

Quarterly Report

March 2007

Prepared by the Critical Care Secretariat

This issue:

This issue of the Critical Care Strategy Quarterly Report focuses on the Province's implementation of Critical Care Response Teams (CCRTs), the evidence to support their implementation and the impact they are having on hospitals and patients across Ontario.

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Ontario's expansion of Critical Care Response Teams

Introduction

The Province of Ontario is currently funding 27 adult Critical Care Response Teams (CCRTs) and 4 paediatric demonstration CCRTs in hospitals across the province. This is the world's largest known implementation of CCRTs.

This policy decision is already improving patient safety and mitigating the demand for intensive care services largely associated with the changing age demographic in Ontario, and the medical system's increased ability to treat disease and prolong life.

Using ICU resources as efficiently as possible is essential to enable the system to respond to the baby boomer surge in demand for critical care and ensure that the ICU component of any site-based or system-wide surge response is maximized.

What are CCRTs and what do they do?

CCRTs (also known as 'Medical Emergency Teams', 'Critical Care Outreach Teams' or 'Rapid Response Teams') are a major innovation in hospital process and culture. Critical Care Response Teams consist of critical care (generally ICU) clinicians, that is, physicians, nurses and respiratory therapists who are available to respond rapidly to calls they receive from bedside caregivers regarding ward patients who show physiologic signs of deterioration in their health. The goal of the CCRT is to bring critical care resources, including clinicians and equipment, to intervene early and thereby avoid ICU admission, facilitate timely admission or avoid inappropriate or unwanted treatments through discussion with patients and their families. CCRTs also monitor every patient discharged from the ICU to the ward for 48 hours to ensure that the care plan is communicated and maintained throughout the transition from ICU to ward care. Implementing these teams requires that a "call and respond" process be created and communicated broadly throughout a hospital. Successful implementation requires extensive education of, and marketing to ward staff and physicians who admit to the hospital wards, regarding 'calling criteria' to activate the team.

The evidence to support CCRTs

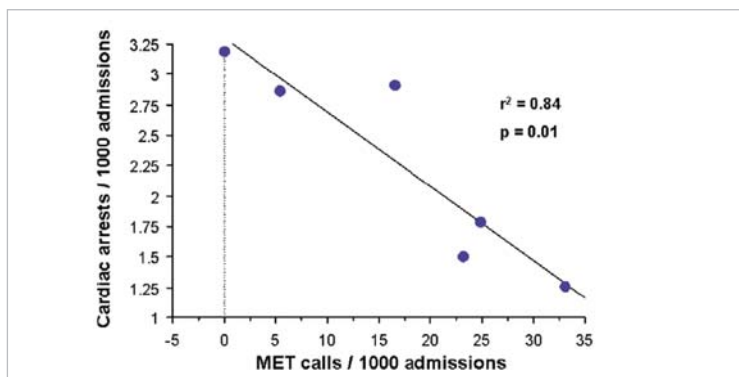
The research leading up to the development of the teams and the patient safety benefits where teams have been implemented are persuasive. (Appendix I) In the late 1980's and early 1990's a number of researchers published studies showing that when patients are deteriorating on the wards they may not:

- have their vitals signs taken
- be treated by the person best suited to manage acute resuscitation needs
- be treated until they are critically ill.

The literature also identifies a six to eight hour period of deterioration prior to ward patients needing ICU admission or suffering cardiac arrest.

Rinaldo Bellomo, an Australian physician who has pioneered the implementation, study and improvement of these teams, which in Australia are called medical emergency teams (MET), has identified that for every 17 MET calls, 1 cardiac arrest is prevented (see Figure 1).¹ In addition he has shown that the use of the MET service, that is the number of calls, has continuously improved over a six-year period, and the increase in MET calls is significantly correlated to a decrease in ward patients suffering cardiac arrests.

Figure 1: Correlation between the number of medical emergency teams (MET) calls and the rate of cardiac arrests between 1999 and 2004.



Although CCRTs provide life-saving resuscitation for patients on the wards, it is important to note that CCRTs do not replace, but rather complement existing cardiac arrest or 'Code Blue' teams. However, by intervening earlier, CCRTs can often prevent in-hospital cardiac arrests altogether thus decreasing the number of Code Blue calls overall and improving patient outcomes. Studies demonstrate that when properly implemented, CCRTs can decrease Code Blue calls in a hospital by up to 50%. A 50% reduction in Code Blue calls represents a significant improvement in ICU access, as a standard course recovery following an in-hospital cardiac arrest involves a 7 to 10 day ICU admission. Avoiding in-hospital cardiac arrest is crucial, as survival rates following in-hospital cardiac arrest, even with cardiac arrest teams in place, are poor, approaching only 15%. As Dr. Peter Safar, one of the originators of critical care medicine memorably noted, "The most sophisticated intensive care often becomes unnecessarily expensive terminal care when the pre-ICU system fails."

¹ Bellomo, Rinaldo et al. 2005. "Long term effect of a medical emergency team on cardiac arrests in a teaching hospital." <http://ccforum.com/content/9/6/R808>

The Ontario demonstration project

In 2004/05, as part of Year I of Ontario's Critical Care Strategy, the MOHLTC funded a \$4.1M demonstration project to test the Critical Care Response Team (CCRT) concept at four Ontario hospital sites, The Ottawa Hospital - General site, Queensway Carleton in Ottawa, University Health Network - Toronto General site and Halton Healthcare Services - Oakville-Trafalgar site. Early results from the demonstration projects trended in the direction of the outcomes reported in the international literature. (Appendix II)

Key results from the demonstration sites are:

The Ottawa Hospital, General Site

3.4% drop in ICU admissions from the wards
12% decreased in ICU lengths of stay
39 % decrease in ICU readmission rates
38% decrease in code blue calls

The University Health Network, Toronto General Hospital

23% decrease in respiratory arrests
7% decrease in cardiac arrests
8.4% decrease in hospital mortality

The current provincial CCRT expansion program is based on the lessons learned from this successful demonstration project, which informed the implementation model of the CCRT expansion project.

The first expansion group

The decision to expand the implementation of CCRTs in Ontario was announced on January 30, 2006 with 22 sites funded to implement CCRTs. An additional 5 sites were reviewed for eligibility and funding was announced in Nov 2006 for a total of 27 hospital sites with adult CCRTs. The goal of this first wave of funding to implement CCRTs is to improve the utilization of the ICU resources at sites where the impact will be felt throughout the system.

The criteria for funding any site were as follows:

The Hospital:

- Has an intensivist led closed ICU
- Is able to staff a CCRT with RN's to provide 24/7 service
- Has 24/7 availability of intensivists to the ICU and the CCRT
- Is open to CritiCall (the Province's existing critical care bed and resource registry)
- Has ≥ 12 mechanically ventilated beds or ≥ 16 beds

Has at least 2 of the following services:

- Designated Trauma Centre
- Designated Neuro-critical care
- Designated Transplant Centre
- Advanced Ventilation Capacity
- Large ICU Capacity ≥ 19 Beds
- ICU-Based Renal Replacement Therapy

The Hospital also:

- Has strong clinical leadership with a commitment to support this and the entire Critical Care Strategy
- Is able to make RN staff and MD's available for training and meetings related to the initiative.

The Ontario model:

It is important to stress that funding CCRTs will not ensure their effectiveness. CCRTs that are not called in often enough or are called in too late have little impact on patient outcomes. Implementation must be carefully managed and CCRTs must be supported in achieving benchmark results.

This provincial initiative has a defined implementation model designed to succeed within various hospital cultures. Sites have enriched their implementation in a variety of ways that work within the context of their own corporate structures and norms while they implement with the support of the high level plan which includes:

Central coordination and facilitation

- Provincial Medical Advisor (Dr. Stuart Reynolds) and Project Coordinator (Mary Ellen Salenieks) within the Critical Care Secretariat
- Information, templates, materials, manual
- Opportunity to shadow teams at demonstration sites
- Biweekly teleconferences; two retreats thus far

Administration:

- CEO sign back of accountabilities associated with funding
- Site lead to present and obtain endorsement of Medical Advisory Committee
- Physician site lead
- RN or RRT co lead for each site

Education:

- Course developed by Canadian Resuscitation Institute for CCRTs, 12 RNs and / or RRTs from each site
- 12 week in-house preceptorship funded (weekday service with MD teaching and mentoring team members)

Clinical:

- Standardized, simple calling criteria based on physiologic parameters
- Clinical outcomes: rates of ward admissions to the ICU, cardiac arrests, respiratory arrests and code blues; initiation or confirmation that end of life discussion has been offered to the patient, ICU length of stay and 48 hour readmission rate and hospital mortality are key outcomes targets

Measurement and feedback

- Web-based data entry
- Real-time site-based reports
- Monthly cross-site comparison reports with sites de-identified, although sites know which site they are; data normalized to outcome per 1,000 hospital inpatient admissions or percentages.

The quality improvement cycle of data and discussion facilitated on an ongoing basis by the CCRT project team within the Critical Care Secretariat, will form the underpinning of all sites' continuously improving their implementation and the use of their CCRT service. The critical care LHIN leaders will be updated regularly of the progress of sites within their LHINs and of the profile of activity at sites across the province.

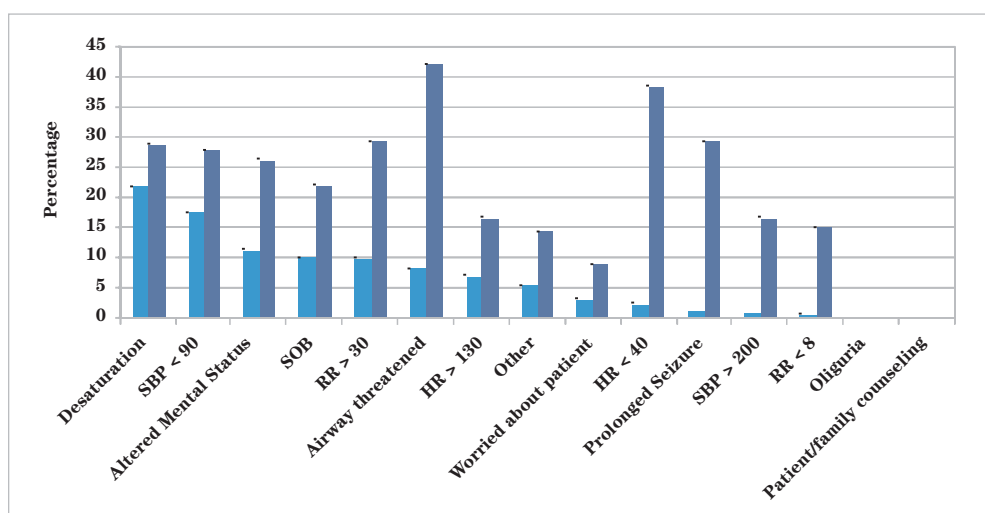
Evaluation principles:

- Data supports both facilitation and accountability
- Doing the right things will bring the right outcomes; measure activity and outcomes

Although the data set being collected for each patient visit by CCRTs is relatively small, the consistent reporting across the 23 sites currently seeing patients is already producing data that mirrors international research and evaluation published on activity patterns and intermediate outcomes.

In a period of less than 3 months (Nov 06/06 until Jan 31/07) during which time 6 sites were offering 24/7 service and 17 were only offering weekday service (preceptorship) there were 1739 consults. 23.86 % of the patients the teams were called to see were admitted to the ICU. The criteria for which the teams were

Figure 2: Percentage call criteria and ICU admit by criteria.



called mirrored what was in the published literature. In addition we were able to report the incidence of being transferred to the ICU, depending on the criteria for the call. This was discussed with the sites and they are keen to have this information as the large volume of calls allows clinicians to see credible patterns that might take many months or years, to reliably discern if one site alone were generating and analyzing data. (see Figure 2).

Over the next year, with robust discussion with the clinical leaders across all participating sites to question and interpret the data, provincial benchmarks for activity, rates of improvement and patient safety outcome improvements will be established for CCRTs in the province of Ontario to improve access to quality critical care and ensure that ICU resources are appropriately used in timely fashion.

Expanding the model to Paediatrics

In March 2006 four paediatric centres received funding to implement a demonstration CCRT project. Dr. Desmond Bohn of The Hospital for Sick Children provided the project leadership. The other participating sites are the Children's Hospital of Western Ontario, The Children's Hospital of Eastern Ontario and McMaster Children's Hospital. Team development at each site and a training course similar to the adult CCRT course were developed in collaboration with the Canadian Resuscitation Institute. A full report on the results of the demonstration project will be submitted to the Critical Care Secretariat in April 2007.

Alternative model CCRTs

The majority of hospitals in Ontario may never meet criteria to be eligible for funding to implement an intensivist led CCRT due to size, location relative to a tertiary care centre, and areas of specialization. Yet, many of them may benefit from the implementation of an alternative model CCRT.

The next focus of MOHLTC funded CCRTs, pending appropriate approvals, will be to support six hospitals in Ontario to implement three distinct alternative models designed to serve hospitals of varying size and critical care resources. Funding of successful applicants is scheduled to commence in fiscal 2007/08. The successful applicants will implement and evaluate alternate models for CCRT so that the system can benefit from three or four CCRT models that optimize hospitals' existing resources and capacity - and meet the needs of patients.

For more information about Ontario's Critical Care Strategy

Please contact: **Robert McKay**, Manager, Critical Care Secretariat
Health System Accountability and Performance Division
Ministry of Health and Long-Term Care
Phone: 416-550-0037 email: Robert.McKay@moh.gov.on.ca

For more information about the Expansion of CCRTs in Ontario, please read our Year One Report available on our website at www.health.gov.on.ca/criticalcare

Appendix I

The following table highlights background studies conducted from 1990 onwards, identifying the problem of patient deterioration while on hospital wards.

Reviews	Population	Findings
RM Schein, N Hazday, M Pena, BH Ruben and CL Sprung. Clinical antecedents to in-hospital cardiopulmonary arrest. Chest, Dec 1990; 98: 1388 - 1392.	64 patients had cardiac arrest 161 ± 26 hours after hospital admission.	84% had documented deterioration or new complaints within eight hours of arrest.
Franklin C, Mathew J. Developing strategies to prevent in hospital cardiac arrest: analyzing responses of physicians and nurses in the hours before the event. Critical Care Medicine, 1994 Feb;22(2):244-7.	150 cardiac arrests on medical unit.	In 66% of cases, a nurse or physician had documented deterioration in the patient's condition within 6 hours prior to the arrest. Failures: communication and assessment. Former ICU patients at higher risk than other patients.
P McQuillan, S Pilkington, A Allan, B Taylor, A Short, G Morgan, M Nielsen, D Barrett, G Smith. Confidential inquiry into quality of care before admission to intensive care. BMJ 1998;316:1853-1858 (20 June).	100 patients (50 from each of two hospitals) admitted from ward to ICU; pre ICU care evaluated by independent assessors.	20% well managed, 54 % suboptimal care, 26% assessors disagreed. Suboptimal care increased mortality and morbidity; ICU admissions might have been avoided. Reasons for suboptimal care: communication, knowledge, organization structure, inadequate supervision, and failure to seek advice. Recommend: audit, reorganize, Medical Emergency Teams.
McGloin H, Adam SK, Singer M. Unexpected deaths and referrals to intensive care of patients on general wards. Are some cases potentially avoidable? : J R Coll Physicians Lond. 1999 May-Jun;33(3):255-9.	Six month audit of: - unexpected ward deaths (377 deaths) - ward to ICU admissions (98 admission of 86 patients)	13 of the unexpected deaths may have been avoidable 31 ward to ICU admission patients received suboptimal care due to non recognition of severity or inappropriate treatment.
A Minnes, JT Granton, W Demajo, AM Sweeney, SF Reynolds, TE Stewart, ND Ferguson. Is Early Death Following ICU Admission Preventable? UHN	Five year categorization of early (≤ 24 hours) versus late (> 24 hours) of ICU admissions. Six month review of all ward admission deaths.	Early death occurs in 40% of all ICU admissions. During six month audit, in 21 early deaths among 120 deaths from ward, patients who suffered early death were less likely to have complete vital signs documented in the 6 hours prior to admission to ICU.

Appendix II

Literature regarding the development and implementation of CCRT's has been largely Before/After studies and these have been varied with regard to endpoints and results. A small selection of these studies follows, along with the one large RCT published to date.

Study	Setting / design	Outcomes
PJ Bristow, KM Hillman, T Chey, K Daffurn, TC Jacques, SL Norman, GF Bishop, EG Simmons Rates of in-hospital arrests, deaths and intensive care admissions: the effect of a medical emergency team. MJA 2000; 173: 236-240	Three hospitals, one with MET (rapid response).	Hospital with MET had decreased admission to ICU.
MD Buist, GE Moore, SA Bernard, BP Waxman, JN Anderson, TV Nguyen. Effects of a medical emergency team on reduction of incidence of and mortality from unexpected cardiac arrests in hospital: preliminary study. BMJ 2002;324:387-390.	300 bed referral teaching, tertiary hospital, year before MET (rapid response) implemented and year after implementation. Incidence of and mortality from unexpected cardiac arrests.	Decreased incidence of unexpected cardiac arrest from 3.77 per 1000 hospital admissions to 2.05 per 1000 hospital admissions (50% reduction) and decreased mortality from unexpected cardiac arrests from 77% to 55%.
C Ball, M Kirkby, S Williams. Effect of critical care outreach team on patient survival to discharge from hospital and readmission to critical care: non-randomized population based study. BMJ 2003;327:1014-1017.	1200 bed, teaching tertiary referral hospital; outreach team consisted of nurse consultant and critical care nurse who do daily follow up of patients discharged from critical care; service offered 12 hours per day. (NOT rapid response)	Introduction of outreach service associated with a 6.8% increased survival to discharge and 6.4% decrease in readmission to critical care. Not a MET (rapid response) and results cannot be extrapolated to MET services.
R Bellomo et al. A prospective before and after trial of a medical emergency team. EMJA 2003; 179 (6): 283-287	Tertiary referral hospital, 1700 ICU admissions per year. Four month before and four month after implementation of MET (rapid response).	63 arrests (37 deaths) before, 22 arrests (16 deaths) after MET introduced. 302 deaths in before period (per 21,090 hospital admissions) 222 in after period (per 20921 hospital admissions).
K Hillman, J Chen, M Cretikos, R Bellomo et al. Introduction of the medical emergency team (MET) system: a cluster –randomized controlled trial.	23 Australian hospitals randomized to MET (12 hospitals) or no MET. Composite primary outcome of cardiac arrest, unexpected death or unplanned ICU admission during 6-month study period after MET implementation. 2 months pre-implementation, 4 months training and implementation.	Poor uptake of service; only 30 % of patients who met criteria and were admitted to ICU had MET called. No significant difference in primary composite outcome or individual secondary outcomes; decrease in cardiac arrests and unexpected deaths in both groups during study period.

Mounting evidence developed through before and after trials supported the effectiveness of MET's and other Outreach services however the evidence was not born out in the Merit trial. The greatest learning from the Merit trial was the post hoc analysis of the problems with the design/ duration of the trial and the implementation of the teams. In particular the IHI analysis identified that:

- A significant change could be made in a short time frame (decreased cardiac arrest and death in both groups)
- Insufficient monitoring of physiological parameters occurs on the wards
- There was an incomplete uptake of the service in the MET hospitals with only 8.6 calls per 1000 hospital admissions compared to other Australian literature reporting over 20 calls per 100 admissions and American studies identifying call rates of 15 per 1000 admissions

The Merit study analysis also highlights the need for extensive preparation and education to support the cultural and political change associated with the introduction of MET's.