

Implementation of a Pediatric Rapid Response Team: Experience of the Hospital for Sick Children in Toronto

V KUKRETI, R GAITEIRO AND H MOHSENI-BOD

From Department of Critical Care, The Hospital for Sick Children, Toronto, Canada.

Correspondence to: Dr Hadi Mohseni-Bod, Pediatric Critical Care Unit, The Hospital for Sick Children, 555 University Avenue, Toronto, Ontario M5G 1X8, hadi.mohseni-bod@sickkids.ca

Rapid Response Systems have been introduced in the last decade to increase patient safety and decrease the rate of cardiorespiratory arrest on the hospital wards and readmission to the intensive care units. In this article we share our experience at the Hospital for Sick Children in Toronto on implementation and evolution of a pediatric rapid response team; the process, barriers, and ongoing challenges.

Keywords: Cardiac arrest, Critical care unit, Medical emergency team, Rapid response systems.

In-hospital cardiac arrest has high mortality and significant neurologic morbidity. Despite resuscitation measures, death rates for such patients remain high and only 17% of adults and 27% of children survive to hospital discharge [1,2]. Patients admitted from hospital wards to Critical Care Unit (CCU) have higher mortality than patients admitted from emergency department [3]. It is well established that physiological abnormalities exist before cardiac arrest [4]. These studies suggested that it may be possible to develop strategies to prevent cardiac arrest in hospitalized patients.

Implementation of Rapid Response Systems (RRS) is believed to improve efficacy in recognizing and responding to deteriorating patients. These have been known as Medical Emergency Team (MET), Rapid Response Team or Outreach Team. METs include at least one critical care physician while RRTs can be led by nurses or respiratory therapists. Since 1990 when they were first described in Australia, RRS have been effective in reducing hospital mortality, CCU admissions and arrest before transfer to CCU. Many hospitals have implemented them across North America. These teams are similar in that they rely on prompt identification and treatment of in-hospital patients [5]. The Institute for Healthcare Improvement (IHI) included deployment of RRT as one of the main recommendations in their 100,000 Lives Saved and the 5 Million Lives Saved campaigns [6]. RRS is different from Code team in that they assess patients in whom respiratory, neurologic or cardiac deterioration develops rather than patients who already had a respiratory or cardiac arrest [7]. In some models one team have both functions.

CHARACTERISTICS OF RAPID RESPONSE SYSTEMS

There are four components in any RRS: (1) the afferent limb identifies deterioration in the patient and triggers a response (consists of calling criteria for activating the RRS plus the personnel who can trigger system activation); (2) the efferent limb consists of the personnel (and equipment) brought to the patient; (3) the audit or monitoring component focuses on patient safety and quality improvement and provides feedback and evaluation of the events to the providers, healthcare system designers and to the patient and families; (4) the governance or administrative component which ensures ongoing training and education of staff, implementation and sustaining the service [8]. The composition of RRS team depends on the institutional resources and goals, and the purposes of the team.

The objectives of having a MET at our Hospital were: (i) As a tool to strengthen the culture of patient safety throughout the institution by taking the critical care skills to all corners of the hospital; (ii) to reduce the code blue events; (iii) to reduce the unplanned admissions to the Critical care unit; (iv) to reduce the readmission rates to the Critical care unit; and (v) to educate the medical and nursing staff on the floors on issues related to recognition and initial management of critically ill children.

BLUEPRINT FOR ESTABLISHING A RAPID RESPONSE SYSTEM

Establishing a RRS is a process that should be guided by local needs and availability of personnel and resources. The first step is to demonstrate a need, and then buy-in from the hospital managers and clinical services. You may need to spend up to six months or longer to

complete a needs assessment, build a case for a RRS, and develop a model that would best suit your institution.

BARRIERS TO EMPLOYMENT OF RRS

One of the most important goals of the MET in our institution has been “empowerment” of all members of the interprofessional healthcare team to seek help in stabilizing and managing the deteriorating ward patient. Traditional institutional hierarchy can be a serious barrier to this cultural change.

Wholehearted acceptance of a MET at all levels of a hospital may take years and requires repeated and continuous education and periodic satisfaction surveys. These periodic surveys will help to identify areas that the MET should improve upon and also obstacles to the utilization of the service. Strategies we used to overcome the apparent and potential barriers were:

- For six months, we went to essentially every stakeholder group in the hospital (clinicians, managers) and gave presentations about the team and answered the questions and concerns raised.

BOX 1. BLUEPRINT FOR ESTABLISHING A RAPID RESPONSE SYSTEM

- The RRS should be planned and tailored locally.
- Needs assessment: Review the charts of Code Blue patients in your institution, urgent admissions to the CCU, and readmissions to the CCU.
- Establish who the members of the Team are and what their skill levels should be.
- Establish an RRT or MET structure that would best suit your hospital.
- Establish criteria on when to activate the RRS.
- Create data collection, documentation, and record keeping tools.
- Provide hospital-wide education prior to rolling out.
- Start as a pilot project with your best people and best coverage during the day-time.
- Audit; develop feedback and evaluation mechanisms
- Full 24 x 7 rolling out phase
- Provide initial and ongoing education for responders
- Assess satisfaction rate and collect feedback from the stakeholders.

- We asked the callers to always inform the most responsible physician at the same time they requested a MET consult.
- We included the pediatric residents in our team to increase collaboration and address concerns about de-skilling of the residents.

EFFECT ON PATIENT OUTCOME

Many single center studies [9-14] have demonstrated effectiveness of the RRS. The only pediatric multicenter study to determine the effectiveness of a RRS showed that there is a decrease in rate of CCU mortality after readmission but not actual cardiopulmonary arrest rate [9]. Decisions about whether to implement RRS will rely on the individual institution.

HOSPITAL FOR SICK CHILDREN EXPERIENCE

In March 2006, four Pediatric Academic Health Science Centres in Ontario were granted funding by the Ministry of Health and Long-Term Care to initiate pediatric METs. These centres worked together to develop and implement a pediatric MET in their respective institution in a standardized method across the four sites. Each centre was tasked with developing and implementing a team that best met the needs of their individual institution. The method has been described elsewhere [15]. The program was introduced in three phases at the Hospital for Sick Children in Toronto.

Phase 1: (May to October 2006): Planning and development of the core requirements for the team: A hospital-wide algorithm for activating the MET, as well as the calling criteria was agreed upon. Team make-up and roles were defined, and the hiring process was initiated. Concurrently, a broad public relations plan was implemented. The public relations strategy spanned six months with over 150 presentations given to the clinical interprofessional groups (physicians, nursing, physiotherapy, respiratory therapy, social work) and hospital management.

Phase 2: (November 2006 to January 2007): MET service was introduced on a limited basis Monday to Friday, 08:00 to 16:00. This allowed the team to ramp up their internal educational needs, as well as to begin the integration of the MET into the hospital environment. All team members attended simulation-based courses focusing on the identification, assessment and management of the deteriorating pediatric patient. At the same time, an education curriculum was developed that met the educational needs of ward/clinic staff. The public relations presentations continued throughout Phase 2 in order to maintain momentum and answer any questions that might have arisen during implementation.

Phase 3: (February 2007-ongoing): Full 24/7 service was rolled out to all areas of the hospital. Further refinement on the roles occurred based on feedback received from satisfaction surveys. Data collection on key outcome measures also commenced for every new consult (The reason for activation; who called the team; how long the activation criteria were present before calling the team; the primary service, the time to response by the team, recommendations and treatments initiated by the team, the outcome of the consult) and for all follow-ups post new consults and post-discharge from the CCU.

EDUCATIONAL FOOTPRINT

At our hospital another equally important MET mandate is provision of both formal and informal educational opportunities for MET members as well as for ward staff (nurses, allied health workers, and residents). To this extent, the team developed educational programs to meet the unique needs of the staff. Forums for delivery include lunch & learn sessions, monthly rounds/meetings, hour-long in-services, and a twice yearly full day simulation based education session. Also, there has been formal integration of pediatric residents into team activities in order to address any concerns about minimizing educational opportunities and “de-skilling” of the residents. The “MET rotation” provides residents with a defined set of learning objectives that focus on assessment and management of acute deterioration, and the management of Code Blue. At the end of their rotation, a formal evaluation process is conducted, with feedback from the MET MD lead and MET members.

PRE- AND POST-IMPLEMENTATION SURVEYS

Pre-implementation surveys were distributed over three months in order to get a sense of the existing culture in the institution. The pre-implementation survey indicated a need for a service that the staff could call to seek help and advice about rapidly deteriorating patients. The Ontario Critical Care Secretariat performed a post-implementation survey in January 2011. The questions reflected the core functions of the teams and the open-ended questions allowed for more comments. We found:

- Over 92% of physician and nurse respondents had participated in the care of a patient with the MET.
- Most respondents (98%) agreed that the MET was used primarily for consults for unstable patients on the ward.
- Respondents identified that MET were used to support end of life discussion and education and advice on drugs.

The majority of respondents (>95%) were satisfied

with both the quality and timeliness of the MET service. Also >90% of respondents believed that the MET has had a positive impact on patient care. When asked if there were barriers to calling the MET 23% answered in the affirmative. Of these, over 70% identified “MET responds negatively if they deem the call inappropriate”[16].

TORONTO HOSPITAL FOR SICK CHILDREN MET CALLING CRITERIA

Call MET if one or more of the following exists: (For age specific criteria refer **Table I**).

- Healthcare Provider worried
- Airway threat (any concerns by the provider that airway is compromised, i.e. noisy breathing, stridor, increased work of breathing).
- Saturation <90% in any amount of O₂; saturation <60% in any amount of O₂ in children with cyanotic heart disease.
- Respiratory distress (any concern by the provider that the frequency or work of breathing is abnormal, any apneas).
- Tachycardia, Bradycardia (as explained in age-adjusted **Table I**).
- Hypotension (as explained in age-adjusted table I), poor peripheral pulses, prolonged capillary refill time, mottled extremities.
- Acute change in neurological status, decreased activity or responsiveness in small infants, acute drop in GCS by more than 2, Seizures.

REVIEW OF THE ACTIVITY OF THE MET AT THE HOSPITAL FOR SICK CHILDREN IN TORONTO IN 2011

The following figures represent the activity of the MET during 2011 at the Hospital for Sick Children in Toronto (2011 is chosen as a representative year; our data from 2007 to 2012 show a similar pattern) (**Fig.1 and 2**):

TABLE I THE HOSPITAL FOR SICK CHILDREN MET CALLING CRITERIA (AGE-ADJUSTED PHYSIOLOGICAL PARAMETERS)

| Age | Hypotension Systolic BP | Brady- cardia | Tachy- cardia | Tachypnea |
|-------------|----------------------------|------------------|------------------|-----------|
| Term – 3 mo | <50 | <100 | >180 | >60 |
| 4 – 12 mo | <60 | <100 | >180 | >50 |
| 1 – 4 yr | <70 | <90 | >160 | >40 |
| 5 – 12 yr | <80 | <80 | >140 | >30 |
| >12 yr | <90 | <60 | >130 | >30 |

CONCLUSION

In a survey done by the Ontario Ministry of Health and Long-Term Care in 2011, three of the perceived benefits of the MET at our Hospital were: (1) the education we provide on the hospital floors and clinics, (2) the satisfaction of our users (patients, nurses, and physicians), and (3) empowerment of the bedside staff [16]. Bedside nurses provide direct and continuous care and are the first to recognize a deteriorating patient. The physiological signs of deterioration may be observed or recorded by bedside staff but frequently are not recognized or acted upon in a timely manner [17]. Increasingly more patients with significant residual pathology or decreased physiological reserve or dependency on technology are discharged to the hospital wards. The increasing acuity of patients and lack of resources and inadequate educational support for the bedside staff on the wards might be contributing factors to failure to rescue deteriorating patients [18-20]. Rapid Response Systems have been implemented to prevent failure to rescue events [21]. The goal of RRSs is to take the critical care expertise and resources out of the CCU walls to all corners of a hospital hoping that this would lead to a decrease in cardiopulmonary arrest rate and unexpected CCU admission.

At the Hospital for Sick Children in Toronto, we have not witnessed a significant reduction in the Code Blue rate or the readmission rate to the CCU with implementation of the MET [9,22]. There are many reasons that a Code Blue is called at our hospital; many a times a Code is called to get help, medication, equipment, or skills at the bedside in a timely manner. In the majority of patients who “coded” on the wards in our hospital, the

MET have not been involved prior to the Code or have been involved for less than 4 hours prior to the Code. 25% of the readmissions to CCU occur within 6 hours of their first MET visit post CCU discharge [22].

When comparing the readmission rates as well as the outcome following readmission during the three eras (the two years before MET, 2 early MET, and 2 mature MET years; span of 2005 to 2011) there was no significant difference in the readmission rate [22].

It is likely that the causes for Code Blue or readmission to the CCU after discharge require a different approach to using the rapid response system at our hospital. We have seen a decrease in mortality of the readmitted patients [9], which means these patients were in a “better shape” when readmitted, or the input from the team has stabilized them to some degree before readmission. The length of time to readmission was reduced from 23.8 hours (12.3 – 32.7) to 17.9 hours (8.4 – 27.0) [22].

Before implementing a RRS, we need to ask what do we want to achieve with the team and try to design the team to achieve those goals. The efficiency and cost effectiveness of RRS in developing countries is an open question that has not been answered yet, and it is important for planners to consider their local needs and skills when embarking upon implementing a RRS.

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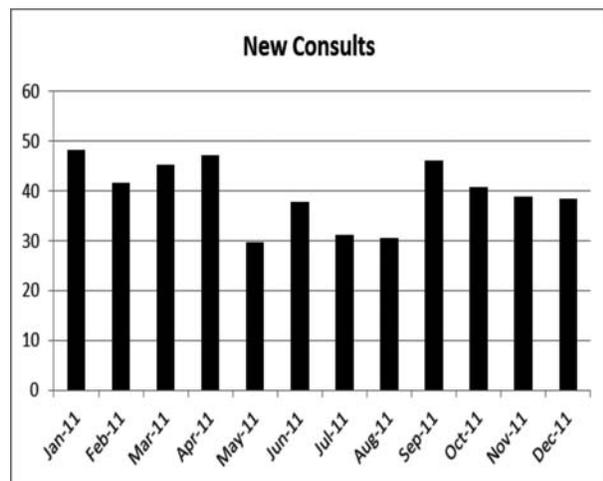


FIG. 1 The number of new consults according to the month of the year.

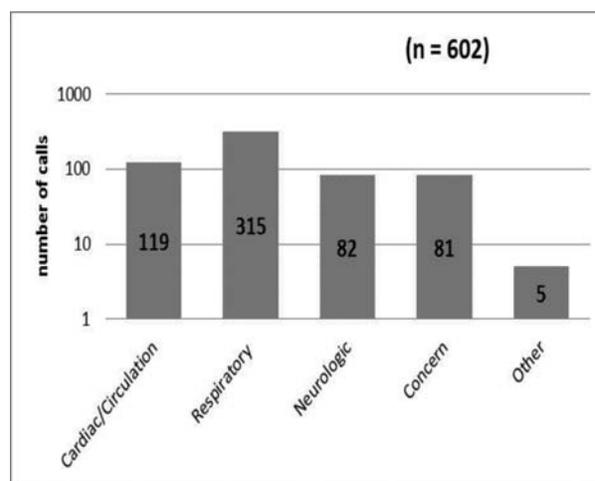


FIG. 2 Indication for the MET consults.

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