

The effect of a charted history of depression on emergency department triage and outcomes in patients with acute myocardial infarction

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ABSTRACT

Background: Patients with acute myocardial infarction may have worse outcomes if they also have a history of depression. The early management of acute myocardial infarction is known to influence outcomes, and patients with a coexisting history of depression may be treated differently in the emergency department than those without one. Our goal was to determine whether having a charted history of depression was associated with a lower-priority emergency department triage score and worse performance on quality-of-care indices.

Methods: We conducted a retrospective population-based cohort analysis involving patients with acute myocardial infarction admitted to 96 acute care hospitals in the province of Ontario from April 2004 to March 2005. We calculated the adjusted odds of low-priority triage (Canadian Emergency Department Triage and Acuity Scale score of 3, 4 or 5) for patients with acute myocardial infarction who had a charted history of depression. We compared these odds with those for patients having a charted history of asthma or chronic obstructive pulmonary disease (COPD). Secondary outcome measures were the odds of meeting benchmark door-to-electrocardiogram, door-to-needle and door-to-balloon times.

Results: Of 6784 patients with acute myocardial infarction, 680 (10.0%) had a past medical history of depression documented in their chart. Of these patients, 39.1% (95% confidence interval [CI] 35.3%–42.9%) were assigned a low-priority triage score, as compared with 32.7% (95% CI 31.5%–33.9%) of those without a charted history of depression. The adjusted odds of receiving a low-priority triage score with a charted history of depression were 1.26 ($p = 0.01$) versus 0.88 ($p = 0.23$) with asthma and 1.12 ($p = 0.24$) with COPD. For patients with a charted history of depression, the median door-to-electrocardiogram time was 20.0 minutes (v. 17.0 min for the rest of the cohort), median door-to-needle time was 53.0 (v. 37.0) minutes, and median door-to-balloon time was 251.0 (v. 110.0) minutes. The adjusted odds of missing the benchmark time with a charted history of depression were 1.39 ($p < 0.001$) for door-to-electrocardiogram time, 1.62 ($p = 0.047$) for door-to-needle time and 9.12 ($p = 0.019$) for door-to-balloon time.

Interpretation: Patients with acute myocardial infarction who had a charted history of depression were more likely to receive a low-priority emergency department triage score than those with other comorbidities and to have worse associated performance on quality indicators in acute myocardial infarction care.

Competing interests:
None declared.

This article has been peer reviewed.

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**CMAJ 2011. DOI:10.1503/
cmaj.100685**

In the United States, more than six million patients with conditions related to mental health are seen each year in the nation's emergency departments.¹ Some of these comprise the six million patients with chest pain who are also seen annually in the emergency department.² Several studies have suggested that patients with acute myocardial infarction fare worse if they also suffer from depression.^{3–5} The cause for less favourable outcomes is thought to be multifactorial and to include poor adherence

to treatment.⁵ To our knowledge, quality of care in emergency departments has not been examined as a possible contributor. It has been suggested that patients with mental illness receive a lower-priority triage score than other patients in emergency departments because of the stigma of the disease.^{6,7}

Virtually all patients who present to an emergency department are initially assessed by a trained triage nurse. The nurse assigns them a triage score based on their illness acuity, priori-

tizing them for subsequent emergency care. In Ontario, all emergency departments are mandated to use the five-level Canadian Emergency Department Triage and Acuity Scale.⁸ This uniformity provides an opportunity to study the effect of triage at the population level. In the United States, various triage tools are used.⁹

Previously, we established that the emergency department triage scores assigned to patients who are ultimately found to be having an acute myocardial infarction are independently associated with delays in diagnostic testing and reperfusion.¹⁰ In this study, we examined the emergency department care of patients with acute myocardial infarction who had a medical history of depression noted in their emergency department chart. We aimed to determine whether these patients were assigned lower-priority triage scores than other patients with acute myocardial infarction and whether there was an association between a charted history of depression and performance on established quality-of-care indices.¹¹

Methods

Study design

This was a retrospective cohort study. We obtained ethics approval from Sunnybrook Health Sciences Centre.

Setting and data sources

The Enhanced Feedback for Effective Cardiac Treatment (EFFECT) study¹² involved a population-based sample of patients with acute myocardial infarction from the province of Ontario, Canada. In summary, the study included clinical data from retrospective chart reviews of 7736 patients with acute myocardial infarction seen at 81 hospital corporations in Ontario from April 2004 to March 2005.¹² To be eligible, hospitals had to treat more than 15 patients with acute myocardial infarction per year; all but 4 of the 86 eligible hospital corporations in Ontario participated. Chart reviews were performed according to prespecified rules by nurses trained as data abstractors and involved a random sample of patients with acute myocardial infarction at each hospital. Interrater reliability showed high reliability for all of the indicators assessed by the EFFECT study.¹³

The National Ambulatory Care Reporting System contains abstracted data on all visits by patients to emergency departments in Ontario. To determine the volume of patients with acute myocardial infarction seen in each emergency department during the study period, we identified patients with acute myocardial infarction in the Discharge Abstract Database, which contains information on all hospital admissions in

Ontario. We linked these patients to the emergency department database.

The Canadian Emergency Department Triage and Acuity Scale implementation guidelines were published in 1998.⁸ Educators from each emergency department in Ontario were trained to disseminate the guidelines to the nursing staff at their hospitals. Training was usually delivered in a course that had a suggested duration of eight hours, but the method of delivery was permitted to vary according to site choice and resources.¹⁴

Selection of participants

The EFFECT study included Ontario residents between the ages of 20 and 105 years with a valid Ontario Health Insurance Program number who were admitted to an acute care hospital with a most responsible diagnosis of acute myocardial infarction.¹² Patients were identified from the Discharge Abstract Database, and each case was verified using the hospital chart. Consistent with current acute myocardial infarction criteria,¹⁵ the diagnosis was confirmed if patients had positive cardiac enzymes plus the presence of either electrocardiogram changes or symptoms. Thus, all of the patients in our cohort had a confirmed acute myocardial infarction.

Patients were excluded if the acute myocardial infarction was an in-hospital complication, if they bypassed the emergency department and went straight to an in-hospital bed or catheterization laboratory or if they were missing an emergency department triage score. Patients who received a prehospital electrocardiogram or fibrinolysis were excluded because these interventions would likely have overpowered any influence of a history of depression in the emergency department triage assessment of potential cardiac ischemia.

Outcome measures

The primary outcome measure was emergency department triage score, which was either high-priority (1 or 2) or low-priority (3, 4 or 5) based on formal recommendations by the Canadian Emergency Department Triage and Acuity Scale. According to these recommendations, patients suspected of having an acute myocardial infarction are assigned a score of either 1, corresponding to requiring resuscitation, or 2, corresponding to requiring emergent assessment by a physician.⁸ The scale uses clinical symptoms and past medical history (e.g., risk factors for acute myocardial infarction) as well as vital signs to classify patients with possible acute myocardial infarction.

We defined the following three a priori secondary outcome measures: benchmark door-to-electrocardiogram time (< 10 min), door-to-needle

time (< 30 min) and door-to-balloon time (< 90 min).¹¹ We chose process-of-care measures because they are more within the direct control of the health care team of the emergency department than mortality, which may be affected by many confounding variables that occur long after a patient is seen in the emergency department.

Two comparator diseases in the past medical history, asthma and chronic obstructive pulmonary disease (COPD), were selected a priori to evaluate their effect on emergency department triage of patients with acute myocardial infarction. Like depression, these diseases are relatively common (allowing sufficient sample size for analysis) and are not risk factors for acute myocardial infarction. It was therefore expected that they would not obviously affect the triage process in the presence of possible acute myocardial infarction. We also evaluated the independent effect of the two comparator diseases on the secondary outcome measures.

Methods of measurement

Door-to-electrocardiogram time was defined as the interval between the patient's arrival at the emergency department and the time of the initial electrocardiogram. Door-to-needle time was defined as the interval between arrival and the time when fibrinolysis infusion began. Door-to-balloon time was defined as the interval between arrival and time of balloon inflation during percutaneous coronary intervention. The time of emergency department arrival was defined as the time at which the patient was seen by an emergency department triage nurse, which in Canada occurs before patient registration, as it does in the United States.

Information on each patient's history of depression was taken from the emergency department chart (as recorded in either the physician's or nurses' notes). Time of initial electrocardiogram was determined from the electrocardiogram stamp. An ST-segment elevation myocardial infarction was defined as either ≥ 1 mm ST-segment elevation in two contiguous electrocardiogram leads or a left bundle branch block, in the presence of chest pain.¹¹

In regression models, we accounted for 19 potential confounders, including the covariables of several validated instruments for predicting severity of acute myocardial infarction.^{16,17} In the door-to-needle analysis, we included location of fibrinolysis (emergency department, ward or unit), who administered fibrinolysis (emergency physician or consultant) and presence of a non-diagnostic initial electrocardiogram (bundle or paced rhythm). In our door-to-balloon model, we chose a limited number of the above covariables

Table 1: Baseline characteristics of the study cohort of 6784 patients with acute myocardial infarction, by charted record of history of depression

Characteristic	History of depression, no. (%) n = 680	No history of depression, no. (%) n = 6104
CTAS triage score*		
1	40 (6.1)	294 (4.9)
2	358 (54.8)	3713 (62.4)
3	223 (34.2)	1799 (30.2)
4	30 (4.6)	136 (2.3)
5	2 (0.3)	10 (0.2)
Age, yr, mean (SD)	70.9 (14.1)	69.2 (14.0)
Sex, male	331 (48.7)	3882 (63.6)
Income quintile†		
1	168 (24.8)	1419 (23.5)
2	128 (18.9)	1309 (21.5)
3	141 (20.8)	1185 (19.5)
4	123 (18.1)	1125 (18.5)
5	118 (17.4)	1040 (17.1)
Came to emergency department from		
Home	623 (91.9)	5285 (86.7)
Doctor's office	31 (4.6)	410 (6.7)
Other	24 (3.5)	404 (6.6)
Chest pain at presentation	434 (63.8)	4412 (72.3)
Presence of shortness of breath	307 (45.2)	2276 (37.3)
One or more cardiac risk factors‡	556 (81.8)	4622 (75.7)
Two or more cardiac risk factors‡	450 (66.2)	3626 (59.4)
History of coronary artery disease	315 (46.3)	2544 (41.7)
Arrival by ambulance	410 (60.3)	2737 (44.8)
Time of day		
Daytime (0800–1600)	287 (42.2)	2674 (43.9)
Evening (1601–0000)	231 (34.0)	1979 (32.5)
Night (0001–0800)	162 (23.8)	1437 (23.6)
Time of week, weekend	192 (28.2)	1709 (28.0)
Hospital type		
Teaching (13 sites)	134 (19.7)	1151 (18.9)
Community (73 sites)	521 (76.6)	4725 (77.4)
Small (10 sites)	25 (3.7)	228 (3.7)
PCI hospital	152 (22.4)	1425 (23.4)
AMI volume of emergency department§		
Low (24 sites)	92 (13.7)	704 (11.6)
Moderate (18 sites)	81 (12.1)	789 (13.0)
High (12 sites)	93 (13.8)	843 (13.9)
Very high (36 sites)	406 (60.4)	3728 (61.5)
Length of hospital stay, d, median (IQR)	6.0 (4–9)	5.0 (4–9)
Length of hospital stay, d, mean (SD)	8.2 (9.1)	7.3 (6.9)
Mortality		
30-day	109 (16.0)	635 (10.4)
90-day	145 (21.3)	827 (13.6)
1-year	211 (31.0)	1202 (19.7)

Note: AMI = acute myocardial infarction, CTAS = Canadian Emergency Department Triage and Acuity Scale, IQR = interquartile range, PCI = percutaneous coronary intervention, SD = standard deviation.

*Unknown for 179 patients.

†Unknown for 28 patients.

‡Diabetes mellitus, hypertension, smoker or dyslipidemia.

§Volume was defined as follows: < 100 AMI patients/yr = low volume; 101–200 patients/yr = moderate; 201–300 patients/yr = high; ≥ 301 patients/yr = very high.

a priori, based on clinical importance, to avoid overfitting the model.¹⁸

Primary analysis

To determine the independent effect of a charted history of depression on triage score, we used logistic regression modelling, using generalized estimating equation methods to account for the clustering of patients within emergency departments. In separate models, we analyzed data for patients with acute myocardial infarction who had a charted history of asthma and data for those who had a charted history of COPD. Patients who had a history of both depression and one of the two comparator diseases were excluded.

For secondary outcomes, we dichotomized door-to-electrocardiogram time according to a benchmark time of 10 minutes, door-to-needle time with a benchmark time of 30 minutes and door-to-balloon time with a benchmark time of 90 minutes.¹¹ We assessed the adjusted odds of meeting benchmark times for patients with acute myocardial infarction with a charted history of

depression, as well as for those with a charted history of asthma and those with a charted history of COPD. Because we expected the cause of delays to be from low-priority triage (which is on the causal pathway), we did not include triage as a covariate in our models. However, we conducted a sensitivity analysis with triage score included in the models. All models were examined for collinearity and goodness-of-fit.

Results

Of the 7736 patients with confirmed acute myocardial infarction who were initially identified in the EFFECT study, 952 were excluded because they received an electrocardiogram or fibrinolysis in the ambulance, bypassed the emergency department entirely or did not have a valid triage score, leaving a final study cohort of 6784 patients. Baseline characteristics of patients are shown in Table 1. The 30-day mortality was 11.0% (95% CI 10.2%–11.7%). The median door-to-electrocardiogram time was 17.0 (interquartile range [IQR] 9.0–35.0) minutes, the median door-to-needle time was 37.5 minutes (IQR 23.0–68.0), and the median door-to-balloon time was 115.5 minutes (IQR 69.0–259.0). There were 2094 (30.9%) ST-segment elevation myocardial infarctions. A low-priority triage score was assigned to 2200 patients (32.4%, 95% CI 32.2%–34.5%).

There were 680 (10.0%, 95% CI 9.3%–0.8%) patients with acute myocardial infarction who had a charted history of depression. Of these patients, 39.1% (95% CI 35.3%–42.9%) were assigned a low-priority triage score, compared with 32.7% (95% CI 31.5%–33.9%) of the other patients with acute myocardial infarction ($p < 0.001$). The median door-to-electrocardiogram time for those with a charted history of depression was 20.0 minutes (IQR 10.0–47.0), compared with 17.0 minutes (IQR 28.0–115.0) for the other patients. The median door-to-needle time for patients with a history of depression was 53.0 minutes (IQR 28.0–115.0) versus 37.0 minutes (IQR 23.0–65.0) for others, and the median door-to-balloon time was 251.0 minutes (IQR 110.0–795.0), whereas in the other patients it was 110.0 minutes (IQR 67.5–234.0).

In the adjusted analyses, having a charted history of depression increased the odds of being assigned a low-priority triage score by 1.26 ($p = 0.01$) (Table 2; see also Appendix 1, available at www.cmaj.ca/cgi/content/full/cmaj.100685/DC1). There were 416 patients (6.1%) with a charted history of asthma and 766 (11.3%) with a charted history of COPD. The adjusted odds of receiving a low-priority triage score were

Table 2: Adjusted odds of receiving a low-priority triage score for patients with acute myocardial infarction

Characteristic	OR	95% CI	<i>p</i> value
Chart record of depression	1.26	(1.05–1.51)	0.01
One cardiac risk factor*	0.98	(0.82–1.17)	0.85
Two or more cardiac risk factors	1.00	(0.87–1.16)	0.97
History of CAD	1.04	(0.91–1.20)	0.56
History of PCI or CABG	0.84	(0.69–1.03)	0.09
Age, per 10 year†	1.09	(1.04–1.14)	< 0.001
Sex, male	0.89	(0.79–1.00)	0.05
Highest income	1.01	(0.84–1.20)	0.95
Chest pain in ED	0.29	(0.25–0.35)	< 0.001
Chest pain within 72 hr	0.68	(0.53–0.86)	0.001
Short of breath	0.90	(0.80–1.02)	0.10
Cardiac arrest or shock	0.01	(0.00–0.07)	< 0.001
Pulmonary edema	0.45	(0.34–0.60)	< 0.001
Arrived by ambulance	0.65	(0.57–0.74)	< 0.001
Came from home	0.92	(0.74–1.14)	0.44
Arrival time of 0001–0800	0.91	(0.79–1.05)	0.20
Weekend arrival	0.99	(0.86–1.13)	0.86
Teaching hospital	1.18	(0.70–1.99)	0.54
PCI hospital	0.79	(0.43–1.47)	0.46
Very high ED AMI volume‡	0.28	(0.19–0.41)	< 0.001

Note: AMI = acute myocardial infarction, CABG = coronary artery bypass graft, CAD = coronary artery disease, ED = emergency department, OR = odds ratio, PCI = percutaneous coronary intervention.

*Diabetes mellitus, hypertension, smoker or dyslipidemia.

†Values reflect odds of receiving a low-priority score per every 10-year increase in age.

‡Volume was defined as follows: < 100 AMI patients/yr = low volume; 101–200 patients/yr = moderate; 201–300 patients/yr = high; ≥ 301 patients/yr = very high.

0.88 ($p = 0.23$) in the model for asthma and 1.13 ($p = 0.24$) in the model for COPD.

For patient with a charted history of depression, the adjusted odds of missing benchmark times for process-of-care measures were 1.39 ($p < 0.001$) for door-to-electrocardiogram time (Appendix 2, available at www.cmaj.ca/cgi/content/full/cmaj.100685/DC1), 1.62 ($p = 0.047$) for door-to-needle time (Appendix 3, available at www.cmaj.ca/cgi/content/full/cmaj.100685/DC1) and 9.12 ($p = 0.019$) for door-to-balloon time (Appendix 4, available at www.cmaj.ca/cgi/content/full/cmaj.100685/DC1). In comparison, the adjusted odds of missing benchmark times if the patient had a noted past medical history of asthma or COPD were not significant (Table 3). In the sensitivity analysis, the effect of a charted history of depression was similar for door-to-electrocardiogram time (adjusted odds 1.37 [$p = 0.005$]), door-to-needle time (1.50 [$p = 0.08$]) and door-to-balloon time (11.7 [$p = 0.02$]).

Interpretation

In this population-based study, 10% of patients with acute myocardial infarction who were seen in an emergency department had a history of depression recorded in their chart, and this history was associated with an increased risk of receiving a low-priority emergency department triage score as well as delays in diagnostic testing and definitive care. Interestingly, other components of medical history, including the traditional cardiac risk factors of diabetes, smoking, hypercholesterolemia and hypertension, were not associated with triage score in the models; only depression affected the score.

To discern whether the effect on triage of having a chart-documented history of depression was a phenomenon exclusive to depression, we assessed the adjusted effects of having a charted history of two other diseases. Unlike depression, neither a history of asthma or of COPD were

associated with low-priority triage or with delays in diagnostic testing or treatment for acute myocardial infarction. It seems that depression itself has a particular adverse influence on the triage process and on subsequent care for patients with acute myocardial infarction.

Mental health advocates have charged that patients who have a mental illness are stigmatized by their illness in the emergency department setting,^{6,7} but no studies have investigated whether these patients receive differential emergency department treatment. A large study involving in-hospital Medicare beneficiaries who had acute myocardial infarction found that those with a history of affective disorder were significantly less likely to receive cardiac procedures during their hospital admission compared with those without this comorbidity.¹⁹ Those findings suggest that the differential care we found in emergency departments also occurs in the in-hospital setting. The results of another study suggest that such patients are less likely to meet quality-of-care indices; a higher one-year mortality disappeared after adjusting for five established quality indicators for care of patients with acute myocardial infarction.²⁰ These findings are consistent with our findings in the emergency department setting, where a charted history of depression had a negative impact on established quality-of-care indices.

We hypothesize that a charted history of depression results in lower emergency department triage scores and delays in definitive care because the patient's symptoms are assumed by emergency department staff to be somatization of the depression instead of ischemic in origin. Alternatively, their symptoms may be assumed to be anxiety-related. Of the enormous number of patients who present to the emergency department each year with chest pain, less than 10% are ultimately found to be having an acute myocardial infarction,²¹ and anxiety is a common cause of chest pain, shortness of breath and diaphoresis.²² However, an assumption that anxiety is the

Table 3: Adjusted odds of receiving a low-priority triage score and of missing benchmark times for process of care when patients had a charted record of depression versus asthma or chronic obstructive pulmonary disease

Characteristic	Depression (95% CI)	Asthma (95% CI)	COPD (95% CI)
Low-priority triage score (3, 4 or 5)	1.26 (1.05–1.51)	0.88 (0.71–1.09)	1.13 (0.92–1.38)
Missed door-to-ECG time	1.39 (1.16–1.67)	0.99 (0.80–1.25)	1.22 (1.00–1.43)
Missed door-to-needle time	1.62 (1.01–2.61)	0.81 (0.50–1.32)	1.15 (0.70–1.87)
Missed door-to-balloon time	9.12 (1.44–57.7)	0.39 (0.05–2.86)	1.33 (0.23–7.69)

Note: CI = confidence interval, COPD = chronic obstructive pulmonary disease, ECG = electrocardiogram.

cause of the patient's symptoms is of particular concern given that true chest pain of acute myocardial infarction can cause a patient to be obviously anxious. Unfortunately, the presence of depression as a comorbidity may cause some staff to reduce their suspicion that acute myocardial infarction may be the source of the patient's symptoms, in favour of a ready alternative.

We speculate that mistriage of such patients does not result from purposeful discrimination by emergency department staff, but rather that most emergency department staff are unaware of data that suggest a link between depression and coronary artery disease.^{23,24} This information needs to be disseminated, and emergency department staff need to differentiate between anxiety and depression.

Depression may independently increase the risk of mortality following an acute myocardial infarction;⁴ the exact cause is unknown.⁵ Our study found that patients with acute myocardial infarction who had a charted history of depression experience delays in diagnostic testing and reperfusion. Delays in reperfusion measured in minutes have been associated with higher mortality;^{25,26} thus, we speculate that delays in emergency department care contribute to worse outcomes experienced by these patients. We note, however, that we did not independently verify the history of depression in our cohort, so we cannot claim depression-related delays in emergency department care directly contributed to the worse outcomes found in other studies.

Accounting for triage score in our sensitivity analyses did not remove the delays in meeting benchmark times, suggesting that it is not just the triage nurse whose patient care is affected by the label of depression. Rather, it suggests that a chart-documented history of depression alters the management decisions made by emergency physicians and nurses, cardiologists and the catheterization laboratory team, in addition to the triage nurse. This finding is consistent with that of another study that showed that having an affective disorder was associated with fewer cardiac procedures being performed in patients with acute myocardial infarction.¹⁹ It seems that the label of depression influences many health care providers along the care pathway of patients with acute myocardial infarction.

Limitations

In our study, we assumed that information on past medical history of depression was collected by the triage nurse, given that this is part of the triage process,⁸ but it is possible that this history was only elucidated by the physician. However, the recording of all current medications is a stan-

dard component of triage, and the record of an antidepressant would have alerted the triage nurse to a history of depression. As well, if the triage nurse wasn't aware of the history of depression, this might have created a misclassification bias, resulting in underestimation of the true effect of a history of depression on triage in our results.

We did not confirm the history of depression that was documented on the emergency department chart with an outside source. Again, this could have resulted in misclassification of study patients. However, we were less interested in certainty of the past diagnosis than in the health care provider's perception of the previous diagnosis of depression. Our results do not apply to patients who received a prehospital electrocardiogram or fibrinolysis, but such patients make up a relatively small proportion of patients with acute myocardial infarction. Only half arrive by ambulance,²⁷ and less than 10% of American patients with ST-segment elevation myocardial infarction receive a prehospital electrocardiogram,²⁸ with lower numbers in Canada.²⁹

Because of a relatively small number of patients who received primary percutaneous coronary intervention, we did not have the statistical power to include all 19 of the possible covariables in the model for door-to-balloon time.¹⁸ We chose covariables based on clinical importance rather than with stepwise selection (which results in biased parameter estimates). We note that the increased odds of missing the benchmark door-to-balloon time when patients are admitted on a weekend was reproduced in another study,³⁰ providing face validity for our model. Another limitation was the retrospective collection of data, with some of the inherent limitations of chart review. However, rigorous training of nurses in abstraction of chart data, use of standardized data collection instruments and evaluation of interrater reliability should limit bias.¹³

Conclusion

A charted history of depression was common among patients with acute myocardial infarction presenting to the emergency department and was independently associated with lower-priority emergency department triage, as well as delays in benchmark diagnostic and reperfusion times. A history of depression should not be assumed to be the cause of presenting symptoms in emergency department patients with possible cardiac ischemia.

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- Funding:** This project was supported in part by a Canadian Institutes of Health Research (CIHR) Team Grant in Cardiovascular Outcomes Research and by an operating grant from the Heart and Stroke Foundation of Ontario (HSFO) (grant no. NA5703). Clare Atzema was supported by a Clinician Scientist Award from the HSFO. Michael Schull was supported by an Applied Chair in Health Services and Policy Research from CIHR. Dr. Tu was supported by a Canada Research Chair in Health Services Research from CIHR and by a Career Investigator award from the HSFO. The HSFO had no involvement in the design or conduct of the study, the data management or analysis, or the manuscript preparation, review, or authorization for submission. This study was supported by the Institute for Clinical Evaluative Sciences (ICES), which is funded by an annual grant from the Ontario Ministry of Health and Long-Term Care (MOHLTC). The opinions, results and conclusions reported in this paper are those of the authors and are independent from the funding sources. No endorsement by ICES or the Ontario MOHLTC is intended or should be inferred.
- Acknowledgements:** The authors thank Marian J. Vermeulen for biostatistical support.