Rapid Response Teams—Walk, Don't Run

Bradford D. Winters, MD, PhD							
Julius Pham, MD							
Peter J. Pronovost, MD, PhD							

N THE 6 YEARS SINCE THE INSTITUTE OF MEDICINE REleased its landmark report *To Err Is Human*,¹ progress toward improving patient safety has been slow and arduous. Clinicians and researchers are struggling to advance the science of patient safety, understand its epidemiology, clarify priorities, implement scientifically sound yet feasible interventions, and develop measures to evaluate progress.

As errors have become more visible and patients continue to experience preventable harm, the public, regulators, accreditators, and clinicians have become frustrated. As frustration increases, so does the risk of implementing interventions without critically and independently evaluating whether they are effective or efficient. Surowiecki² has described how crowds generally make correct decisions if the crowds are diverse and the decisions are independent. However, when decisions are not independent and the initial decision is incorrect, a negative information cascade may ensue and an incorrect decision may be widely implemented.

The drive to implement rapid response team (RRT) programs across the United States may be an example of a negative information cascade. In this commentary, we briefly review the evidence supporting RRT programs, the reasons they have been so broadly implemented, and the potential risks of doing so and also offer suggestions for future directions.

Rationale for RRTs

The underlying basic concept of RRT programs appears intuitively sensible. Patients receiving care in general hospital units often have physiological deteriorations several hours prior to developing a cardiac or respiratory arrest.^{3,4} As such, strategies to identify and treat these patients may improve clinical outcomes. The rationale is that if recognition of physiological instability affecting the patient in a noncritical care setting could be improved and an appropriate clinician is dispatched to the bedside of that patient suspected of experiencing a problem, physicians may be able to intervene early enough to prevent a critical event.⁵

Implementation of RRT programs is one potential mechanism to accomplish this. Rapid response team programs often provide a system for educating caregivers (nurses, physicians, respiratory therapists, and others) in the recognition of the signs and symptoms of physiological instability, developing "alert criteria," and activating a team of clinicians who come to the patient's bedside for directed evaluation, treatment, and possibly triage to another setting such as the operating room or an intensive care unit.

Evidence on RRT Effectiveness

While a large number of articles have reported on RRT programs, only 10 published studies5-14 evaluating RRT implementation have provided adequate comparisons of outcomes between control and intervention groups. Of these, 8 were observational⁶⁻¹³ and 2 were randomized.^{5,14} The other published reports on RRT programs did not provide these comparisons. Of the observational studies, 6 used historical controls⁶⁻¹¹ and 2 used concurrent cohort controls.^{12,13} Although the outcomes evaluated varied among the studies, we focused our analyses on in-hospital mortality and cardiac arrest, outcomes for which all patients exposed to the intervention were evaluated with minimal bias. Two studies9,12 did not evaluate these outcomes. Seven of the studies^{5-8,10,13,14} reported in-hospital mortality data, and 6 of the studies^{5,6,8,10,11,13} reported in-hospital cardiac arrest data (TABLE).

Among observational studies that examined mortality, only two^{7,8} of 5 studies showed statistically significant improvement in mortality with an RRT program. Two of the remaining studies^{6,10} had lower but nonstatistically significant reductions in mortality, and one study¹³ with 2 comparison groups had one nonstatistically significant increase in mortality and one nonstatistically significant reduction in mortality. Among observational studies that examined cardiac arrest, three^{7,10,11} of 5 studies had statistically significant reductions in the incidence of cardiac arrest. The remaining studies^{6,13} had either nonsignificantly reduced or equal cardiac arrest rates in the RRT groups.

Only 2 studies used a randomized study design.^{5,14} The smaller (2792 patients) of the 2 cluster-randomized studies¹⁴ was a single-institution study that found a statistically significant result in favor of the RRT program reducing mortality. (Cardiac arrest outcomes were not reported.) However, the

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Author Affiliations: Department of Anesthesiology and Critical Care Medicine (Drs Winters, Pham, and Pronovost) and Department of Emergency Medicine (Dr Pham), Johns Hopkins University School of Medicine, Baltimore, Md.

Corresponding Author: Bradford D. Winters, MD, PhD, Department of Anesthesiology and Critical Care Medicine, Johns Hopkins University School of Medicine, 600 N Wolfe St, Baltimore, MD 21287 (bwinters@jhmi.edu).

Table. Summary of Mortality and Cardiac Arrest Rates in Studies Evaluating Rapid Response Teams (RRTs)								
Source	Sample Size		Mortality Rate (per 1000 Admissions)			Cardiac Arrest Rate (per 1000 Admissions)		
	Control Group	RRT Group	Control Group	RRT Group	Odds Ratio of Death (95% CI)*	Control Group	RRT Group	of Cardiac Arrest (95% CI)*
Observational studies Bristow et al, ¹³ 2000†	19545	18338	15.1	13.3	1.2 (1.0-1.43)	5.1	3.8	1.00 (0.73-1.37)
Bristow et al, ¹³ 2000†	13 059	18338	18.4	13.3	0.93 (0.77-1.2)	5.1	3.8	0.88 (0.62-1.24)
Buist et al, ¹⁰ 2002	19317	22 847	19.7	17.2	0.87 (0.71-1.01)	3.77	2.05	0.50 (0.35-0.73)
Bellomo et al, ⁷ 2003	21 090	20921	14.3	10.6	0.74 (0.70-0.79)	2.98	1.05	0.35 (0.22-0.57)
Bellomo et al, ⁸ 2004	1116	1067	65.4	42.2	0.64 (0.45-0.93)	NA	NA	NA
Kenward et al, ⁶ 2004	~53 500	~53 500	20	19.7	0.99 (0.91-1.07)	2.6	2.4	0.92 (0.72-1.17)
Devita et al,11 2004	143776	55 248	NA	NA	NA	6.5	5.4	0.81 (0.71-0.93)
Cluster-randomized studies Priestley et al, ¹⁴ 2004	1336	1456	57	50	0.52 (0.32-0.85)	NA	NA	NA
Hillman et al,⁵ 2005	56756	68376	1.18	1.06	1.03 (0.84-1.28)	1.64	1.31	0.94 (0.79-1.13)
Abbreviations: CI, confidence inter	val; NA, not appl	licable.						

*Reported/adjusted odds ratio.

†This study used 2 separate concurrent cohort control hospitals.

large (125 132 patients) multicenter (23 hospitals) clusterrandomized study⁵ found no statistically significant benefit for any of the outcomes studied. The adjusted OR for mortality was 1.03 (95% CI=0.84-1.28) and for the incidence of cardiac arrest, the OR was 0.94 (95% CI=0.79-1.13). Thus the only randomized trial that evaluated cardiac arrest⁵ failed to find a risk reduction with RRT implementation.

Overall, the observational studies tend toward demonstrating a benefit with RRT programs, but there is significant heterogeneity in these studies. Additionally, compared with randomized trials, observational trials tend to overestimate treatment effects.¹⁵ Among the randomized studies, one is small and only examined mortality,¹⁴ and the other, a large multicenter study,⁵ found no benefit for any of the outcomes studied. In the larger trial,⁵ both intervention and control groups showed equal improvement in in-hospital mortality and incidence of cardiac arrest compared with the preimplementation time period. It is unknown whether these results are attributable to contamination of the control group or whether RRT programs did not have a treatment effect, and the reduction in mortality and cardiac arrest was secondary to another intervention that occurred in control and intervention hospitals. It seems unlikely that contamination of the control group would result in the exact same mortality reduction as the intervention group. It seems more likely that the training provided to the intervention group would result in a higher proportion of patients exposed to the intervention and, as such, a lower mortality.

Implementation of RRT Programs: Interest, Costs, and Risks

Despite the uncertain evidence associated with RRT implementation, several organizations have made the wide implementation of RRT programs a priority. For instance, the Institute for Healthcare Improvement included implementation of RRT programs as one of its 6 interventions in the 100 000 Lives Campaign.¹⁶ The Association of American Medical Colleges in partnership with The Robert Wood Johnson Foundation, The Delmarva Foundation for Medical Care, and the University of Pittsburgh has recently developed a collaborative to implement RRT programs in university health centers.¹⁷ The Joint Commission on Accreditation of Healthcare Organizations has considered making RRT programs one of its patient safety goals.¹⁸ In addition, some have suggested that implementation of RRT programs become a standard of care and that not having them might constitute malpractice.¹⁹

Given the equivocal evidence supporting the effectiveness of RRT programs, with the largest best-designed study showing no benefit, it is unclear why there is such interest in implementing this intervention and making it a care standard. For most interventions in patient safety, evidence on effectiveness from valid clinical studies is lacking and clinicians are forced to rely on less rigorous studies and often common sense. While the concept of and rationale for RRT programs are strong, more research is needed before implementation of RRT programs can be required or strongly recommended. It would seem prudent to fund efforts to evaluate the effectiveness of RRTs rather than support efforts to implement these programs that include little to no evaluation. Rapid response team programs may be one viable approach for intervening on behalf of patients in general hospital wards who are experiencing clinical deterioration, yet other approaches may be as, or more, effective. For example, the presence of hospitalists, ²⁰ nurse practitioners, or physician assistants on hospital units or the use of automated monitoring systems^{21,22} may provide alternate mechanisms to identify and treat deteriorating patients early and improve patient outcomes.

It is unclear whether the potential benefit of RRT programs actually derives from summoning a special team to intervene on behalf of a deteriorating patient or from edu-

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cating the general staff on how to better recognize deteriorating patients earlier.²³ This may have been one reason the study by Hillman et al⁵ had a similar improvement in outcome in its control group compared with the RRT group. In-hospital mortality and other patient outcomes may be improved simply through educating caregivers in how to recognize the deteriorating or critically ill patient.

Moreover, few data are available on the costs of RRT programs. Without data on costs and effectiveness, it is difficult for hospitals to determine whether they should invest in RRT programs or other interventions (such as staffing intensive care units with intensivists,²⁴ using hospitalists,²⁰ or increasing nurse staffing²⁴) that have stronger evidence, larger mortality benefit, and more clear estimates of costs. Without these data, it will be difficult to make an informed decision on how to invest scarce resources.

The risks of making RRT programs a standard of care may be significant. Hospitals may decide to consume valuable and fixed resources on implementing an intervention for which patients may not benefit, thus limiting their ability to implement other interventions with a stronger evidence base. Research on other interventions that not only identify and treat, but also prevent patients from deteriorating, may decrease. Given the equivocal evidence to support RRT programs, physicians may discredit patient safety efforts and research and be reluctant to implement other patient safety efforts. In addition, hospitals and physicians may be subject to financial and reputational risks from liability claims from failing to implement an intervention considered a standard, even if that intervention remains unproven. Expending resources on interventions that may not be effective is detrimental to patients, clinicians, and society.

Conclusions

Hospitals should create systems to prevent patients from deteriorating and to identify and treat them if they do. However, the evidence is insufficient to inform how that should be accomplished. Implementation of RRT programs is one option, but introducing hospitalists or nurse practitioners or increasing nurse staffing may not only identify and treat deteriorating patients earlier but may also prevent such deteriorations to begin with. Comprehensive education programs that help caregivers recognize deteriorating patients remains a sparsely studied alternative. Hospitals electing to implement RRT programs should be aware that the strongest evidence, albeit imperfect, suggests that RRTs do not improve patient outcomes. Anecdotes of the benefits of hospitals implementing RRT programs are generally not of sufficient quality to inform this debate. Rather, additional well-conducted clinical studies are needed. As such, the recommendations made by national societies and organizations to make the implementation of RRT programs a standard of care should be reconsidered.

National efforts to improve patient safety should be supported by sufficiently strong evidence to warrant such a commitment of resources. To create national patient safety standards, a scientifically sound and transparent process that is free from conflict of interests should be established. Given that most safety interventions will not be supported by randomized trials, rigorous methods (such as the RAND appropriateness method²⁵) that incorporate evidence from clinical studies and expert opinion may help to provide a framework for analysis. In the meantime, science, not frustration, should guide the development of national patient safety standards.

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