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3 **Patients who do and do not have incentives billed on their behalf in British Columbia: is there**
4 **any rhyme or reason?**
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Abstract

Background: Chronic disease incentive payments were introduced in 2007 with the intent of supporting better care for patients in British Columbia. Previous studies show that not all primary care physicians are billing incentives and not all eligible patients are receiving them. We investigate both physician and patient characteristics associated with receipt of an incentive.

Methods: We used linked administrative health data to analyze community-based primary care physicians and patients with eligible conditions within British Columbia during 2010/11 to 2013/14. Descriptive analyses of patients and physicians compared three groups: 1) no incentives in any of the four years; 2) incentives in all four years; and 3) incentives in one, two or three of the study years. Multi-level logistic regression models identified the patient- and physician- level characteristics associated with incentives.

Results: Of 428,770 patients only 33.2% had an incentive billed on their behalf in all four study years and 35.6% never did. Of 3,936, 66.7% billed at least one incentive in each of the four study years and 18.8% never did. The strongest predictors of having an incentive billed are the number of GP contacts a patient has (100+ contacts OR 204.90, CI 162.87 – 257.79) and whether their primary care physician has a large number of patients in their practice for whom incentives are billed (quartile 4 vs. quartile 1 OR 41.43, CI 33.81 – 50.78).

Interpretation: It appears that physicians are billing incentives for patients based on who they see most often rather than using a population health management approach to their practice.

Introduction

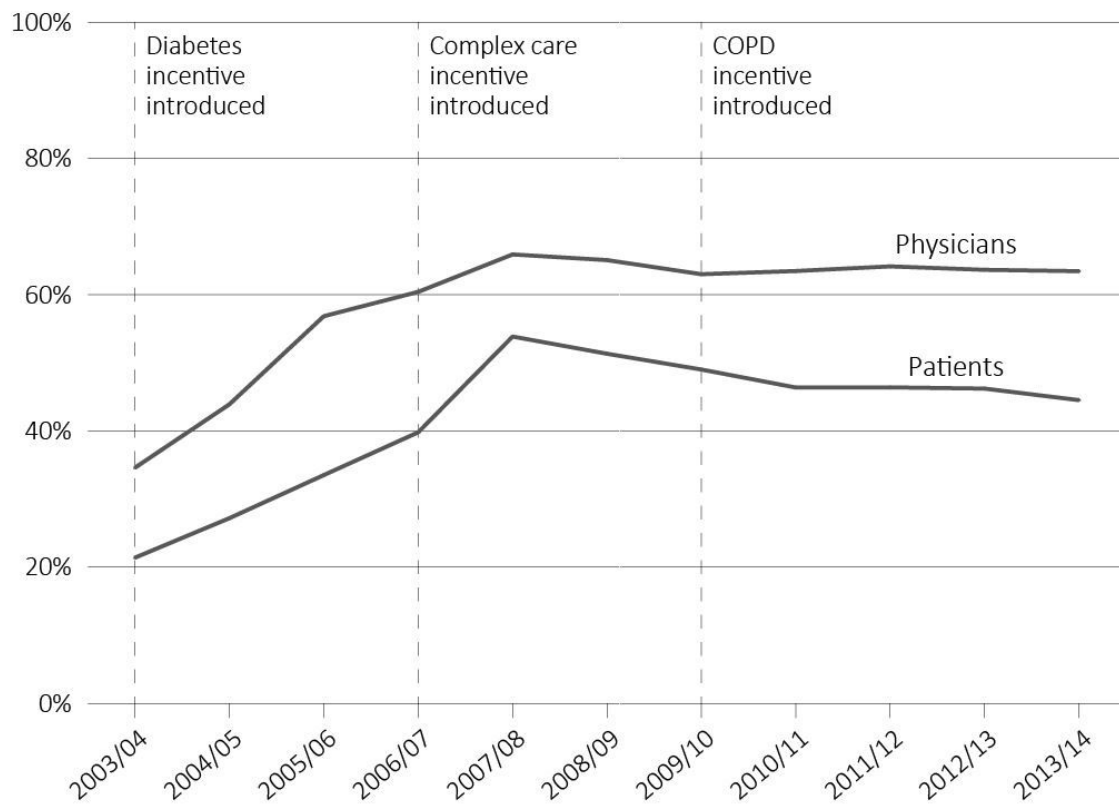
Incentive payments for chronic disease were put in place to encourage better provision of primary care in British Columbia. The intent of additional per-patient annual payments for accepting longitudinal responsibility for care of patients with one or more chronic conditions was to emphasize the value of this form of care and enable more physicians to orient to this kind of “full service” family practice. (1)

More than a decade into the availability of fee-for-service-based chronic disease and complex care incentives in British Columbia we know that only about two-thirds of primary care physician bill incentives (2), and less than half of eligible patients have incentives billed on their behalf. Despite the intent of the incentive program, Figure 1 shows that there was no appreciable increase in either the proportion of physicians engaged with the incentive program or the proportion of patients for whom they are billed after the introduction of the complex care incentives in 2006/07.

Previous analyses showed that the likelihood of billing an incentive is strongly related to data-derived characterization of physician practice style, with “walk-in” style physicians billing very few to no incentives. (3) The incentive program overall shows little effect on

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3 patient care, with small increases in some clinical process measures of care (such as
4 increased prescribing for patients with COPD) (4), but no effect on acute care
5 admissions or cost savings. (2) These observations, particularly the latter, are consistent
6 with the international literature, which overall suggests that incentives tend to be billed
7 by providers already providing higher quality patient care or in contexts where care was
8 already improving. (5–7)
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12 **FIGURE 1:** Percent of primary care physicians who bill at least one chronic care or
13 complex care incentive payment, and percent of patients who have an incentive billed
14 on their behalf, by year, 2003 to 2013
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45 We observe in previous analyses that among those who qualified for the complex care
46 incentive, patients who have incentives billed on their behalf have lower costs and
47 higher continuity of care both before and after the start of the incentive program. (2) It
48 is well understood that observational study designs are prone to selection bias.(8) We
49 tend to think of these in terms of patient-related selection factors, but in the case of
50 incentives when not all physicians participate, there clearly may be selection effects at
51 the physician level as well.
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3 Surveys show 85% of Canadians report having access to a regular medical doctor. (9)
4 Reasons for not having a physician vary, but often relate to the presence of local
5 physicians who are willing to accept new patients. This raises the possibility that not
6 having a regular medical doctor may mean not having an incentive billed on your behalf,
7 which may in turn be associated with receiving lower continuity and/or quality of care,
8 resulting in more expensive care and potentially worse outcomes. That is, while
9 incentives do not appear to alter the course of care, they may be a marker that
10 differentiates the type of primary care people are receiving.
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14 This paper investigates both physician and patient characteristics associated with
15 receipt of an incentive. We compare two distinct groups of patients who qualify for
16 incentives: 1) patients who have an incentive billed on their behalf in all study years;
17 and 2) patients who do not have an incentive billed on their behalf in any year. Our
18 hypotheses are:
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- 20 1. People without an incentive billed on their behalf see a larger number of primary
21 care physicians and have lower overall continuity of care;
- 22 2. People without an incentive billed on their behalf tend not to see physicians who
23 bill incentives for their patients; and
- 24 3. Characteristics of a patient's primary care physician are a stronger determinant
25 of incentive billing than patient characteristics.
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30 **Methods**

31 Data sources

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33 We used linked administrative data from 2010/11 to 2013/14, including: the British
34 Columbia (BC) Medical Service Plan (MSP) fee-for-service physician payment files (10); a
35 registered patients file containing demographic information (11); physician
36 demographics from the BC College of Physician Surgeons (12); and all prescriptions filled
37 in BC (13). Population Data BC provided all data for the study with unique, study-specific
38 study ID codes to ensure non-identifiability of both physicians and patients. The UBC
39 Behavioural Research Ethics board approved this study.
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45 Variable development

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47 *Primary care physicians:* Our focus was physicians who provide community-based
48 primary care. We limited analysis to primary care physicians who saw at least 100 but
49 no more than 6500 unique patients in a year (with that high number suggesting issues
50 with data). We then excluded: physicians who billed any specialty consultation fee
51 items, as this makes providers ineligible for the incentive fee items (14); physicians who
52 did not see any patients eligible for the incentives, which might happen for example in a
53 focused practice; and physicians who were not assigned as a continuity provider for any
54 patients. We assigned physicians as the regular provider to individual patients where
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3 they were the primary care provider seen most often as measured by 1) highest # of
4 visits, 2) if tied, highest dollars billed (of those tied), or 3) if still tied, most recently
5 visited (of those tied).
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8 *Physician characteristics* included age, sex, region of practice (using the five geographic
9 health authorities in BC),
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12 *Classifying other aspects of physician practice style:* Other analytic variables included
13 total billings per year, number of unique patients, and percentage of eligible patients for
14 whom an incentive is billed.
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17 *Eligible patients* were identified as those with conditions covered by the incentive
18 program. We excluded patients qualifying only for the hypertension incentive program
19 as these patients had much lower care needs on average and the value of the incentive
20 was also lower, which may mean different considerations shaped incentive billing. We
21 required at least two physician diagnoses and/or one hospital diagnosis within a two-
22 year period. (15,16) Once eligible, patients were deemed eligible over time; they did not
23 have to qualify in each two-year period. We excluded patients who died during the
24 study period and those who were not registered at least 275 days in each year of
25 analysis. We eliminated patients who had no GP visits during the study period, since
26 they would not have had an opportunity to have an incentive billed on their behalf. We
27 excluded patients who appeared (based on the data we have) to be residing in long-
28 term care at any point during the study period as they use primary care differently and
29 are not the main target of the incentive program. We excluded patients who were
30 assigned a regular provider who was not part of the final physician cohort.
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35 *Patient characteristics* include age, sex, region of residence, neighbourhood income, and
36 number of incentive-eligible chronic conditions.
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39 *Classifying other aspects of patient health care use:* Other patient variables include
40 encounters with primary care providers paid outside the fee-for-service system, total
41 number of physician visits, total number of GPs seen and continuity of care measured
42 using the Usual Provider of Care index (17), which is the percentage of visits in each year
43 with the primary care physician seen most often.
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46 Analysis:

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48 Descriptive analyses of patients and physicians compared three groups: 1) no incentives
49 in any of the four years; 2) incentives in all four years; and 3) incentives in one, two or
50 three of the study years.
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53 Multi-level logistic regression models identify the patient- and physician- level
54 characteristics associated with incentives, with the outcome of receipt of incentive in all
55 four years vs. in no years. The SAS procedure *glimmix* was used with physician-level
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random effects, a logit link function and a binary distribution. (18) Both patient-level and physician-level fixed effects were entered, and patients were nested within GPs based on the GP with whom they had the most contacts over the four years.

Results

The patient population

There were 1,073,680 patients eligible to receive incentives by the end of 2010. We excluded 494,773 individuals who were only eligible for the hypertension incentive, 96,239 individuals who died during the study period or were not registered at least 275 days per year, 6,337 patients who had either no physician visits or only non-GP visits, and 17,384 residing in long-term care. We then excluded 30,159 patients whose usual provider of care physician was excluded from the cohort of primary care physicians. Finally, we excluded 18 patients who had a non-GP who billed an incentive. This left a final cohort of 428,770.

Overall, only 33.2% of eligible patients had an incentive billed on their behalf in all four study years, and 35.6% never did (Table 1). There were more eligible males overall, and males were more likely to receive incentives than females, both for all four years (54.1% vs. 45.9%, $p < 0.001$) and for some of the study years (53.3% vs. 46.7%, $p < 0.001$). Patients aged 75+ make up 29.8% of the total eligible population, but 40.4% of the population who receive an incentive in all four years. Conversely, those under age 45 are 9.9% of the eligible population but only 2.6% of those who have an incentive in all four years (differences $p < 0.001$). Differences by geography are small, and socioeconomic status, number of different GPs seen over four years, and whether there is contact with an APB physician, and number of physicians seen are all statistically significant but likely not significant for policy or clinical practice. Patients with 20+ more physician visits per year were and with more than one incentive-eligible condition were more likely to have incentives billed on their behalf in any of the study years (both $p < 0.001$).

Table 1: Patient characteristics of those that have an incentive billed and those who do not have one billed on their behalf 2010-2013

	Overall	Did not receive incentives all 4 years	Received incentives 1-3 years	Received incentives all 4 years	Chi-Sq or anova p-value
	N (%)	N (%)	N (%)	N (%)	
N	428,770	152,686 (35.6%)	133,609 (31.2%)	142,475 (33.2%)	
Sex					
Female	204,832 (47.8%)	77,014 (50.4%)	62,402 (46.7%)	65,416 (45.9%)	<0.0001
Male	223,811 (52.2%)	75,644 (49.6%)	71,169 (53.3%)	76,998 (54.1%)	
Age Group					
0-17	6,815 (1.6%)	6,309 (4.1%)	407 (0.3%)	99 (0.1%)	<0.0001
18-44	35,635 (8.3%)	23,921 (15.7%)	8,090 (6.1%)	3,624 (2.5%)	
45-74	258,623 (60.3%)	91,170 (59.7%)	86,245 (64.6%)	81,208 (57.0%)	

75+	127,697 (29.8%)	31,286 (20.5%)	38,867 (29.1%)	57,544 (40.4%)	
Health Authority					
Interior	75,525 (17.6%)	24,566 (16.1%)	22,679 (17.0%)	28,280 (19.9%)	<0.0001
Fraser	157,241 (36.7%)	57,683 (37.8%)	49,993 (37.5%)	49,565 (34.8%)	
Vancouver Coastal	96,180 (22.5%)	38,239 (25.1%)	28,595 (21.4%)	29,346 (20.6%)	
Island	76,642 (17.9%)	24,275 (15.9%)	24,055 (18.0%)	28,312 (19.9%)	
Northern	22,709 (5.3%)	7,722 (5.1%)	8,133 (6.1%)	6,854 (4.8%)	
Income Quintile					
Lowest	94,909 (22.4%)	33,513 (22.2%)	29,975 (22.7%)	31,421 (22.3%)	<0.0001
2nd	92,858 (21.9%)	32,973 (21.8%)	28,935 (21.9%)	30,950 (21.9%)	
Middle	85,283 (20.1%)	30,213 (20.0%)	26,298 (19.9%)	28,772 (20.4%)	
4th	79,239 (18.7%)	28,158 (18.6%)	24,710 (18.7%)	26,371 (18.7%)	
Highest	71,983 (17.0%)	26,168 (17.3%)	22,136 (16.8%)	23,679 (16.8%)	
# incentive eligible conditions 1st yr					
1	248,472 (57.9%)	113,697 (74.5%)	78,964 (59.1%)	55,811 (39.2%)	<0.0001
2	139,278 (32.5%)	34,036 (22.3%)	43,197 (32.3%)	62,045 (43.5%)	
3	36,868 (8.6%)	4,651 (3.0%)	10,463 (7.8%)	21,754 (15.3%)	
4	4,152 (1.0%)	302 (0.2%)	985 (0.7%)	2,865 (2.0%)	
APB Encounter					
No	305,037 (71.1%)	108,066 (70.8%)	96,018 (71.9%)	100,953 (70.9%)	<0.0001
Yes	123,733 (28.9%)	44,620 (29.2%)	37,591 (28.1%)	41,522 (29.1%)	
# of GP visits					
1-5	10,615 (2.5%)	8,673 (5.7%)	1,854 (1.4%)	88 (0.1%)	<0.0001
6-10	18,916 (4.4%)	12,865 (8.4%)	5,309 (4.0%)	742 (0.5%)	
11-15	28,385 (6.6%)	15,547 (10.2%)	9,691 (7.3%)	3,147 (2.2%)	
16-20	37,913 (8.8%)	16,395 (10.7%)	13,467 (10.1%)	8,051 (5.7%)	
21-30	88,572 (20.7%)	30,174 (19.8%)	29,321 (21.9%)	29,077 (20.4%)	
31-40	73,411 (17.1%)	22,011 (14.4%)	22,833 (17.1%)	28,567 (20.1%)	
41-60	83,958 (19.6%)	23,967 (15.7%)	25,317 (18.9%)	34,674 (24.3%)	
61-100	58,576 (13.7%)	15,511 (10.2%)	17,522 (13.1%)	25,543 (17.9%)	
100+	28,424 (6.6%)	7,543 (4.9%)	8,295 (6.2%)	12,586 (8.8%)	
# of GPs seen					
1-2	63,259 (14.8%)	25,431 (16.7%)	18,064 (13.5%)	19,764 (13.9%)	<0.0001
3-4	96,166 (22.4%)	34,188 (22.4%)	29,117 (21.8%)	32,861 (23.1%)	
5-7	114,239 (26.6%)	39,592 (25.9%)	35,910 (26.9%)	38,737 (27.2%)	
8-10	68,529 (16.0%)	23,460 (15.4%)	22,134 (16.6%)	22,935 (16.1%)	
11+	86,577 (20.2%)	30,015 (19.7%)	28,384 (21.2%)	28,178 (19.8%)	
UPC index - COC (Mean, SD)					
	70.1 (20.9)	66.3 (22.8)	68.1 (20.8)	76.1 (17.2)	<0.0001

The physician population

There were 6,209 physicians eligible to bill incentives during the study period. We excluded five who billed specialty consults, 1,896 who either billed less than 100 or more than 6500 unique patients in a year, 224 who did not see any patients eligible for incentives and 153 physicians who were not matched as a continuity of care provider to any patients in the final cohort. This left a total cohort of 3,936 primary care physicians.

Two-thirds of physicians (66.7%) billed at least one incentive in each of the four study years, while 14.5% billed in one to three years, and 18.8% billed no incentives during the study period (Table 2). The all-year billers had higher average total payments, number of patients, and percentage of eligible patients for whom an incentive was billed. Overall, the four-year group billed incentives for an average of 30.7% of eligible patients seen, compared to 5.7% for the one to three-year group and (by definition) 0% for the non-incentive group ($p < .001$). Almost two-thirds (64%) of the provider population is male, and males were more likely to bill incentives in any year ($p < .001$).

Table 2: Physician and practice characteristics, those who do and do not bill incentives, 2010-2013

	Overall	Did not bill incentives in all 4 years	Billed incentives all 4 years	Billed incentives 1-3 years	Chi-Sq or anova p-value
	N (%)	N (%)	N (%)	N (%)	
N	3,936	740 (18.8%)	2,625 (66.7)	571 (14.5)	
Total billings (4-year average) (Mean, SD)	\$228,846.3 (\$128,283.0)	\$151,462.6 (\$123,551.6)	\$266,341.5 (\$118,601.0)	\$156,760.6 (\$98,024.4)	<0.0001
Number of patients (4-year average) (Mean, SD)	1854.4 (1056.4)	1742.9 (1279.8)	1886.8 (967.3)	1849.9 (1119.2)	0.00467
Percentage of eligible patients for whom incentives billed (4-yr) (Mean, SD)	21.3 (19.9)	0 (0)	30.7 (17.7)	5.7 (7.4)	<0.0001
Sex					
Female	1,417 (36.0%)	246 (33.2%)	908 (34.6%)	263 (46.1%)	<0.0001
Male	2,519 (64.0%)	494 (66.8%)	1,717 (65.4%)	308 (53.9%)	
Age Group					
Under 35 years old	158 (4.0%)	25 (3.4%)	84 (3.2%)	49 (8.6%)	<0.0001
35-44 years old	766 (19.5%)	155 (20.9%)	458 (17.4%)	153 (26.8%)	
45-54 years old	1,279 (32.5%)	243 (32.8%)	895 (34.1%)	141 (24.7%)	
55-64 years old	1,168 (29.7%)	192 (25.9%)	853 (32.5%)	123 (21.5%)	
65 years & over	565 (14.4%)	125 (16.9%)	335 (12.8%)	105 (18.4%)	
Health Authority					
Interior	755 (19.2%)	126 (17.0%)	507 (19.3%)	122 (21.4%)	0.00298
Fraser	1,087 (27.6%)	232 (31.4%)	713 (27.2%)	142 (25.0%)	
Vancouver Coastal	1,033 (26.3%)	199 (26.9%)	675 (25.7%)	159 (27.9%)	
Island	823 (20.9%)	156 (21.1%)	547 (20.9%)	120 (21.1%)	
Northern	212 (5.4%)	21 (2.8%)	168 (6.4%)	23 (4.0%)	

Regression results show that male patients had higher odds of having an incentive billed on their behalf (OR 1.42, CI 1.39 – 1.45) as did older patients (e.g. OR for 0-17 years of age 0.05, CI 0.04 – 0.06), those residing in less metropolitan health authorities (e.g. Northern HA OR 1.68, CI 1.37 – 2.06), individuals in lower income neighbourhoods (OR comparing lowest to highest 1.14, CI 1.10 – 1.18) and those eligible for more incentives at the start of the study period (e.g. 4 incentives OR 6.70, CI 5.70 – 7.86). The likelihood of having incentives billed increases with the number of GP visits (100+ contacts OR 204.90, CI 162.87 – 257.79) but declines with number of different GPs seen (e.g. OR for

11+ GPs compared to 1, 0.69, CI 0.65 – 0.74). Continuity of care, measured as the percentage of visits with a single physician, has a small positive association with incentives (OR 1.03, CI 1.02 – 1.03).

Physician effects tend to be smaller, with some variables showing little relationship. However, male physicians were less likely to bill incentives than females (OR 0.87, CI 0.78– 0.97). The likelihood of billing incentives decreases with physician age (e.g. OR for 55-64 years of age compared to 45-54 0.84, CI 0.75 – 0.94). Perhaps not surprisingly, patients are more likely to have an incentive billed if they see physicians who have higher participation as measured by percentage of eligible patients for whom an incentive is billed (e.g quartile 4 compared to quartile 1 OR 41.43, CI 33.81 – 50.78).

Table 3: Multi-level regression model results

	Point Estimate	Confidence Limits	
Patient-level variables			
Patient Sex			
Male vs. Female	1.42	1.39	1.45
Patient Age Group			
0-17 years vs. 75+ years	0.05	0.04	0.06
18-44 years vs. 75+ years	0.25	0.24	0.27
45-74 years vs. 75+ years	0.76	0.74	0.77
Patient Health Authority			
Interior vs. Vancouver Coastal	1.44	1.26	1.64
Fraser vs. Vancouver Coastal	1.15	1.09	1.20
Island vs. Vancouver Coastal	1.34	1.17	1.54
Northern vs. Vancouver Coastal	1.68	1.37	2.06
Patient Income Quintile			
Lowest income vs. highest income	1.14	1.10	1.18
Second income vs. highest income	1.12	1.08	1.16
Middle income vs. highest income	1.11	1.07	1.15
Fourth income vs. highest income	1.05	1.02	1.09
Number of Eligible Incentives (Start of Study Period)			
1 vs. 2	0.31	0.31	0.32
3 vs. 2	2.70	2.58	2.83
4 vs. 2	6.70	5.70	7.86
Non-Fee-for-Service Encounter			
Yes vs No	0.87	0.85	0.90
Number of GP Contacts			
6-10 vs 1-5	7.04	5.56	8.92
11-15 vs 1-5	24.89	19.83	31.23
16-20 vs 1-5	59.13	47.20	74.06
21-30 vs 1-5	114.60	91.58	143.40
31-40 vs 1-5	154.31	123.21	193.24
41-60 vs 1-5	173.38	138.38	217.25
61-100 vs 1-5	196.42	156.54	246.45
100+ vs 1-5	204.90	162.87	257.79

Number of GPs			
3-4 vs. 1-2	0.89	0.86	0.92
5-7 vs. 1-2	0.74	0.71	0.78
8-10 vs. 1-2	0.68	0.65	0.72
11+ vs. 1-2	0.69	0.65	0.74
Continuity (UPC)	1.03	1.02	1.03
Physician-level variables			
Practitioner Sex			
Male vs. Female	0.87	0.78	0.97
Practitioner Age Group			
<35 years vs. 45-54 years	1.41	1.09	1.83
35-44 years vs. 45-54 years	1.32	1.15	1.52
55-64 years vs. 45-54 years	0.84	0.75	0.94
65+ years vs. 45-54 years	0.70	0.60	0.81
Practitioner Health Authority			
Interior vs. Vancouver Coastal	1.00	0.83	1.21
Fraser vs. Vancouver Coastal	1.10	0.97	1.25
Island vs. Vancouver Coastal	1.13	0.94	1.36
Northern vs. Vancouver Coastal	1.33	1.00	1.77
Total billings	1.03	1.03	1.03
Number of patients	1.00	1.00	1.00
Percentage of eligible patients for whom incentives billed			
Q2 vs Q1	3.13	2.59	3.78
Q3 vs Q1	14.09	11.64	17.05
Q4 vs Q1	41.43	33.81	50.78

Interpretation

Only one-third of eligible patients have an incentive billed on their behalf in all four years of the study period and 35.6% never do. One-third of physicians either infrequently or never bill incentives during this time period.

Only one of our three hypotheses was supported by these analyses. It is the case that seeing a larger number of different primary care providers is associated with lower likelihood of having an incentive billed, while there is a positive association between incentives and continuity of care. People without an incentive billed on their behalf, however, do see physicians who bill incentives, so the absence of an incentive is not a matter of a mismatch between providers and patients. Perhaps more importantly, it is characteristics of patients and not physicians that are more strongly associated with billing of incentives, most prominently age, number of eligible conditions, and number of GP contacts.

The association between a larger number of different GPs seen and lower likelihood of an incentive may reflect that where care is dispersed, no primary care provider feels ownership of or responsibility for an ongoing relationship with a patient. The very strong association with number of visits, however, suggests it may be that physicians are

prompted to bill the incentives by the fact that the patient is in front of them – suggesting care that is perhaps more reactive than proactive. The fact that physicians are variable in the proportion of eligible patients for whom they bill an incentive suggests, as well, that physicians pay different levels of attention to billing incentives.

Anecdotal reports from physicians indicate that not all take a “population health management” approach to their practices. Physicians may bill incentives for the patients who they know about and who come into their office, but without a systematic approach to managing their entire patient panel and identifying all patients with chronic conditions in their practice overall. Further research should test this hypothesis, as there is evidence that population health management produces higher quality care. (19,20)

Limitations

This study used only administrative data, without information on patient or physician perspectives on who their usual provider or patients are. We are unable to differentiate patient choice from system factors, e.g. whether patients see a large number of GPs because that is their preference or because they cannot find a regular provider of care. We were not able to measure complexity of condition other than through counting the number of co-morbidities.

Conclusion

The strongest predictors of having an incentive billed on a patient’s behalf are the number of GP contacts a patient has and whether their primary care physician has a large number of eligible patients in their practice for whom incentives are billed. These findings are consistent with the notion that physicians are identifying and billing for eligible patients based on who they see most often. Further research should identify the extent to which population health management is in current practice in Canada. The lack of billing of incentives may be a symptom of broader issues in primary care. It should be a priority to find out if that is the case.

References

1. General Practice Services Committee. Longitudinal Care Incentive Program [Internet]. 2015 [cited 2017 Dec 11]. Available from: <http://www.gpsc.bc.ca/what-we-do/longitudinal-care/incentive-program>
2. Lavergne MR, Law MR, Peterson S, Garrison S, Hurley J, Cheng L, et al. A population-based analysis of incentive payments to primary care physicians for the care of patients with complex disease. *Canadian Medical Association Journal* [Internet]. 2016;188(15):E375–83. Available from: <http://www.cmaj.ca/cgi/doi/10.1503/cmaj.160692>
3. Mcgrail K, Lavergne R, Lewis SJ, Peterson SLM, Barer M. Classifying Physician Practice Style A New Approach Using Administrative Data in British Columbia. 2015;53(3):276–82.
4. Lavergne MR, Law MR, Peterson S, Garrison S, Hurley J, Cheng L, et al. Effect of incentive payments on chronic disease management and health services use in

- 1
2
3 British Columbia, Canada: Interrupted time series analysis. Health policy
4 (Amsterdam, Netherlands) [Internet]. Elsevier; 2018 Feb 1 [cited 2018 Apr
5 26];122(2):157–64. Available from:
6 <http://www.ncbi.nlm.nih.gov/pubmed/29153847>
7
- 8 5. Kiran T, Victor JC, Kopp A, Shah BR, Glazier RH. The relationship between financial
9 incentives and quality of diabetes care in Ontario, Canada. Diabetes care
10 [Internet]. American Diabetes Association; 2012 May 1 [cited 2017 Dec
11 11];35(5):1038–46. Available from:
12 <http://www.ncbi.nlm.nih.gov/pubmed/22456866>
13
- 14 6. Serumaga B, Ross-Degnan D, Avery AJ, Elliott RA, Majumdar SR, Zhang F, et al.
15 Effect of pay for performance on the management and outcomes of hypertension
16 in the United Kingdom: interrupted time series study. BMJ (Clinical research ed)
17 [Internet]. British Medical Journal Publishing Group; 2011 Jan 25 [cited 2017 Dec
18 11];342:d108. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/21266440>
19
- 20 7. Campbell S, Reeves D, Kontopantelis E, Middleton E, Sibbald B, Roland M. Quality
21 of Primary Care in England with the Introduction of Pay for Performance. New
22 England Journal of Medicine [Internet]. Massachusetts Medical Society ; 2007 Jul
23 12 [cited 2017 Dec 11];357(2):181–90. Available from:
24 <http://www.nejm.org/doi/abs/10.1056/NEJMSr065990>
25
- 26 8. Shadish WR (William RS, Cook TD, Campbell DT. Experimental and Quasi-
27 Experimental Designs for Generalized Causal Inference [Internet]. Wadsworth
28 Publishing; 2001 [cited 2011 Apr 15]. 656 p. Available from:
29 [http://www.amazon.com/Experimental-Quasi-Experimental-Designs-Generalized-
30 Inference/dp/0395615569](http://www.amazon.com/Experimental-Quasi-Experimental-Designs-Generalized-Inference/dp/0395615569)
31
- 32 9. Statistics Canada. Access to a regular medical doctor, 2014 [Internet]. 2015.
33 Available from: [https://www.statcan.gc.ca/pub/82-625-x/2015001/article/14177-
34 eng.htm](https://www.statcan.gc.ca/pub/82-625-x/2015001/article/14177-eng.htm)
35
- 36 10. British Columbia Ministry of Health. Medical services plan (MSP) payment
37 information file. Victoria: Population Data BC; 2011.
38
- 39 11. British Columbia Ministry of Health. Consolidation file (MSP registration &
40 premium billing). Victoria: Population Data BC; 2011.
41
- 42 12. College of Physicians and Surgeons of British Columbia. Medical Services Plan
43 physician database. Victoria: Population Data BC; 2011.
44
- 45 13. British Columbia Ministry of Health. Data Stewardship Committee PharmaNet.
46 Data extract. Victoria: British Columbia Ministry of Health; 2011.
47
- 48 14. British Columbia Ministry of Health. Medical Services Commission Payment
49 Schedule [Internet]. 2016 [cited 2017 Dec 11]. Available from:
50 [https://www2.gov.bc.ca/assets/gov/health/practitioner-pro/medical-services-
51 plan/msc-payment-schedule-december-2016.pdf](https://www2.gov.bc.ca/assets/gov/health/practitioner-pro/medical-services-plan/msc-payment-schedule-december-2016.pdf)
52
- 53 15. Lix L, Yogendran M, Burchill C, Metge C, Mckeen N, Moore D, et al. Defining and
54 Validating Chronic Diseases: An Administrative Data Approach. 2006 [cited 2018
55 Feb 7]; Available from: [http://mchp-
56 appserv.cpe.umanitoba.ca/reference/chronic.disease.pdf](http://mchp-appserv.cpe.umanitoba.ca/reference/chronic.disease.pdf)
57
- 58 16. Chronic Disease Information Working Group. BC Chronic Disease and Selected
59
60

- 1
2
3 Procedure Case Definitions [Internet]. Victoria, BC; 2015 [cited 2018 Feb 7].
4 Available from: [https://www2.gov.bc.ca/assets/gov/health/conducting-health-](https://www2.gov.bc.ca/assets/gov/health/conducting-health-research/data-access/chronic-disease-registries-case-definitions.pdf)
5 [research/data-access/chronic-disease-registries-case-definitions.pdf](https://www2.gov.bc.ca/assets/gov/health/conducting-health-research/data-access/chronic-disease-registries-case-definitions.pdf)
6
7 17. Breslau N, Reeb KG. Continuity of care in a university-based practice. *Journal of*
8 *medical education* [Internet]. 1975 Oct [cited 2018 Apr 30];50(10):965–9.
9 Available from: <http://www.ncbi.nlm.nih.gov/pubmed/1159765>
10
11 18. [SAS/STAT] software, Version [9.4] of the SAS System for [Windows]. Copyright ©
12 [2013] SAS Institute Inc. Cary, NC, USA.
13
14 19. Schmittiel JA, Gopalan A, Lin MW, Banerjee S, Chau C V, Adams AS. Population
15 Health Management for Diabetes: Health Care System-Level Approaches for
16 Improving Quality and Addressing Disparities. *Current diabetes reports* [Internet].
17 NIH Public Access; 2017 [cited 2018 Nov 21];17(5):31. Available from:
18 <http://www.ncbi.nlm.nih.gov/pubmed/28364355>
19
20 20. Bodenheimer T, Ghorob A, Willard-Grace R, Grumbach K. The 10 building blocks
21 of high-performing primary care. *Annals of family medicine* [Internet]. American
22 Academy of Family Physicians; 2014 Mar 1 [cited 2018 Nov 27];12(2):166–71.
23 Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24615313>
24
25 21. Langton JM, Wong ST, Johnston S, Abelson J, Ammi M, Burge F, et al. Primary care
26 performance measurement and reporting at a regional level: could a matrix
27 approach provide actionable information for policy makers and clinicians?
28 *Healthcare Policy*. 12(2):33–51.
29
30 22. Porter ME, Pabo E a, Lee TH. Redesigning primary care: a strategic vision to
31 improve value by organizing around patients’ needs. *Health affairs (Project Hope)*
32 [Internet]. 2013 Mar [cited 2014 Jul 28];32(3):516–25. Available from:
33 <http://www.ncbi.nlm.nih.gov/pubmed/23459730>
34
35 23. Epping-Jordan JE, Pruitt SD, Bengoa R. Improving the quality of health care for
36 chronic conditions. *Qual Saf Health Care* [Internet]. 2004 [cited 2018 Nov
37 21];13:299–305. Available from: www.qshc.com
38
39
40
41
42
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STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	3 3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5-7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up (b) For matched studies, give matching criteria and number of exposed and unexposed	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-6
Bias	9	Describe any efforts to address potential sources of bias	5-6
Study size	10	Explain how the study size was arrived at	5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) If applicable, explain how loss to follow-up was addressed (e) Describe any sensitivity analyses	6-7 n/a n/a n/a n/a
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	7-9 7-9 n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) Summarise follow-up time (eg, average and total amount)	7-9 n/a n/a
Outcome data	15*	Report numbers of outcome events or summary measures over time	10-11

1	Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10-11
2			(b) Report category boundaries when continuous variables were categorized	10-11
3			(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
4				
5	Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
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11	Discussion			
12	Key results	18	Summarise key results with reference to study objectives	11-12
13	Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12
14				
15	Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-12
16				
17	Generalisability	21	Discuss the generalisability (external validity) of the study results	11-12
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21	Other information			
22	Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2
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*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.