The Quality of Quality:

A Comparative Analysis of Two Different Canadian Hospital Report Cards

The 2007 Hospital Report Research Collaborative's Ontario Hospital Report and

The 2008 Fraser Institute's British Columbia Hospital Report Card

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Executive Summary

Context: Hospital report cards have been around for at least a century. In their contemporary expression, hospital report cards are often seen as originating with the mandatory report cards on coronary artery bypass graft surgery (CABG) in New York and Pennsylvania in the early 1990s. While hospital report cards have proliferated in the US as well as the UK, Canada has adopted their use at a slower pace and as a result has fewer of them. The late 1990s were witness to the first Ontario Hospital Report. In response to the Ontario Hospital Report, Canada's Fraser Institute developed and publicly released its own version of a hospital report card. As report cards become increasingly popular in Canada, it is worth reflecting on pitfalls to be avoided in their production as well as on how they might best function to help hospitals achieve a standard of excellence. This care in reflection is particularly important given the fact that the fervor or enthusiasm for the public reporting of quality improvement data is well ahead of the science that supports such reporting.

Objective: In this paper we compare the Ontario Hospital Report with one produced by the Fraser Institute for both British Columbia and Ontario. The two reports are quite different in format although both use a similar data source from the Canadian Institute of Health Information (CIHI).

Analysis Design: The two hospital report cards were evaluated according to the following: 1) relevance of the indicators (importance of areas covered, comprehensiveness of the picture of hospital performance, validity of indicators as

measures of quality); 2) relevance of the methodology (does methodology compensate for indicator limitations, sufficiency and quality of data used, appropriateness of scoring system), and 3) analysis and interpretation of results (objective presentation of results, presentation of limitations, utility of presentation of results).

Results: The Ontario Hospital Report employed a balanced scoreboard approach. This specific hospital report card should be regarded as a work in progress. Some of the indicators used were fairly new, and even some of the more established indicators could benefit from validation studies. Nevertheless, the *process* by which the research group has developed and is refining this hospital report card---including extensive stakeholder participation, repeated investigation of data quality issues, and ongoing assessment of indicators---is very strong. This process inspires confidence that the report is currently as good as it can be, and that it will continue to improve. Moreover, the data analysis and interpretation of the report card was scientifically sound. The results were objectively reported, limitations clearly described, and over-interpretation and sensationalism avoided. In contrast, the Fraser Institute report used indicators developed by the Agency for Healthcare Research and Quality (AHRQ), an organization with a history of rigorous research in the service of healthcare quality and safety. However, the manner in which these indicators were used and interpreted was not always appropriate. The Fraser Institute report makes inflated claims about what can be concluded from Hospital standardized mortality ratios (HSMRs) and adverse-event indicators by ignoring or glossing over serious methodological controversies. Through a combination of too much and too little information, the report makes it easy for the

reader to potentially draw inaccurate conclusions, and difficult to draw sound ones. Nevertheless, the AHRQ Patient Safety Indicators are worthy of further study and scientifically responsible use.

Conclusions: There is at present no clear agreement about which indicators should be included in hospital report cards. Considerable argument has also taken place regarding what type(s) of data should be used for report cards. Additionally, there is some controversy about whether comparative information should be reported publicly, and if so, at what level of specificity (i.e., individual providers vs. individual hospitals). Ultimately the pragmatic utility of a hospital report card is that it provides an avenue for accountability. Any individual hospital report card will have pragmatic utility encompassed by limitations. On balance hospital report cards are able to identify broadly both areas of concern and areas deserving recognition. Hospital report cards can also provide *rudimentary direction* for quality improvement planning. If asked to choose between pursuing one or the other of the two styles and methodologies of the report cards compared here we would recommend the balanced report card produced in Ontario over the report card produced by the Fraser Institute.

Introduction

Even though hospital report cards have become a ". . .prominent part of the quality improvement landscape over the last quarter century" (1; p. 1240) they are hardly a new invention. Indeed hospital report cards, or facsimiles of such, have been around for at least a century if not longer. (2, 3) Some date their existence to 1863 when Florence Nightingale published the third edition of her *Notes on Hospitals* (4) while others to 1532 when Henry VII began gathering weekly *Bills of Mortality* (5) in response to plague-related deaths. In their most contemporary expression, hospital report cards are often seen as originating with the mandatory coronary artery bypass graft surgery (CABG) report cards in New York and Pennsylvania in the early 1990s. (6) While in the US hospital report cards of many stripes have flourished and are readily available both online and in print (7) they are newer to the Canadian quality-improvement landscape.

In the late 1990s the Cardiac Care Network of Ontario (CCN) published a CABG focused report card (8) that was similar in information and scope to the earlier US CABG report cards (New York and Pennsylvania). (6) The publication of this Ontario CABG report card has become an annual event. The late 1990s were also witness to the first Ontario Hospital Report. (9) In response to the Ontario Hospital Report, the Fraser Institute in Canada developed and publicly released its own version of a hospital report card. (10) To date, the Fraser Institute has focused its hospital report card efforts on two provinces: Ontario and British Columbia. (10, 11)

Regardless of where one dates the origin of hospital report cards to, it is an ironic fact that just as today, when Nightingale published her evaluations of mortality in

London's hospitals, methodological arguments over statistical analyses and numerator and denominator inclusion and exclusion criteria ensued. (12-14) Like today, these debates were carried out in both the popular press and the medical literature. (15)

What in large measure has given rise to the contemporary report card movement is the persistent gap between healthcare and quality despite the expenditure of considerable resources. (16) As such there tend to be two overarching reasons driving the current hospital report card movement: 1) the perceived need to provide information to the public to enable informed and educated choices when selecting health care services, and 2) the perceived need to stimulate healthcare providers to improve care outcomes. (3) Hospital report cards are often directed to two disparate audiences---patients and decision-makers. Recent studies suggest that, although many patients express a desire for hospital report cards, these have had minimal impact on patient behavior. (1, 17) On the other hand, there is evidence that decision-makers attend to and use hospital report card information. (1, 18)

While in their current manifestation hospital report cards tend to be of 2 types---those that measure outcomes and those that measure processes (1, 7)---some report cards have made a concerted effort to include both process and outcome measures. (19) Hospital report cards tend also to be diverse in terms of target (CABG, acute inpatient care, nursing processes, etc.), methodology (survey vs. chart review vs. analysis of administrative/billing data) and transparency level (hospitals identified by name, providers identified by name, neither level of data publicly available).

There is at present no clear agreement about which indicators should be included in hospital report cards. For instance, the Agency for Healthcare Research and

Quality (AHRQ) has developed 32 patient safety indicators (PSIs) or measures (20) to identify potentially preventable complications of acute inpatient care that can be used to analyze hospital discharge (administrative) data. (20) Likewise, to explore nursing's contribution to patient care in acute-care settings, the American Nurses Association has also developed and implemented a hospital report card that includes a number of outcome, process, and structural indicators, for which data is collected via a combination of patient interviews and survey as well as a nurse's survey. (21) Most recently, the Hospital Quality Alliance, a public-private collaboration of several organizations including: the American Medical Association, Blue Cross and Blue Shield Association, National Business Coalition on Health and the Joint Commission on Accreditation of Hospitals (JCAHO), developed the Hospital Compare database that requires some US hospitals (acute care hospitals) but not others (rural, non-critical access hospitals) to report clinical data. (22) The Hospital Compare indicators include eight acute myocardial infarction (AMI/heart attack) measures, four measures related to heart failure care, six pneumonia care measures and two measures related to surgical infection prevention. (23)

In many instances, the reliability and validity of many of the indicators used have not been demonstrated. For instance, while the AHRQ indicators result from a systematic process; this process does not include steps to validate the indicator results. (24) AHRQ acknowledges this on their webpage which explicitly states that using these indicators with *administrative* data is only a first step, and recommends that research with *clinical* data be conducted to assess the sensitivity and specificity of the indicators. (19)

Considerable argument has also taken place regarding what type(s) of data should be used for report cards. Some argue that clinical or medical chart data are superior, while others that administrative or billing data such as hospital discharge data provide more or just as reliable information. Still others argue for the collection of primary data via surveys or interviews. In an interesting way, the improvements in standards and quality of care at the root of this reporting, have not yet been built into the measures supporting that reporting.

Additionally, there is some controversy about whether comparative information should be reported publicly, and if so, at what level of specificity (i.e., individual providers vs. individual hospitals). Public reporting of provider names has been noted to heighten the level of anxiety among providers, especially since it may impact their market share. Such reporting leads to the understandable demand that data reliability and measurement methodologies achieve near perfection---a literal impossibility. (25)

There is greater, though not complete, agreement that hospital report cards should identify hospitals by name. (26) One argument in favor of this approach is that public reporting may have the greatest potential to spur hospitals to action. In a key randomized study, hospitals undertook more quality-improvement activities after receiving publicly-reported than privately-reported quality information. (18)

In general, there has been limited research on the effects that report cards may have on healthcare delivery. (1, 26-27) The research that has been conducted has yielded mixed results. For instance, the New York CABG report card initially resulted in a reduction of risk-adjusted mortality from 4.17% to 2.45% during the first three years of the report's life. (16) However, less dramatic results have been documented since then.

(16) Furthermore, public reporting has been associated with some adverse consequences: in order to improve their scores, providers may “game” the system by rejecting the sickest patients. (1) However, from the perspective of public accountability, public reporting of hospital names would seem to have the advantage. (1) If a goal of report cards is to provide the public with comparative information about hospital performance, then this goal can only be achieved when hospital names are transparent. Moreover, public disclosure is seen as evidence of transparency and willingness to be held accountable. Although not a measure that can be easily validated, it appears that political currency can best be achieved by reasonable transparency.

Finally, while a notion of *quality* care underlies the effectiveness of all hospital report cards, a shared definition of such does not exist. The definition of quality proposed by the Institute of Medicine (IOM) in 1990, however, comes close to capturing this elusive term for all parties. (3) In the context of healthcare, the IOM defined quality as the “. . . degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with the current professional knowledge.” (28)

Ultimately the pragmatic utility of a hospital report card is that it provides an avenue for accountability. While not always welcomed, accountability, in the current healthcare environment is far from a bad thing. The accountability offered by hospital report cards regarding the quality of provided care is an important counterbalance to escalating healthcare costs and increased awareness of health disparities. That said, hospital report cards can only provide information on the specific indicators selected for

inclusion. Without exception, this means that any individual hospital report card will have pragmatic utility encompassed by limitations. On balance hospital report cards are able to identify broadly both areas of concern and areas deserving recognition. Hospital report cards can also provide *rudimentary direction* for quality improvement planning. Hospital report cards cannot provide definitive information on the quality of care. No single report card will be able to provide a complete picture of all factors informing or influencing the provision of acute inpatient care or the outcomes of such.

The Research Question

In this paper we compare the Ontario Hospital Report (9) with one produced by the Fraser Institute for both British Columbia and Ontario. (10, 11) The two reports are quite different in format although both use a similar data source from the Canadian Institute of Health Information (CIHI).

The Ontario Hospital Report (9) was developed by the Hospital Report Research Collaborative (HRRC) made up largely of academic researchers, with start-up funding from the Ontario Hospital Association. Since inception, this project has grown and the Ontario hospital report has become an annual occurrence. Funding for the project has also grown and is currently provided by a joint partnership between the Ontario Hospital Association and the Ontario Ministry of Health and Long Term Care. The Acute Care report was produced by the Canadian Institute for Health Information (CIHI) in conjunction with research teams from the HRRC. (29)

Similar to the objectives of most hospital report cards, the Ontario Hospital Report (9) has the stated objectives of: 1) improving the quality of care provided by

Ontario's hospitals; 2) enhancing hospital accountability; and 3) conducting research into the determinants of good performance in health care. While it is clear that this annual report card is designed largely for use by health care providers and managers who are interested in the performance of hospitals in Ontario, it suggests possible use by members of the public. The Ontario Hospital Report (9) employs a balanced scorecard approach. (30)

In contrast, the Fraser Institute is a private sector Canadian think tank, headquartered in British Columbia, which espouses free market principles. The Fraser Institute has called for the private involvement in Canadian health care which is not surprising given their stated vision of: “a free and prosperous world where individuals benefit from greater choice, competitive markets, and personal responsibility.” (10, 11) The funding source for the Fraser Institute Hospital Report Card has not been disclosed.

The Fraser Institute’s Hospital Report Card (10, 11) adapted both Patient Safety Indicators (PSIs) and Inpatient Quality Indicators (IQIs) developed by AHRQ in conjunction with Stanford University to Canadian circumstances. The overall goal of the 2008 British Columbia Fraser Institute’s Hospital Report Card was to contribute to the improvement of inpatient care by providing hospital-specific information about quality of service directly to patients and to the general public.

Comparing these two reports is not easy. As mentioned earlier, hospital report cards are newer to Canada and as such the plethora of formats related to acute inpatient care does not presently exist for the Canadian health system. Comparing two hospital report cards that rely on similar data examined through very different lenses

allows for a proactive assessment of the reports that could help health planners decide the utility of each.

Comparison of the Two Hospital Report Cards

The following analysis compares the 2007 Ontario Hospital Report – Acute Care (9) and the 2008 Fraser Institute's Hospital Report Card for British Columbia. (11) While the focus is, in part, on the hospital report card that the Fraser Institute produced for British Columbia, the exact same format was used in the hospital report card the institute produced for Ontario. Hence, all comments made about the British Columbia hospital report card pertain to the on they produced for Ontario.

The analysis of the 2007 Ontario Hospital Report takes into account information presented in the most recent technical summaries that are available to the public. (31-34) It is possible that these documents do not reflect the most recent changes or improvements to indicator calculation; however, there were no obvious discrepancies between the 2006 technical summaries and the 2007 report (e.g., different indicators). The reports are evaluated according to the following: 1) relevance of the indicators (importance of areas covered, comprehensiveness picture of hospital performance, validity of indicators as measures of quality); 2) relevance of the methodology (does methodology compensate for indicator limitations, sufficiency and quality of data used, appropriateness of scoring system), and 3) analysis and interpretation (objective presentation of results, presentation of limitations, utility of presentation of results). The Ontario Hospital Report Card (9) is discussed first. Table 1 (p. 29-30) presents a summary comparison of the two hospital report cards.

The Ontario Hospital Report Card

Relevance of the Indicators and the Methodology

Overall observations. The Ontario Hospital Report Card includes indicators in four distinct domains: clinical utilization and outcomes, system integration and change, patient satisfaction, and financial performance and condition. This Balanced Scorecard reflects an increasingly popular approach. Some might argue that clinical outcomes are more important than processes, patient satisfaction scores, or financial performance. However, to the extent that concerns exist about the validity of outcome-related indicators, other categories of indicators may provide valuable "checks and balances."

By choosing a balanced scorecard approach the producers are allowing that a hospital's performance may vary across distinct aspects of quality. In 2007, no hospital attained "top performer" status in more than one quadrant. Since no attempt is made to aggregate the four domains, there is no need to assess convergent validity among them. On the other hand, the observed lack of association between process, outcome, and patient-satisfaction indicators might be further explored. (35, 36)

The report presents results in terms of risk-adjusted rates (clinical utilization and outcomes), risk-adjusted scores (patient satisfaction), or simply scores (financial performance, system integration and change). The scores are not transformed in any unusual way, and calculations appear to be statistically sound. To be designated as high performers in a certain domain, hospitals must attain above-average scores on several indicators, with no below-average scores.

A key strength of the report is the high degree of stakeholder participation in the process of indicator selection and/or development. The engagement of content experts

and key representatives from many Ontario hospitals increases the likelihood that the findings will be credible to, and used by, local decision-makers. The technical summaries also reveal that the authors sought to validate the indicators over the years, and to improve them in an ongoing way.

The relevance of the specific indicators and methodologies are discussed separately for each of the four domains.

Clinical utilization and outcomes. The Ontario Hospital Report does not focus on risk-adjusted mortality rates but rather on risk-adjusted rates of readmissions and adverse events. A key limitation of risk-adjusted indicators in general is that "risk-adjustment only *reduces* the effect of differences in the patient population across hospitals; it cannot eliminate the effect of these differences completely." (31, p. 44) As indicated in the technical summary, hospitals that treat sicker, rare, or highly specialized groups of patients may score poorly even if quality of care is not an issue. Standardization techniques are less effective in identifying extremes of acuity, demography or utilization.

The validity of adverse-event indicators can be threatened by the difficulty of distinguishing an adverse event from a pre-existing comorbidity. (24, 37) To mitigate this threat, the CIHI---the organization overseeing the Discharge Abstract Database (DAD), the data source for this report---instructed hospitals to use separate codes depending on whether a condition was present at admission (Type 1) or developed after admission (Type 2). Only Type 2 diagnoses were included in the adverse-event indicators. So far, re-abstraction studies have not suggested that coding confusion

between Type 1 and Type 2 diagnoses is a serious problem. (38) However, inaccurate coding may still occur to some extent. (24)

CIHI (38) has recognized that there may be inter-hospital differences in the propensity to report adverse events. Particularly in Ontario, over-reporting for fiscal reasons has been identified as a potential problem. Accordingly, the Ontario Hospital Report indicators only counted adverse events that were associated with a length-of-stay (LOS) above the provincial median, or with patient death. This method could help to counteract the effects of over-coding (i.e., by ignoring events that actually had no impact on patient management). However, this method might also penalize hospitals characterized by long LOS for other reasons. Further validation studies could shed light on this issue.

The use of broad groupings (medical, surgical) may produce more reliable results than the use of condition-specific groups where conditions may be rare. However, size bias may still be an issue for some outcome measures, especially the indicator of surgical adverse events (which recorded values of zero for most small hospitals and half of the community hospitals).

The authors clearly gave serious thought to the question of which cases should be included in various calculations (31). It makes sense to exclude patients with cancer or compromised immune systems, who are at high risk of adverse outcomes, readmission, or death even if they receive high-quality care. It also makes sense that the denominator of the readmission indicators excludes patients who died.

System integration and change. The indicators used for this quadrant have face validity; the items measured were widely thought to reflect greater system

integration and innovation. However, a crucial question is: Do all these processes, roles, and systems actually produce better care? Hospitals were assigned points simply for having a particular staff position or intervention in place, regardless of whether this person or thing was demonstrated effective in promoting quality, safety, access, and/or efficiency. Mission statements, patient safety officers, and electronic records may be a helpful start, but they do not guarantee that the mission statement will be followed, the officer will effect real change, or the electronic record will actually be used to improve care processes. A recent mixed-methods study (39) suggested that the predictors of effective care might actually be intangibles such as common purpose, staff engagement, and strong leadership.

In an effort to avoid the biases associated with self-report, the questionnaire employed avoided soliciting attitudes or subjective judgments, and asked managers to simply state whether certain interventions were present or absent. However, reporting biases may still exist. This could be offset by use of some other source of data to validate managers' reports. As well, questionnaires could be completed by more than one individual at each hospital, allowing for the calculation of inter-rater reliability.

Patient satisfaction. There are many methods for learning about patient experiences, but if one is seeking an *indicator* of patient satisfaction, then the only viable option is to use a patient satisfaction survey. However, such surveys have their limitations. For instance: they tend to pick up a biased sample, they often show a strong positive bias (i.e., most patients will give positive scores even if their experiences have been negative), and they offer an incomplete opportunity for patients to express their views, and as such may miss important aspects of the hospital experience. (40)

Nevertheless, the Picker questionnaire, used in this report, is thought to be among the best patient satisfaction surveys. (41) It was developed with input from stakeholders, including patients, and encompasses some system-level issues such as coordination of care.

The observed response rate of 48% overall (and as low as 33% for a given hospital) is a serious limitation. Although the risk-adjustment procedure may help to make inter-hospital comparisons more reliable, some types of patients (e.g., those with low English or French literacy) may not be represented in the sample.

Financial performance and condition. This domain taps a variety of areas, including financial performance itself, percent spent on certain budget items, sick time, and nursing productivity. Information about such matters may not be of primary importance to patients, but would be important to decision-makers (the primary audience for this hospital report card). As validation studies have not yet been conducted, it is difficult to determine how accurately these indicators reflect efficiency *vs*. waste (rather than, for instance, issues related to case mix or hospital specialization). Scores on these indicators are particularly difficult to interpret because excessively high and low scores are both thought to be undesirable. It is not clear how the rankings took this problem into account.

Analysis, Interpretation, and Presentation

Overall Integrity. Overall, the Ontario Hospital Report offers an objective presentation of the results. The authors clearly state that factors other than quality of care can influence scores, and they offer some descriptions of non-quality-of-care

factors that could systematically affect the results. They also clearly note that high scores in one area do not imply high scores in another.

Nevertheless, it would be helpful for some more detail about the methodology (e.g., risk-adjustment procedure) to be available *with* the report, perhaps in an appendix. While the technical summaries, unlike the report itself, are difficult to find online they are even *more* forthright about the limitations of the actual hospital report card. On the other hand, certain limitations (e.g., potential effect of reporting practices on adverse event scores, limitations of manager self-report, very low response rates for patient-satisfaction surveys) are not really addressed in either the report or the technical summaries.

The authors chose to highlight the "top performers" in each area rather than offer a complete list of ranks or a list of both top and bottom performers. This may be appropriate since indicators may not be sufficiently sensitive to identify individual ranks, and public reporting of "bottom performers" can carry risks (e.g., patient dumping).

Utility. The report's length, style, and use of visual aids (in particular, box plots) make it user-friendly for decision-makers. It is easy to see patterns (or the lack thereof) in the tables provided, and the reader is not overwhelmed with data. On the other hand, the report is still rather complex and technical for use by lay readers. Despite this, the complexity is probably not beyond the reports primary readership---policy makers.

The separate presentation of teaching, community, and small hospitals promotes more valid comparisons. The presentation of results by Local Health Integration Networks (LHIN) is also useful. The discussion of province-wide trends is a welcome

additional focus; rather than place all the emphasis on competition between hospitals, the report also comments on developments in the health system as a whole.

General Discussion

The Ontario Hospital Report might be best regarded as a work in progress. Some of the indicators are fairly new, and even some of the more established indicators (e.g., adverse events) could benefit from further validation studies. However, the *process* by which the research group is developing and refining its hospital report – including extensive stakeholder participation, repeated investigation of data quality issues, and ongoing improvement of indicators – is very strong. This process inspires confidence that the report is currently as good as it can be, and that it will continue to improve. In the meantime, the researchers have analyzed and interpreted the data in a way that is scientifically sound. They have also reported the results objectively, clearly describing at least some of the project's limitations, and avoiding over-interpretation and sensationalism. Although some areas may require further development, the Ontario Hospital Report's overall process and product form a viable model for provincial hospital report cards.

Fraser Institute *Hospital Report Card*

Relevance of the Indicators

Hospital standardized mortality ratios (HSMRs), which form the backbone of the Fraser Institute report, are a controversial measure of hospital quality. (36, 42, 43). Although some research has supported the potential of HSMRs to distinguish at least

the best from the worst hospitals, many studies have raised serious doubts about whether HSMRs should be used as a sole means of comparing hospital performance. A systematic review concluded that HSMR calculations are too heavily subject to both systematic and random error to yield conclusions about the quality of a particular hospital or the relative quality of two hospitals. (44) A subsequent study confirmed that "even with perfect risk adjustment, identifying poor quality hospitals on the basis of mortality rate performance is highly inaccurate." (45) Moreover, there is evidence that even today's sophisticated methods of risk-adjustment are far from perfect. Studies have found that current methods of risk-adjustment may have little impact on hospital mortality rates (46), and that different methods of risk-adjustment often yield different results. (44) In addition, problems with data availability and quality may further weaken the effectiveness of risk-adjustment. Without sufficient adjustment for patient risk, the hospitals with the highest mortality rates are likely to be the ones that treat the sickest patients, not the ones that provide the poorest care. Furthermore, it has been noted that mortality rates provide neither a sensitive nor specific indicator of quality, since "most deaths do not reflect quality problems, and most quality problems do not cause death." (43, p. 155).

The Patient Safety Indicators (PSIs) used in the report were developed by the AHRQ. Some attempts have been made to validate these indicators, and the Fraser Institute is to be commended for contributing to their further testing. However, early validation studies have raised some serious cautions that should not be overlooked. First, figures may be distorted by systematic between-hospital differences in reporting practices (38). Some have argued that such indicators actually measure the propensity

to report adverse events, not the true incidence of adverse events. (47) A second, equally significant problem is the difficulty of distinguishing between actual adverse events and conditions that were present on admission. (24). The Fraser Institute report makes no mention of utilizing CIHI's Type 1 and Type 2 diagnosis codes, which might have helped to distinguish between comorbidities and complications. Third, in order to use the ARHQ PSIs, the Case Mix Groups or CMGs, used by Canadian hospitals had to be converted to Diagnosis-related Groups of DRGs used by US hospitals. There is no easy way of converting one to the other without losing important contextual information. Finally, PSIs are not adjusted for important patient risk factors and hospital variables. (48)

An issue often raised in the context of HSMRs and PSIs is that of convergent validity. (49) For instance, past research has found that hospital mortality rates were unrelated to quality-of-care measures. (35, 36) Since quality and safety are complex issues, one might expect some variability across hospital domains. However, if one measure of hospital quality is completely uncorrelated with another, one might question whether both can be valid. This question becomes even more pointed when the two measures are intended to tap the same dimension of quality. In the Fraser Institute report, the aggregation of mortality indicators and PSIs *implies* an assumption that the two types of indicators are essentially measuring the same thing---clinical outcomes. However, prior research has brought such an assumption into question. For instance, Isaac and Jha's analysis (49) showed a lack of association between hospital mortality rates and PSIs. Nevertheless, Isaac and Jha's (49) findings should be interpreted with caution, since they compared surgical mortality rates with non-surgical PSIs.

Accordingly, we re-examined some of the scores presented in the Fraser Institute report to ascertain whether the PSIs were correlated with the mortality rates. Our results indicated that none of the PSIs emerged as a significant predictor of mortality rates (see Appendix A).

In addition to the indicator groups described above, the Fraser Institute report also presents some data on utilization. This could be a relevant indicator for procedures where high volumes appear to predict better outcomes. (50) However, it is more questionable to use volumes as an indicator of appropriateness, since there is no current consensus on whether typical practices reflect appropriate use, over-use, or under-use. (52, 53)

Relevance of the Methodology

Data availability and quality. Data on in-hospital mortality are readily available, and this is the major asset of HSMRs. However, in-hospital mortality may not be as "definite" an event as is assumed. For instance, hospitals that provide palliative care (rather than discharge patients to receive palliative care in other settings) are likely to show inflated mortality rates. (42) While the Fraser Institute report did not take into account whether patients were receiving palliative care, it was noted that they might do so in future reports. A broader, still-unresolved issue concerns whether hospital mortality rates would be more accurate if they included deaths occurring shortly after discharge. (42, 53)

The All Patient Refined Diagnosis-related Group (APR-DRG) is a highly regarded means of risk-adjustment. (54) However, there are times when data quality issues can

make risk-adjustment weak in practice. Some hospitals may tend to under-report comorbidities (weakening the risk-adjustment procedure), or may report irrelevant conditions. (43) Reporting practices may differ systematically between hospitals, creating error. (38) As earlier noted, the Fraser Institute analysts do not appear to have used CIHI's Type 1 and Type 2 diagnosis codes to promote a full and accurate list of comorbidities. Furthermore, the Canadian dataset lacks information on patient race and SES that would otherwise be included in APR-DRG calculations.

The Fraser Institute report notes that many of the PSIs were subject to size bias (i.e., small institutions showed artificially low or otherwise distorted rates). This would not be a problem if such indicators were reported only for sufficiently large hospitals; however, they are reported for all hospitals. A composite score would be less subject to size bias, although less precise. Moreover, potential data quality issues involving PSIs have not yet been explored in Canada.

Scoring and ranking. The scoring system where the lowest performer on each indicator receives 0 points and the highest performer receives 100, could result in a distorted view of the actual degree of variability on different indicators. Indicators with very low variability would appear to have the same spread of scores as indicators with high variability. This problem could have been avoided by the use of Z scores. The current scoring system could introduce error into the process of combining indicator scores to produce the Hospital Mortality Index (HMI).

Analysis, Interpretation and Presentation

Overall integrity. On the whole, the Fraser Institute report appears to de-emphasize its limitations. It does not address the controversy surrounding HSMRs, or discuss non-quality-of-care factors that could systematically affect results. To their credit, the authors acknowledge that data on comorbidities are subject to some serious quality issues, but they do not acknowledge that this could affect risk-adjustment and potentially some of the PSIs (i.e., by hindering the correct identification of complications).

In addition, some of the statements made in the report are questionable; for instance, the report claims to offer an "absolute" rather than "relative" measure of patient safety (p. 16) but the scores are based on inter-hospital comparisons---by definition a relative measure.

Utility. Public reporting of hospital performance is not very useful if the identities of the hospitals are unknown. The lack of hospital identifiers in this report, however, is not the Fraser Institute's fault. As stated in the report: "None of BC's 95 acute-care hospitals granted us authorization to identify them by name in this report" (11: Appendix D, Hospital Identification). We do not know why this permission was not granted, and as such, it is difficult to pinpoint the reason for the lack of transparency.

The results are not presented by size or type of hospital, nor by health region but by municipality. This choice is perplexing since healthcare is not a municipal responsibility. The report's approach of separating out mortality attributable to different conditions is potentially useful, but does not resolve the larger issues surrounding

HSMR validity. It would also be more useful if the prominently displayed table of HMI rankings were to specify which differences were statistically significant.

Although patients are identified as a primary intended audience for this report, its format is not user-friendly. There is a great amount of repetition, with the same 27 pages repeated 10 times, and data for each indicator is presented in four different ways. In addition, there is a fair amount of extraneous information; in particular, the methodological appendices mix important material, such as indicator definitions, with minute detail about the calculation of such variables as age. Use of specialized vocabulary is also an issue. With the growing concern of health literacy the use of unexplained medical terminology (e.g., iatrogenic pneumothorax) contributes to the lack of user-friendliness of the report card to patients as end-users.

General Discussion. The Fraser Institute report uses indicators developed by the AHRQ, an organization with a history of rigorous research in the service of healthcare quality and safety. However, the manner in which these indicators are used and interpreted is not always appropriate. The report makes inflated claims about what can be concluded from HSMRs and adverse-event indicators by ignoring or glossing over serious methodological controversies. Through a combination of what might be seen as too much and too little information, the report makes it easy for the reader to potentially draw inaccurate conclusions, and difficult to draw sound ones. Nevertheless, the AHRQ Patient Safety Indicators are worthy of further study and scientifically responsible use.

Conclusions, Lessons Learned and Recommendations

This project has compared two different Canadian hospital report cards in order to provide an assessment aimed at helping concerned parties make decisions about the utility of one type of report card over another. Hospital report cards have become a part of the international health care landscape for a variety of reasons, the most prominent being: to facilitate consumer choice, to promote public accountability, and to guide hospitals in concerted quality improvement efforts. In their contemporary manifestation the development, production and dissemination of hospital report cards is high on the policy agenda in the US and the UK. (26) At present there is a wide array of hospital quality reports and reporting initiatives in the US. (26) In the UK, hospital report cards are central to National Health Service. (26) In Scotland, hospital report cards have been used to asses the quality of care received in all of its hospitals since the mid-1990s. (26, 55)

While hospital report cards have proliferated in the US as well as the UK, Canada has adopted their use at a slower pace and as a result has fewer of them. (26) As report cards become increasingly popular in Canada, it is worth reflecting on pitfalls to be avoided in their production as well as how they might best function in terms of helping hospitals achieve a standard of excellence.

This care in reflection is particularly important given the fact that the fervor or enthusiasm for the public reporting of quality data is well ahead of the science that supports such reporting. Indeed, as indicated throughout this paper, there has been a growing body of evaluative research literature addressing the impact and use of hospital report cards that has emerged in tandem with the different hospital report card initiatives

themselves. This body of literature underscores the fact that there continue to be multiple methodological questions that need to be acknowledged and addressed in order to maximize the effectiveness and minimize the adverse consequences of the public reporting of quality of care data in the form of hospital report cards.

That said there are eight recommending conclusions we can draw from our analysis. First, despite methodological flaws, hospital report cards have the potential to increase healthcare system accountability. Hospital report cards are useful in providing some degree of accountability compelling hospitals (or health systems) to self-reflect, and to hopefully work on improving the quality of patient care provided. There is some evidence from the scientific literature that this happens.

Second, the methodological concerns identified with hospital report cards are many and need to be acknowledged along with the recognition that hospital report cards are still somewhat early in their development. Hospital report cards should be seen as still evolving.

Third, hospital report cards are in and of themselves complex and multi-faceted; no hospital report card can provide a comprehensive picture of all aspects of the quality of care provided by an organization as complex as a hospital. Each report card has limitations, and these need to be recognized and articulated by report card producers.

Fourth, for hospital report cards to be effective, time and attention must be directed to ensuring stakeholder involvement and buy-in. Minimally, the major stakeholders are health ministries and regional healthcare authorities, hospital administrators, all levels of health care providers, and patients.

Fifth, to achieve public acceptance and utility hospital identifiers need to be included in the report card. This transparency should be accompanied by extensive public education.

Sixth, hospital report card style and presentation are significant contributors to the actual utility of a report card. A hospital report card that is hundreds of pages long with complex tables and text will have much less utility than one that is shorter and clearer in its presentation. Since patients constitute one of the stakeholders and are a significant audience for many report cards, presentation and style should take issues of health literacy into account.

Seventh, secular trends influencing care and healthcare outcomes may be equal in importance to inter-hospital comparisons. Efforts must be made when developing hospital report cards to include these in their analyses and eventual conclusions.

Finally, for all of the reason already discussed, if asked to choose between pursuing one or the other of the two styles and methodologies of the report cards compared here we would recommend the balanced report card produced in Ontario over the report card produced by the Fraser Institute.

Table 1. Summary Comparison of Ontario and Fraser Hospital Reports		
	Ontario Hospital Report Card	**Fraser Institute Hospital Report Card**
Overall Description	• The Ontario Hospital Report includes indicators in four distinct domains: clinical utilization and outcomes, system integration and change, patient satisfaction, and financial performance and condition. • This report card adopts a Balanced Scorecard approach. • The report presents results in terms of risk-adjusted rates (clinical utilization and outcomes), risk-adjusted scores (patient satisfaction), or simply scores (financial performance, system integration and change).	• The Fraser Hospital Report uses AHRQ PSI indicators and All Patient Refined Diagnosis-related group (**APR**-**DRG**) risk-adjustment; these have been widely used, and there have been some attempts at validation.
Relevance of the Indicators	The main *Clinical utilization and outcomes* indicators concern risk-adjusted rates of readmissions and adverse events • risk-adjustment only *reduces* the effect of differences in the patient population across hospitals; it cannot eliminate the effect of these differences completely • the validity of adverse-event indicators can be threatened by the difficulty of distinguishing an adverse event from a pre-existing comorbidity The 12 *System integration and change* indicators have face validity and the items measured are widely thought to reflect greater system integration and innovation • a crucial question is: Do all these processes, roles, and systems actually produce better care? 4 *Patient satisfaction* indicators • the Picker questionnaire is thought to be among the best patient satisfaction surveys *Financial performance and condition* indicators tap a variety of areas, including financial performance itself, percent spent on certain budget items, sick time, and nursing productivity • since validation studies have not yet been conducted, it is difficult to determine how accurately these indicators reflect efficiency *vs*. waste	The backbone of the Fraser Institute report, hospital standardized mortality ratios (HSMRs), are a highly controversial measure of hospital quality • some research has supported the potential of HSMRs to distinguish at least the best from the worst hospitals, other research has raised serious doubts about whether HSMRs should be used as a means of comparing hospital performance • HSMR calculations are too heavily subject to both systematic and random error to yield conclusions about the quality of a particular hospital or the relative quality of two hospitals • past research has found that hospital mortality rates are unrelated to quality-of-care measures The Patient Safety Indicators (PSIs) used in the report were developed by Agency for Healthcare Research and Quality (AHRQ) • attempts have been made to validate these indicators, the Fraser Institute is to be commended for contributing to their further testing • early validation studies, however, have raised some serious cautions • such indicators may actually measure the propensity to report adverse events, not the true incidence of adverse events • difficulty of distinguishing between actual adverse events and conditions that were present on admission
Relevance of the Methodology	It would be helpful for some more detail about the methodology (e.g., risk-adjustment procedure) to be available *with* the report, in an appendix. • The technical summaries regarding methodologies used are difficult to find on the internet While the technical summaries are even *more* forthright about the limitations of the hospital report • Certain limitations (e.g., potential effect of reporting practices on adverse event scores, limitations of manager self-report, very low response rates for patient-satisfaction surveys) are not really addressed in either the report or the technical summaries	Use of HSMRs is problematic. • Hospitals that provide palliative care (rather than discharge patients to receive palliative care in other settings) are likely to show inflated mortality rates • A broader, still-unresolved issue concerns whether hospital mortality rates would be more accurate if they included deaths occurring shortly after discharge AHRQ PSIs were developed for use on US hospital data and may not be analytically transferable to Canadian data. • Canadian dataset lacks information on patient race and SES that would otherwise be included in APR-DRG calculations

Table 1. Summary Comparison of Ontario and Fraser Hospital Reports		
	Ontario Hospital Report Card	**Fraser Institute Hospital Report Card**
Analysis, Interpretation, and Presentation	The Ontario Hospital Report offers a fair and objective presentation of the results • authors forthrightly state that factors other than quality of care can influence scores • authors offer some description of non-quality-of-care factors that could systematically affect the results • authors clearly note that high scores in one area do not imply high scores in another The report's length, style, and use of visual aids (in particular, box plots) make it user-friendly for decision-makers • It is easy to see patterns (or the lack thereof) in the tables provided, and the reader is not overwhelmed with data • the report is still rather complex and technical for use by lay readers	• The report prominently displays a full list of hospital rankings on the HMI, but fails to note which differences are statistically significant. • The report does not address the well-known controversy about HSMRs, or remind the reader about non-quality-of-care factors that could systematically affect the results • The report does not break down the results by size or type of hospital, nor by health region The report is not user-friendly. • There is a great amount of repetition, with the same 27 pages repeated 10 times, and data for each indicator presented in four different ways
Report Strengths	• Attempts to give a broad picture of performance across four domains • Uses indicators that are refined and improved over time, based on extensive investigation of local coding practices and issues • Many efforts to avoid biases (i.e., risk-adjustment, additional inclusion criteria, distinguishing between Type 1 and 2 diagnoses) • Stakeholder involvement and ownership • Presentation of results is statistically appropriate and user-friendly (to decision-makers) • Generally clear and objective account of what can and cannot be concluded from the results.	• Attempts to focus on an area of primary importance • Uses AHRQ indicators and APR-DRG risk-adjustment; these have been widely used, and there have been some attempts at validation. • Some efforts to avoid biases (i.e., risk-adjustment)
Report Weaknesses	• Indicators in some areas are relatively new and of uncertain validity. • There may be inadequate data in the areas of system integration (one manager's report) and patient satisfaction (low response rates).	• Focuses almost exclusively on HSMR, which is known to have serious limitations as a means of comparing hospital performance. • Unbalanced discussion with inflated and potentially misleading claims. Only token efforts to address limitations. • Very lengthy, repetitious, and not user-friendly to either decision-makers or patients.

References

1. Werner RM, Asch DA. The unintended consequences of publicly reporting quality information. JAMA. 2005;293:1239-44.

2. Iezzoni LI. 100 apples divided by 15 red herrings: a cautionary tale from the mid-19th century on comparing hospital mortality rates. Ann Intern Med. 1996;124:1079-85.

3. Ireson CI, Ford MA, Hower JM, Schwartz RW. Outcome report cards: a necessity in the health care market. Arch Surg. 2002;137:46-51.

4. Nightingale F. Notes on Hospitals. 3d ed. London: Longman, Green, Longman, Roberts, and Green; 1863.

5. Walker HM. Studies in the History of Statistical Method. Baltimore: Williams & Wilkins; 1929.

6. Dranove D, Kessler D, McClellan M, Satterthwaite M. Is More Information Better? The Effects of “Report Cards” on Health Care Providers. Journal of Political Economy. 2003; 3: 555-588.

7. Rosenstein AH. Am J Med Qual. 2004;19:183-92.

8. Ghali WA, Rothwell DM, Quan H, Brant R, Tu JV. A Canadian comparison of data sources for coronary artery bypass surgery outcome "report cards". Am Heart J. 2000;140:402-8

9. Baker GR, Anderson G, Brooks N, Brown A, McKillop I, Murray MA, Pink GH. The Hospital Report '98: A System-wide review of Ontario's hospitals. http://www.hospitalreport.ca/downloads/previous/1998/1998_HospitalReport.pdf Last Accessed 9 December 2008.

10. Esmail N., Hazel M. The Fraser Institute Hospital Report Card: Ontario 2008.

11. Esmail N., Hazel M. The Fraser Institute Hospital Report Card: British Columbia 2008.

12. Woodward J. To Do the Sick No Harm: A Study of the British Voluntary Hospital System to 1875. London: Routledge & Kegan Paul; 1974.

13. Eyler JM. Victorian Social Medicine. The Ideas and Methods of William Farr. Baltimore: Johns Hopkins University Press; 1979.

14. Bristowe JS, Holmes T. Report on the Hospitals of the United Kingdom. Sixth Report of the Medical Officer of the Privy Council, 1863. London: George E. Eyre and William Spottiswoode, for her Majesty's Stationery Office; 1864.

15. Kong D. High hospital death rates. Boston Globe. 30 October 1994:1, 6, 7.

16. Drozda JP Jr, Hagan EP, Mirro MJ, Peterson ED, Wright JS; American College of Cardiology Foundation Writing Committee. J Am Coll Cardiol. 2008;51:1993-2001.

17. Howard DH, Kaplan B. Inquiry. 2006;43:150-9.

18. Hibbard JH, Stockard J, Tusler M. Health Affairs. 2003;22:84-94.

19. Lilford R, Mohammed MA, Spiegelhalter D, Thomson R. Use and misuse of process and outcome data in managing performance of acute medical care: avoiding institutional stigma. Lancet. 2004; 363: 1147–54.

20. Agency for Healthcare Research and Quality (AHRQ) Quality Indicators. http://www.qualityindicators.ahrq.gov/

Last Accessed 9 December 2008.

21. Moore K, Lynn MR, McMillen BJ, Evans S. Implementation of the ANA report card. J Nurs Adm. 1999;29:48-54.

22. Lutfiyya MN, Bhat DK, Gandhi SR, Nguyen C, Weidenbacher-Hoper VL, Lipsky MS. .A comparison of quality of care indicators in urban acute care hospitals and rural critical access hospitals in the United States. Int J Qual Health Care. 2007;19:141-9.

23. United States Department of Health and Human Services. Hospital Compare. Information for professionals. http://www.hospitalcompare.hhs.gov/

Last Accessed 22 June 2006.

24. Bahl V, Thompson MA, Kau TY, Hu HM, Campbell DA. Do the AHRQ patient safety indicators flag conditions that are present at the time of hospital admission? Med Care 2008;46: 516–522

25. Harper DL. Cleveland's five-year experience with public reporting of hospital quality performance measurements. Healthcare Quarterly. 1999;2:47-49.

26. Marshall MN, Shekelle PG, Davies HTO, Smith PC. Public reporting on quality in the United States and the United Kingdom. Health Affairs. 2003;22:134-148.

27. Leatherman S, Berwick D, Iles D, Lewin LS, Davidoff F, Nolan T, Bisognano M. The business case for quality: case studies and an analysis. Health Affairs. 2003;260:17-30.

28. Institute of Medicine. Crossing the Quality Chasm. A New Health System for the 21st Century. Washington D.C.: National Academy Press, 2000.

29. Canadian Institute for Health Information. http://secure.cihi.ca/cihiweb/dispPage.jsp?cw_page=PG_890_E&cw_topic=890&cw_rel=AR_1070_E

Last Accessed 5 Dec 2008.

30. Kaplan RS, Norton DP. The balanced scorecard--measures that drive performance. Harvard Business Review. 1992; January-February: 71- 79.

31. Choy L, Tallentire M, Anderson G. Hospital report 2006: Acute care clinical utilization and outcomes technical summary. http://www.hospitalreport.ca/downloads/2006/AC/2006_AC_cuo_techreport.pdf
Last Accessed 9 Dec 2008.

32. Glussich A, Button I, McGillis-Hall L, McKillop I, Pink G, Zinck G, et al. Hospital report 2006: Acute care: Financial performance and condition technical summary. http://www.hospitalreport.ca/downloads/2006/AC/2006_AC_finance_techreport.pdf
Last Accessed 9 Dec 2008.

33. Loreti M, Murray M. A. Hospital report 2006: Acute care: Patient satisfaction technical summary. http://www.hospitalreport.ca/downloads/2006/AC/2006_AC_ps_techreport.pdf
Last Accessed 9 Dec 2008.

34. Wagg J, Tse J, Seeman N, Baker R, Flintoft V, Paul J. Hospital report 2006: Acute care: System integration and change technical summary. http://www.hospitalreport.ca/downloads/2006/AC/2006_AC_sic_technotes.pdf
Last Accessed 9 Dec 2008.

35. Griffith JR, Knutzen SR, Alexander JA. Structural versus outcomes measures in hospitals: A comparison of Joint Commission and Medicare outcomes scores in hospitals. Quality Management in Health Care. 2002;10:29-38.

36. Pitches DW, Mohammed MA, Lilford RJ. What is the empirical evidence that hospitals with higher-risk adjusted mortality rates provide poorer quality care? A systematic review of the literature. BMC Health Services Research. 2007; *7*: 91.

37. Glance LG, Dick AW, Osler TM, Mukamel DB. Accuracy of hospital report cards based on administrative data. Health Services Research. 2006; 41(4 Pt 1):1413-1437.

38. Canadian Institute for Health Information. Coding variations in the discharge abstract database (DAD) data. Ottawa, ON: CIHI, 2003.

39. Keroack MA, Youngberg BJ, Cerese JL, Krsek C, Prellwitz LW, Tervelyan E. Organizational factors associated with high performance in quality and safety in academic medical centers. Academic Medicine. 2007;82:1178-86.

40. Williams B, Coyle J, Healy D. The meaning of patient satisfaction: an explanation of high reported levels. Social Science and Medicine. 1998; 47: 1351-1359.

41. Perneger TV, Kossovsky MP, Cathieni F, di Florio V, Burnand B. A randomized trial of four patient satisfaction questionnaires. Medical Care. 2003; 41:1343-1352.

42. Penfold RB, Dean S, Flemons W, Moffatt, M. Do hospital standardized mortality ratios measure patient safety? HSMRs in the Winnipeg Regional Health Authority. Healthcare Papers. 2008; 8:8-24.

43. Shojania KG, Forster AJ. Hospital mortality: When failure is not a good measure of success. CMAJ. 2008;179:153-157.

44. Thomas JW, Hofer TP. Research evidence on the validity of risk-adjusted mortality rate as a measure of hospital quality of care. Medical Care Research and Review. 1998; 5: 371-404.

45. Thomas JW, Hofer TP. Accuracy of risk-adjusted mortality rate as a measure of hospital quality of care. Medical Care. 1999; 37: 83-92.

46. Dimick JB, Birkmeyer JD. Ranking hospitals on surgical quality: Does risk-adjustment always matter? Journal of the American College of Surgeons. 2008; 207: 347-351.

47. Jarman B. In defence of the hospital standardized mortality ratio. Healthcare Papers. 2008; 8:37-42.

48. Tabak YP, Johannes RS, Silber JH, Kurtz SG. Should do-not-resuscitate status be included as a mortality risk adjustor? The impact of DNR variations on performance reporting. Medical Care. 2005; 43: 658-666.

49. Isaac T, Jha AK. Are patient safety indicators related to widely used measures of hospital quality? Journal of General Internal Medicine. 2008;23: 1373-1378.

50. Hannan EL, Wu C, Ryan TJ, Bennett E, Culliford AT, Gold JP, et al. Do hospitals and surgeons with higher coronary artery bypass graft surgery volumes still have lower risk-adjusted mortality rates? Circulation. 2003; 108:795-801.

51. Hemingway H, Crook AM, Feder G, Banerjee S, Dawson JR, Magee P, et al. Underuse of coronary revascularization procedures in patients considered appropriate candidates for revascularization. NEJM. 2001; 344: 645-654.

52. Kent GM, Power L, Gregory DM, Barrett BJ, MacCallum GC, Stone EW, et al. Need for coronary artery bypass grafting in Newfoundland and Labrador: The impact of increased demand. The Canadian Journal of Cardiology. 2004; 20: 399-404.

53. Johnson ML., Gordon HS, Petersen NJ, Wray NP, Shroyer AL, Grover FL., et al. Effect of definition of mortality on hospital profiles. Medical Care. 2002; 40:7-16.

54. Averill R, Goldfield N, Hughes J, Muldoon J, Gay J, McCullough E, et al. What are APR-DRGS? An introduction to severity of illness and risk mortality adjustment methodology. 2003.

http://www.3m.com/us/healthcare/his/products/ coding/refined_drg.jhtml

Last accessed 9 Dec 2008.

55. Russell Mannion R, Goddard M. Public disclosure of comparative clinical performance data: lessons from the Scottish experience. Journal of Evaluation in Clinical Practice. 2003; 9: 277–286.

APPENDIX A: Correlation Analysis

This secondary analysis of data from the Fraser Institute's B.C. Report Card investigated the extent to which various patient safety indicators (PSIs) predicted risk-adjusted mortality rates. The tables below present Spearman correlations between the relevant scores, as reported by the Fraser Institute. (Virtually identical results were obtained when risk-adjusted rates were used instead of scores.)

Predictive value of key PSIs: 2005 data

	AMI	CHF	Stroke	GI	Hip	Pneu	All 6
Lo-DRG	.05	.02	-.02	.26*	.36*	.22	.16
FtR	.18	.10	-.18	.01	.14	.05	-.01
Ulcer	-.08	.03	.05	.15	.09	-.08	.14
Infection	.11	-.03	-.34	.15	.27	.04	.03
Adverse	-.11	.09	-.17	-.17	-.05	-.25	-.26

AMI = Death from Acute Myocardial Infarction. CHF = Death from Congestive Heart Failure. Stroke = Death from Stroke. GI = Death from Gastrointestinal Haemorrhage. Hip = Death from Hip Fracture. Pneu = Death from Pneumonia. All 6 = Aggregate of all six causes of death included in the Hospital Mortality Index.
Adverse = Aggregate of non-obstetric adverse events. Note that the components were not highly correlated, and that size bias may have affected the results.
* $p < .05$

Predictive value of key PSIs: three-year average (2003-05):

	AMI	CHF	Stroke	GI	Hip	Pneu	All 6
Lo-DRG	-.01	.10	-.08	.14	.10	.14	.14
Ftr	.05	.00	-.15	.01	.01	.07	.15
Ulcer	-.07	-.14	-.06	.15	.02	.05	-.01
Infection	.07	.04	-.23	.09	.24	.05	-.06
Adverse	.00	-.14	-.10	-.14	-.01	-.08	-.28

These results show that none of the PSIs consistently predicted mortality (across categories and/or years). In line with Isaac and Jha.'s (2008) results, the correlations between PSIs and HMRs were typically low and sometimes negative. In contrast to their results, failure to rescue did not emerge as a strong predictor of mortality rates.