

Effect of Physician Alternative Payment Plans on the Validity of Administrative Health Data

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Word Count: 2,730, Tables: 4

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ABSTRACT

BACKGROUND: In Canada, fee-for-service (FFS) physicians submit billing claims to be remunerated. Physicians on alternative payment plans (APP) are remunerated regardless of whether claims are submitted. There are concerns nationally APPs may be associated with erosion of data quality. We validated claims submitted by APP and FFS physicians in Calgary, Canada.

METHODS: A survey of physician specialists was conducted to determine APP and FFS status and obtain consent to use physicians' claims data from four acute care hospitals.

Inpatient and emergency department (ED) services were identified from provincial hospital discharge abstract and ambulatory care classification system administrative databases.

Services were linked to Alberta physician claims from 2002 to 2009 using unique patient and physician identifiers. After identifying proportion of claims submitted, inpatient chart review determined completeness of submissions defined by positive predictive value.

RESULTS: Of 182 physicians selected, 51.6% were exclusively FFS physicians, 28.0% were exclusively APP physicians. Overall completeness of physician claims submissions was 91.8% for FFS physicians and 90.0% for APP physicians. Submission rate varied by medical specialty (surgery: 92.4% for FFS vs. 88.6% for APP; internal medicine: 94.1% vs. 91.3%; neurology: 95.1% vs. 91.0%; and paediatrics: 95.1% vs. 89.3%). Among claims submitted, the accuracy of medical conditions by FFS physicians was 87.8% and by APP physicians was 85.0%.

INTERPRETATION: Contrary to popular beliefs, overall submission rate and accuracy of recording diagnosis for APP and FFS physicians is high. High quality and completeness of physician claims may be related to reporting requirements and incentives associated with shadow billing.

INTRODUCTION

Canada, because of universal healthcare and the collection of the physician claims database, has one of the richest coded health care data sources in the world [1]. In the traditional fee-for-service (FFS) payment model, physicians must submit claims for every medical service they provide to receive remuneration [2, 3]. The physician billing claims database contains unique patient identifiers, unique physician identifiers, and clinical information, such as a patient's diagnosis at the time of a visit [4]. Health administrators, decision makers and researchers use these data extensively to examine the trajectory of patient care volume, forecast health care budgets, and for disease surveillance and related health services research [5-8]. With this widespread use of physician claims data, the quality, accuracy and completeness of these data are of the utmost importance. The validity of physician claims data is being questioned with the introduction of alternative payment plans (APP) for physicians across Canada.

Because FFS physicians must submit a claim to be paid, it has been assumed that this payment system provides relatively complete and accurate estimates of medical service provision. However, the overwhelming reliance on the FFS payment mechanism is an often cited source of inefficiency in the Canadian health system and works poorly for chronic disease management [9]. The FFS payment mechanism creates financial incentives for physicians to encourage overconsumption of care, since physicians are rewarded for a high volume of services. In other words, physicians get paid more when their patients consume more care [9].

As of 2009, over 20% of Canada's 55,000 physicians receive some payments for clinical care from an APP [10]. APP physicians are paid a fixed amount of money, rather than being paid for each medical service they provide. APP mechanisms for physicians, such as

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3 salary or capitation payment, promise greater control over the levels of physician
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5 compensation expenditures and more efficient use of health care facilities [11-13].
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7 Unfortunately, APPs do not typically provide financial incentives for physicians to submit
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9 claims for all their services (i.e. they are not compensated for their time spent submitting
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11 claims, referred to as “shadow-billing”) raising concern about potential data erosion due to
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13 non-submission of shadow billings. This gap within payment models may create potential
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15 inequities in the quality of claims and result in data erosion. The impact of incomplete and
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17 inaccurate billing submissions is a concomitant decrease in ability to effectively track health
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19 service volume and utilization, for instance, the burden of chronic diseases. Worse still, this
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21 creates doubt in the usefulness and overall validity of administrative databases.
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25 The objectives of our study was to determine the proportion of claims submitted by
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27 APP and FFS physicians and to identify and compare the validity of information coded in
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29 physician billing claims submitted by APP and FFS physicians in Calgary, Alberta. The
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31 occurrence and extent of data erosion has important implications for use of these data,
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33 including the need to statistically adjust for losses in estimates of disease burden and budget
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35 projections. Finally, given the widespread use of physician claims data for research purposes,
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37 confidence in the quality of these data is critical for the future of their use in health services
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39 and population health research.
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45 **METHODS**

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47 We recruited APP and FFS physicians from a broad range of specialties (see below)
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49 practicing at four adult and pediatric acute care hospitals in Calgary, Canada between January
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51 1, 2002 and December 31, 2009. Calgary is a city with a population of approximately 1.1
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53 million [14]. We extracted claims submitted by each consenting physician to determine
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55 submission rates and validated the claims diagnoses through clinical chart review.
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Physicians Survey

To generate a baseline sample, an online survey of Calgary physicians was conducted to determine physician APP, FFS and blended status and obtain consent to use their claims data. Blended physicians may have both FFS and APP remuneration components to their contracts. The survey sample frame was generated using the list of physicians from the Alberta College of Physicians and Surgeons directory, the 2008 Canadian Medical Directory and hospital and university clinical department directories. Contact information was verified through the latest Calgary telephone directory, the Yellow Pages™, and physician contact directories posted on websites of Alberta Health Services, hospitals and the University of Calgary. The following physician specialties were targeted: intensive care unit (ICU), internal medicine, neurology and neurosurgery, pediatrics, psychiatry and general surgery. We restricted our sample to these specialties as they were established APP and FFS programs and these specialty groups had a large number of registered physicians in Calgary, Canada. We included physicians who were practicing in 2009 and providing inpatient services at one or more of the four acute care hospitals in the city. We excluded general practitioners as the majority were remunerated by FFS and medical trainees (i.e. medical students, residents, and fellows), as they do not generally submit billings.

We emailed the survey package to the selected physicians, including an invitation letter, a consent form and a brief self-administered questionnaire that contained information regarding physicians' billing status (FFS versus APP), whether they are obligated to shadow bill as part of their APP contract (if applicable), whether incentives are provided to them to shadow bill (if applicable) and demographic information. An example of a type of incentive provided to APP physicians was "Are there any personal income increases tied to shadow

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3 billing?” Respondents had the choice to complete the survey online, by email or via paper
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5 method. Three reminders were sent through email. The time interval between each of the
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7 three reminders was three weeks.
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10 11 **Determining Completeness of Submissions through Linking Claims with Inpatient and** 12 13 **Emergency Department Services** 14

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16 The hospital discharge abstract database (DAD) and the ambulatory care classification
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18 system (ACCS) administrative data were linked with the physician survey using physician
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20 unique identifier (i.e. PRAC ID). We extracted all services provided by these physicians as
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22 the most responsible physicians from January 1, 2002 to Dec 31, 2009. The linked records
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24 formed the denominator (i.e. ‘standard reference’; number of services provided by
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26 physicians).
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30 After the physicians’ unique PRAC ID was verified within the Alberta physician
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32 claims database, the extracted DAD and ACCS services were then linked to Alberta
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34 physician claims from January 1, 2002 to May 31, 2010 using unique patient numbers (i.e.
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36 Personal Health Number), service location, service date and PRAC ID to identify the
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38 numerator (i.e. number of services claimed by physicians).
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43 **Validating Claims through Chart Review** 44

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46 To assess the validity of submitted claims, we randomly extracted claims submitted by
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48 the consenting physicians during January 1, 2002 to December 31, 2009 using their unique
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50 PRAC ID. A total of 55 physicians were randomly chosen (24 FFS, 31 APP) for this chart
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52 review. A random number was assigned to each claim within the dataset. The claims records
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54 were then sorted by this random number in ascending order. We selected the first 10-19 sorted
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56 claims records from each stratum, resulting in a total of 1115 claims records.
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3 Corresponding inpatient charts for the sampled claims were located using a
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5 combination of the hospital ID, patient chart number, personal health number, admission date
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7 and physician PRAC ID. Two chart reviewers underwent training in the data extraction
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9 process. In the training session, the definition of study variables was discussed and 20 charts
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11 were reviewed by both reviewers together to identify any issues with interpretation of coding
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13 or medical terminology. A sample of 30 charts was then reviewed independently by both
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15 reviewers for consensus agreement. Reviewers agreed upon 29 of the 30 charts on diagnoses
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17 (97% agreement).
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21 Finally, the reviewers extracted data independently for evidence of the diagnoses
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23 submitted in physician claims through an examination of the entire chart up to the date of the
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25 claim (i.e. medical service date). Administrative data is typically coded using the World
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27 Health Organization's (WHO) International Classification of Disease (ICD). In physician
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29 claims, diagnoses during the study period were coded using the International Classification of
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31 Disease, 9th version (ICD-9), Alberta modification. The physician claims database contains up
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33 to 3 diagnoses. However, about 95% claims records contain only one diagnosis. Thus we
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35 verified the diagnosis coded in the first coding field. Reviewers recorded the diagnosis and
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37 extracted additional medical notes from the chart and then determined whether there was a
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39 match in the chart review and the ICD-9 diagnosis in the physician claims data.
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44 **Statistical Analysis**

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46 The unit of analysis is the "physician service" provided by physicians who
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48 participated in the survey and consented to data linkage. Descriptive statistics were used to
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50 report physician characteristics, submission rate (proportion) and validity of the claims
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52 diagnosis by payment status, type of service, and medical specialty. Chi-square tests were
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54 used to assess differences between three payment plans.
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3 To calculate the claims submission rate, the percentage of number of services claimed
4 by physicians was divided by that of services provided by physicians. Positive predictive
5 value (PPV) for ICD-9 diagnosis submitted by physicians was calculated accepting the chart
6 review data as a 'reference standard'. PPV determines the extent to which a diagnosis present
7 in the ICD-9 claims data was also present in the chart review data. The PPV was used to
8 assess the overall validity of the chart review data compared to the ICD-9 claims data. Ethics
9 approval for this study was granted by the Conjoint Health Research Ethics Board at the
10 University of Calgary.
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21 22 23 **RESULTS**

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25 Of 904 physicians surveyed, 317 consented to have their medical services linked to
26 their claims data (35% response rate). Out of the 317 physicians who consented, 182 unique
27 physicians PRAC ID's were linked with DAD and ACCS. Of the 182 physicians whose data
28 were linked, 51 were APP physicians, 94 were FFS physicians and 37 were on a blended
29 model.
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36 Of the FFS physicians, 77.9% were male; 57.4% were age 40-59 and 44.1% practiced
37 ≥ 15 years (see Table 1). Of the APP physicians, 61.4% were male; 40.9% had practiced for
38 5-14 years and 67.1% specialized in internal medicine.
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43 We analysed 149,380 services provided by 182 physicians (see Table 2). The overall
44 submission claims rate was 90.0% for APP physicians, 95.6% for blended and 91.8% for FFS
45 physicians. For FFS physicians, psychiatry (97.0%) had the highest submission rate followed
46 by neurology/neurosurgery (95.1%), paediatrics (95.1%), internal medicine (94.1%), and
47 surgery (92.4%). For APP physicians, the submission rate varied by speciality from a high of
48 91.3% for internal medicine and a low of 88.6% for surgery. For APP physicians, the
49 proportion of submitted claims was significantly higher when an incentive was provided
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(93.6% vs. 89.4%). Submission rate was associated with length of practice (for FFS physicians, <5 years: 95.9%, 5-14 years: 89.7%, >=15 years: 91.6% and for APP physicians; <5 years: 92.4%, 5-14 years: 86.5%, >=15 years: 90.9%).

We analysed the differences in submissions among physicians whose payment program was changed from FFS to APP during the study period. The proportion of submitted claims decreased significantly from 95.6% for pre-APP to 90.1% for post-APP (see Table 3).

Of the 1115 charts requested for review, 849 were included, 447 (52.6%) for FFS physicians and 402 (47.3%) for APP physicians. Charts were not included if they had missing data, did not have a corresponding ICD-9 codes to match, were duplicates or were not available when requested from health records. FFS physicians had a slightly higher PPV (87.0%) compared to APP physicians (85.8%). For FFS records, psychiatry had the highest PPV (100%), followed by surgery (91.0%), paediatrics (82.4%) and internal medicine (76.5%). For APP records, neurology had the highest PPV (93.3%), followed by surgery (92.0%), paediatrics (91.0%) and internal medicine (81.0%).

DISCUSSION

We analysed physician claims submitted by Alberta specialists for inpatient and emergency department services and found that Alberta APP physicians, similar to FFS physicians, submit a high proportion of medical service claims, and that the accuracy of diagnostic coding of these claims is also high. There is a slight decrease in the overall rate of submission after APP implementation but this was lower than 10% non-submissions for APP physicians, and a much smaller proportion than expected. The potential for data loss with the implementation of APPs seems to be minimal and does not appear to have affected the overall completeness and accuracy of claims being submitted in Alberta. As such, our study provides compelling evidence for the ongoing use of physician claims for disease

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3 surveillance, to determine allocation of health care funds, to track service volume and to
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5 assess and monitor patient outcomes.
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7 We found that overall submission rates across payment programs were high, and that
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9 the difference between FFS and APP physicians was only about 2% (APP: 90% vs FFS:
10 91.8%). When restricting our sample to APP physicians only and looking at pre and post APP
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12 submission rates, there was a slight but statistically significant decrease in completeness (Pre-
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14 APP: 95.6% vs Post-APP: 90.1%).
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17 We assumed that submission rates would be close to 100% for FFS physicians, but it
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19 was not. Potential explanations that could account for missing billing submissions include
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21 physicians or administrative staff forgetting to submit a claim, rejected claims, and inaccurate
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23 data inaccurate linkage. Additionally, since the majority of Albertans (i.e. 80%) [15] visit
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25 family doctors or general practitioners (GP) who are on FFS plans as opposed to physician
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27 specialists on APPs, the impact of non-submission of claims from APP physician specialists
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29 may have little impact on chronic disease surveillance (i.e. missing diagnosis from APP
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31 specialists could be captured by GP claims.).
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36 Alberta is one of several Canadian provinces that require APP physicians to submit
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38 shadow bills to account for the services they provide. In addition, many provincial APP
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40 programs based at teaching hospitals utilize incentive-based programs to motivate physicians
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42 to submit billings. Our results suggest that such incentives may be effective. For example in
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44 some divisions or departments APP physicians who do not submit the recommended quota of
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46 shadow billings based on their expected patient workload annually face a potential
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48 withholding (e.g. 15%) of their yearly earnings [16]. This is also determined by internally
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50 reviewing physicians' shadow billing submissions for the year compared to other physicians
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52 within their specialty with a similar expected workload [17]. Similarly, in Nova Scotia, to
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54 ensure complete and accurate submission of shadow billing information, the value of shadow
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3 billing data is periodically compared to total payments under the physician's APP contract
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5 [17]. Unfortunately, departmental or provincial incentives are an area that has received
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7 relatively little evaluation to date [18].
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10 Shadow billing monitoring has the potential to improve the quality and completeness
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12 of claims submitted by physicians. Canadian provincial governments and health agencies are
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14 beginning to realize the possible risk of data erosion with the switch to APPs and are
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16 implementing policies to adjust for the possible under-submissions of shadow bills. Our
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18 findings imply that such policies appear to be effective at improving claims submission rates
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20 since APP physicians who were aware of departmental incentives had a higher rate of claims
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22 submissions (93.6%) compared to APP physicians who were unaware of departmental
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24 incentives (89.4%). Further, our study supports the development of provincial and national
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26 shadow billing incentive programs to preserve the overall quality of physician claims data.
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30 Our study has several limitations. First, we only surveyed physician specialists and
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32 did not survey GPs as the majority of GPs in Alberta are on FFS programs. Therefore, our
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34 findings may not be generalizable to other Canadian provinces with APP programs for GPs.
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36 Second, we focused on inpatient and emergency room claims records and did not analyze
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38 outpatient records. Private or outpatient clinic physicians may display different billing
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40 behaviors. Third, we only calculated PPV and did not report all validation statistics, including
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42 sensitivity, specificity and negative predictive value. Fourth, we surveyed urban area
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44 physicians, not rural based physicians. However, only a small proportion of specialists are
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46 practicing in rural areas. Finally, the results may not be applicable to countries with different
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48 health care systems or different payment models.
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51 52 53 **CONCLUSIONS** 54 55 56 57 58 59 60

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The findings from this study offer valuable insight into one of the largest and richest sources of Canadian administrative health data. Our analyses show the overall claims submission rates for both APP and FFS physicians are high, as is the validity of diagnostic coding. These findings suggest that contrary to popular beliefs, physician payment programs may not have as much of an impact on the quantity or quality of claims data. Incentive programs should be considered nationally in order to preserve the overall quality of physician claims data and there should be continuing vigilance with respect to completeness and accuracy of physician data, regardless of the payment system.

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ACKNOWLEDGMENTS

H. Quan, & N. Jetté, and are supported by Alberta Innovates Health Solutions (AIHS) Population Health Investigators Salary Awards. N. Jetté is a Canada Research Chair Tier 2 holder. N. Jette also holds a Canada Research Chair Tier 2 in Neurological Health Services Research. CT Cunningham is funded by a CIHR doctoral research scholarship (2013-2016).

COMPETING INTERESTS

None of the authors have any conflict of interest to declare.

AUTHORS CONTRIBUTIONS

This paper is not under consideration elsewhere and none of the paper's contents have been previously published. All authors have read and approved the manuscript. Authors, CTC, PC, DT, LWS, NJ and HQ contributed substantially to conception and design. Authors, PC and HQ completed acquisition of data and analysis and all authors contributed to the interpretation of data. All authors (CTC, PC, DT, LWS, NJ and HQ) drafted the article or revised it critically for important intellectual content and have given final approval of this version to be published.

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Table 1 Characteristics of physicians by payment program (N=182)

	*FFS (% of 94)	*Blended (% of 37)	*APP (% of 51)	P-value
Proportion of physicians	51.6	20.3	28.0	
Physician specialty				
Surgery	38.2	26.9	11.3	
Internal medicine	22.1	23.1	67.1	
Neurology/Neurosurgery	-	3.9	2.2	
Paediatrics	7.4	19.2	18.2	
Psychiatry	20.6	15.4	-	-
Others	11.8	11.5	1.1	<0.001
Are you obligated or recommended to shadow bill?				
Yes obligated	-	61.5	94.3	
Yes, it is recommended	-	3.8	3.9	
No/Unsure	-	34.6	2.0	<0.001
If your program or department has an APP, does it use any type of incentives to promote the use of shadow billing?				
Yes	-	8.1	13.7	
No	-	72.9	76.5	
Unsure	-	18.9	9.8	<0.001
Age				
30-39 years	30.8	26.9	28.4	
40-59 years	57.4	73.8	60.2	
≥59 years	11.7	0.0	11.3	<0.001
Sex				
Male	77.9	76.9	61.4	
Female	22.1	23.1	38.6	<0.001

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Length of time in practice				
<5 year	14.7	19.2	20.5	
5-14 years	41.2	34.6	40.9	
≥15 years	44.1	46.2	38.6	<0.001

*Note: Alternative Payment Program (APP), Fee-For-Service Payment Program (FFS), Blended (FFS and APP)

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Table 2 Physician submission claims rate (% of total claims) by payment program

	*FFS N(%)	*Blended N(%)	*APP N(%)	P-value
Overall claims	99208 (91.8)	22094 (95.6)	28078 (90.0)	<0.001
Physician Specialty				
Surgery	36797 (92.4)	3894 (93.2)	4686 (88.6)	<0.001
Internal medicine	10213 (94.1)	4440 (95.0)	11174 (91.3)	<0.001
Neurology/Neurosurgery	142 (95.1)	169 (98.2)	215 (90.7)	0.006
Paediatrics	31639 (95.1)	13530 (96.7)	11929 (89.3)	<0.001
Psychiatry	3357 (97.0)	22 (36.4)	-	-
Others	17060 (82.1)	39 (61.5)	74 (77.0)	0.002
Are you obligated or recommended to shadow bill?				
Yes	-	7963 (95.1)	27373 (90.0)	<0.001
No	-	14131(94.7)	705 (96.4)	<0.001
If your program or department has an APP, does it use any type of incentives to promote the use of shadow billing?				
Yes	-	2828 (96.0)	3407 (93.6)	<0.001
No	-	19266 (95.5)	24671 (89.4)	<0.001
Physician Age				
<40	33906 (95.3)	14079 (96.6)	6829 (90.1)	<0.001
40-59	62770 (89.9)	7535 (93.7)	20847 (90.0)	<0.001
≥60	2532 (92.1)	480 (95.8)	402 (83.3)	<0.001
Sex				
Male	70109 (91.7)	17855 (95.6)	21269 (88.8)	<0.001
Female	29099 (92.0)	4239 (95.5)	6809 (93.4)	<0.001
Length of time in practice				
<5 year	21211 (95.9)	834 (96.0)	5773 (92.4)	<0.001
5-14	36668 (89.7)	16010 (96.0)	8178 (86.5)	<0.001
≥15	41329 (91.6)	5250 (94.3)	14127 (90.9)	<0.001

*Note: Alternative Payment Program (APP), Fee-For-Service Payment Program (FFS), Blended (FFS and APP)

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Table 3 Submission claims rate among services provided by physicians whose payment program changed from FFS to APP

	*Pre-APP N (%)	*Post-APP N (%)	P-value
Overall claims	20093 (95.6)	13040 (90.1)	<0.001
Physician specialty			
Surgery	3313 (95.0)	1243 (93.9)	0.1096
Internal medicine	3997 (94.2)	5400 (90.0)	<0.001
Neurology/Neurosurgery	166 (96.0)	24 (96.0)	0.9912
Paediatrics	12617 (96.3)	6373 (89.4)	<0.001

*Note: Alternative Payment Program (APP), Fee-For-Service Payment Program (FFS)

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Physician Alternative Payment Plans

Table 4 Validity of physician claims in recording diagnosis (positive predictive value)

Number of claims	*Claims by FFS 447 (%)	*Claims by APP 402 (%)	P-value
Overall	389 (87.0)	345 (85.8)	<0.001
Physician specialty			
Surgery	240 (91.0)	11 (92.0)	<0.001
Internal medicine	91 (76.5)	176 (81.0)	<0.001
Neurology/Neurosurgery	--	82 (93.2)	--
Paediatrics	28 (82.4)	76 (91.0)	<0.001
Psychiatry	30 (100)	--	--

*Note: Alternative Payment Program (APP), Fee-For-Service Payment Program (FFS), (N=182 unique physician)

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