

Michael A. DeVita · Ken Hillman
Rinaldo Bellomo *Editors*

Textbook of Rapid Response Systems

Concept and
Implementation

 Springer

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*To my wife Sharon, and my children Lizzie,
Chris, Tim, and Annie who are my life,
and to my parents for challenging me
and preparing me to achieve.*

*I am indebted to my teachers, Dennis
Greenbaum, Jim Snyder, Ake Grenvik,
and Richard Simmons, who have taught
me what critical care excellence is.*

MAD

*To Sue Williams, a loyal and committed
colleague of 20 years.*

KH

*To the many patients who have suffered
and suffer because of an outdated approach
to acute hospital care.*

*May this book help make their time in
hospital safer.*

RB

Preface

When we created the Manual of Medical Emergency Teams (MET), Implementation and Outcome Measurement, the concept was relatively new. The term MET was not well recognized and had different meanings to different people. The Institute for Healthcare Improvement (IHI) was just starting to promote the same process using different terminology: the Rapid Response Team (RRT). We created our manual to provide readers with the tools to create teams of their own, and with the resources needed to measurably succeed.

Since then, even though it was a mere four years ago, much has happened. Two consensus conferences have been held. The first defined the terminology and the process better. At that meeting, it was recognized for the first time that the intervention is much more than a team. It is a system, the Rapid Response System (RRS), and it has four components, without which the team is unlikely to succeed. A unifying set of terms was created, and a lexicon for describing interventions and reporting outcomes was proposed and is now being utilized more frequently. The aim was to promote the ability to compare interventions between organizations and more accurately analyze results. We assumed that it is possible that an intervention that has nursing responders might have different results than interventions that have physician responders. Differing support structures in the administrative or quality improvement limbs might also impact outcomes. The ability to compare, we believed, was essential to understanding the influence of various components of the system and would enable improvement and growth internationally. At the second consensus conference, which was focused on defining and improving the ability to detect crises outside of the critical care setting (that is, the “afferent limb”), the need for monitoring was explored and a classification system was proposed. Participants recognized the differences between continuous and intermittent monitoring in terms of costs, equipment, and capabilities. Two major purposes of monitoring (continuous or intermittent) were recognized. First, it enables prognostic risk stratification. There is now ample data to show that those with abnormal vital signs are more likely to suffer a serious or lethal event. This risk stratification can facilitate the ability to move patients to a level of staffing and equipment to promote safety. Of course, these prognostic systems are not perfect. Patients are identified who in fact do not have an event, while others who will have an event are not recognized. As a consequence, many at the conference promoted

the second function of a monitoring system, the ability to detect critical deteriorations as they occur. This function, of course, requires a continuous monitoring system. Such a system costs more, but it may reduce unexpected mortality and morbidity in hospitalized patients. Future studies will clarify the cost and the benefit of the two approaches. We hope our textbook clearly recounts the issues involved and promotes needed investigations.

A second major event that has transpired is the addition by The Joint Commission for the Accreditation of Healthcare Organizations (JCAHO) in North America of a patient safety goal that includes the principles of the Rapid Response System. Healthcare providers must have the capability to detect patients with sudden clinical deterioration and a system in place to rapidly respond to the patient's needs. These days, most hospitals in the United States have some sort of RRS, with some teams being nurse-led (RRT), and others physician-led (MET). Still others did not create a new team but "hot-wired" existing systems to promote the goal. The use of the RRS is spreading in Europe, Asia, and Central America. In short, in just a few years, it is becoming a global standard. Recognizing the importance of the system, reports are published in major journals with increasing frequency, and it is becoming difficult to keep abreast of the field as it is growing so rapidly. A lively debate exists regarding the benefit of the RRS. In this textbook, we have tried to capture that debate, including potential emerging applications of the system.

A year ago, we decided to update our manual to make it current with recent publications. However, as the project progressed, it became obvious that the field had expanded so significantly that more than an update was required. Instead, we chose to create a new work, the first "Textbook of Rapid Response Systems." We added over a dozen chapters, recruited many new researchers in the field, and have tried to create a comprehensive resource for the clinician, administrator, and researcher. As in our first book, we tried to make each chapter capable of standing alone, yet tightly integrated with the others into a cohesive whole.

The RRS concept is now being applied to a number of problems and processes in hospitals that require a "short circuit" to timely and expert help. When we each created our RRS at our home institutions, none of us recognized the many problems that might be amenable to the approach or the potential applications of the system. In this textbook we describe an RRS to rapidly and safely find lost, eloped, or wandering patients, another to immediately support staff who have suffered mental or psychological trauma in the course of their work, and yet another to provide support for suddenly dangerous patients, staff, or visitors. These problems share the common need for early recognition that an RRS provides using additional expertise and hands (afferent limb), and a planned, systematic approach to provide support (efferent limb). The ability to recognize the need, to capture and analyze data to guide change (quality improvement limb), and to provide resources (administrative limb) is also necessary to each application's success.

In a sense, the RRS is becoming, in some hospitals, a "system of systems." In this textbook, we hope to provide readers with the tools they need to create systems that emulate some of the work reported in the book, and to discuss the expansion of the RRS to address other critical needs.

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Part I
RRSs and Patient Safety

Chapter 1

Rapid Response Systems History and Terminology

Bradford D. Winters and Michael DeVita

Keywords Rapid • Response • Systems • History • Terminology

Principles

The Rapid Response System (RRS) concept has matured substantially since its inception in the early 1990s when critical care physicians, primarily in Australia, Pittsburgh, PA, and the UK started asking some crucial questions regarding patients who deteriorated and often arrested on general hospital wards prior to their admission to the ICU. Specifically, they asked exactly what is happening to general hospital ward patients in the minutes and hours prior to their cardio-respiratory arrests and whether we can do something to intervene and halt these deteriorations before the patient arrests or nearly arrests. This was a sea-change in thought and perspective since, at that time, resources focused on resuscitation were primarily concerned with how to improve performance of CPR and ACLS rather than preventing the event to start with. Critical Care physicians were well aware, in a general sense, that patients admitted or readmitted to the ICU from the general ward uncommonly went from “just fine” to critically ill. This sense was confirmed by early studies that clearly showed that arrests and deteriorations were not sudden but rather commonly heralded by long periods of obvious hemodynamic and respiratory instability that was often unappreciated by general ward providers.¹⁻¹⁷ The development of critical illness on the general ward was rarely “sudden,” only suddenly recognized.

Given this result, critical care physicians reasoned that if we could create usable criteria for general ward staff to use in the early recognition of impending deterioration and empower these staff members to bring a team of critical care physicians

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and/or nurses outside of the ICU to the bedside, we could improve the outcomes of these patients. Data from these studies of the antecedents to arrest provided the basis for developing the physiological criteria that were put into place for general ward staff to use as a guide for making the decision to call for help.¹³⁻¹⁷ Intensive Care Unit staff formed the team that would come to the patient's bedside to evaluate, stabilize and help create a new care and triage plan. Through sheer will, and often working in isolation without the support of the health community, these critical care clinicians created a new patient safety and quality initiative, long before patient safety and quality became a national and international concern and had the attention of the public and policymakers.¹⁸⁻⁴⁹

These early programs were often referred to as Medical Emergency Teams (METs), although other terms, such as Condition C Teams and Critical Care Outreach Teams were also used. This linking defined activation criteria to a response team and empowering the ward staff to summon that team, has become a powerful patient safety and quality initiative that has enjoyed wide adoption in the US, Australia, New Zealand, Canada and the UK and ever-increasing acceptance around the world, such that the first International Conference on Medical Emergency Teams was held in Pittsburgh, PA, in May, 2005. Subsequent conferences have been held each year again in Pittsburgh and also in Toronto, Canada, and Copenhagen, Denmark. The RRS concept has reached such significance that the Institutes for Healthcare Improvement (IHI) included Rapid Response Systems as one of its six "planks" for improving patient in its "100,000 Lives" Campaign.⁵⁰ Additionally, the essential principles of the RRS have recently been embraced by the Joint Commission (the accreditation organization for US hospitals) as a mandate for American hospitals in the form of National Patient Safety Goal 16 and 16A.⁵¹

While this goal does not specifically ask hospitals to create response teams or dictate activation criteria, it requires hospitals to develop systems that "improve recognition and response to changes in a patient's condition with the organization selecting suitable methods that enable healthcare staff members to directly request additional assistance from a specially trained individual or individuals when a patient's condition appears to be deteriorating." Clearly, while the Joint Commission mandate does not demand RRSs by name, RRSs are the logical solution for meeting this requirement and providing patients with the safety net they need to help prevent medical deteriorations from progressing and degenerating into an arrest and death. While other solutions have been proposed, such as increased nurse-to-patient ratios, hospitalist services and others, none has the practicality and body of evidence in their favor like RRSs.

One of the primary goals of RRSs is to prevent cardio-respiratory arrest and therefore the very high mortality known to be associated with such in-hospital events. Since the physiological instability that precedes the arrest is usually evident for substantial periods of time prior to the arrest, there is significant face validity to the notion that RRSs should result in a reduction in the incidence of cardiac arrest and mortality. Additionally, RRSs should be able to, through early recognition and intervention, reduce unanticipated ICU admission. By catching problems early in

their course, it is envisioned that patients not only won't arrest but also may not even require ICU care and be able to be managed on the general ward. This helps to keep ICU beds open for other patients and improve through-put. Likewise, with reductions in serious deteriorations and complications, length of stay should also decrease. Even when patients still require transfer to an ICU as a result of their deterioration, in principle, having the early intervention afforded by an RRS should have the patient arriving in the ICU in better condition than without such a system. The expected benefit in this circumstance is reduced ICU and hospital mortality and reduced ICU and length of hospital stay.

The foundation for achieving these goals is an underlying principle and strength of RRSs, namely that RRSs address the mismatch between the patient's needs and the available resources on the general wards.⁵² This imbalance between what the patient needs (human resources, monitoring, specialized equipment and medications) and what the general ward can provide (staffing, monitoring and policy limitations) are at the center of these deteriorations. RRSs are commonly activated by nurses who determine that the patient is seriously ill and cannot be managed under the current circumstances. These circumstances may include staff/acuity limitations, inadequate care plans, and/or new events such as sepsis. Through rapid assessment and intervention, new plans can be developed and communicated to the ward staff and primary service and resource/needs imbalances accounted for resulting in an effective triage and care plan for the patient. Often the patient requires triage to a higher level of care to achieve a re-balancing of resources and needs, but if needs are reduced through RRS intervention, that re-balancing can be achieved with the patient remaining on the ward.

Many of these goals and benefits have been realized through the implementation of RRSs, while some have been less successful and yet others not well evaluated.¹⁸⁻⁴⁹ While outcome measures such as mortality are important to clinicians, regulators and patients, other measures of RRS success and positive impact need to also be considered. Some of these include process of care measures (such as meeting sepsis management guidelines and appropriate institution of Not for Resuscitation status),⁵³⁻⁵⁵ patient and nursing satisfaction⁵⁶⁻⁵⁸ and especially the value RRSs bring to staff education in the recognition and management of the critically ill patient who presents as such outside the walls of the ICU.^{59,60} In fact, this last goal and benefit of RRSs may be the most under-appreciated, although in many ways the most important. RRSs change culture and culture is a crucial element of the health systems in which we work. RRSs are not just teams, they are systems in themselves that include a component that emphasizes and educates in the early detection of problems and a component that responds to the call for help.

The RRS functions within a greater system that spans from the patient, through the providers, their environment and up to the departmental, hospital and institutional and even governmental level. This realization requires that RRSs have two additional components besides the activation process and a responding team. The first is an evaluative element that continuously assesses the performance of the RRS and helps to inform the hospital Quality Improvement (QI) process.⁵² Institutions such as the University of Pittsburgh have used their RRS to scrutinize all of their arrest and MET calls in an ongoing QI process that has had great impact for their

hospital.⁶¹ The second component is a governance and administration structure.⁵² This helps to develop, implement and, most crucially, maintain and improve the RRS program. The work of the evaluation/QI element and the governance/administrative structure has been greatly improved in the last 2 years with the addition of RRS data fields to the American Heart Association's (AHA) National Registration for CPR database.⁶² From this database useful reports and comparisons can be generated to support the RRS. While these two additional components are not absolutely essential to having an RRS, they enhance its effectiveness, role and status within the hospital system and are well worth consideration.

RRSs have become a great agent for change, encouraging and empowering ward staff to ask for help for their patients. The archaic concept, often held and promulgated by physicians and occasionally others, that calling for help is "a sign of weakness" is washed away by the RRS as it changes the culture to an understanding that the patient and his well-being is the primary concern of all providers and that calling for help is the sign of the wise and caring clinician.

Terminology

It is important to have a clear understanding of the terminology for Rapid Response Systems so as to get the most from this book and any review of RRS literature. Historically, the early RRSs were most commonly called "Medical Emergency Teams" or METs, although other terms were also used, including Medical Emergency Response Teams (MERT), Patient-at-Risk Teams (PART), Critical Care Outreach Teams (CCOT), and eventually Rapid Response Teams (RRTs). Some of these terms are used interchangeably in places such as Australia where RRT and MET often mean the same thing. While hospitals and institutions often create specific names for their programs based on local preferences and the desire to use something memorable to encourage utilization, consensus has been developed on specific terminology that should be used when reporting and sharing information and data in the public forum (publications, research articles etc).^{52,63} The term Rapid Response System refers to the entire system for responding to all patients with a critical medical problem. Most broadly, this can include the Cardiac Arrest Team (Code Team) and the MET as well as other specialized teams that may exist within the hospital, such as a Difficult Airway Response Team, although most commonly and preferably the term RRS is used to refer to systems that seek to prevent deterioration and arrests rather than respond to arrests. This term encompasses both the recognition process (the activation criteria and the activation process) and the responding team. These two sub-components are referred to as the Afferent and Efferent Limbs of the RRS, respectively. Additional confusion may arise when the Code Team and the MET are one and the same in terms of personnel but take on different roles depending on the patient's situation (arrest versus deterioration).

The historical MET and similar systems are now defined through consensus based on the team structure and functionality.⁵² Teams that include physicians along with nurses, but may also include respiratory therapists and others, are properly called Medical Emergency Teams, which have full capability for assessment, treatment and triage planning, while teams that do not include physicians as responders and rely on nurses and others only are referred to as Rapid Response Teams (RRTs). These nurse-led RRTs often have physician consultation available but the physician does not respond to the bedside as a member of the initial response. RRTs often provide an intermediate range of capability since nurses cannot write orders for therapy. An exception to this is the Nurse Practitioner in the US, who can write a range of orders. As such, true RRTs are able to assess and provide some level of stabilization but if needs and resources are severely out of balance, the patient is likely to require triage to a higher level of care. Teams that provide follow-up service and surveillance on patients discharged from the ICU on a regular basis, as well as response to any general ward patient that may or may not have been in an ICU previously, are described as Critical Care Outreach Teams. These teams are often staffed by nurses and therefore their response to deteriorating patients would be an RRT-type response team. Other terms, such as Patient-at-Risk Team, may be used as the local name for the program and hospitals may choose to call their system an RRT even though it has physicians as responders; such names should only be for local use and should be avoided in the literature. So that proper comparisons may be made, the preferred nomenclature should describe the response component of the RRS as an MET, RRT or CCOT-based on these consensus definitions.

As mentioned previously, another important terminology distinction to consider is the difference between the process of recognition that the patient is deteriorating and that of the teams that respond. The process and criteria used for triggering the call for help is called the Afferent Limb, while the response to that call, the team, is the Efferent Limb. While both work in concert as a system, their separate nomenclature and consideration is important. Many think of the Efferent Limb as the RRS but the Afferent Limb is equally important, if not more so since this is where the recognition is made that the patient needs help. Providing a responding team is of less benefit if the patient has already progressed to the point where arrest is imminent; the earlier the recognition is made, the better. Some have argued that it may not even matter who comes to help the patient (a critical care team, a hospitalist team or the primary service) as long as it is recognized that help is needed early enough to make a difference. The importance of early recognition was addressed by the first Consensus Conference on Medical Emergency Teams and then further emphasized by the special Afferent Limb Consensus Conference convened ahead of the third International Conference on Medical Emergency Teams. In these forums, the question of how RRSs might improve their identification of seriously ill general ward patients was considered and debated. The report of the first Consensus Conference⁵² indicates that RRS should use clear methods of detection for identifying “emergent unmet patient needs” and deteriorations. Objective criteria are preferred and several identification systems exist, including direct vital sign parameters and various scoring systems.^{52,64–81} The upcoming report of the Afferent

Limb Consensus Conference suggests that technological solutions are going to be essential to better monitoring and detection in the mostly ambulatory general ward patient population but that we still are struggling to determine what best needs to be monitored and how. This is an area of very active research with many exciting possibilities likely to result in the next few years.⁸²⁻⁸⁴

The Efferent Limb also continues as an area of active research. New education modalities and strategies such as simulation are being used to improve team performance and function and prepare teams for unusual or rare scenarios. The kind of team that makes up the Efferent Limb probably does matter - not so much by what their title is, but rather by how well they are prepared and how well they work as team members.⁸⁵⁻⁸⁷

Summary

RRSs have grown substantially since their inception almost two decades ago to become a robust strategy for improving patient care and healthcare culture. Clinicians who support these initiatives have striven to be evidence-based and thorough, resulting in an ever-expanding body of literature and experience that points to RRSs as a successful systems-based solution to the problem of deteriorating general ward patients and the imbalance of resources necessary to care for them. Clear definitions and nomenclature have aided this process. By working to improve the Afferent and Efferent Limbs of RRSs through methods best suited to their uniqueness and melding them into an effective system, RRSs can continue to be a developing and dynamic patient safety and quality of care improvement paradigm.

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