Getting Started Kit:

Rapid Response Teams

Bibliography

Safer Healthcare Now!

We invite you to join the *Safer Healthcare Now!* Campaign (SHN) to help improve the safety of our healthcare system in Canada. *Safer Healthcare Now!* is a campaign to enlist Canadian healthcare organizations in implementing six targeted interventions in patient care. The campaign is supported by the Institute for Healthcare Improvement (IHI) and is patterned after IHI's *100,000 Lives* Campaign. Further details, including materials, contact information and discussions are available at

http://www.saferhealthcarenow.ca

These kits, based on those originally developed by IHI for its *100,000 Lives* Campaign, are designed to engage your teams and clinicians in a dynamic approach for quality improvement, and to provide a thorough basis for *getting started*. **Please note that although the SHN kits and the original kits developed by IHI are similar, there are also key differences in the content of the interventions and corresponding measures for some kits.** These differences are clearly noted in the body of the SHN kits themselves, and on the SHN website.

The information in these "Getting Started" kits is based on the current state of knowledge. Consistent with the dynamic nature of this campaign, which continues to evolve, emerging evidence may influence adaptation of the kits in the future. We remain open to working consultatively on updating the content as together we make healthcare safer in Canada.

Acknowledgement

We wish to thank and acknowledge the Institute for Healthcare Improvement (IHI) for their significant support and contributions to the *Safer Healthcare Now!* Campaign (SHN).

The references included in this Bibliography are those contained in the bibliography for IHI's 100K Lives Campaign, with additional references identified by SHN.

BIBLIOGRAPHY – RAPID RESPONSE TEAMS

Bellomo R, Goldsmith D, Russell S, Uchino S. Postoperative serious adverse events in a teaching hospital: a prospective study. *Med J Aust*. 2002;176(5):216-218.

Serious adverse events were found to be common and result in high mortality, raising important issues of optimal perioperative management.

Bellomo R, Goldsmith D, Uchino S, et al. Prospective controlled trial of effect of medical emergency team on postoperative morbidity and mortality rates. *Crit Care Med.* 2004; 32(4):916-921.

Prospective, controlled before-after trial. In the control period, there were 301 adverse outcomes/1,000 surgical admissions, which decreased to 127/1,000 surgical admissions during the intervention period. There was also a significant decrease in the number of postoperative deaths.

Bellomo R, Goldsmith D, Uchino S, et al. A prospective before-and-after trial of a medical emergency team. *Med J Aust.* 2003;179(6):283-287.

The incidence of in-hospital cardiac arrest and death following cardiac arrest decreased after introduction of an intensive-care-based medical emergency team, as did overall hospital mortality.

Berlot G, Pangher A, Petrucci L, Bussani R, Lucangelo U. Anticipating events of in-hospital cardiac arrest. *Eur J Emergency Med.* 2004;11(1):24-28.

Most in-hospital cardiac arrests were preceded by events (including alterations in consciousness, cardiac arrhythmias, dyspnoea, and chest pain) that were often overlooked.

Bristow PJ, Hillman KM, Chey T, et al. Rates of in-hospital arrests, deaths and intensive care admission: the effect of a medical emergency team. *Med J Aust.* 2000;173(5):236-240.

Three hospitals were included, one with a medical emergency team (MET) which could be called for abnormal physiological parameters or staff concern, while the other two had conventional cardiac arrest teams. There was no significant difference in the rates of cardiac arrest or total deaths among the three hospitals, but the MET hospital had fewer unanticipated ICU/HD admissions, with no increase in in-hospital arrest rate or total death rate. Further study of the MET concept was recommended.

Buist MD, Jarmolowski E, Burton PR, Bernard SA, Waxman BP, Anderson J. Recognising clinical instability in hospital patients before cardiac arrest or unplanned admission to intensive care. A pilot study in a tertiary-care hospital. *Med J Aust.* 1999; 171(1):22-25.

Over a 12-month period relatively few patients suffered a critical event, but those who did frequently manifested abnormalities in simple physical observations and laboratory tests prior to the critical event.

Buist MD, Moore GE, Bernard SA, Waxman BP, Anderson JN, Nguyen TV. Effects of a medical emergency team on reduction of incidence of and mortality from unexpected cardiac arrests in hospital: preliminary study. *BMJ.* 2002;324(7334):387-390.

Clinical intervention by a medical emergency team prompted by clinical instability in a patient significantly reduced the incidence of unexpected cardiac arrest (50% reduction after adjustment for case mix) and mortality from unexpected cardiac arrest.

Buist M, Bernard S, Anderson J. Epidemiology and prevention of unexpected in-hospital deaths. *Surgeon.* 2003;1(5):265-268.

Small literature review. Concluded that a number of studies suggest that in-hospital deaths are both predictable and preventable and that more work is required to determine effective strategies to manage the problem.

Buist M, Bernard S, Nguyen TV, Moore G, Anderson J. Association between clinically abnormal observations and subsequent in-hospital mortality: a prospective study. *Resuscitation.* 2004;62(2):137-141.

Six abnormal clinical observations were found to be independently associated with an increased high risk of mortality: decrease in level of consciousness (decrease > 2 points in Glasgow Coma Score)(odds ratio (OR) 6.4), hypotension (systolic blood pressure < 90 mmHg)(OR 2.5), loss of consciousness (Glasgow Coma Score of 3)(OR 6.4), respiratory rate < 6/min (OR 14.4), hypoxia (SaO_2 < 90%)(OR 2.4), and tachypnea (respiratory rate > 30/min)(OR 7.2). Among these events, the most common were hypoxia (51% of events) and hypotension (17%). These events should be included among criteria for the early identification of patients at increased risk of in-hospital cardiac arrest.

Castle N, Kenward G, Hodgetts T. Avoidable cardiac arrest: lessons for an A&E department. *Accid Emerg Nurs.* 2003;11(4):196-201.

Deterioration to cardiac arrest is not always sudden and unexpected and, as a vast majority of emergency admissions originate via A&E, this has implications for A&E.

Cioffi J. Recognition of patients who require emergency assistance: a descriptive study. *Heart Lung.* 2000;29(4):262-268.

Primary findings showed that nurses relied on the following four characteristics to apply the medical emergency team criterion, “seriously worried about a patient”: feeling “not right,” color, agitation, observations marginally changed or not changed at all. Additional validation and refinement of the four characteristics were recommended.

Cooper N. Patient at risk! *Clin Med.* 2001;1(4):309-311.

This article summarizes recent efforts in the U.K. to improve care for critically ill patients. Among the activities described is the development of early warning scoring systems to be used on general medical wards to identify patients who might benefit from transfer to an ICU.

Cretikos M, Hillman K. The medical emergency team: does it really make a difference? *Intern Med J.* 2003;33(11):511-514.

Review. Lists benefits of a medical emergency team and discusses how it empowers nursing staff and junior medical staff to call for immediate assistance.

Crispin C, Daffurn K. Nurses’ responses to acute severe illness. *Aust Crit Care.* 1998;11(4):131-133.

Identified a need to educate health professionals regarding the warning signs of acute severe illness and when to summon assistance.

DeVita MA, Braithwaite RS, Mahidhara R, Stuart S, Foraida M, Simmons RL. Use of medical emergency team responses to reduce hospital cardiopulmonary arrests. *Qual Saf health care.* 2004;13(4):251-254.

Increased use of medical emergency team may be associated with fewer cardiopulmonary arrests; a retrospective analysis over 6.8 years showed a 17% decrease in the incidence of cardiopulmonary arrests from 6.5 to 5.4 per 1000 admissions.

Foraida MI, DeVita MA, Braithwaite RS, Stuart SA, Brooks MM, Simmons RL. Improving the utilization of medical crisis teams (Condition C) at an urban tertiary care hospital. *J Crit Care.* 2003;18(2):87-94.

Over a three-year period, interventions that involved objective definition and dissemination of criteria for initiating the Condition C response were significantly associated with increased utilization. Interventions that involved giving feedback to medical personnel based on review of their care were not.

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Franklin C, Mathew J. Developing strategies to prevent inhospital cardiac arrest: analyzing responses of physicians and nurses in the hours before the event. *Crit Care Med.* 1994;22(2):244-247.

Cardiac arrests on the general wards are commonly preceded by premonitory signs and symptoms. Training strategies for nurses and physicians should include the need to devote special attention to patients discharged from ICU who are at greater risk of cardiac arrest.

Frost P. In response to "Effect of introducing the Modified Early Warning score on clinical outcomes, cardiopulmonary arrests and intensive care utilization in acute medical admissions," Subbe et al, *Anaesthesia* 2003;58(8):797-802. *Anaesthesia* 2003;58(11):1154.

Goldhill DR, Worthington L, Mulcahy A, Tarling M, Sumner A. The patient-at-risk team: identifying and managing seriously ill ward patients. *Anaesthesia.* 1999;54(9):853-860.

Identification of critically ill patients, early advice, and active management are likely to prevent the need for cardiopulmonary resuscitation and improve outcome.

Hillman K. Critical care without walls. *Curr Opin Crit Care.* 2002;8(6):594-599.

Critical care specialists are expanding their roles beyond ICUs and becoming involved in strategies such as the medical emergency team.

Hillman KM, Chen J. et al MERIT study investigators. Introduction of the medical emergency team (MET) system: a cluster-randomised controlled trial. *The Lancet.* 2005;365:2091-2097

The main conclusions of this study were that "The MET system greatly increases emergency team calling, but does not substantially affect the incidence of cardiac arrest, unplanned ICU admissions, or unexpected death."

Hillman KM, Bristow PJ, Chey T et al. Antecedents to hospital deaths. *Intern Med J.* 2001;31(6):343-348.

This study showed a high incidence of serious vital sign abnormalities in the period before potentially preventable hospital deaths; such abnormalities may identify patients who would benefit from earlier intervention.

Hillman KM, Bristow PJ, Chey T et al. Duration of life-threatening antecedents prior to intensive care admission. *Intensive Care Med.* 2002;28(11):1629-1634.

In over 60% of patients admitted to intensive care, potential life-threatening abnormalities were documented during the 8 hours before admission; this may represent a population who could benefit from improved care at an earlier stage.

Hillman K, Parr M, Flabouris A, Bishop G, Stewart A. Redefining in-hospital resuscitation: the concept of the medical emergency team. *Resuscitation.* 2001;48(2):105-110.

This article describes the characteristics of a Medical Emergency Team (MET) and identifies issues to be addressed in implementing a MET program, including the development of criteria for calling the MET.

Hodgetts TJ, Kenward G, Vlackonikolis I. et al. Incidence, location and reasons for avoidable in-hospital cardiac arrest in a district general hospital. *Resuscitation.* 2002;54(2):115-123.

Expert panel review of case-notes from 139 consecutive adult in-hospital cardiac arrests over 1 year. The majority were felt to be potentially avoidable and the panel judged that 100% of this majority received inadequate prior treatment.

Hodgetts TJ, Kenward G, Vlachonikolis IG, Payne S, Castle N. The identification of risk factors for cardiac arrest and formulation of activation criteria to alert a medical emergency team. *Resusitation.* 2002;54(2):125-131.

A multivariate analysis of cardiac arrest cases identified three positive associations: abnormal breathing, abnormal pulse, and abnormal systolic blood pressure. Risk factors were weighted and tabulated, and formulated into a table of activation criteria for alerting a clinical response.

Kause J, Smith G, Prytherch D. et al. A comparison of antecedents to cardiac arrests, deaths and emergency intensive care admissions in Australia and New Zealand, and the United Kingdom – the ACADEMIA study. *Resuscitation.* 2004;62(3):275-282.

Data obtained from 90 hospitals over a three-day period confirmed that antecedents are common before death, cardiac arrest and unanticipated ICU admission (the most common were hypotension and a fall in Glasgow Coma Scale). Differences in patterns of primary events, provision of ICU/HDU beds, and resuscitation teams between the UK and Aust/New Zeal were noted.

Kenward G, Castle N, Hodgetts T, Shaikh L. Evaluation of a medical emergency team one year after implementation. *Resuscitation.* 2004;61(3):257-263.

Multiple physiological abnormalities are associated with increased mortality. Initiating “do not attempt resuscitation” (DNAR) decisions is a key part of MET activity. A reduction in cardiac arrest rate and overall mortality was noted but was not statistically significant. New systems need time to develop (“bed in”) and further research is needed to observe significant reductions in cardiac arrests and overall mortality.

McArthur-Rouse F. Critical care outreach services and early warning scoring systems: a review of the literature. *J Adv Nurs.* 2001;36(5):696-704.

Further study is required to evaluate effectiveness and ward staff need to be educated in identifying those patients at risk of developing critical illness. Nurses’ decision making in relation to calling the outreach team requires further investigation.

Morgan RJM, Williams F, Wright MM. An Early Warning Scoring System for Detecting Developing Critical Illness. *Clin IC.* 1997;8(2):100.

Parr MJ, Hadfield JH, Flabouris A, Bishop G, Hillman K. The Medical Emergency Team:12 month analysis of reasons for activation, immediate outcome and not-for-resuscitation orders. *Resuscitation.* 2001;50(1):39-44.

713 MET calls to 559 inpatients. Three commonest criteria for calling the MET were a fall in Glasgow Coma Scale>2, systolic blood pressure<90mmHg, respiratory rate >35. A high proportion of patients required admission to Intensive Care. Patients for whom a NFR order should be considered were identified.

Peberdy MA, Kaye W, Ornato JP, et al. Cardiopulmonary resuscitation of adults in the hospital: a report of 14720 cardiac arrests from the National Registry of Cardiopulmonary Resuscitation. *Resuscitation.* 2003;58(3):297-308.

The three most common reasons for cardiac arrest in adults were: cardiac arrhythmia, acute respiratory insufficiency, and hypotension. 44% of cardiac arrest victims had a return of spontaneous circulation and 17% survived to hospital discharge.

Prasad V, Morgan RJM. Pre-emptive care on acute surgical wards – Early warning scoring. *CPD An.* 2002;4(2):56-60.

Priestley G, Watson W, Rashidian A, et al. Introducing Critical Care Outreach: a ward-randomised trial of phased introduction in a general hospital. *Intensive Care Med.* 2004;30(7):1398-1404.

This study investigates the effect of a "Critical Care Outreach Team" (analogous to a Medical Emergency Team) on in-hospital mortality and length of stay in an 800-bed general hospital in the north of England. The authors report a 48% reduction in in-hospital mortality. Findings on length of stay are equivocal.

Saklayen M, Liss H, Markert R. In-hospital cardiopulmonary resuscitation. Survival in one hospital and literature review. *Medicine(Baltimore).* 1995;74(4):163-175.

This study is a retrospective review of all CPR attempts at the VA Medical Center in Dayton, Ohio, during a two-year period (January 1, 1988, through December 31, 1989). The authors report that 44% of patients survived initial CPR, but only 30% were alive 24 hours later and only 13% were alive one month later. Patients with witnessed arrests were more likely to survive initial CPR (57%) than patients with unwitnessed arrests (22%).

Salamonson Y, Kariyawasam A, van Heere B, O'Connor C. The evolutionary process of Medical Emergency Team (MET) implementation: reduction in unanticipated ICU transfers. *Resuscitation.* 2001;49(2):135-141.

The overall number of ICU transfers remained constant. More seriously ill patients were transferred to ICU via the MET system with an accompanying significant fall in unanticipated ICU transfers. The study could not demonstrate whether the observed slight improvement in hospital survival rate over the three years of the study was due to the MET system.

Schein RM, Hazday N, Pena M, Ruben BH, Sprung CL. Clinical antecedents to in-hospital cardiopulmonary arrest. *Chest.*1990;98(6):1388-1392.

Patients developing arrest in the general hospital ward services have predominantly respiratory and metabolic derangements immediately preceding their arrests. Their underlying diseases are generally not rapidly fatal. Arrest is frequently preceded by a clinical deterioration involving either respiratory or mental function.

Sharpley JT, Holden JC. Introducing an early warning scoring system in a district general hospital. *Nurs Crit Care.* 2004;9(3):98-103.

The informal and gradual approach used to optimize the effectiveness of introducing the early warning scoring system is highlighted and explanations given of the training processes undertaken, the pilot evaluation, and lessons learned from the process.

Subbe CP, Davies RG, Williams E, Rutherford P, Gemmell L. Effect of introducing the Modified Early Warning score on clinical outcomes, cardio-pulmonary arrests and intensive care utilization in acute medical admissions. *Anaesthesia.* 2003;58(8):797-802.

Patients with a Modified Early Warning Score>4 were referred for urgent medical and critical care outreach team review. Data analysis confirmed respiratory rate as the best discriminator in identifying high-risk patient groups. Further study recommended.

Wright MM, Stenhouse CW, Morgan RJ. Early detection of patients at risk. *Anaesthesia.* 2000;55(4):391-392.

This letter comments on the publication by Goldhill et al. describing experience with a "patient-at-risk team" (PART) (*Anaesthesia* 1999;54:853-860). The authors suggest that their own Early Warning Scoring System (EWSS) might be a useful tool for the detection of patients with impending critical illness who might benefit from evaluation by a PART. The EWSS is based on five parameters: pulse, systolic blood pressure, respiratory rate, temperature, and response to stimulus.