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Development of a novel rapid response event review process for quality improvement

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ABSTRACT

Introduction Rapid response team (RRT) and code activation events occur relatively commonly in inpatient settings. RRT systems have been the subject of a significant amount of analysis, although this has been largely focused on the impact of RRT system implementation and RRT events on patient outcomes. There is reason to believe that the structured assessment of RRT and code events may be an effective way to identify opportunities for system improvement, although no standardised approach to event analysis is widely accepted. We developed and refined a protocolised system of RRT and code event review, focused on sustainable, timely and high value event analysis meant to inform ongoing improvement activities.

Methods A group of clinicians with expertise in process and quality improvement created a protocolised analytic plan for rapid response event review, piloted and then iteratively optimised a systematic process which was applied to all subsequent cases to be reviewed.

Results Hospitalist reviewers were recruited and trained in a methodical approach. Each reviewer performed a chart review to summarise RRT events, and collect specific variables for each case (coding). Coding was then reviewed for concordance, at monthly interdisciplinary group meetings and 'Action Items' were identified and considered for implementation. In any 12-month period starting in 2021, approximately 12–15 distinct cases per month were reviewed and coded, offering ample opportunities to identify trends and patterns.

Conclusion We have developed an innovative process for ongoing review of RRT-Code events. The review process is easy to implement and has allowed for the timely identification of high value improvement opportunities.

INTRODUCTION

Rapid response team (RRT) activations are mechanisms in inpatient settings by which a clinical response team is dispatched urgently to the bedside of patients showing signs of clinical deterioration. This process is designed to bring additional skill sets and resources to the bedside in a timely manner to prevent further deterioration of a patient's clinical status, by either stabilising the patient in situ or transitioning the patient to a higher level of care if initial management strategies fail to yield satisfactory clinical improvement.

Although there is no clearly defined consensus on a standardised clinical composition of an RRT, the activation of an RRT brings an interdisciplinary team of care providers to the bedside which, depending on the institution or the clinical setting, might comprise intensive care unit clinicians, respiratory therapy or advanced airway specialists, vascular access technicians, pharmacists, primary team and other housestaff.[1 2]

RRTs were initially introduced as a response to reduce the incidence of in-hospital cardiac arrest, by dispatching a specialised team to at-risk and actively decompensating patients. Today, RRT services are widely available in both the USA and abroad.[3] Common reasons for activation of an RRT include change in mental status (obtundation, unresponsiveness or agitation), haemodynamic instability (hypotension, hypertension, bradycardia or tachycardia), respiratory compromise (tachypnoea, hypopnoea, hypoxia).[4]

Analyses of RRT implementation and impact have evaluated a variety of factors including opportunities for early identification of vulnerable patients,[5] characteristics of successful RRT teams and events[6–8] and outcomes on both a patient and system level.[9 10] Some debate remains regarding the effectiveness of RRT systems, in part due to variable methodological approaches employed in the analyses of outcomes,[11–13] although this has not prevented widespread adoption of RRT systems.

While publications have reported on RRT processes and outcomes using a variety of research methodologies for retrospective analysis, there is not a significant amount of literature reporting standardised methodologies for the use of ongoing review of RRT

events for quality and process improvement purposes. In contrast, a number of publications have documented the implementation of 100% mortality review for system improvement.[14–18] Given the relative infrequency of mortality events, it stands to reason they are relatively insensitive indicators of system vulnerabilities, whereas review of relatively frequent RRT events is likely to identify additional opportunities for system improvement.[19–21]

With this goal in mind, we developed and refined a system for multidisciplinary internal review of RRT and Code events intended to identify patterns in event activation, to understand drivers of the events and to identify opportunities for improvement, prevention, response and management.

METHODS

Setting

The Johns Hopkins Hospital is a large academic medical centre, located in an urban environment with a capacity of >1000 beds. The hospital serves both as a community hospital for the east Baltimore community, as well as a national and international referral centre. Within the hospital, the Department of Medicine manages 289 beds, of which the Division of Hospital Medicine manages approximately 106 beds daily, all of which are dedicated to the care of hospitalised general internal medicine patients. The majority of patients are cared for directly by academic hospitalist attendings on general care units, with a smaller proportion of patients being cared for on hospitalist-supervised resident teaching services, or a hospitalist-supervised advanced practice provider team managing primarily intermediate care (also known as 'step down') patients. Nurse-to-patient ratio is on average 1:4 or 1:5 on general care units on average, and 1:3 on intermediate care units. At our institution, RRT activation usually brings to the bedside a senior resident from the medical intensive care unit, a pharmacist, a triage nurse, a vascular access team nurse, a chaplain, a security team member and representatives of the primary medical team (if not already present). Code response teams will also include representatives of the anaesthesia team and an intensivist.

Data collection

Our process was developed for review of RRT and Code events occurring while a patient is cared for on the Division of Hospital Medicine clinical service lines. All RRT or Code Team activation events occurring within clinical units supervised by the Division of Hospital Medicine were targeted for review, without exclusion criteria. The cardiopulmonary resuscitation (CPR) office at our institution is responsible for CPR training and certification of the institution's employees. This office also routinely tracks the occurrence and limited data elements from every RRT and cardiopulmonary arrest event within our hospital. These data are used for internal and external reporting of metrics related to cardiorespiratory arrest events ('Code' events), although non-cardiorespiratory arrest RRT events are not routinely analysed or reported on. Our internal RRT review process used RRT events identified by the CPR office, and subsequent data collection was performed by manual chart review in the electronic medical record by a process described below.

Process development

The multistep process we developed consisted of the following overarching elements:

1. A multidisciplinary team of content experts was formed. The team was composed of hospitalist physicians, nursing representatives from relevant clinical units, a clinical pharmacist and representative of bed management.
2. A draft data collection and coding tool was created by physicians with experience in safety event review and quality improvement.
3. Pilot event reviews were undertaken on a subset of RRT events (5–10 per reviewer).
4. The findings of these pilot reviews were discussed in multidisciplinary committee, and based on these discussions an initial coding strategy was determined.
5. The initial coding strategy was applied routinely to all subsequent cases, with ongoing minor refinement of the coding strategy when deemed appropriate by review committee consensus.

Data management

Data were managed on a HIPAA-compliant institutional cloud services platform (Microsoft 365 cloud services) in which all team members were able to review and input data related to case reviews.

Patient and public involvement statement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this project.

RESULTS

The review process we developed can be characterised in five steps, which include reviewer training, chart review from the electronic medical record, a standardised coding approach, an interdisciplinary review of each case based on coding by two physicians, followed by identification of event-related trends and patterns, concluded by identification of improvement opportunities (figure 1).

Participant selection, training and timeline

A group of volunteer hospitalist physicians was recruited and received training to perform independent chart reviews, and to report the findings of their review in a standardised manner. Although no strict experience was required, volunteers were identified based on academic interest in clinical excellence and/or quality and safety. Ultimately, the physician group represented early career, mid-career and later-career faculty. The training was a two-part activity: (1) a didactic component where the trainee

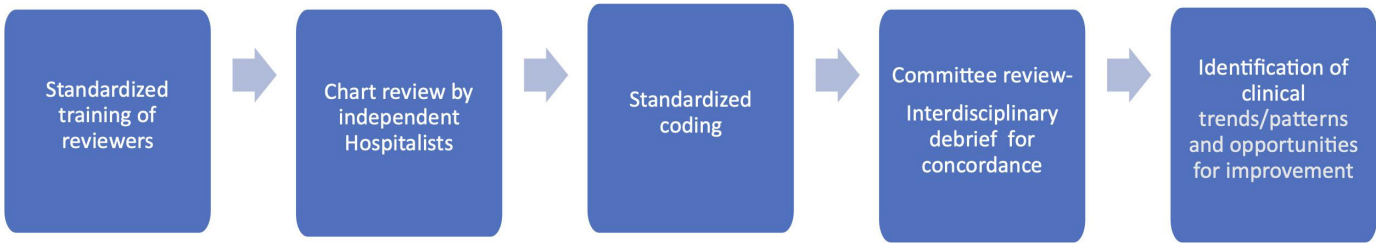

Figure 1 Flow diagram of the newly developed systematic protocolised review process of rapid response team activation events.

was instructed on expectations for the chart review process, the reporting and summarisation of their findings at the conclusion of the individual independent review and (2) an observation component where the trainee observed a live session where experienced colleagues performed and presented their independent review.

A pilot review was initially started in 2021, with a limited number of clinician reviewers, with the aim of testing the newly created protocolised tool. Then in 2022, consistent reviews using initial coding strategies for all cases were completed. On average, over a 12-month period, about 12–15 cases divided among reviewers per month were coded, resulting in an average of 24–30 total monthly case reviews (as each case was reviewed by two independent physicians).

Committee chart review and coding

Each hospitalist reviewer was tasked to perform a chart review to summarise the event and collect specific variables for each case (coding), according to a grid of descriptive and qualitative variables of interest (table 1).

Reviewers were given 1–2 weeks each month to review their case load, and each case was coded by two reviewers independently. The average amount of time per reviewer per month was estimated at 10–20 min per case reviewed. The interdisciplinary committee met once a month for 1 hour, and all cases which occurred in the previous month were discussed. Cases were coded on a variety of indicators including timeliness, event quality, documentation, likely cause, preventability, estimated risk of recurrence of a similar event and the likelihood of harm if a similar event was to recur (table 1). Relevant clinical data deemed helpful to review the case were also documented (time and doses of medication administration, abnormal vitals, abnormal laboratory results, etc). A brief narrative summary was also created for each event, including the patient's final disposition and clinical outcome after the event. Coding was then reviewed for concordance at monthly interdisciplinary group meetings. Significant coding disparities were reconciled based on group discussion, although mild discordance was allowed to remain given the subjective nature of some elements of assessment. For instance, a case in which one reviewer rated high likelihood of recurrence and another rated low likelihood for recurrence would prompt additional discussion, although ratings of moderate and high by two reviewers (respectively) would not necessarily prompt additional review.

Risk/Safety assessment of events

Each reviewer assessed whether the event was preventable (scored as yes, no or maybe), and estimated both the risk of recurrence of a similar event on the hospitalist clinical services within 6 months (graded low, moderate or high), and the likelihood of harm if a similar event were to recur (graded low, moderate or high). Based on these scores and their overall clinical assessment, each hospitalist reviewer also coded whether a possible action item should be discussed during committee review. Any expected additional task by a review group member was considered an 'Action Item', and the final plan for 'Action Items' was determined during monthly committee discussion. Typical examples of 'Action Items' were additional data collection, requesting subspecialist input, a plan to provide education or feedback to involved parties or staff cadres at large or plans to request or formulate system-based improvement plans. All events ending in a patient's death were also systematically reviewed by a separate mortality review committee (distinct from our process).

DISCUSSION

We have developed a process for ongoing review of RRT-Code events for quality improvement purposes. To date, there is limited documentation of processes similar to ours in the literature,[19 22 23] and no consensus on best practices for event review of this type. While some past studies have identified RRT review as a promising method to identify medical error, our process was focused not on the identification of error, but the identification of high value improvement opportunities which may also be present in cases where no medical error was committed. The coding rubric for cases, as described above, provides adequate information for aggregate review to identify recurrent themes and event drivers, as well as to target events and/or processes that would be most impactful to address (eg, those deemed preventable, and high risk of recurrence and harm). Not every event scored as preventable, high risk of harm and/or high risk of recurrence identified a concrete improvement target, although this subgroup may be helpful in identifying targets via additional quality improvement evaluations (eg, ease-impact assessment). In addition, events reviewed took place in

Table 1 Table of variables, definitions and codebook options, designed for uniform collection and summarisation of rapid response team activation events data

	Variable name	Definition	Codebook options
Descriptive	Patient's name	Case patient's last name, middle name and first name	Obtained from CPR office—prepopulated
	MRN	Case patient's medical record number	Obtained from CPR office—prepopulated
	Event date	RRT activation date	Obtained from CPR office—prepopulated
	Event time	RRT activation time	Obtained from CPR office—prepopulated
	Event location	In-hospital geographic location of the patient for whom the RRT was activated	Obtained from CPR office—prepopulated
Case synopsis	Notes from hospitalist review	Narrative summary based on chart review, and any other communications highlighting the clinical context, series of events, supportive objective data, management and outcome of the RRT	Free text
Objective	Event note present	Reports whether a clinical event note was documented by a clinician responding to the RRT activation	Yes, no
	Phase of care	Captures whether the RRT activation occurred following a transition of care	ED to inpatient admission (within 24 hours), direct admission (within 24 hours), post-ICU (within 48 hours), peri-procedural (within 24 hours)
	Service structure	Denotes whether the patient was cared for on a resident teaching team, an APP team or on a direct hospitalist care service	Teaching, APP, direct care
	Pathophysiology	Preliminary underlying clinical cause leading to the RRT activation	Free text with suggestions: cardiac (volume overload, HF, arrythmia), infection/sepsis, pulmonary (non-cardiac), adverse medication event, intoxication/overdose, renal/electrolytes/metabolic, other
	Discharged alive	Disposition at the end of hospitalisation	Yes/No/Hospitalised at time of review
Assessment	RRT activation timing	Assesses whether the RRT was activated within a reasonable timeframe based on the documented clinical course. Differentiate if there were areas of improvement in the recognition of clinical change, or activation of RRT in response to clinical change	Timely, could improve—monitoring/recognition time, could improve—recognition to activation time, late or missed indication, cannot be determined
	RRT event quality	Captures whether the management of the RRT was conducted according to standard of care	Good, could improve, missed standard of care, cannot be determined
	Risk of recurrence	Risk that the same circumstances will occur again on a hospitalist service within 6 months	Low, moderate, high
	Likelihood of harm if recurs	Risk of serious harm if similar circumstances occur again. Serious harm is defined as loss of life or limb, escalation to a higher level of care, prolongation of hospitalisation or need for additional treatments	Low, moderate, high
	Preventable	Assesses whether the event was potentially preventable based on available information	No, maybe, yes
	Possible action item	Suggests whether an additional follow-up action should be discussed during multidisciplinary review	Yes, no, with free text

APP, advanced practice provider; CPR, cardiopulmonary resuscitation; ED, emergency department; HF, heart failure; ICU, intensive care unit; RRT, rapid response team.

the month preceding the committee meeting, which allowed for relatively real-time pattern identification and response, thus increasing the chance of impactful and timely interventions.

While it is beyond the scope of this manuscript to describe all the specific activities prompted by the application of this review methodology, the following examples may help illustrate the early impact of the process. Internal hospitalist division 'action items' are most common, and range from directed educational feedback to specific providers, to the organisation of division-wide faculty development sessions targeting high-risk conditions (eg, the recognition

and management of medical emergencies in patients with sickle cell disease). Event reviews have prompted improvement beyond our hospitalist group as well. For instance, following the identification of aspiration as a major recurrent driver of events, a hospitalist reviewer became the physician champion of a hospital-wide quality improvement initiative on aspiration prevention (with a goal of eventual system-wide policy improvements). As a final example, the evaluation of a bleeding-related RRT prompted a collaborative review of existing haematology team recommendations for prophylactic anticoagulation in patients with COVID-19. This review led to the alteration of system-wide treatment guidelines, decreasing the risk of another similar bleeding event.

Sustainability is key for ongoing improvement processes, and often differentiates them from time-limited retrospective research-style evaluations on similar topics. While the above process required staff time for review and committee meetings, the burden was relatively easily sustained by a group of volunteer staff who did not receive additional protected time or specific resources to support their involvement (other than author BB who does receive some protected time for general quality and safety activities). While we have had turnover among our reviewers and multidisciplinary team, we have not encountered any difficulties in maintaining a sufficient group of participants to allow continued monthly review sessions.

This process is also relatively easy to implement. In addition to the modest time requirements from involved staff, the process requires access to a centralised source of RRT-Code event data, although this is likely to be available at most institutions using an RRT service. Given the widespread adoption of RRT services, it is likely that event review processes such as this one have significant potential for wider application.

In addition to responsive actions following case reviews, future work is expected to include a summative mixed qualitative/quantitative analysis of cumulative event data, which is expected to inform additional improvement approaches. Nevertheless, the limitations associated with this protocol consist of the subjective nature of some coding designations and a potential gap in interobserver reliability. Although we discussed limited time requirements for reviewers, this time spent can nevertheless be seen as a barrier and make the process costly. Additionally, the lack of ability for rigorous comparison of our methodology to other potential event review approaches can be perceived as a potential limitation. Yet, due to the fact that this is an iterative improvement process, we do not foresee any limitation on future refinement to the process or comparison with other approaches when they become available, which may allow further improvement in the process itself.

CONCLUSION

The use of RRT review in a protocolised methodology is a promising technique for identifying improvement opportunities. We have developed a novel, low-cost and easy-to-apply approach to event review, which has the potential to provide timely and high-value actionable insights on safety events happening at institutions like ours.

Correction notice This article has been corrected since it was first published. Author 'Crystal Silbak' has been added in the author byline.

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