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The Fraser Institute

Hospital Report Card British Columbia 2011

by Bacchus Barua and Nadeem Esmail

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Contents

When reviewing mortality or other indicators of inpatient 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.

Hospital Report Card: British Columbia 2011

Overview and Observations

Introduction and overview

The Fraser Institute's *Hospital Report Card: British Columbia 2011* is constructed in order to contribute to the improvement of inpatient care in British Columbia by providing hospital-specific information about quality of service directly to patients and to the general public. It aims to promote greater accountability within hospitals, thereby stimulating improved performance through independent and objective measurement. This is an interactive web-based report card, and all results and accompanying information are available at <http://www.hospitalreportcards.ca/bc>.

The Institute 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 British Columbia.

The report card uses the Discharge Abstract Database (DAD) of the Canadian Institute for Health Information (CIHI) as its primary information source, employs the 3M™ APR™-DRG Classification System[1] to risk-adjust the data (ie., adjust rates for patients with the same condition but a different health status), and consists of 39 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) developed by the US Agency for Healthcare Research and Quality (AHRQ)[2] in conjunction with Stanford University. This latest edition of the *Hospital Report Card: British Columbia* also includes two experimental indicators[3] adapted by the Fraser Institute that attempt to capture the potentially distinct circumstances of care provision in British Columbia.

The Fraser Institute spent two years developing the methods, databases, and computer programs required to adapt the AHRQ 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.

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

2 AHRQ's indicators are presently used to measure provider quality in more than a dozen US states including New York, Texas, Florida, and California.

3 IQI EXP 6: Percutaneous Transluminal Coronary Angioplasty volume (Experimental) and IQI EXP 30: Percutaneous Transluminal Coronary Angioplasty mortality rate (Experimental), adapted from AHRQ's IQI 6 and IQI 30 (see "Experimental indicators," p. 6, and "A note on experimental indicators," p. 50.)

The indicators are shown for all acute-care hospitals and municipalities (based on patient residence postal codes) in British Columbia from 2001/02 to 2008/09, comprising over three million patient records. This constitutes the most comprehensive and detailed publicly available measure of acute-care hospital performance in Canada at the present time.

Indicators are expressed as observed rates (such as deaths due to hip replacement surgery) and risk-adjusted rates (the same rate adjusted for patient health status). Each institution is given a score from 0 to 100 based on its risk-adjusted rate where available or on its observed rate (where 100 is the best), and is then ranked based on its score (where 1 is the best).[4] A further analysis, based on statistical upper and lower bounds of the 95% confidence intervals for the risk-adjusted rates, is also conducted and is discussed below. The 39 indicators and two experimental indicators used in the 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 (see table 1).

This is the second time British Columbia's provincial government has allowed the identification of all acute-care hospitals in the Fraser Institute's independently produced hospital report card. Indeed, British Columbia can be considered a leader in providing transparency and accountability with respect to the publicly funded care being delivered in the province's hospitals.

The *Hospital Report Card*'s interactive website

A report based on over three million patient records, shown across 39 quality and safety indicators developed by the AHRQ as well as two additional experimental indicators adapted by the Fraser Institute, for 95 hospitals and 50 municipalities, over eight years, is not something that can be summarized in a few words. In order to provide patients with access to information on specific medical procedures and conditions, and to give British Columbians a better understanding of the variation in hospital care across the entire system,

4 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. At the same time, these institutions and municipalities may appear to have higher mortality rates in a particular year due to a small denominator accompanied by death or complications that would have occurred even when all standards of care had been met. The authors recommend viewing rates across several years in such circumstances.

Table 1: Indicators of Inpatient Quality and Patient Safety used in the Fraser Institute Hospital Report Card: British Columbia 2011

A. Conditions

Death rates

- Acute myocardial infarction (AMI) mortality rate
- Acute myocardial infarction (AMI) mortality rate (without transfers)
- Congestive heart failure (CHF) mortality rate
- Acute stroke mortality rate
- Gastrointestinal hemorrhage mortality rate
- Hip fracture mortality rate
- Pneumonia mortality rate
- Death in low mortality DRG
- Failure to Rescue

Adverse events

- Decubitus ulcer
- Iatrogenic pneumothorax
- Selected infections due to medical care
- Transfusion reaction

B. Procedures

Death rates

- Esophageal resection surgery mortality rate
- Pancreatic resection surgery mortality rate
- Coronary artery bypass graft (CABG) mortality rate
- Craniotomy mortality rate
- Hip replacement mortality rate
- Percutaneous transluminal coronary angioplasty (PTCA) mortality rate
- *Percutaneous transluminal coronary angioplasty (PTCA) mortality rate (Experimental)*
- Carotid endarterectomy mortality rate

Volume of procedures

- Esophageal resection surgery volume
- Pancreatic resection surgery volume
- Coronary artery bypass graft (CABG) volume
- Percutaneous transluminal coronary angioplasty (PTCA) volume
- *Percutaneous transluminal coronary angioplasty (PTCA) volume (Experimental)*
- Carotid endarterectomy volume

Utilization rates

- Laparoscopic cholecystectomy

Adverse events

- Foreign body left during procedure
- Post-operative physiologic and metabolic derangements
- Post-operative respiratory failure
- Post-operative sepsis
- Accidental puncture or laceration

C. Obstetric (birth-related)

Utilization rates

- Cesarean delivery
- Vaginal birth after cesarean (VBAC), uncomplicated
- Primary cesarean delivery
- Vaginal birth after cesarean (VBAC), all

Adverse events

- Birth trauma
- Obstetric trauma-—vaginal with instrument
- Obstetric trauma—vaginal without instrument
- Obstetric trauma—cesarean section

For definitions, see Appendix E.

all documents and results are available at our interactive website <http://www.hospitalreportcards.ca/bc> as well as at <http://www.fraserinstitute.org/report-cards/hospital-performance/overview.aspx>.

How to use the interactive website

While observed rates are provided, the report card focuses on statistical comparisons of risk-adjusted results (where available) for the sake of hospital performance measurement. Where risk-adjusted rates are available, the results are presented as follows:

- those hospitals and municipalities that have performed better on an indicator than the British Columbia average for a selected year are indicated by *blue* cells or bars;
- those hospitals and municipalities that have performed worse on an indicator than the British Columbia average for a selected year are indicated by *red* cells or bars;
- those hospitals and municipalities that have performed no differently from the British Columbia average for a selected year are indicated by *white* cells or bars.[5]

While ranks and scores are calculated for all indicators, it is recommended that these be viewed alongside the performance of all other institutions and municipalities rather than in isolation. Inpatient Quality Indicator (IQI) rates are expressed as rates per 100 patients while Patient Safety Indicator (PSI) rates are expressed per 1,000.

Volume indicators represent counts of admissions in which procedures were performed for which there is evidence that a higher volume is associated with lower mortality. These indicators are not risk-adjusted, and scores are based on providers achieving evidence-supported thresholds. For these indicators, it is recommended that readers focus on the scores presented for both individual hospital or municipality assessments and comparisons of facilities or municipalities (for more information, see Appendix F).

Performances on indicators for which the AHRQ methodology does not provide risk-adjustment (death in low-mortality DRGs, foreign body left during procedure, transfusion reaction, obstetric trauma-cesarean delivery) may be examined by comparing the provider's observed rate to the average for British Columbia.[6] Ranks and scores are provided for these indicators and it is recommended that these be viewed alongside the performance of all other institutions or municipalities rather than in isolation.

5 These comparisons are made using 95% confidence intervals for risk-adjusted mortality rates (for further explanation, see Appendix F).

6 An analysis of the statistical significance of these results has not been provided in this report.

Changes to the Fraser Institute's *Hospital Report Card: British Columbia*

Experimental indicators

In order to provide an alternative measure that may more accurately represent the volume of procedures and mortality rates experienced at institutions for Percutaneous Transluminal Coronary Angioplasties, the report card includes two new experimental indicators this year. IQI EXP 6—Percutaneous Transluminal Coronary Angioplasty volume (Experimental)—and IQI EXP 30—Percutaneous Transluminal Coronary Angioplasty mortality rate (Experimental)—were adapted by the Fraser Institute to include *out-of-hospital* procedures, and attribute rates to the hospitals at which the procedure was performed rather than the acute-care facility at which the patient is registered. For an explanation of the rationale behind this, as well as an examination of how these indicators were calculated, please see "A note on experimental indicators," page 50.

Interventions performed in other facilities during a patient's hospitalization

The Fraser Institute's *Hospital Report Card: British Columbia 2009* refined the method employed to exclude interventions performed outside the hospital.[7] Hence, results before 2006/07 are not strictly comparable to results after.

Limitations, caveats and notes of caution

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 is often required while reviewing the results from this report.

Further, 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.

7 Its predecessor, the *Hospital Report Card: British Columbia 2008* removed all "cases" where an "intervention" was found to be accompanied by an "Out of Hospital Indicator = Y" (this applies to results from 2001/02–2005/06). The *Hospital Report Card: British Columbia 2009* introduced a change such that only the "intervention" accompanied by an "Out of Hospital Indicator = Y" was removed. The patient case (including all other relevant interventions performed) was retained in the database for further processing (this applies to results from 2006/07–2008/09).

While outcomes report cards (see "The four primary types of hospital report cards") provide objective measures of differences in the quality of care, they 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 favour of healthier patients, to skew results upward. This unintended effect can, however, be mitigated through the appropriate application of risk-adjustment in the measures.

Data Quality

The 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, as well as 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., Canadian Institute for Health Information et al., 2007; Aubrey-Bassler et al., 2007).

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" (Choy et al., 2006: 6). However, in order to produce good information about data quality, the CIHI established a comprehensive and systematic data-quality program whose evaluation tool involves 19 characteristics relating to the five data-quality dimensions of accuracy, timeliness, relevance, comparability, and usability (CIHI, 2005a).

A number of publications have addressed data-quality issues in the DAD. Notable among these are the following studies.

1 *The CIHI's data quality studies (2002, 2004b)* These summarize the findings of the CIHI's reabstraction studies that go back to the original patient charts and recode the information using a different set of expert coders.[8] The CIHI's

8 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.

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.

Source: CIHI, 2004b.

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 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: 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). Similarly, the CIHI's 2004 study also noted discrepancy rates related to chart counts, selection of diagnosis typing and code selection in conditions that are diagnosis driven: AMI, stroke, pneumonia, and chronic obstructive pulmonary disorder COPD (CIHI, 2004b).

Overall, according to the 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.

2 *The CIHI's data quality study (2010a)* This summarizes the results of a reabstraction study the CIHI carried out on the data from 2007 to 2008 that was submitted to the DAD. The study notes the following rates of agreement between what was initially coded and what was coded on reabstraction:

- **a** non-clinical data: 92%–100%
- **b** selection of intervention codes (procedure codes): 91%–95%
- **c** selection of significant diagnosis codes: 85%–88%
- **d** selection of most responsible diagnosis: 72%–78%
- **e** typing of co-morbidities: pre-admit: 70%–75%; post-admit: 64%–73%
- **f** diagnosis typing: 79%–82%

Source: CIHI, 2010a.

The report also focused on evaluating the "coding quality of palliative care, strokes, fractures of the hip and femur, acute renal failure in cardiac cases, acute myocardial infarction, obstetrical trauma, birth trauma and pulmonary embolism or deep vein thrombosis" (CIHI, 2010a: 3), and found that "hospitalizations for these health conditions were generally well represented in DAD, though there was a tendency for these health conditions to be under-reported to DAD. The following specific conditions were found to have lower coding quality: unspecified stroke, ST-elevation myocardial infarction (STEMI), non–ST elevation myocardial infarction (NSTEMI), post-admission acute myocardial infarction, birth trauma and post-admission pulmonary embolisms or deep vein thrombosis." (CIHI, 2010a: 54). However, "[t]here were several areas where the coding quality of diagnoses and interventions in DAD improved for the data submitted in 2007–2008, compared to the data submitted in 2005–2006" (CIHI, 2010a: 76). In general, while making note of coding issues, the findings of the CIHI's data quality study of the 2007–2008 discharge abstract database supported the notion that "the DAD data is fit for use with respect to the health conditions studied" (CIHI, 2010a: xi).

The authors of this edition of the Fraser Institute's *Hospital Report Card: British Columbia* also recommend exercising caution when interpreting IQI 15 (Acute Myocardial Infarction Mortality Rate) since they have observed significant variation in the number of patients aged 18 and over

diagnosed with AMI over the years at particular hospitals.[9] Though the variation found in IQI 32 (Acute Myocardial Infarction [without transfers]) was less when compared to IQI 15, the authors also advise caution when interpreting this indicator, especially when trending across years.

Conclusion

The Fraser Institute's *Hospital Report Card: British Columbia 2011* provides a detailed and comprehensive measure of inpatient acute-care conditions in British Columbia's hospitals. This is the third edition of the report card for patients in British Columbia. Three reports for Ontario, and one for Alberta, are already available. We welcome comments on the content and format of this report via: <http://comments@hospitalreportcards.ca>.

9 In addition, one may note that CIHI's data quality study reported that "[e]ighty-three percent of hospitalizations where acute myocardial infarction was documented in the patient chart had the infarction included on the DAD abstract" (2010a: 49).

Background

Hospital report cards are used to measure 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] They are published in order to provide data that can both improve the quality of care in hospitals and inform patients' health care decision-making. This allows for a fact-based discussion of relative levels of quality and eliminates measurement based on anecdotal information.

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, quality, or 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 the quality of care and customer service they received. 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

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

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 favour of healthier patients (to skew results upward). This unintended effect can, however, be mitigated through the appropriate application of risk-adjustment in the measures. These report cards generally provide an empirically sound basis for analysing the quality of care. The Fraser Institute's *Hospital Report Card* is an outcomes-based report card.

4 Balanced scorecards

The balanced scorecard was developed in the early 1990s by Robert Kaplan and David Norton (1992) to examine a business beyond the financial bottom line. Translated into the health care 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 [1] financial performance and conditions; [2] patient/client satisfaction; [3] clinical utilization and outcomes; and, [4] 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 about hospital performance may be overlooked.

Hospital report cards in the United States

The United States was one of the first nations to begin measuring, comparing, and publishing measurements of hospital performance. Hospital report cards 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 more than 4,100 hospitals over three years alongside other measures of hospital performance (Couch et al, 2010). 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 health care 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://health.usnews.com/best-hospitals>

- 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/Home.aspx>
- Quality Check
  <http://www.jointcommission.org/performance_measurement.aspx>
- *Cardiac Surgery in New Jersey*
  <http://www.state.nj.us/health/reportcards.shtml>
- *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>
- *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>.

Hospital report cards in the United Kingdom

The hospital reporting market in the United Kingdom is a fraction of that in the United States. 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.

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

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 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 journalists at the *Sunday Times*, 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.

Hospital report cards in 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 2001, the Ontario Ministry of Health and Long Term Care joined as a sponsor 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. With the addition of investigators over the years, the Hospital Report Research Collaborative was formed (in January 2008 the research activities of the Hospital Report Research Collaborative were assumed by the Health System Performance Research Network), though overall management of the project continues to be based at the University of Toronto. The *Hospital Report* series appears in a "balanced scorecard" format and assesses the performance of hospitals in four quadrants including: [1] financial performance and conditions; [2] patient/client satisfaction; [3] clinical utilization and outcomes; and [4] system integration and change. The report is available online at <http://www.hospitalreport.ca>. 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 the 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 20 years, the Fraser Institute has published *Waiting Your Turn*, Canada's only national, comparable, and comprehensive measurement of wait times for medically necessary elective treatment (see, for example, Barua, Rovere and Skinner, 2010).

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 Canadian hospitals for a fixed fee per facility (Hay Group, 2011).

The CIHI's *Hospital Standardized Mortality Ratio*

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: British Columbia 2011* use data from the CIHI's Discharge Abstract Database, there are several significant differences between the measures published by the CIHI and those published by the Fraser Institute. These differences make comparisons between the two reports difficult and lead to the conclusion that the CIHI and the *Hospital Report Card: British Columbia 2011* 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 the CIHI is the level of detail available. According to the CIHI's report, the *Hospital Standardized Mortality Ratio* is a "big-dot summary measure that is used to track a hospital's mortality over time" (CIHI, 2010b). 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 2).

By comparison, the measures published in *Hospital Report Card: British Columbia 2011* 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 as well as two additional experimental indicators are examined in the Fraser Institute's report.

Further, the *Hospital Standardized Mortality Ratio* 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. (Scoring and ranking is constructed relative to each hospital/municipality. Further, an analysis of performance relative to the provincial average in the same year is also conducted.)

These significant differences in the approaches used by the CIHI's *Hospital Standardized Mortality Ratio* and the Fraser Institute's *Hospital*

3 The number of deaths is computed for the 65 diagnosis groups listed in table 2, accounting for 80% of in-patient mortality.

Table 2: Diagnosis groups used in the CIHI's *Hospital Standardized Mortality Ratio*

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

Source: CIHI 2010c.

Report Card: British Columbia 2011 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 differences in what is being measured in the *Hospital Standardized Mortality Ratio* and the various indicators of *Hospital Report Card: British Columbia 2011*. In addition to these significant differences in approach is a difference in risk-adjustment methodologies: the indicators in *Hospital Report Card: British Columbia 2011* are risk-adjusted using the publicly available 3M™/AHRQ methodology/software and are not risk-adjusted in the manner developed and employed by the CIHI for the *Hospital Standardized Mortality Ratio*.

However, while the two sets of measures cannot be directly compared, it is nevertheless true that the *Hospital Standardized Mortality Ratio* provides a measure of hospital mortality that can be used in conjunction with the measures produced in *Hospital Report Card: British Columbia 2011*.[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.

The measurable impacts of 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 seen in Pennsylvania and New Jersey following the publication of their report cards.[6]

4 Note that the regional results published by the CIHI are based on where patients were treated, while municipal measures published in the *Hospital Report Card: British Columbia 2011* are based on where patients lived.

5 It is worth noting that the 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.

The findings in New York have 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 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).

More recently, a 2010 NBER working paper (Wang et al., 2010) examined Pennsylvania data[8] from 1998 to 2005 and found that, while public reporting led to a decrease in volume for unrated and poor performing surgeons,[9] a statistically significant effect on hospital volume was not found (this contrasts with Cutler's finding above). Finally, in Canada, a paper examining the impact of the Enhanced Feedback for Effective Cardiac Treatment (EFFECT) report cards found that:

> a carefully designed publicly released report card based on high-quality clinical information did not result in a measurable greater [system wide] improvement in 2 composite AMI or CHF process-of-care indicators at the early feedback hospitals in Ontario. However, the EFFECT study data likely stimulated some important local, hospital-specific changes in delivery of care that may have contributed to the better outcomes observed at the early feedback hospitals. (Tu et al., 2009: 2,336)

Notably, a survey completed by CEO's and clinical contacts at each hospital suggested that "a majority of hospitals in the early feedback group undertook

7 "Up-coding" is a term used to describe the practice by a physician or hospital of falsely representing patients' medical conditions in order to increase payment received.

8 The study used Pennsylvania Inpatient Hospital Discharge Data collected by PHC4, Pennsylvania's *Guide to Coronary Artery Bypass Graft Surgery*, the web site of the Pennsylvania Department of State Bureau of Professional and Occupational Affairs, and the American Hospital Association's Annual Survey of Hospitals.

9 Interestingly, the volume of the high performing surgeons did not increase by an offsetting amount.

one or more quality improvement initiatives in response to the publicly released report card" (Tu et al., 2009: 2,336). Though subject to a number of caveats regarding their design and structure, report cards appear to 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 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 examples of accepted and proven methodologies that were not otherwise proprietary information and thus could be employed by the Fraser Institute. 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 US Agency for Healthcare Research & Quality (AHRQ), an agency of the US federal government's Department of Health and Human Services. 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.[10] Although they cannot be used to provide definitive measures of the quality of health care directly, they are used to provide indicators of health care quality and to serve as the basis for subsequent in-depth investigation of issues of quality and patient safety at the facility level.

10 More information about HCUP Quality Indicators can be found at <http://qualityindicators.ahrq.gov/Archive/Default.aspx>.

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.

The four modules of the AHRQ Quality Indicators

1 *Prevention Quality Indicators (PQIs)* Consisting of ambulatory care-sensitive conditions, PQIs report hospital admissions that could have been prevented by 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 the 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 (as well

11 Since Prevention Quality Indicators (PQIs) identify the quality of care for ambulatory care-sensitive conditions and are measures of the overall health care system, they were not used in the Fraser Institute's *Hospital Report Card*, which was designed to analyze the care inside acute-care hospitals.

12 An iatrogenic event is one that is caused by medical examination or treatment.

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/Modules/pdi_overview.aspx>.

as two additional experimental indicators adapted by the Fraser Institute).[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 counterpart is the Canadian Institute for Health Information's Discharge Abstract Database (DAD).

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] Importantly, the AHRQ Quality Indicators were designed to be used in conjunction with 3M™ All Patient Refined™ Diagnosis Related Groups (APR™-DRG) software, which risk-adjusts the indicators 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.

The OECD has also 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 indicators offer broad coverage for studies of in-hospital patient safety and they were developed to measure complications of hospital-based care among a group of patients for whom the complications seemed preventable or highly unlikely.

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.

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).

15 For further details, please refer to Appendix B and <http://solutions.3m.com/wps/portal/3M/en_US/3M_Health_Information_Systems/HIS/Products/APRDRG_Software/>.

Method

All hospital data used in the Fraser Institute's *Hospital Report Card: British Columbia 2011* 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.[1] Only inpatient acute records were used in this report (see Appendix A for the DAD data fields used).

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.[2] 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).[3]

Since more highly 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 performance grading that the hospital would have received if it had provided services to patients with the average mix of medical complications.[4]

1 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. As a result of a decision by British Columbia's Ministry of Health, all of British Columbia's acute-care hospitals are identified in this report.

2 Version 24 was used in order to ensure overall compatibility as later versions contained significant changes.

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

4 The version of the APR™-DRG software that is built into the AHRQ software was used for this report.

The final step in our methodology was to produce separate indicators for hospital performance based on the methodology[5] developed by the Agency for Healthcare Research and Quality's (AHRQ) Evidence-Based Practice Center (EPC) at the University of California San Francisco-Stanford.[6]

Figure 1 shows a graphical representation of the methodology. Inpatient Quality Indicators (IQIs) reflect the quality of care inside hospitals and include mortality rates, the use 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). In addition, the web version of the report card presents an analysis (performed by the Fraser Institute) of statistically significant performance measures based on 95% confidence intervals. 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 score (see Appendix F for details on calculating scores, ranks, and statistical significance of results).[7]

It is important to note that the 39 indicators[8] 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.

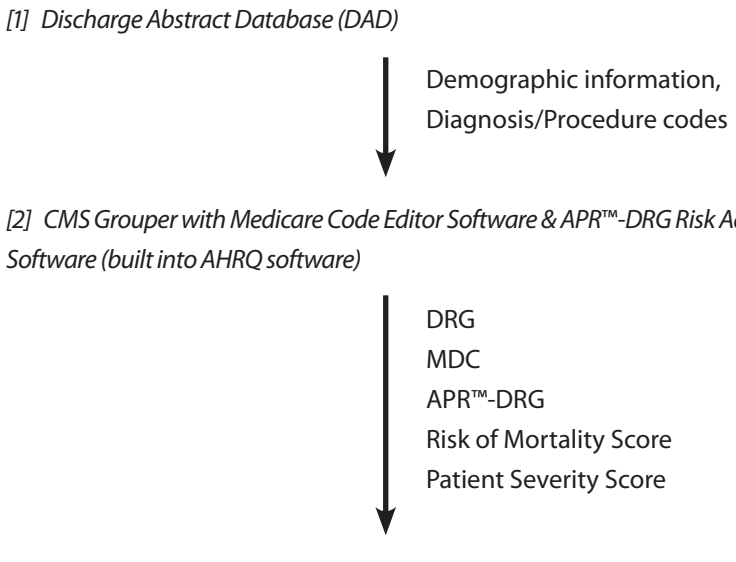
5 Version 3.1 b/apr of AHRQ's Quality Indicators software was used in order to ensure consistency across the *Hospital Report Cards* for British Columbia.

6 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/>.

7 Ranks are not used for comparisons of hospitals across indicators as they are based on a varying number of hospitals. Readers may rely on the scores 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 authors advise that focus be paid primarily to the analysis of statistical significance based on 95% confidence intervals (represented by the blue/white/red coloring of relevant cells/bars) where available, or on the scores for volume of procedure indicators.

8 Two additional indicators, adapted by the Fraser Institute, are also included in this years report. See "A note on Experimental Indicators," page 50.

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



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 not published if the patient population in any given indicator was five or less in any institution or municipality.

Legend for sample data table

Use the sample table (page 28) and the explanations below to help you understand how each indicator is displayed in the downloadable data tables of the *Hospital Report Card*. (Note that, unlike the web-version of the report card, the downloadable data tables do not contain the colour-coded analysis of the statistical significance of the risk-adjusted results. The upper and lower bounds of the intervals for these indicators are provided in separate data tables.)

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 (a raw measure) (file: 1_BC_Observed_Rates_11.xls);
2. a risk-adjusted rate (file: 2a_BC_Risk_Adjusted_Rates_11.xls) including upper (file: 2b_BC_Risk_Adjusted_Lower_Stat_CI_11.xls) and lower (file: 2c_BC_Risk_Adjusted_Upper_Stat_CI_11.xls) 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, and statistical significance of results) (file: 3_BC_Scores_11.xls);
4. a rank (file: 4_BC_Ranks_11.xls).

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 percentage. 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 the CIHI for the period from Fiscal 2001 (April 1, 2001 to March 31, 2002) to Fiscal 2008 (April 1, 2008 to March 31, 2009).

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.

A B C D

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

Hospital	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
Arrow Lakes Hospital	—	—	0.00	—	0.00	—	—	—
Ashcroft & District General Hospital	—	—	—	—	—	—	—	—
B.C. Cancer Agency	—	—	—	—	—	—	—	—
B.C. Children's Hospital	—	—	—	—	—	—	—	—
B.C. Women's Hospital	—	—	—	—	—	—	—	—
Bella Coola General Hospital	—	—	0.00	—	—	—	—	—
Boundary Hospital	16.57	0.00	0.00	0.00	0.00	0.00	0.00	—
Bulkley Valley District Hospital	0.00	0.00	9.79	0.00	13.25	7.48	0.00	0.00
Burnaby Hospital								
Burnaby Mental Health Services Psychiatric In-patient Ur								
Burns Lake and District Hospital								
Campbell River and District General Hospital	0.00	3.77	5.75	8.44	2.64	19.07	6.80	10.60
Cariboo Memorial Hospital	0.00	2.35	4.11	4.38	4.01	0.00	7.46	0.00
Castlegar & District Community Health Centre	0.00	0.00	—	—	—	—	—	—
Chetwynd General Hospital	0.00	—	—	0.00	0.00	—	—	—
Chilliwack General Hospital	10.55	5.95	1.20	1.33	2.79	7.74	7.72	2.08
Cormorant Island Health Centre	—	0.00	—	—	—	—	—	0.00
Cowichan District Hospital	10.01	8.69	5.01	5.28	4.77	2.37	4.92	11.37
Creston Valley Hospital	0.00	29.16	0.00	0.00	27.72	0.00	0.00	9.30
Dawson Creek and District Hospital	13.74	12.22	7.22	0.00	0.00	0.00	0.00	22.86
	5.56	7.15		0.00	0.00	15.64	0.00	
	4.49				4.35	3.67	3.97	
Care Centre	3.69					10.40		
						5.06		
Saint Mary's Hos								
Shuswap Lake General Hospital			14.42					13.93
Slocan Community Health Centre		—	—	—				—
South Okanagan General Hospital	0.00	18.30	0.00	7.62	19.1		0.00	15.72
Sparwood Health Centre	—	—	—	—	—		—	—
Squamish General Hospital	0.00	0.00	0.00	0.00	12.18	0.00	0.00	0.00
St. Bartholomew's Health and Healing Centre	—	—	—	—	—	—	—	—
St. John Hospital	0.00	0.00	0.00	0.00	36.21	0.00	0.00	0.00
St. Joseph's General Hospital	2.27	5.30	3.95	4.25	3.56	13.79	9.47	7.04
St. Mary's Hospital	0.00	0.00	4.95	0.00	10.42	0.00	0.00	0.00
St. Paul's Hospital	7.13	4.07	2.24	5.13	4.25	6.69	1.61	3.95
St. Vincent's Hospital	15.37	—	—	—	—	—	—	—
Stewart General Hospital	—	—	—	—	—	—	—	—
Stuart Lake Hospital	0.00	—	—	—	0.00	0.00	—	—
Summerland Health Centre	0.00	—	—	—	—	—	—	—
Surrey Memorial Hospital	10.28	3.63	3.86	3.88	2.32	5.47	5.49	5.79
Tofino General Hospital	83.96	—	0.00	—	—	—	—	—
UBC Health Sciences Centre	4.77	1.29	34.34	3.63	0.00	2.28	0.00	—
Vancouver General Hospital	3.35	5.92	4.08	5.74	4.96	3.29	4.91	5.46
Vernon Jubilee Hospital	6.15	5.17	2.96	4.03	5.75	1.18	2.43	3.97
Victoria General Hospital	3.55	4.77	3.39	2.34	3.73	5.61	4.93	4.53
Victorian Community Health Centre of Kaslo	—	—	—	—	—	—	—	—
West Coast General Hospital	0.00	9.36	2.90	7.36	4.23	43.60	0.00	4.16
Wrinch Memorial Hospital	0.00	0.00	0.00	23.62	0.00	0.00	27.01	14.23
British Columbia	**5.60**	**5.11**	**4.41**	**4.48**	**4.51**	**5.89**	**5.29**	**5.54**

E

F

G

"—" indicates either no data were available for that fac 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 ≤ 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 the 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 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 Sex 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 Code identifying the level of care provided by the facility from which the patient was transferred to the acute-care institution, where

0 = Organized Outpatient Department of Reporting Facility
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
B = Private Clinic
E = Emergency Room
N = Ambulatory Care

Institution to type Code identifying the level of care of the facility to which the patient was transferred. See *Institution from type*.

Admission category Type of admission to the facility, where
U = Emergent/Urgent
L = Elective
N = Newborn (born in reporting hospital or outside reporting facility and admitted within first 24 hours of life)
S = Stillbirth (in the reporting hospital)
R = Cadaver (admitted for organ/tissue retrieval).

Discharge disposition Disposition of Patient, i.e. whether the patient died while in the facility, where
01 = Transferred to another facility providing inpatient hospital care (includes other acute, sub-acute, psychiatric, rehabilitation, cancer centre/agency, pediatric hospital, etc.)
02 = Transferred to a long-term care facility (personal care homes, auxiliary care, nursing homes, extended care, homes for the aged, senior's homes, DVA homes, etc.)
03 = Transferred to other (palliative care/hospice, addiction treatment centre, etc.)
04 = Discharged to a home setting with support services (senior's lodge, attendant care, home care, meals on wheels, homemaking, supportive housing, etc.)
05 = Discharged home
06 = Signed out (against medical advice)
07 = Died
08 = Cadaver (admitted for organ/tissue retrieval)
09 = Stillbirth
10 = Newborn and pediatric discharges to Child & Family Services (for use by Manitoba only)
11 = Private Adoption (for use by Manitoba only).

Entry code Method of admission to the facility, where
E = Emergency Department from the reporting hospital
D = Direct

N = Newborn (born alive in the reporting hospital)
S = Stillborn (in the 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 Code denoting a cancelled procedure.[3]

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

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

1 For further details on ICD-10-CA, see <http://www.cihi.ca/CIHI-ext-portal/internet/en/document/standards+and+data+submission/standards/classification+and+coding/codingclass_icd10>.
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[1] and 3M™ APR™-DRG Classification System software, the DAD dataset received from the CIHI required several standard modifications to account for differences between 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 (Fraser Institute)	Description of variable required by the software	Value description	DAD Data Element or Comment
Name	Patient name	*Alphanumeric*	This information is not contained in the DAD used by the Fraser Institute. Left blank.
Mednumb	Medical record number	*Alphanumeric*	This information is not contained in the DAD used by the Fraser Institute. Left blank.
Accnumb	Account number	*Alphanumeric*	This information is not contained in the DAD used by the Fraser Institute. Left blank.
Admission_ date	Date of admission Used in age and length of stay (LOS) calculation	*Numeric* mm/dd/yyyy format	Date of Admission was taken directly from DAD. Format changed from yyyymmdd.
Discharge_ date	Date of discharge Used for LOS calculation	*Numeric* mm/dd/yyyy format	Date of Discharge was taken directly from DAD. Format changed from yyyymmdd.

1 Version 24 was used for this report in order to retain consistency and compatibility. As of 2007, beginning with version 25 (now called MS-DRG), the groups have been resequenced.

Variable name (Fraser Institute)	Description of variable required by the software	Value description	DAD Data Element or Comment
Discharge_ status	Discharge status	*Numeric* 2 = Discharged to short term hospital 5 = Discharged to other facility 20 = Patient died	Three DAD fields were combined to create the "Discharge status" field. Patients discharged to a short-term hospital were extracted from the DAD by combining the fields "Institution from type" and "Institution to type" (see Appendix A for further details). NB: All patients who died in hospital were extracted from DAD field "Discharge Disposition" = 07 (died). All records not classified as being discharged to a short-term hospital or that died in hospital were classified as "other".
Prim	Expected primary payer.	*Primary pay source* 01 = Medicare 02 = Medicaid 03 = Title V 04 = Other Government 05 = Work Comp 06 = Blue Cross 07 = Insur Company 08 = Self Pay 09 = Other 10 = No Charge	Due to differences in the Canadian health care system, the DAD does not contain this information.
LOS	Calculated Length of stay overrides entered Length of stay	*Numeric* (Days)	Field left blank; calculated by the software using "Admit date" and "Discharge date".
Birth	Date of birth	*Numeric* mm/dd/yyyy format	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.
Age_B	Age in years at admission	*Numeric* Age in years	See Appendix I for details
Gender	Sex of patient	*Numeric* 1 = Male 2 = Female	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.
Admit	Admit diagnosis	*ICD-9-CM diagnosis code without decimal* All blanks if no value is entered.	Left blank.

Variable name (Fraser Institute)	Description of variable required by the software	Value description	DAD Data Element or Comment
Diag_ code_1A – Diag_ code_25A	ICD-9-CM diagnosis codes: principal diagnosis followed by 24 fields for secondary diagnoses	*String*	All Diagnosis codes contained in the DAD were converted to ICD-9-CM. Please refer to Appendix J for further explanation on classification conversions.
Interv_cci_ code_1A – Interv_cci_ code_20A	ICD-9-CM procedure codes: principal procedure followed by 19 secondary procedures.	*String*	All Procedure codes contained in the DAD were converted to ICD-9-CM. 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 the CIHI

In order to use AHRQ's IQI and PSI modules, the original DAD dataset received from the CIHI required several standard modifications to account for differences between 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 (Fraser Institute)	Description of variable required by the software	Value description	DAD Data Element or Comment
Key	Unique case identifier.	*Numeric*	Each record analyzed was given a unique case identifier number.
Age_B	Patient's age in years at admission.	*Numeric* Age in years	See Appendix I for details.
Age_a	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* 1 = White 2 = Black 3 = Hispanic 4 = Asian/Pacific Island 5 = Native American 6 = Other	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 (Fraser Institute)	Description of variable required by the software	Value description	DAD Data Element or Comment
Gender	Patient's sex	*Numeric* 1 = Male 2 = Female	DAD codes: Male = M, Female = F. These values were recoded to Male = 1 and Female = 2. All other values of "Other" and "Undifferentiated" were omitted from all analysis.
Prim	Expected primary payer	*Numeric* 1 = Medicare 2 = Medicaid 3 = Private, incl. HMO 4 = Self-pay 5 = No charge 6 = Other	Due to differences in the Canadian health care system, the DAD does not contain this information. Accordingly, all patient records were set to "6" (Other).
Muni	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.
Inst_Code	Data source hospital ID	*Numeric* Hospital identification number	Institution Number as described by CIHI. No changes were made to this field.
Discharge disposition	Patient's disposition.	*Numeric* 1 = Routine 2 = Short-term hospital 3 = Skilled nursing facility 4 = Intermediate care 5 = Another type of facility 6 = Home health care 7 = Against medical advice 20 = Died in the hospital	Three DAD fields were combined to create the "Discharge status" field. Patients discharged to a short term hospital were extracted from the DAD by combining the fields "Institution from type" and "Institution to type" (see Appendix A for further details). NB: All patients who died in-hospital were extracted from DAD field "Discharge Disposition" = 07 (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* 1 = Emergency 2 = Urgent 3 = Elective 4 = Newborn 5 = Delivery ('88–'97) = Not used ('98–'02) = Trauma Center ('03–) 6 = Other	Please see Appendix C, 2A for further details.

Variable name (Fraser Institute)	Description of variable required by the software	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.
LOS2	Length of Stay.	*Numeric*	Information taken from DAD fields "Admission Date" and "Discharge Date".
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. The MDC (Major Diagnostic Category) is determined automatically from DRG.
Diag_ code_1A - Diag_ code_25A	ICD-9-CM diagnoses diagnosis codes. Diagnosis 1A is the principal diagnosis, Diagnosis 2A to Diagnosis 25A are secondary diagnoses.	*String, 3, 4, or 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.
Interv_cci_ code_1A - Interv_cci_ code_20A	ICD-9-CM procedure codes. Interv_cci_code_1A is the principal procedure, Interv_ cci_code_2A to Interv_cci_code_20A are secondary procedures.	*String, 2, 3, or 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.
VPR1 –VPR20	Days from admission to procedure. Interv_cci_code_1A is the principal procedure, Interv_ cci_code_2A to Interv_cci_code_20A are secondary procedures.	*Numeric*	Some PSIs require this field for calculating a given indicator.

Variable name (Fraser Institute)	Description of variable required by the software	Value description	DAD Data Element or Comment
Weight	Birthweight for newborns.	*Numeric*	Option data element that is passed directly to the APR™ DRG Grouper. This field is not used for pediatric birthweight categories. This information was taken directly from the DAD field "Weight". (ICD-9-CM diagnosis codes can be used to indicate birthweight).
Discharge_ date_c	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 2001/02 to 2008/09), this optional data field was created to exclude this code from all years of data analysed for IQI 17.
Discharge_ date_b	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
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
0 = Organized Outpatient Department of Reporting Facility	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.

Appendix D
Hospital identification

All of British Columbia's 95 acute-care hospitals are identified by name in this report. The following table describes whether and how each hospital submitted DAD data in a given year, where:

Y = Hospital submitted DAD data.
W = Submits data with another institution
— = no data submitted.

Name of hospital	2001 /02	2002 /03	2003 /04	2004 /05	2005 /06	2006 /07	2007 /08	2008 /09
Arrow Lakes Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Ashcroft & District General Hospital	Y	Y	—	—	—	—	—	—
BC Cancer Agency	Y	Y	Y	Y	Y	Y	Y	Y
BC Children's Hospital	Y	Y	Y	Y	Y	Y	Y	Y
B.C. Women's Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Bella Coola General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Boundary Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Bulkley Valley District Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Burnaby Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Burnaby Mental Health Ser. Psychiatric In-patient Unit	Y	Y	—	—	—	—	—	—
Burns Lake and District Hospital (Lakes District Hospital and Health Centre)	Y	Y	Y	Y	Y	Y	Y	Y
Campbell River and District General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Cariboo Memorial Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Castlegar & District Community Health Centre	Y	Y	—	—	—	—	—	—
Chetwynd General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Chilliwack General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Cormorant Island Health Centre	Y	Y	Y	Y	Y	Y	Y	Y
Cowichan District Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Creston Valley Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Dawson Creek and District Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Delta Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Dr. Helmcken Memorial Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Eagle Ridge Hospital	Y	Y	Y	Y	Y	Y	Y	Y
East Kootenay Regional Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Elk Valley Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Enderby and District Memorial	Y	—	—	—	—	—	—	—

Name of hospital	2001 /02	2002 /03	2003 /04	2004 /05	2005 /06	2006 /07	2007 /08	2008 /09
Fort Nelson General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Fort St. John General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Fraser Canyon Hospital	Y	Y	Y	Y	Y	Y	Y	Y
G.R. Baker Memorial Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Golden and District Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Invermere and District Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Kelowna General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Kimberley and District Hospital	Y	Y	—	—	—	—	—	—
Kitimat General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Kootenay Boundary Regional Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Kootenay Lake Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Lady Minto / Gulf Islands Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Ladysmith Community Health Centre	Y	Y	Y	Y	Y	Y	Y	—
Langley Memorial Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Lillooet Hospital and Health Centre	Y	Y	Y	Y	Y	Y	Y	Y
Lions Gate Hospital	Y	Y	Y	Y	Y	Y	Y	Y
MacKenzie and District Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Masset Hospital (Northern Haida Gwaii Hospital and Health Centre)	—	—	—	Y	Y	Y	Y	Y
Matsqui-Sumas-Abbotsford General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
McBride and District Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Mills Memorial Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Mission Memorial Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Mount Saint Joseph Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Nanaimo Regional General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Nicola Valley Health Centre	Y	Y	Y	Y	Y	Y	Y	Y
One Hundred Mile District General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Peace Arch District Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Penticton Regional Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Port Alice Hospital	Y	Y	—	—	—	—	—	—
Port Hardy Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Port McNeill and District Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Powell River General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Prince George Regional Hospital (The University Hospital of Northern British Columbia)	Y	Y	Y	Y	Y	Y	Y	Y
Prince Rupert Regional Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Princeton General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Queen Alexandra Centre for Children's Health	Y	Y	Y	Y	Y	Y	Y	Y
Queen Charlotte Islands General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Queen Victoria Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Queen's Park Hospital	—	Y	Y	Y	Y	Y	Y	Y

Name of hospital	2001 /02	2002 /03	2003 /04	2004 /05	2005 /06	2006 /07	2007 /08	2008 /09
R.W. Large Memorial Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Richmond Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Ridge Meadows Hospital and Health Care Centre	Y	Y	Y	Y	Y	Y	Y	Y
Royal Columbian Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Royal Inland Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Royal Jubilee Hospital	W	W	W	W	W	W	W	W
Saanich Peninsula Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Saint Mary's Hospital (New Westminster)	Y	Y	Y	—	—	—	—	—
Shuswap Lake General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Slocan Community Health Centre	Y	—	—	—	—	—	—	—
South Okanagan General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Sparwood Health Centre	Y	Y	—	—	—	—	—	—
Squamish General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
St. Bartholomew's Health and Healing Centre	Y	Y	—	—	—	—	—	—
St. John Hospital	Y	Y	Y	Y	Y	Y	Y	Y
St. Joseph's General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
St. Mary's Hospital	Y	Y	Y	Y	Y	Y	Y	Y
St. Paul's Hospital	Y	Y	Y	Y	Y	Y	Y	Y
St. Vincent's Hospital	Y	Y	Y	—	—	—	—	—
Stewart General Hospital	Y	Y	Y	Y	Y	Y	—	—
Stuart Lake Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Summerland Health Centre	Y	Y	—	—	—	—	—	—
Surrey Memorial Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Tofino General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
UBC Health Sciences Centre	Y	Y	Y	Y	Y	Y	Y	Y
Vancouver General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Vernon Jubilee Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Victoria General Hospital	W	W	W	W	W	W	W	W
Victorian Community Health Centre of Kaslo	Y	Y	—	—	—	—	—	—
West Coast General Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Wrinch Memorial Hospital	Y	Y	Y	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*, and *Hospital Report Card: British Columbia 2011*. 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 who are considered unlikely to die in the hospital. Lower rates are more desirable.

9 *Failure to Rescue (PSI 4)* Deaths in patients who 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.

6a[1] *Percutaneous transluminal coronary angioplasty (PTCA) mortality rate (Experimental) (IQI EXP 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. This experimental indicator includes "out of hospital" procedures, and attributes numbers to the hospital at which the procedure was performed.

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 Volumes of Procedures and their Thresholds.

1 Note that this is an experimental indicator adapted by the Fraser Institute. See "A note on experimental indicators" at the end of this section for more details.

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.

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.

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.

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.

4a[2] *Percutaneous transluminal coronary angioplasty (PTCA) volume (Experimental) (IQI EXP 6)* Number of procedures performed to open blockages in the arteries that carry blood to the heart. Numbers above 200 are more desirable. This experimental indicator includes "out of hospital" procedures, and attributes numbers to the hospital at which the procedure was performed.

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.

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 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.

2 Note that this is an experimental indicator adapted by the Fraser Institute. See "A note on experimental indicators" at the end of this section for more details.

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.

A note on experimental indicators

The AHRQ IQI indicators are designed to be used with hospital *inpatient* discharge data. In response to feedback received, the authors examined and confirmed that many Percutaneous Transluminal Coronary Angioplasties (PTCAs) are transferred and performed *out of hospital* in British Columbia, often as day surgeries. This may have resulted in seemingly low levels of patients or procedures being counted for IQI 6 (Percutaneous Transluminal Coronary Angioplasty volume) and IQI 30 (Percutaneous Transluminal Coronary Angioplasty mortality rate) at hospitals to which these cases were transferred.

In order to provide an alternative measure that may more accurately represent the volume of procedures and mortality rates experienced at institutions, the *Hospital Report Card: British Columbia 2011* includes two new experimental indicators this year. IQI EXP 6 and IQI EXP 30 (as noted above) include out-of-hospital procedures, and attribute rates to the hospitals at which the procedure was performed rather than the acute-care facility at which the patient is registered.

In order to adapt these indicators, our methodology for processing the DAD was altered in the following ways (in a separate analysis). First, we did not remove interventions accompanied by an "Out of Hospital Indicator = Y." Next, we examined the day surgery institution at which the procedure was performed, mapped it to its corresponding acute-care facility, and then used this identifier number to replace the number identifying the acute care facility at which the patient was previously registered. The remaining methodology for the report remained identical.

Appendix F
Calculating the scores, ranks, and statistical significance of results

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 varies 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, M.G., C.U. Corvera, R.E. Glasgow, et al. (1998). A Hospital's Annual Rate of Esophagectomy Influences the Operative Mortality Rate. *J Gastrointest Surg* 2, 2: 186–92.	Dudley, R.A., K.L. Johansen, R. Rand, et al. (2000). Selective Referral to High-Volume Hospitals: Estimating Potentially Avoidable Deaths. *JAMA* 283, 9: 1159–66.
Pancreatic resection (IQI 2)	10	11	Glasgow, R.D., and S.J. Mulvihill (1996). Hospital Volume Influences Outcome in Patients Undergoing Pancreatic Resection for Cancer. *West J Med* 165, 5: 294–300.	Glasgow and 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, K.A., R.A. Guyton, R. Davidoff, et al. (1999). 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* 34, 4: 1262–347.	Hannan, E.L., H. Kilburn, Jr., H. Bernard, et al. (1991). Coronary Artery Bypass Surgery: The Relationship between Inhospital Mortality Rate and Surgical Volume after Controlling for Clinical Risk Factors. *Med Care* 29, 11: 1094–107.
Percutaneous Transluminal Coronary Angioplasty (IQI 6)	200	400	Ryan, T.J., W.B. Bauman, J.W. Kennedy, et al. (1993). 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* 88, 6: 2987–3007.	Hannan, E.L., M. Racz, T.J. Ryan, et al. (1997). Coronary Angioplasty Volume-Outcome Relationships for Hospitals and Cardiologists. *JAMA* 277, 11: 892–98.
Carotid endarterectomy (IQI 7)	50	101	Manheim, L.M., M.W. Sohn, J. Feinglass, et al. (1998). Hospital Vascular Surgery Volume and Procedure Mortality Rates in California, 1982–1994. *J Vasc Surg* 28, 1: 45–46.	Hannan, E.L., A.J. Popp, B. Tranmer, et al. (1998). Relationship between Provider Volume and Mortality for Carotid Endarterectomies in New York State. *Stroke* 29, 11: 2292–97. Dudley, R.A., K.L. Johansen, R. Brand, et al. (2000). Selective Referral to High-Volume Hospitals: Estimating Potentially Avoidable Deaths. *JAMA* 283, 9: 1159–66.

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

All other indicators

The scores for all other indicators, on a scale of 0 to 100, reflect the relative positions of risk-adjusted rates where available, or 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 Statistical significance of measures

In order to determine the reliability of indicator results, the report card compares the upper and lower bounds of the 95% confidence interval of each institution's and municipality's risk-adjusted rate (where available) to the upper and lower bounds of the 95% confidence interval (CI) of the province's risk-adjusted rate (per indicator). This analysis measures the statistical significance of each result. Institutions and municipalities whose upper-bound risk-adjusted confidence interval lies below the lower bound of the British Columbia risk-adjusted confidence interval are statistically "better than average" for indicators where lower rates are better. Institutions and municipalities whose lower-bound risk-adjusted confidence interval lies above the upper bound of the British Columbia risk-adjusted confidence interval are statistically "worse than average" for indicators where lower rates are better. For IQIs 22, 23, and 34, where higher rates are better, the opposite is true.

This analysis is presented in the interactive web-based tool at <www.hospitalreportcards.ca/bc> through colour coding, where blue colour coding signifies a statistically significant better-than-average performance, white colour coding signifies a performance that is not statistically significantly different from the average, and red colour coding signifies a performance that is statistically significantly worse than the average performance.

The authors recognize that this is a conservative analysis of statistical significance. Though it is always true that, if the confidence intervals do not overlap then the statistics will be statistically significantly different, the opposite does not hold. That is, it is possible for confidence intervals to overlap even though the statistics are statistically significantly different (Knezevic, 2008).

1 Volume indicators were not ranked since they have threshold requirements.

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 respectively. 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 as shown in the table below into corresponding municipalities as described by Canada Post in 2006/07.[1] The same grouping was used in this year's report.

Municipality	Forward Sortation Areas (FSAs)
Abbotsford	V2S, V2T, V3G, V4X
Burnaby	V5A, V5B, V5C, V5G, V5H, V5J
Campbell River	V9H, V9W
Castlegar	V1N
Central Saanich	V8M
Chilliwack	V2P, V2R, V4Z
Coquitlam	V3J, V3K
Courtenay	V9J, V9M, V9N
Cranbrook	V1C
Dawson	V1G
Delta	V4C, V4E, V4G, V4K, V4L, V4M
Duncan	V9L
Fort St John	V1J
Kamloops	V1S, V2B, V2C, V2E, V2H
Kelowna	V1P, V1V, V1W, V1X, V1Y, V1Z, V4T
Kitimat	V8C
Ladysmith	V9G
Lake Country	V4V
Langley	V2Y, V2Z, V2A, V4W
Maple Ridge	V2W, V2X, V3Y, V4R

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)
Merritt	V1K
Mission	V2V, V4S
Nanaimo	V9R, V9S, V9T, V9V, V9X
Nelson	V1L
New Westminster	V3L, V3M, V3N, V5E
Parksville	V9P
Penticton	V2A
Port Alberni	V9Y
Port Coquitlam	V3B, V3C, V3E
Port Moody	V3H
Powell River	V8A
Prince George	V2K, V2L, V2M, V2N
Prince Rupert	V8J
Qualicum	V9K
Quesnel	V2G
Richmond	V6V, V6W, V6X, V6Y, V7A, V7B, V7C, V7E
Salmon Arm	V1E
Salt Spring	V8K
Sidney	V8L
Squamish	V8B
Surrey	V1M, V3R, V3S, V3T, V3V, V3W, V3X, V4N
Terrace	V8G
Trail	V1R
Vancouver	V5K, V5L, V5M, V5N, V5P, V5R, V5S, V5T, V5V, V5W, V5X, V5Y, V5Z, V6A, V6B, V6C, V6E, V6G, V6H, V6J, V6K, V6L, V6M, V6N, V6P, V6R, V6S, V6T, V6Z, V7G, V7H, V7J, V7K, V7L, V7M, V7N, V7P, V7R, V7S, V7T, V7V, V7W, V7X, V7Y
Vernon	V1B, V1H, V1T
Victoria	V8N, V8P, V8R, V8S, V8T, V8V, V8W, V8X, V8Y, V8Z, V9A, V9B, V9C, V9E
White Rock	V4A, V4B, V4P
Whitehorse	Y1A
Williams Lake	V2G
Yellowknife	X1A

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 expressed in years. Patient is 2 or more years old.
- **b** E = age is estimated in years. Patient who is less than 1 with a Birth Date that is estimated is recorded as E000. Patient who is between 1 and 2 years old with a Birth Date that is Estimated is recorded as E001.
- **c** M = age expressed in months. Patient is less than 2 years old.
- **d** D = age expressed in days. Patient is less than 31 days old.
- **e** B = age recorded for Newborns/Stillborns.
- **f** U = age unknown.

2 *Age units* Denotes the age of patient at time of admission.
- **a** *i* bNB = Newborn
  - *ii* bSB = Stillbirth
  - *iii* bbU = Patient's age is 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: The DAD fields "Entry code" = "S" and "Entry code" = "N" were used to separate stillbirths from newborns. Stillbirths were omitted from analysis.

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

Age in years Age of the patient. Valid values: 0–124 years. Age can be an entered or a calculated value. The birth and admit dates are used to calculate the age of the patient; calculated age overrides entered age. Birth date must be ≤ admit date.[1]

In order to accommodate the differences in how the age of a patient is captured in the DAD, the two DAD fields ("Age code" and "Age Units") were split into the required the equivalent of "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 "Admission Category = N" were defined as "Age in days" = 0 (after removing stillbirths denoted by "S" in the "Entry code" field from analysis).

C Age Requirements for AHRQ IQI and PSI modules

Age Age in years at admission

Age in Days Patients less than one year are placed in the "Age in days" category. Valid values 0–364. (See explanation above for modifications applied).

1 While the CMS grouper software contains certain rules for the calculation of age dependent on a birth date, the DAD provided to us does not report the birth date of a patient, and hence these rules do not specifically apply.

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 the 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 2001 in British Columbia), many Canadian hospitals were using ICD-9-CM. This being so, the 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 necessarily an imperfect process as a result of changes in the way many diseases and conditions are handled, the CIHI assigns grades to describe the quality of each conversion, where:

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

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.
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" decision was made, i.e. most probably to default to "other specified" category.
3 = Poor match. This represents a force fit. There is no specific code available: for example, the ICD-10-CA code may represent a new concept that was not available in the previous classification.

Sources: CIHI 2003, 2004c, 2005b, 2006, 2008

Two of the ICD-10-CA/CCI codes analysed by the AHRQ IQI & PSI indicators are classified as a "3" conversion:

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 the 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 the 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 and 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 the 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 2001, health care services in British Columbia have been managed and delivered by five regional health authorities and a Provincial Health Services Authority (British Columbia, Ministry of Health Services, 2011a). A list of hospitals in British Columbia, segmented by the authority that governs them, is provided below using information from the British Columbia, Ministry of Health Services website (2011b).[1]

Fraser Health Authority

CITY	HOSPITAL
Abbotsford	Abbotsford Regional Hospital and Cancer Centre
Abbotsford	Matsqui-Sumas-Abbotsford General Hospital
Burnaby	Burnaby Hospital
Burnaby	Fellburn Hospital
Chilliwack	Chilliwack General Hospital
Delta	Delta Hospital
Hope	Fraser Canyon Hospital
Langley	Langley Memorial Hospital
Maple Ridge	Ridge Meadows Hospital and Health Care Centre
Mission	Mission Memorial Hospital
New Westminster	Queen's Park Hospital
New Westminster	Royal Columbian Hospital
Port Moody	Eagle Ridge Hospital & Health Care Centre
Surrey	Surrey Memorial Hospital
White Rock	Peace Arch District Hospital

1 Hospitals managed by two "societies", as per address information, are also listed.

Interior Health Authority

CITY	HOSPITAL
100 Mile House	100 Mile District General Hospital
Alexis Creek	Red Cross Outpost Nursing Station, Alexis Creek
Armstrong	Pleasant Valley Health Centre
Ashcroft	Ashcroft & District General Hospital
Barriere	Barriere and District Health Centre
Blue River	Red Cross Outpost Nursing Station, Blue River
Castlegar	Castlegar & District Community Health Centre
Chase	Chase and District Health Centre
Clearwater	Dr. Helmcken Memorial Hospital
Cranbrook	East Kootenay Regional Hospital
Creston	Creston Valley Hospital
Edgewood	Red Cross Outpost Nursing Station, Edgewood
Elkford	Elkford and District Diagnostic and Treatment Centre
Fernie	Elk Valley Hospital
Golden	Golden and District General Hospital
Grand Forks	Boundary Hospital
Invermere	Invermere and District Hospital
Kamloops	Overlander Extended Care Hospital
Kamloops	Royal Inland Hospital
Kaslo	Victorian Community Health Centre of Kaslo
Kelowna	Kelowna General Hospital
Keremeos	South Similkameen Health Centre
Lillooet	Lillooet Hospital and Health Centre
Logan Lake	Logan Lake Health Centre
Lytton	St. Bartholomew's Hospital
Merritt	Nicola Valley Health Centre
Nakusp	Arrow Lakes Hospital

CITY	HOSPITAL
Nelson	Kootenay Lake Hospital
New Denver	Slocan Community Health Centre
Oliver	South Okanagan General Hospital
Penticton	Penticton Regional Hospital
Princeton	Princeton General Hospital
Revelstoke	Queen Victoria Hospital
Salmon Arm	Shuswap Lake General Hospital
Sparwood	Sparwood Health Centre
Summerland	Summerland Memorial Health Centre
Trail	Kootenay Boundary Regional Hospital
Vernon	Vernon Jubilee Hospital
Williams Lake	Cariboo Memorial Hospital

Northern Health Authority

CITY	HOSPITAL
Atlin	Atlin Health Centre
Burns Lake	Lakes District Hospital and Health Centre
Chetwynd	Chetwynd General Hospital
Dawson Creek	Dawson Creek and District Hospital
Dease Lake	Stikine Regional Health Centre
Fort Nelson	Fort Nelson General Hospital
Fort St James	Stuart Lake Hospital
Fort St John	Fort St. John General Hospital
Fort St. John	Peace Lutheran Extended Care Centre
Fraser Lake	Fraser Lake Diagnostic and Treatment Centre
Houston	Houston Health Centre
Hudson's Hope	Hudson's Hope Gething Diagnostic and Treatment Centre

CITY	HOSPITAL
Kitimat	Kitimat General Hospital
Mackenzie	Mackenzie and District Hospital
Masset	Northern Haida Gwaii Hospital and Health Centre
Mcbride	McBride and District Hospital
Pouce Coupe	Pouce Coupe Care Home
Prince George	The University Hospital of Northern British Columbia
Prince Rupert	Prince Rupert Regional Hospital
Quesnel	G.R. Baker Memorial Hospital
Smithers	Bulkley Valley District Hospital
Stewart	Stewart General Hospital
Terrace	Mills Memorial Hospital
Tumbler Ridge	Tumbler Ridge Health Care Centre
Ueen Charlotte	Queen Charlotte Islands General Hospital
Valemount	Valemount Health Centre
Vanderhoof	St. John Hospital

Vancouver Coastal Health Authority

CITY	HOSPITAL
North Vancouver	Lions Gate Hospital
Pemberton	Pemberton and District Health Centre
Powell River	Powell River General Hospital
Richmond	The Richmond Hospital
Sechelt	St. Mary's Hospital
Squamish	Squamish General Hospital
Vancouver	G.F. Strong Centre
Vancouver	George Pearson Centre
Vancouver	Mary Pack Arthritis Centre

CITY	HOSPITAL
Vancouver	UBC Health Sciences Centre Hospital
Vancouver	Vancouver General Hospital
Whistler	Whistler Diagnostic and Treatment Centre

Vancouver Island Health Authority

CITY	HOSPITAL
Alert Bay	Cormorant Island Community Health Centre
Bamfield	Red Cross Outpost Nursing Station, Bamfield
Campbell River	Campbell River & District General Hospital
Chemainus	Chemainus Health Care Centre
Comox	St. Joseph's General Hospital
Duncan	Cowichan District Hospital
Gold River	Gold River Health Clinic
Kyuquot	Red Cross Outpost Nursing Station, Kyuquot
Ladysmith	Ladysmith Community Health Centre
Nanaimo	Nanaimo Regional General Hospital
Parksville	Trillium Lodge
Port Alberni	West Coast General Hospital
Port Alice	Port Alice Hospital
Port Hardy	Port Hardy Hospital
Port Mcneill	Port McNeill and District Hospital
Qualicum Beach	Eagle Park Health Care Facility
Saanichton	Saanich Peninsula Hospital
Salt Spring Island	The Lady Minto Gulf Islands Hospital
Tahsis	Tahsis Health Centre
Tofino	Tofino General Hospital
Victoria	Juan de Fuca Hospitals (Aberdeen, Glengarry, Mt. Tolmie, Priory)

CITY	HOSPITAL
Victoria	Queen Alexandra Centre for Children's Health
Victoria	Royal Jubilee Hospital
Victoria	The Gorge Road Hospital
Victoria	Victoria General Hospital

Provincial Health Services Authority

CITY	HOSPITAL
Coquitlam	Riverview Hospital
Vancouver	British Columbia Cancer Agency
Vancouver	British Columbia's Children's Hospital
Vancouver	British Columbia's Women's Hospital and Health Centre
Vancouver	Sunny Hill Health Centre for Children

United Church Health Services Society

CITY	HOSPITAL
Bella Bella	R.W. Large Memorial Hospital
Bella Coola	Bella Coola General Hospital
Hazelton	Wrinch Memorial Hospital

Providence Health Care Society

CITY	HOSPITAL
Vancouver	Brock Fahrni Pavilion
Vancouver	Holy Family Hospital
Vancouver	Mount Saint Joseph Hospital
Vancouver	St. Paul's Hospital
Vancouver	St. Vincent's Hospital

Frequently Asked Questions

FAQ 1 *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. The Fraser Institute's *Hospital Report Card* is published 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, the report compares the upper and lower bounds of the 95% confidence interval of each institution's and municipality's risk-adjusted rate (where available) to the upper and lower bounds of the 95% confidence interval (CI) of the province's risk-adjusted rate (per indicator). This analysis is performed to measure the statistical significance of each result.

Institutions and municipalities whose upper-bound risk-adjusted confidence interval lies below the lower bound of the British Columbia risk-adjusted confidence interval are statistically "better than average" for indicators where lower rates are better. Institutions and municipalities whose lower-bound risk-adjusted confidence interval lies above the upper bound of the British Columbia risk-adjusted confidence interval are statistically "worse than average" for indicators where lower rates are better. For IQIs 22, 23, and 34, where higher rates are better, the opposite is true.

This analysis is presented in the interactive web-based tool at <www.hospitalreportcards.ca/bc> through colour coding, where blue colour coding signifies a statistically significant better than average performance, white colour coding signifies a performance that is not statistically significantly different from the average, and red colour coding signifies a performance that is statistically significantly worse than the average performance.

While the scores, rankings, observed rates, risk-adjusted rates, and confidence interval comparisons of risk-adjusted rates all provide valuable insights into hospital performance, it is recommended that readers focus on the 95% confidence interval colour-coded risk-adjusted rate comparisons where available and use the additional information provided to build a fuller picture. It is not recommended that readers rely solely on the scores or rankings to compare hospital performance for the majority of indicators (for volume indicators, it is recommended that readers focus on the scores provided as these give a comprehensive picture of performance on these indicators).

With regard to small hospitals and municipalities (or small numbers of cases at hospitals and municipalities), 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. The CIHI provided our database and has a standard policy of censoring any data cells that are three or fewer.

Further exploration on the subject of indicators for small hospitals can be found in FAQ 3.

FAQ 2 *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.

The Fraser Institute's *Hospital Report Card* has 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 3 *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 some adverse events tend to be rare and smaller places 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 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 an adverse event inevitable where volume is higher. Therefore,

results for some indicators must be interpreted with caution in the case of smaller institutions and municipalities. AHRQ can be referenced for work in this regard. Note that Patient Safety Indicators, in particular, measure very rare outcomes (i.e., one adverse event in 1,000 or more discharges) and thus should be interpreted with caution for smaller institutions and municipalities.

At the same time, it is also possible that smaller hospitals may appear to have higher mortality rates in a particular year due to a small denominator accompanied by death or complications that would have occurred even when all standards of care had been met. The authors recommend viewing rates across several years in such circumstances.

FAQ 4 *How were the AHRQ indicators adapted for use in Canada? Canadian hospitals capture information about the types of health problems and procedures that patients have in ways that 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 British Columbia historically used a different, though similar, classification system but all switched to a new system in 2001. 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 British Columbia, the Canadian International Classification of Disease, Version 10 (ICD-10-CA/CCI) has been in use since 2001. 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 the CIHI and applied to the codes in the DAD. Each code required for the *Hospital Report Card*'s 39 indicators[1] 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 to the degree possible. All of this is discussed in the Appendices.

1 Two additional indicators, adapted by the Fraser Institute, are also included in this years report

FAQ 5 *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 is it that there were data processing or coding mistakes in the data you bought from the CIHI? Or, did you do the coding yourself?*

The Fraser Institute's *Hospital Report Cards* are built from the Canadian Institute for Health Information's (CIHI) Discharge Abstract Database (DAD), which contains information on hospital stays and patient discharges 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, to conduct analyses of health conditions and injuries, and increasingly to track patient outcomes. The DAD is a major data source used by the CIHI to produce various reports such as annual reports on the performance of hospitals (including the CIHI's comparison of mortality in hospitals, the *Hospital Standardized Mortality Ratio* or HSMR) and the health care system as well as 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., Canadian Institute for Health Information et al., 2007; Aubrey-Bassler et al., 2007).

Data for the DAD is provided by individual hospitals to the CIHI. The CIHI then applies a comprehensive editing and correction system for the DAD and inaccuracies or incorrect information are checked at the hospital level when the DAD is sent back to the hospitals for data validation. 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, the CIHI established a comprehensive and systematic program designed to evaluate the overall quality of coding of clinical and non-clinical data with particular focus on selected health conditions. You can find an extensive discussion of their findings in the main body of the report (see "Data Quality," pages 7–10).

The CIHI's data quality studies, while making note of coding issues outlined in the main text of the report, determined that their three-year DAD reabstraction studies "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), and that "the DAD data is fit for use with respect to the health conditions studied" (CIHI, 2010a: xi).

FAQ 6 *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. The CIHI began instructing institutions on how best to indicate a palliative patient as of June 19, 2006. 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 FY2008/09, the frequency of this code is 2.5% (or 10,272 of 408,780 patient records) across all diagnosis fields. At present, AHRQ does not provide any specific guidance about how to handle these cases appropriately.

FAQ 7 *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.

FAQ 8 *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 naming of all of British Columbia's acute-care hospitals, the detail provided at the hospital and indicator level, the clear presentation of statistical significance in the web-based interactive tool, and the focus on patient-oriented information, as well as the fact that it uses the population of patient records for British Columbia rather than a sample, which over the eight-year period studied is over 3 million records in total.

FAQ 9 *What about its weaknesses?*

The weaknesses of the report card are its limited coverage (applying only to inpatient acute care) and potential issues with data quality. For a further examination see "Limitations, Caveats, and Notes of Caution," pages 6–10.

FAQ 10 *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 the CIHI required several standard modifications to account for differences in the Canadian and US coding methodologies. All of these standard modifications are explicitly described in Appendices B, C, and J.

FAQ 11 *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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