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# 2010 Measuring & Monitoring for Success

Health Quality Council of Alberta

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	Being Healthy				
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Promoting and improving patient safety and health service quality across Alberta

The core mandate of the Health Quality Council of Alberta (HQCA) is to measure, monitor, assess and report on the quality and safety of health care services in Alberta and to support improvement through collaboration with service-providing organizations, health professionals and Alberta Health and Wellness.

The HQCA's monitoring role requires it to systematically measure selected aspects of health care conditions, services, programs, projects or initiatives to track changes and progress in the achievement of improved quality and safety. This involves highlighting successes and areas of improvement as well as providing relevant recommendations.

To measure quality and safety, the HQCA uses tools such as surveys, focus groups, analysis of administrative and operational data, evaluations and inquiries.

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## Foreword

It is imperative that Alberta develop a sophisticated and robust measurement system. This is a foundational requirement for informed strategic decision-making, improved service quality and, ultimately, the sustainability of the health care system.



On behalf of the Health Quality Council of Alberta (HQCA), I am pleased to present the 2010 Measuring e3 Monitoring for Success, our second report that examines quality measurement in Alberta's health care system. This report follows one released in 2009 that looked at drivers of expenditure in the health system and highlighted Alberta health care innovations where effective measurement demonstrated improvements in the quality of health care.

The HQCA has a legislated mandate to measure, monitor, assess and report on the quality and safety of Alberta's health care system. This monitoring role requires us to measure selected aspects of health care conditions, services, programs, projects or initiatives to track changes and progress in achieving improved quality and safety.

The theme of the 2010 report is the power of measurement to inform decision-making and improve the quality and sustainability of the health care Albertans receive. The first section of the report provides an overview of health information management initiatives within Alberta's health system. It outlines a model for the integration of clinical-level and system-level health information for managing quality and strategic decision-making.

The second section showcases frontline quality improvement initiatives and the related dimensions of quality identified in the *Alberta Quality Matrix for Healtb.*<sup>1</sup> These initiatives highlight how information and measurement have been used to guide, evaluate and advance specific improvement strategies. They represent the innovation and interest of health care providers to improve the quality of care they deliver. They also illustrate the critical importance of measurement in guiding, evaluating and spreading innovation in health care. Effective and integrated health information management is capable of bringing evidenced-based information and practices back to the point of care where it can be acted upon to influence patient outcomes and improve the health system. Alberta is still some years away from realizing a robust and integrated health information infrastructure. To better quantify what is needed to assure Albertans that they will receive high-quality health care when they need it, it is imperative that Alberta develop a sophisticated and robust measurement system. This is a foundational requirement for informed strategic decision-making, improved service quality and, ultimately, the sustainability of the health care system.

We thank Alberta Health Services, Alberta Health and Wellness and our many stakeholders for contributing their time and expertise to this report. These organizations and the advice they provide to this and other HQCA initiatives is much appreciated. Their enthusiasm for improving patient safety and health service quality is commendable.

John Coweel

John W. Cowell, MD Chief Executive Officer Health Quality Council of Alberta November 2010

HEALTH QUALITY COUNCIL OF ALBERTA

# **Executive Summary**

### Introduction: Quality – the route to sustainability

The Health Quality Council of Alberta (HQCA) seeks to ensure that our province's health system reflects the six dimensions of quality described in the *Alberta Quality Matrix for Health* <sup>1</sup> – acceptability, accessibility, appropriateness, effectiveness, efficiency and safety. High-quality health care based on excellent performance in each of these dimensions will result in a sustainable health system.

An effective infrastructure of information, measurement and quality improvement is needed to support sound decisions, actions and policies. Such infrastructure must facilitate:

- > systematic application of best evidence
- > routine assessment of care quality and outcomes
- > evaluation of innovative and diverse care processes
- > performance management

For managing patients and quality of care, this infrastructure should also deliver decision support features to clinicians such as direct access to patient records, reminders and warnings, condition-specific encounter templates and order entry systems.

The 2010 Measuring & Monitoring for Success report showcases examples of the power of information and measurement to inform decision-making and improve the quality and sustainability of the health care Albertans receive.

#### **Section 1.0: System-Level Processes**

The first section of the report provides an overview of health information management initiatives within Alberta's health system.

Effective and integrated health information management is vital due to its capability to bring evidence-based information and practices to the point of care – to places where information and/or strategies can be acted upon to influence patient outcomes and improve the health system. This requires an information management model with a rational integration of functions. While these different functions appear to live in discrete worlds, all are ultimately linked by the individual patients who travel through the various points of care.

Electronic data collection, with the capability for system-wide aggregation and real-time reporting, would ultimately deliver better monitoring and reporting of quality indicators and significantly advance quality improvement. Though Alberta is still some years away from such an integrated information management model, there are numerous examples of how information management benefits health care in Alberta – strategies with considerable potential to enable better patient management and improve health care quality – provided these strategies are used to full capacity.

Alberta Netcare, the program that encompasses all the projects, processes, products and services that work together to make Alberta's electronic health record a reality for every citizen, provides an integrated provincewide electronic health record solution. By offering key information elements to health care service providers at points of care, Netcare delivers decision support that helps improve the quality and safety of patient care. Electronic medical records (EMR) assist Alberta's family physicians by facilitating improved business processes and clinical management. Patient registries are used to monitor a variety of diseases as well as targeted patient groups and the Physician Office System Program supports the development and integration of patient registries with EMRs.

Alberta's health care system is evolving from a focus on volume or procedures reactive to patient health issues to a health system approach that is person-centred and emphasizes prevention, health support and coordinated team-based care. A quality focused health care system capable of preventing and managing illness will reduce the high costs of health care and improve overall quality. Alberta's \$15-billion per year<sup>2</sup> health care system needs to measure its primary output (restoration or maintenance of functional health) and the cost of that output (cost per clinical outcome) in order to systematically assess value and improve sustainability. In addition to these high-level measures of system performance, sets of indicators for each clinical area are also required.

#### **Section 2.0: Clinical-Level Processes**

Section 2.0 showcases Alberta quality improvement initiatives, which are grouped according to the six dimensions of quality in the *Alberta Quality Matrix for Health*.<sup>1</sup> For each of the case studies, background information provides a wider context for the advances highlighted. The following are summaries of each case study. For more detail, see the individual case studies later in the report.

#### 1. Acceptability

Using resident and family feedback to improve care in long term care facilities

This case study looks at what most influenced survey participants' overall care ratings in the 2007 HQCA surveys of resident and family experience in Alberta long term care facilities. It also provides examples of quality improvements that resulted from the survey.

Advance care planning for the end of life

This case study points out the benefits of advance end-of-life care planning and examines implementation of the goals of care designation order for adult patients receiving care and treatment in facilities owned or contracted by Alberta Health Services – Calgary Zone.

#### 2. Accessibility

Improving access to children's mental health services

Research proves that society can benefit enormously from intervening early in children's mental health problems. One of many initiatives underway in this area is a centralized intake to child and adolescent mental health program services. Results of this network-based regional tracking system include a dramatic reduction in wait times for all service levels, doubling of treatment capacity for 0 to 18 year olds, and the ability to evaluate different service models.

Improving access to MRI and CT services

As examples in this case study reveal, Alberta Health Services has significant opportunity to use diagnostic imaging resources more efficiently – particularly MRIs where wait times are increasing. A computerized provider order entry system combined with guidelines for the appropriate use of MRI and CT services and concurrent measurement of relevant quality indicators could lead to more efficient MRI and CT utilization.

Monitoring emergency department wait times

Between 2007 and 2009, overall length of stay increased among the 12 highest-volume urban and regional emergency departments in Alberta. Yet, a large decrease was noted in a regional hospital where a bundle of quality improvement actions was implemented. While not all of these actions can be applied to all emergency departments and communities, data shows that the redesign and/or addition of community and emergency department/acute care resources can significantly affect both wait times and the patient experience.

#### **3.** Appropriateness

Web-based surgical records help promote evidence-based practices

Variations in surgical processes influence patient outcomes; yet, historically details of the surgical process have not been captured and compared. Web-based surgical medical records developed for cancer surgery are making this possible. As of October 2009, 75% of eligible Alberta cancer surgeons were voluntarily using this system, which replaces dictated operative reports with an easy-to-read synoptic report automatically generated and sent to all relevant recipients. This electronic approach also seamlessly incorporates current practice guidelines with the potential of increasing survival, decreasing morbidity and reducing cost and resources.

Chronic obstructive pulmonary disease and asthma: Decreasing return visits to emergency departments

Although Alberta trends show decreases in return visits to emergency departments due to asthma or chronic obstructive pulmonary disease, further reductions are anticipated with wider adoption of selfmanagement programs and with greater prevalence of comprehensive chronic disease management programs in the community.

## 4. Effectiveness

Measuring the quality of trauma care

The Regional Trauma Services Program utilizes and monitors a comprehensive and integrated set of indicators that link care processes to patient outcomes. This case study examines how this monitoring information provided a means to identify and address areas for improvement.

Learning from adverse events and close calls

This case study highlights the benefits of adverse event reporting and learning systems. The example demonstrates how what was seen as a rare local event became relevant at the system level when data related to appropriate patient identification in laboratory services was aggregated with data from other areas.

Delivering stroke treatment sooner

The diagnosis and treatment of a stroke is extremely time dependent because of the rapid deterioration of brain function. Accordingly, the Alberta Provincial Stroke Strategy has established primary stroke centres throughout Alberta, which provide advanced acute stroke treatment using telestroke connections to comprehensive stroke centres in Calgary and Edmonton. This case study details the improved health outcomes and cost savings realized by this initiative using an example from a predominantly rural area.

#### 5. Safety

Improving patient safety using clinical decision support systems for venous thromboembolism prophylaxis

This case study sheds light on one of the most common and preventable complications of hospitalization – venous thromboembolism. Venous thromboembolism refers to both deep venous thrombosis and pulmonary embolism. Hospital patient information systems can play a role alerting physicians about venous thromboembolism risk.

#### Reducing use of dangerous abbreviations

The use of specific abbreviations has been identified as an underlying cause of serious, even fatal, medication errors. This case study looks at the effectiveness educational campaigns and computerized provider order entry systems have in addressing this problem. It concludes that computerized provider order entry systems can better sustain the behavioural change needed to minimize the use of dangerous abbreviations.

#### Incidence of surgical site infection

Most surgical site infections develop post-discharge and are not captured by current surveillance methods. Therefore surgical site infection rates may be underestimated and can lead surgeons to assume the problem is minimal. The HQCA used provincial health data linked at the patient level to provide more realistic surgical site infection estimates for specific surgeries.

Measuring the incidence of pressure ulcers to stimulate preventive actions

The preventive actions of health care providers can have a significant impact on the incidence of pressure ulcers. Skin integrity management programs should include ongoing measurement of the incidence of pressure ulcers to assess the impact of prevention strategies. This case study looks at the problem and provides an example of a successful prevention program implemented in an acute care setting.

Reducing the incidence of venous central line-associated bloodstream infection

Preventive actions can drastically reduce the incidence of venous central line-associated bloodstream infections. The implementation of criteria to guide decisions on the insertion and maintenance of central venous catheters and training nurses in ultrasound use to guide peripheral catheter insertion are examples of effective quality improvements examined in this case study.

By disseminating this quality improvement snapshot, the HQCA strives to advance the wider adoption of these worthwhile endeavours, stimulate dialogue about future directions and commend the commitment of Alberta's health care providers to quality improvement. Health information and measurement has considerable decision-making at all levels of the health care system – strategies that are pillars for sustainability.

#### Section 3.0: In Summary

Section 3.0 offers conclusions about the current status of health care information and measurement in Alberta and possible directions for the future.



# Section 1.0: System-Level Processes

Better decision-making and long-term management based on meaningful measurement can reduce resource utilization and help prevent undesirable health outcomes throughout the health care system. This is the power of measurement.

## **Health Information Management in Alberta**

#### Achieving a quality-focused health care system

The Health Quality Council of Alberta (HQCA) believes that steady increases in health care expenditures for limited gains in service or service reductions to control expenditure can be expected until measurement and quality improvement become ingrained as a core business strategy. As many examples in this report show, better decision-making and long-term management based on meaningful measurement throughout the health care system can reduce resource utilization (i.e., waste) and help prevent undesirable health outcomes. This is the power of measurement. A quality-focused health care system capable of preventing and managing illness can reduce the high costs of health care and improve quality.

# Managing quality using relevant measures at system and clinical levels

As noted in the 2009 Measuring & Monitoring for Success report, Alberta's \$15-billion per year health care system needs to measure its primary output (restoration or maintenance of functional health) and the cost of that output (cost per clinical outcome) in order to systematically assess value and improve sustainability. Understanding system-level cost drivers in each health care sector is also vital. Such drivers could help explain what increases costs after general inflation, population growth and aging have been taken into account.

In addition to these high-level measures of system performance, sets of indicators for each clinical area are required as the case studies in this report demonstrate. These indicators should be based on current evidence, driven by local clinical expertise and closely tied to care processes or clinical care pathways for unique patient populations. Program staff should also be involved in indicator selection. Ideally, both process and outcome measures would be included as well as those measures that address other aspects of quality specific to the clinical processes.

### Advancing quality improvement through the integration of health information

The power of measurement as a business strategy becomes most evident when quality and safety measures are embedded at every level of the system. This in turn is further enabled by integrating these measures into an overarching health information strategy and the information systems that support that strategy.

For instance, effective management of health information can bring evidenced-based information and practices back to the point of care or even directly to individual Albertans – places where information can be acted upon to influence patient care and improve the health system. Effective and integrated health information is vital to both system- and clinical-level decision-making. As shown in Figure 1, establishment of a whole patient record is at the heart of an integrated health information model.



The model depicts relationships between those involved – from care providers and researchers to policy-makers and patients – as well as the systems supporting them, the different information functions of clinical, system and patient decision-making and evidence resolution. Optimizing these systems to improve quality requires that they include support applications for clinical decision-making, order entry, and other aspects of patient management.

Emerging data systems should also include the capacity for real-time measurement and reporting on care quality and performance for specific patient populations and diverse programs, and the refinement of evidence and best practice. While these different functions appear to live in discrete worlds, all are ultimately linked by the individual patients who travel through these various points of care.

Studies report that hospital information automation, including clinical documentation, computerized provider order entry and clinical decision support can reduce hospital mortality, complication rates and costs.<sup>3</sup> For example, clinicians of the Veterans Health Administration (VA) in the United States, one of the largest single payer health providers globally, developed an integrated electronic health record from the ground up based on day-to-day business needs surrounding patient care.<sup>4</sup> It was used to standardize practice and continuously measure and improve the quality of patient care. As a result, the VA has outperformed other American health systems in quality measures since 2003 and by 2006, the life expectancy of veterans over 65 years of age was longer than for those in Medicare. In achieving these quality milestones, the VA realized nearly zero cost inflation from 1995-2004, a period that saw Medicare costs and the medical consumer price index rise by about 40%.<sup>5</sup>

The VA example illustrates that embedding quality and safety measurement into management strategies and protocols can improve the quality and efficiency of patient care.

#### Information management and electronic health information systems in Alberta

In Alberta, the ideal, fully integrated health information management model, including measurement strategies and protocols, is still years away. However, there are examples of how information management initiatives currently benefit health care in Alberta. The following section highlights several health information management initiatives that have contributed significantly to Alberta health care quality and safety improvements – initiatives that could enable measurement for the purposes of improving quality and safety across Alberta's health care system.

#### Alberta Netcare<sup>6</sup>

Alberta Netcare refers to all the projects and activities related to Alberta's electronic health record (EHR). As the Alberta Netcare website states, "It was developed by Alberta Health and Wellness in partnership with Alberta Health Services and many others including the health professional colleges and associations."

The vision for Alberta Netcare was established in 2005 when the Government of Alberta set the goal of an EHR for every Albertan. According to the website, "Many health service providers are working to achieve

this goal... more than 14,000 physicians, pharmacists and other health service providers are registered users of the Alberta Netcare EHR portal, and the number grows every day."

"The Alberta Netcare EHR is a secure lifetime record of an Albertan's key health information available for consultation by authorized health service providers. However, it is not a patient's full health or medical record." EHR content is maintained and updated primarily by automated information captured from the existing electronic data systems of pharmacies, laboratories, diagnostic services and Alberta Health Services' facilities.

The EHR design improves patient care by providing immediate up-to-date information at the point of care. Alberta Netcare EHR captures several key data elements from the clinical records of its authorized health service providers and includes the following information:

- > personal demographic information to help uniquely identify each patient
- > prescribed dispensed drugs
- > known allergies and intolerances
- immunizations
- laboratory test results
- diagnostic imaging reports
- other medical reports (transcribed reports, discharge or care summaries)

Proposed future expansion will include the following:

- Summarized information from encounters with various providers or acute care facilities including such elements as diagnostic and treatment codes, care composition profiles and chronic disease management information.
- An e-prescription component that will allow physicians to prescribe medication on a secure network accessible to any Alberta pharmacy and prescribing decision support and computerized physician order entry system.
- > A personal health portal whereby patients can access their own electronic health record.

By presenting information immediately at the point of care, the Netcare EHR Portal is intended to reduce treatment delays, decrease unnecessary test duplication (e.g., laboratory and diagnostic imaging), and support diagnostic and treatment decisions. Speeding up the transfer of health information promotes a common understanding of a patient's health condition, which can prevent unwarranted delays and treatments and limit the occurrence of adverse events. Consequently, improvements in health outcomes are also anticipated.

Importantly, EHRs can improve completeness, accuracy and clarity of medical records accessed at the point of care. With full implementation of the Alberta Netcare EHR Portal, health service providers will have decision support tools that offer:

- > drug-to-drug allergy interactions and alerts to avoid conflicting prescriptions.
- > a database of all available drugs with common dosages.
- > links to information support such as clinical guidelines from the Alberta Medical Association.

Features such as trending of laboratory values and drug monographs (published standards and information) will also help with patient consultations.

An important tool for the advancement of quality improvement throughout the health system, the Netcare EHR Portal facilitates better decision-making and improved patient safety by making basic patient information readily available to health service providers.

#### Electronic medical records at family physician offices

The Physician Office System Program is funded as part of a trilateral agreement between Alberta Health and Wellness, the Alberta Medical Association and Alberta Health Services. It supports the transition of physicians' practices from paper medical records to standardized electronic medical records (EMRs) and is designed ultimately to improve patient care through the automation of care pathways and the use of best-practice templates, registries and efficiency tools and helpdesk services.<sup>7</sup>

Alberta is recognized as a leader in Canada, particularly regarding EMR implementation. According to the 2007 National Physician Survey,<sup>8</sup> Alberta doctors are more apt to manage their workplaces using innovative technologies when compared with physicians overall in Canada (Figure 2). The use of electronic charts alone is already common practice for more than 21% of Albertan physicians, while a further 34% use a combination of paper and electronic charts.



Source: National Physician Survey 2007

ELECTRONIC AIDS	ALBERTA (%)	CANADA (%)
Billing	53	53
Scheduling	48	42
Enter and retrieve patient notes	40	26
Interface to lab/diagnostic imaging	42	30
Reminders for patient care	18	10
Interface to sharing information	28	19
Warning for adverse prescribing	17	10
Decision aids	13	10
Interface to external pharmacy	6	4
Interface to external patient registry	3	2

Table 1. Proportion of physicians by utilization of electronic aids (2007)

Source: National Physician Survey 2007

As the data in Table 1 shows, Alberta family physicians led the use of electronic aids (e.g., for billing, scheduling, interfacing with lab and diagnostics, etc.). However, patient registries were and still are a novelty in the province (3%) and throughout Canada (2%).<sup>8</sup>

#### **Patient registries**

A patient registry is less complex than an EMR and can be used to monitor patients with specific sets of health care needs such as those with chronic disease. This tool allows early diagnosis of progressive illness and the treatment and prevention of complications because it guides a proactive process of care. This is accomplished by tracking process and outcome indicators and providing electronic supports such as alerts for the effective management of specific chronic illnesses. These systems enable performance management at both the patient and the population level.

Though patient registries are rare, Edmonton undertook a specific application that proved successful. As of June 2009, the diabetes component of the chronic disease management registry had been deployed to 48 clinics and 196 primary care physicians from five primary care networks.<sup>9</sup> The registry contained 15,280 diabetes patients. The flow of information and activities begins with the Hemoglobin A1c (HbA1c), a lab test that reflects the average blood glucose of the previous two to three months and is an important indicator of diabetes control. HbA1c data is extracted from the Netcare laboratory repository and becomes the starting point of a diabetes patient registry within the physician's office information system. This type of information management tool supports more effective diabetes care.

#### The Calgary Patient Care Information System Project

The plan to replace Calgary's clinical information system, which served two large acute care hospitals, might have been routine had it not been for the unfortunate deaths of two patients due to an error with dialysis fluids.<sup>10</sup> A renewed focus on safety and quality advanced the mandate for the patient care information system (PCIS) project. From administration to the front line, this new system was framed as part of a clinical transformation that would improve both patient outcomes and patient safety.

The PCIS project was founded on specific principles. First, the move from a facility-based, primarily paper chart system to a unified single electronic patient care record across all care facilities. And second, that the system design and content would be led largely by the system users – by clinicians for clinicians. The goal was to reach 100% compliance with computerized provider order entry for all orders.

During system design, requirements for clinical content (i.e., order sets, alerts and clinical decision support) were collected from all existing programs. Based on this information, consensus was reached about standardized practice; no individual content was supported. For practice areas spanning multiple departments and with high implications for safety, expert working groups were convened to create evidence-based, high impact pan-departmental order sets. At the time of this report, more than 2,000 order sets had been designed with 1,500 in use.

Each of the acute care hospitals underwent a "big-bang" implementation of the new PCIS. The three adult sites went live over five months ending in January 2007. The Alberta Children's Hospital was delayed because of a move to a new facility and went live in June 2009. Four hospitals with over 2,150 beds are now providing care to all inpatients using the new clinical information system.

#### Clinical transformation delivered by the acute care patient care information system

After the PCIS implementation in all Calgary acute care facilities, considerable effort went into measuring its adoption and the impact on clinical care. As computerized provider order entry was one of the most critical and transformative changes, its adoption was the first measured. Since PCIS implementation, all orders in acute inpatient units have been entered electronically and of those, 90% have consistently been entered directly by the ordering providers.

Clinicians are also alerted to drugs they should avoid to reduce an adverse event related to medication orders. PCIS configurations alert ordering clinicians when drugs the patient is allergic to are ordered or when a new drug order may interact adversely with or is redundant to a drug the patient is already taking. All such signals are a potent method of increasing the safety of medication management and guiding clinicians to better treatment decisions.

Several types of order sets were also built into the PCIS to enable simple, quick and accurate ordering of complex care processes. In bringing together clusters of common orders for medications, diagnostic imaging

or laboratory tests, and by creating simple monitoring schedules for activities such as repeat tests, ordering for many common items is now more consistent and efficient than it was with a paper system.

Soon after PCIS implementation at the Rockyview General Hospital, a 20% decline in the number of chemistry test orders was noted (Figure 3). This benefit appeared to be due partly to the way repeated lab tests were organized in the new order sets.



Source: Sunrise Clinical Manager™ patient care information system

Order sets were designed to optimize evidence-based care to manage the following conditions or processes: acute coronary syndrome, hospital diabetes care using self-adjusting insulin regimens, and the appropriate ordering of antibiotic prophylaxis prior to elective surgical procedures. One of the more complicated order sets calculates the right mix of nutrients for babies in neonatal intensive care units (total parenteral nutrition). Overall, these ordering procedures result in better and safer care, especially for some of the more vulnerable patients.

The PCIS also provides a graphing function to allow for better viewing and trending of patient data (e.g., labs, vital signs, weights and other observations). Clinicians have several pre-built and customizable lists and filters they can use to get quick big picture views of a patient's progress.

In addition to guiding better decision-making, the PCIS facilitates the measurement and reporting of health care performance. By measuring decisions, the subsequent steps of care and the outcomes of care, these systems provide aggregate health care data that feeds the process of continuous quality improvement and the generation of new guidelines for care processes.

For instance, in one of Calgary's emergency departments, PCIS allowed clinicians to define rules, which when implemented, reduced the use of Doppler ultrasound for diagnosis of deep venous thrombosis by 24% and CT scans for diagnosis of pulmonary embolus by 8%. Refining clinical practices and reducing unneccesary resource utilization can improve the flow of patients, the efficient use of health system resources and the overall quality of care in a clinical environment.

#### Conclusion

Information is vital to improving the quality and safety of Alberta's health care system; yet, not all of the vast amounts available are useful or appropriate. Currently, emerging health information systems are not adequately addressing the need for timely analysis of care quality for specific patient populations, better overall patient care, program management and system-level decision-making. Relevant evidence-based information and related performance measures focused on enabling delivery of high-quality health services is needed and a fully integrated whole patient record is a critical element.

There are numerous examples of information management initiatives in Alberta that benefit the quality of patient care by making patient data and decision support tools easily accessible to frontline clinicians. However, to take advantage of all the possible benefits of these information resources, functions must extend beyond a clinical focus to include the ability to look at quality from the perspective of specific patient populations or programs. Health information has considerable potential to enable improved patient management and health care quality and better decision-making at all levels of the system. Information management and quality measurement are vital to improving the quality and safety of Alberta's health care system and are pillars for sustainability.

# Section 2.0: Clinical-Level Processes

This section of the report showcases improvement initiatives related to the six dimensions of quality. The importance of selecting relevant measures at the unit or program level cannot be overemphasized as it facilitates the spread of successful frontline initiatives across Alberta's health care system.

#### **Alberta Quality Improvement Initiatives**

#### Introduction

Every health service unit or program has unique care processes and related outcomes. Therefore, each would benefit from implementing a set of performance measures that allow monitoring of both traditional and unique program elements. These measures should be constructed so improvements can be easily identified and are feasible for the unit or program to implement. To facilitate this, it is valuable to include program staff in the selection, use and evaluation of the monitoring process.

In Alberta, health care quality and safety are defined using six dimensions identified in the *Alberta Quality Matrix for Health*<sup>1</sup> as described here.

- Acceptability health services are respectful and responsive to user needs, preferences and experiences
- Accessibility health services are obtained in the most suitable setting in a reasonable time and distance
- Appropriateness health services are relevant to user needs and are based on accepted or evidence-based practice
- Effectiveness health services are provided based on scientific knowledge to achieve desired outcomes
- Efficiency resources are optimally used in achieving desired outcomes
- > Safety risks are mitigated to avoid unintended or harmful results

This section of the report illustrates many innovative solutions across Alberta and showcases improvement initiatives related to the quality dimensions. The importance of selecting relevant measures at the unit or program level cannot be overemphasized as it facilitates the spread of successful frontline initiatives across Alberta's health care system. The Health Quality Council of Alberta (HQCA) offers the measures for each example as a means to effectively monitor progress and encourages promotion of these innovative quality improvement initiatives provincewide.

### **Health Quality Dimension: Acceptability**

### Using resident and family feedback to improve care in long term care facilities



## 뚭 OF MEASUREMENT Q Resident and famil H a key measure of q Resident and family experience is a key measure of quality and an important aspect of providing and improving care and services for long term care residents.

#### Background

The Alberta Quality Matrix for Health<sup>1</sup> defines acceptability as "health services that are respectful and responsive to user needs, preferences and expectations". Such care includes compassion, empathy and effective communication between care providers and patients. Achieving acceptability is part of establishing an effective partnership between providers and their patients. In this context, acceptability is not just the final outcome of patient satisfaction. It is also about helping to improve processes of engagement, support and communication.

In 2007, the HQCA conducted provincial surveys of long term care residents and their families to collect feedback about their experiences and to enable comparison among service providers.

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The objective of these surveys was to:

- > Identify areas of excellence and opportunities for improvement in the long term care sector.
- Get standardized and comparable information across the province, health regions and service providers.
- > Provide baseline data for monitoring new initiatives to improve quality of care in long term care.

Overall, 3,415 interviews were conducted with cognitively able residents in 172 long term care facilities; this represented 24% of all long term care residents in the province. Concurrently, a survey was mailed to residents' families. The response rate for the family survey was 70.2%.

#### **Indicator Definition**

Numerator: Number of long term care facility residents and/or family members who rated the care in the nursing home as excellent, average or poor.

Denominator: Total number of long term care facility residents and/or family members.

#### What the Data Shows

Overall, nearly half or 45% of those family members (or most involved person) surveyed rated the care at the nursing home as excellent (9 or 10 out of 10). 41% rated the care as average (7 or 8 out of 10) and 14% rated the care as poor (0 to 6 out of 10).<sup>11</sup> Overall, half of those residents surveyed (50%) rated the care they received from nursing home staff as excellent (9 or 10 out of 10). 32% rated the care as average (7 or 8 out of 10) and 10% out of 10) and 18% rated the care as poor (0 to 6 out of 10).

As Table 2 and Table 3 show, the number of beds (facility size) appears related to the overall rating of care. Table 2 shows that in facilities with 80 beds or less, 55.6% of family members rated the care as excellent and 9.1% rated the care as poor. For facilities with 150 beds or more, the excellent rating decreased to 34% and the poor rating increased to 18.4%. These differences are statistically significant.

Table 2. Family members' overall care rating (Alberta, 2007)					
OVERALL CARE RATING	< = 80 BEDS (%)	81 TO 149 (%)	150 OR MORE (%)		
Excellent	55.6	43.8	34.0		
Average	35.3	42.2	47.7		
Poor	9.1	14.0	18.4		

Source: Health Quality Council of Alberta Long Term Care Family Experience Survey Provincial Technical Report 2008

Table 3. Residents' overall care rating (Alberta, 2007)					
OVERALL CARE RATING	< = 80 BEDS (%)	81 TO 149 (%)	150 OR MORE (%)		
Excellent	57.3	52.1	45.8		
Average	29.6	30.6	31.4		
Poor	13.0	17.4	22.9		

Source: Health Quality Council of Alberta Long Term Care Resident Experience Survey Provincial Technical Report 2008

For residents, Table 3 shows that in facilities with 80 beds or less, 57.3% rated the care as excellent and 13% rated the care as poor. For facilities with 150 beds or more, the excellent rating decreased to 45.8% and the poor rating increased to 22.9%. These differences are statistically significant.

The majority of the family survey questions reflected respondents' observations of or experiences with the care and services provided at the nursing home. Questions were grouped into sets of related items that addressed a common underlying issue. Analysis revealed a strong correlation between these related questions (combined as composite variables) and the overall care ratings provided by families. Beginning with the strongest association to the overall care rating, composites ranked in the following order:

- 1. Nursing home staffing, care of belongings and environment: finding a nurse or aide, how often there are enough nurses/aides, resident's medical belongings or clothes lost, resident's room or public areas look and smell clean, cleanliness of the resident.
- 2. Kindness and respect: nurses/aides treated resident with respect and kindness, nurses/aides really cared about resident, nurses/aides were rude to resident, nurses/aides were appropriate with difficult resident.
- 3. Providing information and encouraging family involvement: nurses/aides give respondent information about resident, nurses/aides explain things in an understandable way, nurses/aides discourage respondent questions, respondent stops self from complaining, respondent involved in decisions about care, respondent given information about payments and expenses.

Residents had somewhat different priorities. Communication had the strongest relationship with their overall rating:

- 1. Communication and respect: how respectful staff are to residents, how well staff listen and how well they explain things to residents.
- 2. Care: pain control, staff responsiveness, privacy, staff help with and gentleness when dressing, bathing, showering or toileting.
- 3. Environment: food, eating in the dining room and mealtime enjoyment, nursing home temperature and cleanliness, safety and security, quietness at night and noise during the day, privacy with visitors.

#### **Actions for Improvement**

In 2009, the HQCA conducted an e-mail poll of long term care service providers to identify the impact of the results from the HQCA's 2007 resident and family surveys.

The poll identified that numerous activities have taken place in long term care facilities throughout the province in response to the survey results. One long term care provider used the results to establish benchmarks and set targets for each of its facilities. Another made *Treating Patients with C.A.R.E.* (courtesy, attitude, responsibility and excellence) communications skills training mandatory for all staff. Other long term care providers held focus groups with families, residents and staff to articulate issues and have since implemented some of the suggestions. In another facility, the survey triggered establishment of a monthly newsletter to improve communication with families.

In the 2007 HQCA survey, the Shepherd's Care Foundation residents rated their experience higher than residents of other long term care facilities in Alberta in the following areas: respect for privacy (97% versus 90% provincially), comfort in voicing concerns (87% versus 79%), and quality of life factors such as being happier and less worried, lonely or bored. However they expressed concerns with mealtime enjoyment (6.1 out of 10 versus the 6.7 provincial average).

Focus groups were held with residents and families to present the survey results and hear their ideas about areas for improvement. As a result, extensive menu review meetings were held with residents and families, which led to improved standardized recipes based on residents' preferences and implementation of two meat choices at the supper meal. The dining room atmosphere was reviewed with changes made to tables and chairs and greater use of tablecloths, and planning has begun to redevelop the dining areas to enhance the dining experience for the residents.

#### Discussion

Acceptability, as a dimension of health care quality, means that health services are respectful and responsive to user needs, preferences and expectations. Client experience surveys are one method of assessing this important aspect of the quality of care and services. At a provincial level, the HQCA's long term care family experience survey found that nursing home staffing, care of belongings and environment have the greatest impact on the overall care rating. From the residents' perspective, communication and respect were the major issues affecting the overall rating of care. As indicated in the follow-up provider poll the HQCA conducted, numerous long term care providers and management teams used the HQCA family and resident experience survey results to improve the quality of resident care and services as well as aspects of residents' quality of life.

G A whole patient re include the most cu A whole patient record should include the most current version of patients' choices regarding the care they would like to receive if unable to speak for themselves. Receiving the most appropriate care according to patient wishes can deliver a better quality of life for patients and their caregivers.



#### Advance care planning for the end of life

#### Background

An aging population and advances in health care are dramatically changing how and where people die. People may live for many years with potentially life threatening or progressively debilitating diseases; "two of every three individuals will die with one or more serious chronic illnesses. Frailty due to conditions such as dementia, cardiovascular disease, renal disease and Parkinson's disease will shape the last years of life for the majority of us."12 Everyone needs to consider what would happen if a serious illness or injury made it impossible to speak for ourselves or make our own health care decisions.

A study from the Canadian Medical Association Journal identified the following important elements in end-of-life care: trust in the treating physician, effective communication, avoidance of unwanted life support, continuity of care and life completion.<sup>13</sup> A recent American study showed such discussions are associated with less aggressive medical care near death and earlier hospice referrals.<sup>14</sup> According to this research, aggressive care is associated with poorer quality of life for the patient and poorer bereavement adjustment for family members.

The study used a scale of 1 to 10 where 10 represented high quality of life and 1 poor quality of life. For patients who received two or less therapies, the quality of life score was 6.4 whereas patients who received three or more had a lower score of 4.6. These therapies could involve admission to intensive care, ventilator use, resuscitation, chemotherapy or feeding tubes. Among caregivers, the risk of depression was reported to be 3.4 times greater in the group where the patient received three or more therapies compared with the caregivers of patients who chose a less aggressive plan. As a result of earlier hospice referral, the length of stay in hospice was longer for patients who had been involved in an end-of-life discussion.

Health care costs, another facet of end-of-life care, were examined with the study population referenced above, though written up in a different publication.<sup>15</sup> These patients were matched by socio-demographic characteristics, site, treatment preferences and disease type.

The average per patient cost for those who reported having end-of-life discussions was \$1,876 whereas those who did not averaged a cost of \$2,917. For this study population, patients who had been involved in an end-of-life discussion expended 36% fewer health care dollars in the last week of life in addition to accruing the quality of life benefits noted earlier.

#### **Indicator Definition**

Numerator: Number of adults with an advance care plan by sector of the health care system.

Denominator: Total number of adult patients or residents by sector of the health care system.

#### What the Data Shows

A 2007 Health Quality Council of Alberta survey that sampled 1,200 adult Albertans found:

- > 55% had heard of advance care planning based on the definition provided.
- > 51% had not discussed with friends or family the health care treatment they wanted if they could not speak for themselves.
- > 91% had not discussed with a health care professional the health care treatment they wanted if they could not speak for themselves.
- > 80% did not have a written advance care plan that they had shared with others.
- 77% did not have a personal directive.

#### Actions for Improvement

Since November 2008, Alberta Health Services – Calgary Zone has utilized goals of care designation orders to guide decision-making about specific care interventions such as transfer to an acute care facility or life support measures. The order prompts people to think about their values regarding health care choices, learn about the medical information relevant to their health concerns, communicate their wishes and values to their designated agent(s), loved ones and health care providers, and document their choices so their decisions are available to health care providers wherever they receive care. With such orders in place, health care professionals can assist in rapid decision-making in times of crisis and provide guidance regarding the location and general intentions of the care and interventions provided. It is important that these orders align with any health care instructions contained in an individual's personal directive.<sup>16</sup>

Documentation of the goals of care designation is required on the health record of every adult patient receiving care and treatment in a facility owned or contracted by Alberta Health Services – Calgary Zone, with the exception of home care. Only "clinically relevant" patients in the home care program (i.e., those who may benefit from advance care planning) require the goals of care designation. Patients without this documentation on their health record receive appropriate life-support interventions unless it is known through another channel that the patient specifically refuses them.

Goals of care are identified in three categories:

- R Medical care and interventions including resuscitation and transfer to the intensive care unit, if required. Patient is expected to benefit from and is accepting of appropriate interventions.
- M Medical care and interventions, excluding resuscitation. Goals of care and interventions are for cure or control of illness.
- C Medical care and interventions focus on comfort. Goals of care and interventions are for symptom control without cure or control of underlying illness.

Another program tool informs clinicians across the continuum of care of ongoing discussions and decisions. This advance care planning tracking record travels with the patient in a green sleeve – now a well recognized conveyance for important documents related to goals of care designations.

Before implementing the policy, the Calgary Zone collected retrospective baseline data that determined whether or not a sample of discharged or deceased patients had instructions about their levels of care. The levels of care classification system provided information on the nursing and personal care requirements of residents of long term care facilities. More narrowly focused on resuscitation, levels of care were physician orders in some sectors and identified by the patient or family in others (see Table 4, Pre-implementation).

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SECTOR	PRE-IMPLEMENTATION (%) (January-August 2007)	POST-IMPLEMENTATION (%) (February-July 2009)	SAMPLE FROM
Acute care	84	90	9 targeted urban inpatient units and 1 rural hospital
Assisted living	54	67	Residents in 2 facilities
Home care	27	45	Targeted teams (palliative, seniors)
Hospice	0	73	Patients from 3 hospices
Long term care	95	86	Residents in 4 urban facilities and 1 rural
Overall	65	71	

Table 4. Proportion of selected patients 50 y	ears or older by	y sector with a goals	of care designation
(Alberta Health Services – Calgary Z	one)		

Note: Target = 100%

Source: Palliative/End-of-Life Care, Alberta Health Services

During spring 2009, a post-implementation audit of active patient records was undertaken (see Table 4, Post-implementation). Charts were randomly selected from those that met the sample criteria and focused on patients most likely to benefit from advance care planning and requiring a goals of care designation. The results, therefore, may not be generalized to the overall patient/client population served in these sectors.

The results presented show that for the most part, the goals of care designation was completed to a greater extent than the previous levels of care.

### Discussion

The implementation of the goals of care designation order in Alberta Health Services - Calgary Zone represents leading quality improvement work for end-of-life care. Respectful of and responsive to patients' preferences, it delivers a better quality of life for patients and their caregivers. To ensure this information is readily available to health care providers, a whole patient record should include the most current version of patients' choices regarding the care they would like to receive if unable to speak for themselves or make their own health care decisions.

## **Health Quality Dimension: Accessibility** Improving access to children's mental health services

## Background

The rates of child mental health issues are significant and to achieve the best outcomes requires the health system to provide timely access to appropriate services. The most diagnosed mental health problems in children are related to development disorders, including conduct disorder, attention deficit disorders and delayed development.

Data from Alberta physician claims in 2007/08 shows that:<sup>17</sup>

- > Attention deficit disorder was diagnosed in 3% of boys and 1% of girls seen at physicians' offices.
- > Girls were more likely to visit a physician for anxiety disorders than boys with rates of 1.8% and 1.6% respectively. The rate of anxiety disorder diagnosis was highest for 15 to 17 year olds.
- > Depression was also more likely to be diagnosed in girls (1.1%) than boys (0.8%). Depression rates for 15 to 17 year olds were also dramatically higher than for younger children.

These conditions are not neurological diseases; rather, they are behavioural problems that result from the interactive influences of genes and experiences or the lack of experiences in the first years of life. They can be reversed with long-term treatment involving the children, caregivers, school and health care providers. If the system fails to help these children, consequences can be reflected in drug addictions, suicides, borderline personality disorders and more extreme antisocial behaviour as they become adults.<sup>18</sup> To achieve the best outcomes, the health system needs to provide timely access to appropriate services.

Integrated health information

없 OF MEASUREMENT can quantify the impact of various approaches to improving access to children's mental health services.

The first three years of life are a sensitive period for brain development. Research demonstrates that a strong nurturing foundation in the early years increases the probability of positive outcomes and optimal adaptation as the child grows into adulthood. An active ingredient in this process is the nature of children's relationships with their parents and other significant caregivers in their families and communities.<sup>19</sup>

Emotional well-being, social competence and cognitive abilities are inextricably related, constituting the foundation for human development. On the other hand, toxic stress in early childhood disrupts neural and neurohumoral regulatory systems, perturbing brain structure and function in ways that may lead to lifelong adaptive problems. Basic neuroscience principles indicate that improving conditions for healthy early childhood development is more effective than treating problems at a later age.

American experts recently pointed out the following links to adult health:

"A scientific consensus is emerging that the origins of adult disease are often found among developmental and biological disruptions occurring during the early years of life. These early experiences can affect adult health in two ways—either by cumulative damage over time or by the biological embedding of adversities during sensitive developmental periods. In both cases, there can be a lag of many years, even decades, before early adverse experiences are expressed in the form of disease. From both basic research and policy perspectives, confronting the origins of disparities in physical and mental health early in life may produce greater effects than attempting to modify health-related behaviors or improve access to health care in adulthood."<sup>20</sup>

Children who wait extended periods for professional services may experience an increase in problem severity. Waiting may further disrupt the relationship within families and between families and service organizations, lowering expectations and decreasing the readiness for change when families eventually meet providers.<sup>21</sup>

#### **Indicator Definition**

Distribution of wait time: Wait time (days) between the date of referral and date of first face-to-face appointment.

#### What the Data Shows

More than 8,800 children were enrolled in mental health programs across Alberta in 2008/09, representing an increase of 24% since 2004/05.<sup>22</sup> Although the proportion of children waiting more than 30 days for treatment did not show a significant change, the increase in mental health enrollment indicates a higher number of children waiting more than 30 days for their first face-to-face appointment.





Source: Alberta Health Services – Addiction and Mental Health Services

#### **Actions for Improvement**

A wide range of innovative access improvements to children's mental health services have been implemented across Alberta. The following are highlights of both provincial and zone initiatives that are having a positive impact on access.

> Access Mental Health has been the primary gateway for intake to child and adolescent mental health program services in Alberta Health Services - Calgary Zone.<sup>23</sup> It uses a centralized regional access and intake information system that serves as a source for mental health information in the Calgary region. While the child and parent wait for their first appointment, they receive self-help materials and can elect to enroll in a support group related to their reason for contacting the program. A single therapy session may also be provided if circumstances warrant more timely intervention.

Centralizing access and intake and implementing a network-based regional tracking system has enabled the capture of more consistent data and increased the measurement capacity for a complex array of system, demographic and clinical variables. Systematic analysis of these data has formed the basis for performance measurement, the population-based identification of unmet need and the framework from which innovations have been quantified in terms of relative efficacy and effectiveness.

Following are some results from the centralized intake and improved processes:

Median wait time for children dropped from 33 days in 2002/03 to seven days in 2008/09 for all levels of services (scheduled, urgent/emergent).

- The capacity to serve the 0 to 18-year-old population nearly doubled, increasing from 0.6% to 1% between 2002 and 2009.
- Similar central intakes are the primary gateway in two other health zones.
- The wealth of data that has emerged from the centralized tracking system has led to collaborative research opportunities and the advancement of health services research in the area of child mental health.<sup>24</sup> For example, in the last four years 12 bachelor of health sciences students have completed summer studentships and presented their work based on the centralized access and intake data base system at research conferences.
- > Regional Pediatric Developmental and Mental Health is an Alberta Health Services Edmonton Zone initiative that provides services for school-age children. It consists of five teams located at six sites. Fragmentation of service access and delivery, as well as lack of clarity regarding resources and infrastructure, is being addressed through a change in governance models. Implementation of the new governance model is underway.
- Mental Health Capacity Building for Children, Youth and Families in Schools is an initiative that integrates mental health promotion, prevention and early intervention, providing these services in a school-based setting. There are currently 31 project sites implemented across Alberta with plans to add an additional nine sites.
- Student Health Initiative Partnerships brings community partners from many sectors together to provide more integrated and accessible student health services. Children who require hospitalization are transitioned back to school settings earlier with the help of specialized psychiatric staff whose roles are: 1) Supporting the child in transitioning back to school; 2) Supporting teachers by demonstrating the skills needed to aid children with high needs; and 3) Supporting parents with at-home coping skills. This program increases access to services by freeing up beds in specialized services and increasing the effectiveness of transition to the community.
- Student Health Partnership Pilot adjusts the service delivery model to a more education and consultation-focused model.<sup>25</sup> Capacity increased from 13 students receiving assessment and intervention in four schools in three months to 89 students being served in the same schools over the same time interval. This pilot project continued for an additional year during which it was demonstrated the model could be disseminated to other therapists and teachers.
- Canadian Research and Education for the Advancement of Child Health (CanREACH) is a group of Alberta specialist physicians that have partnered with the leader of the REACH Institute to receive faculty training to disseminate evidence-based practice methods to community-based physicians using a novel educational model.<sup>26</sup> The CanREACH model addresses a well-defined service gap in the community. For example, each year community physicians provide on average two mental

health interventions to approximately 2% of the population aged 0 to 18.<sup>27</sup> Historically, community physicians receive minimal psychiatric training during their residencies and there is no requirement that this experience include training related to assessment or treatment of children. By supporting physicians in the community, the CanREACH group has begun to move community practice toward improving the quality of care for this population in keeping with recommendations of both the U.S. Surgeon General and child mental health leaders in Canada.<sup>28</sup>

- Collaborative Mental Health Care (CMHC) targets family physicians, daycare providers and child protection workers concerned about the mental health of preschoolers in their care. All children aged 0 to five referred from Alberta Health Services Calgary Zone are eligible for these mental health services. Through specialized consultation and promotion of resiliency skills, CMHC has been shown to significantly reduce mental health service utilization by offering more specific and specialized information. Eleven per cent (11%) of children with CMHC involvement were enrolled in three or more unique programs compared to 26% with no CMHC involvement (standard care). Those receiving CMHC team consultations had significantly shorter wait times for treatment (mean days 16.4) than the children who received standard care (mean days 65.3). They also had a shorter length of stay for treatment (mean days 138.2) than the children who received standard care (mean days 220.5).<sup>29</sup>
- Children and Youth with Complex Cases are formal partnerships between multiple stakeholders in all five Alberta Health Services zones to integrate care plans for children and youth with complex needs. An Alberta government interministerial partnership exists between Alberta Health Services – Mental Health Services, Child and Family Services, Justice and Education to facilitate these relationships.

As well as these specific services, other ongoing activities include telehealth, on-call therapists, walk-in clinics, partnerships with school boards and residential treatment beds. These examples demonstrate the broad range of services and innovative practices addressing children's mental health in Alberta. Using advances in education and consultation-based child mental health services, Alberta Health Services can bring the limited quotient of specialized psychiatric expertise to a much larger number of children.

#### Discussion

Research proves that society can benefit enormously from early intervention in children's mental health problems, especially for the very young. Further measurement is required to quantify the impacts of the various quality and access approaches in the area of children's mental health services – the ultimate goal being to broadly implement those with the best results. Systemic improvements are still required as 8% of children in 2008/09 waited more than three months for their first service. In addition, primary care physicians can sometimes be the only providers of mental health services to children. It is crucial to support primary care providers with specialized services, information and clear referral processes to ensure continuity of care.

G Computerized prov 에 entry for diagnostic Computerized provider order entry for diagnostic imaging, with alerts based on clinical guidelines and standardized triage, will help with prioritization, more timely communication between radiologists and health care providers and improved access to services.



#### Improving access to MRI and CT services

#### Background

Prolonged wait times for diagnostic imaging by computed tomography (CT) or magnetic resonance imaging (MRI) are particularly important because they may delay diagnosis and treatment. Since its introduction in the 1970s, CT has become an important diagnostic tool supplementing other diagnostic imaging procedures. CT combines special x-ray equipment with sophisticated computer technology to produce multiple images or pictures of the inside of the body. CT of internal organs, bone, soft tissue and blood vessels provides greater clarity and reveals more details than regular x-ray exams.

MRI complements CT by providing images with enhanced soft tissue resolution. Particularly useful for disorders of the nervous and musculoskeletal systems, MRI continues to develop with use growing in the areas of abdominal, pelvic, cardiac and breast imaging. MRI does not use ionizing radiation - an advantage that will undoubtedly lead to many disease processes now imaged by CT being replaced by MRI. This issue is of greatest concern for children who are 10 times more sensitive to the induction of cancer compared with adults. For example, an abdominal CT in a young girl results in a risk of fatal cancer later in life of about one in a 1,000. Lack of timely access sometimes results in patients having an ionizing radiation test rather than the most appropriate test, which is often MRI.<sup>30</sup>

In 2008, the Health Quality Council of Alberta's Satisfaction with Health Care Services Survey found 10% of those adult Albertans surveyed said they had an MRI in the previous 12 months. This may have included a CT or positron emission tomography (PET) scan, assuming some respondents may have had difficulty distinguishing between these tests. Nine per cent (9%) said they received the MRI in a private clinic; 66% of these said they chose a private clinic because wait times in the public sector were too long.<sup>31</sup>

#### The importance of pre-test probability and diagnostic imaging guidelines

Although diagnostic imaging accuracy results from the joint function of the quality of the technical image and human interpretation, the efficacy of the diagnostic image is a function of the physician requesting the appropriate test for a patient.<sup>32</sup> This improves if the diagnostic image is examined after an increase in the pre-test probability. Pre-test probability is defined as the probability of the target disorder before the diagnostic test result is known. It is especially useful for: interpreting diagnostic test results, selecting one or more diagnostic tests, choosing whether to start therapy, and deciding whether it is worth testing at all.<sup>33</sup> An increase in pre-test probability can be achieved through patient history, careful physical examination and, in some circumstances, laboratory tests.<sup>34</sup>

Further underscoring the importance of pre-test probability is the fact that no diagnostic image is 100% accurate. A single positive result does not always mean an individual has the disease, just as one negative result does not guarantee the patient is disease free. Diagnostic imaging guidelines help reduce the incidence of false results.

Guidelines to encourage the appropriate use of diagnostic imaging have been developed throughout the world. The Royal College of Radiologists (U.K.) published referral guidelines for the use of diagnostic imaging as early as 1990. In 1994, the American College of Radiologists Appropriateness Criteria (ACRAC) were released comprising clinical scenarios and recommending diagnostic imaging procedures.<sup>35,36</sup> Currently, ACRAC contains 800 clinical presentations organized in 167 topics. Each topic has a literature review and each clinical presentation has a table with a list of image procedures (rated for appropriateness), comments and relative radiation level. Some specialties, such as cardiology, have created their own consensus guidelines for appropriate diagnostic imaging use. The ACRAC were developed by an expert panel using the Delphi technique with successive rounds of voting on scores of appropriateness until consensus was reached. These are continually updated and the last version was released in September 2009. In some health systems, use of the ACRAC is mandatory.<sup>37</sup>

#### Pre-authorization program with central intake

Israel's public health system provides an example of a central intake pre-authorization program for MRI and CT scans operated by radiologists.<sup>38</sup> Parameters of the model include:

- Radiologists analyze requests based on the latest guidelines of the Royal College of Physicians (U.K.) or the American College of Radiologists.
- > Pre-authorization is mandatory; requests are received by fax in a standard form.
- > The pre-authorization centre guarantees a 48-hour response time.
- > Radiologists can have access to electronic medical files.
- Radiologists can defer, approve, and encourage the use of a less costly but acceptable modality or recommend a more expensive procedure.

- > The final decision rests with the referring physician.
- Physicians complete a mandatory lecture series of 50 two-hour sessions on the appropriate use of CT and MRI.

An evaluation of this model showed a decrease in utilization rates of CT from 25.9 per thousand in January 2000 to 17.3 per thousand in December 2003. The rate of MRI usage increased in the first two years to 7 per thousand in February 2002 and later decreased to 5.6 per thousand in December 2003. In the same period, the deferral/deny rate (an indicator of appropriateness) was 9.8% for CT and 17% for MRI.

#### Computerized provider order entry systems

Computerized provider order entry (CPOE) systems can play a role in decreasing CT and MRI utilization. The University of Florida Health Science Center instituted web-based computerized radiology order entry with a decision support system. After correction for steady growth in clinic visit volumes, there was a reduction in the growth rate of CT utilization by 2.5% per quarter and in MRI utilization by 1.2% per quarter.<sup>39</sup>

#### **Canadian experience**

In 2005, the Canadian Association of Radiologists published guidelines for selected clinical scenarios identifying five intervention options:<sup>35</sup>

- Indicated most likely to contribute to clinical diagnosis and management.
- Specialized investigation only after discussion with a radiologist or in context of locally agreed on
  protocols.
- Not indicated initially clinical problem usually resolves with time. Only perform if symptoms and/or signs persist and are important enough to warrant action.
- Indicated only in specific circumstances only if physician provides cogent reasons or if radiologist believes examination represents an appropriate way of furthering diagnosis and management.
- > Not indicated rationale for request untenable.

Management of MRI wait lists through a standardized triage request is an approach that has received very limited attention in Canadian facilities.<sup>40</sup> Researchers identified that prioritization was usually based on implicit assessments by the radiologists using handwritten and frequently incomplete information submitted by the ordering physician rather than through documented criteria. This research suggests that patient status, results of prior imaging, body part and the medical specialty of referring physicians are critical elements in the priority-setting process in Canada.

#### Alberta experience

In 2005, a joint committee of representatives from Alberta Health and Wellness, the Alberta Association of Radiologists and the province's former health regions released guidelines to maximize the effective utilization of CT and MRI for outpatients. The fundamental principles were:

 Emergencies or urgent cases shall be discussed clinician to clinician or transferred to an emergency care centre capable of monitoring/supporting the patient.
- > The prioritization scales and urgency criteria are guidelines and there may be individual variation depending upon the patient's condition.
- Preoperative studies are usually more urgent as they often have already been in another waiting situation.
- > In general, the most effective test should be done first.

The committee released a list of recommended MRI and CT tests for defined clinical presentations.<sup>41</sup> Each clinical presentation was assigned a level of urgency. Recommended wait times were then identified for each level of urgency as follows in Table 5.

Table 5. Recommended MRI and CT wait times by level of urgency					
LEVEL OF URGENCY	MRI WAIT TIMES	CT WAIT TIMES			
Priority 1	Less than 7 days	Less than 7 days			
Priority 2	Less than 30 days	Less than 30 days			
Priority 3	Less than 90 days	Less than 60 days			
Priority 4	Follow up	Follow up			

Source: Calgary Health Region Diagnostic Imaging Department

Requests that did not fit with the recommended guidelines would have been considered inappropriate. Request forms for CT and MRI were developed with the aim of facilitating communication between radiologists and other physicians. Despite development of these Alberta guidelines, they were not fully implemented across the province.

# **Indicator Definition**

**90th percentile wait time for MRI and CT** – Individual wait times were sorted from shortest to longest. The indicator shows the time elapsed between booking and testing for 90% of the patients studied. Each measure represents the cumulative data of the previous three months.

# What the Data Shows

Figure 5 shows the wait time by month for 90% of patients waiting to access CT and MRI in Alberta. While access to CT appears stable through this period, access to MRI is worsening. Figure 6 presents detailed data from the former health regions showing the range of availability of these diagnostic tests throughout the province during a specified time.



Figure 5. 90th percentile wait time\* for MRI and CT in Alberta (August 2008 – August 2009)



Figure 6. 90th percentile wait time\* for MRI and CT by former Alberta health region (August 2009)

\*Note: Excludes 10% of patients who waited longest. Each month reflects an average of the previous three months. Source: Alberta Waitlist Registry

<sup>\*</sup>Note: Excludes 10% of patients who waited longest. Each measure represents the cumulative data of the previous three months. Source: Alberta Waitlist Registry

#### Actions for Improvement

The Acute Knee Injury Clinic (AKIC) at the University of Calgary Sport Medicine Centre implemented a new delivery model that involved:<sup>42</sup>

- Changing the assessment process by training non-physician experts to work alongside a physician/ surgeon in the diagnosis and treatment of selected acute injuries.
- Accepting referrals from family physicians or other health care providers such as physiotherapists, chiropractors and nurses as well as patients and self-referrals.
- > Monitoring outcomes and developing research to compare results to other clinics.

The clinic's new approach has proven to be cost effective and has also led to a significant decrease in the number of MRIs being ordered. For every 1,000 patients, this model of care achieved savings between \$200,000 and \$400,000 mainly by reducing the number of MRI tests.<sup>42</sup>

Table 6 shows the percentage of MRI utilization in the AKIC compared with a sample of patients with the same diagnosis (knee injury) managed by family physicians. The clinic contacted every family physician in Alberta to evaluate its new model. Two hundred and seventy five patients (275) with knee injuries were identified and 140 patients completed a survey (51% response rate). Of the 139 patients in the AKIC sample, 20 were excluded as they had been enrolled in the clinic and had had a previous MRI.<sup>42</sup>

Table 6. Comparison of MRI utilization between the AKIC and the current health service deliver	/ model	using
a patient sample with the same diagnoses (Alberta 2009)		

	<b># OF PATIENTS</b>	MRI REQUESTS	PUBLIC MRI PROVIDER	PRIVATE MRI PROVIDER
AKIC – new model	119	6 (5%)	6	0
Standard services	140	94 (67%)	85	9

Source: Acute Knee Injury Clinic - University of Calgary

In August 2009, the Minister of Health and Wellness directed senior system stakeholders to assess MRI service delivery in Alberta. A working group was convened to review and make recommendations to address the appropriate utilization of publicly funded MRI services across Alberta according to the dimensions of quality as defined by the *Alberta Quality Matrix for Health*.<sup>1</sup> The working group developed an MRI Action Plan that included the following recommendations addressing the appropriate and effective use of MRI services in Alberta:

- 1. Identify leading and best evidence-based targeted practices for appropriate and effective use of MRIs to achieve specific patient outcomes.
- 2. Develop MRI ordering guidelines for specific conditions such as lower back pain, stroke, headaches and osteoarthritis of the knee.

- 3. Design and implement a series of interventions to influence physicians' use of evidence-based practices and algorithms.
- 4. Develop a business case for investment in information systems infrastructure in the areas of physician order entry, decision support and performance management.

# Discussion

Alberta has a significant opportunity to make more efficient use of its valuable diagnostic imaging resources. However, comprehensive appropriateness measures are lacking and consequently, the extent of inappropriate overuse or underuse of MRI or CT services in Alberta is unknown. An evidence-based approach to the appropriate use of MRI and CT is essential for the system to be sustainable and meet the ever-growing demand.

Currently, no formal communication method exists between imaging specialists and requesting physicians to assess the appropriateness of test requests. Communication usually happens at the discretion of the radiologist either verbally or through written comments returned to the physician on the requisition. Communication could, however, be facilitated through a central intake system and supported by a CPOE system. When radiologists receive relevant clinical histories and focused clinical questions, they will be better equipped to review exam requests – a key to advancing the learning curve for the appropriate use of MRI and CT. A CPOE system that incorporates guidelines for appropriate use of MRI and CT, feedback to the ordering physician and concurrent measurement of quality indicators could result in more efficient MRI and CT utilization.

The AKIC demonstrated that it is important to provide timely access for triage and appropriate assessment and treatment options for an acute condition, ideally before such conditions become chronic problems. This approach can be applied to a wide variety of clinical problems and lead to an overall improvement in access, quality of care and more appropriate use of CT and MRI.

H OF MEASUREMENT 이 Electronic time stan 만 reporting of time int Electronic time stamps and routine reporting of time intervals facilitate the definitive evaluation of initiatives targeting crowding and wait times in emergency department settings, helping guide system-level policies and procedures regarding access to care.



# Monitoring emergency department wait times

# Background

Administering and managing emergency department (ED) clinical pathways involves knowing the length of time between a patient's arrival/registration in the ED and his/her departure. However, understanding how each segment of care contributes to overall wait time requires monitoring of all the time intervals within the ED stay as detailed in Figure 7.

Figure 7. Segmented wait times in the emergency department

Time from registration/triage to initial physician assessment

Time from physician assessment to decision to discharge/admit

Time from decision to admit to move to acute care unit

#### Total ED length of stay

When these specific time segments are measured they can be managed more easily. This case study looks at the experience of ED users in terms of their overall length of stay from the time of arrival through to discharge home or transfer to an acute care unit.

Numerous direct measures of patient experience were collected in the 2009 Health Quality Council of Alberta's (HQCA) Urban and Regional Emergency Department Patient Experience Report.<sup>43</sup> Using results obtained from a 2007 ED survey as a baseline, the purpose of the 2009 study was to monitor changes in the performance of EDs with the greatest crowding pressures, longest wait times and lowest rating of patient experience.

Patients studied were a random sample of those seen in EDs between March 15 and 28, 2009. Patient survey data was combined with patient administrative data to validate the patient experience of urgency and wait times.

The HQCA's 2009 report included measures that identified and estimated factors that affect the patient experience and global ratings of care. The H1N1 epidemic did not affect the results as data collection was done before the outbreak. There were no differences between the 2007 and 2009 results regarding the determinants of overall satisfaction. However, there were differences in the length of stay.

# **Indicator Definition**

Median length of stay: To calculate this indicator, each ED visit was sorted from the shortest to longest wait time (from moment of arrival in the ED to moment of discharge or arrival in the acute care unit). This sorted distribution was then split in half, using the median value that divides the first 50% of the population from the second.

# What the Data Shows

Patient-reported wait times were similar to those computed from administrative data – 39% of 2007 patients and 48% of 2009 patients reported a length of stay in the ED greater than 12 hours. The administrative data in Table 7 provides a more detailed breakdown of the median length of stay.

Table 7. Median length of stay in emergency department calculatedfrom administrative data (Alberta, 2007 and 2009)					
INDICATORS	2007	2009			
Median length of stay for discharged patients	3.4 hours	3.6 hours			
Median length of stay for admitted patients	11.1 hours	14.4 hours			
Median time from triage to physician assessment	77 minutes	95 minutes			

Note: Study population identified in the random sample of the 2009 Health Quality Council of Alberta *Urban and Regional Emergency Department Patient Experience Report* For discharged and admitted patients respectively: 2007 n = (3,933; 860); 2009 n = (3,981; 961) Source: Health Quality Council of Alberta

A component of total length of stay is the time from triage to initial physician assessment. Table 8 identifies the Canadian Association of Emergency Physicians guidelines for time to initial physician assessment for different Canadian triage and acuity scale (CTAS) categories. The lower the CTAS level, the more severe the patient's condition on arrival and the shorter the suggested wait time for physician assessment. CTAS I should be assessed immediately; however, data for this category is not reliably captured and is not presented. For all other CTAS categories, Table 8 reveals that CTAS guidelines are missed for a majority of patients and the situation continues to deteriorate.

Table 8. Proportion of patients assessed by a physician within Canadian triage and acuity scale (CTAS) guidelines (Alberta, 2007 and 2009)

CTAS GUIDELINES	2007 (%)	2009 (%)
CTAS II – assessed within 15 minutes	15	14
CTAS III – assessed within 30 minutes	15	13
CTAS IV - assessed within 60 minutes*	43	36
CTAS V - assessed within 120 minutes*	80	64

Note: Study population identified in the random sample of the 2009 Health Quality Council of Alberta *Urban and Regional Emergency Department Patient Experience Report* \*Denotes statistically significant difference Source: Health Quality Council of Alberta

# Actions for Improvement

Despite these overall trends, some EDs have shown improvement based on patients' self-reported wait-time experience of more than 12 hours. For example, in Alberta's Northern Lights Regional Hospital, this indicator decreased from 27% in 2007 to 15% in the 2009 survey. Improvement in length of stay and patient experience was positively influenced by the following actions:

- > Arrival of 15 new primary care physicians to the region.
- > Unattached ED patients were assigned to a family doctor before being discharged for follow up.
- > Direct referrals to primary care networks for those with chronic illness.
- > Direct follow up with an orthopedic technician without having to return to the ED.
- > Urology and nephrology outpatient clinics established.
- > Clearer signage at triage area.
- > Enhanced triage process with two nurses per shift.
- > Electronic triage tracer implemented.
- > True trauma stretchers acquired (can move to diagnostic imaging and back).
- Mental health crisis intervention nurse available.
- > Addition of unit clerk to help with requests, labs, etc.
- > Introduction of a licensed practical nurse.
- > Ongoing review of charting expectations tied to staff performance review.
- > Utilization coordinator (two-hour limit for boarded patients) position for all shifts.
- > Implementation of provincial stroke strategy protocol.
- > Ambulatory care functions moved out of ED (1,300 patients per week).
- > Staff workshops: *Treating Patients with C.A.R.E.*, Workplace Abuse, Quality Safety.
- > New MRI and CT scanners acquired.

- > Introduction of hospitalist program.
- Beds added to medical and surgical floor.
- > Enhanced discharge instructions/charting expectations (reviewed).

Significant improvements between the 2007 and 2009 surveys were found in the following areas:

- In the hospital: The proportion of patients waiting more than 15 minutes to see a triage nurse decreased from 66% to 28%, the proportion of patients reporting waiting more than two hours to see a physician decreased from 42% to 32%, and the proportion of patients not being checked on or not being checked on as often as desired decreased from 58% to 52%. The overall score for the staff care and communication composite increased from 67% to 72% and the proportion of patients who considered leaving before treatment decreased from 44% to 36%.
- In the community: The proportion of patients with a family doctor increased from 73% to 83%. As a consequence, the proportion of patients reporting the ED was the only place to go decreased from 71% to 62%, the proportion of patients finding the ED very or extremely crowded decreased from 38% to 31%, and the proportion of patients going to the ED because of worsening chronic conditions decreased from 17% to 13%.

# Discussion

EDs are often seen as a barometer for health system performance. They reflect the success of effectively managing patients within primary health care, as well as the transition of seriously ill patients into acute care hospitals and beyond into continuing care. In Alberta between 2007 and 2009, length of stay increased among the majority of the 12 highest-volume urban and regional EDs. At the Northern Lights Regional Hospital, the length of stay decreased and this progress was associated with implementation of a bundle of quality improvement actions. While not all of these actions can be applied to diverse EDs and communities across Alberta, the data shows purposeful changes such as the redesign and/or addition of community and ED/acute care resources can significantly affect both wait times and the patient experience in EDs.

# **Health Quality Dimension: Appropriateness**

# Web-based surgical records help promote evidence-based practices

# Background

Variations in surgical processes influence patient outcomes. The quality of surgical treatment is particularly relevant for cancer patients; yet, historically, details of the surgical process have not been captured and compared. Web-based electronic tools facilitate this possibility and could eventually help address the measurement challenge of determining how intra-operative decision-making affects the quality of the cancer surgery performed.

In Alberta, a computerized synoptic operative report<sup>44</sup> called WebSMR has been developed by Cancer Surgery Alberta. It provides a powerful tool to ensure important surgery details are captured. As of October 2009, the WebSMR contained more than 7,500 records and 75% of eligible surgeons were voluntarily using this format.

WebSMR's major achievement was substituting the dictated operative report with an easy-to-read synoptic report automatically generated and sent to all relevant recipients such as health records, cancer registry, pathology and family physicians. This feature eliminates transcription and decreases the review time for surgeons and other care providers. As a result, the Alberta WebSMR reduces costs by approximately \$100 to \$150 per operative record. The electronic synoptic approach also incorporates guidelines seamlessly into the system, with the potential of increasing survival, decreasing morbidity and reducing cost and resources.45

The WebSMR facilitates a dynamic questionnaire structure with data sets agreed upon through surgeon consensus. The electronic form consists mainly of predetermined data fields (through drop down menus, check boxes, etc.) although text boxes are also used. Forms are reviewed with the aim of improving templates based on surgeon feedback. Computer entries can be made in operating rooms or surgeons' offices immediately following surgery, which facilitates accurate data capture. Mandatory fields ensure users cannot submit an operative

- H OF MEASUREMENT O The Alberta web-ba H surgical medical rec The Alberta web-based surgical medical record is a leading example of bottom-up implementation of an electronic patient registry managed by surgeons with real-time measurement feedback. This resource facilitates the
  - standardization of evidencebased practice.



report without providing key information such as intra-operative staging. This effective educational tool reminds the surgeon of essential steps and surgery details. It also gives surgeons access to both individual and provincial aggregate indicators in real time. It is anticipated that by knowing and comparing their process and outcome indicators, surgeons will be able to implement practice changes as needed.<sup>44</sup>

In 2007, the Canadian Partnership Against Cancer (CPAC) facilitated a national workshop to explore the value of standardized reporting and synoptic reporting tools in cancer surgery and pathology. The result was consensus on the recommendation for standardized synoptic reporting of surgery and pathology to optimize cancer outcomes. Under CPAC's synoptic reporting tools project, the WebSMR currently used in Alberta is being piloted in Manitoba, Ontario, Quebec and Nova Scotia with breast, colorectal, head and neck, and ovarian templates implemented in select sites. National working groups for each of these tumour categories aim to standardize the reports nationally and share outcomes.

Two indicators captured by the WebSMR are the rate of total mesorectal excision for colorectal cancer and breast conservation surgery for breast cancer. In recent years, colorectal surgery for the excision of rectal tumors has changed with total mesorectal excision (TME) considered the best practice.<sup>46</sup> TME was adopted by Cancer Surgery Alberta as the standard practice.<sup>47</sup> Breast conservation surgery (BCS) is a less radical cancer surgery than mastectomy. For many women with stage I or II breast cancer, breast conservation therapy plus radiotherapy is as effective as mastectomy. Survival rates are the same for women treated with these two approaches.<sup>48, 49</sup> BCS has been adopted by Cancer Surgery Alberta as the standard practice.<sup>47</sup>

### **Indicator Definition**

Numerator: Number of surgeries that comply with evidence-based practice during a period of time.

Denominator: Total number of Alberta surgeries for a specific procedure in a specific time period.

#### What the Data Shows

An example of a process indicator collected by WebSMR is adherence to new clinical guidelines. Table 9 presents changes in practice over time for two surgical procedures in Alberta. The table demonstrates how the WebSMR's function of measuring outcomes provides a valuable tool for ongoing improvement.

Table 9. Proportion of colorectal cancer surgeries that followed total mesorectal excision procedure and proportion of breast cancer surgeries for patients in stages I or II that followed breast conservation surgery procedure in Alberta

	1996-1997 (%)	2003 (%)	2006 (%)	2009 (%)
Total mesorectal excision	20	59	93	97
Breast conservation surgery	NA	NA	76	77

Source: Cancer Surgery Alberta

The target for each measure is TME = 100% and BCS = 70%; BCS is not an option for all women with stage I and II breast cancer.

## Actions for Improvement

The WebSMR also allows examination of variation in use of evidence-based practice across Alberta. A quality assurance committee meets biannually to assess this data. For example, between January 2006 and January 2010, BCS rates across Alberta were as shown in Table 10.

Table 10. Pr sta	oportion of bro age II in 5 sites	east conservati in Alberta (Jar	on surgery of t nuary 2006 – Jai	otal breast can nuary 2010)	cer surgeries fo	r patients in stage I or
SITE	A (%)	B (%)	C (%)	D (%)	E (%)	PROVINCIAL AVERAGE (%)
BCS	69	76	81	76	69	76

Source: Cancer Surgery Alberta

The data indicates there is not a significant difference in BCS rates between community and tertiary sites in Alberta.<sup>47</sup>

Figure 8 shows the increasing adherence of breast cancer surgeons to the WebSMR. The increased number of reporting cases is due to increased surgeon uptake and continued entry from early adopters. The increased voluntary adherence proves this system adds value for surgeons.



Source: Cancer Surgery Alberta

#### Discussion

Grassroots implementation of the Alberta WebSMR tool is a good example of an electronic patient registry that delivers real-time feedback to end-users. Developing an electronic synoptic report requires commitment to reach consensus on core data sets for each kind of surgery and to create a practical process for end-users. The WebSMR shows it is feasible for a group of health providers with a common practice to share the same database to improve the quality of their patients' care. The technology can be replicated and tailored to any surgical specialty.

# Chronic obstructive pulmonary disease and asthma: Decreasing return visits to emergency departments

Herein CF MEASUREMENT Construction of Herein tregistry for The introduction of an electronic patient registry for asthma and chronic obstructive pulmonary disease at family physician offices will assist with monitoring patients and compliance with a self-management plan. Monitoring return visits to emergency departments through access to a whole patient record can help evaluate the success of these interventions.



# Background

Chronic obstructive pulmonary disease (COPD) is the common term for chronic bronchitis and emphysema, two lung diseases that often occur together. Both are responsible for progressive damage to the lung tissue causing decreased lung function and breathing difficulties. Patients with advanced COPD may experience acute exacerbations of their disease and require significant medical interventions, emergency department (ED) visits and inpatient hospital care.

Asthma is another prevalent chronic disease that affects people of all ages including young children. Asthma is characterized by acute episodes when the airways are markedly narrowed, making breathing increasingly more difficult. These episodes distress the patient and those around him/her and, if poorly managed, can be potentially fatal. Episodes often require urgent medical care and can utilize significant health care resources. With appropriate treatment, asthma can be managed and have minimal impact on quality of life.

Self-management is a key component of success dealing with chronic diseases such as asthma and COPD. Self-management programs provide patients with knowledge and skills to manage their symptoms in addition to ready access to a team of medical supports when needed. As both diseases often require complex medication therapy, patients need to be able to make critical decisions related to their medication management plans.

Self-management plans also assist patients with managing their recovery from exacerbation once discharged home from EDs. After an acute episode, patients with asthma or COPD are at higher risk for a

subsequent exacerbation,<sup>50, 51</sup> although the risk decreases over time. There is a critical period of at least four weeks when the inflammation and/or infection that caused the initial exacerbation can trigger another one. Proper control of the initial episode helps prevent relapses.

Canadian researchers performed a study regarding the incremental costs of implementing enhanced asthma care based on the Canadian asthma consensus guideline focusing on patient education and spirometry testing. The study found the cost of providing enhanced asthma care with spirometry and individual education was \$100 per patient in the first year and \$43 for each following year. A similar German study published in 1993 identified a cost savings per patient in the first year of \$630 using group education, \$4,200 in the second year and \$3,700 in the third year following intervention. These savings were related to reduced health care service utilization and fewer absences from work. Similar value was identified in a 1990 American study that found savings of \$728 per person for the first year of treatment.<sup>52</sup>

In a patient sample from several Alberta cities, University of Calgary researchers studied the use of selfmanagement action plans in two surveys, five years apart: 1997 and 2002. These plans outline actions for the patient should asthma symptoms change. The goal is to limit escalation of symptoms. The survey participants were patients with physician-confirmed asthma attending pharmacies to fill prescriptions for asthma medications. Overall asthma control was reported by 27% of respondents in 1997 and 31% in 2002, despite the fact that in 2002, 85% of patients had prescriptions for inhaled corticosteroids, which are the core of asthma management.<sup>53</sup>

This data demonstrates that a relatively low proportion of study participants identified their disease as under control and there was little progress in overall reports of asthma management in the five-year study period. Although asthma education has been available and a national certification of asthma educators was developed during these years, self-management plans were only used by 7% and 5% of patients in 1997 and 2002 respectively.<sup>53</sup>

#### **Indicator Definition**

Numerator: Number of patients returning to the ED at least once in 8 to 30 days following an ED visit or a hospital discharge for COPD or asthma.

Denominator: Total number of patients discharged from the ED or hospital with COPD or asthma in Alberta.

### What the Data Shows

Treatment of an exacerbation of asthma or COPD in an ED or hospital aims to manage the acute episode. The inflammation and/or infection related to such exacerbations requires follow-up treatment in the community to avoid further acute recurrences. The return to the ED in a period of 8 to 30 days after an episode is an indicator that the follow-up care, including self-management plans, was insufficient to manage symptoms.

Table 11. COPD: Proportion (2002/03 – 2007/0	of emergency 8)	department/u	irgent care ret	urn visits in ar	n 8- to 30-day	period*
ED/UDGENT CARE LOCATION	2002/02 (9/)	2002/04 (9/)	2004/05 (%)	2005/06 (%)	2006/07 (9/)	2007/00

ED/URGENT CARE LOCATION	2002/03 (%)	2003/04 (%)	2004/05 (%)	2005/06 (%)	2006/07 (%)	2007/08 (%)
Calgary	7.9	8.7	9.2	9.0	12.2	8.5
Edmonton	10.1	10.7	11.4	10.9	12.9	8.8
Fort McMurray	7.0	9.2	7.8	14.9	10.4	8.5
Grande Prairie	45.9	46.7	46.0	43.5	10.0	7.5
Lethbridge	12.2	11.7	11.7	11.6	13.2	9.8
Medicine Hat	4.4	8.7	12.0	6.0	9.0	8.4
Red Deer	12.4	7.3	12.1	14.5	8.5	7.1
Rural North	13.8	14.7	16.6	14.5	15.1	11.2
Rural South	11.1	10.8	11.8	11.7	13.5	10.9
Alberta	<b>11.5</b> n=7,831	<b>12.2</b> n=8,191	<b>13.4</b> n=8,913	<b>12.5</b> n=9,879	<b>13.2</b> n=10,328	<b>9.7</b> n=10,558

Analysis: Health Quality Council of Alberta

Source: Ambulatory care classification system data

\*The 8- to 30-day period represents the majority of respondents and represents a time period that allows for accessing a family physician.

ED/URGENT CARE LOCATION	2002/03 (%)	2003/04 (%)	2004/05 (%)	2005/06 (%)	2006/07 (%)	2007/08 (%)
Calgary	8.0	8.1	7.9	7.5	8.1	6.8
Edmonton	8.4	9.1	9.1	8.6	8.7	6.7
Fort McMurray	9.6	8.4	9.6	7.0	9.7	7.3
Grande Prairie	40.0	42.1	42.1	37.1	9.8	8.3
Lethbridge	8.3	10.2	6.9	8.4	7.7	7.2
Medicine Hat	10.1	8.5	9.6	7.2	5.8	5.0
Red Deer	10.4	10.9	8.7	10.7	11.7	8.3
Rural North	14.8	13.3	14.2	10.4	10.1	8.5
Rural South	10.6	10.1	10.3	9.9	10.3	8.0
Alberta	<b>11.6</b> n=20,808	<b>11.5</b> n=25,653	<b>11.2</b> n=25,949	<b>10</b> n=28,067	<b>9.2</b> n=24,472	<b>7.5</b> n=22,631

Table 12. Asthma: Proportion of emergency	department/urgent ca	are return visits in	an 8- to 30-day	period
(2002/03 – 2007/08)				

Analysis: Health Quality Council of Alberta

Source: Ambulatory care classification system data

\*The 8- to 30-day period represents the majority of respondents and represents a time period that allows for accessing a family physician.

Table 11 shows a significant decrease in the proportion of return ED visits in an 8- to 30-day period for COPD in 2007/08 in Alberta. Table 12 shows a significant decrease in the proportion of return ED visits in an 8- to 30-day period for asthma from 2002/03 to 2007/08 in Alberta. The asthma decrease was true for almost all Alberta cities and rural regions. The trend shows better management for these conditions but the proportion of returns could be lower given the current knowledge about how to control these chronic conditions at the primary care level. There is no consensus regarding a target for this indicator.

Notably, Grande Prairie decreased return visits for both COPD and asthma significantly in the two-year period 2005/06 and sustained that gain through to 2007/08, while maintaining the same volume of ED visits.

# Actions for Improvement

The decrease in return ED visits realized and sustained in Grande Prairie resulted from significant program changes.<sup>54</sup> Additional respiratory therapist resource capacity was added, which allowed the ED staff to activate respiratory therapists for assessment of all COPD and asthma patients early in the ED process. As well, referral programs were designed and promoted within the regional hospital. Other changes that shifted the approach, processes and ultimately the outcomes included:

- Visits by one of the two hospital-based, community-focused respiratory therapists to all doctors' offices in the former health region promoting asthma clinics for referral.
- Creating pamphlets about the Adult Asthma/COPD Clinic, the Pulmonary Rehabilitation Program and the Pediatric Asthma Clinic, which were provided to all relevant patients as referral information in the ED and inpatient units.

Another quality improvement initiative in the province is being led by the COPD & Asthma Network of Alberta (CANA). CANA is a cross-provincial team comprising multidisciplinary representatives from the health care professions, the public, private and not-for-profit sectors and advocacy groups who have come together for the purpose of enhancing COPD and asthma care.<sup>55</sup>

CANA activities include:

- Alberta Breathes a provincial initiative to enhance a collaborative approach to solutions in respiratory
  disease care and prevention.
- Awareness campaigns addressing smoking cessation, use of spirometry, application of current Canadian asthma and COPD guidelines and patient education.
- A provincial resource catalogue and an electronic system map to help patients and providers find services close to home.
- > Self-management tools that address literacy and language issues for all age groups.

Action plan of: Personal goals Possible Triggers (circle) Action Plan Other	e colds animals pollens	Date:	weather changes strong emotions
Asthma under control?	Yes Normal life, regular activities	Cough, wheeze, short of breath, tight chest, colds, allergies	Very short of breath, trouble speaking, blue/grey lips / fingernails
1. Daytime symptoms	3 times or less/week	More than 3 times/week	Continuous & worsening
2. Nighttime symptoms	None	Some nights	Continuous & worsening
3. Reliever 🛛 👢	3 times or less/week	More than 3 times/week	Relief less than 3-4 hours
4. Physical activity	Normal	Limited	Very limited
5. Able to go to school or work	Yes	Maybe	No
6. Peak expiratory flow	85 to 100 % to	60 to 85 % to	Less than 60 % Less than
What to do:	Stay controlled & avoid triggers	Adjust	Call for help
Preventer/Controller: Use DAILY to control airway swelling & other symptoms. Rinse mouth after each use. 1	Take AM DPM	Take AM PM	EMERGENCY (, 911 Take all asthma medications at the highest dose recommended by your doctor until help arrives.
Reliever/Rescue: Quickly relieves symptoms by relaxing muscles around airways.	Take as needed	Take as needed	(This may include prednisone)

Figure 9 shows a provincially standardized self-management asthma action plan that could be used in primary care practices.

Source: COPD & Asthma Network of Alberta

**Figure 9. Asthma Action Plan** 

A self-management plan is an agreement between the family physician/nurse practitioner/asthma educator and the patient. It identifies targets to be achieved by the patient in a certain period (usually six months) and a treatment plan for each level of severity of the condition. The treatment plan involves teaching how to identify symptoms, the proper use of medication and/or how to access other resources in the community if needed. CANA also made a self-management instrument available to COPD patients.<sup>55</sup>

To be successful, self-management requires commitment from both sides. Thus, the patient and the physician must each sign the self-management agreement. To sustain its results, the former Peace Country Health

region adopted asthma action plans in 2009. After patients were assessed by the regional hospital's respiratory therapists, plans were sent to the family physician. The family physician's signature authorized the plan's activation. 54

# Discussion

The introduction of a patient registry for asthma and COPD management in family physician offices will assist them to monitor if patients are adhering to their self-management plans. As comprehensive chronic disease management programs for COPD and asthma become more prevalent in the community (e.g., primary care networks), it is expected that ED return visits related to these conditions will decrease as the Grande Prairie example showed.

# **Health Quality Dimension: Effectiveness**

# Measuring the quality of trauma care

# Background

According to the Trauma Association of Canada (TAC) accreditation guidelines: "Injury is the most common cause of death in the first four decades of life, responsible for more deaths in children than all other causes combined, an increasing burden in the elderly, and costs the Canadian economy an estimated \$4 billion per year".<sup>56</sup> As TAC further notes: "Injury is no accident; it is often predictable and predicated on defined risks. Targeted injury prevention has reduced some of these risks and impacted injury rates from a number of causes, most notably motor vehicle crashes". There is no question that the health care system's ability to respond to injuries sustained in vehicle crashes, other incidents or disasters is crucial to reducing related mortality and disabilities.

# Integrated trauma systems

Large urban centres develop trauma systems to create the capacity needed to manage the medical complexities associated with trauma. A trauma system delivers a full spectrum of trauma care from the time of injury to recovery and extends beyond the acute care centre.

While the system is designed to manage a low volume of complex medical cases such as motor vehicle accidents, trauma centres also take on the role of lead facility in multi-casualty incidents where immediate coordination and control is required to manage an unusually high volume of injured patients.



POWER OF MEASUREMENT Alberta's Regional Trauma Services Program utilizes and monitors a comprehensive and integrated set of indicators that link care processes to patient outcomes. These indicators provide a means to identify and address areas for improvement within the trauma system.

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The success of integrated trauma systems in reducing mortality and morbidity stems from: standardizing care for those seriously injured, prioritizing access to emergency, diagnostic and surgical services, and rigorously measuring performance as part of a trauma quality improvement program.<sup>57</sup>

A comprehensive and fully inclusive trauma system will have clinical, administrative, surveillance, prevention, training and research elements working in unison. Each clinical component is a vital link in a chain ensuring patients move quickly and safely along the continuum of care. The non-clinical components are required to support the overall trauma system and provide a broad injury control perspective.

According to the TAC accreditation guidelines, components of a trauma system include:

- Administration leads the system, facilitates legislation, funds development, collects data and engages in quality improvement and evaluation processes.
- Clinical components:
  - Pre-hospital services provide timely access based on communications, triage, transport and stabilization.
  - Acute care facilities deliver patient care until the end of the acute phase.
  - Rehabilitation services provide rehabilitation and assist with reintegration into the community and workforce.
- Injury surveillance and prevention monitors and reports on comprehensive quality indicators.
- Research, education and training commits to standardization, innovation and dissemination of new knowledge and practices.
- Emergency preparedness prepares the system to respond to natural and socio-political disasters involving high volumes of casualties.

The TAC, which initiated standardization processes and Canadian accreditation in this field, uses five classification levels to designate adult trauma centres and two levels for pediatric care. Level one represents the most comprehensive medical centres providing tertiary and often quaternary level care. Accredited level one trauma centres in Alberta include Foothills Medical Centre and Alberta Children's Hospital in Calgary and the University of Alberta Hospital in Edmonton.

Calgary has served as the trauma referral centre for southern Alberta, southwestern Saskatchewan and southeastern British Columbia for a number of years. Trauma services are guided by the collaborative work of the Regional Trauma Services Program, which in 2004 became Canada's first accredited trauma system.

Further progress includes ongoing development and expansion of the provincial trauma advisory committee. Established in 2007, this group is working towards creating an integrated Alberta trauma system with provincewide monitoring capability.

# **Indicator Definition**

Numerator: Number of clinical units/programs that routinely report, analyze and act on a set of process and outcome indicators.

Denominator: Total number of clinical units/programs in Alberta.

# What the Data Shows

The ability of a program or service to monitor and manage the quality of care it provides requires it to select and use locally relevant quality indicators and apply statistical and epidemiological methods to maximize the value of the resulting data. The indicator definition above is intended to monitor progress towards this goal across the health system.

# Actions for Improvement

A list of trauma system process and outcome indicators used by the Regional Trauma Services Program in the former Calgary Health Region is provided in Table 15. These comprehensive and integrated indicators enable monitoring of health care practices and identify areas for improvement within the trauma service. The following example shows how monitoring patient outcomes such as mortality rates can lead to more in-depth analysis, which has the potential to identify improvement opportunities.

Trauma centres capture the severity of their patients' injuries and monitor trauma system performance using numerous scoring systems. One prevalent measure is the injury severity score (ISS). It classifies patients with multiple injuries based on the severity of injury in each of the following six body regions: head/neck, face, thorax, abdomen, extremities including pelvis, and external. During chart reviews, a severity rating from 1 (minor) to 5 (critical) is defined for each body region. Ratings of the three most severely injured body regions are then squared and added together to produce the ISS score.<sup>58</sup> This score correlates with mortality, morbidity and hospital stay.

Table 13 represents patients admitted to the emergency department (ED) with an ISS greater than or equal to 12. The number of deaths represents fatal outcomes during pre-hospital, emergency department or in-hospital care.

YEAR	NUMBER OF PATIENTS	NUMBER OF DEATHS	<b>PROPORTION (%)</b>
2001/02	790	92	11.6
2002/03	767	92	12.0
2003/04	860	87	10.1
2004/05	894	97	10.9
2005/06	969	127	13.1
2006/07	1,094	110	10.1
2007/08	1,118	116	10.4
2008/09*	1,037	117	11.3

Table 13. Incidence of death (pre-hospital, ED or in-hospital) among trauma patients with ISS ≥	12 at
Foothills Medical Centre (2001/02 – 2008/09)	

\*Partial results

Source: Calgary Health Region Regional Trauma Services Annual Report 2007/08

The data shows that during this seven-year period, the mortality rate peaked in 2005/06. Further investigation of this variation using time-dependent analysis specifically identified deaths within the first 24 hours and deaths after 24 hours. The assumption for these cut-off points was that within the first 24 hours, the following determinants contribute to death: case severity, team response at the accident scene and timeliness and appropriateness of operating room intervention. After 24 hours, the process of hospital care and case severity are the main contributing factors.<sup>59</sup>

(200	)3/04 – 2008/09)	
YEAR	% DEATH IN THE FIRST 24 HOURS	% DEATH AFTER 24 HOURS*
2003/04	6.2	4.2
2004/05	6.4	4.8
2005/06	5.8	7.8
2006/07	5.7	4.7
2007/08	5.1	5.6
2008/09**	7.4	4.2

Table 14. Incidence of death among trauma patients with ISS ≥ 12 by time from start of care at the accident scene (2003/04 – 2008/09)

\*Cases deceased in the first 24 hours excluded from the denominator \*\*Partial results

Source: Calgary Health Region Regional Trauma Services Annual Report 2007/08

Table 14 suggests the mortality rate increased in the group who died 24 hours after arrival in 2005/06 and in the group who died in the first 24 hours in 2008/09. Further data and analysis would be required to identify possible clinical commonalities or to conclude that these variations happened by chance. This example underscores how the combination of different epidemiological scenarios related to the same outcome can hide substantive differences.

## Table 15. Monitoring indicators: Calgary Health Region Regional Trauma Services

#### **PRE-HOSPITAL PHASE**

- 1. Proportion of patients with a Glasgow coma scale (assess level of consciousness based on eye, verbal and motor responses lower scores represent poorer conditions) less than or equal to 8 who received an airway at scene.
- 2. Proportion of patients transferred from a hospital outside Calgary who spend less than 2 hours in the sending hospital prior to transfer to the trauma centre.
- 3. Proportion of patients transferred from a hospital outside Calgary who spend less than 4 hours from injury time to arrival at the trauma centre.

#### **RESUSCITATIVE CARE PHASE**

- 4. Proportion of patients with a Glasgow coma scale less than or equal to 8 who received a mechanical airway at the ED.
- 5. Proportion of patients attended by the trauma team leader response team within 20 minutes (the trauma team is activated at the discretion of the ED physician or through pre-hospital process of communication).
- 6. Proportion of patients whose length of stay at the ED was less than 4 hours.
- 7. Proportion of patients with a Glasgow coma scale less than 13 who had a computer tomography scan of the head within a designated period of time.

#### **DEFINITIVE CARE PHASE**

- 8. Proportion of patients with a brain hematoma who had a craniotomy within 4 hours.
- 9. Proportion of patients with a joint dislocation (hip, shoulder, knee, elbow) who had an attempt to relocate the joint within 1 hour.
- 10. Proportion of patients with a femur fracture who had surgery within 24 hours of arrival at the trauma centre.
- 11. Proportion of immobile patients who received thromboembolic prophylaxis within 24 hours of admission at the trauma centre.
- 12. Proportion of patients with a major facial fracture (mandible, maxilla, orbit) who had surgery within 7 days of injury.
- 13. Proportion of patients with a spinal fracture who had surgery within 7 days of injury.
- 14. Proportion of patients with suspected intra-abdominal injury with hemorrhagic shock who had a laparotomy within 1 hour of arrival at the trauma centre.

#### OUTCOME

- 15. Number of patients who had an unplanned return to the operating room within 48 hours after the initial procedure.
- 16. Number of patients who had a delayed diagnosis or missed injury after 48 hours from arrival at the trauma centre.
- 17. Number of patients who had an unplanned return to the intensive care unit.
- 18. Incidence of death with ISS score > or = 12 at the trauma centre.

Source: Calgary Health Region Regional Trauma Services Annual Report 2007/08

#### Discussion

The ongoing reporting of process and outcome indicators enabled monitoring of trauma system quality improvement initiatives and more in-depth analysis of historical trauma trends. To remain relevant, these measurement systems need to be responsive to changing needs and allow as close to real-time reporting as needed for effective monitoring and decision-making. The comprehensive and integrated indicators used by the regional trauma services provide a means to identify and address areas for process and patient outcome improvement within the trauma centre.

The following activities and measures could also be considered to further enhance performance measurement for trauma care:

- 1. Identify targets for each process indicator. If a target is not reached, an administrative measure should be taken. If a target is reached, a new target can be set.
- 2. Conduct case studies for unexpected outcomes. Example: fatal outcome for a case with an ISS less than 12.
- Explain variation in each outcome indicator trend. Tools to distinguish random variation from real variation exist. The limits for variation in these tools come from definitions of cut-off points in a normal distribution (the same pattern of distribution above and below the average).
- 4. Analyze data by specific place, time or disease etiology because the combination of different epidemiological scenarios related to the same outcome can hide substantive differences. For example in Table 13 the overall mortality in 2005/06 at 13.1% was not statistically significant compared to the mortality rates of other years. However, breaking the numerator down into two time-based sets as seen in Table 14 (first 24 hours and after 24 hours), reveals a statistically significant variation specifically, mortality after 24 hours at 7.8%. The reason for this discrepancy is that mortality determinants after 24 hours differ from those in the first 24 hours. Through detailed analysis, it was possible to break down the data and identify a potentially actionable indicator. In contrast, aggregated indicators (adjusted or not) can hide important variations and potential improvement areas.
- 5. Identify risk factors that can explain total or partial variation. A monitoring system identifies cases and non-cases. Hypotheses can be tested by building a retrospective cohort study if data on potential risk factors has already been collected or by building a case-control study if further data collection is needed. Causes of the variation could then be identified by multivariate analysis enabling the discovery of new actions to prevent further occurrences. For example, is it possible that hospital-acquired infections are responsible for the increase in deaths after 24 hours in 2005/06 in Table 14? A case-control design study could test this hypothesis. Is it possible that the case severity in 2008/09 was much higher than previous years justifying the increase in deaths in the first 24 hours? An adjustment of the mortality by ISS could test this hypothesis.

# OF MEASUREMENT

THE POWER

The most important function of an adverse event reporting and learning system is to use the results of data analysis and investigation to formulate and disseminate recommendations for both local and health system learning and improvement.



#### Learning from adverse events and close calls

#### Background

In the airline industry, aviation incidents are routinely investigated and the lessons learned disseminated systematically. In contrast, the health care industry is just beginning to embrace the concept that effective adverse event reporting is fundamental to improving health care quality and safety.<sup>60</sup> Learning from adverse events and close calls can be leveraged beyond the actual incident to stimulate system changes that minimize the opportunity for future occurrences. For reporting and learning from adverse events to be truly effective, an organization must support a no-blame culture that is open to accepting responsibility for and acting upon lessons learned at both the individual and organizational level.<sup>61</sup>

Adverse event reporting and learning systems are information systems created to collect reports on incidents that have the potential to produce harm (close calls) or have caused harm (adverse events) to patients or staff. Each unit or program in a health service has unique processes of care and related outcomes. Adverse events and close calls are specific, rare unexpected outcomes that require in-depth analysis of the circumstances that allowed them to happen. The information derived from these analyses should guide actions to mitigate recurrence.

The Australian Commission on Safety and Quality in Health Care defined eight severe incidents that must be publicly reviewed with results reported back to the Commission. These are:

- 1. Death of a patient receiving inpatient mental health care.
- 2. Maternal death or serious morbidity associated with labour or delivery.
- 3. Medication adverse event leading to the death of a patient reasonably believed to be due to incorrect management of medications.
- 4. Intravascular gas embolism resulting in death or neurological damage.
- 5. Hemolytic blood transfusion reaction resulting from ABO blood type incompatibility.

- 6. Procedures involving the wrong patient or body part.
- 7. Retained instruments or other material after surgery requiring reoperation or further surgical procedure.
- 8. Infant abduction or discharge to the wrong family.

The State of Queensland's health minister added to this list, requesting any death or permanent loss of function unrelated to the natural course of any underlying condition be reported at the local level. The local level can also add events related to their services beyond state and federal requirements. Unit managers aggregate reviews of all close calls and adverse events and inform their teams. These managers are also responsible for reporting cases at the federal and state levels as per the requirements.<sup>62</sup>

Alberta Health Services' strategic plan includes implementation of a provincial adverse event monitoring system supported by an organization-wide learning process.<sup>63</sup> Planning is underway to determine the functionality of the proposed system.

#### **Indicator Definition**

Numerator: Number of service areas that routinely report and analyze close calls and adverse events.

Denominator: Total number of service areas in Alberta Health Services.

# What the Data Shows

The ability of local health service areas to monitor and manage the quality of care or services they provide requires the use of an adverse event reporting and learning system. The indicator definition above is intended to monitor progress towards this goal. Some local units already have their own tracking systems for close calls and adverse events. At the regional level, information systems have been implemented to report adverse events at a higher administrative level. Calgary Laboratory Services provides an example of how initiatives that address a local unit's reporting needs can work with a regional system.

#### Actions for Improvement

#### Local service area example

Laboratories follow standards and guidelines such as those developed by the College of Physicians & Surgeons of Alberta and the Clinical and Laboratory Standards Institute. Despite this, errors may still happen due to improper sample preparation, transportation or collection from numerous sites, deteriorated reagents, improper equipment calibration, misreading of results or documentation mistakes.

In recent years, technology has enabled automation of numerous critical processes and minimized many of the associated risks. However, sample collection, preparation and transport remain manual processes and are more vulnerable to error. Lack of training or limited experience account for most human errors. Such risks are mitigated through regular quality assurance measures that verify processes related to identification labels, cap colours on collection tubes and adequate specimen quantity and quality. Problems discovered through these quality control processes undergo root cause analysis where warranted and result in appropriate corrective actions such as additional training or process improvements.

The Tissue Typing Laboratory, a highly secure unit of Calgary Laboratory Services, built a local adverse event reporting and learning system to accommodate its needs and improve services. The clinical director developed three data fields for each phase of specimen flow: before, during and after specimen examination. In each field, a menu of adverse event categories was created. For each adverse event, the system records the phase in which the event occurred, the type of adverse event, and a description of the event and actions taken. Summary reports aggregate events according to the outcome (i.e., harm to patients, potential harm to patients and variance without further implications). The lab team discusses this data monthly.

# Regional level example

In 2008, the former Calgary Health Region implemented an adverse event safety reporting and learning system for the entire organization. Today it operates in the new Alberta Health Services – Calgary Zone. As part of Alberta Health Services, Calgary Laboratory Services participates in this system.

Calgary Laboratory Services reported close calls due to the lack of appropriate patient identification (e.g., patient wristbands) at the moment of specimen collection using the safety reporting and learning system. What was initially seen as a rare local event became relevant at the system level when data was aggregated from many clinical units. As a result, patient identification processes were reviewed and recommendations developed to make the health system safer for patients.

#### Discussion

Misdiagnoses, treatment failure and adverse events are part of any health care practice. Errors still occur despite strict standards and guidelines; therefore, the need remains for an adverse event reporting and learning system that supports continuous quality improvement and a safer health care system. It remains to be seen if the health industry can replicate the success of the aviation industry in the area of safety.

Fortunately, many areas across the health care system have processes and systems in place to learn from adverse events and take action to continuously improve. A provincial system should be flexible and able to accommodate local level needs to embrace the full learning potential such systems afford. The Calgary Zone's experience represents a first step towards realization of an Alberta adverse event reporting and learning system.



# OF MEASUREMENT 이 Effective stroke tr 일 extremely time de

Effective stroke treatment is extremely time dependent. A telehealth connection between tertiary centres and remote rural areas allows access to CT scans and rapid administration of a clot-busting drug. Measuring the timeliness of the interventions is an indicator of the success of stroke treatment.

#### **Delivering stroke treatment sooner**

#### Background

Stroke is the leading cause of disability and the third leading cause of death in Canada.<sup>64</sup> Ischemic strokes make up 80% of all strokes – a condition in which a blood clot formed in the vascular blood system becomes lodged in a smaller blood vessel in the brain, blocking the blood flow to that area.<sup>65</sup> Neurologists refer to this type of stroke as a "brain attack"; it causes damage/death to brain (neuronal) cells at a rate of two million cells a minute following the onset of symptoms.<sup>66</sup>

A transient ischemic attack (TIA) or temporary presentation of the same stroke-like symptoms may be an early warning sign. Statistics show 30 to 35% of patients suffering a TIA may go on to have a full blown stroke within the first 90 days following the initial symptoms. Up to 50% of these strokes occur within the first two days if timely care is not provided. The symptoms are sudden dizziness, weakness, trouble speaking, vision problems or headache.

The single most effective treatment for ischemic strokes is to administer tissue plasminogen activator (tPA), a clot-busting drug that can greatly reduce the disability resulting from prolonged blood flow blockage during a stroke. The medication acts rapidly to dissolve the blood clot, restoring blood flow to the area of the brain and limiting further damage or cell death. Stroke patients who meet the criteria to receive this medication must, however, get to the hospital as quickly as possible. The tPA must be administered within a very short window of 0 to 4.5 hours from symptom onset. Initiating treatment sooner will lead to improved patient outcomes.

Because of this rapid deterioration in brain function, stroke treatment is an extremely time-dependent event. Hyperacute stroke management requires early initiation of treatment modalities using rapid, coordinated and consistent treatment responses. With this need in mind, the Alberta Provincial Stroke Strategy (APSS) established designated primary stroke centres (PSC) in 2006. Since then, 13 additional sites have opened.

To establish PSCs across the province, Alberta's nine former heath regions participated in the provincial strategy and demonstrated how cooperation and targeted program planning can achieve improvements in patient outcomes. As of March 2009, each of the nine former health regions had at least one PSC operating within its boundaries.<sup>67</sup> These PSCs provide advanced acute stroke treatment using telestroke connections with stroke neurologists in comprehensive stroke centres (CSC) in Calgary and Edmonton.

Prior to the APSS, treatment was available in a few selected areas of the province. Since the new PSC implementation, fewer Albertans experience the catastrophic consequences that can occur from a stroke.

The strategy identified five key components required for facilities seeking PSC designation. This ensured that universal protocols and standardized service would be available and accessible at each selected site. Components include:

- > Computed tomography (CT) scan
- > Time from door to CT in less than 20 minutes
- > Stroke expertise on site or by telestroke
- ➤ tPA treatment
- > Willingness to service surrounding communities

The APSS worked with rural hospitals to ensure the technology and all clinical processes and protocols were in place to allow telestroke consultations to occur between the new PSCs and the CSCs in Edmonton and Calgary. In addition to emergency department (ED) use, this telehealth/telestroke technology also links inpatient acute care units and rehabilitation centres within the province. This linkage helps facilitate staff education/mentoring and provides patient care throughout the stroke pathway.<sup>68</sup>

A telestroke prevention clinic was implemented using remote outreach clinical consultation to help manage patients post-stroke and as a secondary prevention program. This course of treatment includes development of patient self-management plans/goals with the help of physicians, nurses, dietitians and pharmacists who work as an interdisciplinary team.<sup>69</sup>

At rural PSCs, a patient with signs and symptoms of a potential stroke is immediately rushed for a CT scan to rule out other possible causes for the condition and validate tPA eligibility. The CT image is sent electronically to Edmonton or Calgary through a picture-archiving communications system where a stroke neurologist reviews and examines it. The neurologist also physically assesses the patient through the telestroke link, which allows the specialist to see the patient and identify appropriate treatment choices. Using the National Institute of Health Stroke Scale, local health care workers assess the stroke severity and share patient information with the neurologist through two-way face-to-face communication links.

Rural hospitals now administer tPA for appropriate patients without physically transferring the patient. As a result, up to 80% of patients are treated and managed at the local PSC. For the CSCs, this means improved capacity to manage more critical patients. When looking at the impact on patient outcomes, some parts of the province have noted initiation of thrombolytic therapies by as much as 120 minutes earlier than previously available. This time is equivalent to 240,000,000 brain cells saved.

Cost savings are also achieved as most PSCs treat and keep up to 80% of presenting stroke patients, reducing the need for emergency medical services (EMS) transport to Edmonton or Calgary. In the former East Central Health Region, EMS transfers for stroke patients to CSCs decreased by 92% since program implementation.70

In February 2009, the APSS released standards of care for the pre-hospital phase, secondary stroke prevention and inpatient care. This added to the rehabilitation and community integration standards released in January 2007. These four documents are benchmarks for a comprehensive and evidence-based health care program. The APSS also introduced a public relations campaign that delivers messages about stroke symptoms and the need for immediate care. Annual campaigns (ongoing in some parts of the province) continue to build public awareness.

# **Indicator Definition**

Numerator: Number of deaths after hospitalization for an ischemic stroke event.

Denominator: Total number of patients with an ischemic stroke event admitted to hospital from an ED.

# What the Data Shows



Figure 10. Alberta stroke (cerebral infarction) age standardized mortality rates for patients presenting to

\*Significantly higher than Calgary and Edmonton Analysis: Health Quality Council of Alberta Source: Ambulatory care classification system data An indicator of stroke severity is in-hospital mortality. Less severe cases will have less recovery time and need for rehabilitation as well as lower mortality rates. Figure 10 shows hospitals in Red Deer, Lethbridge and rural Alberta had a mortality rate for ischemic stroke significantly higher than the reference centres in Calgary and Edmonton. This gap should decrease with implementation of the telestroke and PSC initiatives.

# Actions for Improvement

One of the first PSCs began operating in Camrose, Alberta in March 2007. Since the APSS project was implemented, a total of 319 stroke/TIA patients have been managed and treated. As a result, 92% fewer patients were transferred out of the area, significantly decreasing the impact on the tertiary care centre.

After the first year of operation, all staff members at the Camrose ED were certified in the National Institute of Health Stroke Scale assessment tool and the use of early dysphagia screening tools. All stroke patients are referred to a stroke rehabilitation program early in the acute care phase and transferred from acute care to a rehabilitation centre within seven days to facilitate patient progress. The following table shows monitoring of selected indicators and successes achieved since program implementation.<sup>70</sup>

(June 2008 and June 2009)		
PROCESS INDICATORS	JUNE 2008	JUNE 2009
Average time from door to CT scan	32 min	6 min
Average time from door to drug administration	64 min	49 min
Total EMS transfers to Edmonton	20%	8%
TIA patients progressing to stroke	N/A	1.8%
Stroke/TIA patients treated at PSCs	178	184
Percentage receiving thrombolytics	18.9%	18.1%
Percentage of patients managed in region	79.7%	80.2%

Table 16. Camrose Primary Stroke Centre: Process indicators for assessment and treatment of TIA/stroke patients (June 2008 and June 2009)

Source: Camrose Primary Stroke Centre

The total number of bed days saved by decreasing the length of stay was 1,164 days. At approximately \$903 per day, this equals a total savings in the magnitude of \$1,050,000 per year. The total cost for Camrose advanced life support transfers decreased from more than \$150,000 in 2005/07 to less than \$11,500 in 2007/09, a two-year savings of more than \$140,000.<sup>70</sup>

The success seen in the Camrose area spread east to the Wainwright area. The local heart and stroke steering committee had to step outside the box and look at utilizing new technology to remain financially viable.

Research led the steering committee to a portable CT unit that had proven itself in a number of clinical settings and applications in the U.S. However, it had not been used to offer frontline or emergency management of stroke and TIA patients.<sup>71</sup>

On November 11, 2008 East Central Health, in cooperation with the APSS, opened a second PSC in the Wainwright Health Care Centre, a small rural site with 25 acute care beds in the far eastern part of the health region. Wainwright was the first site in the world to use this technology for acute stroke management during the hyper acute phase and has shown it can meet and even exceed existing care standards. Success was made possible by immediate access, assessments using the portable CT and telestroke capacity connecting Wainwright's ED with stroke neurologists in Edmonton 24 hours a day, seven days a week.<sup>71</sup>

Table 17. Comparative results of process and outcome indicators for stroke/TIA patient care (June 2009)

	CANADA	ALBERTA	CAMROSE	WAINWRIGHT
Proportion of patients receiving thrombolysis in less than 3 hours	3-5%	20%	18%	18.1%
Average time from onset to patient arrival in the ED	147.8 min	90.6 min	144 min	134 min
Average time from ED arrival to CT scan	25 min (CSS*)	N/A	6 min	11 min
Average time from ED arrival to tPA	60 min (CSS*)	78.8 min	62 min	61 min
Average baseline NIHSS** (tPA patients)	N/A	16	12.7	12.2
6-month mortality rate	14.2%	16%	9.7%	N/A

\*Canadian Stroke Strategy

\*\*National Institute of Health Stroke Scale

Source: Camrose Primary Stroke Centre

#### Discussion

The successes in Camrose and Wainwright show how important the APSS project is to rural Albertans and demonstrate the impact each centre has had on stroke care. This initiative exemplifies how changes that benefit patients and the health care system can come about when clinical guidelines and new communication technologies are employed. Better patient outcomes due to improved access to reperfusion can justify the costs of telehealth implementation.

Given tools, resources, education, professional support and cooperation, rural facilities and medical care providers can offer effective, efficient and safe tertiary level care closer to the patient's home.

# **Health Quality Dimension: Safety**

# Improving patient safety using clinical decision support systems for venous thromboembolism prophylaxis

# Background

Venous thromboembolism (VTE) refers to both deep venous thrombosis (DVT) and pulmonary embolism (PE). DVT occurs when a blood clot forms inside a vein deep in the leg, causing pain and swelling while pulmonary emboli refer to blood clots that have broken off in a leg and travelled to the lungs. A patient with such emboli will experience shortness of breath or chest pain and, in some cases, death.

Every year in the United States, VTE accounts for more deaths than breast cancer, AIDS and motor vehicle crashes combined; yet, VTE is one of the most common and preventable complications of

H OF MEASUREMENT Computerized prov 린 entry systems can p Computerized provider order entry systems can provide electronic alerts and mandatory data entry fields that facilitate compliance with clinical guidelines. They can also provide ongoing audits of drug and medical device utilization. This functionality can lead to improved patient safety and system efficiency.

hospitalization. The rate of hospital-related VTE, if a thromboprophylaxis is not used, is reported to be 10 to 40% among medical or general surgery patients and 40 to 60% after major orthopedic surgery.<sup>72</sup> PE is considered to be the third most common cause of all hospital-related deaths. Massive PE is the cause of death in approximately 5 to 10% of hospitalized patients. It generally occurs without warning and without the opportunity to intervene and is the most common preventable cause of hospital death.<sup>73</sup> A Canadian study of postoperative complications demonstrated both hospital costs and median length of hospital stay doubled for patients who developed VTE after surgery.<sup>74</sup>

A comprehensive analysis of patient safety practices prepared by the U.S. Agency for Healthcare Research and Quality found the appropriate use of thromboprophylaxis was the number one ranked patient safety practice for hospitals among 79 safety practices when prevalence and severity, strength of the evidence supporting prevention and implementation costs were considered.<sup>75</sup>

In addition to the acute consequences of hospital-associated VTE, there are also important long-term complications. DVT and PE require anticoagulation for several months and up to 5% of patients can experience a clinically significant bleed episode while in treatment. Patients who had VTE are also at risk of recurrent thromboembolic events. Furthermore, 30 to 50% of patients with DVT develop post-thrombotic syndrome within 10 years. Physical repercussions of this include chronic leg swelling, discomfort and possible leg ulcers. The social impact entails significant costs in terms of patient quality of life and health care resources.73

The American College of Chest Physicians (ACCP) sponsors what is generally considered to be the most comprehensive and utilized evidence-based guidelines on the prevention of VTE.<sup>72</sup> The ACCP guidelines are peer reviewed, revised every three years and have become the international reference standard for thromboprophylaxis. The guideline recommends VTE prophylaxis for most general, open gynecologic or urologic surgery patients, all hip or knee arthroplasty, hip fracture surgery, major trauma and spinal cord injury. Ambulatory patients undergoing minor surgeries are excluded. All non-surgical patients not fully mobile should also receive VTE prophylaxis. For patients at high risk of bleeding, the prophylaxis should be mechanical and not based on pharmaceutical intervention.

Using the ACCP guideline, a Canadian chart audit of 29 hospitals (three in Alberta) during a three-week period between October and November 2002 created a baseline for future evaluations.<sup>76</sup> The audit evaluated selected cases with length of stay more than three days and less than 30 days, not receiving anticoagulant treatment, not pregnant and not in a clinical trial. It identified that 90% of patients in the audit were eligible for VTE prophylaxis in accordance with ACCP clinical guidelines. Among eligible patients, 20% had a contraindication to pharmaco-prophylaxis and mechanical prophylaxis could have been initiated. However, of this latter group only 5% received the appropriate mechanical prophylaxis. Among the 80% of patients eligible for pharmaco-prophylaxis, only 19% received the recommended intervention. Of the 1,702 patients that should have received appropriate pharmaco or mechanical VTE prophylaxis, only 278 (16%) received this safety intervention.

The pan-Canadian *Safer Healthcare Now!* initiative has developed several programs focusing on improved compliance with VTE prophylaxis for adult patients undergoing major general surgery (open abdominal) and hip fracture surgery. The goal of these initiatives is to develop and implement local quality improvement initiatives to increase appropriate VTE prophylaxis compliance in these target surgical groups.<sup>73</sup>

Hospital patient information systems increasingly play a role in alerting physicians about VTE risk. These powerful clinical decision support systems can be designed to cue clinicians to order thromboprophylaxis or to document the reason why prophylaxis is not needed or is contraindicated.<sup>77</sup>

# **Indicator Definition**

Numerator: Number of patients with length of stay 72 hours or more who received VTE prophylaxis according to the ACCP guideline.

Denominator: Number of patients who met the ACCP criteria to receive VTE prophylaxis.

## What the Data Shows

The process indicator defined above is reported in some acute care facilities in Alberta. Using available provincial data, the Health Quality Council of Alberta did an estimate of post-surgical VTE at 90 days for selected elective surgeries. The resulting outcome indicator includes hospitalizations and emergency department (ED) visits for PE and hospitalizations, ED visits, outpatient visits and physician office visits for DVT. Results are displayed in Table 18.

SURGERY	VTE RATES (PE RATES; DVT RATES) PER 100		
SORGERT	18-59 YEARS	60 YEARS OR GREATER	
Coronary artery bypass graft	2.7 (1.0; 1.7)	2.8 (0.9; 1.9)	
Cardiac valve replacement	1.6 (0.3; 1.3)	1.4 (0.4; 1.0)	
Hip replacement	3.7 (0.7; 3.0)	4.5 (0.8; 3.7)	
Knee replacement	4.3 (0.8; 3.5)	5.2 (1.1; 4.1)	
Spine procedures	0.8 (0.2; 0.6)	1.5 (0.6; 0.9)	
Hysterectomy	0.8 (0.2; 0.6)	1.5 (0.5; 1.0)	
C-section	0.5 (0.1; 0.4)	0.0	

Table 18. Alberta VTE rate estimates up to 90 days post-surgery by age group (April 2002 – December 2007)

Source: Alberta inpatient morbidity, physician claims, ambulatory care classification system data

Analysis: Health Quality Council of Alberta

Table 18 shows a 4.5% incidence of VTE (approximately one in 20 cases) for hip replacement and 5.2% (approximately one in 25 cases) for knee replacement in the 60 years or older age group. The incidence of VTE is higher in almost all surgeries for people 60 years of age or older; however, this is only significant for spine procedures and hysterectomy. Rates for PE are lower than DVT but PE is clinically more severe. DVT is a risk factor for PE.

# Actions for Improvement

In 2008, the Sunrise Clinical Manager<sup>TM</sup> computer system was introduced to Calgary hospitals. One of the first order sets activated involved VTE prophylaxis. The intervention choices were one or more of the following: pneumatic compression/antiembolism stockings, low molecular weight heparin, warfarin, heparin intravenous infusion and unfractionated heparin. These order sets remind physicians about the need for VTE prophylaxis and the information system documents their choices. Aggregate data provides an electronic audit of the proportion of VTE prophylaxis in the in-hospital population. Figure 11, on the following page, shows the proportion of inpatients by hospital and age group for which VTE prophylaxis was ordered.





Source: Sunrise Clinical Manager™ patient care information system

The target is to have 100% of patients over 60 years of age and those less than 60 years of age with additional risk factors receive VTE prophylaxis. Chart reviews done in 2006 suggest compliance with VTE prophylaxis was nearly 50%. By the end of 2008, the number had increased to more than 70% with closer to 85% compliance for those in the over 60 age group. Education, a pocket decision tool and the computerized provider order entry (CPOE) system are considered the main driving forces for this improvement. Next steps for the clinical decision support project include providing ongoing audit and feedback of VTE prophylaxis compliance rates to service groups as well as further development of the clinical decision support provided in the order sets.<sup>78</sup>

Ideally this process indicator (proportion with VTE prophylaxis) should be monitored with the outcome indicator (rates of DVT or PE). Nevertheless, it is possible to see the outcomes of specific actions related to VTE prophylaxis. Thromboprophylaxis is already a common practice for surgeries like hip and knee replacement. Results can be seen in the following trend analysis in Figures 12 and 13.



Figure 12. Alberta rates of post-surgery DVT or PE within 90 days following elective hip replacements among

\*Partial results: 18 months data

Analysis: Health Quality Council of Alberta

Source: Alberta inpatient morbidity, physician claims, ambulatory care classification system data



\*Partial results: 18 months data

Analysis: Health Quality Council of Alberta Source: Alberta inpatient morbidity, physician claims, ambulatory care classification system data

In Alberta, the rates of post-surgical DVT or PE within 90 days after surgery in adults 60 years or over are decreasing significantly for hip replacement but do not show statistically significant differences for knee replacements.

# Discussion

For the purpose of tracking hospital-acquired PE and DVT, the U.S. Agency for Healthcare Research and Quality identified codes to be extracted from health records that the Health Quality Council of Alberta used in this report.<sup>79</sup> Although there is some controversy regarding the accuracy of these codes,<sup>80</sup> tracking trends remains important, for example, as in the monitoring of the prevalence of appropriate VTE prophylaxis.

A 2007 article from the International Journal of Clinical Practice identified the following reasons for lack of use of VTE prophylaxis: 81

- Lack of consensus in adapting a guideline for VTE prophylaxis.
- > Lack of evidence/research for some clinical groups.
- > VTE is often clinically silent; therefore, many physicians and surgeons believe this is a rare event.
- > Some physicians still believe the inherent risk of hemorrhaging due to prophylaxis is greater than the benefit.
- > Lack of clinical awareness of VTE and its prevention.

CPOE systems can provide electronic alerts and mandatory data entry fields that facilitate compliance with clinical guidelines. These can also provide ongoing audits of drug and medical device utilization. This functionality can lead to improved patient safety and system efficiency.

# **Reducing use of dangerous abbreviations**

H OF MEASUREMENT Computerized provi H medication prescrib Computerized provider order entry systems can significantly reduce medication prescribing errors and associated adverse drug events, including those related to the use of dangerous abbreviations. Until such systems are widely implemented, periodic audits of the use of prohibited abbreviations in medication orders can help measure compliance with organizational policies intended to curtail the use of abbreviations in prescribing medication.



# Background

Handwritten prescriptions can be prone to errors. Illegible writing, dangerous abbreviations or missing components such as drug name, dose, dosage form, route and dosing frequency are common issues for community and hospital pharmacies. Substituting an electronic prescription with specific safety prompts and warnings can reduce prescribing errors.<sup>82</sup> However, until electronic prescriptions become more widely available, alternative practical solutions to improve the quality of handwritten orders must be identified and implemented.<sup>83</sup>
Use of abbreviations has been identified as an underlying cause of serious, even fatal, medication errors. According to studies of the United States Pharmacopeia (USP), medication errors at hospitals occurred more often during prescribing and documenting (41%) than administering (37%) or dispensing (21%).<sup>84</sup> From the total of abbreviation-related medication errors reported to the USP, three-quarters were due to orders written by medical staff.<sup>85</sup> Errors due to the use of abbreviations are potentially preventable.

In 2009, Accreditation Canada implemented a new patient safety required organizational practice related to dangerous abbreviations. It now requires all organizations to identify abbreviations, symbols and dose designations not to be used in the organization.<sup>86</sup>

Acute care and long term care facilities are beginning to implement computerized provider order entry (CPOE) systems, which are designed to prevent medication errors that occur during the ordering process. With CPOE, physicians enter patient orders directly into a computer where they are usually integrated with other patient information, including laboratory and prescription data. CPOE systems vary in sophistication, with the most advanced systems incorporating clinical decision support (CDS) tools that automatically check the order for potential errors or problems and provide alerts to the prescriber. Specific benefits of CPOE with integrated CDS include:

- > Prompts that warn against the possibility of drug interaction, allergy or overdose.
- > Accurate, current information about new drugs as they are introduced into the market.
- > Drug-specific information that eliminates confusion among sound-alike drug names.
- > Improved communication between physicians, nurses and pharmacists.
- > Reduced health care costs due to improved efficiencies.
- > Elimination of abbreviations known to contribute to medication errors.

CPOE systems have been shown to reduce the relative risk of medication errors by 13 to 99% and the relative risk of medication-related adverse events by 30 to 84%.<sup>87</sup> A higher relative risk reduction is seen when CPOE is compared to handwritten order systems, and systems with advanced CDS that provide prescriber alerts are more effective than more basic systems.<sup>87</sup> Abbreviation-related errors can be virtually eliminated with CPOE.<sup>88, 89</sup>

#### **Indicator Definition**

Numerator: Number of medication orders containing a prohibited abbreviation.

Denominator: Total number of medication orders.

#### What the Data Shows

Currently there is no process or system in place to monitor this indicator at a provincial level. However, this indicator has been useful in monitoring the progress of local initiatives designed to curtail the use of abbreviations in medication ordering.

#### **Actions for Improvement**

In January 2005, the Health Quality Council of Alberta (HQCA) brought the directors of pharmacy from Alberta's nine former health regions together to discuss common issues regarding medication safety in the acute care sector. This group identified the elimination of selected abbreviations, symbols and acronyms from medication orders as its highest priority initiative. Because work in this area was already underway in both the former Capital Health and David Thompson Health Regions, other health regions chose to await the outcomes of these initiatives before undertaking their own projects. In June 2007, the directors agreed on a core list of five medication ordering practices that should be discouraged. This "do not use" list was approved by the HQCA's Health Quality Network and the organization undertook a provincial initiative to raise awareness of the list and problems related to the misuse of abbreviations.

Capital Health and Caritas (Edmonton) initiated a campaign in 2005 to reduce medication errors attributed to abbreviation use. The campaign focused on reducing the use of seven commonly used abbreviations from the Institute for Safe Medication Practices (ISMP) list <sup>90</sup> as noted in Table 19.

Table 19. List of prohibited abbreviations and respective correct use – Capital Health and Caritas

PROHIBITED ABBREVIATIONS	CORRECT USES
IU	Unit
U or u	Unit
QD or qd	Daily
QOD or qod	Every other day
Zero after decimal point (e.g., 1.0 mcg)	Never use zeros after decimal (e.g., 1 mcg)
No zero before decimal (e.g., .5 mg)	Always use zeros before decimal (e.g., 0.5 mg)
Drug name abbreviations	Complete spelling of generic drug names

Source: Institute for Safe Medication Practices

The project began with a baseline compliance audit that revealed 21% of all medication orders contained at least one prohibited abbreviation. A safety initiative was developed that included presentations across the region, distribution of tool kits, and letters to key stakeholders. The tool kits contained posters for unit-level display, bookmarks for application to the page divider facing medication order sheets, sticky notes for flagging orders containing prohibited abbreviations, a set of frequently asked questions and an instruction sheet on how to use the tool kit. All print material was posted on the regional quality office website along with a presentation and speaker notes for sites wishing to provide education to staff and physicians. Letters

from senior clinical (vice president, medical affairs) and academic (dean of medicine at the University of Alberta) leaders were sent to each physician within the region to notify them of the initiative. Letters were distributed to nurse practitioners from the dean of nursing at the University of Alberta. This initiative is still ongoing in Alberta Health Services sites in the Edmonton area.

Ongoing compliance audits from baseline to the four-year mark of the project demonstrate a statistically significant decrease in the use of targeted abbreviations (see Table 20). The audits helped identify problematic abbreviations that required more specific targeting in the ongoing campaign. Recommendations from stakeholders continue to be implemented, including information sessions for nurse practitioners and resident physicians during education days, and reminders to all providers on pay stubs.

	BASELINE JAN 2005	AUDIT DEC 2005	AUDIT JUN 2006	AUDIT JAN 2008	AUDIT JAN 2009		
Total # drug orders audited	4,315	6,184	6,626	6,818	6,923		
Total # of drug orders with prohibited abbreviations	917	846	653	615	546		
% with prohibited abbreviations (site variation)	22.2 (20–23)	13.7 (12–15)	10.4 (8–5)	9 (8-10)	7.9 (5-9)		
Most commonly used prohibited abbreviations	QD or qd	Drug name and QD	Drug name and QD	Drug name and QD	Drug name		

Source: Pharmacy Services - Edmonton Zone of Alberta Health Services (formerly Capital Health)

Table 20. Medication order compliance audit results – Capital Health

In response to recommendations arising from the review of a fatal medication error in 2004, the David Thompson Health Region implemented strategies to reduce the use of abbreviations in medication orders. A list of 26 target terms was identified based on the ISMP list of error-prone abbreviations, symbols and dose designations, <sup>90</sup> and was introduced in instalments of five to seven terms. Implementation strategies included letters to prescribers and staff, posters in patient care areas, and reminder notices sent to prescribers by the pharmacy department each time a prohibited term was used in a medication order. The initial response was positive with a 50% reduction in the number of abbreviations appearing in medication orders, with an 89% reduction in the use of 'QD' for 'daily'. However active follow up with individual prescribers was not sustainable and when it was stopped, the use of abbreviations rose to baseline levels.

In 2007, the David Thompson Health Region conducted an evaluation of the impact of three different educational and quality improvement interventions on the use of the target abbreviations in handwritten medication orders in 14 hospitals and three community pharmacies: a) comparative feedback report, b) physician reminder letters and chart insert reminders, and c) the combination of interventions a) and b).<sup>91</sup> The rate of abbreviation use was measured at baseline and following a 28-week intervention period. Results were reported as number of prohibited abbreviations recorded per 100 medication orders.

In the baseline observation period, the abbreviation use rate was 21.8 in the hospital group and 38.2 in the community pharmacy group. After 28 weeks, the abbreviation use rate had decreased to 17.4 in hospitals, but little change was noted in the community pharmacy group (37.5). No observations were made about the comparative effectiveness of the different intervention strategies.

The former Calgary Health Region addressed the issue of abbreviations in medication ordering through both organizational policies and implementation of CPOE in its acute care facilities. The CPOE system supports electronic ordering of medications using predefined fields that restrict use of prohibited abbreviations. While some abbreviations are used by the system, dangerous abbreviations known to contribute to medication errors are not allowed. Integrated CDS tools provide additional medication ordering safeguards, including alerts that are triggered when drug interactions occur, when the patient has an allergy to a drug being ordered, and when orders for duplicate medications are made.

#### Discussion

Alberta Health Services has identified the issue of abbreviations in medication ordering as a patient safety priority and is continuing with initiatives to curtail their use. Educational campaigns, reminders and feedback strategies are examples of interventions that have been used to create awareness of the dangers related to handwritten prescription orders. However, without a change in process it is difficult to sustain behavioural change.

CPOE in the community and all acute care and ambulatory care facilities is imperative to reduce medication errors and prevent adverse events related to incomplete orders, abbreviations, drug interactions and allergies. In the meantime, initiatives like the prohibited abbreviations campaign are a step in the right direction.

#### Incidence of surgical site infection

#### Background

Surgical site infection (SSI) rates are one outcome measure of particular interest to surgery departments as they are associated with considerable morbidity. It has been reported that over one-third of postoperative deaths are related, at least in part, to a SSI.<sup>92</sup> SSI can double the length of time a patient stays in hospital and thereby increase health care costs.<sup>93</sup>

Although the occurrence of a SSI is determined by factors associated with the surgery (pathogens are implanted at the time of surgery), onset of infection can happen many days, weeks and months later.<sup>94</sup> Accordingly, the internationally accepted U.S. Center for Disease Control and Prevention definition of SSI uses an onset window period of 30 days after surgery without prostheses and one year with prostheses.<sup>95</sup> However, shorter inpatient stays and day surgeries make it difficult to measure post-discharge infection rates at 30 days for most clean surgeries because the time at which post-surgery follow up occurs varies.

H OF MEASUREMENT Surgical site infection due to the short mod Surgical site infection rates appear to be underestimated due to the short monitoring period while patients are in hospital. Measurement of surgical site infection rates using electronic whole patient records can provide a more comprehensive estimate of rates and will help to improve surveillance and patient safety.



Typically deep and organ/space infections are captured when patients require readmission and/or return to outpatient surgery care. However, more common superficial infections are often identified and treated at the primary care level, frequently without the surgeon's knowledge. In the literature, additional cases of SSI identified through post-discharge surveillance range from 47 to 84%.96

With the recent introduction of bundles of evidence-based preventive measures known to significantly reduce SSI rates, there is an urgent need to ensure these measures become the practice standard for surgical care.<sup>97</sup> Monitoring SSI rates provides a measure of quality of care and information about patient outcomes that can stimulate adherence to preventive measures and drive continuous improvement activities. Administrative data linked at the patient level or an electronic health record could capture clinical information beyond hospital discharge that could then be reported back to the acute care system in a timely way to drive quality improvement initiatives aimed at reducing SSI.

Even though studies published from the 1960s to the 1990s on surgical prophylaxis concluded that a single dose of antibiotic administered shortly before the incision would be effective in preventing infections for most surgeries,<sup>98</sup> guidelines from international organizations or surgical associations are not emphatic in recommending single-dose prophylaxis.99

For example, studies on antibiotic prophylaxis comparing short with prolonged regimens in cardiac surgery have been published since 1972. In 2008, Spanish researchers published the first blinded randomized prospective trial comparing a single dose of antibiotic prophylaxis with 24-hour coverage of the same drug.<sup>100</sup> The trial enrolled 835 surgical cardiac patients (coronary artery bypass grafting and heart valve implantation). Outcomes were evaluated during hospital stay by physicians blinded for the prophylactic regimen. Cardiac surgeons followed the patients after discharge for 12 months. The whole cohort had an infection rate of 5.9%. The single-dose group had an infection rate of 8.3% and the 24-hour group had a rate of 3.6% (statistically significant). The 4.7% difference (in SSI rates) between the two groups means that treating an additional 21 patients (100/4.7) with a 24-hour prophylactic regimen will avoid one additional case of SSI.

Using prophylactic antibiotics in elective and non-elective cesarean deliveries substantially reduces the incidence of fever, endometritis, wound infection, urinary tract infection and other serious related infections.<sup>101</sup> Evidence-based guidelines strongly recommend administration of antibiotic prophylaxis prior to surgery but controversy exists for cesarean deliveries. Due to concerns about neonatal exposure, the standard protocol for cesarean section has been administration of antibiotic prophylaxis after delivery and umbilical cord clamping.<sup>102</sup> A meta-analysis grouping the data of three recently published double-blind randomized clinical trials was published in 2008.<sup>103</sup> It demonstrated benefits for mothers and the absence of additional risks for neonates when antibiotic prophylaxis was changed from after-cord clamping to before cesarean incision. The analysis comprised 749 laboured and elective cesarean deliveries with 377 women receiving antibiotics before the skin incision, 372 receiving them at cord clamp, 387 neonates being enrolled from the preoperative group and 384 from the cord clamp group.

Based on current findings, a change in policy regarding the timing of prophylactic antibiotics from postcord clamping to pre-incision was implemented at an academic centre in the U.S. in 2006.<sup>104</sup> The intervention started when implementing improvements on aseptic technique did not have a significant effect on lowering caesarean delivery infection rates. An overall SSI rate reduction of 67%, primarily due to reduced cases of endometritis, was achieved the year following the changed timing of the antibiotic prophylaxis.

#### **Indicator Definition**

Numerator: Number of SSIs for a specific type of surgery.

**Denominator:** Total number of surgical patients, for a specific type of surgery, followed for a certain period of time.

#### What the Data Shows

Data currently provided to surgery departments in Alberta is based primarily on information from acute care facilities, and only where positive laboratory results confirm the presence of an infectious microorganism. Clinical presentations of SSI are not captured in the first admission when laboratory cultures are not ordered or results are negative. They may be captured if the SSI has progressed sufficiently for the patient to be readmitted to hospital. SSI developing after discharge and cared for in the community is not captured by the surveillance system currently in place.

Using provincial data linked at the patient level, the Health Quality Council of Alberta (HQCA) estimated SSI rates occurring at 30, 60, 90, 120, 180 and 360 days after selected elective surgeries over a five-year period. The search of the provincial data included hospitalizations, outpatient visits, emergency department visits and all physician billings. SSIs were identified using the following diagnostic codes: infection and inflammatory reaction to prosthesis, puerperal infections, infection following a procedure and disruption of operation wound (see technical report for details and code specific rates). Results using this search method are shown in Table 21.

	SSI RATES (# OF INTERVENTIONS	PROPORTIONAL INCREASE OF		
SURGERY	IDENTIFIED DURING ADMISSION OR READMISSION	IDENTIFIED DURING ALL ENCOUNTERS	CASES WHEN ALL ENCOUNTERS ARE CONSIDERED (%)	
Coronary artery bypass graft	6.4	11.5	+ 80	
Cardiac valve	4.2	7.1	+ 69	
Hip replacement	2.6	4.4	+ 69	
Knee replacement	3.7	7.1	+ 92	
Spine procedures	1.7	3.5	+ 106	
Hysterectomy	2.5	8.8	+ 252	
C-section	1.7	8.9	+ 424	

Table 21. Alberta SSI rate estimates up to 30 days post-surgery (April 2002 – September 2007)

Analysis: Health Quality Council of Alberta

Source: Alberta inpatient morbidity, physician claims, ambulatory care classification system data

Table 21 shows that searching by type of surgery for SSI developing up to 30 days post-surgery in all health care encounters resulted in increases of 69 to 420% in infection rate estimates (by particular surgery) compared to estimates calculated using only information from hospital admissions and readmissions.

Figure 14 shows the source of SSI information. This figure displays only the selected surgeries used in Table 21 during the same time period. Twelve per cent (12%) of cases were identified from the original inpatient stay and 19% from readmissions and transfers. Six per cent (6%) were identified through physician billing in in-hospital cases that were not coded in the original stay and readmitted as SSI-related. Sixty three per cent (63%) of SSIs were identified in emergency departments and outpatient clinics and in the community.



Source: Alberta inpatient morbidity, physician claims, ambulatory care classification system data

Trend analysis for elective coronary artery bypass graft and cesarean section surgeries showed the SSI rate remained relatively stable (see Figure 15 and Figure 16). It is possible to analyze trends for each of the surgeries listed in Table 21 although they are not shown here.



Figure 15. Estimated SSI rates within 60 days after elective coronary artery bypass graft surgery in Alberta (2002/03 – 2007/08)

\*Partial results: 18 months data Analysis: Health Quality Council of Alberta

Source: Alberta inpatient morbidity, physician claims, ambulatory care classification system data



Figure 16. Estimated SSI rates within 60 days after elective cesarean section in Alberta (2002/03 – 2007/08)

\*Partial results: 18 months data Analysis: Health Quality Council of Alberta Source: Alberta inpatient morbidity, physician claims, ambulatory care classification system data

#### **Actions for Improvement**

In 2004, the home care program in the former Calgary Health Region implemented surveillance of surgical patients discharged from acute care and referred to its service. Before this, SSIs were often identified by home care when the client was seen prior to the scheduled six-week post-operative appointment with the surgeon. However, post-discharge SSIs were not captured in any information system; therefore, feedback was not provided to either the surgeon or the surgical facility. Home care chose to take a closer look at the incidence of SSI in their patient population resulting in the implementation of a SSI protocol with reporting requirements.

The home care program completed this pilot project in 2004 following 272 patients admitted to their program after cardiac surgery (coronary artery bypass graft or valve replacement) or orthopedic (hip or knee) implant surgery. The study looked at SSI occurring in patients who had these surgeries between December 1, 2003 and June 30, 2004.<sup>105</sup> Follow-up surveillance varied according to duration of enrolment in home care and did not necessarily cover the 12-month window of SSI onset related to implant surgeries.

From a total of 1,524 cardiac and orthopedic implant surgeries conducted in acute care during the pilot period, 39 SSIs were identified during the in-hospital stay and another 15 cases were captured by home care after patients were discharged from hospital. SSI rates were calculated at 2.6% if only in-hospital onsets were considered and 3.5% (approximately 40% more) if both in-hospital and home care onsets were counted. Home care clients' SSIs were identified early in their onset and prompt treatment was managed through home care, minimizing additional costs to the health care system for activities such as readmission to hospital or intravenous therapy. This pilot project illustrates how this type of process can identify increased rates of SSIs from post-discharge case identification.

#### Discussion

Health system administrators may consider in-hospital SSI rates as a proxy for actual rates and therefore a way to track trends, guide broader program changes and prioritize preventive measures. However, hospital epidemiologists may not be able to identify process-related risk factors that guide frontline quality improvement using only this information.

A surveillance system based solely on inpatient information may lead surgeons to underestimate the SSI problem. Under these circumstances, surgeons may be unaware that their patients developed a surgery-related infection and miss a significant opportunity to review and improve their practices.

An alternative to laboratory testing, health professional active surveillance or identification through administrative databases is a patient-based surveillance system.<sup>106, 107, 108, 109, 110, 111</sup> This system collects information directly from patients about their post-discharge experience through a follow-up telephone survey or home visit. A pattern recognition diagnosis can be done by the patients after a clear description of signs and symptoms or by the patient's history of health service utilization due to surgery-related infection.

One study showed that the patients' recall of a prescription for an antibiotic correlated better with the infection control nurses diagnosis than self-diagnosis.<sup>106</sup> A post-discharge surveillance system in Norway followed approximately 2,000 C-section deliveries over a 12-month period.<sup>112</sup> While the in-hospital SSI rate was 1.8%, considering only inpatient data, the total rate rose to 8.9% after the 30-day follow up. Using electronic surveillance, the HQCA found similar rates analyzing Alberta C-section data (see Table 21).

Administrative data has and is being used for SSI surveillance by various researchers and institutions. The Western Australian Nosocomial Infection Surveillance Project uses state-wide administrative inpatient data to estimate SSI rates.<sup>113</sup> A team of North American researchers developed publicly available software that enables users to estimate SSI rates using claims data, including all health encounters and prescription of antibiotics.<sup>114</sup> Canadian researchers from the Institute for Clinical Evaluative Sciences and the University of Toronto linked hospital discharges, physician claims, and prescription databases to calculate SSI rates for all hospitals in Ontario. They calculated SSI rates by surgical procedure using a stratification method similar to the one used by the National Nosocomial Infections Surveillance System of the Centers for Disease Control in the United States.<sup>115</sup> The U.S. Association for Professionals in Infection Control and Epidemiology released a position paper in May 2009 in favour of adopting electronic surveillance to "ease the burden of data management and allow the infection preventionist to go forth and accomplish the profession's highest calling: prevention."<sup>116</sup>

Electronic health records can facilitate surveillance and help raise awareness of currently underestimated SSI rates. An electronic health record, for each patient, that is available to all providers in the system can identify SSI rates more accurately and in real time. Concurrent feedback would enable surgeons and administrators to monitor the quality of surgical processes and the impact of quality improvement efforts. Meanwhile, administrative databases could be used for retrospective analysis until electronic health records are widely available.

#### Measuring the incidence of pressure ulcers to stimulate preventive actions

## Background

Pressure ulcers are localized wounds that develop over bony prominences due to excessive pressure mostly generated by prolonged bed and chair position. In addition to the organizational impact on hospitals and long term care facilities in terms of length of stay and costs, pressure ulcers cause patients pain and suffering. Furthermore, the incidence of pressure ulcers is no longer viewed simply as an indicator of quality of care but as a potentially serious medical problem that can be minimized through a multidisciplinary team approach viewed along the entire continuum of care. Most experts agree 70% of pressure ulcers are preventable.<sup>117</sup>

In 2009, Accreditation Canada defined pressure ulcer prevention in long term care as a required organizational practice. If a risk assessment is performed at admission and repeated throughout the patient stay, prevention actions can be timely and monitored according to individual risk factors. For this purpose, the Canadian Association of Wound Care promotes the use of the standardized Braden Scale for Predicting Pressure Sore Risk.<sup>118</sup>

A wide range of interventions and strategies can be used to mitigate these risks. Providing patients with pressure relief in bed through actions such as appropriate pressure surfaces and turning patients on a scheduled program or providing appropriate seating systems with tailored pressure relief are common strategies for managing skin care. Patients are encouraged to be involved in their own care, to the degree they are able, by being aware of strategies they can use to monitor and manage their unique skin integrity risks.

It is possible to collect data about pressure ulcers using health record coding of diseases and co-morbidities documented on the discharge record of each patient. However, the information may be underestimated because pressure ulcers, particularly in the first stages, are hard to identify without a careful physical examination.

 OF MEASUREMENT Skin integrity mana programs should in Skin integrity management programs should include ongoing measurement of the incidence and prevalence of pressure ulcers to assess the impact of prevention strategies.

In 2002, Swedish researchers found a large difference in day prevalence of pressure ulcers when a patient record audit (14.3%) was compared with physical inspection (33.3%).<sup>119</sup> In 2006, after implementation of an electronic health record system and identification of pressure ulcers as a quality indicator in their hospital, the difference in day prevalence between electronic health record information (20.7%) and physical examination of patients (30.0%) was still high at 9.3%. The authors concluded that for monitoring this quality care indicator, prevalence surveys with standard methods of assessment are more reliable than electronic information.

#### **Indicator Definition**

**Numerator:** Number of new pressure ulcer cases by stage (Braden scale) after one-week follow up with pressure ulcer-free patients.

Denominator: Total number of pressure ulcer-free patients on the first day of the one-week follow up.

#### What the Data Shows

Monitoring pressure ulcers is part of the inter*RAI* assessment conducted in long term care facilities in Alberta (see the Health Quality Council of Alberta's *2009 Measuring & Monitoring for Success* report) and is a required organizational practice for Accreditation Canada. However, there does not appear to be a similar process for acute care facilities. Prevalence estimates based on available administrative data for a selected high-risk group (those patients waiting in acute care for long term care or assisted living placement) were approximately 4.5%. These rates are most likely underestimated based on the results seen in the study referenced above.

#### Actions for Improvement

On September 26, 2007, the Grey Nuns Community Hospital in Edmonton conducted its first pressure ulcer prevalence study of 193 inpatients throughout the hospital, with the exception of maternity and newborns. One week later, a sample of 75 pressure ulcer-free patients was reassessed to see if they had developed ulcers. The day prevalence was approximately 34% and the one-week incidence was 28%. This incidence study demonstrated that many pressure ulcers were developing within the institution. The Grey Nuns Community Hospital responded to the pressure ulcer issue through education and awareness along with implementation of evidence-based practice in the area of skin integrity programs and wound care protocol. Ultimately, the aim was to create a culture shift in the facility from treating pressure ulcers to preventing pressure ulcers.

Major changes in the care process were:

- > Earlier identification of patients at risk and appropriate interventions.
- > Distribution of education materials to patients and caregivers.

- Reestablishment of a wound care committee, which employed an interprofessional approach to prevention.
- Purchase of foam-seated cushions and Ro-Ho seated cushions to reduce pressure on the coccyx area when sitting for long periods.
- Creation of a full-time wound care position to implement the program, including treatment and management of wounds and pressure ulcers.
- > Monitoring of treatment through care reviews.
- > Creation of "pressure ulcer-free zones".

According to the program, when a skin integrity risk assessment is completed, a preventive care plan is implemented based on the patient's risk score. Patients are categorized into one of four levels: at risk, moderate risk, high risk and very high risk. Interventions in each category involve different frequencies of:

- > turning patients in bed who are unable to do it independently
- active remobilization
- heel protection in and out of bed
- > management of moisture issues related to the skin
- management of friction and shear on skin integrity
- > determination of the appropriate level of pressure reduction in all support surfaces
- use of foam edges
- nutrition

A follow-up pressure ulcer prevalence and incidence study was conducted in 2008 and 2009 to determine the effect of the interventions and the same study methods used in 2007 were employed. Day-prevalence rates reflect both in-hospital and pre-existing conditions. Incidence rates reflect the occurrence of new cases or only in-hospital experiences. The day prevalence dropped from 34 to 24% in 2008 and to 19% in 2009. The one-week incidence dropped from 28 to 13% in 2008 but increased to 18% in 2009 (see Figure 17). The cost of managing this condition decreased from \$315,000 to \$220,000 per month, assuming an average cost per case of \$500 in a 30-day period and the total number of cases. This amount was more than enough to compensate a full-time wound care specialist and buy the needed resources to support the program.





Source: Grey Nuns Community Hospital

#### Discussion

Skin integrity issues are a reflection of quality of care. Prevention should be the first priority regardless of the care setting. In fact, the preventive actions of health care providers can have a significant impact on the incidence of pressure ulcers. Any skin integrity management program, whether in acute or continuing care, should include ongoing measurement of incidence of pressure ulcers to assess the impact of prevention strategies.

Equipment is a critical aspect of a skin management program and represents a significant investment. However the expenditure can be justified because of the cost savings seen through the prevention of skin ulcers. Both the device and the clinical benefit have a limited lifespan; therefore, using equipment that no longer provides pressure redistribution or is inadequate for the patient's weight and functional capacity can harm patients and cause pressure ulcers.<sup>120</sup>

Particularly in older and non-ambulatory patients, skin integrity programs should be managed as part of a holistic multidisciplinary care plan regardless of the setting.

# THE POWER

## OF MEASUREMENT

Monitoring the incidence of central line-associated bloodstream infections can measure the effectiveness of evidence-based practices aimed at reducing such infections.



#### Reducing the incidence of venous central line-associated bloodstream infection

#### Background

A vascular access procedure involves inserting a flexible thin plastic tube (catheter) into a blood vessel to provide a painless way of drawing blood or delivering drugs and nutrients into a patient's bloodstream over a period of days, weeks, months or even years.

Two common types of vascular access catheters are:

- > Peripherally inserted central catheter (PICC): a long catheter that extends from an arm vein into the largest vein (superior vena cava) near the heart.
- Central venous catheters (CVC): larger calibre than PICCs; designed to be placed via a relatively large, more central vein such as the jugular vein in the neck or the femoral vein in the groin.

In emergency departments and intensive care units (ICUs), PICCs are preferred because they have a lower risk of infection; however, their use is limited. PICC insertion requires more time and equipment than a CVC, and a peripheral vein cannot handle the large volumes of fluid often needed in an acute or emergency situation. Patients frequently need the larger volume capacity that only CVCs can deliver. In ICUs, CVCs also allow monitoring of central venous pressure, a critical cardiovascular parameter related to blood volume, pulmonary function, heart failure, pleural effusion and cardiac output.

CVCs disrupt the integrity of the skin, causing bacterial and/or fungal infections. Infection may spread to the bloodstream and severe sepsis may ensue, possibly leading to death.

Studies of catheter-related bloodstream infections suggest mortality attributable to these infections is between 4 and 20%. It is estimated that 500 to 4,000 U.S. patients die annually due to catheter-related bloodstream infections. In addition, bloodstream infections prolong hospitalization by a mean of seven days. Attributable costs per bloodstream infection are estimated to be between US\$3,700 and \$29,000.<sup>121</sup>

In 2006, the Canadian Nosocomial Infection Surveillance Program was established to determine the rate and risk factors associated with central line bloodstream infections (CLBSIs) in Canadian ICUs.

A CLBSI is defined as a bloodstream infection detected in patients with a central line that occurs 48 hours after insertion of the CVC. Infections detected before 48 hours of onset or after 48 hours of removal of the CVC must have compelling evidence to be considered a CLBSI.<sup>122</sup> Forty-one ICUs in 19 Canadian hospitals participated in the six-month study that looked at patients with central lines inserted for more than 48 hours. Results identified a mean rate of CLBSIs of 6.2 per 1,000 central-line days for adult ICUs (27 of the 41 ICUs) participating in the study. The range was from 0 to 16.2 per 1,000 central-line days.<sup>125</sup>

The central line-associated infection prevention bundles promoted by the pan-Canadian *Safer Healthcare Now!* initiative were adapted from the Institute for Healthcare Improvement in the United States. These eight interdependent evidence-based best practice interventions for patients with CVCs are grouped into two separate bundles:<sup>121</sup>

Central-line insertion bundle:

- > Hand hygiene before and after activities related to the central line.
- > Use of maximum barrier precautions for line placement.
- > Use of chlorhexidine for skin antisepsis before line insertion.
- > Optimal catheter site selection:
  - The subclavian vein is the preferred site for non-tunneled catheters in adult patients.
  - Site preference in children needs to be individualized.

Central-line maintenance bundle:

- > Daily review of line necessity with prompt removal of unnecessary lines.
- > Dedicated lumen for total parenteral nutrition.
- Accessing the lumens aseptically.
- > Checking entry site for inflammation with every dressing change.

If implemented concurrently and reliably, preventive actions can drastically reduce the incidence of venous CLBSIs. The Johns Hopkins Hospital conducted a quality improvement project with five components: educating the staff, creating a catheter insertion cart, asking physicians daily whether catheters could be removed, implementing a checklist to ensure adherence to guidelines, and empowering nurses to stop the catheter insertion procedure by a physician if a violation of the guidelines was observed. The incidence rate decreased from 11.3/1,000 line days to 0/1,000 line days in five years.<sup>124</sup> The Barnes Jewish Hospital, using a similar approach, reduced the infection rates from 10.8/1,000 line days to 2.8/1,000 line days in five years. Currently this hospital supports a zero tolerance policy for CVC infection.<sup>125</sup>

#### Indicator Definition

Numerator: Number of bloodstream infections among patients who had a CVC in place up to 48 hours prior to the onset of the bloodstream infection.

Denominator: Total number of patient days in ICU with a CVC per quarter.

#### What the Data Shows

The Department of Critical Care Medicine in Calgary collects data related to hospital-acquired infections associated with CVCs.<sup>126</sup> It also captures the proportion of central-line days no longer needed, which is an important process indicator. Since infection risk depends on the length of time the line is in place as well as the aseptic technique related to catheter insertion and insertion site care, removing the line as soon as it is no longer required for clinical management is critical. Figure 18 shows aggregate data from four adult ICUs.



Source: Department of Critical Care Medicine - Calgary

The above graph shows CLBSI rates in Calgary are below the average (6.2/1,000 line/days) for ICUs identified by the Canadian Nosocomial Infection Surveillance Program in 2006.

#### Actions for Improvement

In 2009, the quality improvement and patient safety specialist in the Department of Critical Care Medicine in Calgary managed a campaign to reduce the incidence of central line-associated bloodstream infections at Calgary's four acute care hospitals. The strategy was to develop and implement criteria to guide decisionmaking regarding the insertion and maintenance of central lines. Criteria included:

- > patient on vasoactive medications
- central venous pressure monitoring required
- > peripheral access not available
- > on continuous renal placement therapy (specific hemodialysis for acute cases)
- > on total parenteral nutrition or total nutrient admixtures (contains lipids)
- > active resuscitation (assisted ventilation)
- has a pulmonary artery catheter
- > has a transvenous pacemaker

A three-week baseline prevalence study was performed. The audit identified a total of 884 central-line days involving 149 patients. Of the 884 days, 169 (19%) did not fit in any of the required clinical criteria for central-line insertion and 103 central-line days were identified as no longer needed (12%) because the central-line indicators were no longer present.

In June 2009, a poster with the study results and the clinical indications for central-line criteria was placed in every patient room throughout the ICUs. The campaign goal was to consider the feasibility of peripheral venous access if not already present and to remove the central line within 24 hours of successfully implementing a peripheral intravenous (IV) line. Nurses were empowered to proactively place peripheral IVs when the only reason for having a central line was lack of peripheral access. Another audit is planned for the end of the campaign in 2010.

Another project to help decrease CLBSI involved reducing the need for central venous insertion by substituting PICC in the arm. This procedure is not generally done in ICUs because radiologists and an x-ray image are needed to guide the insertion procedure. The Misericordia Community Hospital in Edmonton developed a quality improvement initiative that increased the probability of peripheral venous access success by nurses, and eliminated the need to go to the diagnostic imaging department for the procedure. The investigators evaluated the introduction of ultrasound guidance to locate veins in the upper arm compared with the standard method of visualizing veins using anatomical landmarks and palpation. With this new technique, the nurses' peripheral venous insertion success rate increased from 78% to 98%. This significantly reduced the number of patients requiring a second procedure by a radiologist or a central venous line insertion, while delivering important cost savings to the hospital and a safer procedure to patients. The incidence of PICC-related thrombosis, which is a potential adverse outcome of PICC insertion, was decreased from 9.3% to 2.1% with the addition of ultrasound guidance.<sup>127</sup>

#### Discussion

Preventive actions and continuous monitoring, as seen in the Department of Critical Care Medicine in Calgary and at Edmonton's Misericordia Community Hospital, can reduce the incidence of central line-associated bloodstream infections.



## Section 3.0: In Summary

Health information and measurement have considerable potential to enable improved patient management and health care quality as well as better decision-making at all levels of the system – strategies that are pillars for sustainability.

Alberta's health care system is evolving from a focus on volume or procedures reactive to patient health issues to a health system approach that is person-centred and emphasizes prevention, health support and coordinated team-based care. A quality-focused health care system capable of preventing and managing illness will reduce the high costs of health care and improve overall quality. Savings can be realized through finding the right things to do for all patients and avoiding the often wasteful and risk-associated overuse of certain health care procedures and resources.<sup>128</sup>

Currently, Alberta's \$15-billion per year health care system does not measure its primary output (restoration or maintenance of functional health) or the cost of that output (cost per clinical outcome) in order to systematically assess value and potential sustainability. As such, it is difficult to understand system-level cost drivers in each health care sector – drivers that can help explain what increases costs after general inflation, population growth and aging have been taken into account.

In addition to these high-level measures of system performance, sets of indicators for each clinical area are also required. As the 2010 *Measuring & Monitoring for Success* report showcases, there are numerous Alberta initiatives that do employ the power of measurement to inform decision-making and improve health care quality.

Effective and integrated health information management is capable of bringing evidenced-based information and practices to the point of care – to places where information and/or strategies can be acted upon to influence patient outcomes and improve the health system. However, in Alberta's current health care system these different functions appear to live in discrete worlds that are ultimately linked by the individual patients who travel through the various points of care.

An effective infrastructure of information, measurement and quality improvement could be realized through a "whole patient record" with the capability for system-wide aggregation of health information and real-time reporting.<sup>129</sup> As shown in the model depicted in Figure 1 on page 11, such a system could ultimately deliver better patient management and significantly advance quality improvement through the monitoring and reporting of quality indicators. However, Alberta is still some years away from realizing such an integrated health information management model.

The power of measurement, as a business strategy, is most evident when measures of quality and safety are embedded at every level of the system. It is, in turn, further enabled through integration of the measures within an overarching health information strategy that possesses the necessary information support systems. Health information and measurement have considerable potential to enable improved patient management and health care quality as well as better decision-making at all levels of the system – strategies that are pillars for sustainability.

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#### Glossary

**Best practices** – The most efficient (least amount of effort) and effective (best results) way of accomplishing a task, based on repeatable procedures that have proven themselves over time for large numbers of people.

**Clinical decision support (CDS)** – Computer applications designed to aid clinicians in making diagnostic and therapeutic decisions in patient care. They can simplify access to data needed to make decisions, provide reminders and prompts at the time of a patient encounter, assist in establishing a diagnosis and entering appropriate orders, and alert clinicians when new patterns in patient data are recognized.

**Clinical guidelines** – Systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances.

**Computed tomography (CT)** – A diagnostic imaging test that combines special x-ray equipment with sophisticated computer technology to produce multiple images or pictures of the inside of the body. CT scans of internal organs, bone, soft tissue and blood vessels provide greater clarity and reveal more details than regular x-ray exams.

**Computerized provider order entry (CPOE)** – Portion of a clinical information system that enables a patient's care provider to enter an order for a medication, clinical laboratory or radiology test, or procedure directly into the computer. The system transmits the order to the appropriate department or individuals so it can be carried out. The most advanced implementations of such systems also provide real-time clinical decision support such as dosage and alternative medication suggestions, duplicate therapy warnings and drug-drug and drug-allergy interaction checking.

**Deep venous thrombosis** – Occurs when a blood clot forms inside a vein deep in the leg causing pain and swelling.

**Diabetes** – A chronic disease associated with abnormally high levels of the sugar glucose in the blood. Diabetes is due to one of two mechanisms:

- (1) Inadequate production of insulin, which is made by the pancreas and lowers blood glucose.
- (2) Inadequate sensitivity of cells to the action of insulin.

The two main types of diabetes correspond to these two mechanisms and are called insulin dependent (type 1) and non-insulin dependent (type 2) diabetes. In type 1 diabetes there is no insulin or not enough of it. In type 2 diabetes, there is generally enough insulin but the cells upon which it should act are not normally sensitive to its action.

**Electronic health record (EHR)** – An individual patient's health record in digital format. EHR systems integrate and retrieve individual patient medical records within a computer system. It may comprise individual electronic medical records from many locations and/or health service providers, (e.g., patient demographics, encounters, diagnosis, treatments, diagnostic imaging, laboratory and medication information) and is accessible by authorized health care providers from various locations.

**Electronic medical record (EMR)** – A local medical record in digital format. For example, a family physician practice may have an EMR for each patient; this information is stored locally and is not directly accessible to other health care providers.

Hemoglobin A1c (HbA1c) – The main fraction of glycosylated hemoglobin (glycohemoglobin), which is hemoglobin to which glucose is bound. Hemoglobin A1c is tested to monitor the long-term control of diabetes. The level of hemoglobin A1c is increased in the red blood cells of persons with poorly controlled diabetes mellitus. Since the glucose stays attached to hemoglobin for the life of the red blood cell (normally about 120 days), the level of hemoglobin A1c reflects the average blood glucose level over the past four months. It is commonly recommended that hemoglobin A1c be measured every three to six months in diabetics.

**Hospitalist** – Health care provider, usually a physician, whose practice is devoted to treating patients in a hospital setting.

**Magnetic resonance imaging (MRI)** – A diagnostic imaging test most commonly used to visualize detailed internal structure and limited function of the body. MRI provides much greater contrast between the different soft tissues of the body than computed tomography (CT), making it especially useful in brain, musculoskeletal, cardiovascular and cancer imaging. Unlike CT, it does not use ionizing radiation.

**Median wait time** – Calculated by sorting the list of waiting patients from the shortest to longest wait times. This sorted distribution is split in half, with the median the value that divides the first 50% of the population from the second.

**Medical ultrasonography or ultrasonography** – A diagnostic imaging test used to visualize subcutaneous body structures including tendons, muscles, joints, vessels and internal organs for possible pathology or lesions. Obstetric ultrasonography is commonly used during pregnancy.

**Morbidity** – A disease state, disability or poor health due to any cause. The term may be used to refer to the existence of any form of disease or to the degree that the health condition affects the patient.

**Mortality** – Incidence of death in a population. It is measured in various ways, often by the probability that a randomly selected individual in a population at some date and location would die in some period of time.

**Patient care information system (PCIS)** – An electronic health record implemented in an acute care environment.

**Patient registry** – A separate database that contains a subset of patients' data to track processes and outcomes. It is a tool that allows early diagnosis, treatment and prevention of complications because it guides a proactive process of care.

**Physician Office System Program (POSP)** – Part of a trilateral agreement between Alberta Health and Wellness, the Alberta Medical Association and Alberta Health Services to support the use of technology to improve workflow and patient care in physician clinics.

**Primary care network (PCN)** – A joint venture between a local group of family physicians and Alberta Health Services to provide primary care services with a multidisciplinary team in a specific geographic area.

**Pulmonary embolism** – Broken off blood clots (thrombus) in a leg that have travelled to the lungs (emboli). A patient with such emboli will experience shortness of breath or chest pain and, in some cases, death.

**Telestroke** – A specific application of telehealth for stroke, early detection and treatment. Telehealth is the use of health services and information via telecommunications technologies connecting remote areas to specialized centres.

**Tissue plasminogen activator (tPA)** – A protein involved in the breakdown of blood clots. It is used in clinical medicine to treat only embolic or thrombolytic stroke.

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## Acknowledgement

The HQCA gratefully acknowledges the many people and organizations that contributed to this report.

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> ISSN 1920-2156 (Print) ISSN 1920-2164 (Online)



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