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## Quality improvement and patient safety: How the challenge applies to critical care

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Quality of care and patient safety are undeniably primary concerns for all providers who work in critical care. Despite these concerns, major reports, which collate data compiled from a wide variety of sources in healthcare, show that there is a wide gap between optimal quality<sup>1,2</sup> and safety<sup>3</sup> and that provided in most institutions. While these reports are based on the American healthcare system, most of the observations also apply to Canada and our critical care units.<sup>4,5</sup> We work in a system that evolved over time, rather than being planned, and as a result, it has lacked the capacity to change in response to the new realities and complexities of modern healthcare delivery. The emerging understanding of these issues by healthcare planners and funding agencies create huge implications for change that healthcare providers must understand and embrace.

### Our structures and processes do not support quality and safety

The basis for concern about quality is reflected in the peer-reviewed literature. Schuster et al<sup>6</sup> reviewed articles published from 1987 to 1999, assessing the quality of healthcare in the United States. They compiled data from 73 articles that met their inclusion criteria and classified those that identified underuse, overuse, or misuse of medical therapy. Although many areas of healthcare were unreported, it is clear from their analysis that there is a broad gap between best available quality care and the care that is delivered. This data was included in *Crossing the Quality Chasm*,<sup>1</sup> a report by the Institute of Medicine (IOM) in the United States. This report provides a comprehensive overview of the rationale for, and a proposed mechanism to respond to the crisis in quality and safety. The well-documented quality gap is a major cause for concern and should be motivation for significant change. An earlier publication by the IOM, *To Err Is Human: Building a Safer Health System*,<sup>3</sup> dealt specifically with medical errors. The report substantiated serious, widespread, and frequently avoidable injuries to patients, and estimated that tens of thousands of patients die and hundreds of thousands are injured annually in the U.S. healthcare system.

As described by the IOM, the underlying reasons for inadequate quality of care fall into four categories:

1. **The growing complexity of science and technology.** Quality healthcare is hindered because our current methods of organizing and delivering care have not advanced as rapidly as our knowledge of drugs and devices.
2. **The increase in chronic conditions.** Increased life expectancy and changing mortality patterns have resulted in an aging population with a greater prevalence of chronic illness. Previously organized to provide acute episodic care, our healthcare



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system is not organized to provide effective long-term continuity of care in a collaborative process for the chronically ill.

3. **Poorly organized delivery system.** A collection of services, rather than a system, healthcare is characterized by multiple steps, and complex processes that are slow, redundant, and wasteful of resources. Ideally the system should include: evidence-based planned care, reorganization to meet the needs of time-consuming patients, systematic attention to the patient's need for information and behavioural change, ready access to all necessary clinical expertise, and supportive information systems.
4. **Constraints on exploiting the revolution in information technology.** These include technical challenges, security of personal information, connectivity, and most importantly, organizational challenges due to multiple aspects of professional autonomy and the decentralized nature of our healthcare industry.

Although quality of care and patient safety concerns are not as well documented in Canada as in Great Britain, the United States, and Australia, there is reason to believe that the problems are similar.<sup>7</sup> Attempts to measure quality have been hindered by the absence of a comprehensive structure or process for systematic reporting of quality. This problem is less serious in Canada where the Canadian Institute for Health Information provides an annual report of key quality indicators across the country

### Our system as it frequently is

*Mr. Davies, August 2002: Although fit at age 67, Mr. D. sustains a fall while riding his bicycle. He is admitted to the emergency department an hour later with a decreased level of consciousness. Physical examination and CT scan confirm an acute subdural hematoma. After a delay due to a backlog of emergent cases in the OR, he has successful surgery. There is a call from the recovery room unexpectedly at 11:30 PM requesting an ICU bed that cannot be accommodated. Mr. D. spends the night in the recovery room and is admitted to ICU the following morning. No past medical history can be obtained and his general practitioner is not available. While in the ICU, his course is complicated by an allergic reaction to antibiotics given for a suspected urinary tract infection on day 3, (previous drug allergy is subsequently confirmed by his G.P.), nosocomial pneumonia on day 6, and the need for tracheotomy to protect his airway and allow weaning. Transfer to the ward is requested on day 18, but this transfer is delayed for 2 days because there are no beds available. On day 20, he is transferred to the ward at 10 AM. At 6 PM, a call requests a repeat assessment for ICU*

*admission due to respiratory distress. A feeding tube had been placed 2 hours previously, but was withdrawn when he deteriorated. Mr. D. is returned to the intensive care unit, treated for aspiration, and is discharged to the ward after a total ICU stay of 29 days.*

### Initiatives for change

Paradoxically, much of the initiative to improve and review quality of care and safety has not originated from professional organizations. The observations by Wennberg<sup>8,9</sup> of a wide variability in the provision of healthcare procedures between institutions or geographical areas, in the absence of obvious population health differences, initiated discussion about the appropriateness for many of the therapies offered. The concept of small area variation that evolved from Wennberg's work was assisted by the revolution in information technology. Through the use of administrative and financial databases developed by third party payers, data became available that allowed observations on the incidence of healthcare interventions. Because these databases were never intended to evaluate the appropriateness or effectiveness of care, they could not provide information on these issues. It is ironic that the information technology revolution that was applied to administrative and financial databases raised many questions about the quality of healthcare. Regrettably, these technologies had not evolved sufficiently in a clinical sense to provide meaningful support for decisions about the delivery and evaluation of care. Although professional and scientific journals are replete with articles that identify deficiencies in quality of care and patient safety, much of the pressure for system change has arisen from payers.

In the United States, the Leapfrog Group<sup>10</sup> was created by a large number of U.S. Healthcare purchasers and major U.S. corporations to "leapfrog" current frustrations with the purchase of healthcare services. Their goal is to develop, disseminate, and execute a common set of purchasing principles designed to promote safety and overall healthcare value. A long-term goal is to reward hospitals and physicians on the basis of excellence in quality improvement. This goal has been frustrated by inadequate information systems and reporting of clinical performance and outcomes. As a result, the group has focused on discrete structural features likely to yield long-term gains in patient safety. Of interest to critical care physicians are the three stated safety initiatives:

- physician order entry by computer
- evidence-based hospital referral
- intensive care unit management by certified critical care physicians.<sup>11</sup>

In Canada, the provincial and federal governments (who serve as single payers) have identified similar issues from mandated reviews. Examples are the Mazankowski report<sup>12</sup> in Alberta and the pending Romanow report at the federal level. Remarkably diverse in origin, the multiple reviews and reports are significantly similar in their overall thrust and recommendations as summarized in Table 1.

### A meaningful response

The recommendations in Table 1 are sweeping and their scope implies a transformational change in the structure, process, and delivery of healthcare. Most providers and many administrators have no formal training or direct experience in many of the skill areas required to transform the system. Many of the 12 items have not previously been considered for formal institutional support. This is particularly true of the organizational infrastructure required for quality improvement initiatives, clinical decision support, and implementation of clinical practice guidelines. In the past, information management in healthcare institutions was driven primarily by measurements of activity for reimbursement by provincial governments and other payers. Although some of this information can be extrapolated to assess quality and appropriateness, much of it is not applicable. In the new system, where clinical leaders, managers, and providers are held accountable for the quality of their programs and their individual activities, there is a pressing need for a shift to information management to provide clinically relevant measurement of all aspects of quality. There is also a need for tools such as electronic clinical decision support that will allow care providers to achieve higher levels of quality.

Most faculties have had no training in quality improvement methodology, multidisciplinary team function, and quality measurement and evaluation. It is unrealistic to make institutions and their managers accountable for quality without providing them with the tools they need. Our current healthcare system is characterized by a shortage of physicians, nurses, and other healthcare personnel. They cannot be expected to develop the new skills and expertise and devote the time necessary to transform the system without additional organizational support. In order to improve quality and safety, institutional support should integrate measurement and information management with a quality improvement team to develop the skills necessary for implementing change in response to measured outcomes.

One example of an organizational response is in the Calgary Health Region. The previously separate functions needed to “Cross the Quality Chasm” have been

**Table 1: A summary of recommendations to improve the quality of healthcare in Canada**

1. The need to stress and support wellness and disease prevention through education and financial or other incentives.
2. The acceptance of 6 specific aims for quality improvement to provide healthcare that is safe, effective, patient-centered, timely, efficient, and equitable.
3. Collaboration of all clinical disciplines to provide team-based care, including all the professional skills needed by the patient.
4. The patient should become a source of control, setting priorities for their care based on their preferences.
5. The need for shared knowledge and the free flow of information, giving patients unfettered access to their own information and to clinical knowledge.
6. The need for transparency to allow patients to make informed decisions about choices of providers and hospitals based on our records of safety evidence-based practice and outcomes.
7. The need to organize around priority conditions and to develop plans for care of chronic illness.
8. The need to adopt standards and provide a common base for the development of information technology that will result in the development and implementation of an electronic patient record.
9. The need to develop a comprehensive plan for healthcare information management, including better indicators of quality and performance, and to apply them across the healthcare delivery system holding providers and institutions accountable.
10. The need to build organizational supports for change, including the provision of quality improvement methodology and education to assist staff in the redesign of care processes, information technology that staff can use effectively to manage information, and support and skills to develop effective teams.
11. The need to provide better decision support at all levels and support of evidence-based practice, healthcare delivery research, practice guideline development and implementation, and enhanced use of computer-based clinical decision support systems.
12. The need to match payment structures to quality incentives.

integrated. With the creation of a portfolio that was designated “Quality Improvement/Health Information,” the region brought together staff with skills in corporate information management, medical records analysis, health services analysis, quality improvement, concurrent review, clinical informatics, medical

education, and accreditation. As an integrated team, the portfolio provides organizational support for a quality improvement delivery structure that includes the delegation of staff with the necessary skill sets.

At the department level, quality improvement teams consisting of funded medical leadership, a quality improvement consultant, data collection support, and information management and analysis provide the skills necessary to initiate a response to quality issues. Departmental quality councils provide the setting for the discussion of quality issues, prioritization of concerns, initiation of projects, development of quality indicators, and education of department members; these councils report to the Department Executive. Members of Departmental Quality Councils attend meetings of the Regional Quality Council, which provides for the exchange of ideas, education, and the setting of regional priorities. To date, 10 such departmental teams have been structured. Early results are promising. The Calgary Health region is an integrated system that allows the use of such support to conduct internal quality improvement collaboratives based on the methodology developed by the Institute for Healthcare Improvement [<http://www.ihl.org/>]. The adoption of a regional theme for quality improvement (increasing patient access by improving patient flow) has allowed a much greater regional impact.

An additional responsibility of the Quality Improvement/Health Information portfolio has been to support and implement an integrated information management strategy for the region with the goal of providing enhanced information for decisional support at all levels. Three projects have been prioritized: implementation of electronic health records, the creation of an information clearing house, and the development of an “enterprise master person index,” which provides a single patient identifier that would be recognized at all levels in the region. Although this approach is still in the early stages, initial results are favourable and may provide a useful template for other institutions.

### Application to Intensive Care

Members of the critical care community have been early adapters in implementing many of the recommendations listed in Table 1. The need to develop indicators of quality and performance was reflected in the early development of ICU scoring systems such as the:

- Acute Physiology and Chronic Health Evaluation (APACHE II and APACHE III)<sup>13,14</sup> scoring and outcome prediction systems,
- Simplified Acute Physiology Score (SAPS II)<sup>15</sup> and,
- Mortality Probability Model (a MPM II).<sup>16</sup>

The Intensive Care National Audit and Research Center (ICNARC) in Britain has developed an hierarchical coding method to allow concurrent diagnostic coding of ICU patients and improve consistency in patient risk-adjusted mortality estimates.<sup>17</sup>

Well-developed quality improvement programs have been present in many intensive care units for over a decade.<sup>18</sup> This is particularly true of the Canadian intensive care community, which has been active in evaluating and managing the processes of care.<sup>18,20,21</sup> In many centres, local databases have been created to oversee quality and use patient risk-adjusted mortality as a benchmark of quality.<sup>19,20,21</sup> The Critical Care Research Network, based in London, Ontario, has provided the leadership to extend these activities on a regional basis<sup>21</sup> and Canadian critical care physicians have been active leaders in applying evidence-based medicine to critical care.<sup>22</sup> In addition, the Canadian Critical Care Clinical Trials Group has been a vital force in designing<sup>23</sup> and conducting<sup>24</sup> large clinical trials in critical care medicine. Results from these trials and others have provided new knowledge, allowing the application of guidelines to decrease variation and improve outcomes in many areas (eg, ventilator management, ventilator weaning, prophylaxis for gastrointestinal bleeding, sedation, analgesia, and blood transfusions).<sup>25</sup> The Institute for Healthcare Improvement (IHI) project for idealized design of intensive care<sup>26</sup> is providing new insights about the process, structure, and function of critical care in improving the delivery and measurement of quality care. They and others<sup>27</sup> continue to develop improved indicators to measure quality of care.

The integration of tools and information to improve the quality of care in Canadian intensive care units is a formidable task. There are 3 other factors that should be considered.

1. Much ICU quality improvement activity has treated the ICU as a stand-alone unit. In order to transform care to a patient-centered perspective as recommended, the emerging concept of quality should evaluate treatment in the ICU as part of a continuum of care for patients. Timeliness and quality of care pre-ICU admission is a

factor in ICU outcomes, and post-discharge care is a factor in ICU readmission rates, often considered a marker of quality.<sup>28</sup>

2. It is reasonable for ICU physician leaders and unit managers to expect that their region or institution will provide the organizational support needed, including funded medical leadership, trained quality improvement coordinators, and data collection and analysis to support their quality improvement and measurement functions. The provision of funds for this support is often a struggle because it is seen as detracting from resources needed for direct patient care.
3. Is it reasonable for the critical care community to evaluate the role played by our professional organizations in supporting what is arguably the largest issue facing our profession? Critical care in Canada is well served by active and effective groups. The Canadian Critical Care Society has provided leadership in developing critical care as a discipline in education and in policy; the Canadian Critical Care Clinical Trials Group has provided leadership in the search for new knowledge and in the design and implementation of large clinical trials; and the Canadian Intensive Care Foundation is in the process of developing community contacts for clinical providers and effective means for fund-raising. Would it be possible for these organizations to work together to support the improvement of quality and patient safety in Canadian intensive care units? Would an enhanced relationship with the Canadian Critical Care Nurses Association and the Canadian Society of Respiratory Therapists allow the exchange of information and improved team relationships?

The use of multicentre collaboratives and the rapid change in quality improvement methodology pioneered by IHI in the United States has been very effective. These projects have included the participation of some Canadian intensive care units. The concepts developed during idealized design work can be rapidly propagated and teams in the collaboratives learn from each other, allowing the rapid spread of effective ideas. Can the extensive intellectual capabilities and energy that exist in Canadian critical care professional organizations be mobilized to initiate quality improvement collaboratives across the Canadian intensive care scene? For the sake of our patients, it must.

## The Canadian system as it could be

**Mr. Calaban August 2004:** *Although fit at 67, Mr. Calaban sustains a fall on the local ski hill. He is admitted to the emergency department an hour later with a decreased level of consciousness. Physical examination and CT scan reveal an acute subdural hematoma. He is reviewed briefly by ICU staff and a neurosurgeon and is taken directly to the OR. Patient flow management in the institution uses a system that assures an open ICU bed for emergent cases and Mr. C. goes directly from the OR to intensive care. A comprehensive past medical history, medication and allergy history, and summary of his physiologic monitoring in the OR is displayed on Mr. C's electronic health record in his ICU room. The ICU team uses the same record for clinical decision support to prevent drug-drug interactions, utilize practice guidelines for ventilator management, prevent nosocomial pneumonia, and aid ventilator weaning. A comprehensive nutrition plan is established with the dietitian member of the team prior to his transfer to the ward on day 7 where a bed is available, based on Mr. C's predicted discharge day. Members of the ICU and ward teams have a brief conference prior to transfer to allow a smooth transfer of care.*

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## References

1. Institute of Medicine. Committee on Quality of Health Care in America. *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington, DC: National Academy Press; 2001.
2. Advisory Commission on Consumer Protection and Quality in the Health Care Industry. *Quality First: Better Health Care for All Americans*. 1998; Vol. 2000.
3. Kohn LT, Janet M. Corrigan, Donaldson MS. *To Err Is Human: Building a Safer Health System*. Washington, DC: National Academy Press; 2000b.
4. Wachter RM, Shojania KG, Saint S, Markowitz AJ, Smith M. Learning from our mistakes: quality grand rounds, a new case-based series on medical errors and patient safety. *Ann Intern Med* 2002;137(2):110-6.

5. Bates DW. Unexpected hypoglycemia in a critically ill patient. *Ann Intern Med* 2002;136(11):826-33.
6. Schuster MA, McGlynn EA, Pham CB, Spar MD, Brook RH. The Quality of Health Care in the United States: A Review of Articles Since 1987. *Crossing the Quality Chasm. A New Health System for the 21st Century*. Washington, DC: National Academy Press, 1999:231-308.
7. Baker GR, Norton P. *Patient Safety and Healthcare Error in the Canadian Healthcare System*. A Systematic Review and Analysis of Leading Practices in Canada with Reference to Key Initiatives Elsewhere.
8. Wennberg JE, Gittelsohn. Small area variations in health care delivery. *Science* 1973;182:1102-8.
9. Wennberg JE. Understanding geographic variations in health care delivery. *N Engl J Med* 1999;340:52-3.
10. Milstein A, Galvin RS, Delbanco SF, Salber P, Buck CR. Improving the Safety of Health Care: The Leapfrog Initiative. *Effective Clinical Practice* 2000;Vol. 2002.
11. Young MP, Birkmeyer JD. Potential Reduction in Mortality Rates Using an Intensivist Model to Manage Intensive Care Units. *Effective Clinical Practice* 2000;Vol. 2002.
12. Mazankowski D. *A Framework for Reform*. Report of the Premier's Advisory Council on Health. Edmonton, AB:Government of Alberta, December 2001;1-77.
13. Knaus WA, Draper EA, Wagner DP, et al. An evaluation of outcome from intensive care in major medical centers. *Ann Intern Med* 1986;104:410-18.
14. Knaus WA, Draper EA, Wagner DP, et al. The APACHE III prognostic system. Risk prediction of hospital mortality for critically ill hospitalized adults. *Chest* 1991; 100:1619-36.
15. Le Gall J, Lemeshow S, Saulnier F. A new Simplified Acute Physiology Score (SAPS II) based on a European/North American multicenter study. *JAMA* 1993; 270:2957-63.
16. Lemeshow S, Teres D, Klar J, et al. Mortality Probability Models (MPM II) based on an international cohort of intensive care unit patients. *JAMA* 1993; 270:2478-86.
17. Young JD, Goldfrad C, Rowan K. Development and testing of a hierarchical method to code the reason for admission to intensive care units: the ICNARC Coding Method. Intensive Care National Audit & Research Centre. *Br J Anaesthesia* 2001;87:543-8.
18. Clemmer TP, Spuhler VJ, Oniki TA, Horn SD. Results of a collaborative quality improvement program on outcomes and costs in a tertiary critical care unit. *Crit Care Med* 1999;27:1768-74.
19. Roberts D, Ostryzniuk P, Loewen E, et al. Control of blood gas measurements in intensive care units. *Lancet* 1991;337:1580-2.
20. Brown G, Dodek P. An evaluation of empiric vs. nomogram-based dosing of heparin in an intensive care unit. *Crit Care Med* 1997; 25:1451-2.
21. Keenan S, Martin C, Kossuth J, Eberhard J, Sibbald W. The Critical Care Research Network: a partnership in community-based research and research transfer. *J Evaluation Clin Pract* 2000; 6:15-22.
22. Cook D, Sibbald W, Vincent J, Cerra F. Evidence-based critical care medicine; what is it and what can it do for us? Evidence Based Medicine in Critical Care Group. *Crit Care Med* 1996; 24:334-7.
23. Hebert PC, Cook DJ, Wells G, Marshall J. The design of randomized clinical trials in critically ill patients. *Chest* 2002;121: 1290-1300.
24. Cook D, Canadian Critical Care Trials Group
25. Holcomb B, Wheeler A, Ely E. New ways to reduce unnecessary variation and improve outcomes in the intensive care unit. *Curr Opin Crit Care* 2001;7:304-11.
26. Institute for Healthcare Improvement, Idealized Design of the Intensive Care Unit, <http://www.ihp.org/idealized/idicu/>
27. Berenholtz S, Dorman T, Ngo K, Pronovost P. Qualitative review of intensive care unit quality indicators. *J Crit Care* 2002;17:12-5.
28. Rotondi AJ, Sirio CA, Angus DC, Pinsky MR. A new conceptual framework for ICU performance appraisal and improvement. *J Crit Care* 2002;17:16-28.

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