JAMA Performance Improvement | PATIENT SAFETY

Rapid Response Teams as a Patient Safety Practice for Failure to Rescue

Chelsea P. Fischer, MD, MS; Karl Y. Bilimoria, MD, MS; Amir A. Ghaferi, MD, MS

GUIDELINE *Making Healthcare Safer III*: *Failure To Rescue*

DEVELOPER AND FUNDING AGENCY Agency for Healthcare Research and Quality (AHRQ)

PRIOR VERSION *Making Health Care Safer II*: *An Updated Critical Analysis of the Evidence for Patient Safety Practices* (2013)

RELEASE DATE March 2020

OBJECTIVES To summarize evidence for rapid response teams (RRTs) as a patient safety practice to decrease failure to rescue; review factors important to successful implementation and adoption of RRTs

MAJOR FINDINGS

- Inconclusive evidence to determine if RRTs decrease mortality or intensive care unit (ICU) transfer rate
- Moderate evidence of RRT association with decrease in rates of cardiopulmonary arrest outside of the ICU
- Often significant lag time between RRT implementation and discernable patient outcome improvement
- Poor hospital safety culture, communication breakdown, and inadequate event detection mechanisms identified as barriers to RRT success

Summary of the Patient Safety Problem

Failure to rescue (FTR) is a patient safety phenomenon of medical or surgical mortality following a major complication, and it generally represents a delay in recognizing or responding to in-hospital complications. Originally a surgical quality measure, FTR is not specific to a particular pathology or disease state; therefore, use as a quality metric across specialties can represent hospital performance rather than patient illness severity. Rapid response teams (RRTs) are a proposed patient safety practice to address FTR and are endorsed by the Institute for Healthcare Improvement and the Joint Commission.[1] These clinical care teams (often multidisciplinary) rapidly assess a patient after an identified critical change in clinical status and determine if a change in care setting (eg, transfer to an ICU) or treatment plan (eg, endotracheal intubation) is necessary.

Characteristics of the Guideline

AHRQ is a federal agency established to improve health care safety and quality by developing evidence, tools, and data for clinicians and health care centers. AHRQ first reviewed evidence for 80 patient safety practices in the 2001 *Making Healthcare Safer* report, updated in 2020 with 47 new patient safety practices. The 2020 guideline identified important patient harms and corresponding patient safety practices using a conceptual framework and conducted a systematic review for the selected practices. There are 2 patient safety practices for FTR: patient monitoring systems and RRTs. This summary will focus on RRTs.

Evidence Base and Discussion

Effect of RRT on Outcomes

RRTs were first implemented to prevent acutely decompensating patients from further clinical deterioration and mortality. This guideline reviewed literature that examined the association between RRTs and mortality, as well as other surrogate outcomes (cardiac arrest and ICU transfers). Two meta-analyses demonstrated decreased hospital mortality rates after RRT implementation: 1.93% vs 1.95% and 1.56% vs 1.62%, respectively.[2,3] In contrast, a 2010 meta-analysis of 15 studies found no overall difference in mortality associated with RRT implementation. However, the included studies had significant heterogeneity (I^2 = 90.3%, $P < .001$), and only 5 studies were deemed high quality for including appropriate controls or methods accounting for time.[4] A 2016 population-based study used an interrupted time-series design to demonstrate that the decreasing mortality trend present before introduction of an RRT continued in the study period, and additionally found mortality decreased among patients admitted with low-mortality diagnoses.[5]

The guideline authors additionally identified cardiac arrest and ICU admission rates as outcomes of interest. Two meta-analyses reported an overall decrease in non-ICU cardiac arrest rates associated with RRTs, although with significant study heterogeneity (0.18% vs 0.32%; RR, 0.62 [95% CI, 0.55-0.69] and 0.20% vs 0.37%, RR, 0.65 [95% CI, 0.55-0.77]) (**Table**), and before-after study designs.[3,4] A third meta-analysis found similar results in both adults and children, with minimal heterogeneity in the pediatric population (Table).[2]

ICU transfer rates were reported in 3 studies as a potential measure of outcomes following RRT implementation, and the results were mixed.[6] Conceptually, the directionality of the change in ICU transfer rate does not imply success or failure because it may indicate increased RRT utilization to appropriately transfer patients experiencing clinical deterioration, or appropriate intervention before a patient condition necessitates a more highly monitored setting.

Unintended Consequences

Despite face validity of RRTs as a patient safety practice, implementation has potential unintended consequences. The authors identified potential loss of non-RRT clinician skill to handle unstable patients and fatigue of the RRT members as potential adverse effects of overuse. A 2010 study identified increased rates of do-not-resuscitate orders in hospitals with an RRT system compared with hospitals without (3.85% vs 1.72%; OR, 2.29 [95% CI, 1.31-4.01]), indicating an RRT system as a potential tool to facilitate early goals of care discussions.[7]

Implementation Facilitators and Barriers

Implementation of a hospital-wide RRT system requires teamwork, engagement of multiple groups (such as nurses, surgeons, hospitalists, and respiratory therapists), and an organizational culture accepting of a new practice. The authors of the guideline discussed possible facilitators and barriers to successful RRT use. Outcome

© 2021 American Medical Association. All rights reserved.

Downloaded From: https://jamanetwork.com/ by Piergiorgio Gigliotti on 06/29/2021

Table. Summary of Major Studies

Source	Study design	Outcomes following RRT implementation
Chan et al,[4] 2010	Meta-analysis (18 studies, 1950-2008)	Mortality rates were not reduced (1.63% vs 1.35%, RR = 0.92 [95% CI, 0.82-1.04], I^2 = 90%) Cardiac arrest rates outside the ICU were reduced (0.20% vs 0.37%, RR = 0.65 [95% CI, 0.55-0.77], I^2 = 74%)
Chen et al,[5] 2016	Interrupted time-series (9 799 081 patients)	Prior to implementation, progressive decreases in mortality and cardiac arrest rates noted After implementation there was reduction of in-hospital mortality (0.79% vs 1.71%, RR = 0.46 [95% CI, 0.40-0.54]) and cardiac arrest rates (1.29% vs 2.39%, RR = 0.54 [95% CI, 0.48-0.62]) Further mortality reduction noted in patients admitted with low-mortality diagnoses (1.95% vs 2.47%, RR = 0.79 [95% CI, 0.68-0.91])
Soloman et al,[3] 2016	Meta-analysis (30 studies, 2000-2014)	Implementation associated with decreased mortality rate (1.56% vs 1.62%, RR = 0.88 [95% CI, 0.83-0.93], I^2 = 86%) Non-ICU cardiac arrests also decreased (0.18% vs 0.32%, RR = 0.62 [95% CI, 0.55-0.69], I^2 = 71%)
Maharaj et al,[2] 2015	Meta-analysis (29 studies, 1990-2013)	Implementation associated with decreased mortality rate (1.93% vs 1.95%, RR = 0.88 [95% CI, 0.82-0.94], I^2 = 86%) Non-ICU cardiac arrests (0.21% vs 0.32%, RR = 0.65 [95% CI, 0.61-0.70], I^2 = 70%) were decreased in adults Mortality (0.51% vs 0.76%, RR = 0.79 [95% CI, 0.65-0.98], I^2 = 78%) and non-ICU cardiac arrest rate (0.11% vs 0.22%, RR, 0.64 [95% CI, 0.55-0.74], I^2 = 7%) were decreased in pediatric patients

Abbreviations: ICU, intensive care unit; RRT, rapid response team; RR, relative risk.

improvements were most consistently observed when the study period was a minimum of 1 year with accompanying educational efforts. This implies that education and time are necessary to achieve cultural change for meaningful use of an RRT system. Additional facilitators included physicians as RRT members.

Barriers to effective RRT implementation included inadequate activation mechanisms and intangible factors such as organizational and safety culture. RRT activation mechanisms were variable across included studies, but the authors noted that mandatory activations based on physiologic criteria were more effective mechanisms. However, standardized RRT activations may contribute to alarm fatigue, a well-documented safety issue.[8] Poor institutional culture was a noted barrier, such as lack of leadership support, or the perception that activating the RRT could be viewed as an admission of clinicians' inadequacy of their ability to care for a deteriorating patient.[9] Other studies have also noted that high-performing institutions had staff members who were empowered to activate RRTs without concern for retribution.[10]

Gaps in Evidence

Overall, there is little current evidence on the direct benefit of RRTs on FTR, and the literature reviewed in this guideline had significant methodologic variability; many of the included studies were conducted more than 5 years ago and most included studies were of low to moderate quality. Conducting randomized clinical trials, or any study design with an appropriate contemporaneous control, may be challenging because RRT system use is widespread both in the US and internationally. However, since many of the studies reviewed were interrupted time-series designs, a stepped-wedge design may be possible for future efforts. The authors of the guideline additionally noted the need to develop consistent terminology and activation mechanisms for RRTs, study cost and resource utilization, and identify best practices for the composition of RRT members.

Overall Assessment and Conclusions

RRTs as a patient safety practice have strong face validity, as evidenced by the widespread utilization in hospital environments. However, definitive evidence that RRTs are associated with reduced rates of FTR is inconclusive.[6]

Moderate evidence that RRTs are associated with reduced secondary outcomes, such as ICU transfer rate and non-ICU cardiac arrest, suggests additional potential benefit and the possibility of improvement in other secondary outcomes. Although the supporting evidence is limited and somewhat dated, thoughtful implementation of RRTs may be helpful practices that could contribute to improved hospital patient safety.

ARTICLE INFORMATION

Author Affiliations: Department of Surgery, Loyola University Medical Center, Maywood, Illinois (Fischer); Division for Research and Optimal Patient Care, American College of Surgeons, Chicago, Illinois (Fischer); Surgical Outcomes and Quality Improvement Center, Department of Surgery, Northwestern University Feinberg School of Medicine, Chicago, Illinois (Bilimoria); Department of Surgery, University of Michigan (Ghaferi); Institute for Healthcare Policy and Innovation, University of Michigan, Ann Arbor (Ghaferi).

Corresponding Author: Amir A. Ghaferi, MD, MS, University of Michigan, 1500 E Medical Center Dr, 2101 Taubman Center, Ann Arbor, MI 48109 (aghaferi@med.umich.edu).

Published Online: June 24, 2021. doi:10.1001/jama.2021.7510

Conflict of Interest Disclosures: Dr Ghaferi reports receiving grants from AHRQ and Blue Cross Blue Shield of Michigan. Dr Bilimoria reports receiving grant funding from the National Institutes of Health, AHRQ, Blue Cross Blue Shield of Illinois, American College of Surgeons, and Accreditation Council for Graduate Medical Education. No other disclosures were reported.

REFERENCES

1. Jones DA, DeVita MA, Bellomo R. Rapid-response teams. *N Engl J Med*. 2011;365(2):139-146. doi:10.1056/NEJMra0910926

2. Maharaj R, Raffaele I, Wendon J. Rapid response systems: a systematic review and meta-analysis. *Crit Care*. 2015;19(1):254.

3. Solomon RS, Corwin GS, Barclay DC, et al. Effectiveness of rapid response teams on rates of in-hospital cardiopulmonary arrest and mortality. *J Hosp Med*. 2016;11(6):438-445.

4. Chan PS, Jain R, Nallmothu BK, et al. Rapid response teams: a systematic review and meta-analysis. *Arch Intern Med*. 2010;170(1):18-26.

5. Chen J, Ou L, Flabouris A, et al. Impact of a standardized rapid response system on outcomes in a large healthcare jurisdiction. *Resuscitation*. 2016;107:47-56.

6. Hall KK, Lim A, Gale B. The use of rapid response teams to reduce failure to rescue events. *J Patient Saf*. 2020;16(3S suppl 1):S3-S7.

7. Chen J, Flabouris A, Bellomo R, et al. The medical emergency team system and not-for-resuscitation orders: results from the MERIT study. *Resuscitation*. 2008;79(3):391-397.

8. *Making Healthcare Safer III: A Critical Analysis of Existing and Emerging Patient Safety Practices*. AHRQ; March 2020. Accessed June 8, 2021. https://www.ahrq.gov/sites/default/files/wysiwyg/research/findings/making-healthcare-safer/mhs3/failure-to-rescue-1.pdf

9. Mitchell OJL, Motschwiller CW, Horowitz JM, et al. Characterising variation in composition and activation criteria of rapid response and cardiac arrest teams. *BMJ Open*. 2019;9(3):e024548.

10. Dukes K, Bunch JL, Chan PS, et al. Assessment of rapid response teams at top-performing hospitals for in-hospital cardiac arrest. *JAMA Intern Med*. 2019;179(10):1398-1405.

© 2021 American Medical Association. All rights reserved.

Downloaded From: https://jamanetwork.com/ by Piergiorgio Gigliotti on 06/29/2021