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Physician financial incentives to reduce unplanned hospital readmissions:

An interrupted time series analysis

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ABSTRACT

BACKGROUND: In 2012, the Ministry of Health in British Columbia, Canada, introduced a $75 incentive payment that could be claimed by hospital physicians each time they produced a written post-discharge care plan for a complex patient at the time of hospital discharge.

OBJECTIVE: To examine whether physician financial payments incentivizing enhanced discharge planning reduce subsequent unplanned hospital readmissions.

DESIGN: Interrupted time series analysis of population-based hospitalization data.

PARTICIPANTS: Individuals with one or more eligible hospitalizations occurring in British Columbia between 2007 and 2017.

MAIN MEASURES: The proportion of index hospital discharges with subsequent unplanned hospital readmission within 30 days, as measured each month of the 11-year study interval. We used interrupted time series analysis to determine if readmission risk changed after introduction of the incentive payment policy.

KEY RESULTS: A total of 40,588 unplanned hospital readmissions occurred among 409,289 eligible index hospitalizations (crude 30-day readmission risk, 9.92%). Policy introduction was not associated with a significant step change (0.393%; 95CI, -0.190% to 0.975%; p = 0.182) or change-in-trend (p = 0.317) in monthly readmission risk. Policy introduction was associated with significantly fewer prescription fills for potentially inappropriate medications among older patients, but no improvement in prescription fills for beta-blockers after cardiovascular hospitalization and no change in 30-day mortality. Incentive payment uptake was incomplete, rising from 6.4% to 23.5% of eligible hospitalizations between the first and last year of the post-policy interval.

CONCLUSION: The introduction of a physician incentive payment was not associated with meaningful changes in hospital readmission rate, perhaps in part because of incomplete uptake by physicians. Policymakers should consider these results when designing similar interventions elsewhere.

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Introduction

Unplanned hospital readmissions are common, costly and associated with adverse outcomes.[1] About 10% of hospitalized Canadians undergo unplanned readmission within 30 days of discharge, resulting in $2.1 billion CAD in additional health system costs each year.[2] One in five patients die within 30 days of readmission, a risk three-fold greater than among non-readmitted patients.[3,4] In response to these striking statistics, clinicians, administrators and researchers have spent over a decade seeking ways to prevent unplanned hospital readmissions.

Important gaps in transitional care are believed to contribute to unplanned hospital readmissions. One third of discharged patients have no physician follow-up within 14 days, and only 50% of readmitted patients visit primary care before returning to hospital.[5,6,7] Only 60% of hospitalized older adults can correctly state their discharge diagnosis, yet discharge summaries are commonly unavailable at the first post-discharge primary care follow-up visit.[8,9] These communication gaps heighten readmission risks.[10] Up to 62% of test results that are unavailable at the time of discharge are never reviewed by a physician.[11] Preventable adverse drug events (including unintentional medication discontinuation) are common after hospitalization and may prompt hospital readmission.[12,13,14] The pervasiveness of these shortcomings suggests some readmissions might be avoided by encouraging early clinical follow-up, expedited communication between hospital and community clinicians, enhanced patient understanding and improved discharge medication reconciliation.

Policymakers have attempted to address unplanned hospital readmissions using financial incentives. The U.S. Centers for Medicare & Medicaid Services' Hospital Readmissions Reduction Program incentivizes improved transitional care by withholding up to 3% of reimbursements to hospitals with unexpectedly high 30-day readmission risks.[15] However, in contrast to outcome-focused hospital-level penalties, the effectiveness of process-focused physician-level incentive payments is less well established. For example, a $25 payment to primary care physicians in Ontario encouraged follow-up within 14 days of hospital discharge and was associated with annual expenditures of $2.1M but no significant improvement in early follow-up, hospital readmission or death.[5] Incentives payments to U.S. primary care clinicians for enhanced transitional care management may have reduced mortality and cost, but population impact has been severely limited by extremely low uptake.[16] Physician financial incentives have remained appealing to policymakers and clinicians despite other studies suggesting a limited impact on outpatient visits or preventative care.[17,18,19,20,21,22]

On June 1, 2012, policymakers in British Columbia introduced a fee-for-service physician payment claim code that was intended "to support clinical coordination leading to effective discharge and community-based management of complicated patients ... at risk of readmission."[23] The incentive payment could be claimed on the day of hospital discharge and was designed to encourage hospital physicians to provide the patient and their primary care provider with a written care plan within 24 hours of discharge. To address some modifiable contributors to readmissions, the care plan was designed to: ensure patients understood their diagnosis; ensure patients had contact information for their primary care physician; remind

physicians to reconcile discharge medications; remind physicians to arrange appropriate follow-up care; and improve overall discharge communication between hospital physicians, patients and primary care providers. In practice, written care plans were typically created separately and in advance of the discharge summary, faxed to the primary care provider just prior to the patient's departure from hospital, and subsequently incorporated into the hospital paper medical record. Successful claims resulted in a $75 payment to the physician in addition to payments for routine day-of-discharge hospital care.

In light of the uncertainty effectiveness of physician financial incentives as a tool to improve population health, we sought to test whether the introduction of BC's incentive payment policy was associated with a reduction in the risk of unplanned hospital readmission.

Methods

Setting

We performed a population-based interrupted time series analysis of hospitalizations in British Columbia (BC), a Canadian province of 4.6 million residents. Over the 11-year study interval, universal health insurance provided BC residents with access to hospital and physician care that was free at the point of service.[24] Most specialist physicians were remunerated by the provincial government on a fee-for-service basis.[25] The fee code of interest ("G78717"; **Appendix, Item SA1**) was developed by the Specialist Services Committee (SSC), a partnership between the BC Ministry of Health and Doctors of BC (the professional association representing

physicians) with a mandate to "identify changes in current physician service delivery that could result in improvements in patient care ... and measurable savings."[26]

All larger and most small hospitals had electronic health records (EHRs) that included laboratory test results, radiology reports, initial physician consultation notes and hospital discharge summaries. Daily progress notes, nursing notes, allied health records and comprehensive discharge planning documents were typically excluded from the EHR and were instead part of a paper-based health record. Access to hospital records by primary care clinics and unaffiliated hospitals was variable, incomplete and cumbersome (often involving transmission by fax machine). Hospital-based discharge planning typically involved multiple weekly meetings between the physician, nurse leader, occupational and physical therapists, pharmacist, social worker and a transitional services team liaison to assist with initiation of community home care services.

Data

De-identified individual-level longitudinal data were obtained from population-based administrative databases used extensively in prior research (**Item SA2**).[27] Data on hospitalizations were obtained from the Discharge Abstract Database (DAD).[28] These were linked to other administrative databases to obtain patient demographics, residential neighborhood income quintile, and comorbidities derived from the diagnostic fields of hospitalization and clinic visits in the year prior to index hospitalization (**Item SA3**).[29,30,31] Baseline prescription medication fills were assessed in the 90 days prior to index admission

date and in the 60 days following index discharge date using PharmaNet, a provincial database capturing all outpatient prescriptions filled in a community pharmacy in BC.[32] Neighbourhood income quintile was missing for 6.6% of the cohort but data were otherwise complete.

Study cohort

The study population was comprised of all adults discharged from an acute-care hospital in BC between April 1, 2007 and January 31, 2017. We excluded hospitalizations for individuals aged <18 years at the time of discharge and those with a Most Responsible Diagnosis corresponding to pregnancy, childbirth, or the puerperal and perinatal periods. We set index hospital admissions as the unit of analysis and individual patients could contribute multiple hospital admissions to the study.

Index hospital admissions were included in the primary analysis if they met the initial 2012 eligibility criteria for the incentive payment: 1) a Most Responsible Provider (MRP) that was a specialist physician; 2) an 'Admission Category' designation of "urgent" (rather than "elective"), and; 3) a 'total length of stay' (LOS) ≥5 days. Hospitalizations were ineligible as index admissions if the admission date occurred within 30 days of a prior hospital discharge date or if they ended in discharge against medical advice or death.

Primary analysis

Our primary analysis used interrupted time series analysis to test the hypothesis that the introduction of the incentive payment policy was associated with a change in the risk of

unplanned hospital readmission within 30 days of hospital discharge. We selected an interrupted time series approach in order to assess the influence of the policy on population-level hospital readmission risks. This approach also avoids bias arising from treatment selection and residual confounding that might limit a study comparing outcomes among G78717 exposed patients and unexposed patients. We aggregated index discharge dates by calendar month and categorized months as belonging to the pre-policy period (April 1, 2007 to May 31, 2012) or the post-policy period (June 1, 2012 to January 31, 2017). Our primary analysis used an autoregressive model with maximum likelihood estimation to account for trends in the monthly hospital readmission risk, with separate regression terms describing the step change and slope change occurring at the transition from the pre- to the post-policy period. Heteroscedasticity was assessed using SAS's ARCHTEST function. Autocorrelation was assessed using the Durbin-Watson statistic. Stationarity was assessed using the Auto Correlation Function and Partial Auto Correlation Function. Seasonality evaluated by observing the scatterplots of the time series data. We assessed model fit using studentized residuals, the normality of the residuals, and White Noise Probabilities. We used Cook's Distance to identify outliers in the data.[33]

Additional analyses

Sensitivity analyses examined the influence of clustering within hospital. Secondary analyses evaluated the appropriateness of post-discharge medication prescription fills because unplanned hospital readmissions can be a consequence of under-prescription of indicated medications or over-prescription of unnecessary medications.[13,34,35] We focused on two commonly prescribed classes of medication with compelling indications for use in clearly-

defined populations. For index admissions for cardiovascular disease (acute coronary syndrome, heart failure, or chronic ischemic heart disease), we calculated the proportion receiving at least one prescription fill for specific beta-blocking drugs (bisoprolol, carvedilol, or metoprolol) within 60 days of index hospital discharge. We interpreted a higher prevalence of beta-blocker prescription fills as an improvement in the quality of medical care (**Item SA4**).[36,37,38,39,40,41,42,43,44,45,46,47,48,49] For index admissions among patients aged 65 years or older, we calculated the proportion with at least one prescription fill for a potentially inappropriate medication (PIM).[50] We interpreted a lower prevalence of these medications as an improvement in the quality of medical care.[50,51,52,53,54,55,56]

We analyzed the net spending benefit of the incentive payment policy in the post-policy period by comparing the government's expected spending on readmissions with actual spending on the new fee code. We calculated the projected number of avoided readmissions in each month by subtracting the observed number of readmissions from the expected number of readmissions. We estimated the expected number of readmissions by multiplying the number of index admissions in that month by the "no policy" counterfactual readmission risk calculated for that month using the pre-policy interval regression equation. We estimated the cumulative cost savings resulting from the policy's influence on readmissions by multiplying the estimated number of avoided readmissions by hospital unit costs (cost per weighted case) provided by the Canadian Institute for Health Information (CIHI) and patients' Resource Intensity Weight (a measure of total patient resource use relative to average acute inpatient resource use).[57] We estimated the cumulative cost of the intervention by multiplying the number of incentive

payment claims by payment cost ($75). We calculated the net cost of the intervention by subtracting the cumulative cost of the intervention from the cumulative cost savings resulting from the intervention.

Ethics

The University of British Columbia Clinical Research Ethics Board approved the study and waived the requirement for individual consent (H17-01039). A study protocol was registered on ClinicalTrials.gov (NCT03256734). Statistical analyses used 2-sided tests and significance was inferred from $p < 0.05$. Analyses were performed using SAS version 9.4 and R version 4.0.4. Data analysis occurred from October 2018 to February 2020. All inferences, opinions, and conclusions drawn in this manuscript are those of the authors, and do not reflect the opinions or policies of the Data Steward(s). The Specialist Services Committee and the Vancouver Coastal Health Research Institute funded the study but were not involved in the design and conduct of the study; collection, management, analysis and interpretation of the data; or preparation, review and approval of this manuscript.

Results

The final study cohort included a total of 290,498 unique individuals with 409,289 index hospitalizations resulting in 40,588 (9.92%) unplanned readmissions within 30 days of index discharge (**Figure 1**). Advanced age, multimorbidity and polypharmacy at the time of index hospital admission were common. About 19% of index hospitalizations included a stay in the

intensive care unit and 45% had a total length of stay ≥10 days (**Table 1**). A total of 6,476 unique individual specialist Most Responsible Providers supervised index hospitalizations eligible for the incentive payment and 1,178 (18.2%) of these physicians claimed one or more incentive payments. Most claims were submitted by specialists in psychiatry and general internal medicine (**Items SA5 and SA6**). Uptake of incentive payment claims by physicians was gradual and incomplete, rising from 6.4% to 23.5% of eligible hospitalizations between the first and last year of the post-policy interval (**Item SA7**). Most physicians only claimed G78717 for a small proportion of eligible hospitalizations (**Item SA8**).

Interrupted time series analysis indicated the introduction of the incentive payment policy was not associated with a change in the risk of unplanned readmission (step change after policy introduction, 0.393%; 95%CI, --0.190% to 0.976%; p = 0.182; slope change after policy introduction, 0.00879% per month, 95%CI, -0.00857% per month to 0.0261% per month; p = 0.317; **Table 2**; **Figure 2**). Similarly, the introduction of the incentive payment policy was not associated with a reduction in mortality within 30 days of index discharge, nor with improvements in beta-blocker prescription fills after hospitalization for cardiovascular disease (**Figure 3; Item SA9**). In contrast, significant improvements in post-discharge prescription fills for potentially inappropriate medication among patients aged ≥65 years occurred in association with the introduction of the incentive payment policy (from 33% in June 2012 to 25% in January 2017).

Although the introduction of the incentive payment policy was not associated with a significant change in the risk of unplanned readmission, we used the difference between observed and expected readmissions to generate best estimates for the potential impact of the policy on readmissions and costs (**Table 3**). The incentive payment policy was not associated with a significant reduction in the risk of unplanned hospital readmission in any major subgroup (**Item SA10**). Sensitivity analyses accounting for hospital-level effects also suggested policy introduction was not associated with changes in readmission risks (**Item SA11**). Supplementary analyses suggested no substantial change in the proportion of patients discharged home (as opposed to long-term care) over the study interval (**Item SA12**).

Discussion

We performed a population-based interrupted time series analysis of non-elective hospital admissions in British Columbia over an 11-year study interval and found that the introduction of a new fee-for-service physician payment incentivizing enhanced hospital discharge communication was not associated with significant changes in the risks of unplanned hospital readmission or mortality within 30 days. Policy introduction was associated with a substantial decrease in prescription fills for relatively contra-indicated medications in the elderly, but no improvement in prescription fills for beta blockers after cardiovascular hospitalization. Our analyses suggest the introduction of the incentive payment policy did not result in significant changes in population risk of unplanned hospital readmission.

Several explanations of our findings are possible. First, the incentive payment might have remunerated physicians for established routines rather than incentivizing new behaviours. Second, physician behaviour might have remained unchanged because of suboptimal incentive design, potentially including insufficient monetary value, lack of immediacy between the incentive and the incentivized behaviour, framing of the incentive as an additional payment (rather than as a financial loss), and lack of verification that incentivized tasks were performed. Third, incentivized physician behaviours might be ineffective if readmission risks are predominantly influenced by factors beyond the control of hospital physicians. Only 27% of unplanned hospital readmissions are thought to be preventable through optimal medical care, suggesting inadequate access to primary care, insufficient community supports, limited health literacy, treatment non-adherence, socioeconomic inequalities and other forces contribute substantially to readmission risk.[8,58,59,60,61,62,63,64] In contrast to the physician-focused G78717 incentive payment, successful readmission reduction initiatives have addressed these contributors using multi-component interventions and a broad coalition of community care providers spanning multiple disciplines and a range of regional health and social service organizations.[65,66,67] These contrasts suggest physician-focused incentives alone might have a limited influence on readmission risks.

The G78717 policy was associated with a substantial decrease in prescription fills for relatively contra-indicated medications in the elderly, but no improvement in prescription fills for beta blockers after cardiovascular hospitalization. This discrepancy might occur because human psychology dictates that medication reconciliation detects errors of commission (e.g.

inappropriately prescribed medications) more effectively than errors of omission (e.g. indicated yet missing medications).[12,68,69] However, the observed reduction in inappropriate prescriptions for the elderly might instead reflect trends in prescription of benzodiazepines and hypnotics (**Item SA13**). Other interventions including workflow redesign, targeted training, automated EHR alerts based on established diagnoses or new test results, and physician-specific performance data and feedback may better address shortcomings in evidence-based discharge medications.[70]

Our study has several limitations. First, physician uptake of the incentive payment was gradual and incomplete. The incentive payment policy may thus appear ineffective at the population level even if incentive payments were efficacious among patients receiving the incentivized services. Uptake might have been modest because provider awareness about the new fee code was limited, the requirements of the code were perceived as burdensome, or because the monetary value of the incentive was unappealing relative to other reimbursed services, but our data do not distinguish between these possibilities. Second, temporal confounding by other policy interventions and unrecognized secular trends may bias interrupted time series analyses. A previous analysis found that the introduction of partial activity-based funding for BC hospitals in 2010 resulted in no change in the risk of readmission.[71] In 2012, BC introduced a "Home First" policy to discourage entry to long-term care directly from an acute care hospital; the effect on unplanned hospital readmissions remains unknown.[72] Third, we lacked granular clinical information and were unable to directly assess if the incentive payment policy resulted in more comprehensive discharge care plans,

more thoughtful medication review or improved physician-to-physician communication at the time of hospital discharge. Fourth, our study focused on hospital readmissions, mortality, and markers of prescription quality and did not evaluate other potential goals of the incentive payment policy such as aligning remuneration with the work required to complete a high-quality hospital discharge or addressing the imbalance in financial compensation between procedural and cognitive medical specialties. Fifth, our study was set within a single Canadian province and may not be generalizable to settings with other physician payment models.

Among patients with non-elective hospital admissions of five days or longer, introduction of a physician payment to incentivize enhanced discharge planning was not associated with significant changes in the risks of subsequent unplanned readmission or death. Decisionmakers seeking to reduce unplanned hospital readmissions should consider our findings before implementing similar physician incentive payments elsewhere.

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Author contributions: JAS, JMS and GL were responsible for study concept and design. JAS was responsible for acquisition of the data and drafting of the manuscript. GL had full access to all study data and was responsible for the integrity of the data and the accuracy of the data analysis. All authors were responsible for critical revision of the manuscript.

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Potential conflicts of interest: JAS has received clinical income from the incentive payment. As a co-funder of this work, the Specialist Services Committee might be perceived as having a political or financial interest in demonstrating the effectiveness of the fee code. As recipients of operational support from SSC for this project, Drs Staples and Sutherland might be perceived as incentivized to produce findings that lend support to claims of the effectiveness of the fee code.

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Physician financial incentives to reduce unplanned hospital readmissions:

An interrupted time series analysis

TABLES & FIGURES

Table 1: Characteristics of the index hospitalization

Characteristic	**Pre-policy interval, 2007 - 2012** (n = 210,512)		**Post-policy interval, 2012 - 2017** (n = 198,777)	
	Frequency	Percent	Frequency	Percent
Age				
<45	48,856	23.2	43,868	22.1
45 - 64	66,342	31.5	61,425	30.9
>=65	95,314	45.3	93,484	47.0
Female sex	98,456	46.8	91,063	45.8
Mean neighborhood household income within the lowest quintile, CAD (SD)	17,188 (4441)	-	17,298 (4315)	-
Rural residence*	21,680	10.3	19,306	9.7
Hospitalizations in prior year	81,945	38.9	78,902	39.7
>/=7 clinic visits in prior year	56,493	26.8	66,527	33.5
Charlson co-morbidity score >=2	60,628	28.8	56,667	28.5
Comorbidities at index admission				
Diabetes, +/- complications	39,885	19.0	42,238	21.3
Cancer or metastatic carcinoma	26,649	12.7	21,047	10.6
Chronic Pulmonary Disease	13,031	6.2	11,710	5.9
Congestive Heart Failure	16,137	7.7	16,442	8.3
Myocardial Infarction	13,427	6.4	12,439	6.3
Cerebrovascular Disease	7,629	3.6	6,721	3.4
Renal Disease	8,572	4.1	11,472	5.8
Dementia	6,138	2.9	5,048	2.5
Medications at index admission				
Opioids	43,877	20.8	40,443	20.4
Antibiotics	58,492	27.8	52,579	26.5
ACEi & ARB	57,008	27.1	53,019	26.7
Diuretics	48,412	23.0	42,659	21.5
Antidepressants	48,586	23.1	48,480	24.4
Beta blockers	38,636	18.4	38,782	19.5
Statins	41,415	19.7	42,737	21.5
Benzodiazepines	53,117	25.2	47,699	24.0
Total medications at admission				
0	37,701	17.9	35,770	18.0
1 to 5	104,654	49.7	97,292	49.0
>/= 6	681,57	32.4	65,715	33.1

Table 1: Characteristics of the index hospitalization (continued)

Characteristic	Pre-policy interval, 2007 - 2012 (n = 210,512)		Post-policy interval, 2012 - 2017 (n = 198,777)	
	Frequency	Percent	Frequency	Percent
Hospital sector				
Community-Large	57,625	27.4	56,138	28.2
Community-Medium	18,154	8.6	16,101	8.1
Community-Small or other	8,584	4.1	8,083	4.1
Teaching	126,149	59.9	118,455	59.6
Most responsible service				
Medical	124,270	59.0	121,619	61.2
Surgical	86,242	41.0	77,158	38.8
Admitted via ED	160,505	76.3	162,618	81.8
ICU stay	40,367	19.2	39,015	19.6
Most responsible diagnosis for index hospitalization**				
Injury	14,573	6.9		
Hip or knee replacement	4,983	2.4	4,683	2.4
Myocardial infarction	12,123	5.8	11,629	5.9
Malignant neoplasm	5,843	2.8	4,864	2.5
Stable coronary artery disease	5,341	2.5	3,647	1.8
Asthma or COPD	4,308	2.1	4,167	2.1
Drug intoxication	4,121	2.0	5,861	3.0
Pneumonia	4,531	2.2	4,755	2.4
Cardiac arrhythmia	6,765	3.2	6,915	3.5
Biliary tract disorder	5,791	2.8	5,450	2.7
LOS				
5-10 days	115,821	55.0	109,542	55.1
>10 days	94,691	45.0	89,235	44.9
Discharge disposition				
Home	150,803	71.6	145,836	83.4
Home with support services	18,538	8.8	15,974	8.0
Long-term care	14,729	7.0	13,121	6.6
Another facility providing sub-acute, psychiatric, rehabilitation, cancer, or pediatric care	22,689	10.8	20,286	10.2
Other (addiction, palliative, hospice, died)	3,744	1.8	3,560	1.8

Table 2: Interrupted time series analysis of unplanned hospital readmissions

Variable	Value (95% CI)	p-value
Intercept on April 1, 2007 (percent readmitted within 30 days)	10.755 (10.367, 11.182)	<0.0001
Baseline trends in readmission risk (change per month in percent readmitted within 30 days)	0.0103 (-0.0009, 0.0215)	0.0717
Level change after policy introduction (change in percent readmitted within 30 days)	0.3926 (-0.1903, 0.9755)	0.1823
Slope change after policy introduction (additional change per month in percent readmitted within 30 days)	0.0088 (-0.0087, 0.0261)	0.3171

Legend: Table displaying the results of the interrupted time series analysis (autoregression model). Main findings are that the introduction of the policy was not associated with a significant step change or slope change in the population-level readmission rate.

Table 3: Cost analysis, 2012 - 2017

Variable	Estimated value (lowest estimate; highest estimate)
Best estimate of additional readmissions associated with the incentive payment policy	1,283 (1,239; 3,430)
Best estimate of additional readmission costs associated with the incentive payment policy	$19,243,137 ($18,604,186; $51,507,195)
Cost of incentive payment claims	$2,099,475
Best estimate of total policy-associated cost	$21,342,612

Legend: Table depicting the estimated costs associated with the incentive payment policy between introduction on June 1, 2012 and the end of the study interval on January 31, 2017. All estimates generated using the study cohort (i.e. urgent admissions under a specialist physician Most Responsible Provider with a length of stay ≥ 5 days). Although the introduction of the incentive payment policy was not associated with a significant change in the risk of unplanned readmission, we generated a best estimate for the number of additional readmissions attributable to the incentive payment policy by comparing the observed monthly readmission rate to the counterfactual rate based on pre-policy secular trends. The cost of these additional readmissions was estimated by multiplying this value by the average Resource Intensity Weight (RIW) of a readmission hospitalization and the cost of a standard hospital stay in BC (for the latter, we used a value of CAD $6,030 from 2015-2016, roughly the midpoint of the post-policy interval). RIW is a standardized measure of total patient resource use compared with average typical acute inpatient resource use. The total cost of incentive payment claims was estimated by multiplying the total number of incentive payment claims by the value physician payment associated with a successful claim (CAD $75). The best estimate of the total policy-associated cost was the sum of the cost of incentive payment claims and the cost of additional readmissions attributable to the policy.

Figure 1: Patient flow diagram

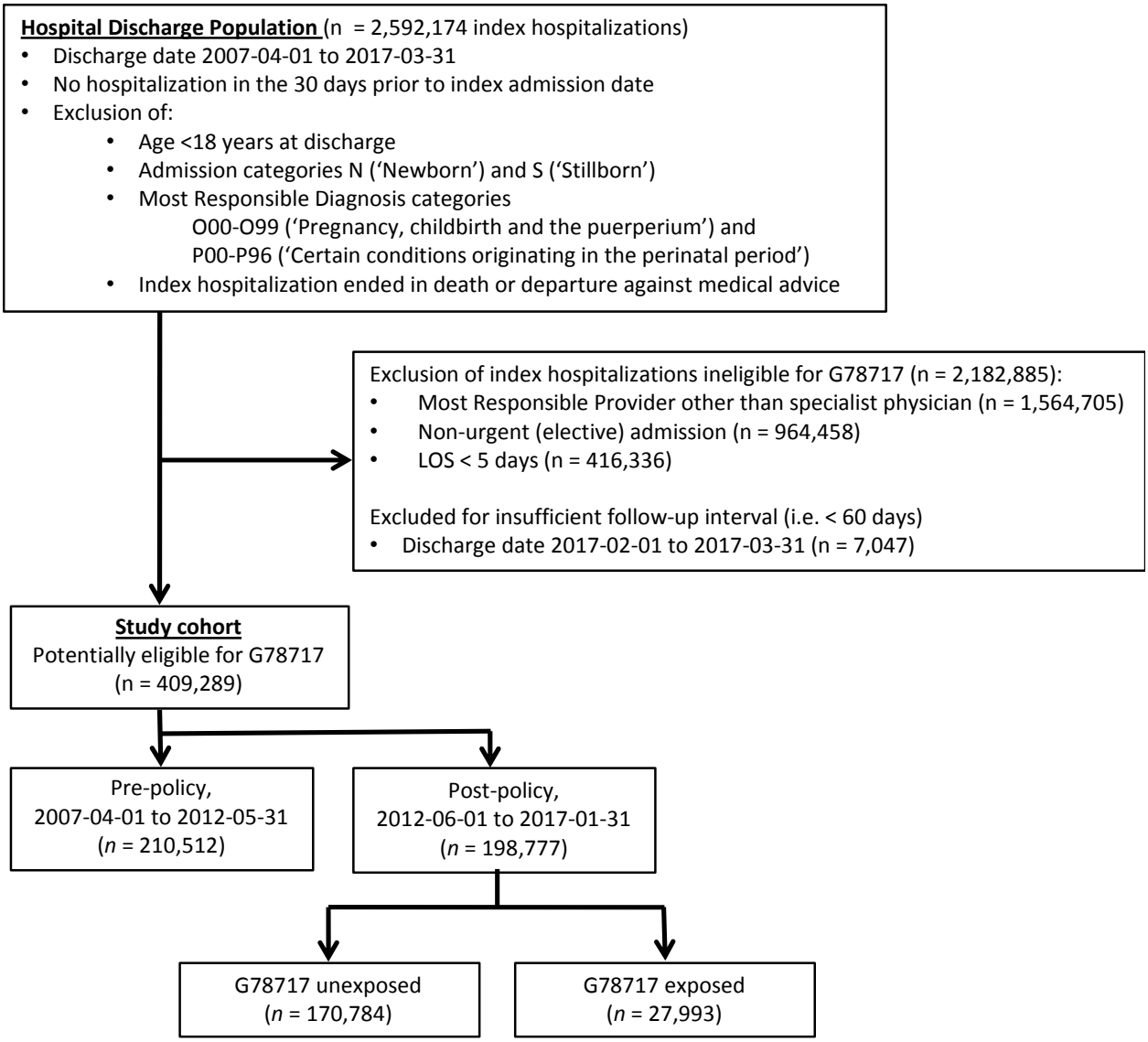
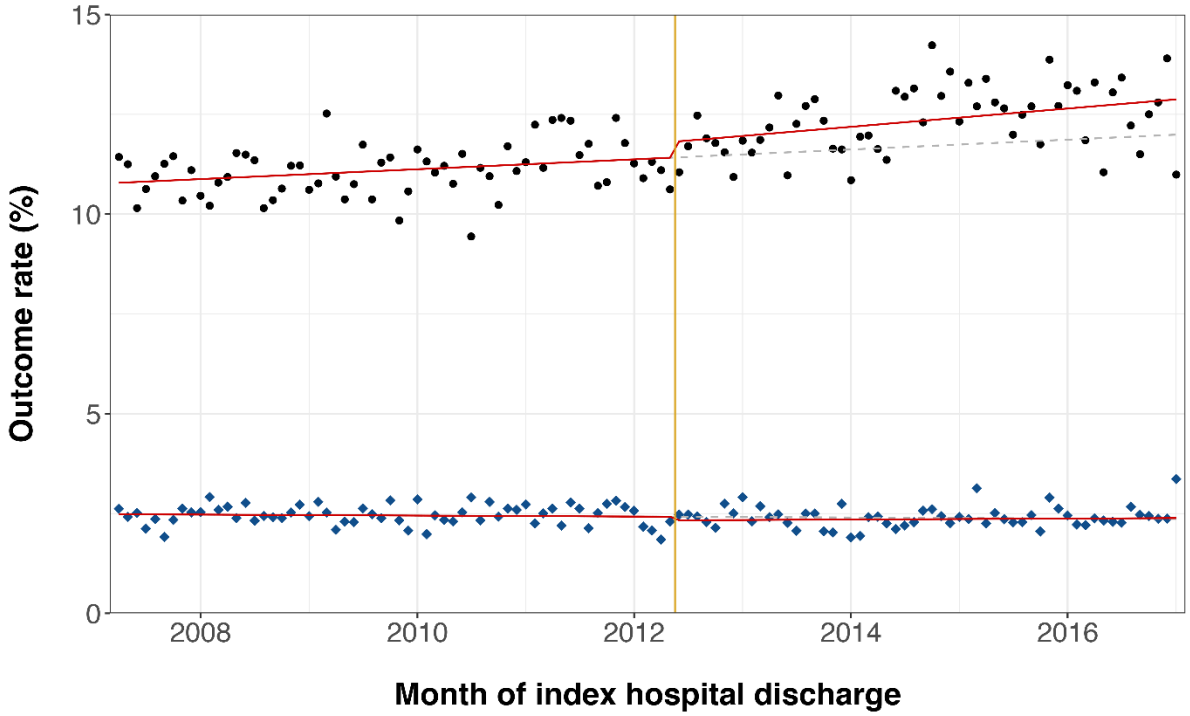
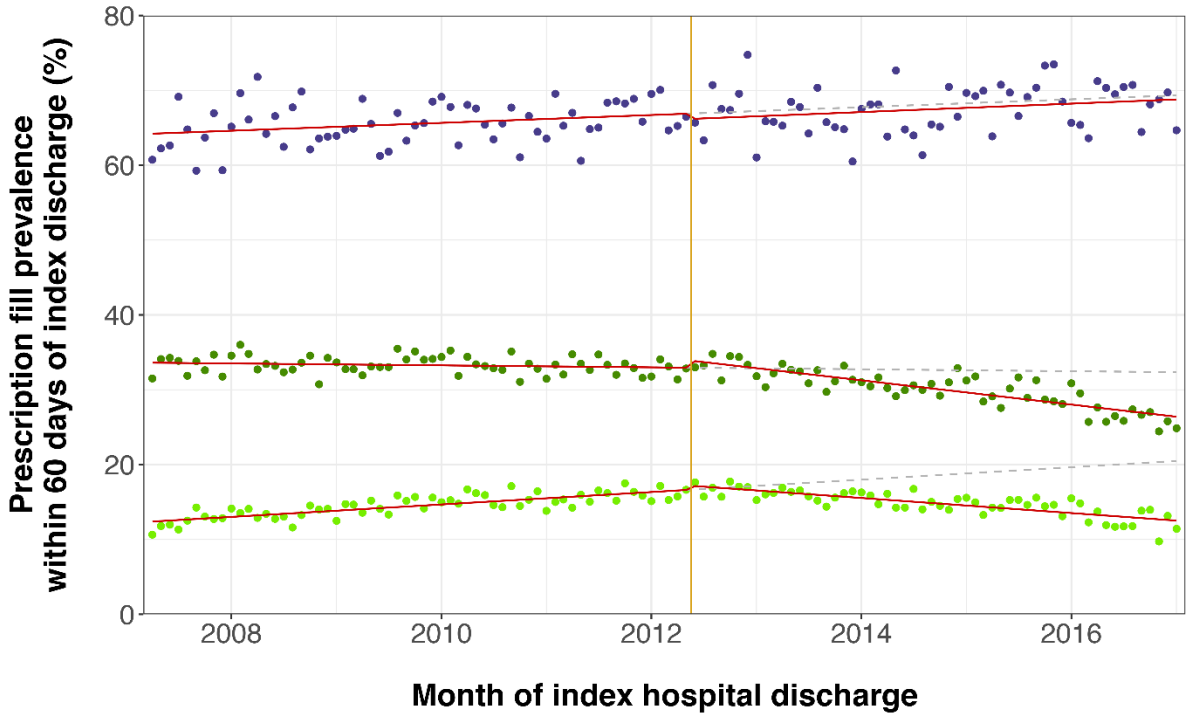


Figure 2: Interrupted time series of unplanned hospital readmissions and deaths within 30 days of index discharge



Legend: Interrupted time series evaluating the influence of the introduction of the incentive payment policy on 30-day readmission rate and 30-day mortality rate. Analysis restricted to index hospital admissions that were potentially eligible for the incentive payment (i.e. Most Responsible Provider a specialist rather than a primary care physician, admission urgent rather than elective, length-of-stay ≥ 5 days). X-axis indicates month of index hospital discharge. Y-axis indicates the proportion of index hospitalizations with the specified outcome within 30 days of discharge. Black circular points depict the observed monthly readmission rate. blue diamond points indicate the observed monthly death rate. Gold vertical line indicates the policy introduction on June 1, 2012. Red lines depict the interrupted time series regression model describing risks before and after the introduction of the policy. Dashed grey lines depict the counterfactual (predicted) risks in the absence of the policy. Main finding is that the introduction of the policy was associated with no significant step or slope change in unplanned readmission risk or death risk.

Figure 3: Interrupted time series analysis of post-discharge prescription quality-of-care



Legend: Interrupted time series evaluating the influence of the introduction of the policy on the prevalence of specific prescription medication fills within 60 days of index hospital discharge. X-axis indicates month of index hospital discharge. Gold vertical line indicates the introduction of the policy on June 1, 2012. Y-axis indicates the prevalence of specific prescription medication fills within 60 days of index hospital discharge.

Purple points depict the observed prevalence of prescription beta-blocker fills within 60 days of index discharge following hospitalization for acute coronary syndrome, heart failure, or chronic ischemic heart disease (Canadian Institute of Health Information Case Mix Group categories 1012, 1013, and 1015, respectively). Dark green points depict the observed prevalence of prescription fills for potentially inappropriate medications (PIMs) within 60 days of index discharge among patients aged ≥65 years. Light green points depict the observed prevalence of prescription fills for benzodiazepines or non-benzodiazepine hypnotics (a subset of PIMs) within 60 days of index discharge among patients aged ≥65 years.

Red line depicts the interrupted time series regression model for each medication group. Dashed grey line depicts the counterfactual (predicted) prescription fill prevalence in the absence of the policy. Main finding is that the introduction of the policy was associated with no significant step or slope change in beta blocker prescriptions among patients with index cardiovascular admission but a significant reduction in PIMs and the subset of PIMs that include only benzodiazepines or non-benzodiazepine hypnotics.