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## Effect of incentive payments on chronic disease management and health services use in British Columbia, Canada: Interrupted time series analysis

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### ABSTRACT

We studied the effects of incentive payments to primary care physicians for the care of patients with diabetes, hypertension, and Chronic Obstructive Pulmonary Disease (COPD) in British Columbia, Canada. We used linked administrative health data to examine monthly primary care visits, continuity of care, laboratory testing, pharmaceutical dispensing, hospitalizations, and total health care spending. We examined periods two years before and two years after each incentive was introduced, and used segmented regression to assess whether there were changes in level or trend of outcome measures across all eligible patients following incentive introduction, relative to pre-intervention periods. We observed no increases in primary care visits or continuity of care after incentives were introduced. Rates of ACR testing and antihypertensive dispensing increased among patients with hypertension, but none of the other modest increases in laboratory testing or prescriptions dispensed reached statistical significance. Rates of hospitalizations for stroke and heart failure among patients with hypertension fell relative to pre-intervention patterns, while hospitalizations for COPD increased. Total hospitalizations and hospitalizations via the emergency department did not change. Health care spending increased for patients with hypertension. This large-scale incentive scheme for primary care physicians showed some positive effects for patients with hypertension, but we observe no similar changes in patient management, reductions in hospitalizations, or changes in spending for patients with diabetes and COPD.

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### 1. Introduction

Incentive payments aimed at improving healthcare delivery have been widely implemented, and many target chronic disease management in primary care [1]. Evidence of the impact of incentive programs on processes of care [2–11] and health outcomes [3,4,7,12] is mixed, though effects, where observed, are typically modest. For some interventions it is difficult to disentangle the effect of new incentive payments from other contemporaneous changes to the delivery of primary care, such as new team-based models and enhanced care coordination, or other quality

improvement efforts, notably performance measurement and public reporting [2,8,10]. Despite a large body of research, not all chronic conditions are well represented. For example, the impact of financial interventions on chronic obstructive pulmonary disease (COPD) management has not been examined [2–9,13]. Systematic reviews have concluded that more research on the impact of financial incentives is still needed [2–9].

The Canadian province of British Columbia (BC) is in a unique position to contribute to this literature. BC implemented incentive payments targeting chronic disease management within the province-wide fee-for-service system (serving a population of approximately 4.5 million), and with no concurrent changes to that payment system (such as salaried or capitation-based remuneration), to the delivery model (such as teams or medical homes), or to quality measurement or reporting requirements [14]. Imple-

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mentation was staggered over time, with incentives introduced for management of diabetes in 2003, hypertension in 2006, and COPD in 2009. A commissioned evaluation examined cross-sectional comparisons of patients who did and did not have incentives billed for their care and reported that, on balance, the incentive payments corresponded with improved access and continuity, and reduced hospitalizations and health care spending [15,16]. Findings are likely subject to selection bias, as in other research where participation in the intervention is optional and only cross-sectional results are reported [2,4–7].

We used linked administrative data and a quasi-experimental interrupted time series design [17] to produce less biased estimates of the impact of these incentive payments. Due to the fact that incentives were implemented province-wide, we could not construct a sound control group, but staggered introduction of incentives by condition allows us to determine if similar effects are observed for incentives introduced at different points in time.

This incentive program is based, in part, on the idea that incentive payments would improve primary care access and continuity for patients with chronic disease, and encourage walk-in clinics to offer more longitudinal and less episodic care [16]. Improved primary care access and continuity would, in was hoped, contribute to enhanced chronic disease management and possibly reduced spending [16,18]. While some patients require hospital care even with high-quality primary care, a goal of chronic disease management in primary care is to prevent acute events, or manage crises in the community, where possible. It is hoped that better primary and secondary preventive care will reduce need for high cost services, and therefore overall health care spending [18,19]. Cross-sectional comparisons found patients with incentives in BC had fewer hospitalizations and lower spending than those without (with the exception of diabetes patients, where hospitalizations were lower but spending higher) [15].

We tracked primary care visits and continuity, process measures of testing and pharmaceutical dispensing, hospitalization rates, and cost of care, before and after the introduction of incentive payments for all patients with diabetes, hypertension, and COPD in BC. These outcome measures reflect care processes mentioned in flow sheets (diabetes and hypertension) or care plan templates (COPD) accompanying incentives, and/or outcomes reported in cross-sectional evaluation of this intervention [15].

## 2. Methods

### 2.1. Study context and intervention

All physician and hospital services are publically funded under BC's single-payer Medical Services Plan (MSP), with no out-of-pocket payments or private insurance for medically necessary services. With few exceptions, primary care physicians are paid fee-for-service. Province-wide fee codes are negotiated between the BC Ministry of Health and Doctors of BC (called the BC Medical Association before 2014). There is no formal rostering of patients, and no province-wide policy mechanisms to support group or team-based care, nor to pay nurse practitioners, physician assistants, or other non-physician primary care providers. Primary care physicians are expected to coordinate patient care and act as gatekeepers to specialist care.

All primary care physicians were eligible to bill for annual payments, in addition to regular visit fees, for providing guideline informed care for patients with diabetes, hypertension, and COPD, over the course of one year. Incentives were introduced in September 2003, April 2006, and September 2009, respectively. Payments were \$75 for diabetes (later increased to \$125), \$50 for hypertension, and \$125 for COPD, and are payable once per year,

per patient, through the billing of new fee codes introduced for each condition. Claims for these fee codes include unique physician and patient identifiers which allowed patients for whom incentives were and were not billed to be identified retrospectively. The charts of patients must include documentation of relevant guideline indicated processes of care [16] and flow sheets or care plan templates for each condition were made available as part of billing guides for this purpose [20]. However, charts were not routinely audited, and there was no new measurement or reporting of quality indicators. Following introduction of the COPD incentive in 2009–10, annual spending on these three fee items exceeded \$35 million, or over 3% of all fee-for-service payments to primary care physicians in BC. Other incentive programs bring total physician income from incentive payments to over 10%. Clinicians were actively involved in program design as this program was implemented through a partnership between Doctors of BC and the Ministry of Health. Provider surveys conducted in 2010, just after the implementation of the last of the three incentives analyzed (COPD), reported 95% of primary care physicians supported this policy approach [21].

### 2.2. Data and study population

We used linked, de-identified data developed by the BC Ministry of Health and provided through Population Data BC [22] covering the period from April 2001 to March 2012. The Medical Services Plan (MSP) registration file includes a record for all BC residents who receive or are eligible to receive publicly-funded health care services, including descriptive information about individuals' age, sex, Health Authority of residence (5 in BC), and number of days in each year registered for health insurance [23]. The MSP payment file includes data on all fee-for-service medical service claims paid to physicians. It describes services billed, including the incentive payments, and includes a patient diagnosis code for each service [24]. The Hospital Separations file includes records of all inpatient and surgical day care discharges and deaths for BC residents, including hospitalizations in other provinces [25]. Each record contains a Resource Intensity Weight variable that can be used to estimate spending. PharmaNet records all prescriptions dispensed in BC, including amount paid, Drug Identification Numbers, and Anatomical Therapeutic Chemical codes [26]. All inferences, opinions, and conclusions drawn in this article are those of the authors, and do not reflect the opinions or policies of the Data Stewards.

For each incentive program we examined a period of two years before and two years after the date of introduction. We identified patients qualifying for each program based on ICD codes associated with two outpatient physician visits or one hospitalization during the study period (Supplementary Table 1), following validated algorithms for identifying chronic disease [27]. We excluded individuals who moved into or out of the province over the study period, and who received care from primary care providers not paid fee-for-service, as these patients' service use is not completely captured in our data. We examined a closed cohort comprised of qualifying patients registered throughout the study period or up until death, regardless of whether or not an incentive was billed for their care. This provides an estimate of the total population-wide effect of incentive payments.

### 2.3. Outcomes

#### 2.3.1. Primary care use and continuity

We tracked the number of visits with any primary care physician (unique combinations of patient/physician/date, regardless of the number of services billed) as a measure of use. Each month, patients were assigned a Usual Provider of Care (UPC) defined as the physician providing the highest number of visits over the preceding year, on a rolling basis. Continuity was measured as the percent of pri-

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