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The Fraser Institute
Hospital Report Card
Alberta 2009

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Overview

The Fraser Institute's *Hospital Report Card: Alberta 2009* is constructed to help patients choose the best hospital for their inpatient care by providing them with information on the performance of acute-care hospitals in Alberta. All of the information in this report is available at our interactive website, <http://www.hospitalreportcards.ca>.

We set out to create a hospital report card that is easy to understand and accessible by the public, where individuals are able to look up a given condition or procedure and compare death rates, volumes of procedures, rates of adverse events, and utilization rates for their hospital to those of other hospitals in Alberta. This is accomplished by using state-of-the-art indicators developed by the US Agency for Healthcare Research and Quality (AHRQ) in conjunction with Stanford University that have been shown to reflect quality of care inside hospitals. These indicators are presently in use in more than a dozen US states, including several of the more populous ones, New York, Texas, Florida, and California.

We are using the Canadian Institute for Health Information's (CIHI) Discharge Abstract Database (DAD) as our primary information source. This information is derived from patient records provided to CIHI by all hospitals in Alberta. Demographic, administrative, and clinical data are extracted from the Discharge Abstract Database for inpatient hospital stays for all acute-care hospitals in Alberta. Since more specialized hospitals may treat more high-risk patients and some patients arrive at hospitals sicker than others, it is important to risk-adjust hospital death rates, adverse events rates, and utilization rates for patients with the same condition but a different health status. The international standard for risk adjustment, the the 3M™ APR™-DRG Classification System,[1] is employed to risk-adjust the data. The Fraser Institute spent two years developing the methods, databases, and computer programs required to adapt the measures to Canadian circumstances. This work has been internally and externally peer-reviewed (Mullins, Menaker, and Esmail, 2006) and is supported by an extensive body of research based on the AHRQ approach.

None of Alberta's 102 acute-care hospitals are identified by name in this report. This contrasts with the Fraser Institute's recently released *Hospital Report Card: British Columbia 2009*, in which, resulting from a decision made by the Minister of Health, all of British Columbia's 95 hospitals were identified. By not allowing hospitals to be identified in the *Report*, Alberta Health Services has restricted the ability of patients in Alberta to assess the health care they receive.

1 3M and APR are trademarks of 3M, used under license in Canada.

What indicators are used?

The Fraser Institute's *Hospital Report Card: Alberta 2009* consists of 39 of AHRQ's indicators of inpatient quality (such as death due to a stroke) and patient safety (such as a foreign body left inside a patient during a procedure). The indicators are shown for all acute-care hospitals in Alberta from 2002/03 to 2006/07, comprising more than 1.7 million patient records. We have also calculated the indicators for all municipalities in Alberta, based on patient residence postal codes. This constitutes the most comprehensive and detailed publicly available measure of acute-care hospital performance in Canada at the present time.

The indicators are expressed as observed rates (such as death due to hip replacement surgery) and risk-adjusted rates (the same rate adjusted for patient health status). Each institution was given a score from 0 to 100 for each indicator based on its risk-adjusted rate where available or on its observed rate, where 100 is the best. The institutions were then ranked based on their scores, where 1 is the best.[2] The indicators are classified into three groups: those related to medical conditions, hospital procedures, and child birth. The indicators are further classified by type: death rates, volumes of procedures, utilization rates, and adverse events.

Hospital Mortality Index

The Hospital Mortality Index (HMI) shows the performance of a hospital (table 1, page 7) or municipality (table 2, page 9) across nine indicators that measure death rates:

1. deaths due to hip replacement surgery
2. deaths due to heart attacks
3. deaths due to heart failure
4. deaths due to acute strokes
5. deaths due to bleeding from the esophagus, stomach, small intestine or colon
6. deaths due to hip fractures
7. deaths due to pneumonia infection
8. deaths among patients that are considered unlikely to die in the hospital
9. deaths in patients that developed complications of care during hospitalization

The final score in the HMI for each hospital and municipality is an average of the scores of these indicators (100 is the best). All institutions and

2 Some adverse events tend to be rare and smaller municipalities and hospitals will not always see these consequences of patient care. It cannot be imputed that a high score on these types of indicators is necessarily due to fewer adverse events for those places with relatively low numbers of cases as their volume of activity may be inadequate to produce the inevitable adverse event. Therefore, results for some indicators must be interpreted with caution in the case of smaller institutions and municipalities.

municipalities were ranked based on their HMI score (1 is the top rank). It is important to note that the 39 indicators and the Hospital Mortality Index are applicable only to acute-care conditions and procedures for inpatient care. The results cannot be generalized to assess the overall performance of any given hospital.

Limitations and caveats

Since this report is based on administrative data, the results have limitations related to coding variations and other factors. Hospital deaths or complications will occur even when all standards of care are followed. Deciding on treatment options and choosing a hospital are decisions that should be made in consultation with a physician. It is not recommended that anyone choose a hospital based solely on statistics and descriptions such as those given in this report.

That said, the Discharge Abstract Database (DAD) is a major data source used to produce various of the reports published by the Canadian Institute for Health Information (CIHI), including annual reports on the performance of hospitals and the health care system. It is also a major data source for seven of the health indicators adopted by the federal, provincial, and territorial governments. These data have also been used extensively in previous reports on health care performance and form the basis for many journal articles. As is noted in the *Ontario Hospital Report*, which uses the same DAD data set underlying this report card, "the data are collected under consistent guidelines, by trained abstractors, in all acute-care hospitals in Ontario. The data undergo extensive edit checks to improve accuracy, but all errors cannot be eliminated" (Ontario Hospital Association and the Government of Ontario, 2006: 6).

There are a number of publications that have addressed the data-quality issues that are discussed in our report. Of note are CIHI's reabstraction studies that go back to the original patient charts and recode the information using a different set of expert coders.[3] Overall, according to CIHI (2004), findings from their three-year DAD re-abstraction studies have confirmed the strengths of the database, while identifying limitations in certain areas resulting from inconsistencies in the coding of some data elements. In addition, the findings from the inter-rater data (that is, comparison between reabstractors) were generally similar to the findings from the main study data (that is, comparison between original coder and reabstractor). This suggests that the database is coded as well as can be expected using existing approaches in the hospital system.

3 Reabstractors participating in the study were required to have several years of coding experience, experience coding in ICD-10-CA and CCI in particular, experience coding at a tertiary care centre, and attendance at specific CIHI educational workshops. They were also required to attend a one-week training session and to receive a passing score on the inter-rater test.

In addition to the aforementioned reabstraction studies, the OECD published a report that supports the AHRQ patient-safety indicator approach, noting that "this set of measures represents an exciting development and their use should be tested in a variety of countries" (Millar, Mattke, et al., 2004: 12). Further, a report published by the Manitoba Center for Health Policy that used the AHRQ Patient Safety Indicators (Bruce et al., 2006) noted two important advantages to using the AHRQ approach. The first advantage is the breadth of coverage offered by the indicators in studying in-hospital patient safety. The second is that the AHRQ patient safety indicators were developed to measure complications of hospital-based care among a group of patients for whom the complications seemed preventable or highly unlikely.

Observations

A report based on more than 1.7 million patient records, shown across 39 inpatient quality and patient safety indicators, for 102 hospitals and 47 municipalities, over five years, is not something that can be summarized in a few words. In fact, the primary purpose of this research is to provide patients with access to information on specific medical procedures and conditions, and to give Albertans a better understanding of the variation in hospital care across the entire system. It is for that reason that we have rates (including both observed and risk-adjusted rates as well as statistical upper and lower bounds for the risk-adjusted rates), scores, and ranks for each separate indicator. All documents are available at <http://www.hospitalreportcards.ca> and <http://www.fraserinstitute.org/reportcards/hospitalperformance/>.

However, we have created one summary measure of mortality, based on the most important and reliable data in this study, the Hospital Mortality Index (HMI). The nine component indicators of the HMI were arrived at by a process of elimination. Starting with our complete group of 39 indicators, we eliminated indicators that had no data for several years or for which there were relatively few hospitals with data. The resulting HMI has scores and rankings for 10 hospitals and 21 municipalities in the latest years since not all hospitals and municipalities had data for all nine indicators in 2005/06 or 2006/07.

Tables 1 (page 7) and 2 (page 9) show scores and rankings for the Hospital Mortality Index for the average score over the latest two years, 2005/06 and 2006/07. This is compared to the average score in the first three years of our study from 2002/03 to 2004/05. The change column shows any improvement or deterioration in score that took place between the two periods. Tables 1 and 2 include only hospitals or municipalities with data in at least one year in both periods.

Hospital Mortality Index: Hospitals

Top-Ranked Hospitals

- The top-ranked hospital for 2005/06 and 2006/07 in Alberta is Anonymous Hospital 67 with an average HMI score of 88.2 out of 100. It experienced the second largest improvement in its score from the previous period.
- Hospital 65 is the second-ranked hospital for 2005/06 and 2006/07 with a score of 86.4. Hospital 45 ranks third with an average score of 86.3.
- Hospital 45, Hospital 67, and Hospital 98 were the three hospitals with the largest improvements in their averaged score since the earlier period (with improvements ranging from 2.4 to 5.1 points).

Bottom-Ranked Hospitals

- Anonymous Hospital 30 is the lowest-ranked hospital with an average score of 74.2 for 2005/06 and 2006/07. It saw a 1.2-point improvement of its averaged score since the earlier period.
- Anonymous Hospital 17 is the second lowest-ranked hospital for 2005/06 and 2006/07, with an average score of 78.6 (down 1.3 points since the earlier period). Hospital 10 is ranked third lowest for 2005/06 and 2006/07, with an average score of 78.9 (down 0.5 points from the earlier period).
- Hospital 84 with an average score of 82.7 experienced the largest deterioration in its average score (down 4.5 points) from the earlier period.

Hospital Mortality Index: Municipalities[4]

Top-Ranked Municipalities

- The top-ranked municipality is Ponoka with an HMI score of 86.9 out of 100, averaged for 2005/06 and 2006/07. The second-ranked municipality, Fort Saskatchewan, scored 85.2 for 2005/06 and 2006/07, after ranking poorly in the earlier years.
- The third-ranked municipality is St. Albert, with a score of 84.5.
- There is little consistency in municipal scores over time. Only five municipalities among the top 10 in 2005/06 and 2006/07 were also among the top 10 from 2002/03 to 2004/05.

4 The Hospital Mortality Index (HMI) is calculated for municipalities using the residence of patients treated in Alberta's acute-care hospitals. Due to patient mobility, municipal scores cannot be reliably used to infer the performance of hospitals.

Table 1: Hospital Mortality Index—Hospitals

	2005/06 & 2006/07		2002/03–2004/05		Change 2002/05–2005/07	
	Score	Rank	Score	Rank	Score	Rank
Hospital 67	88.2	1	83.1	5	5.1	2
Hospital 65	86.4	2	86.2	2	0.2	6
Hospital 45	86.3	3	81.2	7	5.1	1
Hospital 34	86.1	4	84.9	4	1.2	5
Hospital 98	84.0	5	81.6	6	2.4	3
Hospital 4	83.6	6	86.1	3	–2.5	9
Hospital 84	82.7	7	87.1	1	–4.5	10
Hospital 10	78.9	8	79.4	9	–0.5	7
Hospital 17	78.6	9	79.9	8	–1.3	8
Hospital 30	74.2	10	73.0	10	1.2	4

Note: Ranking includes only those hospitals for which a score could be calculated in both periods.

Note: Scores are calculated to exact values and are rounded for inclusion in the table.

Bottom-Ranked Municipalities

- The lowest-ranked municipality in Alberta is Camrose, with an average HMI score of 68.1 for the most recent period, which comes after a decline of 0.1 points from its score during the period from 2002/03 to 2004/05.
- Sylvan Lake is the second-lowest-ranked municipality with an average HMI score of 70.0 for the most recent period. Cochrane is the third lowest-ranked municipality, with an average HMI score of 78.7.
- Many of the bottom-ranked municipalities are consistently of lower rank over the two time periods, with the notable exceptions of Sylvan Lake, which fell from 5th to 20th with a decline of 12.9 points in its averaged HMI score, and Wetaskiwin, which fell from 2nd place to 14th with a 6.7-point decline in its averaged HMI score.
- Sylvan Lake, Wetaskiwin, High River, rural areas, Edmonton, Calgary, Airdrie, Camrose, and Sherwood Park all experienced declines in their HMI scores from the earlier period.

Five Largest Municipalities

- The five largest municipalities in Alberta by number of inpatient stays are: Calgary, ranked 12th on the Hospital Mortality Index for 2005/06 and 2006/07 with an average score of 81.3; Edmonton, ranked 15th with an average score of 78.9; Red Deer, ranked 16th with an average score of 78.8; Lethbridge, ranked 17th with an average score of 78.7; and Medicine Hat, ranked 7th with an average score of 83.9.

Table 2: Hospital Mortality Index—Municipalities

	2005/06 & 2006/07		2002/03–2004/05		Change 2002/05–2005/07	
	Score	Rank	Score	Rank	Score	Rank
Ponoka	86.9	1	58.7	21	28.2	1
other*	86.5	2	83.5	4	3.0	10
Fort Saskatchewan	85.2	3	71.8	18	13.5	2
St Albert	84.5	4	81.9	8	2.7	11
Sherwood Park	84.1	5	84.1	3	−0.0	13
Spruce Grove	84.1	6	82.9	6	1.2	12
Medicine Hat	83.9	7	75.3	15	8.7	4
High River	83.7	8	89.3	1	−5.6	19
Grande Prairie	83.1	9	76.3	14	6.8	5
Stony Plain	83.0	10	77.3	13	5.6	6
Lacombe	81.8	11	78.1	11	3.6	9
Calgary	81.3	12	82.3	7	−1.0	16
Airdrie	80.3	13	81.2	9	−0.9	15
Wetaskiwin	80.1	14	86.8	2	−6.7	20
Edmonton	78.9	15	80.3	10	−1.4	17
Red Deer	78.8	16	74.1	17	4.7	7
Lethbridge	78.7	17	74.8	16	3.9	8
Cochrane	78.7	18	68.9	19	9.8	3
rural*	76.4	19	77.8	12	−1.4	18
Sylvan Lake	70.0	20	82.9	5	−12.9	21
Camrose	68.1	21	68.2	20	−0.1	14

* Municipal patient populations are constructed from the Forward Sortation Areas (FSAs) of patient postal codes. All FSAs containing a "0" as their second character were grouped into a "rural" category (as described by Canada Post). All FSAs not described by Canada Post were placed in the residual group, "other." For more information, see Appendix H.

Note: Scores are calculated to exact values and are rounded for inclusion in the table.

Conclusion

The Fraser Institute's *Hospital Report Card: Alberta 2009* provides a detailed and comprehensive measure of inpatient acute-care conditions in Alberta's hospitals. This is the first edition of the report card for patients in Alberta. Three reports for Ontario are already available, two have been published for British Columbia, and future editions of the Fraser Institute's *Hospital Report Card* will include performance measurement of acute-care hospitals in other provinces. We welcome comments on the content and format of this report via comments@hospitalreportcards.ca.

Introduction and background

The goal of the Fraser Institute's *Hospital Report Card: Alberta 2009* is to contribute to the improvement of inpatient care in Alberta by providing hospital-specific information about quality of service directly to patients and to the general public. This series was the first in Canada to empower patients to make informed choices about their health care delivery options by providing comparable, hospital-specific, performance measurements on a range of clearly identified indicators. The Fraser Institute's *Hospital Report Card: Alberta 2009* has been published to promote accountability within hospitals, thereby stimulating improved performance through an independent and objective measurement of performance.

In Canada, individuals have access to data identifying problem areas in an automobile from information willingly supplied by consumers, the vehicle's manufacturer, and industry experts. They can find which CD player is the best on the market for their needs. They can compare restaurants before heading out for an evening meal. Yet when it comes to health care, which many will consider more important for an individual's well being, consumers are left with remarkably little information about where the best services are available. They cannot even tell which hospitals offer the worst care or have the highest mortality rates (Esmail, 2003).

What are hospital report cards?

Hospital report cards provide a set of consistent performance measurements to rank the services in question and give consumers the information they need to make a more informed choice.[1] In some cases, these indicators may be subjective, based on the opinions of survey respondents. In other cases, the indicators will be objective measures of performance or outcomes.
Hospital report cards are used to measure specific practices in hospitals such as the application of a specific drug or technology to certain events; or performance with respect to access to care or consumer satisfaction; or to measure the likelihood of a positive or negative outcome provided by health facilities in a specific jurisdiction.

1 See Kessler, 2003 for a helpful delineation of the field.

The four primary types of hospital report cards

1 ***Process report cards***

This type of report card describes the inputs used by hospitals, health plans, or individual physicians in the course of treating their patients. An example of these types of report cards can be found in those commissioned by The Leapfrog Group <http://www.leapfroggroup.org/>. The primary strength of a process report card is that it can be developed from existing medical administrative databases with relative ease. The process report card, however, does not necessarily measure the appropriateness, the quality, or the importance of the inputs employed in ensuring good health, although these factors can be captured to some extent by the inclusion or exclusion of specific inputs.

2 ***Survey report cards***

This type of report card is composed of patients' evaluations of their quality of care and/or customer service. An example of this type of report card is found in the California HealthCare Foundation's ratings <http://www.calhospitalcompare.org/>. Although survey-based report cards do provide valuable information on subjective areas of patient care, they cannot measure how treatment decisions by a doctor or hospital lead to objective improvements in patient care.

3 ***Outcomes report cards***

These report cards present average levels of adverse health outcomes based on mortality or complication rates experienced by patients as part of a health plan, as treated by a specific doctor, or in a specific hospital. An example of this type of report card can be found in the Pennsylvania CABG surgery reports <http://www.phc4.org/reports/cabg/>. These report cards provide objective measures of differences in the quality of care but are susceptible to being "gamed" by either doctors or hospitals. For example, the doctor or hospital may avoid exceptionally sick patients (that is, patients who are qualitatively more ill with a listed condition and who will consequently drag average results down) in favor of healthier patients (to skew results upward). This unintended effect can, however, be mitigated through the appropriate application of risk-adjustment in the measures. Outcomes report cards (including the Fraser Institute's *Hospital Report Cards*) provide the most empirically sound basis for analyzing the quality of care.

4 ***Balanced scorecards***

The balanced scorecard was developed in the early 1990s by Robert Kaplan and David Norton to examine a business above and beyond the financial bottom line. Translated into the healthcare field, this results in four quadrants. In the case of the *Ontario Hospital Reports* series, a prime example of the use of a balanced scorecard, these are [a] financial performance and conditions;

[b] patient/client satisfaction; [c] clinical utilization and outcomes; and, [d] system integration and change. While this variant of report card is useful in determining the broadest view of a hospital's operations and functions, specific and relevant indicators regarding hospital performance may be overlooked.

Why are hospital report cards published?

Hospital report cards are published to provide outcomes data that can both improve the quality of care in hospitals and inform patients' healthcare decision-making. Armed with more information based on a set of repeatable measurements about the relative performance of caregivers, both patients and physicians are able to make a more informed choice about which facility or provider to select for a given condition. This allows for a rational discussion of relative levels of quality and eliminates measurement based on anecdotal information, which can be misleading and ultimately harmful.

Where are hospital report cards published?

United States of America

The United States was one of the first nations to begin measuring, comparing, and publishing measurements of hospital performance. Hospital report card initiatives were first undertaken by the federal government, with state governments following its lead. Private-sector information providers offering several competing reports on the quality of health care providers have refined the reporting of information. In 1987, the first US hospital report cards were published by the Health Care Financing Administration (HCFA), the federal agency that administers Medicare and Medicaid. These reports gave detailed annual mortality rates that were measured from the records of hospitalized Medicare patients. However, because of extensive criticism of the accuracy, usefulness, and interpretability of the HCFA's mortality data, this initiative was withdrawn in 1993 (Berwick and Wald, 1990).

In the late 1980s, the state of New York began the Cardiac Surgery Reporting System (CSRS), which collected data from patients' medical histories and recorded whether they died in hospital following surgery. From these data, New York was able to report detailed physician-specific statistics. While the information contained in the CSRS was not originally intended to provide the public with information about the performance of their provider, the news media understood the public's desire for such data and saw the benefit in publishing the information. In December of 1990, the *New York Times* used this information to publish a list of local hospitals,

which ranked facilities according to their mortality rates for Coronary Artery Bypass Surgery (CABG). Invoking the *Freedom of Information Act*, the *New York Newsday* sued the New York State Department of Health to obtain access to its database on bypass surgery and on cardiac surgeons. The goal was to publish physician-specific death rates for patients. The Supreme Court of New York ruled that it was in the public's best interests to have access to these mortality data in order to make informed decisions about their health care (Zinman, 1991). As a result, *Newsday* was able to publish the information on physicians' performance for citizens to assess where the best care was available. Driven by this development, the New York State Department of Health began publishing annual editions of the *Coronary Artery Bypass Surgery Report* in 1996 (New York State, Department of Health, 2005).

Following the precedent set by this pioneering case, a wide variety of hospital performance reports began to be produced in the 1990s by a disparate group that includes the news media, coalitions of large employers, consumer advocacy organizations, and state governments (Marshall et al., 2003). More recently, the US Centers for Medicare and Medicaid Services released mortality-rate estimates for heart attack, heart failure, and pneumonia for every US hospital over two years alongside other measures of hospital performance (Sternberg and DeBarros, 2008). Development of reports in the United States has taken many different paths so there is currently no "standardized" hospital report card or agreement on the indicators to measure. Furthermore, reports range widely in terms of both quality and comprehensiveness. Indeed, as Marshall and colleagues cheekily note: "Public reporting in the United States is now much like healthcare delivery in that country: It is diverse, is primarily market-based, and lacks an overarching organizational structure or strategic plan. Public reporting systems vary in what they measure, how they measure it and how (and to whom) it is reported" (2003: 136). Of course, for patients who are the beneficiaries of such competition between information providers, each of whom strives to deliver a product in some way superior to his competitors, this is no bad thing.

Examples of American Private and Public Information Providers

- Hospital Compare <http://hospitalcompare.hhs.gov>
- America's Best Hospitals—*USNEWS & World Report* <http://www.usnews.com>
- Healthgrades <http://www.healthgrades.com>
- The Leapfrog Group <http://www.leapfroggroup.org>
- National Committee for Quality Assurance (NCQA) <http://www.ncqa.org>
- National Quality Forum <http://www.qualityforum.org>

- Quality Check <http://www.jointcommission.org/PerformanceMeasurement/PerformanceMeasurement/>
- *Cardiac Surgery in New Jersey* <http://www.state.nj.us/health/reportcards.htm>
- *Cardiac Surgery Reports* <http://www.health.state.ny.us/nysdoh/healthinfo/index.htm>
- *Pennsylvania Hospital Performance Reports* <http://www.phc4.org>
- *Indicators of Inpatient Care in New York Hospitals* <http://www.myhealthfinder.com/newyork>
- *Indicators of Inpatient Care in Texas Hospitals* <http://www.dshs.state.tx.us/thcic/>
- *Maryland Hospital Performance Evaluation Guide* <http://mhcc.maryland.gov/consumerinfo/hospitalguide/index.htm>
- *California HealthCare Foundation* <http://www.calhospitalcompare.org/>.

United Kingdom

The hospital reporting universe in the United Kingdom is a fraction of the US market's size. League tables[2] of death rates for English hospitals were available from 1992 to 1996 (Leyland and Boddy, 1998) and mortality statistics for English hospitals were published by the national government in 1998. Although publicly released, these were intended for managerial use and had little discernible impact (Street, 2002). The first initiative designed for public consumption was the Patient's Charter (National Health Service, 1991), which focused on waiting times as opposed to clinical quality.

In 1998, the National Health Service (NHS, Britain's tax-funded, universal program of medical insurance) adopted a new Performance Assessment Framework (PAF) to report clinical outcomes at the hospital level (London Department of Health, 1998). It focused on health gain, fair access, effective delivery of services, efficient delivery of services, health outcomes, and patient/career experience. This initiative received prominence in 2001 as the NHS became the first government plan in the developed world to deal explicitly with report cards. Beginning in September 2001, the UK Department of Health began to publish a new rating system for all NHS non-specialist hospitals in England. The performance of hospitals included in this survey was classified into one of four categories, ranging from zero to three stars based on the hospital's performance on a range of indicators and the outcome of their clinical governance review by the Commission for Health Improvement (CHI). As an additional incentive for improvement, beyond that assumed to come with public reporting of performance, the Department of Health mandated that hospitals scoring at the high end of the scale would receive greater

2 A league table ranks the performance of a range of institutions.

funding and autonomy, while those at the bottom of the scale would be subject to greater government oversight and intervention. For example, those receiving zero stars were subject to investigations and underwent changes in management where necessary.

Although the lion's share of reporting in Britain has been by and at the direction of government, an independent initiative entered the arena in the latter half of 2000 when Tim Kelsey and Jake Arnold-Forster, a pair of Sunday Times journalists, founded Dr. Foster to generate authoritative independent information about local health services on the web at <http://www.drfosterintelligence.co.uk/>. The partnership is in the form of a 50/50 joint venture involving the new Health and Social Care Information Centre (a special health authority of the NHS) and Dr. Foster, a commercial provider of healthcare information. Numerous publications have emerged from this initiative including the Good Birth Guide and the annual Good Hospital Guide, which was first published in 2001 and continues to be published annually. These guides contain information about hospital-specific mortality rates; the total number of staff; wait times; numbers of complaints; as well as, uniquely, private hospitals' prices for services.

Canada

In Canada, as in the United States and the United Kingdom, hospital reporting initiatives have emerged only recently. In 1998, the Ontario Hospital Association produced a report card comparing the hospitals covered by its organization. Undertaken by a research group at the University of Toronto, the publication focused upon inpatient acute care and reported results at both peer group and regional levels of aggregation, but not for individual facilities. *Hospital Report '99*, published the following year, saw the first reporting of hospital-specific acute-care hospital performance indicators in Canada. In 2000, the Government of Ontario joined as a partner in the enterprise and the scope of the report was expanded to include such areas as complex continuing care, mental health, rehabilitation, and emergency department care. In addition, specific reports dealing with women's health, the health of the population as a whole, and nursing care were also produced. These publications have since appeared annually. The *Hospital Report Series* (see, e.g., Ontario Hospital Association and the Government of Ontario: 2006, 2007) appears in a "balanced scorecard" format and assesses the performance of hospitals in four quadrants including (as noted above): [a] financial performance and conditions; [b] patient/client satisfaction; [c] clinical utilization and outcomes; and [d] system integration and change. More recently, in April 2009, the Ontario Hospital Association launched an interactive web site <http://www.myhospitalcare.ca> designed to make performance information about Ontario's hospitals more accessible and useful to the public (OHA, 2009).

Other notable reporting initiatives in Canada include CIHI's *Hospital Standardized Mortality Ratio* (HSMR) (discussed below), *Healthcare Performance Measurement in Canada: Who's Doing What?* (Baker et al., 1998), *Quality of Cardiac Care in Ontario* (CCORT, 2004) and *The State of Hospital Care in the GTA/905* (GTA/905 Healthcare Alliance, 2005). Additionally, two publications that have reported on patient safety and adverse events are the *Ottawa Hospital Patient Safety Study* (Forster et al., 2004) and *The Canadian Adverse Events Study* (Baker et al., 2004), though neither reported institution-specific measures. Similarly, the Manitoba Center for Health Policy released an in-hospital patient safety report using the AHRQ Patient Safety Indicators (Bruce et al., 2006). Additionally, for the last 17 years, the Fraser Institute has published *Waiting Your Turn: Hospital Waiting lists in Canada*, a report that provides Canada's only national, comparable, and comprehensive measurement of waiting times for medically necessary treatment (Esmail and Hazel with Walker, 2008). Another Fraser Institute initiative is *How Good is Canadian Health Care? An International Comparison of Health Care Systems* (Esmail and Walker, 2008), which compares Canada's health policies and health care performance with other nations that guarantee their citizens access to healthcare insurance.

Other avenues for reporting and monitoring hospital performance in Canada have largely been in the form of private assessments of hospital performance by a contracted third party using a proprietary methodology. A prime example of this is the work done by the Hay Group in rating the performance of participating Ontario hospitals for a fixed fee per facility (Hay Group, 2005).

Hospital Standardized Mortality Ratio (HSMR)

The Canadian Institute for Health Information (CIHI) has published its own measure of hospital and regional performances, the *Hospital Standardized Mortality Ratio* (HSMR), since 2007. While both the CIHI's measure and the *Hospital Report Card: Alberta 2009* use data from CIHI's Discharge Abstract Database, there are several significant differences between the measure published by CIHI and those published by the Fraser Institute. These differences make comparisons between the two reports difficult and lead to the conclusion that CIHI and the *Hospital Report Card: Alberta 2009* are measuring hospital performance in two very different ways.

The most significant difference between the measures published by the Fraser Institute and those published by CIHI is the level of detail available. According to the CIHI's report, the *Hospital Standardized Mortality Ratio* (HSMR) is a "big dot summary" measure (CIHI, 2007: 4), or a measure that "tracks progress on broad outcomes at a system level" (2007: vii). More specifically, the HSMR is a composite measure of mortality in diagnosis groups that comprise 80% of all deaths in acute-care facilities (see table 3).

Table 3: Diagnosis groups used in the CIHI's *Hospital Standardized Mortality Ratio* (HSMR)

- Acute pancreatitis
- Acute renal failure
- Adult respiratory distress syndrome
- Alcoholic liver disease
- Alzheimer's disease
- Acute myocardial infarction
- Angina pectoris
- Aortic aneurism and dissection
- Atrial fibrillation and flutter
- Cardiac arrest
- Cerebral infarction
- Chronic ischemic heart disease
- Other chronic obstructive pulmonary disease
- Chronic renal failure
- Complications of procedures, not elsewhere classified
- Convalescence
- Diabetes mellitus type 2
- Diffuse non-Hodgkin's lymphoma
- Diverticular disease of intestine
- Fibrosis and cirrhosis of liver
- Heart failure
- Hepatic failure
- Fracture of femur
- Intracerebral hemorrhage
- Intracranial injury
- Lymphoid leukemia
- Malignant neoplasm of bladder
- Malignant neoplasm of brain
- Malignant neoplasm of breast
- Malignant neoplasm of bronchus and lung
- Malignant neoplasm of colon
- Malignant neoplasm of liver & intrahepatic bile ducts
- Malignant neoplasm of pancreas
- Malignant neoplasm of prostate
- Malignant neoplasm of stomach
- Malignant neoplasm without specification of site
- Multiple myeloma and malignant plasma cell neoplasms
- Myeloid leukemia
- Other and unspecified types of non-Hodgkin's lymphoma
- Other bacterial intestinal infections
- Other diseases of digestive system
- Other diseases of intestine
- Other disorders of brain
- Other disorders of fluid, electrolyte and acid-base balance
- Other disorders of urinary system
- Other interstitial pulmonary diseases
- Other non-traumatic intracranial hemorrhage
- Paralytic ileus and intestinal obstruction without hernia
- Peritonitis
- Pleural effusion, not elsewhere classified
- Pneumonia, organism unspecified
- Pneumonitis due to solids and liquids
- Post-procedural respiratory disorders, not elsewhere classified
- Pulmonary embolism
- Respiratory failure, not elsewhere classified
- Secondary malignant neoplasm of other sites
- Secondary malignant neoplasm of respiratory & digestive organs
- Other septicemia
- Shock, not elsewhere classified
- Stroke, not specified as hemorrhage or infarction
- Subarachnoid hemorrhage
- Unspecified dementia
- Unspecified renal failure
- Vascular disorders of intestine
- Volume depletion

Source: CIHI, 2008.

By comparison, the measures published in the *Hospital Report Card: Alberta 2009* allow for the examination of hospital performance in specific and detailed areas, thus providing patients with a greater level of information about their particular interest or diagnosis and allowing providers greater insight into the areas of care that may be of particular concern in their facilities. In all, 39 specific and well-defined indicators of quality of care are examined in the Fraser Institute's report. The composite measure published in the *Hospital Report Card: Alberta 2009*, the Hospital Mortality Index (HMI), is also a more specific measure of mortality in acute-care hospitals than the CIHI's composite measure and includes only the nine measures shown in table 4.

Table 4: Inpatient Quality and Patient Safety Indicators used in the Hospital Mortality Index

- Hip replacement mortality (IQI 14)
- Acute myocardial infarction mortality (IQI 15)
- Congestive heart failure mortality (IQI 16)
- Acute stroke mortality (IQI 17)
- Gastrointestinal hemorrhage mortality (IQI 18)
- Hip fracture mortality (IQI 19)
- Pneumonia mortality (IQI 20)
- Death in low mortality Diagnosis Related Groups (PSI 2)
- Failure to rescue rates (PSI 4)

Further, the *Hospital Standardized Mortality Ratio* (HSMR) is a relative measure, giving a measure of a hospital's or region's performance relative to Canada's performance as a whole in 2004/05. The indicator measures the ratio of the actual number of deaths for a hospital or region given its case mix (age, sex, length of stay, diagnosis group, etc. of its patients) to the number of deaths that would be expected according to national estimates in 2004.[3] Conversely, the 39 indicators published in the *Hospital Report Card* give absolute measures of indicators of patient safety or inpatient quality of care.

These significant differences in the approaches used by CIHI and the *Hospital Report Card: Alberta 2009* lead to the conclusion that the two measurements cannot be compared with one another directly. Further, the relative rankings of hospitals are not necessarily comparable because of

3 The number of deaths is computed for the 65 diagnosis groups listed above, accounting for 80% of inpatient mortality.

differences in what is being measured in the HSMR and the various indicators of the *Hospital Report Card: Alberta 2009* or the HMI composite measure. In addition to these significant differences in approach is a difference in risk-adjustment methodologies: the indicators in the *Hospital Report Card: Alberta 2009* are risk-adjusted using the publicly available 3M™/AHRQ methodology/software and are not risk-adjusted in the manner developed and employed by CIHI for the HSMR.

However, while the two sets of measures cannot be directly compared, it is nevertheless true that the HSMR provides a measure of hospital mortality that can be used in conjunction with the HMI and the other measures produced in the *Hospital Report Card: Alberta 2009*.[4] Both sets of measures are based on an internationally validated and commonly applied methodology, and both sets of measures can provide patients and providers with insight into where mortality rates may be unacceptably high or exceptionally low.[5] In this sense, the authors of this report welcome the CIHI's measure and hope that greater reporting of, and attention to, provider performances on mortality leads to improved outcomes from care for Canadians.

What are the measurable impacts of patient safety and hospital report cards?

In the United States, hospital report cards have had a number of measurable impacts on performance and the quality of patient care. The first and most notable example came from the *New York State Cardiac Surgery Report*. Hannen et al. (1994) reported an associated 41% decline in the risk-adjusted mortality rate of Coronary Artery Bypass Graft patients with the publication of these outcomes statistics and data. A similar overall trend was experienced in Pennsylvania and New Jersey following the publication of their report cards.[6]

4 Note that the regional results published by CIHI are based on where patients were treated, while municipal measures published in the *Hospital Report Card: Alberta 2009* are based on where patients lived.

5 It is worth noting that CIHI began working with the HSMR measure for Canada in 2005 while the Fraser Institute's research program on the *Hospital Report Card* began in 2004. Further, the Fraser Institute's *Hospital Report Card: Ontario 2006* was the first publicly available report in Canada that allowed the comparison of mortality rates in Canadian hospitals based on a standardized measure.

6 For Pennsylvania data, see PHC4, Pennsylvania Health Care Cost Containment Council, 1998. For New Jersey data, see New Jersey, Department of Health and Senior Services, 2001. For the northern New England initiative, see O'Connor et al., 1996.

These findings have also created controversy about the Cardiac Surgery Reporting System, the database used to create the *New York State Surgery Report*. Critics have raised pertinent questions regarding "up-coding"[7] and the possibility that hospitals have decided not to operate on some complex and critically ill patients and have referred such complex cases to out-of-state jurisdictions (McKee and Healy, 2000). In contrast, using data from the *Cardiac Surgery Reporting System Report* (CSRS) for the period from 1991 to 1999, researchers at the National Bureau of Economic Research found that the reporting program had an impact on the volume of cases and the future quality at hospitals identified as poor performers. Those identified as weaker hospitals lost some relatively healthy patients to competing facilities with better records. Subsequently, these "weaker" hospitals experienced a decline of 10% in the number of patients during the first 12 months after an initial report and this decrease remained in place for three years. Consequently, patients choosing these hospitals demonstrated a decrease in their risk-adjusted mortality rate by approximately 1.2 percentage points (Cutler et al., 2004).

Though subject to a number of caveats regarding their design and structure, report cards have had a beneficial impact on the quality of health care delivery in those regions where they are published.

The Fraser Institute's *Hospital Report Cards*

The primary focus of this project is the construction of a patient-friendly report card on hospital and patient care that is focused on clinical outcomes. This report includes information about all acute-care facilities treating patients in Alberta. The report is built on a recognized methodology for constructing hospital report cards from the Agency for Healthcare Research & Quality (AHRQ), an agency of the US federal government's Department of Health and Human Services.

1 What are the AHRQ Inpatient Quality and Patient Safety Indicators?

The first stage of the research in producing this report was to acquire or create a methodology that was reliable, easily understood by the public and participants, and that produced an accurate measurement of provider performance. An initial period of examining performance-indicator frameworks from earlier literature on hospital report cards provided a number of different

7 "Up-coding" is a term used to describe when financial incentives cause a physician or hospital to exaggerate or falsely represent patients' medical conditions and services provided in order to increase payment received from the government.

examples of accepted and proven methodologies that were not otherwise proprietary information and thus could be employed by the Fraser Institute[8] The search also turned up methodologies that, though available, would be less effective in providing a patient-friendly hospital report card focused on clinical outcomes.

Further examination of the methodologies available led to the selection of the performance-indicator framework developed by the Agency for Healthcare Research & Quality (AHRQ). AHRQ's indicator modules were chosen because they represent a comprehensive set of indictors that are widely used, highly regarded, and applicable to any hospital inpatient administrative data. They are readily available and relatively inexpensive to use. Importantly, they comprise an ideal set of indicators to allow a patient-friendly, clinical outcomes-focused, hospital-specific patient care report card.

The AHRQ indicators date from the mid-1990s when AHRQ developed a set of quality measures, or indicators, that required only the information found in routine hospital administrative data: diagnoses and procedures codes, patient age, sex, other basic demographic and personal information, source of admission, and discharge status. These indicators, 33 in all, made up the Healthcare Cost and Utilization Project (HCUP) Quality Indicators, designed to be used by hospitals to assess their inpatient quality of care as well as by the State and community to assess access to primary care.[9] Although they could not be used to provide definitive measures of the quality of health care directly, they are used to provide indicators of healthcare quality. They serve as the basis for subsequent in-depth investigation of issues of quality and patient safety at the facility level.

In the years following the release of the HCUP, both the knowledge base about quality indicators increased and newer risk-adjustment methods developed. Following input from then-current users, as well as advances in the specific indicators themselves, AHRQ underwrote a project to develop and refine the original Quality Indicators. This project was undertaken by the University of California San Francisco-Stanford Evidence-based Practice Centre. The results of this research were the AHRQ Quality Indicators, which are currently used to measure hospital performance in more than 12 US States including New York, Texas, Colorado, California, Florida, Kentucky, Maryland, Minnesota, New Jersey, Oregon, Utah, Vermont and parts of Wisconsin.

8 For an example of how some report-card methodologies are proprietary, please refer to the Healthgrades user agreement at <http://www.healthgrades.com/aboutus/index.cfm?fuseaction=modnw&modtype=content&modact=UserAgreement>.

9 Further information about HCUP Quality Indicators can be found at <http://www.qualityindicators.ahrq.gov/hcup_archive.htm>.

AHRQ indicators are organized in four modules[10]

1 *Prevention Quality Indicators (PQIs)* Consisting of ambulatory care-sensitive conditions, these indicators pertain to hospital admissions that could have been prevented via high-quality outpatient care.[11]

2 *Inpatient Quality Indicators (IQIs)* These indicators reflect the quality of care inside hospitals and include such items as inpatient mortality; misuse, overuse, or underuse of procedures; and volume of procedures for which evidence shows that a higher volume of procedures is associated with a lower rate of mortality.

3 *Patient Safety Indicators (PSIs)* These indicators focus upon preventable instances of harm to patients such as complications arising from surgery and other iatrogenic events.[12]

4 *Pediatric Quality Indicators (PDIs)* These indicators examine the quality of pediatric inpatient care, as well as the quality of outpatient care that can be inferred from inpatient data, such as potentially preventable hospitalizations.[13]

The Fraser Institute's *Hospital Report Card* uses the IQI and PSI indicators; it is made up of 39 of the 59 indicators available in these categories.[14] These two modules were chosen because they are well respected and have seen widespread use.

The AHRQ indicator modules are designed to be used with data from administrative databases in the United States, which themselves are primarily used by hospitals for billing purposes. This type of record, referred to as "administrative data" consists of diagnoses and procedures codes along with information about a patient's age, sex, and discharge status. The Canadian

10 The Fraser Institute's *Hospital Report Card: Alberta 2009* is composed of 39 indicators from the inpatient quality and patient safety modules of the AHRQ system (see Appendix E for a list of all indicators used in this report).

11 PQIs identify the quality of care for ambulatory care-sensitive conditions and are measures of the overall health care system. Since the *Hospital Report Card* was designed to analyze the care inside acute-care hospitals, PQIs were omitted from this report.

12 An iatrogenic event is one that is inadvertently caused by a physician, a medical/surgical treatment, or a diagnostic procedure.

13 The PDI module became available in February 2006 and is not used in the *Hospital Report Card*. For details on the PDI module, see <http://www.qualityindicators.ahrq.gov/pdi_download.htm>.

14 The 11 area indicators were not used. Out of the 48 provider indicators, nine could not be calculated using Canadian data (see Appendix G for details).

counterpart is the Canadian Institute for Health Information's Discharge Abstract Database (DAD), which contains demographic, personal, administrative, and clinical data for hospital discharges (inpatient acute, chronic, rehabilitation) and day surgeries.

The indicators in the Fraser Institute's *Hospital Report Card: Alberta 2009* analyze more than 1.7 million patient records extracted from the DAD for the years 2002/03 to 2006/07. The data are risk-adjusted using the 3M™ All Patient Refined™ DRG (APR™-DRG) software, commonly recognized to be the gold-standard system for risk-adjusting hospital data.[15] The AHRQ QIs were designed to be used in conjunction with 3M™ All Patient Refined™ Diagnosis Related Groups (APR™-DRG) software, which risk adjusts the QIs for patients' clinical conditions and severity of illness or risk of mortality. Indeed, the version of the APR™-DRG software built into the AHRQ software was used for this report.

Since this report is based on administrative data, the results have limitations. Coding varies from hospital to hospital and codes do not always provide specific details about a patient's condition at the time of admission or capture all that occurs during hospitalization. For these reasons, individual judgment often is required while reviewing the results from this report.

When reviewing mortality or other indicators of quality and patient safety, remember that medicine is not an exact science and death or complications will occur even when all standards of care are followed. Deciding on treatment options and choosing a hospital are decisions that should be made in consultation with a physician. It is not recommended that anyone choose a hospital based solely on statistics and descriptions such as those given in this report.

2 Data Quality

CIHI's Discharge Abstract Database (DAD) contains information on hospital stays in Canada. Various CIHI publications note that the DAD is used extensively by a variety of stakeholder groups to monitor the use of acute-care health services, conduct analyses of health conditions and injuries, and increasingly to track patient outcomes. The DAD is a major data source used to produce various CIHI reports, including annual reports on the performance of hospitals and the health care system and for seven of the health indicators adopted by the federal, provincial, and territorial governments (CIHI, 2002). These data have been used extensively in previous reports on health care performance and form the basis for many journal articles (see, e.g., Ontario Hospital Association and the Government of Ontario, 2007; Aubrey-Bassler et al., 2007).

15 For further details, please refer to Appendix B and <http://www.3m.com/us/healthcare/his/products/coding/refined_drg.jhtml>.

As the *Hospital Report 2006: Acute Care* notes, using the same DAD data set underlying this report card, "the data are collected under consistent guidelines, by trained abstractors, in all acute care hospitals in Ontario. The data undergo extensive edit checks to improve accuracy, but all errors cannot be eliminated" (Ontario Hospital Association and the Government of Ontario, 2006: 6). However, in order to produce good information about data quality, CIHI established a comprehensive and systematic data-quality program, whose framework involves 24 characteristics relating to the five data-quality dimensions of accuracy, timeliness, relevance, comparability, and usability (CIHI, 2005).

There are a number of publications that have addressed data-quality issues, which are discussed in our report. Of note are CIHI's reabstraction studies (2002, 2004b) that go back to the original patient charts and recode the information using a different set of expert coders.[16] The reabstraction studies note the following rates of agreement between what was initially coded and what was coded on reabstraction:

a non-medical data: 96%–100%

b selection of intervention codes (procedure codes): 90%–95%

c selection of diagnosis codes: 83%–94%

d selection of most responsible diagnosis: 89%–92%

e typing of co-morbidities: pre-admit: 47%–69%; post-admit: 51%–69%

f diagnosis typing (which indicates the relationship of the diagnosis to the patient's stay in hospital) continues to present a problem; discrepancy rates have not diminished with adoption of ICD-10-CA.

The coding issues in points (e) and (f) do not affect our results since the most responsible diagnosis is coded with a high degree of agreement and the AHRQ indicators do not discriminate among diagnosis types. Overall, when the rates of agreement in the third year of this reabstraction study (performed on data coded in ICD-10-CA) were compared to the rates of agreement of the previous years' data (coded in ICD-9-CCP), the rates were as good as, or better than, previous rates.

However, with regard to the coding of pneumonia, a potential issue with data quality exists because some coders selected pneumonia instead of chronic

16 Reabstractors participating in the study were required to have several years of coding experience, experience coding in ICD-10-CA and CCI in particular, experience coding at a tertiary care centre, and attendance at specific CIHI educational workshops. They were also required to attend a one-week training session and to receive a passing score on the inter-rater test.

obstructive pulmonary disease (COPD) as the most responsible diagnosis (CIHI, 2004b). This could potentially create false positive results for Pneumonia mortality rate (IQI 20) since this indicator counts deaths due to pneumonia in situations where the primary diagnosis is a pneumonia diagnosis code.

With respect to specific conditions related to the health indicators examined, those that are procedure-driven (i.e. Cesarean section, coronary artery bypass graft, and total knee replacement) were coded well with low discrepancy rates. The following had less than a 5% rate of discrepancy: Cesarean section, coronary artery bypass graft, hysterectomy, total knee replacement, vaginal birth after Cesarean, and total hip replacement. The following had greater than a 5% discrepancy: AMI (8.9%), hip fracture (6.0%), hospitalization due to pneumonia and influenza (6.9%), and injury hospitalization (5.3%) (CIHI, 2002).

Discrepancy rates were noted in conditions that are diagnosis driven: acute myocardial infarction (AMI) (CIHI, 2002: 8), stroke, pneumonia, and COPD (CIHI, 2004b) (as described above). Only the pneumonia codes are potentially affected in our report.

Overall, according to CIHI, findings from their three-year DAD reabstraction studies "have confirmed the strengths of the database, while identifying limitations in certain areas resulting from inconsistencies in the coding of some data elements" (CIHI, 2004b: 41). In addition, the findings from the inter-rater data (that is, comparison between reabstractors) were generally similar to the findings from the main study data (that is, comparison between original coder and reabstractor). This suggests that the database is coded as well as can be expected using existing approaches in the hospital system.

In addition to the aforementioned reabstraction studies, the OECD published a report in support of the AHRQ patient-safety indicator modules noting that "this set of measures represents an exciting development and their use should be tested in a variety of countries" (Millar, Mattke, et al., 2004: 12). Further, a report published by the Manitoba Center for Health Policy that used the AHRQ Patient Safety Indicators (Bruce et al., 2006) noted two important advantages to using the AHRQ module: The first advantage is the breadth of coverage offered by the indicators in studying in-hospital patient safety. The second is that the AHRQ patient-safety indicators were developed to measure complications of hospital-based care among a group of patients for whom the complications seemed preventable or highly unlikely.

3 Participation and identification of hospitals

Participation in the report-card project was not mandatory for hospitals in Alberta. In the end, Alberta Health Services did not agree to have institutions identified. All of Alberta's hospitals are identified in the report using a randomly assigned hospital number.

Overview of methodology used

All hospital data used in the Fraser Institute's *Hospital Report Card: Alberta 2009* are from the Discharge Abstract Database (DAD) that was purchased from the Canadian Institute for Health Information (CIHI). The DAD is an administrative database containing demographic, administrative, and clinical data for hospital discharges (inpatient acute, chronic, rehabilitation) and day surgeries. Only inpatient acute records were used in this report (see Appendix A for details on which DAD data fields were used).

CIHI is unable to release the identity of specific institutions whose data is included in the DAD unless those institutions have explicitly granted permission to the researchers requesting the data. Alberta Health Services did not grant the Fraser Institute authorization to identify institution-specific discharge data in the DAD for the years from 2002/03 to 2006/07. All hospitals in this report are identified using randomly assigned hospital numbers.

The inpatient acute records were grouped into diagnosis-related groups (DRGs) using the Centers for Medicare and Medicaid Services (CMS) Grouper with Medicare Code Editor software. The program sorts patients' records into groups of patients who are expected to make similar use of a hospital's resources. The groupings are based on information extracted from diagnosis and procedure codes as well as the patients' age, sex, and the presence of complications or co-morbidities (see Appendix B for details).[1]

Since more specialized hospitals may treat more high-risk patients and some patients arrive at hospitals sicker than others, it is difficult to compare hospital mortality and utilization rates for patients with the same condition but a different health status. In order to compensate for this possible difference in the mix of hospital cases, the international standard for risk adjustment, developed by 3M Corporation, was employed to risk-adjust the data. This was done to ensure that a hospital's final score reflected the

1 In order to use the Centers for Medicare and Medicaid Services (CMS) Grouper with Medicare Code Editor as well as the Agency for Healthcare Research and Quality (AHRQ) Inpatient Quality Indicators (IQI) and Patient Safety Indicators (PSI) modules, the diagnosis and procedure codes had to be translated from ICD-10-CA/CCI (ICD-10-CA is an enhanced version of ICD-10 developed by CIHI for morbidity classification in Canada; the companion classification to ICD-10-CA for coding procedures in Canada is CCI) to ICD-9-CM. See Appendix J for details.

performance grading that the hospital would have received if it had provided services to patients with the average mix of medical complications.[2]

The final step in our methodology was to produce separate indicators for hospital performance based on the methodology developed by the Agency for Healthcare Research and Quality's (AHRQ) Evidence-Based Practice Center (EPC) at the University of California San Francisco-Stanford.[3] AHRQ's indicator modules use readily available discharge data and were chosen because they have been demonstrated to be a concise and effective tool by which to inform patients' decision-making about their health care. They are currently used to measure hospital performance in more than 12 US states including New York, Texas, Colorado, California, Florida, Kentucky, Maryland, Massachusetts, Minnesota, New Jersey, Oregon, Utah, Vermont and parts of Wisconsin.

Figure 1 shows a graphical representation of the methodology. The Fraser Institute's *Hospital Report Card: Alberta 2009* comprises 39 indicators of the quality of inpatient care and patient safety (for a list of all indicators used in the report, see Appendix E). Inpatient Quality Indicators (IQIs) reflect the quality of care inside hospitals and include mortality rates, the utilization of procedures (where there are questions of misuse, overuse, or underuse), and volume of procedures (for which evidence shows that a higher volume of procedures is associated with a lower rate of mortality). Patient Safety Indicators (PSIs) focus on preventable complications acquired while in hospital, as well as adverse events following surgeries, procedures, and childbirth.

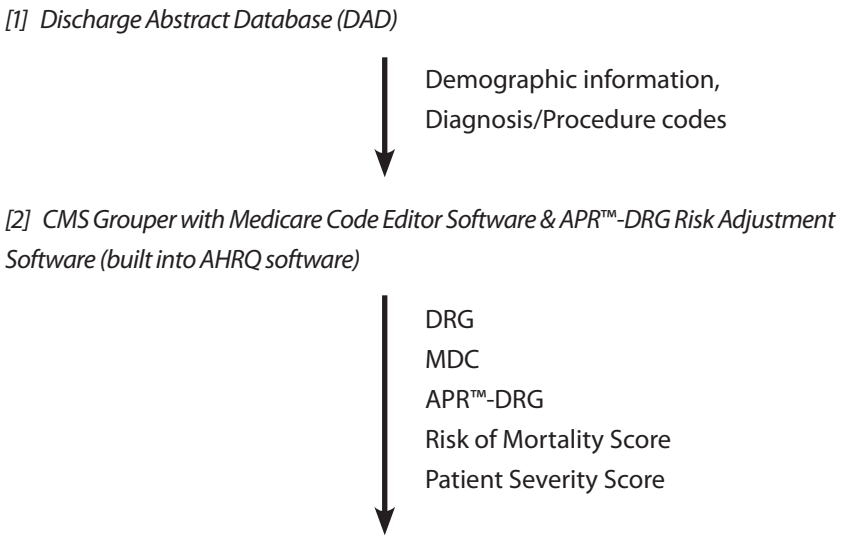
The indicators are expressed as observed rates (which are raw measures) and risk-adjusted rates (incorporating patient severity and risk of mortality scores from the 3M™ software described above). IQI rates are expressed as rates per 100 patients while PSI rates are expressed per 1,000. Each institution was also given a score from 0 to 100 for each indicator based either on its risk-adjusted rate, where available, or on its observed rate and was then ranked based on their scores (see Appendix F for details on calculating scores and ranks).[4]

2 For information about 3M's standard for risk adjustment, see <http://www.3m.com/us/healthcare/his/products/coding/refined_drg.jhtml>. See Appendix B for details of its use in this report.

3 The AHRQ Quality Indicators were developed in response to the need for both multidimensional and accessible quality indicators. They include a family of measures that patients, providers, policy makers, and researchers can use with easily accessible inpatient data to identify apparent variations in the quality of inpatient care. For more information, see <http://www.qualityindicators.ahrq.gov/>.

4 Ranks are not used for comparisons of hospitals across indicators as they are based on a varying number of hospitals. It is advisable to rely on the scores (as in the HMI) to examine the performance of a hospital across indicators; and on the observed or risk-adjusted rates to examine the performance of hospitals on a given indicator. The HMI also has a fairly large number of hospitals so any bias is insignificant.

Figure 1: Overview of methodology used to construct the Fraser Institute's *Hospital Report Cards*



A Hospital Mortality Index (HMI) was constructed to examine the performance of a hospital or municipality across mortality indicators. It consists of nine mortality indicators: *hip replacement mortality* (IQI 14), *acute myocardial infarction mortality* (IQI 15), *congestive heart failure mortality* (IQI 16), *acute stroke mortality* (IQI 17), *gastrointestinal hemorrhage mortality* (IQI 18), *hip fracture mortality* (IQI 19), *pneumonia mortality* (IQI 20), *death in low mortality DRGs* (PSI 2) and *failure to rescue rates* (PSI 4). The final HMI index score is based on an equal-weight construct of the scores for the separate indicators. For an indicator to be included in the HMI, hospitals representing at least 75% of the patient sample for that year had to have measured data in order to ensure an adequate number of hospitals for comparison. For example, in 2006/07 an indicator had to contain at least 263,162 records in order to be included in the HMI.[5] All institutions were ranked based on their HMI score, where the highest rank (1) corresponds to the highest score out of 100 (for details on calculating scores, ranks, the HMI, and rank of the HMI, please see Appendix F).

It is important to note that the 39 indicators and the Hospital Mortality Index are applicable only to acute-care conditions and procedures for inpatient care. The results cannot be generalized to assess the overall performance of any given hospital.

5 The total number of patient records in 2006/07 was 350,883.

Throughout the *Hospital Report Card*, several measures were taken in order to protect patients' confidentiality. First, patient identifiers such as patients' names and addresses were removed before the Fraser Institute had access to the dataset. Also, postal codes were truncated to Forward Sortation Areas (FSAs) and grouped into municipalities in order to assess and compare care received by patients from those jurisdictions (please see Appendix H for details). Furthermore, results were omitted from publication if the patient population in any given indicator was less than, or equal to, five in any institution and/or municipality.

Legend for sample table

Use the sample table (page 31) and the explanations below to help you understand how each indicator is displayed in the data tables of the *Hospital Report Card*.

A The name of the Inpatient Quality Indicator (IQI) or Patient Safety Indicator (PSI) from the Agency for Healthcare Research and Quality (AHRQ). See Appendix E for a complete list of the indicators used in the *Hospital Report Card*.

B All indicators were expressed as:

1. an observed rate (which is a raw measure);
2. a risk-adjusted rate including upper and lower statistical confidence intervals (incorporating patient severity and risk of mortality scores from 3M™ All Patient Refined™ Diagnosis Related Groups [APR™-DRG] Software; see Appendix B for details);
3. a score (see Appendix F for details on calculating scores, ranks, HMI, and rank of the HMI);
4. a rank.

Two additional measures were calculated to examine the performance of a hospital or municipality across mortality indicators: a Hospital Mortality Index (HMI) and a Rank of the Hospital Mortality Index.

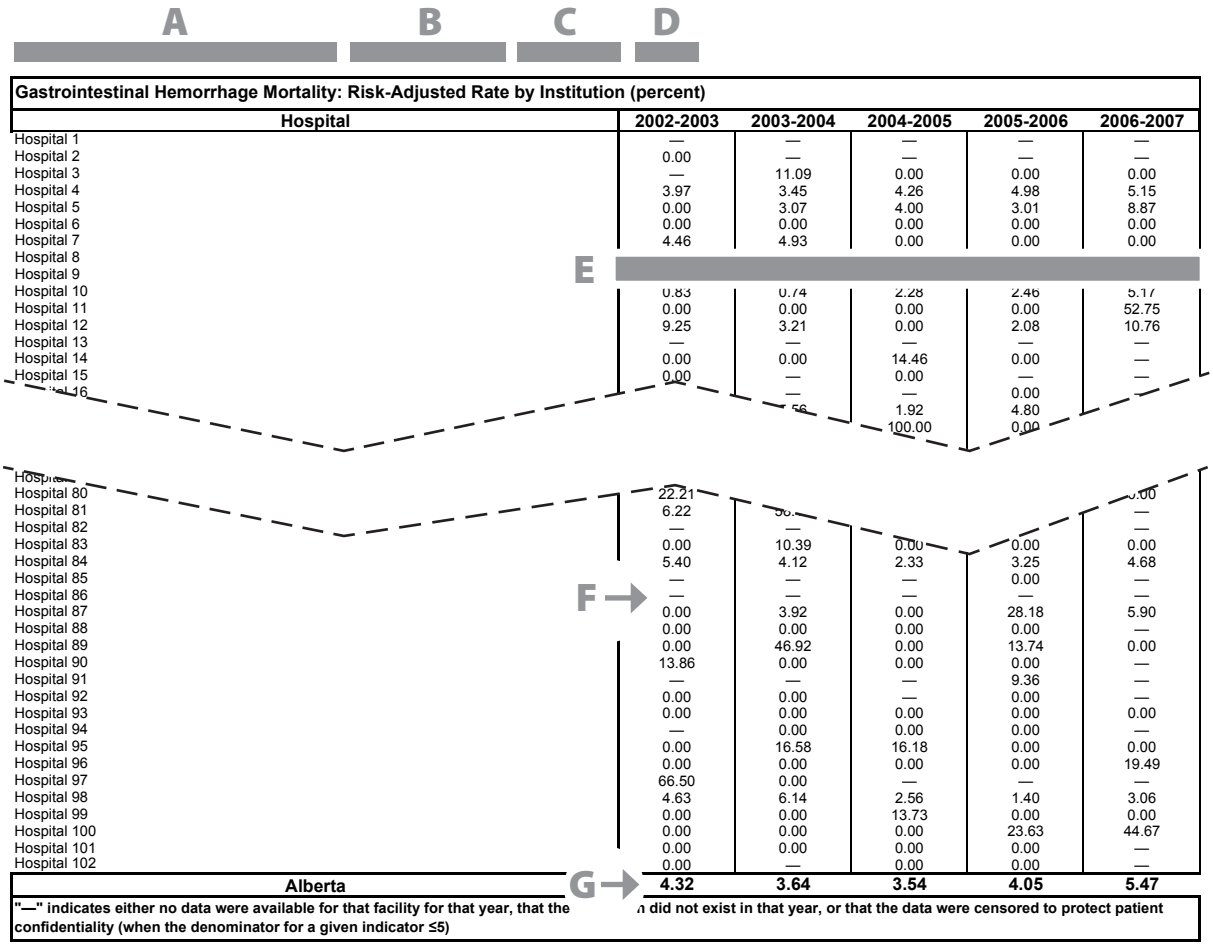
C Indicators are stratified by institution and by municipality. Postal Codes were truncated to Forward Sortation Areas (FSAs) before the Fraser Institute had access to the dataset. All patient FSAs were grouped into corresponding municipalities as described by Canada Post. Please see Appendix H for details.

D All IQIs are expressed as percent. PSIs are expressed per thousand.

E All data used in the *Hospital Report Card* were extracted from the Discharge Abstract Database (DAD), which was purchased from CIHI for the period from Fiscal 2002 (April 1, 2002 to March 31, 2003) to Fiscal 2006 (April 1, 2006 to March 31, 2007).

F "—" indicates that either no data were available for that hospital or municipality for that year, that the institution did not exist in that year, or that the data were censored to protect patient confidentiality (when the denominator for a given indicator is 5 or less).

G The average rate (observed or risk-adjusted) for all the acute-care hospitals in the province.



Gastrointestinal Hemorrhage Mortality: Risk-Adjusted Rate by Institution (percent)

Hospital	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
Hospital 1	—	—	—	—	—
Hospital 2	0.00	—	—	—	—
Hospital 3	—	11.09	0.00	0.00	0.00
Hospital 4	3.97	3.45	4.26	4.98	5.15
Hospital 5	0.00	3.07	4.00	3.01	8.87
Hospital 6	0.00	0.00	0.00	0.00	0.00
Hospital 7	4.46	4.93	0.00	0.00	0.00
Hospital 8					
Hospital 9					
Hospital 10	0.83	0.74	2.28	2.46	5.17
Hospital 11	0.00	0.00	0.00	0.00	52.75
Hospital 12	9.25	3.21	0.00	2.08	10.76
Hospital 13	—	—	—	—	—
Hospital 14	0.00	0.00	14.46	0.00	—
Hospital 15	0.00	—	0.00	—	—
Hospital 16		—	—	0.00	—
		[illegible]	1.92	4.80	
			100.00	0.00	
Hospital [illegible]					
Hospital 80	22.21				0.00
Hospital 81	6.22	[illegible]			—
Hospital 82	—	—			—
Hospital 83	0.00	10.39	0.00	0.00	0.00
Hospital 84	5.40	4.12	2.33	3.25	4.68
Hospital 85	—	—	—	0.00	—
Hospital 86	—	—	—	—	—
Hospital 87	0.00	3.92	0.00	28.18	5.90
Hospital 88	0.00	0.00	0.00	0.00	—
Hospital 89	0.00	46.92	0.00	13.74	0.00
Hospital 90	13.86	0.00	0.00	0.00	—
Hospital 91	—	—	—	9.36	—
Hospital 92	0.00	0.00	—	0.00	—
Hospital 93	0.00	0.00	0.00	0.00	0.00
Hospital 94	—	0.00	0.00	0.00	—
Hospital 95	0.00	16.58	16.18	0.00	0.00
Hospital 96	0.00	0.00	0.00	0.00	19.49
Hospital 97	66.50	0.00	—	—	—
Hospital 98	4.63	6.14	2.56	1.40	3.06
Hospital 99	0.00	0.00	13.73	0.00	0.00
Hospital 100	0.00	0.00	0.00	23.63	44.67
Hospital 101	0.00	0.00	0.00	0.00	—
Hospital 102	0.00	—	0.00	0.00	—
Alberta	**4.32**	**3.64**	**3.54**	**4.05**	**5.47**

"—" indicates either no data were available for that facility for that year, that the [illegible]n did not exist in that year, or that the data were censored to protect patient confidentiality (when the denominator for a given indicator ≤5)

Methodological Appendices

Appendix A
Discharge Abstract Database (DAD)

In the first stage of data processing, records for all hospitals and municipalities were drawn from the DAD data extracts (from CIHI) for use in the Hospital Report Card. The following DAD fields were used in our analysis.

Province Province of the patient.

Institution number Numeric value corresponding to each acute care facility.

Postal Code To protect patient confidentiality, all postal codes were truncated to the first 3 characters (representing the Forward Sortation Area) and grouped into corresponding municipalities as described by Canada Post. Please refer to Appendix H for further details.

Age code A unit value to denote how the patient's age was recorded. Please refer to Appendix I for further details.

Age units Age of patient at the time of admission, which must be evaluated using the age code. Please refer to Appendix I for further details.

Gender Gender of the patient.

Admission date Date the patient was admitted to the facility.

Discharge Date Date the patient was separated from the facility.

Institution from type A code identifying the level of care provided by the facility from which the patient was transferred to the acute care institution, where

1 = acute care
2 = general rehabilitation facility
3 = chronic care facility
4 = nursing home
5 = psychiatric facility
6 = unclassified or other type of facility
7 = special rehabilitation facility
8 = home care
9 = home for the aged

A = day surgery
E = emergency room
O = organized outpatient department of reporting facility
N = ambulatory care facility (added in FY2003).

Admission category Type of admission to the facility, where
E = elective admissions
U = emergent/urgent
N = newborn
S = stillbirth
R = cadaver.

Discharge disposition Disposition of Patient, i.e. whether the patient died while in the facility, where
1 = transferred to another facility providing inpatient hospital care
2 = transferred to a long term care facility
3 = transferred to other (palliative care/hospice, etc.)
4 = discharged to a home setting with support services
5 = discharged home
6 = signed out (against medical advice)
7 = died
8 = cadaver
9 = stillbirth.

Acute transfer indicator A code that identifies the acute transfer status of a patient on discharge from the reporting facility where
0 = no transfer to or from an acute care facility
1 = patient transferred to reporting facility from another acute care facility
2 = patient transferred from reporting facility to another acute care facility
3 = patient transferred to the reporting facility from another acute care facility and then transferred to another acute care facility upon discharge from the reporting facility
Blank = for all day surgery records.

Entry code Method of admission to the facility. This field was used in conjunction with "Age code" to exclude all "Stillbirths" from analysis where
E = emergency department from the reporting hospital
D = direct
N = newborn
S = stillborn (in reporting hospital)
C = clinic from the reporting hospital
P = day surgery from the reporting hospital.

Diagnosis codes International Classification of Disease codes (ICD-10-CA)[1] identifying the condition considered to be the most responsible for the patient's condition treated during hospitalization.

Procedure and/or Intervention codes CCI procedure codes that indicate the procedure performed on the patient during the hospitalization.

Procedure dates Date the procedure was performed on the patient.

Intervention out of hospital indicator = Y Denotes a procedure that was performed in another facility during the patient's hospitalization.[2]

Intervention status attribute = A A code denoting a cancelled procedure.[3]

Acute length of stay The total number of days the patient was in the acute care facility.

Weight in grams Captured for newborns and neonates (age ≤ 28 days) inclusively.

1 For further details on ICD-10-CA, see <http://secure.cihi.ca/cihiweb/dispPage.jsp?cw_page = codingclass_icd10_e>.

2 All procedures denoted as "Intervention out of hospital indicator" = Y were removed from analysis.

3 All procedures denoted as "Intervention status attribute" = A were removed from analysis.

Appendix B

The Centers for Medicare and Medicaid Services (CMS) Diagnosis Related Groups (DRG) grouper

In order to use the CMS and 3M™ APR™-DRG Classification System software, the DAD dataset received from CIHI required several standard modifications to account for differences in the Canadian and US coding methodologies. In other cases, no modifications were required. The table below lists all fields imported from the DAD and specifies what modifications, if any, were required.

Data elements required by the CMS- and 3M™ APR™-DRG classification system software

Variable name	Description	Value description	DAD Data Element or Comment
Key	Unique case identifier	*Numeric*	Each record was given a unique case identifier number
Adate	Date of admission Used for length of stay (LOS) calculation	*Numeric* dd.mm.yyyy	Date of Admission was taken directly from DAD. Format changed from yyyymmdd.
Ddate	Date of discharge Used for LOS calculation	*Numeric* dd.mm.yyyy	Date of Discharge was taken directly from DAD. Format changed from yyyymmdd.
Alos	Calculated LOS overrides entered LOS	*Numeric* (Days)	Acute length of stay information was taken directly from DAD. No changes were made.
Bdate	Date of birth	*Numeric* dd.mm.yyyy	CIHI encrypts all patient identifiers in the DAD prior to cutting the dataset, including "date of birth" information. "Birth date" remained as a "blank" in order to run the software.
Agey	Age in years at admission	*Numeric* Age in years	See Appendix I for details

Variable name	Description	Value description	DAD Data Element or Comment
Sex	Sex of patient	*Numeric* Male = 1 Female = 2	The DAD codes Male = M, Female = F. These values were recoded to Male = 1 & Female = 2. All other values of "Other" and "Undifferentiated" were omitted from analysis.
Pay1	Expected primary payer.	*Numeric* Medicare = 1. Medicaid = 2. Private, incl. HMO = 3. Self-pay = 4. No charge = 5. Other = 6.	Due to differences in the Canadian healthcare system, the DAD does not contain this information. Accordingly, all patient records were set to "6" (Other).
DSTAT	Discharge Status	*Numeric* Discharged to short term hospital = 2 Discharged to other facility = 5 Patient died = 20	Two DAD fields were combined to create the "dstat" field. Patients discharged to a short term hospital were extracted from DAD field "Acute transfer indicator" = "2" (patient transferred from the reporting facility to another acute care facility, please see Appendix A for further details). NB: All patients that died in-hospital were extracted from DAD field "Discharge Disposition" = 7 (patient died). All records not classified as being discharged to a short term hospital or that died in-hospital were classified as "other".
Diagnosis Codes	ICD-9-CM diagnosis codes. DX1 is the principal diagnosis, DX2 to DX25 are secondary diagnoses.	*String*	All Diagnosis codes contained in the DAD were converted to ICD-9-CM. NB: Please refer to Appendix J for further explanation on classification conversions.
Procedure Codes	ICD-9-CM procedure codes. PR1 is the principal diagnosis, PR2 to PR20 are secondary procedures.	*String*	All Procedure codes contained in the DAD were converted to ICD-9-CM. NB: Please refer to Appendix J for further explanation on classification conversions.

Appendix C

Agency for Healthcare Research and Quality's (AHRQ) Inpatient Quality Indicators (IQI) and Patient Safety Indicator (PSI) modules

1. Modifications to DAD dataset received from CIHI

In order to use AHRQ's IQI and PSI modules, the original DAD dataset received from CIHI required several standard modifications to account for differences in the Canadian and US coding methodologies. Other fields required no modifications. The table below lists all relevant fields for AHRQ software (including the 3M™ All Patient Refined™ Diagnosis Related Groups [APR™-DRG Classification System] Software) and what modifications, if any, were performed.

Required AHRQ data element and description

Variable name	Description	Value description	DAD Data Element or Comment
Key	Unique case identifier.	*Numeric*	Each record analyzed was given a unique case identifier number.
Age	Patient's age in years at admission.	*Numeric* Age in years.	See Appendix I for details.
Ageday	Patient's age in days at admission (coded only when the age in years is less than 1).	*Numeric* Age in days.	See Appendix I for details.
Race	Patient's race.	*Numeric* White = 1. Black = 2. Hispanic = 3. Asian/Pacific Island = 4. Native American = 5. Other = 6.	Race information is not captured in the DAD. Accordingly, all patient records were set to "6" (Other). Note: Patient's race is used for risk-adjustment by the 3M APR™-DRG software.

Variable name	Description	Value description	DAD Data Element or Comment
Sex	Patient's sex.	*Numeric* Male = 1. Female = 2.	DAD codes Male = M, Female = F. These values were recoded to Male = 1 & Female = 2. All other values of "Other" and "Undifferentiated were omitted from all analysis.
Pay1	Expected primary payer.	*Numeric* Medicare = 1. Medicaid = 2. Private, incl. HMO = 3. Self-pay = 4. No charge = 5. Other = 6.	Due to differences in the Canadian healthcare system, the DAD does not contain this information. Accordingly, all patient records were set to "6" (Other).
Hospstco	Hospital location (FIPS† State/county code).	*Numeric* Modified Federal Information Processing Standards State/ County code.	To protect patient confidentiality postal codes were truncated to FSAs by CIHI before the dataset was cut. Once received, FSAs were grouped into municipalities as described by Canada Post. Please see Appendix H for details.
Hospid	Data source hospital number.	*Numeric* Hospital identification number.	Institution Number as described by CIHI. No changes were made to this field.
Disp	Patient's disposition.	*Numeric* Routine = 1. Short-term hospital = 2. Skilled nursing facility = 3. Intermediate care = 4. Another type of facility = 5. Home health care = 6. Against medical advice = 7. Died in the hospital = 20.	Two DAD fields were combined to create the "Disp" field. Patients discharged to a short term hospital were extracted from DAD field "Acute transfer indicator" = "2" (patient transferred from the reporting facility to another acute care facility, please see Appendix A for further details). NB: All patients that died in-hospital were extracted from DAD field "Discharge Disposition" = 7 (patient died). All records not classified as being discharged to a short term hospital or that died in-hospital were classified as "other".
Atype	Admission Type.	*Numeric* Emergency = 1. Urgent = 2. Elective = 3. Newborn = 4. Delivery = 5. Other = 6.	Please see Appendix C, 2A for further details.

Variable name	Description	Value description	DAD Data Element or Comment
Asource	Admission Source.	*Numeric* 1 = ER. 2 = Another Hospital. 3 = Another facility. 4 = Court/law enforcement. 5 = Routine/birth/other.	Please see Appendix C, 2B for further details.
LOS	Length of Stay.	*Numeric*	Information taken from DAD field "acute length of stay".
APR_DRG	3M™ APR™-DRG Classification System category	*Numeric*	APR™-DRG from the 3M™ APR™-DRG Classification System software built into the AHRQ software.
DRG	Diagnosis Related Group.	*Numeric* DRG from CMS DRG Grouper.	Produced by 3M™ CMS Grouper with Medicare Code Editor software. Groups patients' records based on the primary diagnosis.
MDC	Major Diagnostic Category.	*Numeric* MDC from CMS DRG Grouper.	Produced by AHRQ Quality Indicators software. Groups patient records based on the primary diagnosis.
DX1 – DX25	ICD-9-CM diagnoses codes. DX1 is the principal diagnosis, DX2 to DX25 are secondary diagnoses.	*String, 5 characters*	All Diagnosis codes contained in the DAD were converted to ICD-9-CM. NB: See Appendix J for further explanation on classification conversions.
PR1 – PR20	ICD-9-CM procedure codes. PR1 is the principal diagnosis, PR2 to PR20 are secondary procedures.	*String, 4 characters*	All Diagnosis codes contained in the DAD were converted to ICD-9-CM. NB: See Appendix J for further explanation on classification conversions.
PRDAY1 – PRDAY20	Days from admission to procedure. PR1 is the principal procedure, PR2 to PR20 are secondary procedures.	*Numeric*	Some PSIs require this field for calculating a given indicator.
Year	Year of discharge. The patient's year of discharge. For example, a patient discharged on July 7, 2004 would have a discharge year of "2004."	*Numeric* YYYY	ICD-9-CM diagnosis code for acute ill-defined cerebrovascular disease (436) (required in the denominator of stroke mortality rate/IQI 17) is used only for patients discharged before or on September 30, 2004. In order to be consistent throughout this study (from 2002/03 to 2006/07), this optional data field was created to exclude this code from all years of data analysed for IQI 17.

Variable name	Description	Value description	DAD Data Element or Comment
DQTR	Quarter of discharge. The calendar quarter of patient's discharge. For example, a patient discharged on July 7, 2004 would have a discharge quarter of "3."	*Numeric* 1 = January to March. 2 = April to June. 3 = July to September. 4 = October to December.	Used to exclude cases with ICD-9-CM code 436 that were discharged after Sept. 30, 2004 from the denominator population of IQI 17. See explanation for "Year" above.

2. Other DAD data elements translated for calculation of AHRQ's IQIs and PSIs

A. Admission type (Atype)

All information used for this field was taken from the DAD field "Admission Category" and converted into the required numeric value for AHRQ's IQI and PSI modules. The following translations were performed.[1]

Admission Category (DAD)	Atype (AHRQ)
L = Elective Admissions	3 = Elective
N = Newborn	4 = Newborn

B. Admission source (Asource)

All information used for this field was taken from the DAD field "Admission Category." The following translations were performed.[2]

Institution from type (DAD)	Asource (AHRQ)
1 = Acute Care	2 = Another Hospital
2 = General Rehabilitation Facility	3 = Another Facility including Long Term Care (LTC)
3 = Chronic Care Facility	3 = Another Facility including LTC
4 = Nursing Home	3 = Another Facility including LTC

1 The "Admission type" variable is only used in calculating PSI indicators (i.e. not for calculating IQI indicators). The values "3" and "4" are referenced by the PSI code to identify elective surgeries and newborn admissions.

2 The value "2" is referenced by the IQI code to identify transfers from another short-term hospital. The values "2" and "3" are referenced by the PSI code to identify transfers from another hospital or facility.

5 = Psychiatric Facility	3 = Another Facility including LTC
6 = Unclassified or other type of Facility	3 = Another Facility including LTC
7 = Special Rehabilitation Facility	3 = Another Facility including LTC
8 = Home Care	3 = Another Facility including LTC
9 = Home for the Aged	3 = Another Facility including LTC
A = Day Surgery	3 = Another Facility including LTC
O = Organized Outpatient Department of Reporting Facility	3 = Another Facility including LTC

Appendix D
Hospital identification

A. Participating Hospitals

None of Alberta's 102 acute-care hospitals are identified by name in this report.

B. Non-Participating Hospitals

The institution numbers from all those that did not agree to be identified in this report were encrypted by CIHI prior to delivery and assigned an arbitrary number. The following table describes whether and how each unidentified hospital submitted DAD data in a given year, where:

Y = Hospital submitted DAD data.
— = no data submitted.

Unknown hospital	2002/03	2003/04	2004/05	2005/06	2006/07
Hospital 1	Y	Y	—	—	—
Hospital 2	Y	Y	—	—	—
Hospital 3	Y	Y	Y	Y	Y
Hospital 4	Y	Y	Y	Y	Y
Hospital 5	Y	Y	Y	Y	Y
Hospital 6	Y	Y	Y	Y	Y
Hospital 7	Y	Y	Y	Y	Y
Hospital 8	Y	Y	Y	Y	Y
Hospital 9	Y	Y	Y	Y	Y
Hospital 10	Y	Y	Y	Y	Y
Hospital 11	Y	Y	Y	Y	Y
Hospital 12	Y	Y	Y	Y	Y
Hospital 13	Y	Y	Y	Y	Y
Hospital 14	Y	Y	Y	Y	Y
Hospital 15	Y	Y	Y	Y	Y
Hospital 16	Y	Y	Y	Y	Y
Hospital 17	Y	Y	Y	Y	Y
Hospital 18	Y	Y	Y	Y	Y
Hospital 19	Y	Y	Y	Y	Y
Hospital 20	Y	Y	Y	Y	Y
Hospital 21	Y	Y	Y	Y	Y

Unknown hospital	2002/03	2003/04	2004/05	2005/06	2006/07
Hospital 22	Y	Y	Y	Y	Y
Hospital 23	Y	Y	Y	Y	Y
Hospital 24	Y	Y	Y	Y	Y
Hospital 25	Y	Y	Y	Y	Y
Hospital 26	Y	Y	Y	Y	Y
Hospital 27	Y	Y	Y	Y	Y
Hospital 28	Y	Y	Y	Y	Y
Hospital 29	Y	Y	Y	Y	Y
Hospital 30	Y	Y	Y	Y	Y
Hospital 31	Y	Y	Y	Y	Y
Hospital 32	Y	—	—	—	—
Hospital 33	Y	Y	Y	Y	Y
Hospital 34	Y	Y	Y	Y	Y
Hospital 35	Y	Y	Y	Y	Y
Hospital 36	Y	Y	Y	Y	Y
Hospital 37	Y	Y	Y	Y	Y
Hospital 38	Y	Y	Y	Y	Y
Hospital 39	Y	Y	Y	Y	Y
Hospital 40	Y	Y	Y	Y	Y
Hospital 41	Y	Y	Y	Y	Y
Hospital 42	Y	Y	Y	Y	Y
Hospital 43	Y	Y	Y	Y	Y
Hospital 44	Y	Y	Y	Y	Y
Hospital 45	Y	Y	Y	Y	Y
Hospital 46	Y	Y	Y	Y	Y
Hospital 47	Y	Y	Y	Y	Y
Hospital 48	Y	Y	Y	Y	Y
Hospital 49	Y	Y	Y	Y	Y
Hospital 50	Y	Y	Y	Y	Y
Hospital 51	Y	Y	Y	Y	Y
Hospital 52	Y	Y	Y	Y	Y
Hospital 53	Y	Y	Y	Y	Y
Hospital 54	Y	Y	Y	Y	Y
Hospital 55	Y	Y	Y	Y	Y
Hospital 56	Y	Y	Y	Y	Y
Hospital 57	Y	Y	Y	Y	Y
Hospital 58	Y	Y	Y	Y	Y
Hospital 59	Y	Y	Y	Y	Y
Hospital 60	Y	Y	Y	Y	Y
Hospital 61	Y	Y	Y	Y	Y
Hospital 62	Y	Y	Y	Y	Y
Hospital 63	Y	Y	Y	—	—

Unknown hospital	2002/03	2003/04	2004/05	2005/06	2006/07
Hospital 64	Y	Y	Y	Y	Y
Hospital 65	Y	Y	Y	Y	Y
Hospital 66	Y	Y	Y	Y	Y
Hospital 67	Y	Y	Y	Y	Y
Hospital 68	Y	Y	Y	Y	Y
Hospital 69	Y	Y	Y	Y	Y
Hospital 70	Y	Y	Y	Y	Y
Hospital 71	Y	Y	Y	Y	Y
Hospital 72	Y	Y	Y	Y	Y
Hospital 73	Y	Y	Y	Y	Y
Hospital 74	Y	Y	Y	Y	Y
Hospital 75	Y	Y	Y	Y	Y
Hospital 76	Y	Y	Y	Y	Y
Hospital 77	Y	Y	Y	Y	Y
Hospital 78	Y	Y	Y	Y	Y
Hospital 79	Y	Y	Y	Y	Y
Hospital 80	Y	Y	Y	Y	Y
Hospital 81	Y	Y	Y	Y	Y
Hospital 82	—	—	—	—	Y
Hospital 83	Y	Y	Y	Y	Y
Hospital 84	Y	Y	Y	Y	Y
Hospital 85	Y	Y	Y	Y	Y
Hospital 86	Y	Y			
Hospital 87	Y	Y	Y	Y	Y
Hospital 88	Y	Y	Y	Y	Y
Hospital 89	Y	Y	Y	Y	Y
Hospital 90	Y	Y	Y	Y	Y
Hospital 91	Y	Y	Y	Y	Y
Hospital 92	Y	Y	Y	Y	Y
Hospital 93	Y	Y	Y	Y	Y
Hospital 94	Y	Y	Y	Y	Y
Hospital 95	Y	Y	Y	Y	Y
Hospital 96	Y	Y	Y	Y	Y
Hospital 97	Y	Y	Y	Y	Y
Hospital 98	Y	Y	Y	Y	Y
Hospital 99	Y	Y	Y	Y	Y
Hospital 100	Y	Y	Y	Y	Y
Hospital 101	Y	Y	Y	Y	Y
Hospital 102	Y	Y	Y	Y	Y

Appendix E

List of the Agency for Healthcare Research and Quality's Inpatient Quality and Patient Safety Indicators used in the Fraser Institute's *Hospital Report Card*

The indicators measured in the *Hospital Report Card* are classified into three groups: those related to medical conditions, hospital procedures, and child birth. The indicators are further classified by type: death rates, volumes of procedures, utilization rates and, adverse events. It should be noted that the indicators may vary in their computation according to the version of the AHRQ software used. Version 3.1 was used for the *Hospital Report Card: British Columbia 2008, Hospital Report Card: Ontario 2008, Hospital Report Card: British Columbia 2009, Hospital Report Card: Ontario 2009*, and *Hospital Report Card: Alberta 2009*. However, the *Hospital Report Card: Ontario 2006* (rev. Sept. 2007) uses Version 2.1. Thus, indicators cannot necessarily be compared among the provinces in all years.

A. Conditions

Death rates

1 *Acute myocardial infarction (AMI) mortality rate (IQI 15)* Deaths from heart attacks. Lower rates are more desirable.

2 *Acute myocardial infarction (AMI) mortality rate (without transfers) (IQI 32)* Deaths from heart attacks; excludes patients that were transferred from another short term hospital. Lower rates are more desirable.

3 *Congestive heart failure (CHF) mortality rate (IQI 16)* Deaths due to heart failure. Lower rates are more desirable.

4 *Acute stroke mortality rate (IQI 17)* Deaths from acute strokes. Lower rates are more desirable.

5 *Gastrointestinal hemorrhage mortality rate (IQI 18)* Deaths due to bleeding from the esophagus, stomach, small intestine or colon. Lower rates are more desirable.

6 *Hip fracture mortality rate (IQI 19)* Deaths due to hip fractures. Lower rates are more desirable.

7 *Pneumonia mortality rate (IQI 20)* Death due to a condition involving an infection in the lungs. Lower rates are more desirable.

8 *Death in low mortality DRG (PSI 2)* Deaths among patients that are considered unlikely to die in the hospital. Lower rates are more desirable.

9 *Failure to Rescue (PSI 4)* Deaths in patients that developed specified complications of care. Lower rates are more desirable.

Adverse events

These indicators focus on preventable instances of harm to patients such as complications arising from surgery.

1 *Decubitus ulcer (PSI 3)* Pressure sores that develop when a patient lies on his or her back for extended periods. Lower rates are more desirable.

2 *Iatrogenic pneumothorax (PSI 6)* The collapse of a patient's lung inadvertently induced by a physician or medical treatment. Lower rates are more desirable.

3 *Selected infections due to medical care (PSI 7)* Cases of infection due to medical care, primarily those related to intravenous (IV) lines and catheters. Lower rates are more desirable.

4 *Transfusion reaction (PSI 16)* Patients with blood transfusion reactions. Lower rates are more desirable.

B. Procedures

Death rates

1 *Esophageal resection surgery mortality rate (IQI 8)* Deaths due to the surgical removal of the tube that connects the mouth to the stomach, often due to esophageal cancer. Lower rates are more desirable.

2 *Pancreatic resection surgery mortality rate (IQI 9)* Deaths due to the surgical removal of the pancreas, an organ that secretes many important

hormones such as insulin, in an attempt to cure pancreatic cancer. Lower rates are more desirable.

3 *Coronary artery bypass graft (CABG) mortality rate (IQI 12)* Deaths due to surgery performed to allow blood to bypass a clogged artery and allow it to carry oxygen to the heart. Lower rates are more desirable.

4 *Craniotomy mortality rate (IQI 13)* Deaths due to the surgical opening of the skull that is performed to remove a brain tumor, repair an aneurysm (ballooning of blood vessels), perform a biopsy or to relieve pressure inside the skull. Lower rates are more desirable.

5 *Hip replacement mortality rate (IQI 14)* Deaths due to hip replacement surgery. Lower rates are more desirable.

6 *Percutaneous transluminal coronary angioplasty (PTCA) mortality rate (IQI 30)* Deaths due to a non-surgical procedure performed to open blockages in the arteries that carry blood to the heart. Lower rates are more desirable.

7 *Carotid endarterectomy mortality rate (IQI 31)* Deaths due to a procedure that removes blockages from arteries in the neck to reduce the chance of stroke and brain damage. Lower rates are more desirable.

Volume of procedures

These indicators are calculated because they reflect procedures for which evidence shows that hospitals performing more of certain highly complex procedures may have better outcomes for those procedures. Providers exceeding these thresholds are considered high volume providers . Please see Appendix F for further details on Volume of Procedures and their Thresholds.

1 *Esophageal resection surgery volume (IQI 1)* Numbers of procedures involving the surgical removal of the tube that connects the mouth to the stomach, often due to esophageal cancer. Numbers above 6 are more desirable. Please see Appendix F for details on Threshold values.

2 *Pancreatic resection surgery volume (IQI 2)* Numbers of procedures involving the surgical removal of the pancreas in an attempt to cure pancreatic cancer. Numbers above 10 are more desirable. Please see Appendix F for details on Threshold values.

3 *Coronary artery bypass graft (CABG) volume (IQI 5)* Numbers of surgeries performed to allow blood to bypass a clogged artery. Numbers above 100 are more desirable. Please see Appendix F for details on Threshold values.

4 *Percutaneous transluminal coronary angioplasty (PTCA) volume (IQI 6)* Number of procedures performed to open blockages in the arteries that carry blood to the heart. Numbers above 200 are more desirable. Please see Appendix F for details on Threshold values.

5 *Carotid endarterectomy volume (IQI 7)* Number of procedures performed to remove blockages from arteries in the neck to reduce the chance of stroke and brain damage. Numbers above 50 are more desirable. Please see Appendix F for details on Threshold values.

Utilization rates

These indicators are calculated because they examine procedures whose use varies significantly across hospitals and for which questions have been raised about overuse, underuse, or misuse. High or low rates for these indicators are likely to represent inappropriate or inefficient delivery of care.

1 *Laparoscopic cholecystectomy (IQI 23)* Minimally invasive removal of the gall bladder, a small pear-shaped sac that stores and concentrates bile, which is needed for digestion. Higher rates are more desirable.

Adverse events

These indicators focus on preventable instances of harm to patients such as complications arising from surgery.

1 *Foreign body left during procedure (PSI 5)* Foreign object left in a patient during a procedure. Lower rates are more desirable.

2 *Post-operative physiologic and metabolic derangements (PSI 10)* Development of disorders that interfere with biochemical processes within the body including kidney failure and diabetes occurring in patients after an elective surgery. Lower rates are more desirable.

3 *Post-operative respiratory failure (PSI 11)* Development of respiratory failure occurring in patients after undergoing elective surgery. Lower rates are more desirable.

4 *Post-operative sepsis (PSI 13)* Patients that undergo elective surgeries and subsequently develop a hospital-acquired infection. Lower rates are more desirable.

5 *Accidental puncture or laceration (PSI 15)* Accidental cut or wound during procedure. Lower rates are more desirable.

C. Obstetric (birth-related)

Utilization rates

These indicators examine procedures whose use varies significantly across hospitals and for which questions have been raised about overuse, underuse, or misuse. High or low rates for these indicators are likely to represent inappropriate or inefficient delivery of care.

1 *Cesarean delivery (IQI 21)* Surgical removal of a baby through the mother's abdomen. Lower rates are more desirable.

2 *Vaginal birth after cesarean (VBAC), uncomplicated (IQI 22)* Rate of vaginal births that occurred for mothers who had delivered previously by Cesarean section. Higher rates are more desirable.

3 *Primary cesarean delivery (IQI 33)* Surgical removal of a baby through the mother's abdomen during the first birth inclusively. Lower rates are more desirable.

4 *Vaginal birth after cesarean (VBAC), all (IQI 34)* Rate of vaginal births that occurred to mothers who had delivered previously by Cesarean section. Higher rates are more desirable.

Adverse events

These indicators focus on preventable instances of harm to patients such as complications arising from surgery.

1 *Birth trauma (PSI 17)* Birth trauma for infants born alive in a hospital. Lower rates are more desirable.

2 *Obstetric trauma—vaginal with instrument (PSI 18)* Cases of potentially preventable trauma (4th degree lacerations, other obstetric lacerations) during vaginal delivery with an instrument. Lower rates are more desirable.

3 *Obstetric trauma—vaginal without instrument (PSI 19)* Cases of potentially preventable trauma (4th degree lacerations, other obstetric lacerations) during vaginal delivery without an instrument. Lower rates are more desirable.

4 *Obstetric trauma—cesarean section (PSI 20)* Cases of potentially preventable trauma (4th degree lacerations, other obstetric lacerations) during Cesarean delivery. Lower rates are more desirable.

Appendix F

Calculating the score, rank, Hospital Mortality Index, and rank of Hospital Mortality Index

1. Score

Each institution was given a score from 0 to 100 for each indicator. The basis for this scoring is described below, as it varied slightly between types of indicators

Volume indicators

Each volume indicator is supported by evidence suggesting that providers performing more than a certain number of procedures have better patient outcomes. The thresholds are listed below. Threshold 1 is the lowest reported threshold in the literature, while threshold 2 is the highest. Providers exceeding these thresholds are considered high-volume providers.

The scores for each volume indicator were calculated in the following manner. If the volume of procedures of a hospital did not exceed Threshold 1, a score of 0 was given. If the volume of procedures of a hospital exceeded Threshold 1 but did not exceed Threshold 2, a score of 75 was given. If the volume of procedures of a hospital exceeded Threshold 2, a score of 100 was given.

Thresholds for volume of procedures indicators

Volume Indicator	Threshold 1	Threshold 2	Reference for Threshold 1	Reference for Threshold 2
Esophageal resection (IQI 1)	6	7	Patti MG, Corvera CU, Glasgow RE, et al. A hospital's annual rate of esophagectomy influences the operative mortality rate. *J Gastrointest Surg* 1998; 2 (2): 186–92.	Dudley RA, Johansen KL, Rand R, et al. Selective referral to high-volume hospitals: estimating potentially avoidable deaths. *JAMA* 2000; 283 (9): 1159–66.
Pancreatic resection (IQI 2)	10	11	Glasgow RD, Mulvihill SJ. Hospital volume influences outcome in patients undergoing pancreatic resection for cancer. *West J Med* 1996; 165 (5): 294–300.	Glasgow, Mulvihill, 1996.

Volume Indicator	Threshold 1	Threshold 2	Reference for Threshold 1	Reference for Threshold 2
Coronary Artery Bypass Surgery (CABG) (IQI 5)	100	200	Eagle KA, Guyton RA, Davidoff R, et al. ACC/AHA Guidelines for Coronary Artery Bypass Graft Surgery: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Revise the 1991 Guidelines for Coronary Artery Bypass Graft Surgery). American College of Cardiology/ American Heart Association. *J Am Coll Cardiol* 1999; 34 (4): 1262–347.	Hannan EL, Kilburn H, Jr., Bernard H, et al. Coronary artery bypass surgery: the relationship between inhospital mortality rate and surgical volume after controlling for clinical risk factors. *Med Care* 1991; 29 (11): 1094–107.
Percutaneous Transluminal Coronary Angioplasty (IQI 6)	200	400	Ryan TJ, Bauman WB, Kennedy JW, et al. Guidelines for percutaneous transluminal coronary angioplasty. A report of the American Heart Association/American College of Cardiology Task Force on Assessment of Diagnostic and Therapeutic Cardiovascular Procedures (Committee on Percutaneous Transluminal Coronary Angioplasty). *Circulation* 1993; 88 (6): 2987–3007.	Hannan EL, Racz M, Ryan TJ, et al. Coronary angioplasty volume-outcome relationships for hospitals and cardiologists. *JAMA* 1997; 277 (11): 892–98.
Carotid endarterectomy (IQI 7)	50	101	Manheim LM, Sohn MW, Feinglass J, et al. Hospital vascular surgery volume and procedure mortality rates in California, 1982-1994. *J Vasc Surg* 1998; 28 (1): 45–46.	Hannan EL, Popp AJ, Tranmer B, et al. Relationship between provider volume and mortality for carotid endarterectomies in New York state. *Stroke* 1998; 29 (11): 2292–97. Dudley RA, Johansen KL, Brand R, et al. Selective referral to high-volume hospitals: estimating potentially avoidable deaths. *JAMA* 2000; 283 (9): 1159–66.

Source: *AHRQ Guide to Inpatient Quality Indicators*, version 3.1 (2007).

All other indicators

Institutions and municipalities were given a score of 0 to 100 on all other indicators. The scores reflect the relative positions of their risk-adjusted rates where available or their observed rates for indicators where the AHRQ

software does not calculate a risk-adjusted rate. For example, if the range of rates across hospitals for one of the indicators was from 1.0% to 4.0%, a score between 0 and 100 was created where 1.0% = 0 and 4.0% = 100. If an institution demonstrated a rate of 3.0% (the threshold of the top 1/3 of the range) then the score was 67. More specifically, where the rate is better when it is higher, the score is the absolute difference between the rate and the minimum of the range, divided by the range. Similarly, where the rate is better when it is lower, the score is the absolute difference between the rate and the maximum of the range, divided by the range.

2. Rank

All institutions were ranked on each indicator based on their scores, where the highest rank of 1 corresponds to the highest score out of 100.[1]

3. Hospital Mortality Index (HMI)

The HMI was created to allow examination of the performance of a hospital or municipality across several mortality indicators. The mortality indicators selected to create the HMI were those indicators that successfully passed through the following filters.

1 *Sample size* Not all institutions contained DAD data required for all indicators since not all institutions perform all procedures or treat patients with all the medical conditions analyzed in the *Hospital Report Card*. For an indicator to be included in the HMI, hospitals representing at least 75% of the patient sample for that year had to have measured data. For example, in 2006/07 an indicator had to contain at least 263,162 records in order to be included in the HMI.[2] This ensured an adequate number of hospitals for comparison.

2 *Size bias* PSIs measure very rare outcomes (i.e. 1 adverse event in 1,000 or more discharges). Since smaller institutions perform fewer procedures, they are less likely to see these adverse events and may have artificially lower PSI rates. Therefore, only 2 PSIs were used in the HMI: Death in Low Mortality DRGs (PSI 2) and Failure to Rescue (PSI 4), neither of which appeared to be affected unduly by this size bias on careful examination of the data.[3]

1 Volume indicators were not ranked since they have threshold requirements.
2 The total number of patient records in 2006/07 was 350,883.
3 As a further control for the size bias, an institution with a rate for Failure to Rescue = 0 was omitted from the HMI (since it is unlikely that an institution would have a rate = 0).

Only nine mortality indicators passed these filters from FY2002 to FY2006. The mortality indicators included in the HMI are: hip replacement mortality (IQI 14), acute myocardial infarction mortality (IQI 15), congestive heart failure mortality (IQI 16), acute stroke mortality (IQI 17), gastrointestinal hemorrhage mortality (IQI 18), hip fracture mortality (IQI 19), pneumonia mortality (IQI 20), death in low mortality DRGs (PSI 2)[4] and failure to rescue rates (PSI 4).[5]

4. Rank of the Hospital Mortality Index (HMI)

All institutions were ranked based on their HMI value, where the highest rank of 1 corresponds to the highest score out of 100.

4 PSI 2 is not risk adjusted in version 3.1 of the AHRQ software. The observed rate, rather than the risk-adjusted rate, of this measure was used for computation of the HMI.

5 The HMI is not a comprehensive rating of overall inpatient care in a hospital setting but is a broad measure of mortality rates, which are likely the most accurately recorded patient outcome.

Appendix G

Indicators omitted from this report

Difficulties in conversion to ICD-9-CM from ICD-10-CA/CCI led to the omission of some quality indicators from this report.

A. Inpatient Quality Indicators omitted

1 *AAA volume/mortality (IQI 4/11)* Numbers of procedures to repair the major artery carrying blood from the heart to the lower part of the body and deaths due to these procedures. Numbers above 10 and lower rates are more desirable. Conversion of the required ICD-10-CA/CCI diagnosis and procedure codes to ICD-9-CM for calculation of IQI 4 & 11 did not produce accurate results. This was caused by intrinsic differences between the classifications.

2 *Incidental appendectomy among elderly utilization rate (IQI 24)* Removal of the appendix at the time of another necessary abdominal surgery. This procedure is performed to eliminate the risk of future appendicitis (inflammation of the appendix). Incidental appendectomy is generally not recommended in the elderly because they have both a lower risk for developing appendicitis and a higher risk of complications after surgery (calculated for patients 65 years or older). Lower rates are more desirable. The numerator of IQI 24 is composed of incidental appendectomy procedure codes: Incidental appendectomy (471), Laparoscopic incidental appendectomy (4711), and Other incidental appendectomy (4719). No ICD-10-CA/CCI codes translate directly into the required ICD-9-CM procedure codes.

3 *Bilateral cardiac catheterization utilization rate (IQI 25)* A diagnostic test performed to see if the blood vessels to the heart are narrowed or blocked. Lower rates are more desirable. The numerator of IQI 25 is composed of the number of simultaneous right and left heart catheterizations: Right/Left heart cardiac catheterization (3723). No ICD-10-CA/CCI codes translate directly into the required ICD-9-CM procedure code.

B. Patient Safety Indicators omitted

1 *Complications of Anesthesia (PSI 1)* Adverse effects from the administration of therapeutic drugs. Lower rates are more desirable. Conversion of the required ICD-10-CA/CCI diagnosis codes to ICD-9-CM for PSI 1 did not produce accurate results. This was caused by intrinsic differences between the classifications.

2 *Post-operative Hip Fracture (PSI 8)* Hip fracture after surgery. Lower rates are more desirable. Conversion of the required ICD-10-CA/CCI diagnosis codes to ICD-9-CM for PSI 8 did not produce accurate results. This was caused by intrinsic differences between the classifications.

3 *Post-operative Hemorrhage or Hematoma (PSI 9)* Bleeding after surgery. Lower rates are more desirable. Conversion of the required ICD-10-CA/CCI diagnosis codes to ICD-9-CM did not produce accurate results. This was caused by intrinsic differences between the classifications.

4 *Post-operative Pulmonary Embolism or Deep Vein Thrombosis (PSI 12)* These conditions occur when a blood clot (usually formed in one of the leg veins) becomes detached and lodges in the lung artery or one of its branches (pulmonary embolism) or lodges in a another part of the body (usually the leg; deep vein thrombosis). This indicator is calculated for patients who develop these conditions after undergoing surgery. Lower rates are more desirable. Conversion of the required ICD-10-CA/CCI diagnosis codes to ICD-9-CM did not produce accurate results. This was caused by intrinsic differences between the classifications.

5 *Post-operative Wound Dehiscence (PSI 14)* Parting of the layers of a surgical wound. Either the surface layers separate or the whole wound splits open. Lower rates are more desirable. The numerator of PSI 14 is composed of the number of discharges with an ICD-9-CM code for reclosure of postoperative disruption of the abdominal wall (5461) in any secondary procedure field. No ICD-10-CA/CCI codes translate directly into the required ICD-9-CM procedure code.

Appendix H

Municipalities and corresponding patient Forward Sortation Areas (FSAs)

Postal Codes were truncated to Forward Sortation Areas (FSAs) before the Fraser Institute had access to the dataset. All patient FSAs were grouped into corresponding municipalities as described by Canada Post as follows for 2006/07.[1]

Municipality	Forward Sortation Areas (FSAs)
Airdrie	T4A, T4B
Athabasca	T9S
Barrhead	T7N
Beaumont	T4X
Bonnyville	T9N
Brooks	T1R
Calgary	T1X, T1Y, T2A, T2B, T2C, T2E, T2G, T2H, T2J, T2K, T2L, T2M,T2N, T2P, T2R, T2S, T2T, T2V, T2W, T2X, T2Y, T2Z, T3A, T3B, T3C, T3E, T3G, T3H, T3J, T3K, T3L, T3M, T3N, T3Z
Camrose	T4V
Canmore	T1W
Coaldale	T1M
Cochrane	T4C
Cold Lake	T9M
Devon	T9G
Drayton Valley	T7A
Edmonton	T5A, T5B, T5C, T5E, T5G, T5H, T5J, T5K, T5L, T5M, T5N, T5P, T5R, T5S, T5T, T5V, T5W, T5X, T5Y, T5Z, T6A, T6B, T6C, T6E, T6G, T6H, T6J, T6K, T6L, T6M, T6N, T6P, T6R, T6S, T6T, T6V, T6W, T6X
Edson	T7E
Fort McMurray	T9H, T9J, T9K

1 All Forward Sortation Areas (FSAs) containing a "0" as their second character were grouped into a "rural" category (as described by Canada Post). All FSAs not described by Canada Post were placed in a residual group, "other."

Municipality	Forward Sortation Areas (FSAs)
Fort Saskatchewan	T8L
Grande Prairie	T8V, T8W, T8X
High River	T1V
Hinton	T7V
Innisfail	T4G
Lacombe	T4L
Leduc	T9E
Lethbridge	T1H, T1J, T1K
Lloydminster	S9V, T9V
Medicine Hat	T1A, T1B, T1C
Morinville	T8R
Olds	T4H
Peace River	T8S
Ponoka	T4J
Red Deer	T4N, T4P, T4R, T4E
Sherwood Park	T8A, T8B, T8C, T8E, T8G, T8H
Spruce Grove	T7X, T7Y
St Albert	T8N
Stony Plain	T7Z
Strathmore	T1P
Sylvan Lake	T4S
Taber	T1G
Vegreville	T9C
Vermilion	T9X
Wainwright	T9W
Westlock	T7P
Wetaskiwin	T9A
Whitecourt	T7S

Appendix I
Codes for Age

Age is coded somewhat differently in the DAD (Discharge Abstracts Database), CMS- and 3M™ APR™-DRG Classification System (Diagnosis Related Grouper) software, and AHRQ IQI (Inpatient Quality Indicator) and PSI (Patient Safety Indicator) modules.

A. Age in DAD

1 *Age code* Denotes how the patient's age is recorded
- *a* Y = age in years. Patient is 2 years or older.
- *b* E = age is estimated in years. Patient is 2 years or older.
- *c* M = age in months. Patient is less than 2 years.
- *d* D = age in days. Patient is less than 31 days.
- *e* B = age recorded for Newborns/Stillborns.
- *f* U = age unknown.

2 *Age units* Denotes the age of patient at time of admission.
- *a* If "Age Code" = "B", "Age Units" is:
  - *i* NB = Newborn
  - *ii* SB = Stillbirth
  - *iii* U = Unknown
- *b* All other values in "Age Units" correspond to the age of the patient expressed as a numeric value (000-999). This information was used in conjunction with the "Age Code" field as follows:
  - *i* If the age of the patient is less than 31 days, the value is expressed in days.
  - *ii* If the age of the patient is less than 2 years, the value is expressed in months.
  - *iii* If the age of the patient is 2 years or more the value is expressed in years.

Note: In order to separate stillbirths from newborns (all are coded as "Age Code" = "B"), patients with "Age Code" = "B" were cross-referenced with the DAD field "Entry code" = "S". Stillbirths were omitted from analysis.

B. Age requirements for the CMS- and 3M™ APR™-DRG Classification System software

1 *AgeY* Denotes age at admission in years (0–124)
   a Birth date must be ≤ admit date

2 *AgeD* Denotes age at admission in days (1–365)
   a Used only when age in years = 0
   b If admit date = birth date, then the calculated age in days = 1

In order to accommodate the differences in how the age of a patient is captured in the DAD and that required by the CMS- and 3M™ APR™-DRG Classification System software, the two DAD fields ("Age code" and "Age Units") were split into the required "Age in years" and "Age in days" fields. Patients ≤ 31 days (corresponding to "D" in "Age code") were separated into the "Age in days" field. The number of months from the DAD was multiplied by 30 days if a patient was 1 to 12 months old. Patients between 1 and 2 years were defined as "Age in years" = 1. Patients with "Age code = B" that were not stillbirths (denoted by "S" in the "Entry code" field) were defined as "Age in days" = 1.

C. Age Requirements for AHRQ IQI and PSI modules

The DAD data was translated as described above (for the CMS- and 3M™ APR™-DRG Classification System software) with the following exceptions.

1 *Patients less than one year are placed in the "Ageday" category.*

2 *If admit date = birth date, then the calculated age in days = 0.*

Appendix J

International Classification of Diseases (ICD) conversion tables[1]

In order to use the CMS- and 3M™ APR™-DRG Classification System software as well as the AHRQ IQI and PSI modules, all diagnoses and procedures were converted from ICD-10-CA/CCI to ICD-9-CM codes preceding analysis.

ICD-10-CA/CCI conversion methodology

The following modifications were made to our database.

1 Conversion tables for ICD-10-CA/CCI to ICD-9-CM were purchased from CIHI and applied to the DAD database.

2 The National Center for Health Statistics (NCHS) and the Centers for Medicare & Medicaid Services (CMS) have issued new diagnosis and procedure codes for the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) every year since 1986. New code assignments are the result of year-long efforts of the ICD-9-CM Coordination and Maintenance Committee, which is sponsored jointly by NCHS and CMS. The effective date for issuing new codes is the same every year, October 1 (Centers for Disease Control and Prevention, 2008).

Until ICD-10-CA/CCI was adopted in Canada (in FY 2002 in Alberta), many Canadian hospitals were using ICD-9-CM. As such, CIHI continually updated the ICD-9-CM codes produced by NCHS in Washington each year until 1999. Since the present study used data coded in ICD-10-CA/CCI, the corresponding ICD-9-CM codes were updated. This information was extracted from the National Center for Health Statistics (NCHS).

3 Since converting ICD-10-CA/CCI to ICD-9-CM is a necessarily imperfect process as a result of changes in the way many diseases and conditions are handled, CIHI assigns grades to describe the quality of each conversion, where:

1 = Good to excellent match; both coding systems are either identical or the ICD-10-CA/CCI terms are indexed to the ICD-9-CM.

1 The same methodological approach was applied to the Intervention codes (CCI).

2 = Fair match; the ICD-10-CA/CCI code is not indexed in the same manner in ICD-9-CM. An inclusion term may be present, which has influenced the choice but generally some default decision was made, with the typical default to the "other specified" category.

3 = Poor match. There is no specific code available; for example, the ICD-10-CA/CCI code represents a new concept that was not available in the previous classification.
*(*CIHI 2003, 2004c, 2005b, 2006)

Only two ICD-10-CA/CCI codes analysed by the AHRQ IQI & PSI indicators are classified as a "3" conversion. They are:

1 S130 (Trauma ruptured cervical intervertebral disc) to 83900 (Cervical Vertebra Dislocation Unspecified). Required for calculating PSIs 2, 6, and 8.

2 G463 (Brain stem stroke syndrome) to 34489 (Other specified paralytic syndrome). Required for calculating PSI 3.

4 As previously mentioned, ICD-10-CA/CCI is a more specific and updated coding classification than ICD-9-CM. Therefore, numerous ICD-10-CA/CCI codes can map to a single ICD-9-CM code. Alternatively, there may be some codes where there is no direct translation from ICD-10-CA/CCI to ICD-9-CM.

All ICD-9-CM codes that did not translate directly from ICD-10-CA were analysed individually with respect to which indicator(s) they appeared in and where the code was located (i.e. in the numerator, denominator, both, or in the exclusions of a given indicator).

In cases where CIHI provided no translation, the CIHI's *International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Tabular List of inclusions and four-character subcategories* (CIHI, 2009) and the Incidence and Prevalence Database ICD-9 and ICD-10 conversion (National Center for Health Statistics, 2008) were used to determine whether other ICD-10-CCI codes translated to ICD-9-CM contained equivalent information to that required by the AHRQ indicator.

For example, 00322 (ICD-9-CM—Salmonella Pneumonia) is one of the codes required for calculation of the Pneumonia Mortality Rate (IQI 20). None of the ICD-10-CA/CCI codes listed in CIHI's conversion table translates directly to 00322. However, there are two ICD-10-CA/CCI codes that would contain this information that do translate to ICD-9-CM codes.

ICD-10-CA to ICD-9-CM code conversion table

ICD-10-CA	ICD-9-CM
A022 Localized salmonella infections	00329 Other localized Salmonella infections
J170 Pneumonia in bacterial disease classified elsewhere	4848 Pneumonia in other infectious diseases

Since 4848 is one of the ICD-9-CM codes analysed to calculate IQI 20, the information for Salmonella Pneumonia is already captured within the indicator. Additionally, since this indicator measures deaths due to pneumonia infection, using the information contained in A022 (Localized salmonella infections), the conversion to 00329 (Other localized Salmonella infections) would be inappropriate as it would include information about Salmonella infections that was not specific to Pneumonia infection.

This exercise was performed to ensure that the proper information contained within the ICD-10-CA/CCI codes was being captured by a given indicator, even in the absence of a direct ICD-10-CA to ICD-9-CM translation.

5 ICD-10-CA/CCI is a more specific and updated coding classification than ICD-9-CM. Therefore, numerous ICD-10-CA/CCI codes can map to a single ICD-9-CM code. Alternatively, some codes do not translate directly from ICD-10-CA/CCI to ICD-9-CM. The following table contains the ICD-9CM diagnosis codes required for calculating Congestive Heart Failure (IQI 16). The italicized codes do not translate directly from ICD-10-CA/CCI to ICD-9-CM.

ICD-9-CM codes required for calculation of Congestive Heart Failure mortality rate (IQI 16)

Code	Description	Code	Description
39891	*RHEUMATIC HEART FAILURE*	42821	Acute Systolic Heart Failure
40201	*MAL HYPERT HRT DIS W CHF*	42822	Chronic Systolic Heart Failure
40211	*BENIGN HYP HRT DIS W CHF*	42823	Acute On Chronic Systolic Heart Failure
40291	*HYPERTEN HEART DIS W CHF*	4289	Heart Failure NOS
40401	*MAL HYPER HRT/REN W CHF*	42830	Diastolic Heart Failure NOS
40403	*MAL HYP HRT/REN W CHF&RF*	42831	Acute Diastolic Heart Failure
40411	*BEN HYPER HRT/REN W CHF*	42832	Chronic Diastolic Heart Failure
40413	*BEN HYP HRT/REN W CHF&RF*	42833	Acute On Chronic Diastolic Heart Failure
40491	*HYPER HRT/REN NOS W CHF*	42840	Systolic/Diastolic Heart Failure NOS
40493	*HYP HT/REN NOS W CHF&RF*	42841	Acute Systolic/Distolic Heart Failure
4280	Congestive Heart Failure	42842	Chronic Systolic/Diastolic Heart Failure
4281	Left Heart Failure	42843	Acute/Chronic Sytolic/Diastolic Heart Failure
42820	Systolic Heart Failure NOS		

Although a direct translation does not exist from an ICD-10-CA code to an ICD-9-CM code, equivalent information can be found in other ICD-10-CA/CCI codes. For example, Rheumatic Heart Failure (ICD-9-CM code 39891) information is contained in ICD-10-CA code I099 (Rheumatic heart disease, unspecified). However, since this is an "unspecified" code, information that is not specific to Chronic Heart Failure Mortality (IQI 16) will also be contained in this code. For this reason, calculation of IQI 16 was restricted to codes 4280, 4281, and 4289. Moreover, all ICD-10-CA codes corresponding to heart failure (code I50) are translated to either ICD-9-CM code 4280, 4281, or 4289.

6 The following ICD-9-CM codes are required for calculation of Acute Myocardial Infarction Mortality (IQIs 15 & 32).

ICD-9-CM codes required for calculation of Acute Myocardial Infarction mortality rate (IQIs 15 & 32)

Code	Description	Code	Description
41001	AMI Anterolateral, Initial	41051	AMI Lateral NEC, Initial
41011	AMI Anterior Wall, Initial	41061	True Post Infarct, Initial
41021	AMI Inferolateral, Initial	41071	Subendo Infarct, Initial
41031	AMI Inferopost, Initial	41081	AMI NEC, Initial
41041	AMI Inferior Wall Initial	41091	AMI NOS, Initial

Both IQIs 15 & 32 measure AMI mortality rates. The ICD-10-CA coding classification does not translate directly into any of these ICD-9-CM codes. In order to capture the information contained in ICD-10-CA codes for patients diagnosed with an AMI, the following ICD-10-CA codes were used for calculating AMI mortality rates.

ICD-10-CA to ICD-9-CM code conversion table

ICD-10-CA	ICD-9-CM
I210 Acute transmural MI of anterior wall	41010 AMI Other Anterior Wall, Episode NOS
I211 Acute transmural MI of inferior wall	41040 AMI Other Inferior Wall Episode NOS
I212 Acute transmural MI of other site	41080 AMI Other Specified Site Episode NOS
I213 Acute transmural MI of unspecified site	41090 AMI Unspecified, Episode Unspecified
I2140 Acute subendocardial MI of anterior wall	41070 Subendocardial AMI, Episode NOS
I2141 Acute subendocardial MI of inferior wall	41070 Subendocardial AMI, Episode NOS
I2142 Acute subendocardial MI of other sites	41070 Subendocardial AMI, Episode NOS
I2149 Acute subendocardial MI, unspecified site	41070 Subendocardial AMI, Episode NOS
I219 AMI unspecified	41090 AMI Unspecified, Episode Unspecified

7 Human Immunodeficiency Virus Disease (ICD-9-CM code 042) is required for calculating Death in low mortality DRGs (PSI 2), Failure to rescue (PSI 4), Infection due to medical care (PSI 7), and Postoperative sepsis (PSI 13). ICD-10-CA/CCI contains this information as HIV disease (B24) which is converted to 0429 in ICD-9-CM by CIHI's conversion table. Therefore, all information on HIV required for calculation of PSI 2, 4, 7, and 13 was taken from ICD-10-CA/CCI code B24.

8 Gastrointestinal Hemorrhage mortality rate (IQI 18) incorporates esophageal hemorrhage and ulcers of the esophagus with bleeding, corresponding to the ICD-9-CM codes 53021 and 53082. The ICD-10-CA codes for ulcers of oesophagus, listed below, translate to the general ICD-9-CM code 5302 but should be included in the indicator when bleeding occurs.

ICD-10-CA codes for ulcer of oesophagus

Code	Description
K2210	ulcer of oesophagus, acute with hemorrhage
K2211	*ulcer of oesophagus, acute with perforation*
K2212	ulcer of oesophagus, acute with both hemorrhage and perforation
K2213	*ulcer of oesophagus, acute without hemorrhage or perforation*
K2214	ulcer of oesophagus, chronic or unspecified with hemorrhage
K2215	*ulcer of oesophagus, chronic or unspecified with perforation*
K2216	ulcer of oesophagus, chronic or unspecified with both hemorrhage & perforation
K2217	*ulcer of oesophagus, chronic without hemorrhage or perforation*
K2219	*ulcer of oesophagus, unspecified as acute or chronic, without hemorrhage or perforation*

The non-italicized codes (K2210, K2212, K2214, and K2216) were included in the calculation of IQI 18.

9 The following ICD-9-CM codes are required for calculation of Birth Trauma—Injury to Neonate (PSI 17)

Code	Description
7670	Subdural and cerebral hemorrhage
76711	Epicranial subaponeurotic hemorrhage
7673	Injuries to skeleton
7674	Injury to spine and spinal cord
7677	Other cranial and peripheral nerve injuries
7678	Other specified birth trauma
7679	Birth trauma, unspecified

As a result of a change to ICD-9-CM, code 76711 was not included in PSI 17 in years prior to 2003 according to the AHRQ methodology and thus rates may be lower for those years.

The ICD-10-CA coding classification does not translate directly into these ICD-9-CM codes for injuries to scalp.

ICD-10-CA codes for birth injury to scalp

Code	Description
P120	*Cephalhaematoma due to birth injury*
P121	*Chignon due to birth injury*
P122	Epicranial subaponeurotic hemorrhage due to birth injury
P123	*Bruising of scalp due to birth injury*
P124	*Monitoring injury of scalp of newborn*
P128	*Other birth injuries to scalp*
P129	*Birth injury to scalp, unspecified*

Only code P122 was included in the calculation of PSI 17.

Appendix K

Hospitals and Health Authorities

Since April 1, 2009, health care services in Alberta have been managed and delivered by the Alberta Health Services Board. The acute-care facilities included in the Fraser Institute's *Hospital Report Card: Alberta 2009* are listed below.

Municipality	Hospital
Athabasca	Athabasca Healthcare Centre
Banff	Mineral Springs Hospital
Barrhead	Barrhead Healthcare Centre
	Barrhead Community Cancer Centre
Bassano	Bassano Health Centre
Beaverlodge	Beaverlodge Municipal Hospital
Black Diamond	Oilfields General Hospital
Blairmore	Crowsnest Pass Health Centre
Bonnyville	Bonnyville Healthcare Centre
	Bonnyville Community Cancer Centre
Bow Island	Bow Island Health Centre
Boyle	Boyle Healthcare Centre
Brooks	Brooks Health Centre
Calgary	Alberta Children's Hospital
	Rockyview General Hospital
	Peter Lougheed Centre
	Foothills Medical Centre
	Tom Baker Cancer Centre (TBCC)
Camrose	St. Mary's Hospital
	Camrose Community Cancer Centre
Canmore	Canmore General Hospital
	Bow Valley Community Cancer Centre
Cardston	Cardston Health Centre
Castor	Our Lady of the Rosary Hospital

Municipality	Hospital
Claresholm	Claresholm General Hospital
Coaldale	Coaldale Health Centre
Cold Lake	Cold Lake Healthcare Centre
Consort	Consort Hospital and Care Centre
Coronation	Coronation Hospital and Care Centre
Daysland	Daysland Health Centre
Desmarais	Wabasca/Desmarais Healthcare Centre
Devon	Devon General Hospital
Didsbury	Didsbury District Health Services
Drayton Valley	Drayton Valley Hospital and Care Centre
	Drayton Valley Community Cancer Centre
Drumheller	Drumheller Health Centre
	Drumheller Community Cancer Centre
Edmonton	Stollery Children's Hospital
	Glenrose Rehabilitation Hospital
	Grey Nuns Community Hospital
	Misericordia Community Hospital
	Royal Alexandra Hospital
	University of Alberta Hospital
	Cross Cancer Institute (CCI)
Edson	Edson Healthcare Centre
Elk Point	Elk Point Healthcare Centre
Fairview	Fairview Health Complex
Fort Macleod	Fort Macleod Health Centre
Fort McMurray	Northern Lights Regional Health Centre
	Fort McMurray Community Cancer Centre
Fort Saskatchewan	Fort Saskatchewan Health Centre
Fort Vermilion	St. Theresa General Hospital
Fox Creek	Fox Creek Healthcare Centre
Grande Cache	Grande Cache Community Health Complex
Grande Prairie	Queen Elizabeth II Hospital
	Grande Prairie Cancer Centre (GPCC)
Grimshaw	Grimshaw / Berwyn and District Community Health Centre
Hanna	Hanna Health Centre

Municipality	Hospital
Hardisty	Hardisty Health Centre
High Level	Northwest Health Centre
High Prairie	High Prairie Health Complex
High River	High River General Hospital
	High River Community Cancer Centre
Hinton	Hinton Healthcare Centre
	Hinton Community Cancer Centre
Innisfail	Innisfail Health Centre
Jasper	Seton – Jasper Healthcare Centre
Killam	Killam Health Care Centre
Lac La Biche	William J. Cadzow – Lac La Biche Healthcare Centre
Lacombe	Lacombe Hospital and Care Centre
Lamont	Lamont Health Care Centre
Leduc	Leduc Community Hospital
Lethbridge	Chinook Regional Hospital
	Lethbridge Cancer Centre (LCC)
Lloydminster	Lloydminster Hospital
	Lloydminster Community Cancer Centre
Manning	Manning Community Health Centre
Mayerthorpe	Mayerthorpe Healthcare Centre
McLennan	Sacred Heart Community Health Centre
Medicine Hat	Medicine Hat Regional Hospital
	Medicine Hat Cancer Centre (MHCC)
Milk River	Milk River Health Centre
Olds	Olds Hospital and Care Centre
Oyen	Big Country Hospital
Peace River	Peace River Community Health Centre
	Peace River Community Cancer Centre
Pincher Creek	Pincher Creek Health Centre
Ponoka	Ponoka Hospital and Care Centre
Provost	Provost Health Centre
Raymond	Raymond Health Centre
Red Deer	Red Deer Regional Hospital Centre
	Central Alberta Cancer Centre (CACC)

Municipality	Hospital
Redwater	Redwater Health Centre
Rimbey	Rimbey Hospital and Care Centre
Rocky Mountain House	Rocky Mountain House Health Centre
Slave Lake	Slave Lake Healthcare Centre
Smoky Lake	George McDougall – Smoky Lake Healthcare Centre
Spirit River	Central Peace Health Complex
St Albert	Sturgeon Community Hospital
St. Paul	St. Therese - St. Paul Healthcare Centre
Stettler	Stettler Hospital and Care Centre
Stony Plain	WestView Health Centre - Stony Plain
Strathmore	Strathmore District Health Services
Sundre	Sundre Hospital and Care Centre
Swan Hills	Swan Hills Healthcare Centre
Taber	Taber Health Centre
Three Hills	Three Hills Health Centre
Tofield	Tofield Health Centre
Two Hills	Two Hills Health Centre
Valleyview	Valleyview Health Centre
Vegreville	St. Joseph's General Hospital
Vermilion	Vermilion Health Centre
Viking	Viking Health Centre
Vulcan	Vulcan Community Health Centre
Wainwright	Wainwright Health Centre
Westlock	Westlock Healthcare Centre
Wetaskiwin	Wetaskiwin Hospital and Care Centre
Whitecourt	Whitecourt Healthcare Centre

Source: Alberta Health and Wellness, Health Facilities Planning Branch, 2009.

Frequently Asked Questions

FAQ 1 *How are some measures (e.g., deaths associated with hip replacement surgery) that do not apply to all hospitals (because they do not perform this type of procedure) handled in calculating an aggregate mortality score? Did you try to pick things for the Hospital Mortality Index that many hospitals did? This is particularly relevant for smaller hospitals (which may not offer a full range of services), specialty hospitals, and individual sites within a hospital corporation or city (where for quality or efficiency reasons some types of care may be concentrated in some site or another).*

The Hospital Mortality Index (HMI) was developed as a result of an interest in a summary measure of patient care outcomes from our study. We started with 39 indicators and initially hoped to include all of them in an index that represented a composite measure of quality and patient safety. This proved impossible for a number of reasons, including the matter of coverage, where not all of the procedures and conditions are found in every hospital. To give examples from 2006/07, we have only two hospitals with data for the CABG Mortality Rate indicator and only three for Percutaneous Transluminal Coronary Angioplasty volume. Through a process of elimination (described in Appendix F), we have ended up with the HMI and its nine measures of mortality.

The HMI has a hospital count of 10 in terms of coverage in the latest year. In terms of adequate patient record sample size, an indicator was not used in calculating the HMI if it did not represent at least 75% of patient records for that year. For example, in 2006 an indicator had to contain at least 263,162 records in order to be included in the HMI (please see Appendix F for further details on calculating the HMI, ranks and scores).

With regard to small numbers of cases at a hospital, we have used the AHRQ recommendations and do not show information where there are five or fewer cases. This is done for reasons of confidentiality and comparability. CIHI provided our database and has a standard policy of censoring any data cells that are three or fewer.

FAQ 2 *How are the measures combined to calculate a composite score in the Hospital Mortality Index rankings? Do they receive equal weighting? This may mean that outcomes for an area that very few patients experience (e.g. a highly specialized type of surgery) are given the same weight as those for another type of care that thousands of patients experience each year. On the other hand, if indicators are not equally weighted, the score values some outcomes more than others. Previous research on composite measures in many fields has shown that changing the weights of components often has a large impact on final scores.*

The measures in the Hospital Mortality Index (HMI) are equally weighted (for further information on calculating the scores, ranks and HMI, please see Appendix F). This is a standard approach of the Fraser Institute and is used in much of our research when indexing components with unknown weights. One alternative would be to weight according to the populations at risk, the denominator of our indicators. In that case, we would have the largest weight for Death in Low Mortality DRGs, as that is the broadest measure. To take the example of Anonymous Hospital 67, the hospital with the largest number of records, this indicator has 10,337 cases in the denominator in 2006/07, while the other components of the HMI have between 1,084 (AMI Mortality) and 118 (Hip Replacement Mortality) cases in their denominators.

This then brings up a relevant question: how important are these indicators when compared to each other? Is it just a matter of how many patients are treated? There is no obvious answer and so we really want to emphasize that the HMI is a summary measure but people should always look to the individual components and the other indicators of quality and patient safety to understand the circumstances at any given hospital. This is explicitly stated in the Introduction, the Overview and Observations, and the text that is on our website.

FAQ 3 *How precisely are the scores being ranked? How meaningful are the differences based on the scores? Is it fair to say that indicator results tend to be more precise for larger hospitals or municipalities than smaller ones? In producing rankings, it is important to take into account the extent to which differences in indicator results may be explained by chance alone, as opposed to real differences in care. Statistical tools such as confidence intervals are often used to evaluate how likely it is that observed differences are simply the result of random variation. Likewise, to what extent does a small difference in score (which may make a big difference in ranking) represent a true difference in the quality of care and patient safety?*

The scores and rankings are a direct result of the underlying indicator rates. We produced both in order to help people understand the relative position of the hospitals for any given indicator (for further information on calculating the scores and ranks, please see Appendix F). In addition, we have compared each institution's and each municipality's risk-adjusted rate (per indicator) to the upper and lower bounds of a 95% confidence interval (CI). This additional analysis was performed to measure the statistical significance of each result. Those below the lower CI are statistically "better than average" and those that are above the upper CI are "worse than average" (with the exception of IQIs 22, 23 and 34, where those below the lower CI are "worse than average" and those above the upper CI are "better than average").

FAQ 4 *Whose results are reflected? Are results for municipalities based on patients treated in hospitals in that area or patients from that area regardless of where they were treated? To what extent were results adjusted for the fact that people who live in some communities (e.g. rural or remote regions) may be more likely to be transferred to specialized centres for care? Depending on how indicators were calculated, this may affect mortality and other indicator results.*

The municipality results are based on the location of the patient's residence and this is determined from the first three digits of their postal code (the Forward Sortation Area). There is no exact match of municipality to hospital, as every municipality has patients at more than one hospital. On the other side, every hospital in our study has patients who are from different municipalities. We have made no adjustment to the municipality measures for the degree to which patients receive care at different hospitals. They are simply measures of results for patients from a given municipality, no matter where the hospital is located in the province.

FAQ 5 *Some types of adverse events are relatively common; others are very rare. In selecting indicators appropriate for a particular level of reporting (e.g. in this case the hospital or municipality level), to what extent has this been taken into account? For example, measures based on rare events (such as foreign objects left in a patient's body after a procedure) may not be valid for small populations, such as individual hospitals or communities.*

It is true that adverse events tend to be rare and smaller places will not always see these consequences of patient care. This was a major reason why only two out of 15 of the patient safety indicators were used in the Hospital Mortality Index summary measure for the study. It cannot be imputed that a high score on these types of indicators is due to fewer adverse events for those places with relatively low numbers of cases (this is further discussed in Appendix E). Their volume of activity may simply be inadequate to produce the inevitable adverse event. AHRQ can be referenced for work in this regard.

FAQ 6 *How were the AHRQ indicators adapted for use in Canada? The ways that Canadian hospitals capture information about the types of health problems and procedures that patients have differ from the methods used in the United States and have changed over time. For example, the AHRQ indicators used in this study were designed for a classification system that was historically used in some Canadian hospitals. Hospitals in Alberta historically used a different, though similar, classification system but all switched to a new system in 2002. Comparing results based on these classification systems is challenging (e.g. because clinical understanding of conditions has changed over time and the level of detail available differs). Also, have the APR-DRGs been adapted for use with the current classification systems in use in Canada?*

Appendix J outlines our entire coding methodology. Both the AHRQ indicators and 3M™ risk adjustment software are measured in the American 9th version of the International Classification of Diseases (ICD-9-CM), whereas in Alberta, the Canadian International Classification of Disease, Version 10 (ICD-10-CA/CCI) has been in use since 2002. We are dealing with over 10,000 classification codes in the 9th version and over 30,000 codes in the 10th version. In order to compensate for differences between ICD-9-CM and ICD-10-CA/CCI, conversion tables were purchased from CIHI and applied to the codes in the DAD. Each code that did not directly translate between the two classifications was individually analyzed with respect to each indicator and other codes that contained the same information. A concentrated effort was applied to this process (which took months to complete) in order to ensure the most accurate translations. All of this is discussed in the Appendices.

FAQ 7 *Has the validity of the data used in calculating specific indicators been assessed? The quality of much hospital data is high but the extent of reporting and consistency of some data varies between institutions and over time. For example, there are known historical issues that may affect the comparability of some of the indicators cited. How likely do you think that there were data processing or coding mistakes in the data you bought from CIHI? Or, did you do the coding yourself?*

CIHI's Discharge Abstract Database (DAD) contains information on hospital stays in Canada. Various CIHI publications note that the DAD is used extensively by a variety of stakeholder groups to monitor the use of acute-care health services, conduct analyses of health conditions and injuries, and increasingly to track patient outcomes. The DAD is a major data source used to produce various CIHI reports, including annual reports on the performance of hospitals and the health care system and for seven of the health indicators adopted by the federal, provincial, and territorial governments (CIHI, 2002). These data have been used extensively in previous reports on health care performance and form the basis for many journal articles (see, e.g., Ontario Hospital Association and the Government of Ontario, 2007; Aubrey-Bassler et al., 2007).

Once a patient is discharged, the data for the patient's stay is subject to a detailed abstraction process conducted by a health records professional and then results are submitted to CIHI. CIHI applies a comprehensive edit and correction system and inaccuracies or incorrect information are followed up on at the hospital level when the DAD is sent back to the hospitals for data validation.

The data are collected under consistent guidelines, by trained abstractors, in all acute-care hospitals in Alberta. The data undergo extensive edit checks to improve accuracy but all errors cannot be eliminated. However, in order to produce good information about data quality, CIHI established a comprehensive and systematic data quality program, whose framework involves 24 characteristics relating to five data quality dimensions of accuracy, timeliness, relevance, comparability, and usability.

There are a number of publications that have addressed data quality issues that are discussed in our report. Of note are CIHI's reabstraction studies that go back to the original patient charts and recode the information using a different set of expert coders.[1]

The reabstraction studies, performed in the province of Ontario, note the following rates of agreement between what was initially coded compared to what was coded on reabstraction:

1 Reabstractors participating in the study were required to have several years of coding experience, experience coding in ICD-10-CA and CCI in particular, experience coding at a tertiary care centre, and attendance at specific CIHI educational workshops. They were also required to attend a one-week training session and to receive a passing score on the inter-rater test.

a non-medical data: 96%–100%
b selection of intervention codes (procedure codes): 90%–95%
c selection of diagnosis codes: 83%–94%
d selection of most responsible diagnosis: 89%–92%
e typing of co-morbidities: pre-admit: 47%–69%; post-admit: 51%–69%
f diagnosis typing (which indicates the relationship of the diagnosis to the patient's stay in hospital) continues to present a problem; discrepancy rates have not diminished with adoption of ICD-10-CA.

The coding issues in points (e) and (f) do not affect our results since the most responsible diagnosis is coded with a high degree of agreement and the AHRQ indicators do not discriminate between diagnosis types. Overall, when the rates of agreement in the third year of this reabstraction study (performed on data coded in ICD-10-CA) were compared to the rates of agreement of the previous years' data (coded in ICD-9-CCP), the rates were as well as or better than the rates previously.

However, with regard to the coding of pneumonia, a potential data quality issue exists because some reabstraction coders selected pneumonia instead of chronic obstructive pulmonary disease (COPD) as the most responsible diagnosis (CIHI, 2004b). This could potentially create false positive results for Pneumonia Mortality rate (IQI 20) since this indicator counts deaths due to pneumonia in situations where the primary diagnosis is a pneumonia diagnosis code. We have noted this proviso in our report.

With respect to specific conditions related to the health indicators examined, those that are procedure driven (i.e. cesarean section (C section), CABG, and total knee replacement) were coded well with low discrepancy rates. The following had less than a 5% rate of discrepancy: C section, coronary artery bypass graft (CABG), hysterectomy, total knee replacement, vaginal birth after cesarean (VBAC), and total hip replacement. The following had greater than 5% discrepancy: acute myocardial infarction (AMI), 8.9%; hip fracture, 6.0%; hospitalization due to pneumonia and influenza, 6.9%; and injury hospitalization, 5.3% (CIHI, 2002).

Discrepancy rates were noted in conditions that are diagnosis driven: AMI (CIHI, 2002), stroke, pneumonia, and COPD (CIHI, 2004b) (as described above). Only the pneumonia codes are potentially affected in our report.

Overall, according to CIHI, findings from their three-year DAD reabstraction studies have confirmed the strengths of the database, while identifying limitations in certain areas resulting from inconsistencies in the coding of some data elements. In addition, the findings from the inter-rater data (that is, comparison between reabstractors) were generally similar to the findings from the main study data (that is, comparison between original coder and reabstractor). This suggests that the database is coded as well as can be expected using existing approaches in the hospital system.

FAQ 8 *How was palliative care handled? Some studies suggest that Canadians receiving end-of-life care in hospital (rather than in a hospice or at home) are more likely to die than similar patients in many other countries. Within Canada, the extent to which end-of-life care occurs in hospital varies from community to community. Deaths among these patients are not unexpected and do not necessarily indicate any issues with quality of care. Identifying these patients is complex but important, particularly when calculating results for indicators such as deaths among patients with pneumonia. For example, about 15% of in-hospital deaths were palliative-care cases in acute-care hospitals. Furthermore, a substantial number of patients who were hospitalized mainly for other conditions also received palliative care services during their stay.*

The Discharge Abstract Database (DAD) is a national database for information on all acute-care hospital separations (discharges, deaths, sign-outs, transfers). Palliative patients are difficult to diagnose (and much palliative care is given outside the hospital setting) and are often identified as such only in hindsight. Only as recently as June 19, 2006 did CIHI begin instructing institutions on how to best indicate a palliative patient. Previously (and until FY2006/07 in their databases), there was no national coding standard to identify patients with terminal illness who are receiving palliative care in hospital. There is, however, an ICD-10-CA code for palliative care. In FY2006/07, the frequency of this code is 0.5% (or 1,799 of 350,883 patient records).
We hope to incorporate these improvements in the DAD in subsequent reports, as the information becomes available.

FAQ 9 *Why is there so little in the report about cancer? Is it particularly difficult to report?*

The treatment of cancer is not included in the AHRQ indicators. We chose the ARHQ methodology because it was objective, backed by a large body of research, in use in a number of jurisdictions, and based on administrative data. We have noted in the report that the indicators are for a very specific portion of hospital care: inpatient acute care. There is nothing directly related to cancer, ambulatory, clinical, ER, and so on, nor are there measures of things like patient satisfaction or the financial performance of hospitals. Comments on hospital performance should be conditioned with the fact that this is not a comprehensive survey of all hospital care. In fact, the main value is probably at the individual indicator level because that is most meaningful for a patient concerned with a certain condition or procedure. AHRQ has conducted extensive research on assessing performance on certain indicators that studies have shown are related to quality. AHRQ has identified four categories of quality indicators that appear to have relationships to the outcomes of care

provided within hospitals: mortality for specific procedures, mortality for specific conditions, procedure utilization, and procedure volume. Research has confirmed that the rate of patient deaths for certain procedures and conditions may be associated with quality of care. While research can predict an expected range of patient deaths for a given procedure or condition, mortality rates above or below the expected range may have quality implications. For some procedures, research has shown that overuse, under use, and misuse (utilization) may affect patient outcomes. For certain procedures, the number of times (volume) the procedure is performed in a hospital has been linked to the patient's outcome.

FAQ 10 *What do you see as the strengths of this report card?*

The strengths of the report card are its transparency in terms of data and methodology, the detail provided at the hospital and indicator level, and the focus on patient-oriented information as well as the fact that we use the population of patient records for Alberta rather than a sample, which over the five-year period was more than 1.7 million records in total.

FAQ 11 *What about its weaknesses?*

The weaknesses of the report card are its limited coverage (applying only to inpatient acute care), the unwillingness of Alberta Health Services to participate by allowing hospitals to be identified, and potential issues with data quality.

FAQ 12 *What is the timeline on this project? What provinces will you add next year? When will you cover the whole country?*

This is the first hospital report card for Alberta. Three hospital report cards (2009, 2008, and 2006, updated 2007) have already been produced for Ontario and two have been produced for British Columbia (2008 and 2009). We hope to prompt participation by Alberta's hospitals and Alberta Health Services in following years and to have full national coverage within five to seven years.

FAQ 13 *Is this exactly the same methodology that New York and other states used in their hospital care surveys? Or were there some changes?*

The AHRQ methodology is the same as that used in more than a dozen US states, including New York, Texas, Colorado, California, Florida, Kentucky, Massachusetts, Maryland, Minnesota, New Jersey, Oregon, Utah, Vermont, and parts of Wisconsin. There is also a report published by the Manitoba Center for Health Policy that used the AHRQ Patient Safety Indicators (Bruce et al., 2006).

In order to use the CMS- and APR-DRG software, the DAD dataset received from CIHI required several standard modifications to account for differences in the Canadian and US coding methodologies. All standard modifications are explicitly detailed in Appendices B, C, and J.

FAQ 14 *To what extent did the risk adjustment improve the "fit" of the model used to describe the indicators? This is typically measured statistically by measures such as a t-statistic, which tells you how much better you were at predicting which patients would die when you used the risk-adjustment model compared to when you did not.*

The AHRQ and 3M™ risk-adjustment processes are employed to control at least partially for variances in patient health status. The methodology employs three types of adjustments involving age, gender, and co-morbidities. They are not used to predict which patients would die. The risk-adjustment model has not been validated by us. It has been thoroughly validated in the course of developing the AHRQ program over the past decade. It also has additional value because the methodology is transparent, is in use in many other jurisdictions, and is done in an identical and therefore comparable way. The software required to run these programs is in the public domain, in contrast to similar reports, which have a proprietary risk-adjustment technique.

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About this publication

About the authors

Nadeem Esmail

Nadeem Esmail is the Director of Health System Performance Studies and Manager of the Alberta Policy Research Centre at the Fraser Institute. He completed his B.A. (Honours) in Economics at the University of Calgary, and received an M.A. in Economics from the University of British Columbia. His recent publications and co-publications for the Fraser Institute include the series *Waiting Your Turn: Hospital Waiting Lists in Canada*, the *How Good Is Canadian Health Care?* series, and *The Alberta Health Care Advantage: An Accessible, High Quality, and Sustainable System*. His articles have appeared in newspapers across Canada, he has spoken internationally on health care policy and reform, and he has been a guest on numerous radio and TV programs across the country.

Maureen Hazel

Maureen Hazel was a health policy analyst at the Fraser Institute until February of 2009. She completed her B.Com. (first class Honours) and M.A. in Economics at McGill University. Her recent publications and co-publications for the Fraser Institute include the 18th edition of *Waiting Your Turn: Hospital Waiting Lists in Canada*, *Hospital Report Card: British Columbia 2008*, and *Hospital Report Card: Ontario 2008*.

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