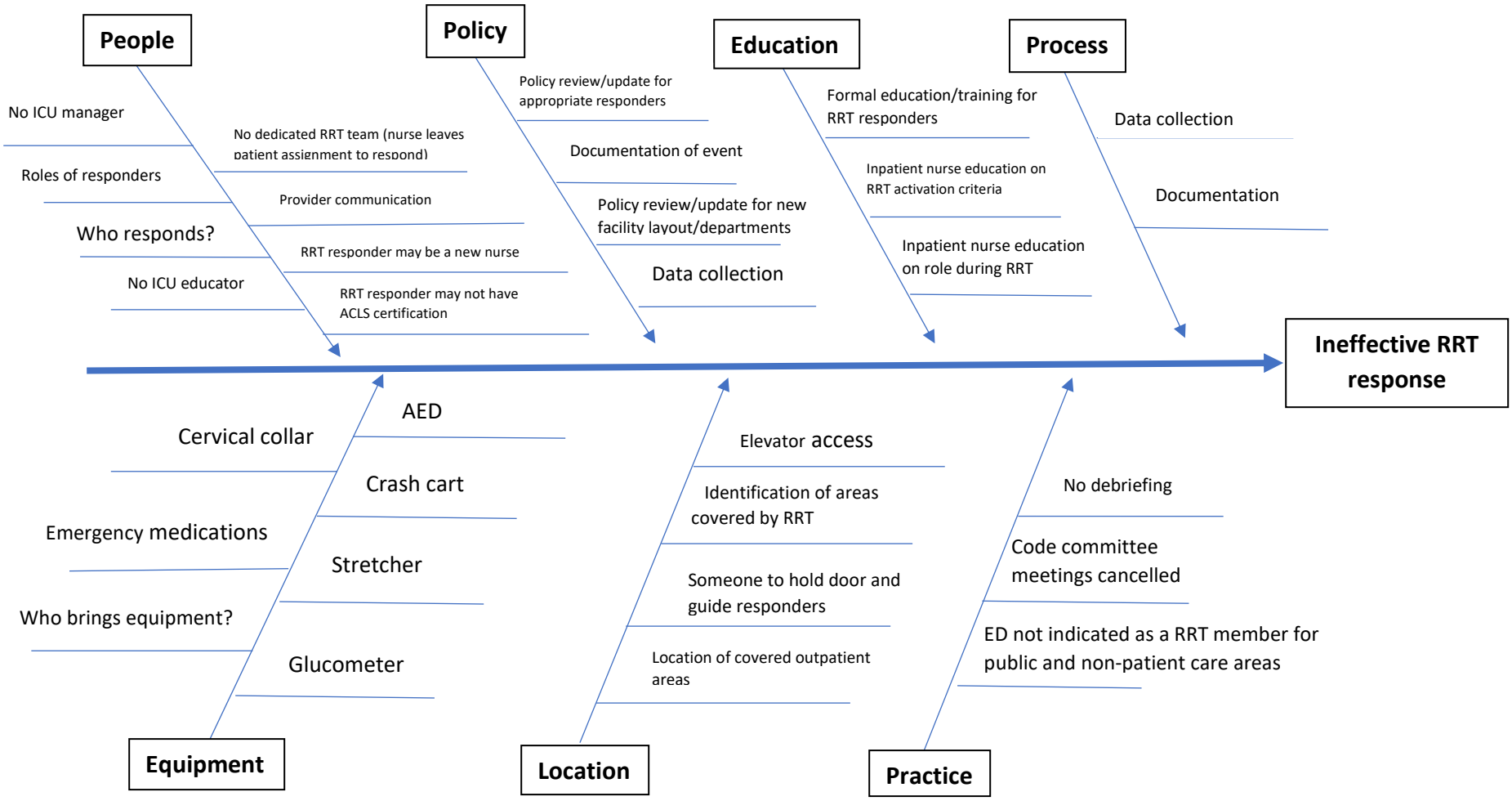
Gap Analysis

Current state	Future state	Gap	Actions to close gap
Policy in place for RRT	Policy in place for RRT includes new health care campus	Policy does not define response to new areas of the hospital and outpatient care areas	Update RRT policy reflective of new hospital and outpatient care areas
Multidisciplinary RRT	Multidisciplinary RRT with team responders and roles clearly defined	Multidisciplinary RRT team is in place but responders and roles	Update RRT policy to include team responders and roles
RRT nursing responders have patient care assignment	RRT has a dedicated team of nursing staff to respond	Responding RRT nurse leaves a patient care assignment to participate in RRT. May need alternate nurse to respond.	Work toward developing dedicated RRT nurse role. Additional tasks could be given to dedicated RRT nurse such as proactive rounding on at risk patients, bedside nursing support, and staff education.
Qualifications of RRT nursing staff not verified	RRT nursing staff are trained in ACLS and critical care	No process to determine RRT nurse responder has appropriate critical care and/or ACLS training	Formal process to determine RRT nurse has ACLS, at least 1 year in their role (after orientation), and approved by their manager to respond
No training for RRT members	Structured formal simulation training for RRT team members	No education/training program has been developed	Develop initial and ongoing training program of RRT responders
RRT documentation of clinical findings and care	Clinical and outcome data gathered on RRT documentation form	Need to update RRT documentation to include not only care and treatments but	Develop RRT tool and process for auditing

		additional data to help monitor outcomes	
RRT data tracking in place	Measurable outcome data obtained and reported monthly at code blue committee meetings	Outcome data not being measured	Develop metrics for measurable outcome data to collect

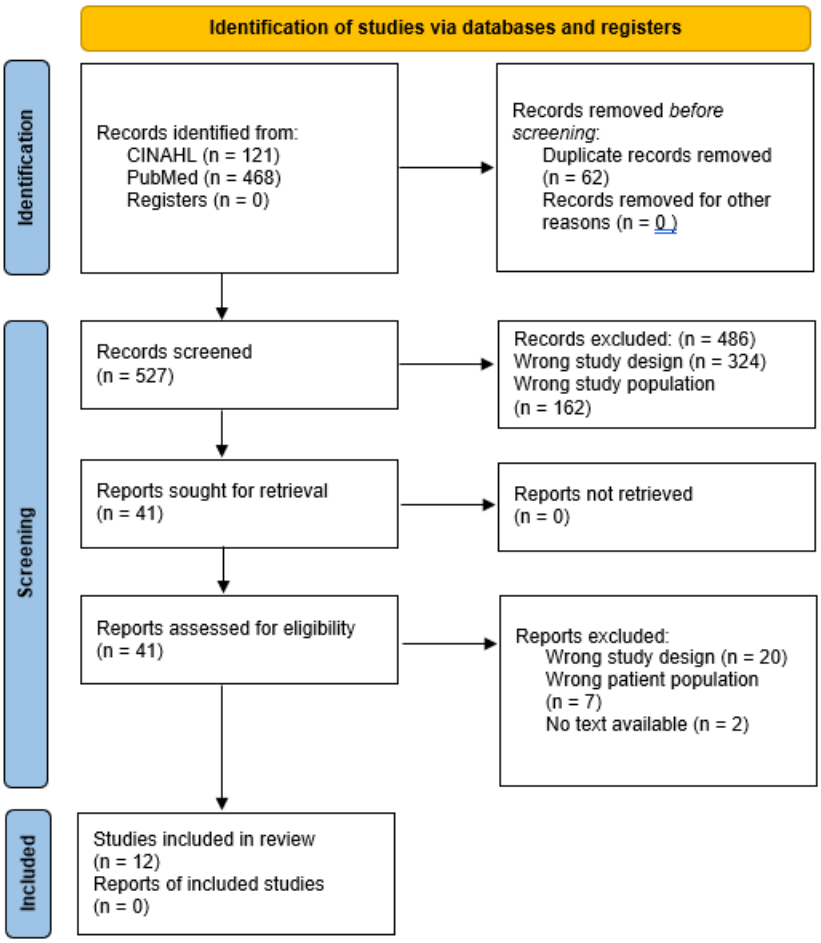
Appendix B

Fishbone Diagram



Appendix C

PRISMA Diagram



(Page et al., 2021)

Appendix D

Literature Synthesis-Critique Table

Article	Design/Purpose	Sample/Setting	Results	Level of Evidence (see Appendix E)	Strengths/ Weaknesses	Relevance to Problem
Avis et al. (2016)	Redesign the RRT to a dedicated team of ICU nurses to decrease the burden of ICU staff when a nurse with an assignment is pulled from the department leaving the department short staffed	Academic medical center	Created a dedicated team of ICU nurses to respond to RRT and support bedside nurses with additional quality improvement interventions (proactive rounding, resource nurse, education, and data collection) to promote early recognition and intervention of non-ICU patients	VII	Single site intervention and may not be generalizable to other facilities	Demonstrates positive impact a dedicated RRT of ICU nurses can make to improve patient care by supporting early recognition and interventions for non-ICU patients. Additional tasks include proactive rounding, staff education, and availability as a resource to bedside nurses.

Burke et al. (2022)	Narrative synthesis Further the understanding of variability in outcomes and complication management and suggest recommendations based on current evidence	55 articles were included in the review	Propose contributing factors for failure to rescue occur in recognizing, relaying, and reacting to decline and establish the framework to improve outcomes	VII	None listed	Utilizing the four concepts recognize, relay, react, and using correct resources provide a framework with steps that can be implemented and audited

Dukes et al. (2019)	Qualitative analysis, semi-structured interviews Researchers were blinded as to whether the site was a top-performing or non-top-performing site Evaluate differences in design and implementation of RRT at top performing and non-top-performing hospitals	158 hospital staff members (nurses, physicians, administrators, and staff) at 9 hospitals	Differences identified in 4 domains: team design and composition, RRT surveillance of at-risk patients, bedside nurse empowerment to activate RRT, collaboration	V	Provided insight into the organization and function of RRT from top-performing hospitals Did not analyze cost implications of implementing identified strategies	Identified differences in RRT structure and function in top-performing and non-top-performing hospitals that could improve safety and reduce unexpected death in hospitalized patients

Hall et al. (2020)	Systematic review Synthesize evidence on the impact of RRT on FRT including in-hospital mortality and in-hospital cardiac arrest	10 articles were included in the review	Moderate evidence linking RRT with decreased mortality and non-ICU cardiac arrest rates. Variability in RRT composition with little evidence to support physician-led teams have improved outcomes Benefit of RRT may take time to fully implement due to organizational culture	V	Studies lack control groups so it is difficult to determine if the decrease in mortality rates is related to RRT intervention or some other cause	Highlights the role organizational culture plans in the success of RRT,
IHI (2022a)	How-to guide to share best practice interventions when implementing RRT	NA	Provides a resource for RRT implementation	VII	Includes tips and tricks as well as frequently asked questions	Provides a detailed best practice resource to use as a guides when structuring and implementing RRT

Le Guen, M., & Costa-Pinto, R. (2021)	Self-administered electronic survey Assess learning and education needs of medical emergency team (MET)	62 MET staff members from multiple disciplines in a single hospital setting in Australia	MET responders strongly agreed that training was valuable, would improve care, and should be multidisciplinary	VII	Study response rate was high, covered both technical and non-technical skills, and large range of learning objectives. Single center study with a small sample size May not be generalizable to other hospitals	Ongoing team training and education needed including the use of simulation
Mitchell et al. (2019)	Descriptive/prospective cross-sectional, internet-based survey 80-item survey to obtain information on the afferent and efferent limbs of the rapid response system Evaluate RRT structure, composition, and function across the United States (U.S.)	103 hospital adult RRT members from 103 hospitals in 30 states in the U.S.	Demonstrated variation in the structure and function of RRT	VI	Limited number of hospitals surveyed. Survey completed by a willing, identified clinician and may resulted in selection bias. Disproportionate number of large, academic medical centers on the east or west coasts of the U.S. which may affect application to smaller hospitals with limited	Evidence-based practice guidelines on the structure and function of RRT is needed to optimize outcomes from in hospital deterioration

Moreira et al. (2018)	Meta-analysis Review literature to determine the main factors that interfere with the performance of RRTs	Integrative review of 19 scientific studies	RRT reduced rates for hospital mortality but identified factors that affect the quality of outcomes including sociocultural barriers, institutional policies, delayed RRT activation, team composition including education and training, tools to identify clinical deterioration	V	Provide guidance to health professionals and managers to identify flaws in RRT performance to improve outcomes No instruments used to assess the methodological quality of the studies and few controlled or randomized clinical trials	Improved RRT performance improves the care of deteriorating patients and may decrease ICU admissions, length of hospital stay, and hospital mortality
Olsen et al. (2019)	Systematic review Identify facilitators and barriers within rapid response systems (RRS)	Qualitative review of 21 articles from hospital-based health systems	Clear protocols, feedback, evaluation, and training were identified as facilitators Fear of reprimand, not understanding when to activate, alarm fatigue, and lack of integration within the hospital were identified as barriers	V	Provides healthcare provider perspective Broad scope-10 nations and more than 20 hospital systems, professions, and levels of experience	Identification of common facilitators and barriers to successful RRS and requires continuous evaluation for quality improvement

Subbe et al. (2019)	Scoping review of literature with potential metrics identified and modified Delphi to arrive at applicable metrics Identification of metrics for RRT teams to monitor quality and performance	Consensus conference with representatives from 5 countries with participants from varied backgrounds including patients	10 quality metrics identified related to structure, process, and outcomes for RRT	VII	International applicability	Provides a framework for data collection with items described as essential, recommended, optional, and experimental to provide standardized metrics to evaluate RRT
Tanguay & Bartel (2017)	Implementation of an RN/RT RRT model with the goal of early intervention for deteriorating patients to prevent ICU admission or death	Tertiary care center in Canada	Successful implementation of an RN/RT model which was replicated in other Canadian hospitals Data collection metrics identified	VII	Single site intervention and may not be generalizable to other facilities	Includes the RRT responding to visitors. Provides data collection metrics

Winterbottom & Webre (2021)	Implementation of a dedicated ICU nurse RRT model c	Quaternary academic medical center in the southern United States	In addition to responding to RRT and code blue, dedicated RRT nurses proactively rounded on at risk patients, provided support and education to bedside nurses. Dedicated RN RRT showed a 65% decrease on cardiac arrest outside the ICU and 27%, 4.7% decrease in ICU admissions from an inpatient unit, and 27% reduction in the risk-adjusted mortality index for patients with proactive rounding encounters.	VII	Single site intervention and may not be generalizable to other facilities	Positive outcomes of dedicated RRT nurse include additional supportive tasks such as proactive rounding on at risk patients, providing support and education to bedside nurses to improve outcomes in patient care

Appendix E

Level of Evidence Table

Level of evidence (LOE)	Description
Level I	Evidence from a systematic review or meta-analysis of all relevant RCTs (randomized controlled trial) or evidence-based clinical practice guidelines based on systematic reviews of RCTs or three or more RCTs of good quality that have similar results.
Level II	Evidence obtained from at least one well-designed RCT (e.g. large multi-site RCT).
Level III	Evidence obtained from well-designed controlled trials without randomization (i.e. quasi-experimental).
Level IV	Evidence from well-designed case-control or cohort studies.
Level V	Evidence from systematic reviews of descriptive and qualitative studies (meta-synthesis).
Level VI	Evidence from a single descriptive or qualitative study.
Level VII	Evidence from the opinion of authorities and/or reports of expert committees.

(Ackley et al., 2008)

Appendix F

Literature Synthesis-Intervention Table

Article	Intervention									
	Dedicated RRT nurse	Team composition	Training and education	Proactive rounding of at-risk patients	Collaborative resource for bedside nurses	Debriefing	Bedside nurse activation of RRT	Sociocultural /leadership	Institutional policies	Outcome Data
Avis et al. (2016)	X	X	X					X		X
Burke et al. (2022)			X				X	X		
Kim Dukes et al. (2019)	X		X	X	X	X	X	X		
Hall et al. (2020)		X						X		X
IHI (2022a)		X	X			X	X	X		X
LeGuen & Costa-Pinto (2021)		X	X							
Mitchell, et al. (2019)	X	X	X							
Moreira et al. (2018)		X	X				X	X	X	

Olsen et al. (2019)			X					X	X	X
Subbe et al. (2019)										X
Tanguay & Bartel (2017)	X	X	X			X				X
Winterbottom & Webre (2021)	X	X	X	X	X	X				X
Total	5	8	10	2	2	4	4	7	2	7

Appendix G

Project Timeline

Appendix H

SWOT Analysis