



Cardiac Care Quality Indicators Report

Production of this document is made possible by financial contributions from Health Canada and provincial and territorial governments. The views expressed herein do not necessarily represent the views of Health Canada or any provincial or territorial government.

Unless otherwise indicated, this product uses data provided by Canada's provinces and territories.

All rights reserved.

The contents of this publication may be reproduced unaltered, in whole or in part and by any means, solely for non-commercial purposes, provided that the Canadian Institute for Health Information is properly and fully acknowledged as the copyright owner. Any reproduction or use of this publication or its contents for any commercial purpose requires the prior written authorization of the Canadian Institute for Health Information. Reproduction or use that suggests endorsement by, or affiliation with, the Canadian Institute for Health Information is prohibited.

For permission or information, please contact CIHI:

Canadian Institute for Health Information
495 Richmond Road, Suite 600
Ottawa, Ontario K2A 4H6

Phone: 613-241-7860

Fax: 613-241-8120

www.cihi.ca

copyright@cihi.ca

ISBN 978-1-77109-639-3 (PDF)

© 2017 Canadian Institute for Health Information

How to cite this document:

Canadian Institute for Health Information. *Cardiac Care Quality Indicators Report*. Ottawa, ON: CIHI; 2017.

Cette publication est aussi disponible en français sous le titre *Rapport sur les indicateurs de la qualité des soins cardiaques*.

ISBN 978-1-77109-640-9 (PDF)

Table of contents

Acknowledgments	5
Executive summary	9
Introduction	11
Background	12
Goals of the report	13
Quality indicators	14
Participating cardiac care centres	15
Methodology	17
Data	17
Record linkage and unit of analysis	17
Indicator calculation	18
Key concepts	19
Interpretation	20
Canadian results	21
Canadian average rates for Cardiac Care quality indicators	22
High-risk patients	26

Provincial and cardiac care centre results	28
30-Day In-Hospital Mortality After PCI	29
30-Day In-Hospital Mortality After Isolated CABG	33
30-Day In-Hospital Mortality After Isolated AVR	37
30-Day In-Hospital Mortality After CABG and AVR	41
30-Day All-Cause Readmission Rate After PCI	45
30-Day All-Cause Readmission Rate After Isolated CABG	49
PCI Volume by Centre	53
Conclusion	55
Appendix A: List of participating cardiac care centres by province	56
Appendix B: Text alternative for images	58
References	80

Acknowledgments

The Canadian Institute for Health Information (CIHI) and the Canadian Cardiovascular Society (CCS) acknowledge and sincerely thank the following individuals for their work on the development of the *Cardiac Care Quality Indicators Report*:

Cardiac Care Quality Indicators Expert Advisory Group

- James Abel, Providence Health Care[†]
- Pam Aikman Ramsay and Carol Laberge, Cardiac Services BC
- Anita Asgar, Montréal Heart Institute
- Akshay Bagai, St. Michael's Hospital*
- Eric Cohen, Sunnybrook Health Sciences Centre*
- Paul Dorian, St. Michael's Hospital
- Anne Ferguson, Canadian Cardiovascular Society
- Ansar Hassan, Saint John Regional Hospital[†]
- Merril Knudtson, Foothills Medical Centre
- Dennis Ko, Sunnybrook Health Sciences Centre and Institute for Clinical Evaluative Sciences*
- Laurie Lambert, INESSS (Institut national d'excellence en santé et en services sociaux)*, [†]
- Douglas Lee, University Health Network and Institute for Clinical Evaluative Sciences[†]
- Mina Madan, Sunnybrook Health Sciences Centre*
- Roy Masters, University of Ottawa Heart Institute[†]
- Alan Menkis and Rakesh Arora, Winnipeg Regional Health Authority, Cardiac Sciences

- Garth Oakes, CorHealth Ontario (formerly Cardiac Care Network of Ontario)*, †
- Blair O'Neill, Mazankowski Alberta Heart Institute*
- Vivek Rao, Peter Munk Cardiac Centre, University Health Network
- Heather Sherrard, University of Ottawa Heart Institute*, †
- Chris Simpson, Kingston General Hospital
- Jack Tu, Sunnybrook Health Sciences Centre and Institute for Clinical Evaluative Sciences†
- Ata ur Rehman Quraishi, Queen Elizabeth II Health Sciences Centre*

* Percutaneous Coronary Intervention Working Group.

† Cardiac Surgery Working Group.

CCS Quality Project Steering Committee

- Paul Dorian (Chair), St. Michael's Hospital

CCS Quality Indicators: Percutaneous Coronary Intervention Working Group

- Akshay Bagai, St. Michael's Hospital
- Ronald Carere, St. Paul's Hospital
- Chantal Couris, Canadian Institute for Health Information
- Basem Elbarouni, St. Boniface Hospital
- Diane Galbraith, APPROACH (Alberta Provincial Project for Outcome Assessment in Coronary Heart Disease)
- Neala Gill, Halifax Infirmary
- Laurie Lambert, INESSS (Institut national d'excellence en santé et en services sociaux)
- Andrea Lavoie, Regina General Hospital

- Sohrab Lutchmedial, Saint John Regional Hospital
- Hung Ly, Montréal Heart Institute
- Mina Madan, Sunnybrook Health Sciences Centre
- Garth Oakes, CorHealth Ontario (formerly Cardiac Care Network of Ontario)
- Neil Pearce, Cardiology Consultants
- Erick Schampaert, Sacré-Cœur Hospital
- Ata ur Rehman Quraishi (Chair), Queen Elizabeth II Health Sciences Centre and Dalhousie University
- Robert Welsh (Vice Chair), University of Alberta

CCS Quality Indicators: Cardiac Surgery Working Group

- James Abel (Chair), Providence Health Care
- Stephen Fremes, Sunnybrook Health Sciences Centre
- Diane Galbraith, APPROACH (Alberta Provincial Project for Outcome Assessment in Coronary Heart Disease)
- Vanita Gorzkiewicz, Canadian Institute for Health Information
- Ansar Hassan (Vice Chair), Saint John Regional Hospital
- Karin Humphries, Providence Health Care Research Institute
- Laurie Lambert, INESSS (Institut national d'excellence en santé et en services sociaux)
- Yves Langlois, Jewish General Hospital
- Louis-Mathieu Stevens, CHUM — Hôtel-Dieu
- Colleen Norris, University of Alberta
- Garth Oakes, CorHealth Ontario (formerly Cardiac Care Network of Ontario)

CCS

- MJ Deschamps
- Anne Ferguson, Chief Executive Officer
- Erin McGeachie

CIHI

Production of this analysis involved many people throughout CIHI. Special thanks go to the Indicator Research and Development team for their contributions to this report.

Executive summary

The *Cardiac Care Quality Indicators Report* was developed by the Canadian Institute for Health Information (CIHI) in collaboration with the Canadian Cardiovascular Society (CCS). The report provides pan-Canadian comparable information on mortality and readmission outcomes following percutaneous coronary intervention (PCI), coronary artery bypass graft (CABG) surgery and aortic valve replacement (AVR). The indicators reported on here are part of a suite of PCI and cardiac surgery indicators that CCS has identified as important for evaluating the quality of cardiovascular care in Canada.¹ The report is aligned with the CCS Quality Project, which was established to bring together key stakeholders for national reporting on cardiovascular care to encourage evidence-based practice.¹

This report focuses on 6 outcome indicators and 1 volume measure. Data from administrative databases that have Canadian standards for data collection was used to calculate results for 38 cardiac care centres across 9 provinces. Reporting is at the Canadian, provincial and cardiac care centre levels. Results are based on 3 fiscal years of pooled data: 2013–2014, 2014–2015 and 2015–2016.

Overall, Canada is performing well on PCI and cardiac surgery readmission and mortality.

Highlights include the following:

- Mortality and readmission rates remained stable over the 3 years studied.
- 30-day in-hospital mortality following PCI, isolated CABG, isolated AVR, and combined CABG and AVR was rare, with Canadian rates of 2.3%, 1.3%, 1.3% and 3.3%, respectively.
- Urgent 30-day hospital readmission rates for PCI and isolated CABG were 7.4% and 9.5%, respectively. Canada's overall 30-day readmission rate among all surgical patients was 6.9%.²
- Canadian average mortality and readmission rates are in line with those of other countries.^{3–14}

- Some countries exclude high-risk patients from PCI mortality rates. Most patients who undergo PCI are low risk. Among low-risk PCI patients, the Canadian rate of 30-day in-hospital mortality was 1.3%, which is similar to the rate in the United Kingdom.⁴
- No cardiac care centres performed above or below average on all indicators.
- Variation in indicator results suggests there may be opportunities for quality improvement and sharing of best practices across centres.

Cardiac care is delivered by many different health care professionals. Results highlighted in this report reflect the care provided by the health care system as a whole rather than being attributable to a particular physician within a centre. Quality outcomes depend not only on a physician's technical skills, but also on the structure and care processes that are found in the environment in which health care is delivered.¹⁵

It is hoped that this report will be a starting point for discussion and will help foster learning and sharing of best practices in the Canadian cardiac care community.

[Supplementary data tables](#) accompany this report. These provide more detailed data breakdowns and information on the risk-adjustment model for the Cardiac Care quality indicators.

Introduction

Heart disease continues to be a major health concern for Canadians, despite improved health outcomes for patients living with the condition. About 2.4 million Canadians are living with heart disease; it is the second leading cause of death in this country.¹⁶ By 2020, the economic burden of cardiovascular disease in Canada is expected to reach \$28.3 billion per year.¹⁷ Given this, it is important to examine the quality of cardiac care in order to support improvements in care and, ultimately, in the health of Canadians.

The *Cardiac Care Quality Indicators Report* was developed by the Canadian Institute for Health Information (CIHI) in collaboration with the Canadian Cardiovascular Society (CCS). The report provides pan-Canadian comparable information on mortality and readmission outcomes following percutaneous coronary intervention (PCI), coronary artery bypass graft (CABG) surgery and aortic valve replacement (AVR). The indicators reported on here are part of a suite of PCI and cardiac surgery indicators that CCS has identified as important for evaluating the quality of cardiovascular care in Canada.¹ The report is aligned with the CCS Quality Project, which was established to bring together key stakeholders for national reporting on cardiovascular care to encourage evidence-based practice.¹

Background

In 2008, CorHealth Ontarioⁱ initiated a pilot project with CIHI to develop and report on Cardiac Care quality indicators in Ontario and British Columbia. The initiative was expanded in 2013 to include all cardiac care centres across Canada. Comparable centre-level information on outcomes for different cardiac interventions has been shared privately each year with these centres and/or jurisdictions to support quality improvement efforts.

In 2009, the Canadian Heart Health Strategy and Action Plan recommended that CCS establish the CCS Quality Project to begin to measure and evaluate the quality of cardiovascular care in Canada. As part of this initiative, pan-Canadian data definitions and 37 priority quality indicators were developed in 6 subspecialty areas (atrial fibrillation and atrial flutter, heart failure, cardiac rehabilitation and secondary prevention, PCI, cardiac surgery and transcatheter aortic valve implantation [TAVI]).¹ Partnerships were established with CIHI and provincial cardiac registries to align data definitions, establish data linkages and address barriers, in order to enable interjurisdictional comparisons. CIHI evaluated the feasibility of pan-Canadian reporting on these quality indicators. Findings indicated that selected indicators could be calculated according to the original data definitions or with some minor modifications, leveraging routinely collected administrative data from CIHI.

In 2016, CIHI entered into a memorandum of agreement with CCS to review and refine existing Cardiac Care quality indicators to ensure that they are of high quality and meaningful to the Canadian cardiac care community; to collaborate on capacity-building initiatives to accelerate the use of indicators for quality improvement; and to plan for a public reporting strategy of the Cardiac Care quality indicators.

i. Formerly known as the Cardiac Care Network of Ontario.

This work has been guided by an expert advisory group composed of cardiac physicians and hospital administrators, as well as representatives from CCS and key cardiac and research organizations across Canada. It also involves collaboration with the CCS Quality Indicators PCI and Cardiac Surgery working groups. Expertise has informed indicator development, from relevance to case selection and risk adjustment, as well as methodological enhancements over time.

Participating cardiac care centres have had the opportunity to review and validate their results. Based on their feedback, CIHI has further implemented methodological enhancements and integrated important interpretation considerations in the report wherever possible.

Goals of the report

The overall goals of the *Cardiac Care Quality Indicators Report* are to

- Increase transparency related to the performance of the cardiovascular health care system;
- Make data more accessible to a variety of audiences, including physicians, to help them identify areas for quality improvement; and
- Enhance the cardiovascular health and care of Canadians.

This report provides cardiac care centres with comparative centre-level information on common cardiac procedures, which can highlight where there are variations in practice across centres. The results are a starting point for discussion and encourage analyses of practices at the system level. Cardiac care is delivered by many different health care professionals. The quality indicator outcomes reflect the care provided by the health care system as a whole rather than being attributable to a particular physician within a centre.¹⁵

Quality indicators

This report focuses on 6 outcome indicators and 1 volume measure.

Cardiac Care quality indicators and measure

Category	Indicator/measure	Definition
Mortality*	30-Day In-Hospital Mortality After PCI	Risk-adjusted rate of all-cause in-hospital deaths occurring within 30 days for patients undergoing PCI
	30-Day In-Hospital Mortality After Isolated CABG†	Risk-adjusted rate of all-cause in-hospital deaths occurring within 30 days for patients undergoing isolated CABG surgery
	30-Day In-Hospital Mortality After Isolated AVR†	Risk-adjusted rate of all-cause in-hospital deaths occurring within 30 days for patients undergoing isolated AVR surgery
	30-Day In-Hospital Mortality After CABG and AVR	Risk-adjusted rate of all-cause in-hospital deaths occurring within 30 days for patients undergoing combined CABG and AVR surgery
Readmission	30-Day All-Cause Readmission Rate After PCI	Risk-adjusted rate of all-cause urgent readmission occurring within 30 days following discharge for an episode of care with PCI
	30-Day All-Cause Readmission Rate After Isolated CABG†	Risk-adjusted rate of all-cause urgent readmission occurring within 30 days following discharge for an episode of care with isolated CABG surgery
Volume	PCI Volume by Centre	Total number of PCI procedures performed in a fiscal year (measure, not risk-adjusted)

Notes

* Mortality indicators are based on in-hospital mortality only.

† Isolated means that no other cardiac surgeries, valve procedures or core concomitant procedures were performed during the hospitalization episode of care.

PCI: Percutaneous coronary intervention.

CABG: Coronary artery bypass graft.

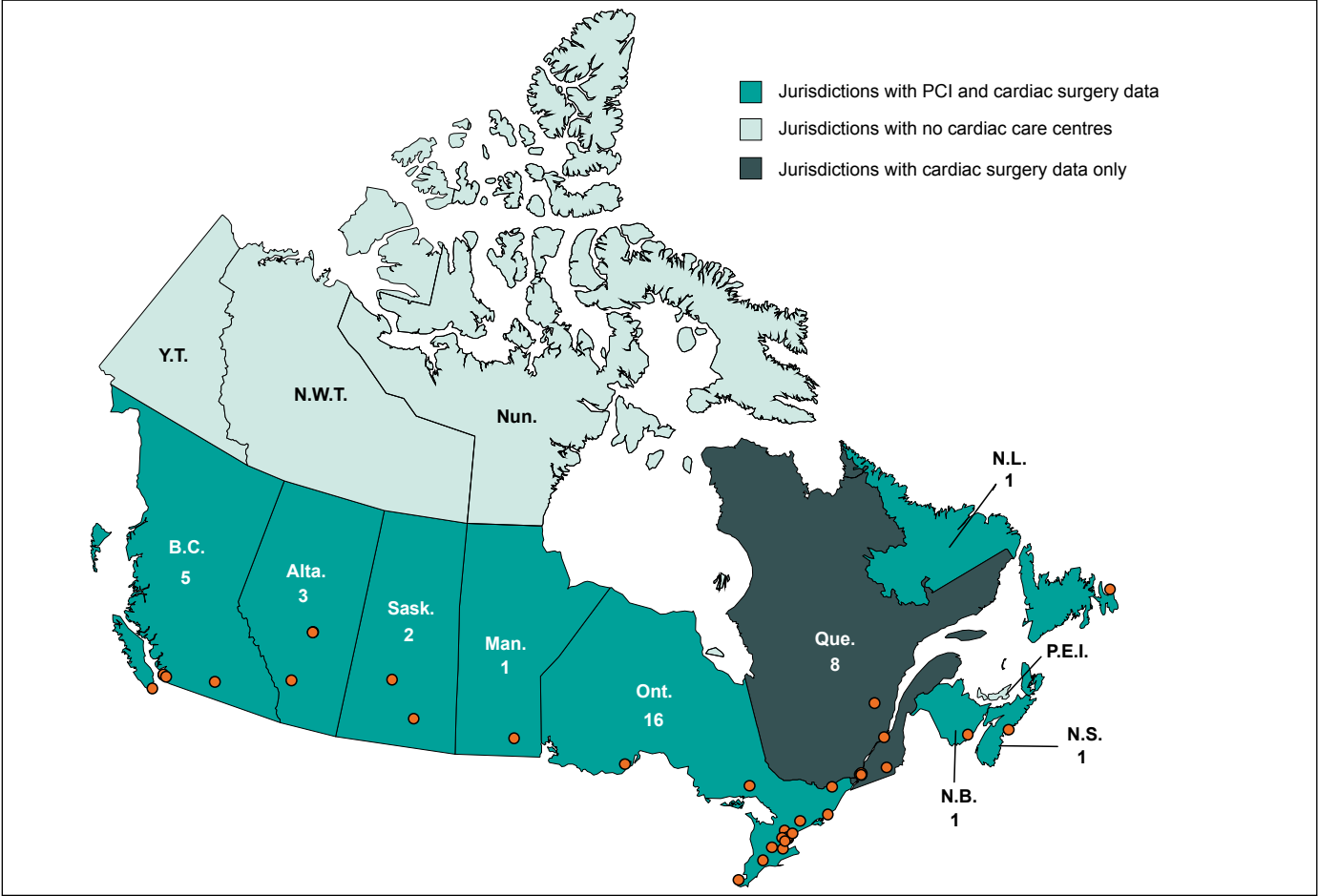
AVR: Aortic valve replacement.

PCI and cardiac surgery outcome indicators were identified as the ideal starting point for public reporting of pan-Canadian Cardiac Care quality indicators, given that these cardiac procedures are common and are performed at most cardiac care centres. In addition, cardiac care centres and/or jurisdictions have had access to these indicators since 2013 through CIHI's annual private release of the *Cardiac Care Quality Indicators Report* to participating centres.¹⁸

Participating cardiac care centres

This report is based on data from 38 cardiac care centres across 9 provinces in Canada that had submitted 3 years of PCI or cardiac surgery data, from fiscal years 2013–2014 to 2015–2016. There is no comprehensive capture of PCI data in Quebec, so there is no reporting on PCI indicators for this province. The map below shows the geographic location of the cardiac care centres participating in this report. A list of the cardiac care centres can be found in Appendix A.

Geographic location of participating cardiac care centres



Note
PCI: Percutaneous coronary intervention.

Methodology

Data

- Data used to calculate the results comes from the CIHI administrative databases that the cardiac care centres routinely submit to each year, following Canadian data abstraction standards: the Discharge Abstract Database (DAD), National Ambulatory Care Reporting System (NACRS) and Hospital Morbidity Database (HMDB). In these databases, medical conditions and cardiac interventions are identified through diagnosis and procedure codes captured according to the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Canada (ICD-10-CA) and the Canadian Classification of Health Interventions (CCI), versions 2012 and 2015. Quebec centres submit data to the MED-ÉCHO database; data is then incorporated into the HMDB.
- There is no comprehensive capture of PCI data for Quebec, so Quebec could not be included in analyses for 30-day in-hospital mortality after PCI, 30-day readmission after PCI and PCI volume by centre.

Record linkage and unit of analysis

- Records from the various databases are linked using an encrypted health care number to follow patients across hospitalizations and to identify outcomes following the different cardiac interventions.
- The unit of analysis for all indicators is an episode of care (hospitalization episode). An episode of care refers to all contiguous inpatient hospitalizations and same-day surgery visits, to take into account any transfers within or between hospitals.
- For all indicators, the result is attributed to the cardiac care centre that performed the PCI or cardiac surgery.

Indicator calculation

- Patient profiles vary across cardiac care centres. Differences in patient risk factors such as age, sex, selected comorbidities and previous interventions are adjusted for in the analysis to make indicator results as comparable as possible across centres. Despite our best effort to take patient risk factors into consideration, there are limitations based on the data available in the administrative databases.
- Reporting is at the Canadian, provincial and cardiac care centre levels.
- Risk-adjusted results and 95% error bars (confidence intervals) are reported at the provincial and cardiac care centre levels.
- Crude and predicted rates are reported at the cardiac care centre level.
- Results are based on 3 fiscal years of pooled data: 2013–2014, 2014–2015 and 2015–2016. Using 3 years of pooled data increases the stability of the rates due to the low number of events (particularly mortality).
- Unstable indicator results are suppressed. These reflect indicator results with a denominator between 1 and 49, or with an expected event less than 1 if the crude numerator count was greater than 0. Due to the nature of the risk-adjusted indicators, results that pass this criterion are reported regardless of the numerator size.
- More comprehensive indicator and methodology information is available through [CIHI's Indicator Library](#).
- [Supplementary data tables](#) accompany this report. These provide more detailed data breakdowns and information on the risk-adjustment model for the Cardiac Care quality indicators.

Key concepts

- **Risk adjustment:** A statistical method used to control for patient characteristics and other risk factors that may affect health care outcomes in order to improve comparability of results. These risk factors can include age, sex, selected comorbidities and previous interventions. There are other risk factors that may contribute to a higher-than-average patient risk, as well as other clinical information (e.g., left ventricle ejection fraction) that is sometimes used in risk adjustment for cardiac patients, that is not available in the administrative data.
- **Crude versus predicted rates:** It is important to consider the comparison of the crude rate with the predicted rate to identify potential opportunities for improvement. The crude rate provides information on the exact number of events for a given population. The predicted rate represents the predicted number of events for a given population, considering the distribution of risk factors in the population, and provides a picture of the patient complexity at each cardiac care centre. Higher predicted values represent a higher-risk patient group, while lower predicted values represent a lower-risk patient group.
- **Confidence intervals:** The width of the confidence interval illustrates the precision of the indicator's risk-adjusted rate. The rate is estimated to be accurate within the upper and lower confidence intervals 19 times out of 20 (95% confidence interval). The narrower the confidence interval, the more precise the rate. Confidence intervals are also used to establish whether the risk-adjusted rate is statistically different from an overall average. For example, if the confidence intervals do not overlap with the Canadian average, the risk-adjusted rate is considered to be statistically significantly different from the Canadian average rate.

Interpretation

- Cardiac care is delivered by many health care professionals. Results highlighted in this report reflect care provided by the health care system as a whole rather than being attributable to a single physician in a centre. Quality outcomes depend not only on a physician's technical skills, but also on the structure and care processes that are found in the environment in which health care is delivered.¹⁵
- Some cardiac care centres are more specialized, perform interventions on more complex patients or accept higher-risk patients than average. CIHI is able to adjust for some of these differences across patient populations; however, the administrative data submitted is limited in its ability to capture and adjust for all differences associated with patient populations. Centres with more complex patients may have increased mortality and/or readmission rates, because not all aspects of complexity can be adjusted for in the administrative data.
- Transferring patients to different hospitals following a cardiac intervention is normal practice for many cardiac care centres. As such, there are potential learning opportunities beyond the centres included in this report.
- Rates with wide confidence intervals should be interpreted with caution as they reflect a less-precise estimate.
- Direct comparisons between cardiac care centres or provinces are discouraged. Comparisons with the Canadian average provide more meaningful information.



Canadian results

Canadian average rates for Cardiac Care quality indicators

Overall, Canada is performing well on Cardiac Care quality indicators for PCI and cardiac surgery.

- 30-day in-hospital mortality following PCI, isolated CABG, isolated AVR and combined CABG and AVR was rare, with Canadian rates of 2.3%, 1.3%, 1.3% and 3.3%, respectively.
- Urgent 30-day hospital readmission rates following PCI and isolated CABG were 7.4% and 9.5%, respectively. Canada's overall 30-day readmission rate among all surgical patients was 6.9%.²
- Canadian average mortality and readmission rates are in line with those of other countries.^{3–14}
- Mortality and readmission rates for Canada remained stable from fiscal years 2013–2014 to 2015–2016. 3-year pooled results are provided in the table on the next page.

Canadian average mortality and readmission rates by indicator

Category	Indicator	Number of hospitalizations	Canadian average rate
Mortality*	30-Day In-Hospital Mortality After PCI	121,378	2.3%
	30-Day In-Hospital Mortality After Isolated CABG [†]	42,989	1.3%
	30-Day In-Hospital Mortality After Isolated AVR [†]	7,186	1.3%
	30-Day In-Hospital Mortality After CABG and AVR	5,794	3.3%
Readmission	30-Day All-Cause Readmission Rate After PCI	120,307	7.4%
	30-Day All-Cause Readmission Rate After Isolated CABG [†]	41,257	9.5%

Notes

* Mortality indicators are based on in-hospital mortality only.

† Isolated means that no other cardiac surgeries, valve procedures or core concomitant procedures were performed during the hospitalization episode of care.

PCI: Percutaneous coronary intervention.

CABG: Coronary artery bypass graft.

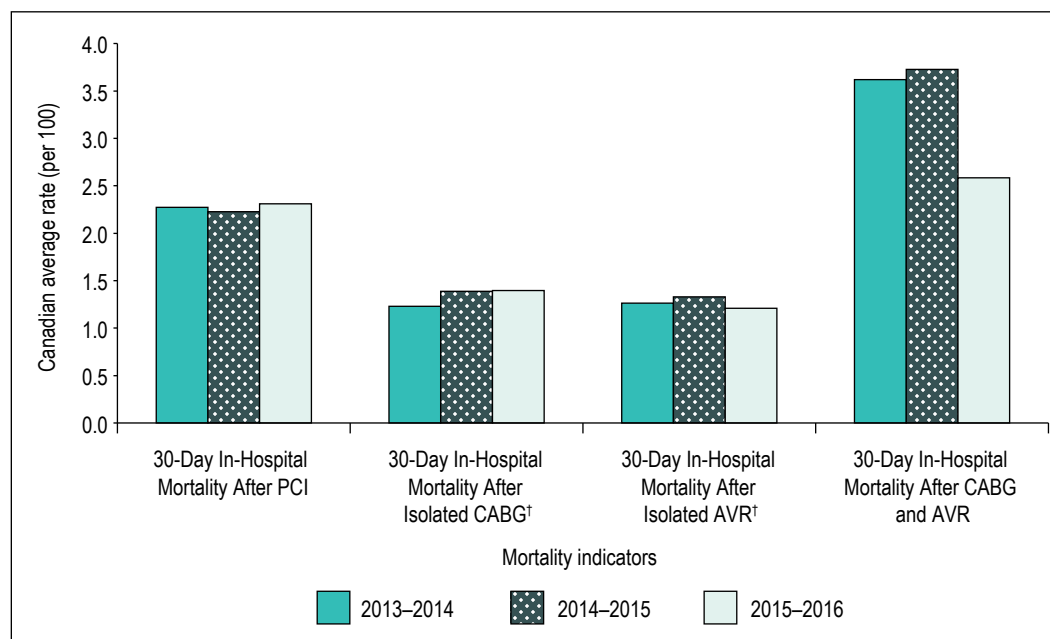
AVR: Aortic valve replacement.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Canadian average mortality* rates by indicator and fiscal year, 2013–2014 to 2015–2016



Notes

* Mortality indicators are based on in-hospital mortality only.

† Isolated means that no other cardiac surgeries, valve procedures or core concomitant procedures were performed during the hospitalization episode of care.

PCI: Percutaneous coronary intervention.

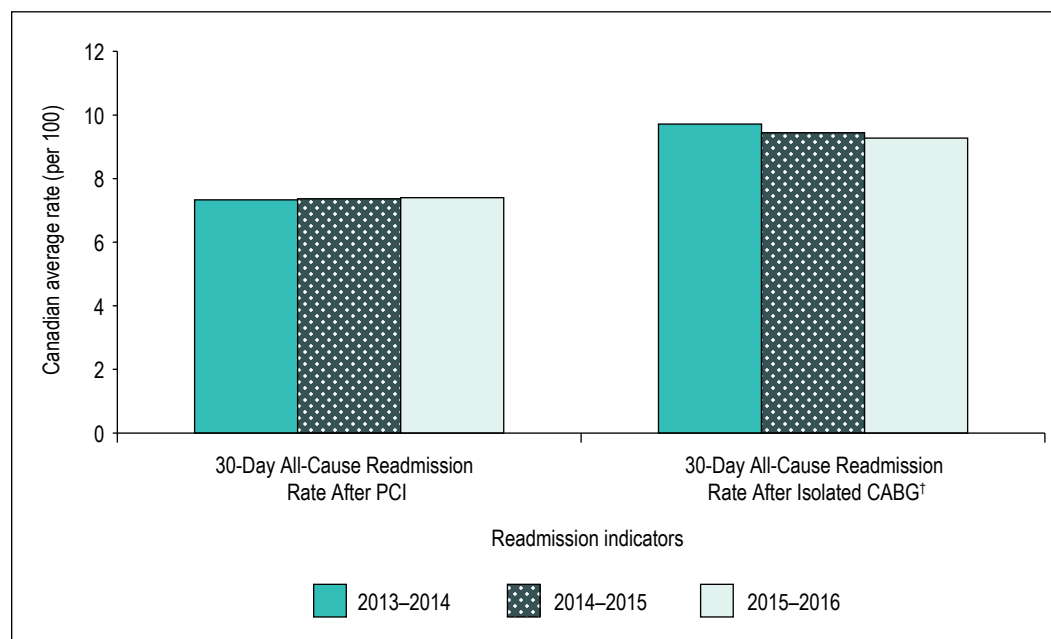
CABG: Coronary artery bypass graft.

AVR: Aortic valve replacement.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Canadian average readmission rates by indicator and fiscal year, 2013–2014 to 2015–2016



Notes

† Isolated means that no other cardiac surgeries, valve procedures or core concomitant procedures were performed during the hospitalization episode of care.

PCI: Percutaneous coronary intervention.

CABG: Coronary artery bypass graft.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

High-risk patients

Some cardiac care centres are more specialized, perform interventions on more complex patients or accept higher-risk patients than average. For the purpose of this report, *high-risk* patients are defined as those who experienced cardiac arrest or shock prior to the cardiac intervention, and *low-risk* patients are defined as those who did not. Other factors can contribute to patients being at higher risk of mortality or readmission, including their coronary syndrome status and additional risk factors (e.g., age, comorbidities, previous interventions) that have been accounted for in the risk-adjustment model. Risk factors such as designation of a patient as salvage, left ventricle ejection fraction and history of transplant are not available in administrative data.

Canadian prevalence of high-risk patients by mortality indicator*

Indicator	Proportion of high-risk patients	Cardiac care centre range
30-Day In-Hospital Mortality After PCI	3.0%	1.4% to 5.7%
30-Day In-Hospital Mortality After Isolated CABG†	1.7%	0.8% to 2.9%
30-Day In-Hospital Mortality After Isolated AVR†	0.8%	0.0% to 3.0%
30-Day In-Hospital Mortality After CABG and AVR	1.2%	0.0% to 4.6%

Notes

* Mortality indicators are based on in-hospital mortality only.

† Isolated means that no other cardiac surgeries, valve procedures or core concomitant procedures were performed during the hospitalization episode of care.

High-risk patients experienced cardiac arrest or shock prior to the cardiac intervention.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

- Some countries exclude high-risk patients from PCI mortality rates.
- In Canada, 3.0% of PCIs were done on high-risk patients; the range across cardiac care centres was 1.4% to 5.7%. See the [supplementary data tables](#) for the proportion of high-risk patients by centre.
- Most patients who undergo PCI are low risk.
- After excluding these high-risk cases, the Canadian rate of 30-day in-hospital mortality after PCI greatly decreased, from 2.3% to 1.3%, which is in line with results from the United Kingdom.⁴
- Rates of 30-day in-hospital mortality after PCI also varied depending on the coronary syndrome status of the patient.
 - Patients who experienced an acute myocardial infarction (AMI) marked by ST elevation (STEMI) had the highest mortality, at 5.2%. This was followed by patients with a non-STEMI (NSTEMI) AMI, at 1.5%; those with stable coronary artery disease, at 0.9%; and those with unstable angina, at 0.3%.

Canadian average 30-day in-hospital mortality after PCI, by coronary syndrome status patient group

Coronary syndrome status patient group	Proportion of patients	Canadian average rate	Cardiac care centre range of crude rates
STEMI	29.4%	5.2%	3.1% to 8.8%
NSTEMI/unspecified AMI	29.1%	1.5%	0.3% to 3.0%
Stable coronary artery disease	32.0%	0.9%	0.4% to 2.6%
Unstable angina	9.5%	0.3%	0.0% to 1.0%

Notes

STEMI: ST elevation myocardial infarction.

NSTEMI: Non-ST elevation myocardial infarction.

AMI: Acute myocardial infarction.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.



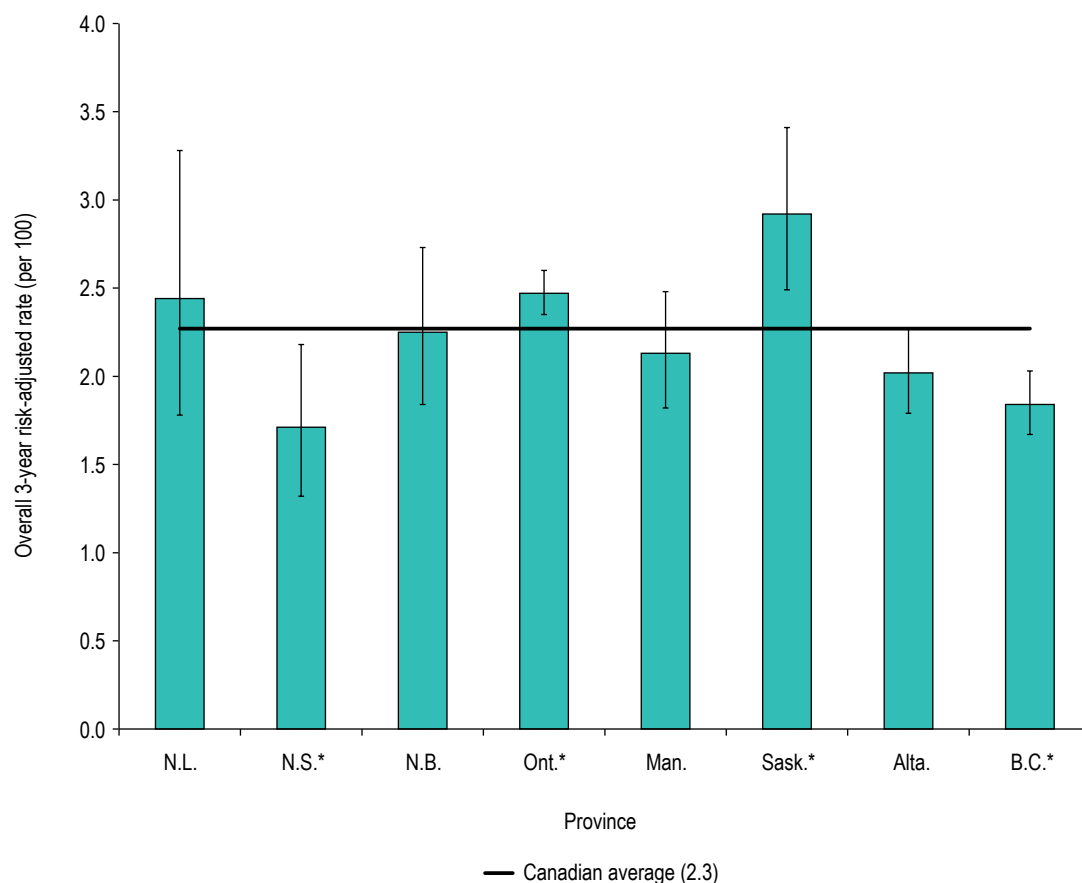
Provincial and cardiac care centre results



30-Day In-Hospital Mortality After PCI

PCI is a well-established procedure to treat coronary artery stenosis. As the number of PCIs has increased in recent years, there is high potential for variation in quality of care. CCS identifies short-term mortality after PCI as a key quality indicator for PCI care. PCI can be performed as a day procedure or as part of an inpatient hospitalization to treat many different types of patients. It can be initiated as a life-saving intervention in high-risk cases or it can be a scheduled course of treatment for stable coronary artery disease. Through innovations and expertise in the delivery of PCI, more cardiac care centres have been taking on more complex cases and saving patient lives where treatment may not have been previously possible.

Provincial risk-adjusted results for 30-Day In-Hospital Mortality After PCI



Risk-adjusted rate of all-cause in-hospital deaths occurring within 30 days of patients undergoing PCI



- The Canadian average was 2.3%, with provincial rates ranging from 1.7% to 2.9%.
- 2 provinces had significantly lower and 2 had significantly higher results compared with the Canadian average.

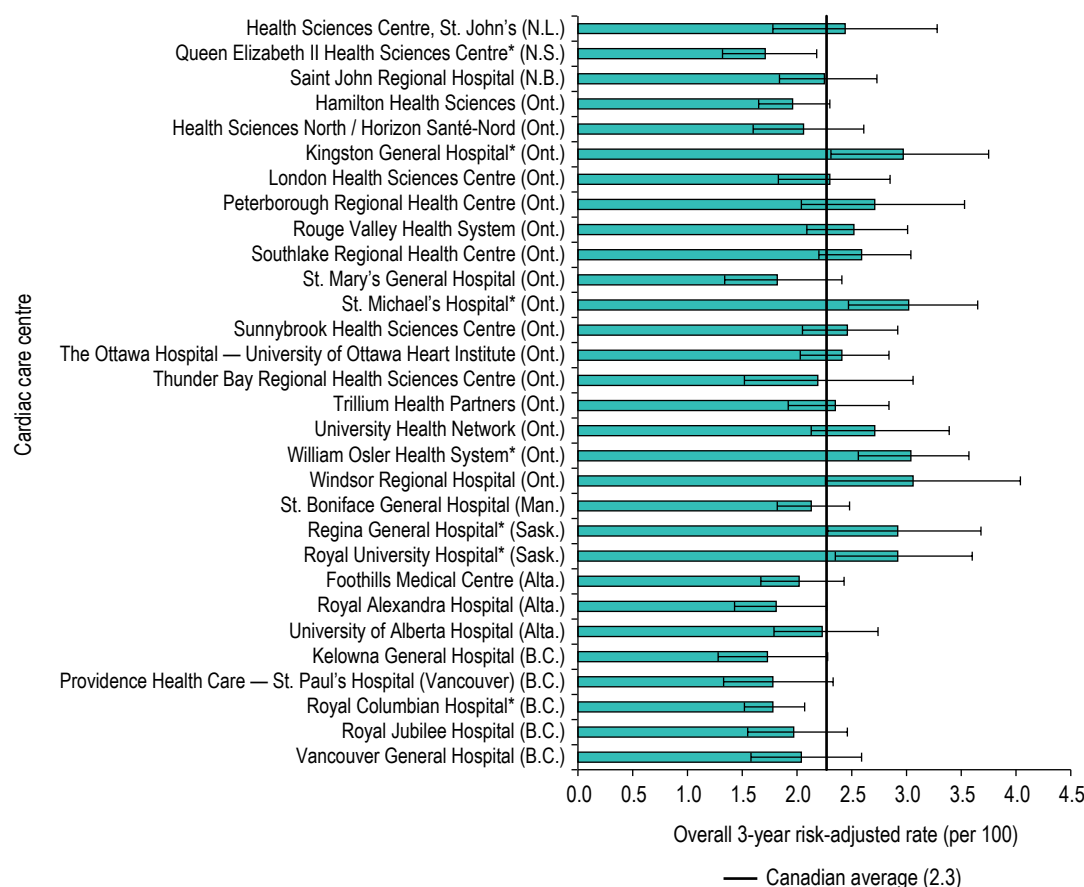
Notes

* Risk-adjusted rate is statistically significantly different from the Canadian average.
3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre risk-adjusted results for 30-Day In-Hospital Mortality After PCI



- Cardiac care centre-specific results ranged from 1.7% to 3.1%.
- 2 centres had significantly lower and 5 had significantly higher results compared with the Canadian average.

Notes

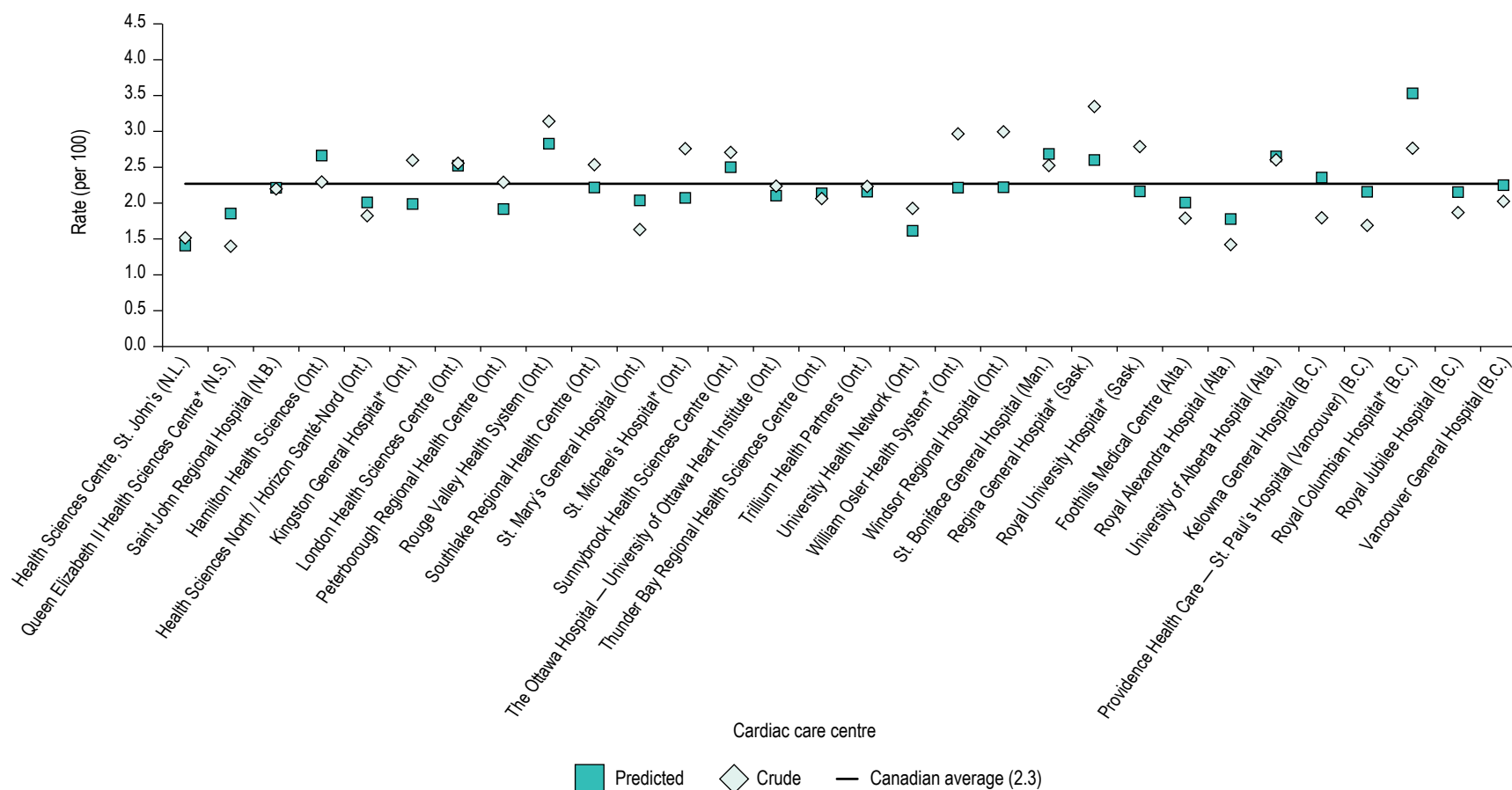
* Risk-adjusted rate is statistically significantly different from the Canadian average.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre crude versus predicted rates for 30-Day In-Hospital Mortality After PCI



Notes

* Risk-adjusted rate is statistically significantly different from the Canadian average.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

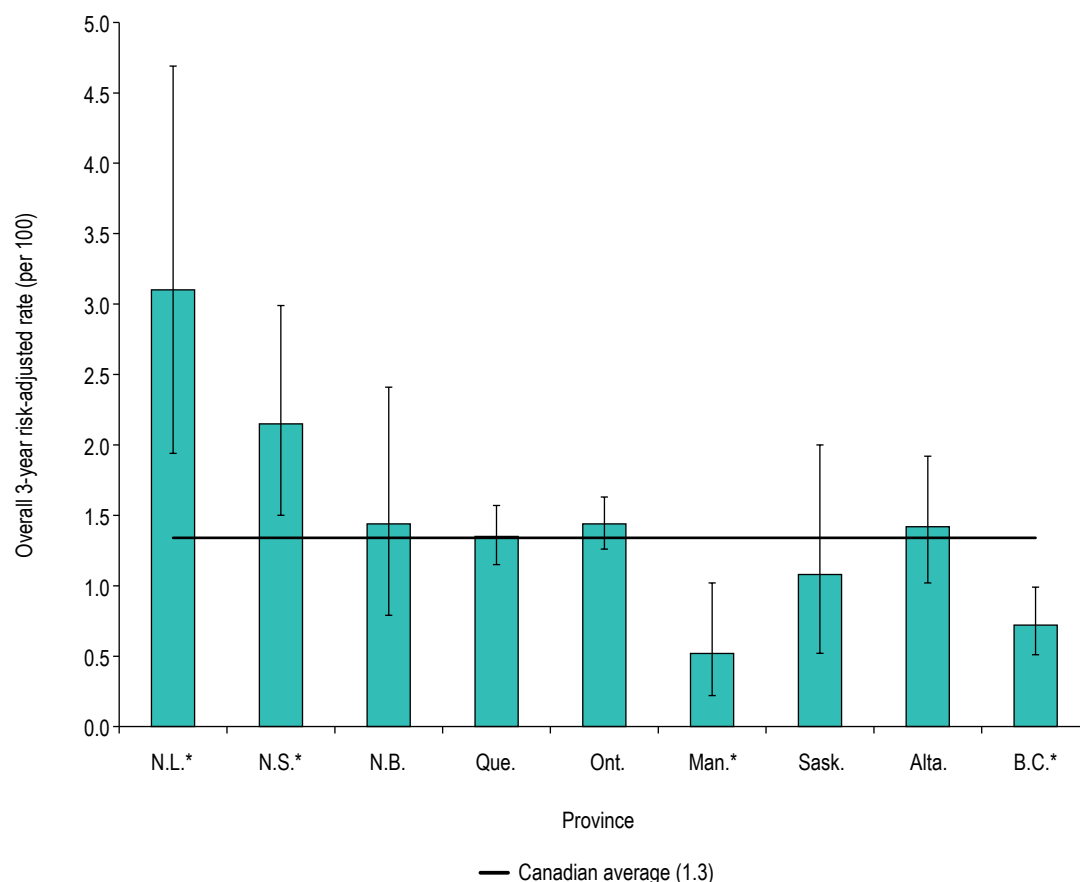
Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.



30-Day In-Hospital Mortality After Isolated CABG

CABG, along with PCI, is a well-established procedure to treat coronary artery stenosis. With the growth of PCI as a revascularization option to treat coronary artery stenosis, CABG surgery is being performed more on patients with advanced coronary disease and comorbid conditions such as diabetes. About three-quarters of revascularization procedures in Canada are done through PCI, with the remaining one-quarter done through CABG. Short-term mortality after CABG has been identified as a key quality indicator for cardiac surgery care by CCS.

Provincial risk-adjusted results for 30-Day In-Hospital Mortality After Isolated CABG



Risk-adjusted rate of all-cause in-hospital deaths occurring within 30 days for patients undergoing isolated CABG



- The Canadian average was 1.3%, with provincial rates ranging from 0.5% to 3.1%.
- 2 provinces had significantly lower and 2 had significantly higher results compared with the Canadian average.

Notes

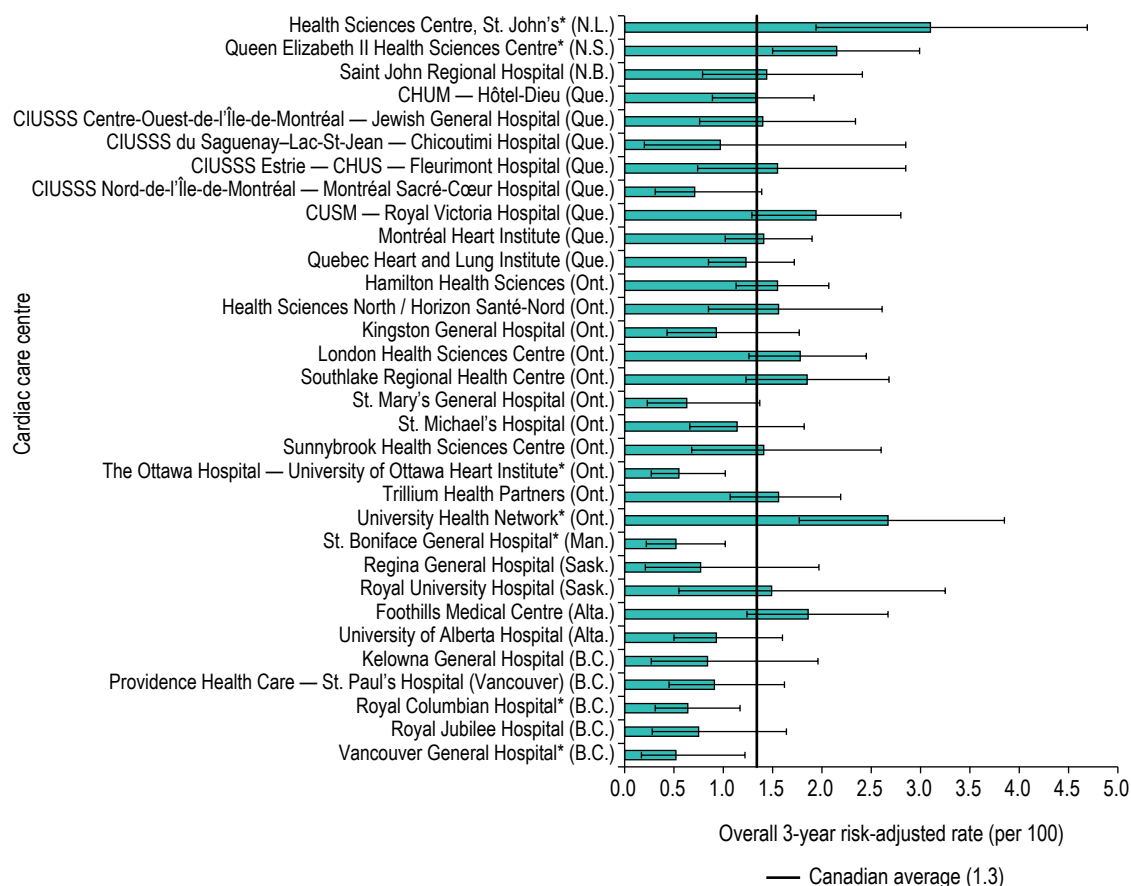
* Risk-adjusted rate is statistically significantly different from the Canadian average.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre risk-adjusted results for 30-Day In-Hospital Mortality After Isolated CABG



- Results ranged from 0.5% to 3.1% across cardiac care centres.
- 4 centres had significantly lower and 3 had significantly higher results compared with the Canadian average.

Notes

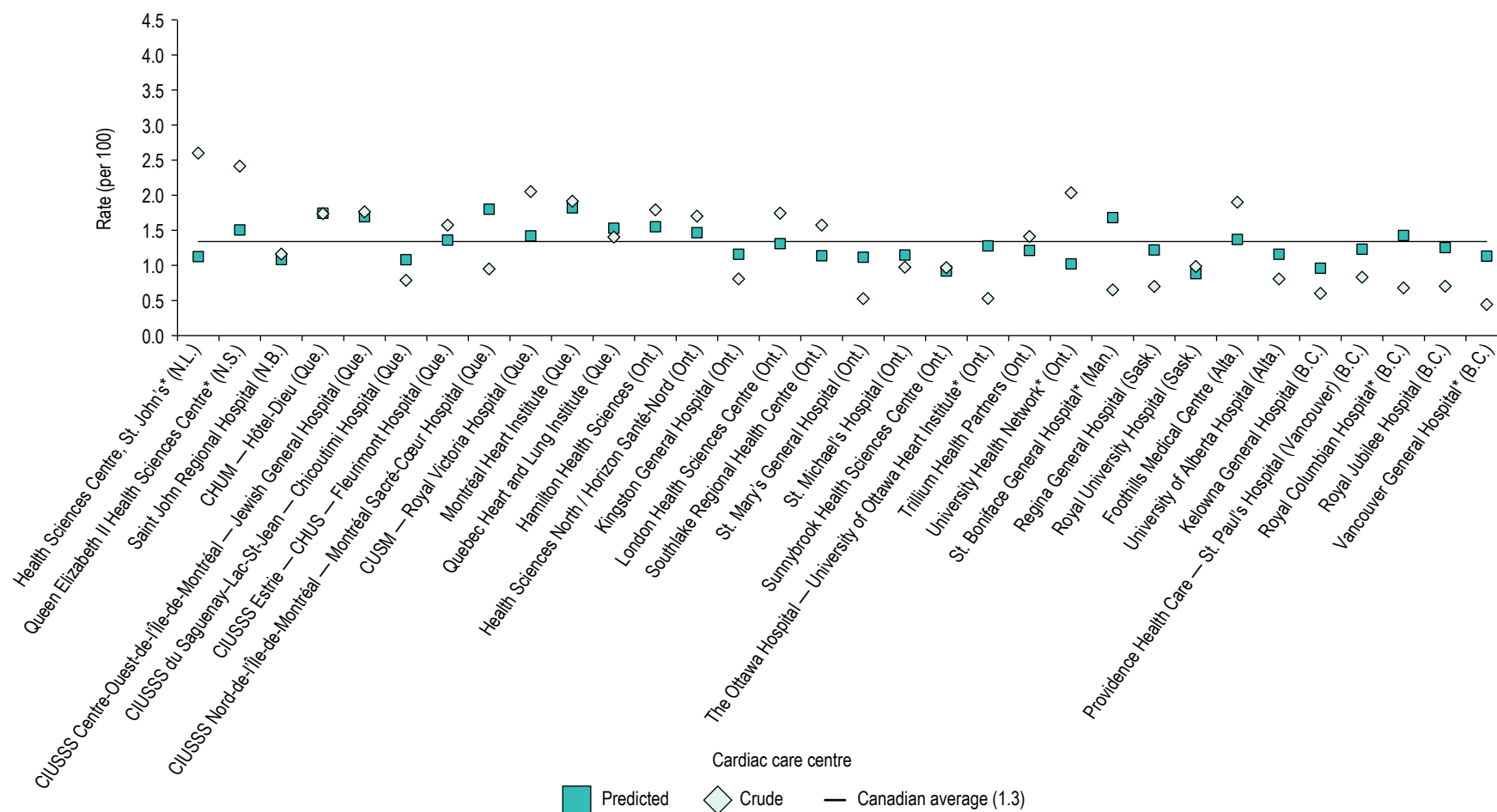
* Risk-adjusted rate is statistically significantly different from the Canadian average.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre crude versus predicted rates for 30-Day In-Hospital Mortality After Isolated CABG



Notes

* Risk-adjusted rate is statistically significantly different from the Canadian average.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

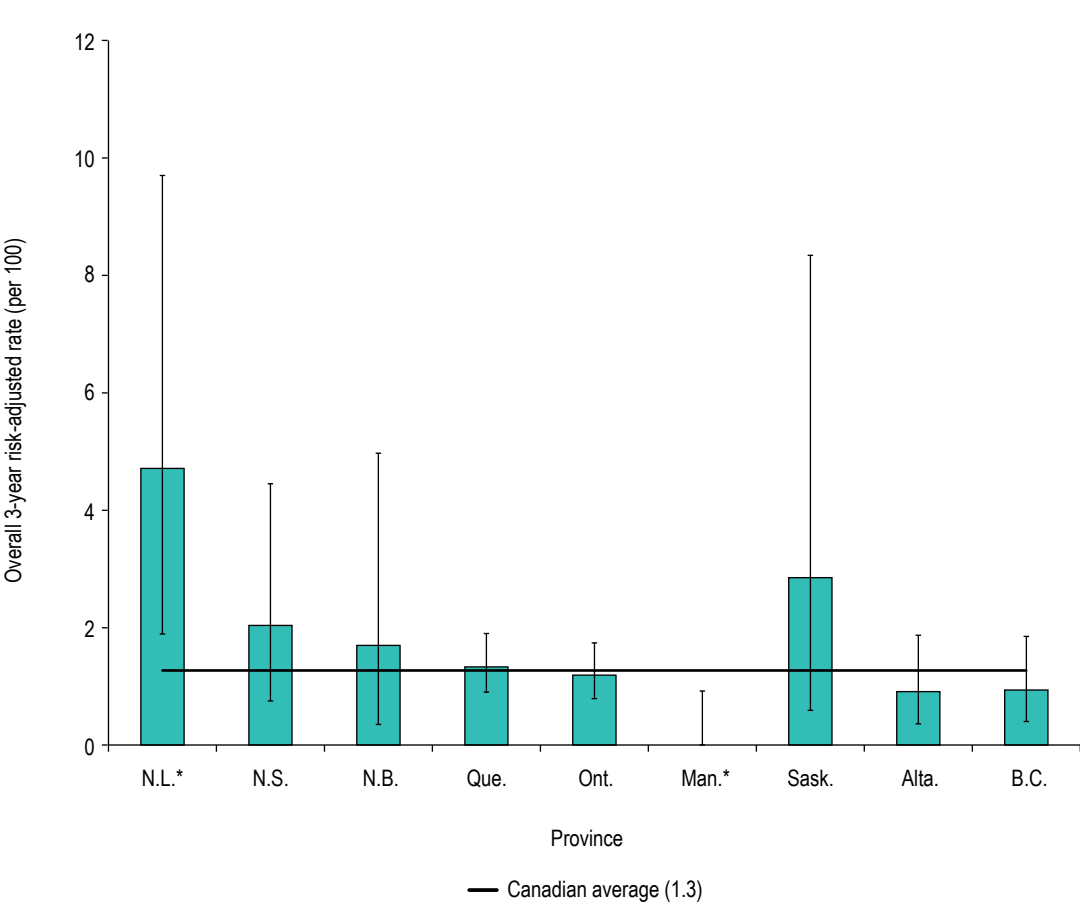
Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.



30-Day In-Hospital Mortality After Isolated AVR

AVR is a common procedure to treat aortic valve stenosis. In most cardiac care centres, AVR is the second most frequently performed cardiac surgery, after CABG. Short-term mortality after AVR has been identified as a key quality indicator for cardiac surgery care by CCS.

Provincial risk-adjusted results for 30-Day In-Hospital Mortality After Isolated AVR



Risk-adjusted rate of all-cause in-hospital deaths occurring within 30 days following isolated AVR



- The Canadian average was 1.3%, with provincial rates ranging from 0.0% to 4.7%.
- 1 province had significantly lower and 1 had significantly higher results compared with the Canadian average.

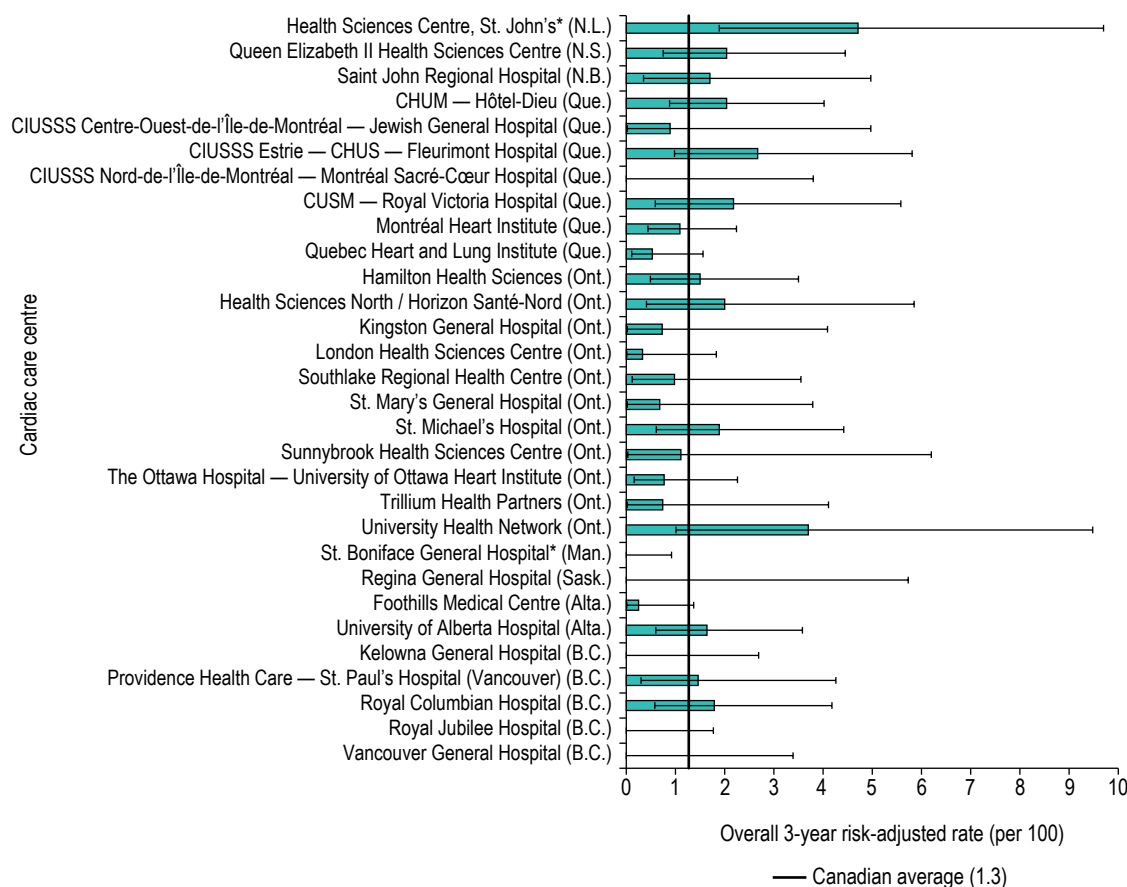
Notes

* Risk-adjusted rate is statistically significantly different from the Canadian average.
3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre risk-adjusted results for 30-Day In-Hospital Mortality After Isolated AVR



- Over the 3-year period, 6 hospitals had a 30-day in-hospital mortality rate after isolated AVR of 0.0%.
- Since AVR is performed on fewer patients, the confidence intervals are wider. Thus the results should be interpreted with caution.
- 1 cardiac care centre had significantly lower and 1 had significantly higher results compared with the Canadian average.

Notes

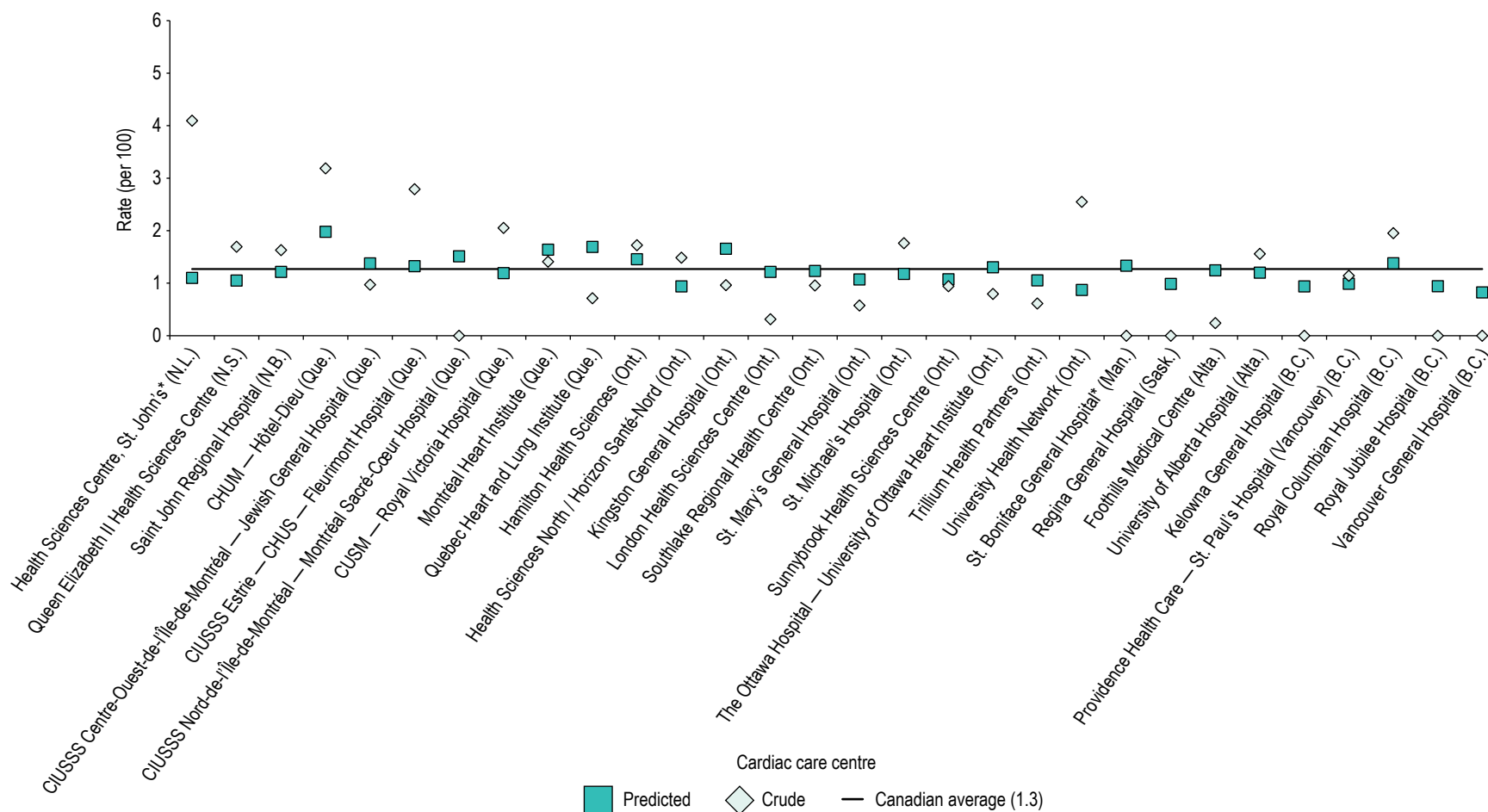
* Risk-adjusted rate is statistically significantly different from the Canadian average.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre crude versus predicted rates for 30-Day In-Hospital Mortality After Isolated AVR



Notes

* Risk-adjusted rate is statistically significantly different from the Canadian average.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

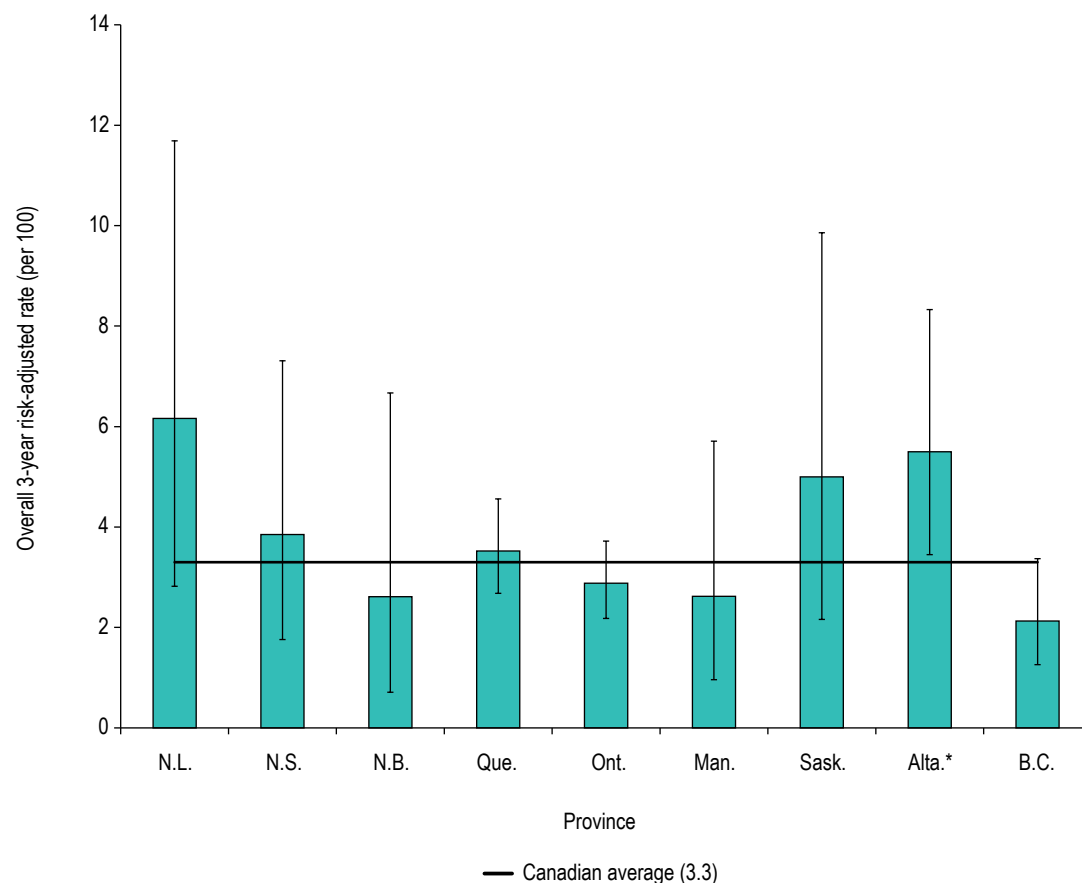
Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.



30-Day In-Hospital Mortality After CABG and AVR

An increasing number of patients suffer from the combination of coronary artery stenosis and aortic valve stenosis and are candidates for combined CABG and AVR surgery. In most cardiac care centres, this is the third most frequently performed cardiac surgery (after isolated CABG and isolated AVR). Short-term mortality following combined CABG and AVR surgery has been identified as a key quality indicator for cardiac surgery care by CCS. Combined CABG and AVR surgery is considered higher risk than isolated CABG and isolated AVR.

Provincial risk-adjusted results for 30-Day In-Hospital Mortality After CABG and AVR



Risk-adjusted rate of all-cause in-hospital deaths occurring within 30 days following combined CABG and AVR



- The Canadian average was 3.3%, with provincial rates ranging from 2.1% to 6.2%.
- None of the provinces had significantly lower results and only 1 had significantly higher results compared with the Canadian average.

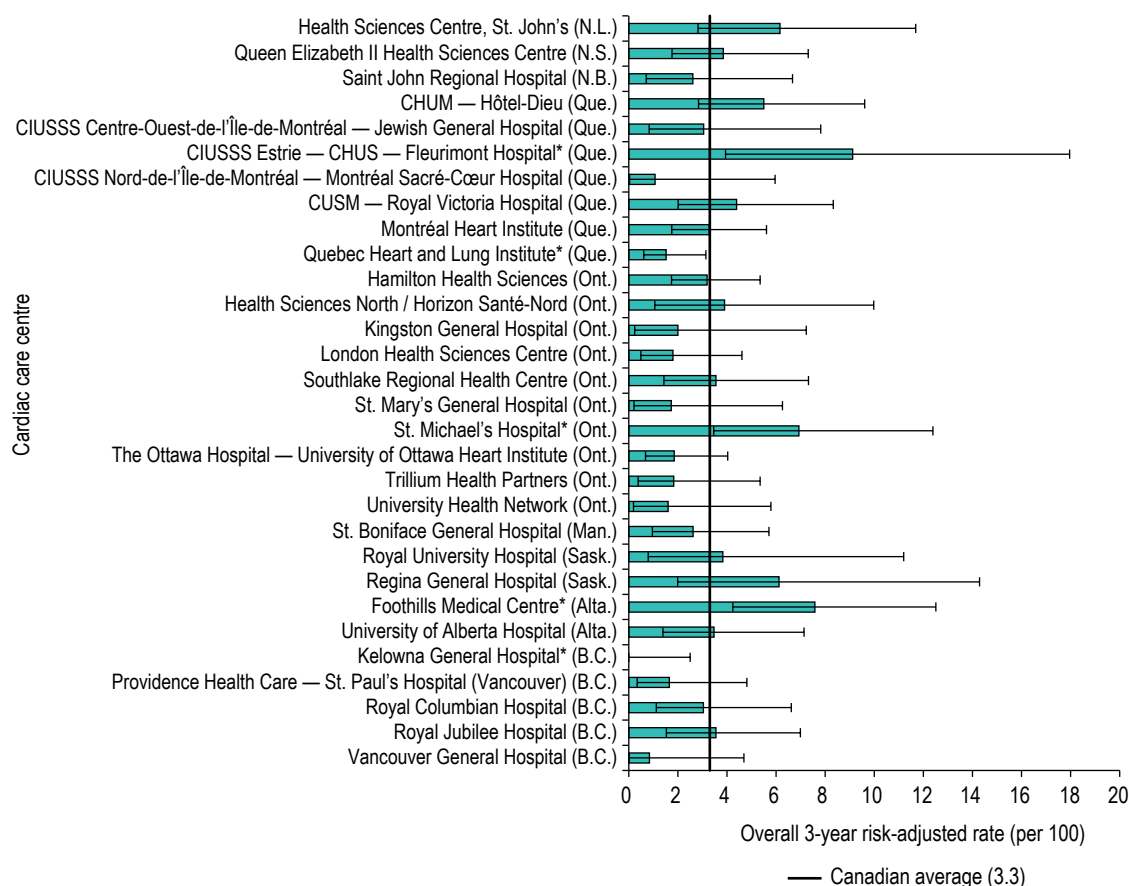
Notes

* Risk-adjusted rate is statistically significantly different from the Canadian average.
3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre risk-adjusted results for 30-Day In-Hospital Mortality After CABG and AVR



- Rates varied across cardiac care centres, from 0.0% to 9.1%.
- As combined CABG and AVR surgery is performed on fewer patients, the confidence intervals are wider. Thus the results should be interpreted with caution.
- 2 cardiac care centres had significantly lower and 3 had significantly higher results compared with the Canadian average.

Notes

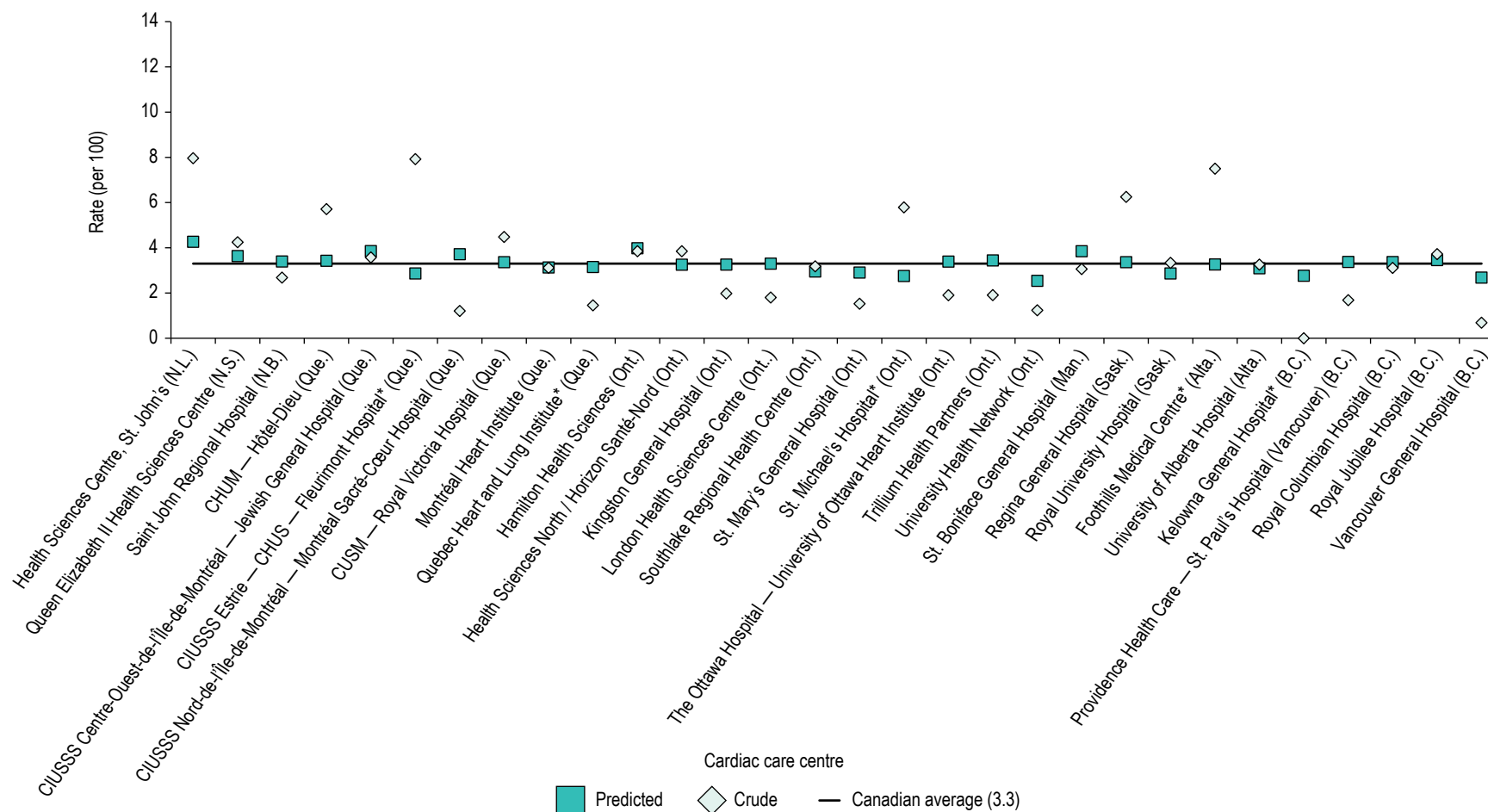
* Risk-adjusted rate is statistically significantly different from the Canadian average.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre crude versus predicted rates for 30-Day In-Hospital Mortality After CABG and AVR



Notes

* Risk-adjusted rate is statistically significantly different from the Canadian average.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

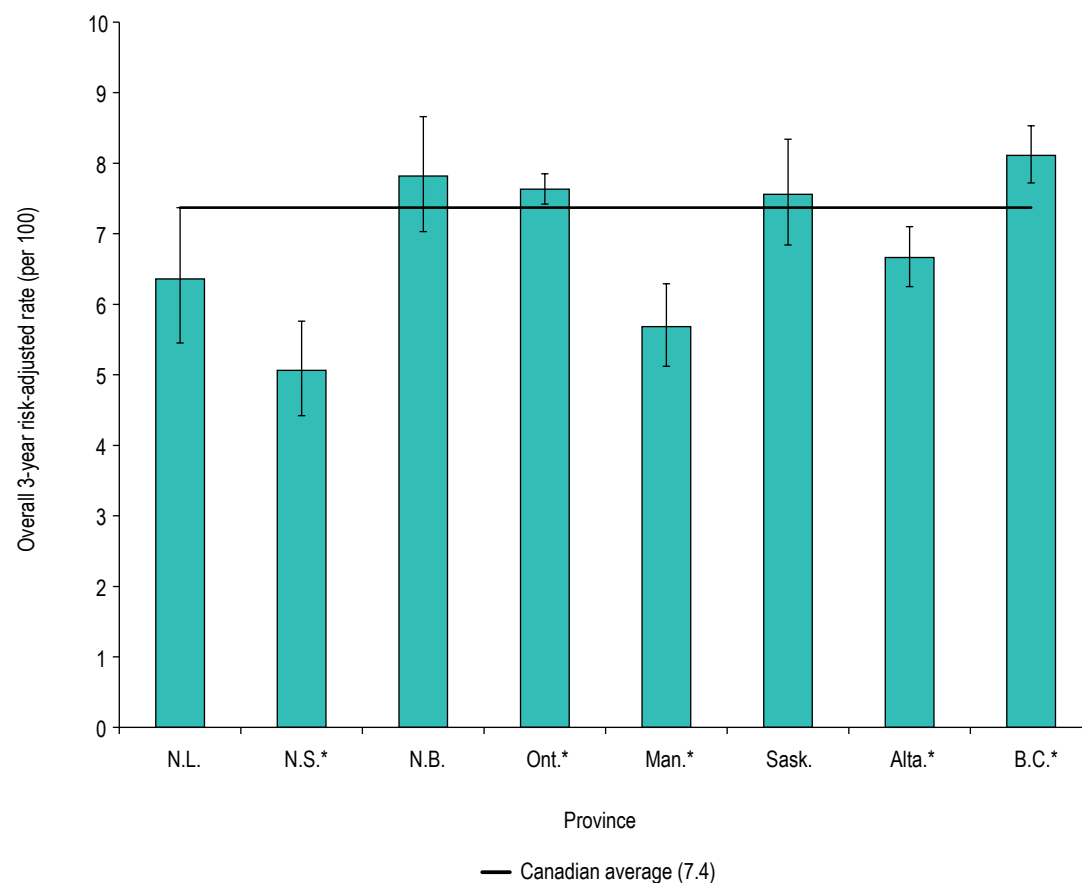
Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.



30-Day All-Cause Readmission Rate After PCI

Urgent 30-day readmission after PCI has been identified as a key quality indicator for cardiac care by CCS. Readmission rates can be influenced by a variety of factors, including patient characteristics, the quality of inpatient and outpatient care (including potential complications of the intervention), the effectiveness of the care transition and coordination, and the availability and use of effective community-based disease management programs. Understanding the reasons for readmission and whether it was avoidable is an important metric by which to evaluate quality of care.

Provincial risk-adjusted results for 30-Day All-Cause Readmission Rate After PCI



Risk-adjusted rate of all-cause urgent readmission occurring within 30 days following discharge for an episode of care with PCI



- The Canadian average was 7.4%, with provincial rates ranging from 5.1% to 8.1%.
- 3 provinces had significantly lower and 2 had significantly higher results compared with the Canadian average.
- The top 5 reasons for readmission (based on the Canadian average rate) were pain in throat and chest (13.9%), heart failure (10.8%), angina pectoris (which includes unstable angina) (7.6%), AMI (7.4%) and chronic ischemic heart disease (which includes atherosclerotic heart disease) (3.9%).

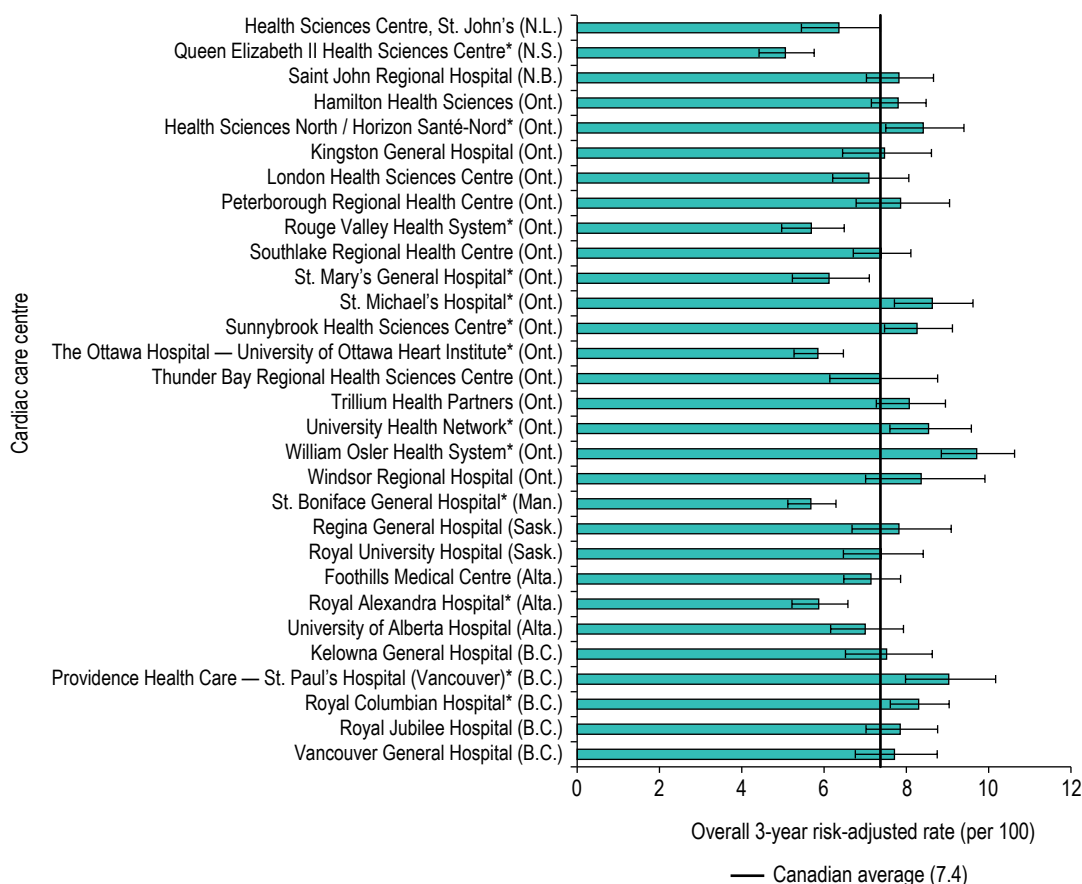
Notes

* Risk-adjusted rate is statistically significantly different from the Canadian average.
3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre risk-adjusted results for 30-Day All-Cause Readmission Rate After PCI



- Cardiac care centre-specific results ranged from 5.1% to 9.7%.
- 6 centres had significantly lower and 7 had significantly higher results compared with the Canadian average.
- Transferring patients to different centres following a cardiac intervention is normal practice for many cardiac care centres. Overall, 76% of PCI cases ended their hospitalization in the same cardiac care centre where the PCI was performed. However, there was variation across centres; the percentage of patients transferred between centres following a PCI ranged from 48% to 99%.
- Results for 30-Day All-Cause Readmission Rate After PCI provide an opportunity for centres involved in transfers-in and -out to discuss patient pathways and to collaboratively investigate factors contributing to the results.

Notes

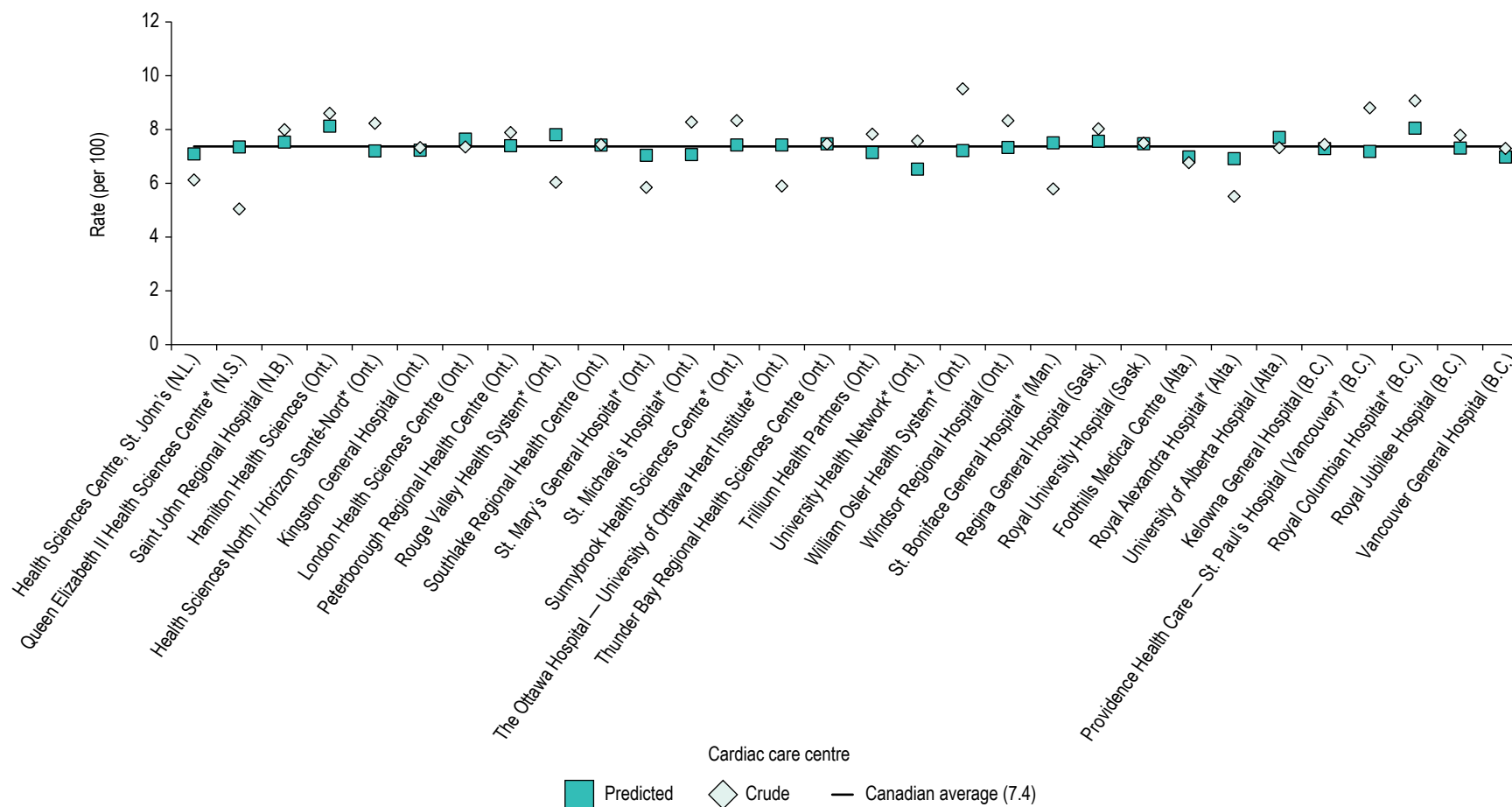
* Risk-adjusted rate is statistically significantly different from the Canadian average.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre crude versus predicted rates for 30-Day All-Cause Readmission Rate After PCI



Notes

* Risk-adjusted rate is statistically significantly different from the Canadian average.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

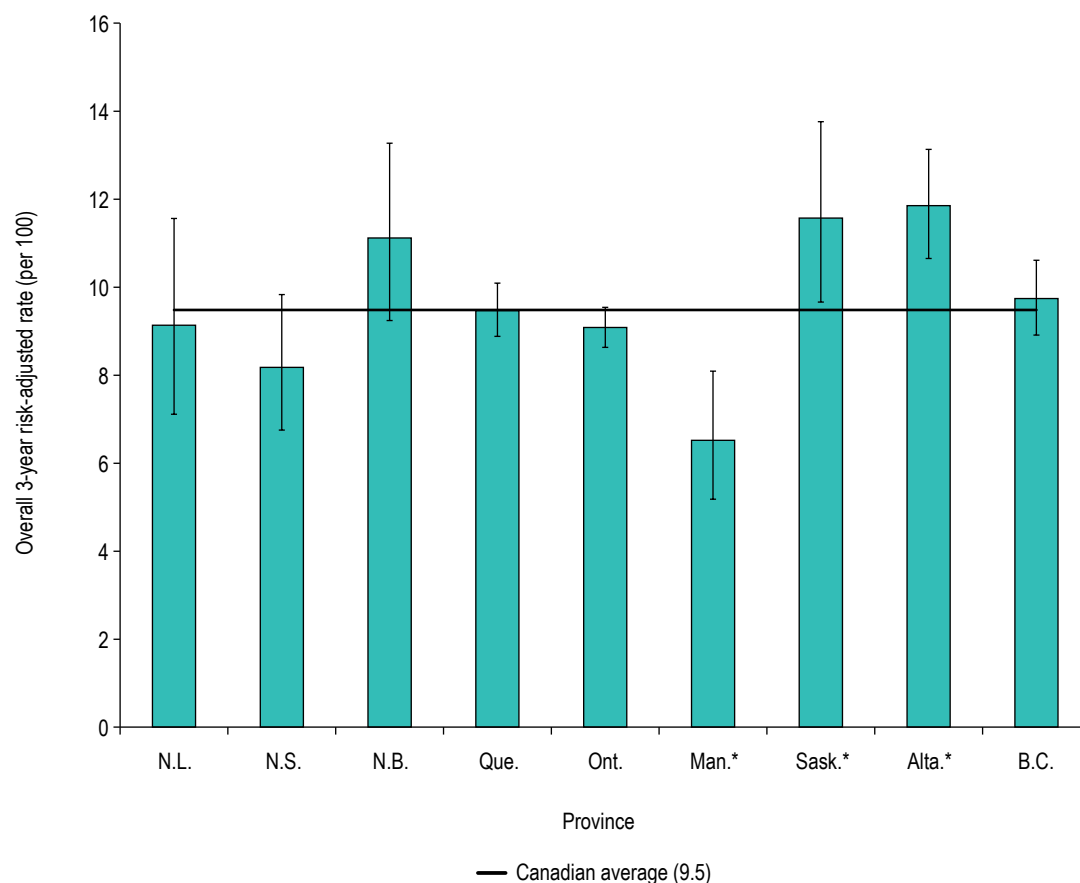
Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.



30-Day All-Cause Readmission Rate After Isolated CABG

Urgent 30-day readmission after CABG has been identified as a key quality indicator of cardiac care by CCS. Readmission rates can be influenced by a variety of factors, including patient characteristics, the quality of inpatient and outpatient care (including potential complications of the intervention), the effectiveness of the care transition and coordination, and the availability and use of effective community-based disease management programs. Understanding the reasons for readmission and whether it was avoidable is an important metric by which to evaluate quality of care.

Provincial risk-adjusted results for 30-Day All-Cause Readmission Rate After Isolated CABG



Notes

* Risk-adjusted rate is statistically significantly different from the Canadian average.
3 years of pooled data: 2013–2014 to 2015–2016.

Sources

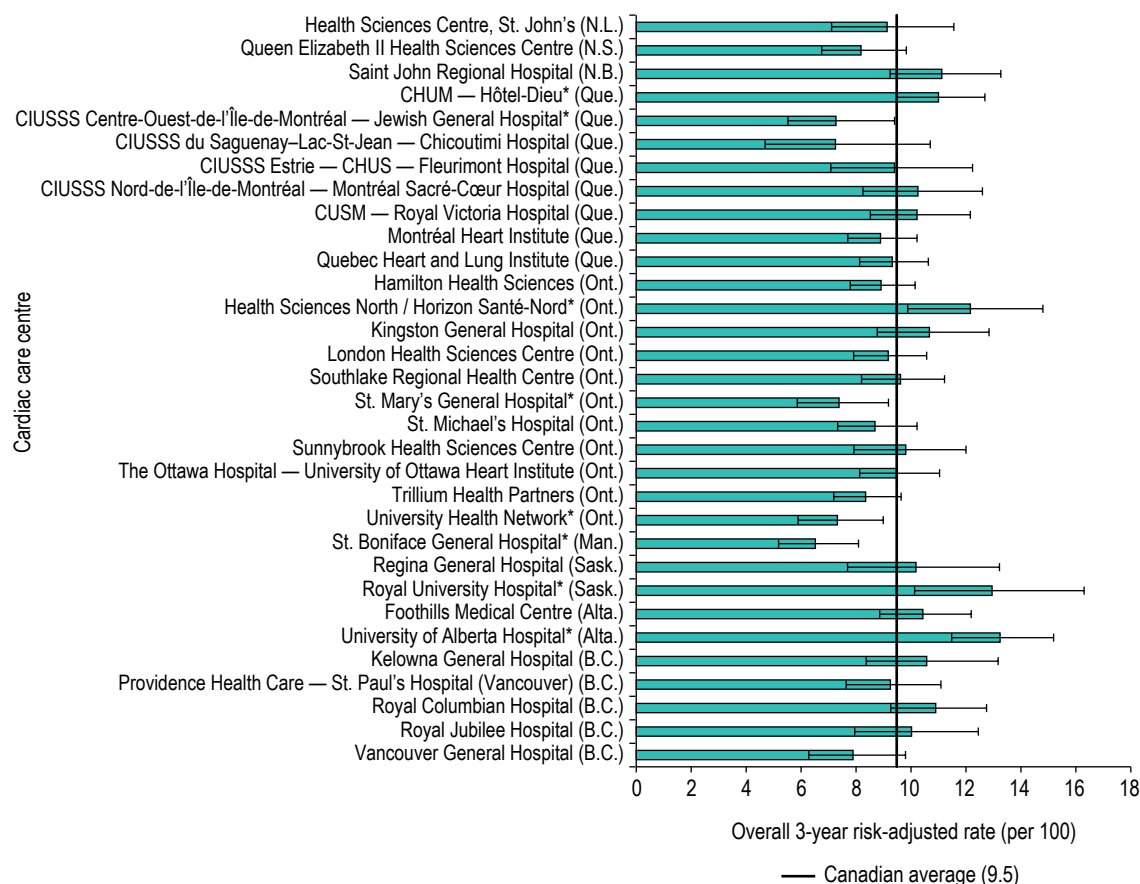
Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Risk-adjusted rate of all-cause urgent readmission occurring within 30 days following discharge for an episode of care with isolated CABG



- The Canadian average was 9.5%, with provincial rates ranging from 6.5% to 11.9%.
- Readmission rates after isolated CABG were higher compared with readmission rates for all surgical patients, at 6.9%.²
- 1 province had significantly lower and 2 had significantly higher results compared with the Canadian average.
- The top 5 reasons for 30-day readmission (based on the Canadian average rate) were complications of procedures, not elsewhere classified (17.5%), heart failure (10.2%), pleural effusion, not elsewhere classified (7.7%), atrial fibrillation and flutter (5.0%) and pain in throat and chest (3.2%).

Cardiac care centre risk-adjusted results for 30-Day All-Cause Readmission Rate After Isolated CABG



- Rates varied across cardiac care centres, from 6.5% to 13.2%.
- 4 centres had significantly lower and 4 had significantly higher results compared with the Canadian average.

Notes

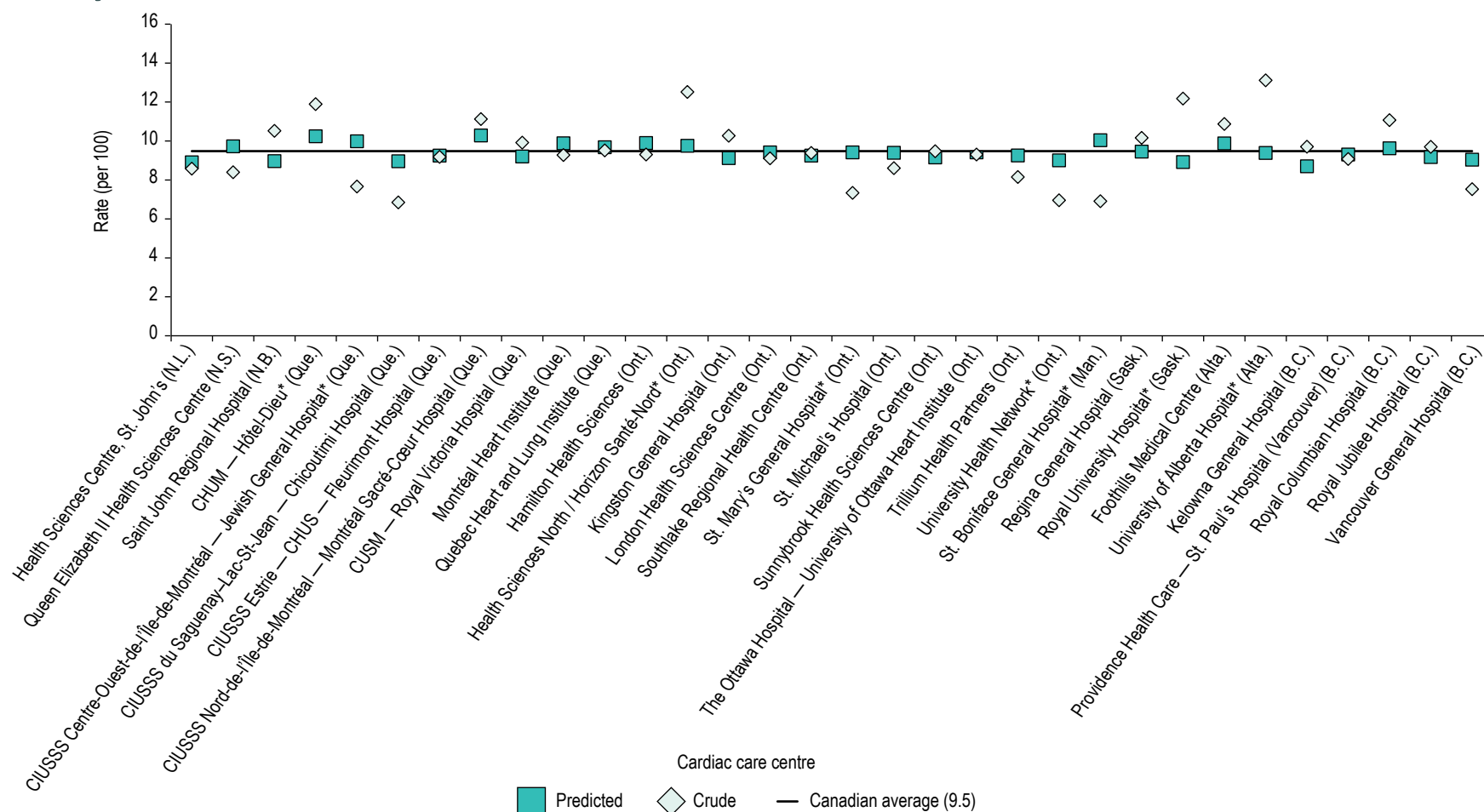
* Risk-adjusted rate is statistically significantly different from the Canadian average.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre crude versus predicted rates for 30-Day All-Cause Readmission Rate After Isolated CABG



Notes

* Risk-adjusted rate is statistically significantly different from the Canadian average.

3 years of pooled data: 2013–2014 to 2015–2016.

Sources

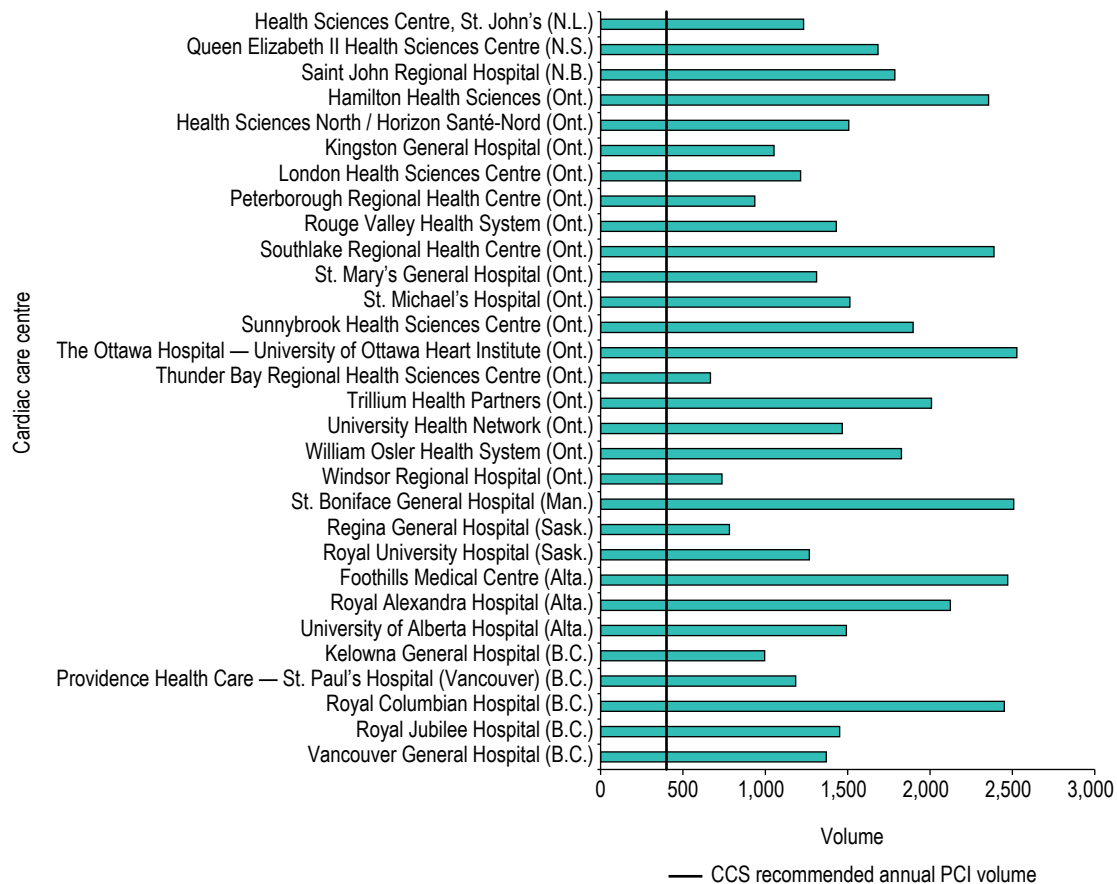
Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.



PCI Volume by Centre

In the late 1990s, cardiac services became regionalized in Canada so that cardiac interventions would be concentrated in a fewer number of centres that performed a large number of cases. This was done to develop specialized expertise in health care teams, to ensure optimal use of costly equipment and to achieve better health outcomes for patients.¹⁹ Current evidence suggests that cardiac care centres that perform fewer than 400 PCIs per year have a higher incidence of adverse events, including mortality after PCI.²⁰ Based on this evidence, CCS recommends a minimum institutional threshold of 400 PCIs per year.²¹ As new PCI centres are established, it might be important to ensure that they too are meeting minimal volume thresholds if the volume/outcome relationship remains supported by evidence.

Annual volume of PCIs, by cardiac care centre, 2015–2016



- A total of 140,905 PCIs were performed by 30 cardiac care centres (excluding Quebec) from fiscal years 2013–2014 to 2015–2016.
- The total annual volume of PCIs in Canada (excluding Quebec) in 2015–2016 was 47,635.
- There was substantial variation in the number of PCIs performed across cardiac care centres in 2015–2016 (from 667 to 2,527).
- There was relative consistency in the annual volume of procedures performed at each centre from fiscal years 2013–2014 to 2015–2016.
- All of the cardiac care centres met the CCS's recommended volume of 400 PCIs per year.
- No correlation was observed between the number of PCI procedures performed and the mortality and readmission outcomes.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Conclusion

This report represents the first time that comparable information on mortality and readmission outcomes following PCI, CABG and AVR are being publicly released at the Canadian, provincial and cardiac care centre levels. The public release builds on the long-standing private release of indicator results to cardiac care centres and/or jurisdictions across Canada. It also follows the strong show of support that this CIHI/CCS collaboration has received from the Canadian cardiac care community.

Overall, Canada is performing well on Cardiac Care quality indicators for PCI and cardiac surgery. 30-day in-hospital mortality is rare, and urgent hospital readmissions are similar to those following other surgeries. However, variations in results across cardiac care centres suggest that there may be opportunities for quality improvement as well as sharing of best practices between centres to achieve even better health outcomes for patients.

The results highlighted in this report are a starting point for discussion and may support improvement strategies to maintain a high level of quality of cardiovascular care in Canada.

Appendix A: List of participating cardiac care centres by province

Province	City	Participating cardiac care centre
Newfoundland and Labrador	St. John's	Health Sciences Centre, St. John's
Nova Scotia	Halifax	Queen Elizabeth II Health Sciences Centre
New Brunswick	Saint John	Saint John Regional Hospital
Quebec	Montréal	CHUM — Hôtel-Dieu
	Montréal	CIUSSS Centre-Ouest-de-l'Île-de-Montréal — Jewish General Hospital
	Chicoutimi	CIUSSS du Saguenay–Lac-St-Jean — Chicoutimi Hospital
	Sherbrooke	CIUSSS Estrie — CHUS — Fleurimont Hospital
	Montréal	CIUSSS Nord-de-l'Île-de-Montréal — Montréal Sacré-Cœur Hospital
	Montréal	CUSM — Royal Victoria Hospital
	Montréal	Montréal Heart Institute
	Québec	Quebec Heart and Lung Institute
Ontario	Hamilton	Hamilton Health Sciences
	Sudbury	Health Sciences North / Horizon Santé-Nord
	Kingston	Kingston General Hospital
	London	London Health Sciences Centre
	Peterborough	Peterborough Regional Health Centre
	Scarborough	Rouge Valley Health System
	Newmarket	Southlake Regional Health Centre

Province	City	Participating cardiac care centre
Ontario (cont'd)	Kitchener	St. Mary's General Hospital
	Toronto	St. Michael's Hospital
	Toronto	Sunnybrook Health Sciences Centre
	Ottawa	The Ottawa Hospital — University of Ottawa Heart Institute
	Thunder Bay	Thunder Bay Regional Health Sciences Centre
	Mississauga	Trillium Health Partners
	Toronto	University Health Network
	Brampton	William Osler Health System
	Windsor	Windsor Regional Hospital
Manitoba	Winnipeg	St. Boniface General Hospital
Saskatchewan	Regina	Regina General Hospital
	Saskatoon	Royal University Hospital
Alberta	Calgary	Foothills Medical Centre
	Edmonton	Royal Alexandra Hospital
	Edmonton	University of Alberta Hospital
British Columbia	Kelowna	Kelowna General Hospital
	Vancouver	Providence Health Care — St. Paul's Hospital (Vancouver)
	New Westminster	Royal Columbian Hospital
	Victoria	Royal Jubilee Hospital
	Vancouver	Vancouver General Hospital

Appendix B: Text alternative for images

Geographic location of participating cardiac care centres, page 16

38 cardiac care centres participated in the *Cardiac Care Quality Indicators Report*, as follows:

- Newfoundland and Labrador, 1
- Nova Scotia, 1
- New Brunswick, 1
- Quebec, 8 (only cardiac care centres performing cardiac surgery)
- Ontario, 16
- Manitoba, 1
- Saskatchewan, 2
- Alberta, 3
- British Columbia, 5

Prince Edward Island, Yukon, the Northwest Territories and Nunavut do not have cardiac care centres.

Canadian average mortality* rates by indicator and fiscal year, 2013–2014 to 2015–2016, page 24

Fiscal year	30-Day In-Hospital Mortality After PCI	30-Day In-Hospital Mortality After Isolated CABG [†]	30-Day In-Hospital Mortality After Isolated AVR [†]	30-Day In-Hospital Mortality After CABG and AVR
2013–2014	2.3	1.2	1.3	3.6
2014–2015	2.2	1.4	1.3	3.7
2015–2016	2.3	1.4	1.2	2.6

Notes

* Mortality indicators are based on in-hospital mortality only.

† Isolated means that no other cardiac surgeries, valve procedures or core concomitant procedures were performed during the hospitalization episode of care.

PCI: Percutaneous coronary intervention.

CABG: Coronary artery bypass graft.

AVR: Aortic valve replacement.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Canadian average readmission rates by indicator and fiscal year, 2013–2014 to 2015–2016, page 25

Fiscal year	30-Day All-Cause Readmission Rate After PCI	30-Day All-Cause Readmission Rate After Isolated CABG [†]
2013–2014	7.3	9.7
2014–2015	7.4	9.4
2015–2016	7.4	9.3

Notes

† Isolated means that no other cardiac surgeries, valve procedures or core concomitant procedures were performed during the hospitalization episode of care.

PCI: Percutaneous coronary intervention.

CABG: Coronary artery bypass graft.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Provincial risk-adjusted results for 30-Day In-Hospital Mortality After PCI, page 30

Provincial risk-adjusted rates ranged from 1.7 to 2.9 per 100 patients. The Canadian average was 2.3 per 100 patients.

2 provinces had statistically significantly lower rates compared with the Canadian average:

- Nova Scotia: risk-adjusted rate, 1.7%; confidence interval, 1.3% to 2.2%
- British Columbia: risk-adjusted rate, 1.8%; confidence interval, 1.7% to 2.0%

2 provinces had statistically significantly higher rates compared with the Canadian average:

- Ontario: risk-adjusted rate, 2.5%; confidence interval, 2.3% to 2.6%
- Saskatchewan: risk-adjusted rate, 2.9%; confidence interval, 2.5% to 3.4%

The rates for the other provinces were not statistically significantly different compared with the Canadian average.

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre risk-adjusted results for 30-Day In-Hospital Mortality After PCI, page 31

Cardiac care centre risk-adjusted rates ranged from 1.7 to 3.1 per 100 patients. The Canadian average was 2.3 per 100 patients.

2 cardiac care centres had statistically significantly lower rates compared with the Canadian average:

- Queen Elizabeth II Health Sciences Centre (Nova Scotia): risk-adjusted rate, 1.7%; confidence interval, 1.3% to 2.2%
- Royal Columbian Hospital (British Columbia): risk-adjusted rate, 1.8%; confidence interval, 1.5% to 2.1%

5 cardiac care centres had statistically significantly higher rates compared with the Canadian average:

- Kingston General Hospital (Ontario): risk-adjusted rate, 3.0%; confidence interval, 2.3% to 3.8%
- St. Michael's Hospital (Ontario): risk-adjusted rate, 3.0%; confidence interval, 2.5% to 3.7%
- William Osler Health System (Ontario): risk-adjusted rate, 3.0%; confidence interval, 2.6% to 3.6%
- Regina General Hospital (Saskatchewan): risk-adjusted rate, 2.9%; confidence interval, 2.3% to 3.7%
- Royal University Hospital (Saskatchewan): risk-adjusted rate, 2.9%; confidence interval, 2.3% to 3.6%

The rates for the other cardiac care centres were not statistically significantly different compared with the Canadian average.

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

**Cardiac care centre crude versus predicted rates for 30-Day In-Hospital Mortality After PCI,
page 32**

For those centres with risk-adjusted rates that were statistically significantly lower than the Canadian average, the crude versus predicted rates were as follows:

- Queen Elizabeth II Health Sciences Centre (Nova Scotia): predicted rate, 1.9%; crude rate, 1.4%
- Royal Columbian Hospital (British Columbia): predicted rate, 3.5%; crude rate, 2.8%

For those centres with risk-adjusted rates that were statistically significantly higher than the Canadian average, the crude versus predicted rates were as follows:

- Kingston General Hospital (Ontario): predicted rate, 2.0%; crude rate, 2.6%
- St. Michael's Hospital (Ontario): predicted rate, 2.1%; crude rate, 2.8%
- William Osler Health System (Ontario): predicted rate, 2.2%; crude rate, 3.0%
- Regina General Hospital (Saskatchewan): predicted rate, 2.6%; crude rate, 3.3%
- Royal University Hospital (Saskatchewan): predicted rate, 2.2%; crude rate, 2.8%

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Provincial risk-adjusted results for 30-Day In-Hospital Mortality After Isolated CABG, page 34

Provincial risk-adjusted rates ranged from 0.5 to 3.1 per 100 patients. The Canadian average was 1.3 per 100 patients.

2 provinces had statistically significantly lower rates compared with the Canadian average:

- Manitoba: risk-adjusted rate, 0.5%; confidence interval, 0.2% to 1.0%
- British Columbia: risk-adjusted rate, 0.7%; confidence interval, 0.5% to 1.0%

2 provinces had statistically significantly higher rates compared with the Canadian average:

- Newfoundland and Labrador: risk-adjusted rate, 3.1%; confidence interval, 1.9% to 4.7%
- Nova Scotia: risk-adjusted rate, 2.2%; confidence interval, 1.5% to 3.0%

The rates for the other provinces were not statistically significantly different compared with the Canadian average.

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre risk-adjusted results for 30-Day In-Hospital Mortality After Isolated CABG, page 35

Cardiac care centre risk-adjusted rates ranged from 0.5 to 3.1 per 100 patients. The Canadian average was 1.3 per 100 patients.

4 cardiac care centres had statistically significantly lower rates compared with the Canadian average:

- The Ottawa Hospital — University of Ottawa Heart Institute (Ontario): risk-adjusted rate, 0.6%; confidence interval, 0.3% to 1.0%
- St. Boniface General Hospital (Manitoba): risk-adjusted rate, 0.5%; confidence interval, 0.2% to 1.0%
- Royal Columbian Hospital (British Columbia): risk-adjusted rate, 0.6%; confidence interval, 0.3% to 1.2%
- Vancouver General Hospital (British Columbia): risk-adjusted rate, 0.5%; confidence interval, 0.2% to 1.2%

3 centres had statistically significantly higher rates compared with the Canadian average:

- Health Sciences Centre, St. John's (Newfoundland and Labrador): risk-adjusted rate, 3.1%; confidence interval, 1.9% to 4.7%
- Queen Elizabeth II Health Sciences Centre (Nova Scotia): risk-adjusted rate, 2.2%, confidence interval, 1.5% to 3.0%
- University Health Network (Ontario): risk-adjusted rate, 2.7%; confidence interval, 1.8% to 3.9%

The rates for the other cardiac care centres were not statistically significantly different compared with the Canadian average.

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre crude versus predicted rates for 30-Day In-Hospital Mortality After Isolated CABG, page 36

For those centres with risk-adjusted rates that were statistically significantly lower than the Canadian average, the crude versus predicted rates were as follows:

- The Ottawa Hospital — University of Ottawa Heart Institute (Ontario): predicted rate, 1.3%; crude rate, 0.5%
- St. Boniface General Hospital (Manitoba): predicted rate, 1.7%; crude rate, 0.7%
- Royal Columbian Hospital (British Columbia): predicted rate, 1.4%; crude rate, 0.7%
- Vancouver General Hospital (British Columbia): predicted rate, 1.1%; crude rate, 0.4%

For those centres with risk-adjusted rates that were statistically significantly higher than the Canadian average, the crude versus predicted rates were as follows:

- Health Sciences Centre, St. John's (Newfoundland and Labrador): predicted rate, 1.1%; crude rate, 2.6%
- Queen Elizabeth II Health Sciences Centre (Nova Scotia): predicted rate, 1.5%; crude rate, 2.4%
- University Health Network (Ontario): predicted rate, 1.0%; crude rate, 2.0%

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Provincial risk-adjusted results for 30-Day In-Hospital Mortality After Isolated AVR, page 38

Provincial risk-adjusted rates ranged from 0.0 to 4.7 per 100 patients. The Canadian average was 1.3 per 100 patients.

1 province had a statistically significantly lower rate compared with the Canadian average:

- Manitoba: risk-adjusted rate, 0.0%; confidence interval, 0.0% to 0.9%

1 province had a statistically significantly higher rate compared with the Canadian average:

- Newfoundland and Labrador: risk-adjusted rate, 4.7%; confidence interval, 1.9% to 9.7%

The rates for the other provinces were not statistically significantly different compared with the Canadian average.

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

**Cardiac care centre risk-adjusted results for 30-Day In-Hospital Mortality After Isolated AVR,
page 39**

Cardiac care centre risk-adjusted rates ranged from 0.0 to 4.7 per 100 patients. The Canadian average was 1.3 per 100 patients.

1 centre had a statistically significantly lower rate compared with the Canadian average:

- St. Boniface General Hospital (Manitoba): risk-adjusted rate, 0.0%; confidence interval, 0.0% to 0.9%

1 centre had a statistically significantly higher rate compared with the Canadian average:

- Health Sciences Centre, St. John's (Newfoundland and Labrador): risk-adjusted rate, 4.7%; confidence interval, 1.9% to 9.7%

The rates for the other cardiac care centres were not statistically significantly different compared with the Canadian average.

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre crude versus predicted rates for 30-Day In-Hospital Mortality After Isolated AVR, page 40

For the centre with a risk-adjusted rate that was statistically significantly lower than the Canadian average, the crude versus predicted rate was as follows:

- St. Boniface General Hospital (Manitoba): predicted rate, 1.3%; crude rate, 0.0%

For the centre with a risk-adjusted rate that was statistically significantly higher than the Canadian average, the crude versus predicted rate was as follows:

- Health Sciences Centre, St. John's (Newfoundland and Labrador): predicted rate, 1.1%; crude rate, 4.1%

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Provincial risk-adjusted results for 30-Day In-Hospital Mortality After CABG and AVR, page 42

Provincial rates ranged from 2.1 to 6.2 per 100 patients. The Canadian average was 3.3 per 100 patients.

1 province had a statistically significantly higher rate compared with the Canadian average:

- Alberta: risk-adjusted rate, 5.5%; confidence interval, 3.4% to 8.3%

The rates for the other provinces were not statistically significantly different compared with the Canadian average.

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre risk-adjusted results for 30-Day In-Hospital Mortality After CABG and AVR, page 43

Cardiac care centre risk-adjusted rates ranged from 0.0 to 9.1 per 100 patients. The Canadian average was 3.3 per 100 patients.

2 cardiac care centres had statistically significantly lower rates compared with the Canadian average:

- Quebec Heart and Lung Institute (Quebec): risk-adjusted rate, 1.5%; confidence interval, 0.6% to 3.1%
- Kelowna General Hospital (British Columbia): risk-adjusted rate, 0.0%; confidence interval, 0.0% to 2.5%

3 cardiac care centres had statistically significantly higher rates compared with the Canadian average:

- CIUSSS Estrie — CHUS — Fleurimont Hospital (Quebec): risk-adjusted rate, 9.1%; confidence interval, 3.9% to 18.0%
- St. Michael's Hospital (Ontario): risk-adjusted rate, 6.9%; confidence interval, 3.5% to 12.4%
- Foothills Medical Centre (Alberta): risk-adjusted rate, 7.6%; confidence interval, 4.2% to 12.5%

The rates for the other cardiac care centres were not statistically significantly different compared with the Canadian average.

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre crude versus predicted rates for 30-Day In-Hospital Mortality After CABG and AVR, page 44

For centres with risk-adjusted rates that were statistically significantly lower than the Canadian average, the crude versus predicted rates were as follows:

- Quebec Heart and Lung Institute (Quebec): predicted rate, 3.2%; crude rate, 1.5%
- Kelowna General Hospital (British Columbia): predicted rate, 2.8%; crude rate, 0.0%

For centres that had risk-adjusted rates that were statistically significantly higher than the Canadian average, the crude versus predicted rates were as follows:

- CIUSSS Estrie — CHUS — Fleurimont Hospital (Quebec): predicted rate, 2.9%; crude rate, 7.9%
- St. Michael's Hospital (Ontario): predicted rate, 2.8%; crude rate, 5.8%
- Foothills Medical Centre (Alberta): predicted rate, 3.3%; crude rate, 7.5%

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Provincial risk-adjusted results for 30-Day All-Cause Readmission Rate After PCI, page 46

Provincial risk-adjusted rates ranged from 5.1 to 8.1 per 100 patients. The Canadian average was 7.4 per 100 patients.

3 provinces had statistically significantly lower rates compared with the Canadian average:

- Nova Scotia: risk-adjusted rate, 5.1%; confidence interval, 4.4% to 5.8%
- Manitoba: risk-adjusted rate, 5.7%; confidence interval, 5.1% to 6.3%
- Alberta: risk-adjusted rate, 6.7%; confidence interval, 6.3% to 7.1%

2 provinces had statistically significantly higher rates compared with the Canadian average:

- Ontario: risk-adjusted rate, 7.6%; confidence interval, 7.4% to 7.9%
- British Columbia: risk-adjusted rate, 8.1%; confidence interval, 7.7% to 8.5%

The rates for the other provinces were not statistically significantly different compared with the Canadian average.

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

**Cardiac care centre risk-adjusted results for 30-Day All-Cause Readmission Rate After PCI,
page 47**

Cardiac care centre risk-adjusted rates ranged from 5.1 to 9.7 per 100 patients. The Canadian average was 7.4 per 100 patients.

6 cardiac care centres had statistically significantly lower rates compared with the Canadian average:

- Queen Elizabeth II Health Sciences Centre (Nova Scotia): risk-adjusted rate, 5.1%; confidence interval, 4.4% to 5.8%
- Rouge Valley Health System (Ontario): risk-adjusted rate, 5.7%; confidence interval, 5.0% to 6.5%
- St. Mary's General Hospital (Ontario): risk-adjusted rate, 6.1%; confidence interval, 5.2% to 7.1%
- The Ottawa Hospital — University of Ottawa Heart Institute (Ontario): risk-adjusted rate, 5.8%; confidence interval, 5.3% to 6.5%
- St. Boniface General Hospital (Manitoba): risk-adjusted rate, 5.7%; confidence interval, 5.1% to 6.3%
- Royal Alexandra Hospital (Alberta): risk-adjusted rate, 5.9%; confidence interval, 5.2% to 6.6%

7 cardiac care centres had statistically significantly higher rates compared with the Canadian average:

- Health Sciences North / Horizon Santé-Nord (Ontario): risk-adjusted rate, 8.4%; confidence interval, 7.5% to 9.4%
- St. Michael's Hospital (Ontario): risk-adjusted rate, 8.6%; confidence interval, 7.7% to 9.6%
- Sunnybrook Health Sciences Centre (Ontario): risk-adjusted rate, 8.3%; confidence interval, 7.5% to 9.1%
- University Health Network (Ontario): risk-adjusted rate, 8.5%; confidence interval, 7.6% to 9.6%
- William Osler Health System (Ontario): risk-adjusted rate, 9.7%; confidence interval, 8.9% to 10.6%

- Providence Health Care — St. Paul's Hospital (Vancouver) (British Columbia): risk-adjusted rate, 9.0%; confidence interval, 8.0% to 10.2%
- Royal Columbian Hospital (British Columbia): risk-adjusted rate, 8.3%; confidence interval, 7.6% to 9.0%

The rates for the other cardiac care centres were not statistically significantly different compared with the Canadian average.

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre crude versus predicted rates for 30-Day All-Cause Readmission Rate After PCI, page 48

For centres that had risk-adjusted rates that were statistically significantly lower than the Canadian average, the crude versus predicted rates were as follows:

- Queen Elizabeth II Health Sciences Centre (Nova Scotia): predicted rate, 7.4%; crude rate, 5.0%
- Rouge Valley Health System (Ontario): predicted rate, 7.8%; crude rate, 6.0%
- St. Mary's General Hospital (Ontario): predicted rate, 7.0%; crude rate, 5.8%
- The Ottawa Hospital — University of Ottawa Heart Institute (Ontario): predicted rate, 7.4%; crude rate, 5.9%
- St. Boniface General Hospital (Manitoba): predicted rate, 7.5%; crude rate, 5.8%
- Royal Alexandra Hospital (Alberta): predicted rate, 6.9%; crude rate, 5.5%

For centres that had risk-adjusted rates that were statistically significantly higher than the Canadian average, the crude versus predicted rates were as follows:

- Health Sciences North / Horizon Santé-Nord (Ontario): predicted rate, 7.2%; crude rate, 8.2%
- St. Michael's Hospital (Ontario): predicted rate, 7.1%; crude rate, 8.3%
- Sunnybrook Health Sciences Centre (Ontario): predicted rate, 7.4%; crude rate, 8.3%
- University Health Network (Ontario): predicted rate, 6.5%; crude rate, 7.6%
- William Osler Health System (Ontario): predicted rate, 7.2%; crude rate, 9.5%
- Providence Health Care — St. Paul's Hospital (Vancouver) (British Columbia): predicted rate, 7.2%; crude rate, 8.8%
- Royal Columbian Hospital (British Columbia): predicted rate, 8.0%; crude rate, 9.1%

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Provincial risk-adjusted results for 30-Day All-Cause Readmission Rate After Isolated CABG, page 50

Provincial risk-adjusted rates ranged from 6.5 to 11.9 per 100 patients. The Canadian average was 9.5 per 100 patients.

1 province had a statistically significantly lower rate compared with the Canadian average:

- Manitoba: risk-adjusted rate, 6.5%; confidence interval, 5.2% to 8.1%

2 provinces had statistically significantly higher rates compared with the Canadian average:

- Saskatchewan: risk-adjusted rate, 11.6%; confidence interval, 9.7% to 13.8%
- Alberta: risk-adjusted rate, 11.8%; confidence interval, 10.7% to 13.1%

The rates for the other provinces were not statistically significantly different compared with the Canadian average.

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre risk-adjusted results for 30-Day All-Cause Readmission Rate After Isolated CABG, page 51

Cardiac care centre risk-adjusted rates ranged from 6.5 to 13.2 per 100 patients. The Canadian average was 9.5 per 100 patients.

4 cardiac care centres had statistically significantly lower rates compared with the Canadian average:

- CIUSSS Centre-Ouest-de-l'Île-de-Montréal — Jewish General Hospital (Quebec): risk-adjusted rate, 7.3%; confidence interval, 5.5% to 9.4%
- St. Mary's General Hospital (Ontario): risk-adjusted rate, 7.4%; confidence interval, 5.9% to 9.2%
- University Health Network (Ontario): risk-adjusted rate, 7.3%; confidence interval, 5.9% to 9.0%
- St. Boniface General Hospital (Manitoba): risk-adjusted rate, 6.5%; confidence interval, 5.2% to 8.1%

4 cardiac care centres had statistically significantly higher rates compared with the Canadian average:

- CHUM — Hôtel-Dieu (Quebec): risk-adjusted rate, 11.0%; confidence interval, 9.5% to 12.7%
- Health Sciences North / Horizon Santé-Nord (Ontario): risk-adjusted rate, 12.2%; confidence interval, 9.9% to 14.8%
- Royal University Hospital (Saskatchewan): risk-adjusted rate, 12.9%; confidence interval, 10.1% to 16.3%
- University of Alberta Hospital (Alberta): risk-adjusted rate, 13.2%; confidence interval, 11.5% to 15.2%

The rates for the other cardiac care centres were not statistically significantly different compared with the Canadian average.

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Cardiac care centre crude versus predicted rates for 30-Day All-Cause Readmission Rate After Isolated CABG, page 52

For centres that had risk-adjusted rates that were statistically significantly lower than the Canadian average, the crude versus predicted rates were as follows:

- CIUSSS Centre-Ouest-de-l'Île-de-Montréal — Jewish General Hospital (Quebec): predicted rate, 10.0%; crude rate, 7.7%
- St. Mary's General Hospital (Ontario): predicted rate, 9.4%; crude rate, 7.3%
- University Health Network (Ontario): predicted rate, 9.0%; crude rate, 7.0%
- St. Boniface General Hospital (Manitoba): predicted rate, 10.0%; crude rate, 6.9%

For centres that had risk-adjusted rates that were statistically significantly higher than the Canadian average, the crude versus predicted rates were as follows:

- CHUM — Hôtel-Dieu (Quebec): predicted rate, 10.2%; crude rate, 11.9%
- Health Sciences North / Horizon Santé-Nord (Ontario): predicted rate, 9.8%; crude rate, 12.5%
- Royal University Hospital (Saskatchewan): predicted rate, 8.9%; crude rate, 12.2%
- University of Alberta Hospital (Alberta): predicted rate, 9.4%; crude rate, 13.1%

Results are based on 3 years of pooled data: 2013–2014 to 2015–2016.

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

Annual volume of PCIs, by cardiac care centre, 2015–2016, page 54

Province	Cardiac care centre	2015–2016
Newfoundland and Labrador	Health Sciences Centre, St. John's	1,232
Nova Scotia	Queen Elizabeth II Health Sciences Centre	1,684
New Brunswick	Saint John Regional Hospital	1,786
Ontario	Hamilton Health Sciences	2,355
	Health Sciences North / Horizon Santé-Nord	1,507
	Kingston General Hospital	1,053
	London Health Sciences Centre	1,214
	Peterborough Regional Health Centre	936
	Rouge Valley Health System	1,431
	Southlake Regional Health Centre	2,388
	St. Mary's General Hospital	1,311
	St. Michael's Hospital	1,513
	Sunnybrook Health Sciences Centre	1,897
	The Ottawa Hospital — University of Ottawa Heart Institute	2,527
	Thunder Bay Regional Health Sciences Centre	667
	Trillium Health Partners	2,009
	University Health Network	1,467
	William Osler Health System	1,826
	Windsor Regional Hospital	737
Manitoba	St. Boniface General Hospital	2,508
Saskatchewan	Regina General Hospital	782
	Royal University Hospital	1,267

Province	Cardiac care centre	2015–2016
Alberta	Foothills Medical Centre	2,471
	Royal Alexandra Hospital	2,123
	University of Alberta Hospital	1,492
British Columbia	Kelowna General Hospital	996
	Providence Health Care — St. Paul's Hospital (Vancouver)	1,184
	Royal Columbian Hospital	2,451
	Royal Jubilee Hospital	1,451
	Vancouver General Hospital	1,370

Sources

Discharge Abstract Database, National Ambulatory Care Reporting System and Hospital Morbidity Database, Canadian Institute for Health Information.

References

1. Canadian Cardiovascular Society. [Quality project](#). Accessed June 24, 2017.
2. Canadian Institute for Health Information. [Your Health System: In Depth](#). Accessed August 22, 2017.
3. The British Cardiovascular Intervention Society. [Risk adjusted outcome](#). Accessed August 22, 2017.
4. McAllister KSL, et al. [A contemporary risk model for predicting 30-day mortality following percutaneous coronary intervention in England and Wales](#). *International Journal of Cardiology*. May 2016.
5. Doost Hosseiny A, et al. [Mortality pattern and cause of death in a long-term follow-up of patients with STEMI treated with primary PCI](#). *Open Heart*. March 2016.
6. Cram P, et al. [Percutaneous coronary intervention outcomes in US hospitals with varying structural characteristics: Analysis of the NCDR® CathPCI Registry](#). *American Heart Journal*. February 2012.
7. Peterson ED, et al. [Contemporary mortality risk prediction for percutaneous coronary intervention: Results from 588,398 procedures in the National Cardiovascular Data Registry](#). *Journal of the American College of Cardiology*. May 2010.
8. Agency for Healthcare Research and Quality. [Coronary artery bypass graft \(CABG\): Hospital 30-day, all-cause risk-standardized mortality rate \(RSMR\) following CABG surgery](#). Accessed August 22, 2017.
9. Data.gov.UK. [National Adult Cardiac Surgery Audit report data 2010/11](#). Accessed August 22, 2017.

10. D'Agostino RS, et al. [The Society of Thoracic Surgeons Adult Cardiac Surgery Database: 2017 update on outcomes and quality](#). *The Annals of Thoracic Surgery*. January 2017.
11. Hansen LS, et al. [30-day mortality after coronary artery bypass grafting and valve surgery has greatly improved over the last decade, but the 1-year mortality remains constant](#). *Annals of Cardiac Anaesthesia*. April 2015.
12. Billah B, et al. [AusSCORE II in predicting 30-day mortality after isolated coronary artery bypass grafting in Australia and New Zealand](#). *The Journal of Thoracic and Cardiovascular Surgery*. November 2014.
13. Reid C, et al. [An Australian risk prediction model for 30-day mortality after isolated coronary artery bypass: The AusSCORE](#). *The Journal of Thoracic and Cardiovascular Surgery*. October 2009.
14. Brennan JM, et al. [Long-term survival after aortic valve replacement among high-risk elderly patients in the United States: Insights from the Society of Thoracic Surgeons Adult Cardiac Surgery Database, 1991 to 2007](#). *Circulation*. 2012.
15. Donabedian A. *The Criteria and Standards of Quality*. 1982.
16. Government of Canada. [Heart disease in Canada](#). Accessed June 25, 2017.
17. Bond, S, Stonebridge C, Thériault L. [The Canadian Heart Health Strategy: Risk Factors and Future Cost Implications](#). 2010.
18. Gorzkiewicz V, et al. [Cardiac care quality indicators: A new hospital-level quality improvement initiative for cardiac care in Canada](#). *Healthcare Quarterly*. February 2012.

19. Canadian Institute for Health Information. [*Health Care in Canada 2001*](#). 2001.
20. Harold JG, et al. [*ACCF/AHA/SCAI 2013 update of the Clinical Competence Statement on Coronary Artery Interventional Procedures: A report of the American College of Cardiology Foundation/American Heart Association/American College of Physicians Task Force on Clinical Competence and Training \(Writing Committee to Revise the 2007 Clinical Competence Statement on Cardiac Interventional Procedures\)*](#). *Circulation*. July 2013.
21. Canadian Cardiovascular Society. [*The Canadian Cardiovascular Society Quality Indicators e-Catalogue — Quality Indicators for Percutaneous Coronary Intervention: A CCS Consensus Document*](#). 2015.



CIHI Ottawa

495 Richmond Road
Suite 600
Ottawa, Ont.
K2A 4H6

613-241-7860

CIHI Toronto

4110 Yonge Street
Suite 300
Toronto, Ont.
M2P 2B7

416-481-2002

CIHI Victoria

880 Douglas Street
Suite 600
Victoria, B.C.
V8W 2B7

250-220-4100

CIHI Montréal

1010 Sherbrooke Street West
Suite 602
Montréal, Que.
H3A 2R7

514-842-2226

cihi.ca

16005-1017

