Editorial

Rapid Response Systems: A Mandatory System of Care or an Optional Extra for Bedside Clinical Staff?

In this issue of The Joint Commission Journal on Quality and Patient Safety, two articles go to the heart of the dilemma of rapid response systems (RRSs)—implementation of RRSs in the face of literature that does not provide an overwhelming mandate. Each group provides a solution that it considers applicable for its organizational context: Lobos et al. adopt a wide-ranging marketing plan translating the methodology from the commercial world, while Jones et al. simply changed their RRS policy to mandate its use. Lobos et al. provide a descriptive review of the implementation of an RRS system in four children’s hospitals in Ontario, Canada. They report an RRS activation rate of 44 per 1,000 admissions for the first two years of implementation, which was associated with a significant reduction in cardiac arrest events and pediatric intensive care unit (PICU) mortality following unplanned PICU admission. Detailed results are to be published shortly. In their article on efforts to make RRS activation mandatory, Jones et al. report a 34% increase (p = .0003) in monthly activation and a 32% decrease (p = .0022) in the incidence of monthly cardiac arrest calls. Unfortunately, the authors provide no data on the rate of compliance with the mandatory RRS policy. What is common to these two articles is the attempt to demonstrate the effectiveness of the respective strategy by showing increased utilization of the RRS, however, neither article contributes to the “evidence-gap” dilemma by showing significant and overwhelming evidence of an improvement in clinical outcomes—that is, the clinical case for RRSs.

Despite the lack of definitive clinical evidence for implementation, RRS uptake on a global basis is widespread and probably irreversible. These articles highlight the question of whether the issue of the effectiveness of RRSs needs to be addressed first to determine the degree of compulsion that needs to be applied to implement such a system of care. Or do we just need a compelling face-validity argument for bedside clinical practitioners to adhere to a policy such as RRSs? This is where the whole debate on the implementation of RRSs gets into trouble. As stated, the literature provides no clear mandate for the effectiveness of RRSs; what we have instead is a plethora of single-hospital historically controlled case studies, one prospective randomized controlled study, one meta-analysis, and several reviews. The “executive summary” of these studies is that, with one exception, in institutions where an RRS has been implemented by early adopters—and, as such, enthusiasts—the results have been positive. However, when the RRS intervention was subject to more rigorous scrutiny—as in the only prospective randomized controlled study—there was no statistically significant difference in outcomes between the intervention and control hospitals. Not surprisingly, the net result from the various reviews has been equivocal.

A compelling face-validity argument for RRS implementation from the perspective of the bedside clinical staff should be so irrefutable that, in effect, a randomized controlled trial would not be needed to prove the point. For example, the face-validity argument for the use of intravenous fluids and antibiotics for the treatment of septic shock is obvious and has not been considered to be required to be put under the scrutiny of a randomized controlled study. The same logic applies to the management of pain with analgesic drugs. However, this same logic or face-validity argument does not necessarily apply, we contend, to the implementation and activation of an RRS.

First, clinical staff, even when trapped in their patients’ “clinical futile cycles,” are so indoctrinated by the traditional hierarchical model of care that broaching it by calling the RRS might be seen as heresy. Second, and possibly more importantly from the bedside-staff perspective, most patients in the general-ward environment who fulfill RRS activation criteria do...
in fact get better by themselves with either no or minimal inter-
vention.24 In other words, the positive predictive value of cur-
rent RRSs’ call activation criteria is just too low for this system
of care to be “sold” to the bedside clinical staff.17–19

So what is the state of play for the RRS movement? First,
there is clear evidence in the literature and a strong face-
validity argument that patients should not die by way of cardiac
arrest in hospital. The evidence is that patients who have such
events invariably have prolonged documented periods of clin-
ical instability before the cardiac arrest25–32 and that survival from
in-hospital cardiac arrest is low.33–36 The face-validity argument
is that death by cardiac arrest is an unsatisfactory and undigni-
fied experience that can be avoided either by earlier resuscita-
on or by the institution of “not for resuscitation” orders and
appropriate palliative care. Second—and on the other hand—
we have a body of literature that suggests that you if you imple-
ment an RRS, the rapid response or medical emergency teams
are going to be busy and still may not prevent all unnecessary
undesirable clinical events.17–19 This may result in an unsatisfac-
tory RRS experience for bedside clinical staff, as reflected in the
following actual comments: “The patient didn’t really need the
response anyway,” “The patient got better without the
response,” or worse, “The RRS team treated me as if I didn’t
know anything!” Such comments suggest organizational cul-
tural issues that we need to know more about.

Is there any middle ground for all of this, and if not, what
needs to be done to get some resolution? In a post hoc reanaly-
sis37 of the data from the MERIT (cluster randomized con-
trolled trial of medical emergency team implementation) study,
the authors concluded that there was a dose response with RRS
across both the hospitals randomized to intervention and con-
trol. For every 10% increase in the proportion of early emer-
gency team calls to the bedside, there was a 2.0 reduction per
10,000 admissions in unexpected cardiac arrests (95% con-
fidence interval, –2.6 to –1.4) and a 0.94 reduction in unexpect-
ed deaths (95% confidence interval –1.4 to –0.5). In other
words, what seemed to matter was not whether your hospital
had an RRS but that unwell patients in the ward area were seen
promptly by some sort of clinical response that had the compe-
tency to deal with such situations. Conversely, and supporting
this dose-response relationship, in the original MERIT data,15 it
appears that in a large number of instances where the compos-
ite outcome occurred, and that despite the patient having RRS
criteria, the staff for whatever reason simply just did not call the
RRS—that is, the randomized treatment was not administered.
For example, for patients in the RRS hospitals who had a car-
diac arrest and who met RRS calling criteria > 15 minutes
before the arrest, the RRS team was not called before the car-
diac arrest in 30% of the instances. Likewise, for unplanned ICU admission and unexpected hospital death, the respective
incidence of failure to call the RRS was 51% and 50%, respec-
tively. This information leads us to the conclusion that the
effectiveness or otherwise of the RRS rests purely and simply on
the effectiveness of its implementation and administration.

Lobos et al.1 and Jones et al.2 tackle the implementation dif-
differently. Lobos et al. took a bottom-up approach with what in
effect was a socialization program of the RRS with a marketing
approach that went out to the end users of the RRS. On the
other hand, Jones et al. took a top-down approach to their
decaling incidence of RRS activations by using clinical leaders
and champions to advocate for a change in policy to make acti-
vation mandatory. Both of these approaches are needed. Finally,
we should not forget that any change in a complex culture such
as that found in a hospital system takes time, as reported recent-
ly by one of the original hospitals that was randomized to inter-
vention in the MERIT study.29

References
2. Jones C.M., Bleyer A., Petre B.: Mandatory rapid response improves quali-
3. State Government of Victoria, Australia, Department of Health: Implemen-
ssl/interventions/rrs.htm (last accessed Apr. 23, 2010).
5. Institute for Healthcare Improvement: Overview of the 5 Million Lives
6. Clinical Excellence Commission: Programs Between the Flags: Keeping
7. Buist M.D., et al.: Effects of a medical emergency team on reduction of inci-
dence of and mortality from unexpected cardiac arrests in hospital:
8. Bellomo R., et al.: A prospective before and after trial of a medical emer-
By the early 1990s, it had become clear that despite decades of emphasis on the development of specialized resuscitation teams, overall survival for patients who experienced a cardiorespiratory arrest in the hospital remained low. Reports suggesting that cardiorespiratory arrests were often preceded by signs of physiologic instability led hospitals in Australia in the late 1990s to begin developing “medical emergency teams” to respond to patients before actual cardiorespiratory arrests occurred. Similar initiatives to provide earlier critical care services to potentially unstable patients in the United Kingdom resulted in “patient-at-risk teams” and “critical care outreach services.” The concept spread to the United States, where some early adopters used the term “rapid response team.” Before-and-after implementation studies of these and other programs suggested that rapid response systems (RRSs) could reduce unexpected cardiac arrests, decrease patients days in intensive care units (ICUs), and even improve hospital survival.

In 2004, an RRS was developed at Wake Forest University Baptist Medical Center, an 872-bed academic medical center located in northwest North Carolina. The system was designed by a group of nurses and physicians to improve performance on the Agency for Healthcare Research and Quality’s Failure to Rescue Patient Safety Indicator. The goals for the new system were as follows:

1. Earlier recognition of patients who were not responding to treatment or who had developed complications
2. Improved communication between nursing staff and physicians caring for those patients
3. “Rapid response nurses” to provide critical care nursing care to suddenly ill patients on medical-surgical nursing units on a consultative basis when requested by either nurses or physicians

An early detection and intervention committee [chaired by C.M.J.], with representation from nursing [including B.P.], the medical staff, and hospital administration, was established to provide oversight for the new RRS. In 2008, this oversight committee recommended a change in policy to make RRS activation mandatory for any patient who met the established criteria. This article describes the evolution of our system from its original design to its current state as a required component of patient care.

### RRS Development

The initial goal of earlier recognition of potentially unstable patients was addressed by the development of an adult trigger tool that could be used by bedside nursing staff during routine monitoring of vital signs. These physiologic instability criteria (Table 1, below) were established on the basis of published studies. Hang tags that could be attached to employee identification badges were created listing the criteria and were distributed to all nursing staff for quick reference. A policy on tagging numeric pages to physicians with *999 was established to distinguish pages about potentially unstable patients from routine calls. Experienced critical care nurses were hired to respond, along with the patients’ on-call physician, to the bedside of patients meeting the physiologic instability criteria. To avoid conflicting responsibilities, the designated rapid response

### Table 1. Wake Forest University Baptist Medical Center Adult Physiologic Instability Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
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<tbody>
<tr>
<td>Temperature</td>
<td>&lt; 95°F or &gt; 102°F (oral)</td>
</tr>
<tr>
<td></td>
<td>&lt; 96°F or &gt; 103°F (rectal)</td>
</tr>
<tr>
<td>Respiratory Rate</td>
<td>&gt; 35 breaths/min for &gt; 30 min</td>
</tr>
<tr>
<td>Oxygen Saturation</td>
<td>&lt; 90% with supplemental oxygen</td>
</tr>
<tr>
<td>Arterial Blood Gas</td>
<td>pH &lt; 7.25 pCO₂ &gt; 60 pO₂ &lt; 50</td>
</tr>
<tr>
<td>Heart Rate</td>
<td>&lt; 40 or &gt; 130</td>
</tr>
<tr>
<td>Systolic Blood Pressure</td>
<td>&lt; 85 mm Hg or &gt; 200 mm Hg</td>
</tr>
<tr>
<td>Acute change in mental status</td>
<td>agitation, restlessness or acute decrease in Glasgow Coma Scale ≥ 2</td>
</tr>
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For editorial, see pages 266–280.
nurse has no other patient care assignments. Simultaneous calls were managed in order of priority on the basis of telephone triage by the rapid response nurse.

**RRS Monitoring and Improvements**

Since the inception of the RRS, the early detection and intervention committee has monitored all RRS operations, including call volume and type, on a quarterly basis. The responding nurse logs all response calls and enters them into a rapid response database. The code blue committee (1) provides feedback on the number of cardiorespiratory arrests and their location in the hospital and (2) reviews all emergency situations in which the code blue team is paged overhead or a code cart has to be restocked to determine if an actual cardiorespiratory arrest has occurred. The mortality committee provides additional information about the timeliness and effectiveness of the RRS on the basis of chart review of all deaths.

Over time, a number of process improvements have been made to the RRS to enhance performance. The early detection and intervention committee developed protocols for diagnostic testing, supplemental oxygen, bronchodilators, and fluid resuscitation for situations in which the rapid response nurse arrived at the bedside before the on-call physician. Automatic activation of the RRS nurses in response to transfer requests to the ICUs was implemented, and the nurses were included as members of the code blue team. In December 2005, in response to increases in call volume, RRS nurse staffing was increased from one to two nurses working 24 hours a day, seven days a week so that two calls could be handled simultaneously.

**Making Rapid Response Mandatory**

Monthly rapid response calls initially increased steadily, peaking at 106 calls per 1,000 admissions in March 2006. In early 2008, a decrease in the annual number of calls from 88 per 1,000 admissions in 2006 to 73 per 1,000 admissions in 2007 was noted, a reduction of 17% (Figure 1, above). At this point, the early detection and intervention committee suggested a policy change to require rapid response activation for all patients meeting the physiologic instability criteria. RRS physician champions, including the chairman of the mortality committee and the chief of professional services, presented the proposed policy at medical staff committees. The nurse managers for the RRS and emergency resuscitation services presented the policy to the nursing leadership and quality councils. Case presentations demonstrating delays in care were particularly effective in swaying opinion for physicians and nurses. The policy was officially approved by the medical center’s quality of care council in April 2008.

The RRS physician champions provided updates on the new policy to housestaff and all attending physicians at grand rounds and other educational forums. Pocket-sized instructional brochures listing the physiologic instability criteria with references to the relevant medical literature were prepared and distributed to new housestaff. The rapid response nurses themselves were enlisted to provide training for floor nurses on the new policy and in-service education on the physiologic instability criteria. New instructional cards (Figure 2, page 268) were prepared and attached to all vital sign–monitoring equipment on the nursing units. Mass e-mails were sent to all physicians and nurses in May 2008 announcing the official implementation of the new policy.

**Results**

Rapid response calls adjusted for the number of admissions on the medical-surgical nursing units increased substantially during the course of the year (Figure 3, page 269). In the first five months of 2008, before implementation of the new policy, the
The number of rapid response calls per month averaged 243. The average calls per month increased to 326 after implementation of mandatory rapid response activation—a 34% increase in the number of calls ($p = .0003$). During the same time period, the average number of cardiorespiratory arrests on the floors decreased from 13.4 to 8.7 per month (Figure 4, page 269)—a 35% decline ($p = .0022$). In general, months with more rapid response calls also had fewer cardiorespiratory arrests (Figure 5, page 270).

**Discussion**

RRSs have been embraced as an important strategy in improving health care quality, as seen for example, in the Institute for Healthcare Improvement’s 5 Million Lives Campaign. Foraida et al. have shown how process interventions can alter both the call rate as well as the culture of managing crises in hospital.

Yet reviews of published studies of rapid response have documented wide variation in the rates of utilization between institutions. Although our RRS could be activated by any health care professional involved in the care of a patient, the majority of the calls were made by bedside nursing staff. Studies at other institutions have suggested that although nurses generally have favorable impressions of rapid response, they may still be reluctant to initiate a call. Fear of criticism after activation is a barrier for some nurses, but more commonly, nurses indicate that they just prefer calling the patient’s physician first. Our policy of mandatory activation was intended to eliminate any fear of criticism on the part of nurses who initiated calls. The inclusion of the patient’s on-call physician as a member of the RRS increased acceptance by nurses and physicians of the mandatory activation policy.

Another problem in utilization that has been documented in institutions with mature RRSs is the simple failure to activate the system in a timely fashion. Rigorous continuing education in recognition of potentially unstable patients and how to activate the RRS has been proposed as the solution for this problem. The implementation of our new policy of mandatory activation was achieved by numerous educational interventions with nurses and physicians, which were likely as important as the policy itself in increasing use of the RRS at our institution. In fact, the number of rapid response calls actually began increasing when the policy was being introduced but before it officially took effect.

Monitoring utilization rates over time, with feedback to appropriate physician and nurse leaders, was recognized as a useful way to improve the effectiveness of one of the first medical emergency teams—in Australia. Without a process for tracking rapid response calls, we could easily have failed to recognize the 17% decrease in calls that triggered the initial discussions of our new mandatory activation policy. Reports showing the subsequent increase in calls and declines in cardiorespiratory arrests on the floor have served to demonstrate the effectiveness of the policy, providing further positive reinforcement for calling rapid response whenever the physiologic instability criteria are met. Although we were unable to track failures to activate rapid response at all, delays were tracked by the rapid response nurses and subsequently reported to nursing unit managers for appropriate disciplinary action. Failure to activate the RRS at all was explicitly monitored by the mortality committee.

The failure of both a large randomized clinical trial and a recent meta-analysis of 18 published studies to demonstrate a reduction in mortality attributable to RRSs has led some to
question the overall benefits of the programs. However, because subsequent analysis of the randomized control data suggests that increased utilization is associated with significant reductions in unexpected deaths, it may be that the failure of the other studies in aggregate is related to underutilization rather than lack of an RRS effect per se. Clearly, having an RRS in place cannot be expected to affect mortality if it is not consistently used for the patients who might benefit. The extreme variability in the reported number of rapid response calls per 1,000 admissions, which have ranged from less than 1 to more than 40, suggests that the study institutions may not have consistently deployed their RRSs. Our institution has achieved higher utilization rates than reported by others both before and after implementation of our new policy. Further studies will be needed to determine the optimal utilization and the true effects of RRSs on mortality.

Conclusions
Despite a well-established RRS with explicit physiologic instability criteria to help trigger appropriate utilization and the deployment of dedicated, experienced critical care nurses providing a high level of nursing care for deteriorating or unstable patients, the number of rapid response calls at our institution decreased after an early period of enthusiasm and an initial steady increase in the number of calls. A new policy requiring mandatory rapid response activation for all patients who met physiologic instability criteria, initiated four years after the RSS’s inception, significantly increased the number of rapid response calls. We believe that the reduction in cardiorespiratory arrests outside of critical care areas that was associated with higher utilization of rapid response is an important improvement in quality of care regardless of the effect on overall mortality. The patients with evidence of physiologic instability receive a higher level of nursing care than would otherwise be possible, including early transfer to critical care if
appropriate. Other patients also benefit by not having their nursing care interrupted or reduced by their nurses needing to respond to emergency situations.}

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Catherine M. Jones, M.D., M.S., is Associate Professor of Internal Medicine, and Chief, Section on General Internal Medicine, Department of Internal Medicine, Wake Forest University School of Medicine, Winston-Salem, North Carolina. Anthony J. Bleyer, M.D., is Professor of Internal Medicine, Section on Nephrology, Department of Internal Medicine, Wake Forest University School of Medicine. Becky Petree, R.N., is Rapid Response Nurse Manager, Department of Nursing, Wake Forest University Baptist Medical Center. Please address correspondence to Catherine M. Jones, cmjones@wfubmc.edu.

References

Ontario is home to more than 13 million people, or roughly one third of Canada’s population. In 2006, the Ministry of Health and Long-Term Care (MOHLTC) of Ontario funded a demonstration project to test the rapid response system (RRS) concept as part of the provincial critical care strategy to improve critical care services in four pediatric hospitals. Although many studies have described the implementation of a pediatric RRS in one hospital, this is the first report to describe the standardized implementation of an RRS using a medical emergency team (MET) across four pediatric hospitals. This article describes a multicenter standardized approach to implementation and promotion that used social marketing principles and shares the lessons learned from this project. In the article we highlight the four important elements of an RRS, discuss the standardized training of MET providers, and describe the use of social marketing principles to promote the RRS and barriers to its implementation.

Setting
The four academic hospitals are as follows:

- The Hospital for Sick Children (HSC; Toronto) and Children’s Hospital of Eastern Ontario (CHEO; Ottawa) are free-standing pediatric hospitals. HSC, affiliated with the University of Toronto, has 300 beds and 32 intensive care beds and provides cardiac surgery, solid-organ and bone marrow transplantation, and rapid deployment extracorporeal cardiopulmonary resuscitation. CHEO, affiliated with the University of Ottawa, has 166 beds, 10 intensive care beds, and a cardiac surgery program.

- McMaster Children's Hospital (MCH; Hamilton) and Children's Hospital London (CHL; London) are pediatric hospitals within adult hospitals. MCH, affiliated with McMaster University, has 120 pediatric beds with 8 intensive care beds. CHL, affiliated with the University of Western Ontario, has 60 beds with 8 intensive care beds and provides renal, liver, and small-bowel transplantation.

There are more than 27,700 pediatric hospital admissions and 3,500 pediatric intensive care unit (PICU) admissions per year across the four centers. All centers have in-house PICU fellows, and none have overnight in-house hospitalists or in-house PICU attendings.

Implementing the Pediatric RRS Project
Following the introduction of an MOHLTC–funded RRS into adult hospitals in Ontario in 2005, the MOHLTC decided to trial a pediatric RRS project to determine whether it improved safety and quality of care. In Spring 2006, as part of their strategy to improve critical care services, leaders at the MOHLTC planned the project with pediatric critical care physician leaders. The goals of the project included determining the effect of a pediatric RRS using a physician-led MET on the rates of hospital code blue events (defined as any activation of the code blue team), unplanned PICU re-admissions, and PICU mortality following unplanned admissions. The physician leaders and the MOHLTC agreed to implement the RRS in three phases (Figure 1, page 272). Each phase included the essential “limbs” for successful RRS implementation, as follows: the administrative component, the afferent (the event detection and response triggering) component, the efferent (crisis response) component, and the process improvement component.

During Phase 1, site champions were recruited and outcome measures were further defined. In addition, the RRS concept was promoted using social marketing principles, and MET providers were recruited and trained according to a pre-agreed standardized educational program.

During Phase 2, the pediatric RRS, which used a physician-led MET, was piloted from Monday to Friday, 8:00 A.M.–4:00 P.M. (8:00–16:00) for three months, providing time for revision of services on the basis of feedback from user groups.

Phase 3 began on January 29, 2007, with the MET available 24 hours per day, 7 days per week.
A MULTICENTER RRS ADMINISTRATION

Research suggests that project champions are essential to the overall success of a safety change initiative and must be able to advocate effectively, build organizational relationships, and understand their organizational culture. To emphasize the importance of interprofessional collaboration, physicians, registered nurses (RNs), and respiratory therapists (RTs) were recruited as site leaders. All physician site leaders were PICU attending physicians and were chosen on the basis of their academic interests in education and collaborative interprofessional practice. RN and RT site leaders were required to have significant clinical experience in pediatric critical care and excellent knowledge of adult learning principles with previous teaching experience.

The site leaders met every two months in person and by monthly teleconference during the first three months and every two weeks during the last three months of Phase 1. During these meetings, the site leaders discussed their roles, the development of the efferent and afferent components and promotional strategies, and data collection and quality improvement strategies.

STANDARDIZING THE RRS AFFERENT COMPONENT: SOCIAL MARKETING IN HEALTH CARE

Changing the hospital culture and professional roles are considered major challenges to effective RRS implementation. Given the significant cultural change required for an effective RRS, the site leaders employed the principles of social marketing to introduce and sustain the RRS concept. Social marketing, the central focus being “social good,” was considered an ideal conduit to achieve the RRS project’s objectives. Social marketing emphasizes social responsibility and the benefits of adopting change. Using social marketing, the site leaders stressed that adopting the RRS by using the physician-led MET was socially responsible because it improved efficiency and safety in the management of sick children. In addition, site leaders highlighted the benefits to the user, the health care provider, such as improved interprofessional support, education, and improved patient care. The social marketing principles used by all site leaders provided a conceptual framework to link system-level goals and process-level performance and are discussed in the following sections.

The social marketing strategy conformed to a standardized framework that consisted of (1) market research and contextualization, (2) definition of measurable objectives, and (3) marketing strategy.

1. Market Research and Contextualization. The RRS project was designed to favorably influence health care quality and safety. During Phase 1, site leaders reviewed the target market (health care providers and nonclinical multidisciplinary teams) to inform their decision making regarding objectives (RRS integration), message positioning (“What communication

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**Figure 1.** Each phase of the multicenter pediatric RRS included the essential “limbs” for successful RRS implementation, as follows: the administrative component, the afferent (the event detection and response triggering) component, the efferent (crisis response) component, and the process improvement component. MET, medical emergency team.
channels can the institutional RRS access to reach specific user groups?"), and message delivery ("What are the best means of getting the RRS concept across?"). To facilitate this, we (the nine site leaders [including A.-T.L, J.G., R.G., and A.K.] and a social marketing expert J.C.) divided our promotion strategy into "user" components ("What personal barriers exist to prevent the health care providers from activating the RRS using the physician-led MET?"), and "system" components ("What institutional barriers prevent activation of the RRS using the physician-led MET?"). User and system components were addressed using a pre-implementation survey, which was sent by mail or e-mail to 1,066 health care providers, including nurses, attending physicians, residents, and allied health care providers. The survey addressed both the need for an institutional RRS service and the gaps in current services, such as the care providers. The survey was designed to provide the site leaders with valuable insight into the user group's beliefs, needs, and culture. As anticipated, the most significant perceived barriers to implementation were the historical doctor-patient relationship and concerns about communication between the physician-led MET and the primary medical team.

The survey revealed that almost one third of responders did not feel supported by their superiors to activate the RRS and that a similar proportion worried about the communication between the MET and the primary medical team. Given the survey results, site leaders decided that it was essential to strengthen the case for adopting the RRS by engaging both clinical and nonclinical stakeholders in the planning of RRS implementation through RRS partnerships. System factors that were not identified during this preliminary process were subsequently identified as the project developed (Table 1, right).

2. Definition of Measurable Objectives. During Phase 1, the site leaders met every two months on objectives that were reliable and reproducible indicators of the RRS concept. We also agreed on a transparent process of data collection and, on the basis of the objectives, surrogate and objective indicators. Our efforts focused initially on increasing awareness and early adoption of the RRS and then later on maintaining RRS uptake and encouraging late adopters of the service.

3. The RRS Social Marketing Strategy. To achieve our objectives, we deployed an RRS marketing strategy, which consisted of six key components. This social marketing strategy provided unique insight into the requirements of the users through engagement and ownership, which helped us to define the approach to facilitating behavioral change—in this case, service uptake of the RRS using a physician-led MET.

a. The RRS Product. There were challenges in addressing the RRS service's "tangible" and "intangible" benefits. Tangible attributes were identified as (1) overall reduction in hospital mortality and morbidity rates and (2) education, debriefing, bedside teaching, ward-based feedback sessions, and hospital-wide formal teaching sessions (grand rounds, institutional education days). There were numerous intangible benefits, as seen in Phases 2 and 3, that were often user specific, such as (1) access to immediate acute care opinion—that is, response within five minutes of activation; (2) facility for provision of additional reassurance to parents; and (3) reinforcement of current ward-based management plans.

b. The RRS Price. The site leaders viewed the "price" of adopting the RRS by activating the physician-led MET as the consequence the health care provider may face by activating the service. We felt that if the perception of benefits to both the patient and the user were greater than perceived consequences (for example, concern about communication between the primary medical team and the MET), increased MET utilization was more likely. We therefore actively addressed the benefits and potential consequences of MET activation through a variety of educational platforms (for example, bedside teaching, institutional grand rounds). The message was twofold: Adopting the RRS by activating the physician-led MET would
not only improve patient safety, care, and process efficiency but would also provide access to skilled acute care providers, who would provide interprofessional support and on-the-spot education. We addressed the potential consequences of MET activation (for example, physicians’ concern about their role in the care of their patient, nurses’ worry about communication and access to the MET) through the engagement of multidisciplinary health care providers via ward-based feedback sessions, the introduction of simultaneous paging of the MET and the physician responsible for the patient, and the introduction of an easy activation process through “one number to call.”

c. The RRS Place. In social marketing, the “place” refers to how contact is made with users. To market the RRS concept, site leaders used “active” communication channels (interprofessional education days, institutional research days, and ward visits) to engage ward health care providers. “Passive” communication channels consisted of multifaceted media campaigns, including institutional intranet, the Internet, posters in all areas (clinical/nonclinical), and in-house publications.

d. The RRS Promotion. The promotion of the RRS concept was the most tangible component of our social marketing strategy. By increasing acknowledgement of institutional demand and patient benefit from using the RRS by activating the physician-led MET, the site leaders focused on sustaining RRS message uptake by ultimately substituting services and simplifying processes. Monthly MET activity and activation rates served as surrogate markers of service engagement and continued to inform our overall marketing activity. Our promotion policy consisted of the integrated use of advertising, public relations, media advocacy, in-house promotion, intranet, and “personal selling” (Table 2, right). The site leaders developed patient and family brochures, which were available on all patient wards and featured language appropriate to the local sociocultural environment. Promotional materials, including calling cards, posters (Figure 2, right), pens, buttons, stickers, and staff brochures, were visible and available around all hospitals in patient rooms, clinics, and wards. We considered branding essential because it provided a consistent message with regular reinforcement; even clothing was designed with site-specific designation for easy recognition of MET providers. The site leaders also developed an RRS Web site on their hospital’s intranet, which detailed activation criteria, communication, and educational resources. The RRS concept was also promoted at each site through local hospital publications and telethons.

e. The RRS Publics. Our marketing strategy focused on both external (stakeholders, secondary audiences) and internal

<table>
<thead>
<tr>
<th>Promotion Medium</th>
<th>Product Used</th>
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<tbody>
<tr>
<td>Active Advertising</td>
<td>Call criteria collection charts</td>
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<tr>
<td>Educational</td>
<td>Lectures and teaching</td>
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<tr>
<td>Personal Promotion</td>
<td>Personalized call cards</td>
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<td>Personal Selling</td>
<td>Daily ward-based visitations</td>
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<td>Passive Advertising</td>
<td>MET provider t-shirts</td>
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<td>Media Advocacy</td>
<td>Hospital magazine publications</td>
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<tr>
<td>Web-Based</td>
<td>Hospital intranet</td>
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* MET, medical emergency team.

Figure 2. The promotion poster for the rapid response system and the medical emergency team, SPOT, as it was branded, at the Children’s Hospital of Eastern Ontario (CHEO). © 2006 Children’s Hospital of Eastern Ontario.
“publics” (MET providers; Table 3, above). To cover the external publics, the RRS was promoted by formal and informal presentations to every stakeholder and user group, including ward health care providers, residency and fellowship programs, patient safety committees, hospital management, and medical and nursing executives. Each presentation, customized to the specific audience, highlighted the purpose and structure of the RRS and evidence supporting its use. To target as many health care providers as possible, site leaders also organized informal lectures and interactive sessions, including question-and-answer sessions, ward “lunch and learns,” and “education coffee carts,” all of which were provided by site leaders and some MET providers. During Phases 2 and 3, site leaders and MET providers also provided feedback on MET activity and overall RRS performance to ward health care providers through “Celebrating Our Successes” campaigns. This was an essential component of engaging our publics because it significantly contributed to the establishment of personal rapport and clinical confidence in the MET and the RRS concept as a whole. Educational programs, designed and provided by site leaders, were also considered essential in reaching internal publics. The day-long lecture- and simulation-based programs, which were scheduled at least four times throughout the year, were aimed at the wider multidisciplinary audience. They were intended to enhance health care providers’ ability to anticipate and recognize the acutely ill child, activate the MET, and communicate with consistency using the Situation-Background-Assessment-Recommendation (SBAR) technique.\textsuperscript{14,15} Participants were asked to submit feedback about their experiences during the educational program (Table 4, above). At local monthly meetings, the site leaders, drawing on input from the MET providers, reviewed the extent of the publics’ engagement. Engaging the MET providers was intended to engender teamwork and ownership and to further the perceived need for continued success.

f. The RRS Partnerships. To embrace the cultivation of RRS partnerships, the site leaders created local advisory committees, which consisted of representatives from nursing groups—clinical (ward, specialist, educational) and nonclinical (management), allied health care providers (respiratory therapy), and medical groups (staff physicians and residents). Including all user groups in the partnership plan was intended

<table>
<thead>
<tr>
<th>Market Segment</th>
<th>Promotion Medium*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholders</td>
<td>Internal mail (passive), intranet (active), lectures (passive) Word of mouth (passive), media advocacy (passive)</td>
</tr>
<tr>
<td>Advisory Committee (external working group)</td>
<td>Internal mail (passive), lectures (passive), daily meetings (active) Media advocacy (passive), staff survey (passive), teaching (active)</td>
</tr>
<tr>
<td>PICU Attendings, Fellows, and Interprofessional Staff</td>
<td>Internal mail (passive), word of mouth (passive) Media advocacy (passive), personal selling (passive)</td>
</tr>
<tr>
<td>Internal Working Group</td>
<td>Self-promotion (passive), educational sessions (active) Monthly staff meetings (active), daily meetings (active)</td>
</tr>
<tr>
<td>Hospitalwide Health Care Providers (end users)</td>
<td>Internal mail (passive), lectures (passive), media advocacy (passive) Staff survey (passive), teaching (active), debriefing sessions (passive) Personal selling (passive), advertising (passive)</td>
</tr>
</tbody>
</table>

*Active/passive: Refers to role the segment has to obtain the “message.” PICU, pediatric intensive care unit.

<table>
<thead>
<tr>
<th>Comment</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>“... enjoyed the MET education day... should have been a couple of days longer.”</td>
<td>RN†</td>
</tr>
<tr>
<td>“All facilitators were extremely knowledgeable and I appreciated the hands-on opportunities... One of the best learning activities I have participated in—ever.”</td>
<td>RN</td>
</tr>
<tr>
<td>“I felt so comfortable participating and not feeling as though I was being judged saying the wrong answer, but felt confident to learn.”</td>
<td>RN</td>
</tr>
<tr>
<td>“Very informative because I find as an RPN, I do not get exposed to a lot of the things that we talked about today.”</td>
<td>RPN</td>
</tr>
</tbody>
</table>

* RRS, rapid response system; MET, medical emergency team; RN, registered nurse; RPN, registered practical nurse.
† In response, the education day was revised and condensed to provide more hands-on and relevant topics on the basis of activity data.
to help ensure buy-in early on and to establish a sense of ownership through contribution to both operational and strategic RRS decisions. The advisory committee also provided a platform for expression of concerns on behalf of the wider institutional environment and proved invaluable to conflict resolution. The advisory committee communicated with the site leaders on a monthly basis through regular meetings. Any significant issues raised were subsequently communicated to each hospital’s stakeholder group (that is, chief executive officer, vice president [education and quality], chair of the patient safety committee, and chairs of pediatrics and pediatric critical care).

**Standardizing the RRS Efferent Component**

A **Standardized Education Program for MET Providers.** Recognizing the efferent limb as an essential component to an effective RRS, the site leaders agreed to standardized recruitment criteria and education of MET providers. During Phase 1, critical care RNs with at least two years’ acute care experience and RTs were recruited to join the MET. MET providers were chosen either by an interprofessional panel or through scores on an interview composed of clinical scenario stations. MET providers were required to have not only the necessary clinical skills but also the excellent communication and conflict resolution skills needed to navigate through the anticipated difficulties of implementing an RRS.

In Phase 2, RN and RT MET providers were trained using a standardized and peer-reviewed two-day Province of Ontario pediatric RRS provider course developed for the Canadian Resuscitation Institute by pediatric critical care physicians, educators, and simulation experts. Interactive large-group sessions addressed core principles of an RRS, and small-group simulation sessions with case scenarios addressed airway, breathing, circulation, and disability knowledge. High-fidelity simulation scenarios also reinforced the importance of good communication, including practicing the SBAR method of communication.

The simulation scenarios were programmed into a high-fidelity patient simulator and tested on pediatric residents for fidelity and revised accordingly before use in the course. These scenarios also focused on the importance of collaboration with the primary medical team and complex situations with families and other health care providers. The value of continuous promotion of the RRS, including encouragement and support of MET activation and tolerance of “false alarms,” was also strongly reinforced. Acknowledging the expertise of the primary medical team and the importance of including primary health care providers in MET activities were also emphasized throughout the course.

**Standardizing Delivery of Service.** Standardization of the delivery of service entailed consideration of team composition, calling criteria, the MET’s role, and other issues.

- **Team Composition.** Although there is no evidence to support what might be considered the “right” response-team composition, the site leaders agreed to implement the RRS using an MET composed of a PICU physician, a critical care nurse, and an RT. At three of the four sites—CHEO, CHL, and MCH—the MET was composed of an in-house PICU attending and resident during the day and an in-house PICU resident or fellow overnight, with a PICU attending back-up. At HSC, the remaining site, an in-house PICU fellow and resident, with a PICU attending back-up, were available 24 hours per day. The MOHLTC’s funding of the RRS enabled the RN and MD providers to be dedicated to the MET. When not directly involved in MET patient-care activities, RN and MD MET providers were involved in RRS data collection and research activities and also offered educational support in the PICU and on the ward, which included presenting interesting case rounds on the basis of their actual MET patient encounters.

- **Calling Criteria.** The MET was activated by health care providers through a dedicated pager when their patient met the calling criteria. Given the role of the MET as an adjunct service, the patient’s primary physician (attending, fellow, or resident) was also called by the hospital operator at the time of MET activation. As of 2006, when we began implementing this RRS project, the 2005 article by Tibballs et al. was the only available report on a successful implementation of a pediatric RRS, and our site leaders agreed to use their calling criteria. These criteria, as shown in Table 5 (page 277), included age-specific physiologic criteria and concern expressed by a primary health care provider or family member. At all four sites, primary health care providers activated the MET through the hospital operator if family members asked for the MET. At MCH, families could also activate the MET directly through the hospital operator. The MET arrived within five minutes of activation.

- **MET’s Role.** The health care provider who called the MET and the patient’s primary nurse and physician were included in the assessment and management of the patient. The MET assisted the primary medical team in the stabilization and transfer of patients who required PICU admission. For patients triaged to remain on the ward, the MET provided suggestions regarding diagnostic investigations and medical interventions and scheduled a follow-up visit(s) to monitor the patient’s progress with the primary medical team. The MET visited
patients until the primary medical team and MET providers agreed that the patient’s condition had improved and no longer required follow-up. Across all four sites, each activation and follow-up visit was recorded and appropriately documented in the patient’s chart. SBAR\textsuperscript{14,15} was used to guide MET documentation of a patient encounter. Each activation or follow-up visit was also seen as an opportunity for intra- and interprofessional on-the-spot learning.

All patients discharged from the PICU were followed by the MET for 48 hours. In addition, when patients seen by the MET on the ward following a PICU admission were later re-admitted to the PICU during the same hospitalization, the MET followed them after they were discharged from the PICU; re-admitted children are at greater risk of death than those with a single PICU admission.\textsuperscript{18,19} Patients were seen by the MET once in 24 hours for two days—or more frequently if the primary medical team or the MET found the patient’s condition worrisome. The follow-up of PICU discharges appeared to be unique to our RRS project; as far as we know, it has not been reported in any other pediatric study.

**Other Issues.** As reported in other studies,\textsuperscript{2–7} the MET in this RRS project was not designed to respond to patients in the emergency department, operating room, postanesthesia care unit, or neonatal intensive care unit. However, the site leaders instructed the METs to respond to all activations, regardless of location, with later review as to the appropriateness of the activation by the site leaders. All sites replaced inpatient PICU consultations with MET activations. In addition, all MET providers—physicians, RNs, and RTs—were added to each hospital’s code blue team as an extra resource to the code blue team leader. The difference between calling the code blue team, which solely responds to cardiac and respiratory arrests, and calling the MET was reinforced with all health care providers on posters, on the local intranet, and through presentations.

**STANDARDIZING THE PERFORMANCE INDICATORS AND QUALITY IMPROVEMENT COMPONENTS**

The site leaders and a database expert created a standardized data collection tool and database that tracked RRS project adoption through MET activity across the four sites.

**Terminology.** The site leaders also agreed on common RRS terminology of MET activity and used the term activation to describe an MET call. Unlike previous studies,\textsuperscript{2–7} code blue events were defined “as any activation of the code blue system”; the site leaders felt that each activation of the code blue system represented a call to an acutely deteriorating child. Code blue event data from the emergency department, operating room, postanesthesia care unit, and neonatal intensive care unit were excluded. Similar to Brilli et al.,\textsuperscript{7} cardiorespiratory arrests were defined as “any event that required chest compressions or positive pressure ventilation > 30 seconds or intubation or IV [intravenous] epinephrine.”

**A Central Database.** To demonstrate the effectiveness of the RRS project, data from hospital and code blue event databases were extracted for two years before (October 31, 2004–October 31, 2006) and during implementation of the RRS (January 29, 2007—present). For all activations, the indication, time, place, and activating profession were recorded. For activations and follow-up visits, the patients’ vital signs, clinical examination findings, interventions performed by the MET, and patient’s disposition were also recorded. The PRISM (Pediatric Risk of Mortality) score obtained from clinical findings and laboratory assessment (and shown to predict PICU mortality probability\textsuperscript{20}), was collected for all patients admitted to the PICU from the ward. Data were also collected on all-cause hospital mortality, the total number of re-admissions and unplanned admissions to the PICU, and the mortality of any unplanned admissions to the PICU from the ward.

The outcome and activity data from each hospital were detailed in a report that the site leaders submitted biannually to the MOHLTC.

**Program Evaluation.** Continuous evaluation\textsuperscript{21} through focus groups, activity data, and interprofessional surveys (Table 6, page 278) was used to track performance on the indicators, enabling site leaders to alter RRS implementation at any point in the project. As an example, early in Phase 2, a few of the RNs responding to the surveys suggested that they would feel uncomfortable calling the MET in the future because of negative reactions from the patient’s attending physician after they

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**Table 5. Pediatric Medical Emergency Team Triggers**

<table>
<thead>
<tr>
<th>Age</th>
<th>Systolic BP</th>
<th>Bradycardia</th>
<th>Tachycardia</th>
<th>Tachypnea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term–3 months</td>
<td>&lt; 50</td>
<td>&lt; 100</td>
<td>&gt; 180</td>
<td>&gt; 60</td>
</tr>
<tr>
<td>4–12 months</td>
<td>&lt; 60</td>
<td>&lt; 100</td>
<td>&gt; 180</td>
<td>&gt; 50</td>
</tr>
<tr>
<td>1–4 years</td>
<td>&lt; 70</td>
<td>&lt; 90</td>
<td>&gt; 160</td>
<td>&gt; 40</td>
</tr>
<tr>
<td>5–12 years</td>
<td>&lt; 80</td>
<td>&lt; 80</td>
<td>&gt; 140</td>
<td>&gt; 40</td>
</tr>
<tr>
<td>&gt; 12 years</td>
<td>&lt; 90</td>
<td>&lt; 60</td>
<td>&gt; 130</td>
<td>&gt; 30</td>
</tr>
</tbody>
</table>

Saturation < 90% or saturation < 60% in cyanotic heart disease (any amount of O2)

Acute drop in GCS by > 2

Seizures

Any health care provider or family member concern

* BP, blood pressure; GCS, Glasgow Coma Scale.

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\textsuperscript{2} BP, blood pressure; GCS, Glasgow Coma Scale.
activated the MET (Table 6). In response, at the request of the site leaders, hospital administrators asked the physicians, in their interactions with multidisciplinary staff, to convey their support of the MET and to reinforce the role of the patient’s nurse and any other ward health care providers in activating the MET. Hospital administrators also emphasized to physicians the fact that all activations were considered serious, worthwhile, and an opportunity for interprofessional education. This support from the hospital administrators improved physician attitudes, and comments from surveys distributed in Phase 3 suggested that nurses felt more comfortable calling the team.

Evaluation of the adoption of the RRS by following MET activity, the social marketing strategy, and outcome objectives was undertaken collectively (Table 7, page 279). During Phases 2 and 3, site leaders met monthly by teleconference and shared local experiences and education ideas and highlighted ways to improve the RRS. For example, although each hospital had different approval processes for developing the hospital chart form, the site leaders tackled this challenge by sharing ideas for the activation and follow-up forms and tips for successful approval. In addition, they discussed the need for an educational program targeting MET providers and discussed and designed the program to address the skill maintenance of MET providers.

Overall, RRS project evaluation was formative and summative. Formative evaluation included local and multicenter surveys describing user perception of progress and attitude change. Recently, a multicenter survey was sent by e-mail to 2,346 health care providers, including nurses, attending physicians, residents, and allied health care providers three years following implementation of the RRS. Despite a low survey response rate (25%), results suggest that responders have embraced the RRS concept, with more than 90% agreeing that the RRS, with use of a physician-led MET, improves patient safety and 94% agreeing that the RRS is a welcome support in the care of their patients. In addition, 80% of responders agreed that the MET helped their patients receive more timely intervention and helped them to manage their patients more effectively. Finally, responders also acknowledged personal benefit from the RRS;

Table 6. Multicenter Interprofessional Surveys: Comments and Impact on RRS Implementation*

<table>
<thead>
<tr>
<th>End-User’s Comments</th>
<th>Site Leader’s Comment/Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Continue to stress that it is OK to call . . . there is still a resistance to call due to physician reaction . . .”</td>
<td>Comment was from the first week of MET activity; such comments are now rare</td>
</tr>
<tr>
<td>“. . . nice to have the extra man power and for allowing other staff to make the “call” . . . education is a bonus.”</td>
<td>RN comment</td>
</tr>
<tr>
<td>“. . . do not feel our clinical judgment is questioned . . . as a nurse I feel much more supported”</td>
<td>RN comment</td>
</tr>
<tr>
<td>“Follow-ups . . . help to monitor patient and support nurse on ward.”</td>
<td>RN comment regarding benefit of MET follow-up visits</td>
</tr>
<tr>
<td>“Knowing the MET is available has really improved my comfort with call from home for the medical teams at night. One of the best improvements to patient safety in our wards in years.”</td>
<td>MD comment</td>
</tr>
<tr>
<td>“It would be nice to have the MET RN more available for nurse-to-nurse consults.”</td>
<td>RN MET providers can be paged directly for RN–RN advice.</td>
</tr>
<tr>
<td>“Working in a psychiatric ward, the MET has been wonderful . . . we feel better equipped to deal with critical events that happen rarely but tend to always be serious.”</td>
<td>RN comment from nonmedical or surgical ward</td>
</tr>
<tr>
<td>“The MET is an amazing team that helps residents dealing with severe acute deterioration of inpatients. Both patients and residents benefit.”</td>
<td>Comment regarding positive impact of the MET on resident education. Site leaders have also introduced optional MET rotations.</td>
</tr>
<tr>
<td>“. . . needs to be better coordination of patients that have had ICU consults in the ED but are transferred to the ward—the MET should follow these patients.”</td>
<td>Site leaders acknowledge that there may be a role for the MET in following high-risk patients from the ED.</td>
</tr>
<tr>
<td>“I would like to see a mechanism whereby parents can activate if they are concerned about any aspect of their child’s care.”</td>
<td>CHEO, HSC, and CHL reassessing direct family activation</td>
</tr>
</tbody>
</table>

* RRS, rapid response system; RN, registered nurse; MD, physician; MET, medical emergency team; ICU, intensive care unit; ED, emergency department; CHEO, Children’s Hospital of Eastern Ontario; HSC, Hospital for Sick Children; CHL, Children’s Hospital London.
more than 60% stated that they had learned new skills from the MET providers.

The summative evaluation included using outcomes and activity data. Pre- versus postintervention data were compared using data extracted from hospital and code blue event databases for two years before (October 31, 2004–October 31, 2006) and during implementation of the RRS (January 29, 2007–present). During the first two years of RRS service, the average activation rate of the MET was 44 activations per 1,000 hospital admissions, with respiratory concerns as the most common reasons for activation (46% of activations). During the first two years of this project, the implementation of the RRS using a physician-led MET was associated with significant decreases in total code blue events and in the rates of PICU mortality following unplanned PICU admissions and PICU mortality following re-admissions to the PICU from the ward during the same hospitalization; detailed outcome and other activity data will be reported elsewhere.22

Discussion
This article describes the standardized implementation of a pediatric RRS, with a focus on the use of social marketing principles to promote the RRS concept. Throughout each phase of implementation, the site leaders gained valuable experiences that helped them improve each component of the RRS.

Social marketing of health care services will always be challenging, particularly when novel services are unproven and already established services are perceived as best practice. In addition, human emotion plays a strong role in the health care environment and practice heterogeneity is common. In the case of our RRS project, physicians were initially concerned that activating the MET would result in questioning of their care and that their role as the care providers primarily responsible for the patients would be undermined. The site leaders attempted to involve the primary medical team in all MET activities, including patient care and on-the-spot education, by, as stated, having the primary physician paged for every activation. This “immediate involvement” and shared responsibility with the primary medical team provided immediate benefit to the users: The MET provided highly skilled acute care to the deteriorating patient, as well as interprofessional support and immediate on-the-spot education. This key component in our social marketing strategy is also reflected in the mean value of 44 activations per 1,000 admissions, higher than previously reported rates of service uptake2,3,5,6 (versus a low of 2.8 in the Brilli et al. study2 and a high of 7.84 in the Sharek et al. study3) during the first two years of service. Our high service uptake during the first two years of the RRS project also resulted in significant reductions in total code blue events and in PICU mortality following unplanned PICU admissions and PICU re-admissions from the ward.22 In our experience, our approach enabled us to challenge current beliefs and practices and to provide a framework for sustainability.

Another key component of our implementation strategy was ensuring uniform implementation of the pediatric RRS, with minimal inconsistencies of service, through standardized education of MET providers and careful uniform recruitment. Educating MET providers in a standardized fashion not only ensured a consistent team response but allowed MET providers across all sites opportunities to network and share stories of success during the RRS provider course. MET activity was routinely discussed at regular site leader meetings, and if consistencies in MET activity or roles were found, they were discussed and addressed. For example, early in Phase 2, as one of the site leaders described, the MET RN at the hospital would visit the wards and proactively ask charge nurses if there were
any acutely ill patients with whom the MET should be involved. Although the site leaders agreed that such a practice might be effective, they determined that the hospital should discontinue it, the reasoning being that it could not be implemented in a standardized way across all sites because of local differences in the availability of the MET RN, reflecting team work load from MET activations and follow-up visits.

Finally, matching the demand for the MET with the available resources in each of the four sites was challenging. Funding was provided for dedicated nurses and physicians for the METs, but the RT providers had additional patient care responsibilities. Because the majority of MET activations during the first two years of the RRS project were due to respiratory concern, reflecting earlier reports, the site leaders believe that RT MET providers should also be dedicated to the MET.

Conclusion

This is the first report describing the standardized implementation of an RRS using a physician-led MET across four hospitals. In our experience, applying social marketing principles to the introduction of the RRS concept provided a comprehensive and reproducible approach that other health care organizations can consider for their RRS or other changes in health care delivery.

Drs. Kotsakis, Lobos, and Gilleland were contracted to develop a Pediatric Medical Emergency Team Provider course by the Canadian Resuscitation Institute, with funding provided by the Ontario Ministry of Health and Long Term Care (MOHLTC), which also funded the development and implementation of the Pediatric Rapid Response System. The Ontario MOHLTC had access to all data but was not involved in data collection, analysis, or writing of the manuscript. The authors thank their hospital administration for supporting the implementation of the Pediatric Rapid Response System. They also thank the nurses and respiratory therapists of the PCCRT, PCCOT, SPOT and PACE teams (as the medical emergency teams were known at the four hospitals), as the main reason for the success of this program, and the critical care secretariat, Julie Trpkovski, Robert McKay, and Bernard Lawless.

Anna-Theresa Lobos, M.D., is Medical Director, Children's Hospital of Eastern Ontario (CHEO) Critical Care Response Team, Department of Pediatrics, Division of Critical Care Medicine, and Assistant Professor, Faculty of Medicine, Pediatrics, University of Ottawa, Ottawa. Jonathan Costello, M.B., M.R.C.P.I., M.B.A., is Emergency Physician, Royal Free Hospital, London. Jonathan Gilleland, M.D., is Medical Director, McMaster Children's Hospital Critical Care Response Team, Department of Pediatrics, Division of Critical Care Medicine, and Assistant Professor, Faculty of Medicine, Pediatrics, McMaster University, Hamilton, Canada. Rose Gaitéiro, R.N., M.S.N., is Critical Care Response Team RN Site Lead, and Afrothite Kotsakis, M.D., is Medical Director, Hospital for Sick Children's Critical Care Response Team, Department of Critical Care Medicine and Cardiology, and Assistant Professor, Faculty of Medicine, Pediatrics, University of Toronto, Toronto. Please address correspondence to Anna-Theresa Lobos, M.D., alobos@cheo.on.ca.

References