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Physician Payment: Data Integrity and Policies for Improvement

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Physician Payment: Data Integrity and Policies for Improvement

by

Ceara Tess Cunningham

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Abstract

Physician compensation is a key component of any health system. In Canada, various reimbursement models which exist for physicians include fee-for-service (FFS), capitation and salaries [1, 2]. There are concerns nationally that the implementation of alternative payment plans (APP) may be affecting certain processes, such as changes in billing claims submissions (i.e. decreases), potentially leading to incomplete billing data and underestimates of disease burdens and outcomes [3, 4]. Thus, four studies were conducted to examine billing patterns between traditional FFS and APP specialists and to assess existing APP policies aimed at governing issues related to physician billing.

In the first study, a survey was conducted to gain consent to access medical and surgical specialist claims data in Calgary, Alberta. With a 35.0% (317/904) response rate, 317 physicians consented to data access (47.7% (71/149) of physicians on APP plans versus 38.9% (46/119) on FFS plans). The second study validated billing claims submitted by surveyed APP and FFS physicians. The proportion of submitted claims for APP and FFS physicians was over 90%. The third study looked at physician claims data to examine the impact of physician reimbursement programs on estimates of hypertension prevalence, cardiovascular disease hospitalization rate and mortality. These estimates (APP claims; 0.6%, n=3677, FFS claims; 99.4%, n=610,167) were minimally impacted if APP physicians did not submit claims. The final study surveyed and interviewed faculty of medicine department heads nationally about APP programs and government stakeholders to determine current policies regarding specialist shadow billing. Disincentive programs appear to be an efficient tool to promote APP physician billing submission. Similar studies should now be conducted in other Canadian regions to confirm the
findings, to objectively explore the extent of the variability between billing submission processes nationally and to determine the impact of APP programs on disease estimates.
Preface

The following manuscripts, based on work from this thesis, have been published, are in press, under review or are ready for submission. For all four papers, Ceara Cunningham was involved in the conceptualization and design of the studies. She was also responsible for drafting the manuscripts, conducting the analysis and interpreting the data with guidance from her thesis committee (Drs. Hude Quan, Nathalie Jette, Tom Noseworthy and Carolyn DeCoster). All authors contributed important intellectual content and provided critical reviews of the papers and individual contact details are presented in the manuscript versions.


3. *Cunningham CT, Chen G, Coward S, Jette N, Noseworthy T, DeCoster C, Campbell NRC, McAlister FA, Quan H. Impacts of alternate payment plan billing claims on hypertension prevalence, mortality and cardiovascular disease hospitalization estimates in Alberta, Canada. (submitting to BMC Health Services Research Journal)


* Individual author details can be found in the individual manuscripts
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I would like to acknowledge both my supervisors, Drs. Hude Quan and Nathalie Jette. This journey we have all embarked on has been one with ups and downs; however I am so proud to say that I have had the chance to learn and grow with both of you. Dr. Quan’s genuine passion and commitment to his students and their growth is a testament to the type of supervisor and man he his. I believe he saw something in me that many people might have missed; he saw my ability, my talent, and my drive to succeed and believed in me during very difficult times during my life. Meeting him truly changed my life and I am so thankful and proud to know him.

Dr. Jette is an amazing person and role model for all the women working in a sector dominated by men. I am taken with her elegance and the pride she puts into her work. I strive every day to live up to the standards and ethics she holds herself to. She is always a soft spot for me to land when I struggled, but pushed me when I needed it. Thank you from the bottom of my soul- you stood in the gap when Dr. Quan could not. I would also like to thank my supervisory committee members (Drs. DeCoster and Noseworthy), who both went above and beyond to help me succeed. A special thanks to Dr. Noseworthy, for taking extra time with me during the most stressful times and as my career advisory. I feel incredibly blessed to have had his guidance along the way and each and every word from him truly meant something to me.

Finally to my family and friends, thanks for seeing me through it all; none of this mattered without you all. To my husband who pushed me through some incredibly difficult times during this entire process; you are my rock and I couldn’t have done this without you. I dedicate this work to my mother, who will be missed dearly and would have been so proud to see me finish this work through till the end; however I know she is somewhere looking down and smiling… we can finally have a toast and cheers mom: I am done!
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funding and associated research training and professional development programs provided
through these organizations were invaluable components to my training and overall success in
completing my thesis work.
~This is for my mother, who stayed strong till her very last breath~

Barter

Life has loveliness to sell,
All beautiful and splendid things,
Blue waves whitened on a cliff,
Soaring fire that sways and sings,
And children's faces looking up
   Holding wonder like a cup.

   Life has loveliness to sell,
   Music like a curve of gold,
   Scent of pine trees in the rain,
   Eyes that love you, arms that hold,
   And for your spirit's still delight,
   Holy thoughts that star the night.

Spend all you have for loveliness,
Buy it and never count the cost;
For one white singing hour of peace
Count many a year of strife well lost,
   And for a breath of ecstasy
Give all you have been, or could be.

By Sara Teasdale
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<td>APP</td>
<td>Alternative Payment Plan</td>
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<tr>
<td>AAPP</td>
<td>Academic Alternative Payment Plan</td>
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<tr>
<td>AMI</td>
<td>Acute Myocardial Infarction</td>
</tr>
<tr>
<td>ARP</td>
<td>Alternative Relationship Plan</td>
</tr>
<tr>
<td>AFP</td>
<td>Alternative Funding Plan</td>
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<td>CCDSS</td>
<td>Canadian Chronic Disease Surveillance System</td>
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<td>CIHI</td>
<td>Canadian Institute for Health Information</td>
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<td>CMGs</td>
<td>Canadian Mix Groupers</td>
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<td>CAPP</td>
<td>Clinical Alternative Payment Plan</td>
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<td>CME</td>
<td>Continuing Medical Education</td>
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<td>CRGs</td>
<td>Clinical Risk Groupers</td>
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<td>DAD</td>
<td>Discharge Abstract Database</td>
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<td>DRGs</td>
<td>Diagnosis-related Groupers</td>
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<td>ED</td>
<td>Emergency Department</td>
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<td>FFS</td>
<td>Fee-for-Service</td>
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<tr>
<td>FTE</td>
<td>Full-Time Equivalent</td>
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<tr>
<td>ISA</td>
<td>Individual Service Agreement</td>
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<tr>
<td>ICES</td>
<td>Institute for Clinical Evaluative Sciences</td>
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<tr>
<td>ICD</td>
<td>International Classification of Diseases</td>
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<tr>
<td>IOM</td>
<td>Institute of Medicine</td>
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<tr>
<td>LHAD</td>
<td>Longitudinal Health Administrative Data</td>
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<tr>
<td>MRD</td>
<td>Most Responsible Diagnosis</td>
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<td>NACRS</td>
<td>National Ambulatory Care Reporting System</td>
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<td>NPV</td>
<td>Negative Predictive Value</td>
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<tr>
<td>PPV</td>
<td>Positive Predictive Value</td>
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<tr>
<td>SOMB</td>
<td>Schedule of Medical Benefits</td>
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<td>SE</td>
<td>Sensitivity</td>
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<td>SNOMED CT</td>
<td>Systematized Nomenclature of Medicine, Clinical Terms</td>
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<td>WHO</td>
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Chapter One: OVERVIEW OF THESIS
In Canada, the use of secondary sources of health information for surveillance, allocation of health care funds and research has become increasingly widespread and popular [5-9]. These sources include administrative data, electronic medical records, clinical registries, laboratory data and pharmacy data [5, 6]. Some countries capture virtually every hospitalization and physician visit for entire populations. In fact, Canada is one of these countries with the richest administrative data in the world [5].

With the widespread use of administrative data for research, the quality of these data has become vital. “Data quality is the perception of data's fitness to serve its purpose in a given context”[6]. Defining data quality can be seen as “the whole of planned and systematic procedures that take place before, during and after data collection to guarantee the quality of data in a database.” Thus data are considered to be of high quality "if they are fit for their intended uses in operations, decision making, and planning” [10, 11] (for a full glossary of terms and definitions see Table 2-1). The overall integrity of an administrative dataset is a function of various components being present and of high quality (i.e. completeness, accuracy, timeliness, comparability, relevance, etc.) [11].

Incomplete data leads to gaps in information, decreasing the utility and integrity of administrative data. A variety of factors can affect the data recorded (e.g. health information) during a physician-patient encounter. For example, changes from traditional physician compensation models such as fee-for-service (FFS) to alternative payment plan (APP) models can influence the mechanisms by which physicians are paid for providing medical services thereby affecting chart documentation and billing submissions [12]. Thus an understanding of issues related to coded health data is essential to produce rigorous results that can contribute to right decision making when using administrative data.
With the recent introduction of APPs (i.e. an alternative payment mode for physicians across Canada), there are concerns about data erosion (i.e. decreased or non-submission of claims) due to variations in the billing submission processes for APP physicians [4, 13]. Canadian FFS physicians must submit claims to their provincial government health care insurance program in order to be remunerated [12, 14]. The provincial physician claims database contains demographic and clinical information from outpatient and inpatient settings and cover a large population; unfortunately, the quality of claims data tends to be poorer than that of hospital discharge abstract data (DAD). The DAD has standards for data collection and coding such as trained accredited coders who undergo two years of education learning about coding practices and diagnostic codes [15, 16]. Several physician claims’ data studies have focused on the validity of diagnostic coding entered at the time of the service event [7, 9, 17]. However, other billing process influences, such as alternative forms of physician remuneration that could impact the quality of these data for research and surveillance have rarely been examined [15]. Even with these knowledge gaps, physician claims remain one of several core administrative databases that are used extensively by governing health authorities for a number of purposes, including to monitor health services and for health policy [18-20].

As of 2013, close to 30% of Canadian physicians received some payments for clinical care from APP [21, 22]. Many APP physicians are paid a fixed amount of money, rather than being paid for each medical service they provide. APP mechanisms for physicians promise greater control over the level of physician compensation expenditures and more efficient use of health care resources [23-25] than FFS. Unfortunately, APPs do not typically provide financial incentives for physicians to submit claims to keep track of all their services, raising concern about potential data loss due to non-submission of shadow billings. APP physicians use a claims
submission process, in which they submit parallel claims (i.e. shadow billings) to account for all of their clinical encounters. However, as of 2012 the portion of physician payments for which there is missing information (i.e. potential non-submitted shadow billings), represents a $7 billion segment of the Canadian health care system [26] accounting for nearly 3.3% of the country’s total health care spending [22].

The occurrence and extent of data loss (i.e. missing data, decreases in frequency of billing claims) due to non-submission of billings has important implications. Thus, the overall purpose of this thesis is to examine how FFS and APP payment plans influenced physician specialist billing submissions and data integrity in Alberta, and examine existing national policies to promote physician billing. The overall aim of the thesis was achieved through four individual studies:

Study 1. To explore survey response rates among physician specialists in a large metropolitan Canadian city (e.g. Calgary) and gain consent from individual physician specialists to utilize their billing claims and determine their payment plans. A survey was developed to gather demographic and billing information from physician specialists in Calgary, Alberta. This survey was distributed to over 900 physicians from various medical and surgical specialties.

Study 2. Using information gathered from the above physician survey, we determined the proportion of claims submitted by physician specialists using FFS and APP, and identified and compared the validity of information coded in physician billing claims submitted by these specialists in Calgary.

Study 3. We then determined hypertension prevalence, frequency of cardiovascular disease (CVD) hospitalization and mortality in administrative data, hypothesizing that APP physicians may not be submitting complete shadow billing claims in Alberta. We compared the
above outcome estimates with and without APP claims. This study indirectly informed the extent of the potential impact of APP data on these outcomes.

Study 4. The final study was to conduct a nationwide survey and face-to-face interviews in Alberta, Canada to determine existing policies and guidelines for incentivizing and promoting physician billing practices in Canada.

This thesis is divided into seven chapters. Chapter 2 provides background information on what are administrative health data, different types of administrative health data, data quality in administrative data and components of data quality, validity components in administrative data, physician documentation processes, physician billing practices and physician payment systems in Canada. Chapters’ 3 to 6 report on the four studies described above. Each of these four chapters represent an independent study with a specific research question, study cohort, and set of methods. Finally, Chapter 7 synthesizes the findings of the thesis. This concluding chapter discusses whether physician claims’ data have been affected by changes in payment plans in Canada and what types of incentives and policies can best motivate physicians to submit their billings. It also discusses directions for future research aimed at improving shadow billing monitoring, physician documentation and data quality.
Chapter Two: **BACKGROUND**
2.1 Secondary data in health care

For the purposes of this thesis, secondary health data are defined as data that are not specifically collected for research [27]. Such data may be available when primary data cannot be obtained [28]. The costs of conducting individual studies to examine health outcomes for large populations would be enormous if every study had to collect its own population-based data. Thus, researchers often rely on data derived from secondary sources.

Several secondary data sources used in population-based health research exist, including: 1) person-level administrative data; 2) aggregate-level administrative data; 3) population/public health data; 4) clinical registries; 5) population survey data; 6) special purpose data holdings and; 7) investigator driven research data funded by public agencies (see Table 2-1) [27]. These data sources available in Canada demonstrate the abundant, widely held and large variety of information that researchers can utilize and analyze for research purposes. For instance, in Manitoba, an extensive data repository including education, social services, and housing databases have been linked to administrative health databases to investigate healthy child outcomes and includes other linkages to the Canadian Community Health Survey [29]. Another example of a data linkage initiative includes Statistics Canada’s Longitudinal Health and Administrative Data (LHAD) Initiative, which links provincial administrative health databases with census, national population-based health survey, vital events, and cancer registry data to better understand the relationships between the determinants of health and health outcomes [30, 31].

2.2 Disease coding and grouping systems

Administrative data are typically coded using the World Health Organization’s (WHO) International Classification of Disease (ICD) [32, 33]. The first version of the ICD was the
International List of Causes of Death, which was created and adopted in the 1850s as an internationally acceptable and comparable classification system of causes of death [33]. Subsequently, classification systems were revised periodically to accommodate updated knowledge with respect to disease and health, with the latest version, ICD 10\textsuperscript{th} version (ICD-10), released by the WHO in 1992 [33]. The ICD-11 is now being developed and is expected to be finalized in 2018. For the first time, through advances in information technology, public health users, stakeholders and other interested parties can provide input to the beta version of ICD-11 using an online revision process.

In the past decade, a variety of electronic health record (EHR) systems were introduced in the Canadian health care system, with great potential to enable the seamless flow of patient information among health care providers [34]. EHRs often provide online access from separate, interoperable automated systems within an electronic network [35]. Within a given network, there may be hundreds of individual electronic medical records (EMR). An EMR is one component of the broader electronic network, it represents an individual patient’s health record. They are secure and private lifetime records that describe a person’s health history and care. The use of an EHR and EMR improves communication and increases the availability of relevant clinical information, however new methods of matching this clinical information with existing coding systems (ICD coding, free-text) are challenging to implement [34].

There are various other ways in which a patient’s health condition(s), attributing risk factors and added data features can be captured within secondary health data sources. For instance, the Systematized Nomenclature of Medicine (SNOMED) is a systematic and computer processable collection of medical terms in human medicine, that provide codes, terms, synonyms and definitions that cover anatomy, diseases, findings, procedures, microorganisms, and
substances [36]. It is a comprehensive health care terminology that contains over 120,000 interrelated health care concepts, supported by synonyms and semantic definitions. In its infancy, SNOMED RT (reference terminology) acted as common reference terminology for the gathering and retrieval of health care data recorded by organizations such as hospitals and health care practitioners [37]. Researchers and clinicians have evaluated the spectrum of standardized clinical vocabularies in a variety of clinical settings [38, 39]. These studies included a comparison of ICD-9-CM, ICD-10, SNOMED RT; however, with the merging of SNOMED RT and Read Codes (coded thesaurus of clinical terms) into the first release of SNOMED CT (clinical terms), a centrally standardized and maintained clinical terminology has become available [36]. Challenges with programs such as SNOMED CT include compatibility of coding components, terms, meanings, implementation guidance and creating educational programs that can improve their uses internationally [36].

There are a variety of methods of grouping morbidity and mortality, generally known as risk-adjusted classification tools [such as diagnosis-related groupers (DRG) and clinically-related risk groupers (CRG)]. In the 1970s, DRGs were created to gauge health care resources use [40]. DRGs categorize large numbers of ICD codes into a manageable number of clinical meaningful categories so providers and administrators can measure and manage health utilization [40]. DRGs are frequently used in the United States for APPs [41]. Various adaptations or versions of the DRGs have been generated since its creation. For example, Canadian Institutes for Health Information (CIHI) developed its own system called Canadian Mix Groups (CMG) [42] while 3M Health Information Systems [43] developed clinical risk groupers (CRGs) that classify patients’ health status using ICD codes [41, 43].
2.3 Advantages and disadvantages of administrative data

Administrative data provide a readily available, cost-effective source of information, representative of the population of interest, and have the ability to span many years and different health care settings [44]. For instance, they are beneficial to study low prevalence disorders, such as motor neuron disease, or rare events, where there is high service use and costs for a small percent of the population [45]. Another noteworthy advantage of administrative data is its potential to be linked to other datasets. Data linkage can be conducted using either unique personal identifier (e.g. personal health number) or a group of personal identifiable information (such as first and last name, date of birth, and postal code) across datasets [5].

Generally, administrative data may not contain certain variables that support various avenues of health services research. For example, the DAD generally does not contain information about disease severity which is important for robust risk adjustment. Case-mix methods are often used instead as proxy of disease severity. Another limitation of administrative data is coding errors and under-coding of certain conditions or symptoms, which can lead to information or misclassification bias [46]. In Canada, professional coders with college level accreditation are responsible for coding conditions and procedures following CIHI guidelines for the DAD. They are the ones that determine which condition during a hospital visit was associated with the greatest health resource use. Thus less acute conditions (such as anxiety) or health status (such as obesity) may be under-coded [47]. This is generally because they are not documented well. Because coders are asked not to interpret medical information documented in charts (such as laboratory tests), they convert physicians’ notes into ICD codes. Variations in practice across coders is unavoidable [16, 48, 49].
Regardless of the original purpose for collection, administrative data have the power to improve our understanding of public health and other health interventions on individuals and the larger population [27]. Thus assessment of data quality prior to their use is necessary.

2.4 Measuring quality in administrative data

Quality is a multidimensional concept that can be interpreted in many ways to meet certain goals and standards. Given its complex nature, the multidimensional nature of data quality is evident in conceptual frameworks developed by national/provincial agencies and organizations.

2.4.1 Data quality frameworks for administrative data

Several data quality indicators are typically used to evaluate the quality of administrative data. For example, CIHI’s data quality framework encompasses concepts of accuracy, timeliness, comparability, usability, and relevance [50]. Accuracy refers to how well the information derived from the data holding reflects the information it was designed to measure; timeliness refers to how current or up to date the data are at the time of release, by measuring the gap between the end of the reference period to which the data pertains and the date at which the data become available to users; comparability refers to the extent to which databases are consistent over time and use standard conventions for format and content in order to make them comparable to other databases; usability reflects the ease with which a data holding may be understood and accessed and; relevance reflects the degree to which a data holding meets the current needs of users, as well as their potential future needs [50].
The Institute for Clinical Evaluative Sciences (ICES) developed a quality assessment model specific to administrative data known as QuAAD (the Quality Assessment of Administrative Data) [11]. The QuAAD models introduces a broad perspective on data quality, recognizing the importance of defining the target audience, the political environment, and the purpose of the data quality evaluation prior to initiating the process [11]. Additionally, opportunities to use data quality assessments for improvement and planning for change in the system are also recognized [5, 11].

Data quality concepts can generally be evaluated using qualitative or quantitative criteria such as rating scales using one of two sets of descriptors: (a) met, not met, unknown, not applicable, or (b) minimal or none, moderate, significant, unknown [11]. For example, to assess completeness of the data, relevant quantitative measures are developed based on population coverage rates, and percent of complete/missing data. Additionally, the accuracy of data gathered from an external source (i.e. administrative data source) can be compared to a primary source (i.e. patients’ true condition or characteristics) of information as the truth, gold standard or reference standard [27]. Data completeness refers to the gaps between the gold standard and administrative data (i.e. missing data and inaccurate data). The overall integrity of an administrative dataset is a function of various components being present and of high quality [50].

2.5 Validity in administrative data

2.5.1 What is it?

In science and statistics, validity is often defined as the “extent to which a concept, conclusion or measurement is well-founded and corresponds accurately to the real world” [51, 52]. In the area of research design and experimentation, validity refers to whether a study is able to scientifically answer the questions for which it is intended [52]. Validity is important because
it can help determine the types of diagnostic and statistical tests to use and help ensure researchers are using methods that are not only ethical, but methodologically sound [53].

Validation studies examine measurement error in diagnoses, procedures, or other health measures by comparing them to data that do not contain measurement error [54]. In the literature, three major types of validation study designs exist: ecological, re-abstraction, and gold standard [55].

Ecological studies compare statistics about events (i.e. prevalence, incidence) calculated from administrative data with statistics from another validated data source, such as clinical registries [55]. For example, Quan et al. compared hypertension prevalence among three databases (administrative data, Canadian Community Health Survey and Physical Measurement Survey). This study assessed the face-validity among datasets without a ‘gold standard’ or ‘reference standard’ [56].

Re-abstraction studies involve collecting data from the original source (i.e. medical chart) and compare the re-abstracted data (reference standard) to administrative data [16]. For example, CIHI assesses health information quality periodically by re-abstracting chart data using experienced, and well-trained accredited coders [16].

Potential gold standard data sources include clinical or laboratory data, a panel consensus review, and medical charts [5]. Carl Van Walraven and Austin [55] describe three methods that were identified to measure the gold standard: “(1) a set of standard clinical laboratory criteria required for disease status, (2) a panel review to consensually determine disease status, or (3) a second dataset that contains an accurate measure of disease status (i.e. a population-based disease registry)”. A ‘perfect’ gold standard may only exist in theory or in cases where explicit
diagnostic or laboratory tests can confirm the presence of a disease. When there is no gold standard, a reference standard is used instead.

2.5.2 Measures of validity in administrative data

DAD, physician billing claims, ambulatory care records, and prescription drug records have been previously validated for health research (for example: [16, 49, 57, 58]). Medical records have been the most commonly used reference standard, including EMR [49]. Traditionally, sensitivity (Se), specificity (Sp), positive predictive value (PPV) and negative predictive value (NPV) have been used to quantify measures of validity. Sensitivity measures how well administrative data detect the presence of a disease for individuals who actually have the disease according to a reference standard, while specificity refers to how well the administrative data record absence of disease when they do not have the disease [7]. Sensitivity and specificity are not influenced by disease prevalence, meaning that results from one study generally could easily be transferred to some other setting with a different prevalence of the disease in the population [59].

The PPV is defined as the proportion of people detected from the administrative data with a disease who actually have the disease, according to the reference standard. The NPV of a test is defined as the proportion of people detected from the administrative data without disease who do not actually have the disease, according to the reference standard [46]. PPV and NPV are influenced by disease prevalence in the examined population. Therefore, predictive values from one study may not be generalizable to other settings or populations with a different disease prevalence [59].
2.6 Common administrative datasets in Canada

There are many different types of administrative data in Canada. However, the three most commonly used administrative datasets in Canada include the DAD, physician claims data and national ambulatory care reporting system (NACRS).

2.6.1 Hospital Discharge Abstract Database (DAD)

CIHI houses national administrative data [60-62]. The DAD is generated by trained medical coders. It includes information on all patients admitted to hospital. Each discharge record contains a unique identification number, patient chart number, date of admission, date of discharge, location of residence, physician specialty, diagnoses (up to 25 coded diagnoses recorded using the ICD-10-CA coding system), procedures (up to 20), and an indicator flagging the occurrence of death during an hospitalization. In Alberta, each hospital has a health records department where trained coders read through patients’ medical charts to assign appropriate ICD-10-CA diagnosis codes for their stay in hospital. The DAD also has a diagnosis type indicator. The coders assign a one-digit ‘diagnosis-type’ code to specify the timing of diagnosis. Type M is the most responsible diagnosis, which is defined in Canada as the condition responsible for the most resource use during the hospital stay [63]. Since inpatient hospital data in Canada are coded using standardized processes and professional, trained coders, these data are generally considered to be valid [16].

2.6.2 National Ambulatory Care Reporting System (NACRS)

CIHI also stores NACRS data that contains facility and community-based ambulatory care information (same-day surgery, emergency room visits, and community rehabilitation program services occurring in publicly-funded facilities). This outpatient database contains
information on patient demographics, services provided, diagnosis, procedure interventions and information about providers and other data elements (i.e. groupers). The NACRS database information can be advantageous for potential benchmarking between different programs in the same province/region, to analyze the utilization and effectiveness of health education programs and to examine continuity of care between inpatient and outpatient settings [64]. The collection of these data while not always professionally coded, is standardized and captured using a continuous quality improvement process (CIHI data holding criteria) similar to the DAD.

### 2.6.3 Physician Billing Claims Data

Alberta physician claims data contain unique patient and physician identifiers, up to three ICD-9 diagnostic codes, one procedure code (using the Canadian Classification of Procedures), provider specialty, and functional centre type. Fee-for-service physicians record this information so they can send a bill to their provincial government in order to be paid for the service they provide. In general, FFS billing claims capture relatively complete and comprehensive information on inpatient and outpatient physician services for all specialties [24]. Since physicians’ billing data are not subjected to a rigorous and standardized process such as is the case for the DAD, the billing and claims’ submission process needs to be carefully monitored and evaluated [48].

### 2.7 Sources of bias and error in physician claims data

With the widespread use of physician claims in health research, the accuracy and completeness of these data have become important issues. An assessment of the sources of bias and error arising from physicians’ billing data is critical to their future use for various purposes.
2.7.1 Billing claims submission

Components of the billing claims generally include information related to the event itself such as an ICD code for diagnosis(es), date of transaction, documented patient characteristics, physician characteristics and facility characteristics. Billing claims may be used for several reasons including administration purposes, informing the physician about their patient population, forecasting health care budgets, and health services research [7, 8, 65, 66]. In most provinces, FFS physicians have to submit a medical bill for services rendered within three to six months of performing the service. Those who fail to do so will not be paid. For example, an omission of this type may occur when a physician fails to record and hand over to the billing staff the record of services performed outside the office (i.e. when on call). Research by the Canadian Medical Association indicates that physicians, on average, fail to bill for at least 5% of the insured services they provide [67].

In most provinces and territories, billing submissions are done by electronic data transfer that are either web-based or over a modem [68]. In Alberta, the provincial government makes payments for services insured by the Alberta Health Insurance Plan in accordance with the payment requirements listed in the Schedule of Medical Benefits (i.e. certain medical services are insured and therefore remunerated) and in accordance with the Medical Governing Rules List (i.e. there must be an ICD code/diagnoses, date of service, patient identifier) and the Health Information Act. Separate fee schedules exist for a variety of specialties, diagnostics, laboratory and other medical services. After the patient has been seen and the physician captures the necessary information, the billing claim can be submitted to the proper health authority. Provincial health authorities which have post-payment review or validation of billing claims, use it as accountability for the use of the insurance funds.
2.7.2 Sources of errors in claims

Various potential sources of error may arise from the billing processes [48]. Physicians or billing clerks may use common ICD codes or select codes with maximum reimbursement regardless of the reason for visit. Payment staff in some provinces check missing values and clinical logics in the submitted claims [69]. Research shows that the procedure code (e.g. major assessment visit) which is linked to the level of reimbursement is generally carefully checked [70]. However diagnostic information that is recorded on each medical service claim is usually not rigorously validated in Canada [86]. For example, if a claim is rejected and sent back to a physician, often a billing clerk (i.e. front office staff) will re-assess the claim for a physician. This is an additional step added into the physician’s documentation process which can lead to errors and misinterpretation of the original diagnosis [48]. In Canada, barriers to improve physician documentation include the lack of uniform or set educational requirements on documentation, lack of cohesion of a standardized method of documentation, and differences in physician remuneration plans.

Poor physician documentation may be due to a lack of training about this important topic in medical schools [71]. Similarly, residency programs are designed to train physicians to become proficient in their respective specialty, and most physicians have had minimal training in medical records’ keeping before entering a residency program [71]. This inattention to good documentation persists through the internship phase of medical training [72]. In Canada, a lack of educational requirements presents as a major challenge to alter physician behavior, with regard to documentation, and as a way to prevent data erosion.
2.8 Physician reimbursement programs

After hospitals, physician expenditures (i.e. physician payment) represent the second largest category of public-sector health care spending (20% in 2011) in Canada [2]. Between 1998 and 2008, physician expenditures increased on average by 6.8% a year [73]. In 2014, physician services expenditures accounted for almost 16% of Canada’s total expenditure on health care. Each province has its own unique blend of physician payment. Each province is itself a separate silo or system with regard to physician payments. CIHI has developed a list of the various types of physician remuneration plans and their overarching descriptions [22]. These plans include, but are not limited to: APP, alternative relationship plans (ARP), alternative funding plans (AFP), academic alternative payment plans (AAPP), clinical alternative payment plans, salary, capitation, block funding, contract and blended programs. For a full descriptions of these plans please see Table 2-2. For the purposes of this chapter, we will focus on the two most common payment arrangements in Canada; FFS and APP programs.

2.8.1 Fee-for-service payment plans

In Canada, FFS is one of the most common payment arrangements for physicians [74]. Traditional FFS methods reimburse physicians for every clinical service they provide, based on a set of billing codes established by the payer [75, 76]. The overwhelming reliance on the FFS payment is an often-cited source of inefficiency in the Canadian health system and works poorly for chronic disease management [2]. Chronically ill patients are generally complex and require more time than a healthy non-complex patient, thus physicians spend more time but are paid the same amount seeing patients with simple conditions in a FFS payment model. As a result of this, access to care has also been identified as a problem for practices operating within the FFS
payment model. Chan (2002) documented reductions in the provision of obstetrics, nursing home visits, hospital inpatient care, and house calls by family doctors [77] operating on a FFS model.

2.8.2 Alternative payment plans

In most APPs, physicians are paid a fixed, up-front or lump sum of money rather than being paid for each medical service they provide [12]. In Canada in 2000, APP payments comprised 10% ($1B of $10B) of total physician payments and by 2009 reached 27% ($4.8B of $17.7B) [26, 78]. Additionally, over 30% of Canada’s physicians receive some payment for clinical care from an APP [21]. APPs are often used over FFS as a means to provide higher or more comparable income to physicians in certain specialties where patient volume is low and cases are complex (i.e. pediatrics), or for academic physicians who teach and do research outside of the clinical setting. Because physicians in an APP system must provide care without any additional payments, higher volume does not translate into more income. However, critics of APP plans argue that a lack of billing detail (i.e. non-submission of shadow billings) will ultimately affect the health care community’s ability to monitor burden of disease resulting in inaccurate estimates used for setting health care resource allocation [79].

2.8.3 Shadow billing process

APP physicians use a claims submission process, in which they submit parallel claims (i.e. shadow billings) to account for all of their clinical encounters; unfortunately, APP programs do not typically provide financial incentives for physicians to submit claims for their services (i.e. not compensated for their time spent submitting claims). As such, this process may not be entirely effective for capturing information on physician-patient encounters, driving concerns about potential data erosion due to non-submission of shadow bills. Unfortunately, this issue has
received relatively little attention to date [80]. The incomplete capture of services due to APPs may result in biased disease burden estimates across years and across health regions [76].

2.8.4 Policies to improve physician billing submission

In Alberta, academic teaching institutions request that APP physicians submit claims primarily for accountability, to ensure that physicians are providing the services indicated in their contracts [4, 12]. In addition, provincial academic APP programs use incentives or punitive-based tools to motivate physicians to submit shadow billings; however, these incentives are not well documented in the literature and vary across provinces [4, 13, 78]. Disincentives may also occur. For example, APP physicians who do not submit the recommended quota of shadow billings (based on their expected annual patient workload) face a potential withholding (i.e. 15%) of their yearly earnings generally called “income at risk” [68, 78, 81].

Shadow billing monitoring has the potential to improve the quality and completeness of claims submitted by physicians [82]. Canadian provincial governments and health agencies are beginning to realize the possible risk of data loss following the implementation of APPs and are creating policies to adjust for the potential under-submissions of shadow bills.
Table 2.1 Glossary of terms and definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>Aggregate-level administrative data</td>
<td>Provincial or national data holdings on health, environmental data and income data [27]</td>
</tr>
<tr>
<td>Clinical registries</td>
<td>Medical or clinical registries such as cancer registries, others include cardiovascular disease, respiratory disease [55]</td>
</tr>
<tr>
<td>Data accuracy</td>
<td>When the information in the external source (administrative data) compared to a primary source (i.e. a patient’s true condition) is deemed as the truth or similar to the gold standard [50]</td>
</tr>
<tr>
<td>Data completeness</td>
<td>Refers to detailed and complete data in health information. A lack of completeness would refer to losses in data, missing data, and inaccurate data [50]</td>
</tr>
<tr>
<td>Data consistency</td>
<td>Refers to the comparability of data validity for data produced at different times or in different geographical locations [50]</td>
</tr>
<tr>
<td>Data erosion</td>
<td>Refers to incomplete, missing or altered administrative data components [50]</td>
</tr>
<tr>
<td>Data integrity</td>
<td>The overall data integrity of an administrative dataset is a function of various data quality components being present and of high value [27]</td>
</tr>
<tr>
<td>Data quality</td>
<td>The whole of planned and systematic procedures that take place before, during and after data collection to guarantee the quality of data in a database for its intended use [50]</td>
</tr>
<tr>
<td>Data relevance</td>
<td>Refers to how well data meets the needs of users [50]</td>
</tr>
<tr>
<td>Data timeliness</td>
<td>Refers to how up to date the data are at time of release [50]</td>
</tr>
<tr>
<td>Data usability</td>
<td>Refers to the ease with which data can be understood and accessed [50]</td>
</tr>
<tr>
<td>Investigator driven research data funded by public agencies</td>
<td>This includes research and data from holdings such as the Canadian Institutes for Health Research, Statistics Canada and PHAC [27]</td>
</tr>
<tr>
<td>Person-level administrative data</td>
<td>Provincial data on health care provision, physician services, workers’ compensation, health human resources, early development instrument, criminal justice, social services, etc. [27]</td>
</tr>
<tr>
<td>Population/public health data</td>
<td>This includes data on disease surveillance, special and vulnerable populations (i.e. aboriginals), immunizations, etc. [27]</td>
</tr>
<tr>
<td>Population survey data</td>
<td>This includes survey data collected for health purposes such as the Census, National Population Health Survey, Canadian Community Health Survey and Longitudinal Health Survey [27]</td>
</tr>
<tr>
<td><strong>Term</strong></td>
<td><strong>Definition</strong></td>
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</tr>
<tr>
<td>Secondary health data</td>
<td>Population based health and health services, administrative data and survey data banks that are representative of an entire population who reside in a geographic region [27]</td>
</tr>
<tr>
<td>Special purpose data holdings</td>
<td>This includes special data repositories such as BC Linked Health Data and Manitoba Population Health Research Data Repository [27]</td>
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</tbody>
</table>
### Table 2.2 Description of remuneration plans for physicians from Canadian Institute for Health Information [22]

<table>
<thead>
<tr>
<th>Payment Plan Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fee-for-service plan</td>
<td>Refers to a payment model or arrangement where services are paid for as itemized in the medical billing claim invoice</td>
</tr>
<tr>
<td>Alternative payment plan (APP, ARP, AFP)</td>
<td>Refer to actual arrangements to pay physicians by alternative modes. The purpose an APP is to provide innovation in clinical service, and may enhance the following 5 dimensions: (1) Recruitment and retention; (2) Team-based approach; (3) Access (4) Patient satisfaction and; (5) Value for money</td>
</tr>
<tr>
<td>Academic alternative payment plan (AAPP)</td>
<td>Refers to a funding arrangement with physicians who teach or who do research at Alberta universities or at medical facilities</td>
</tr>
<tr>
<td>Clinical alternative payment plan (CAPP)</td>
<td>Refers to a compensation model to physicians for providing a set of clinical services at defined facilities to a target population. The compensation model used for a Clinical ARP can take several forms; three models are currently available. All three compensate physicians based on a specified service delivery model. These are:</td>
</tr>
<tr>
<td></td>
<td>1. Annualized model – compensation is based on the number of physician full-time equivalents required to deliver the clinical services within the Clinical ARP. A full-time equivalent is a time-based unit of measure (e.g., hours per year or days per year).</td>
</tr>
<tr>
<td></td>
<td>2. Sessional model – compensation is based on an hourly rate for the delivery of clinical services.</td>
</tr>
<tr>
<td></td>
<td>3. Capitation model – compensation is based on an annual amount per rostered patient. Rosters may be composed of enrolled patients or all patients within a defined geographic area.</td>
</tr>
<tr>
<td>Alternative funding</td>
<td>Refers to methods other than fee-for-service used to fund clinical departments (e.g. practice plans or academic medical centers) or specific programs. The agency that receives the funding is responsible for determining the nature and amount of payment to individual physicians.</td>
</tr>
<tr>
<td>Alternative clinical</td>
<td>Refers to all payments made for clinical services provided by physicians and not reimbursed on a fee-for-service basis. Classifications vary across jurisdictions</td>
</tr>
<tr>
<td>Salary</td>
<td>Physicians employed on a salary basis</td>
</tr>
<tr>
<td>Capitation</td>
<td>Monthly payments for clients rostered with a physician group</td>
</tr>
<tr>
<td>Block funding</td>
<td>Annual budgets negotiated for a group of physicians, usually</td>
</tr>
</tbody>
</table>
| Contract and blended | Refers to models which contain blended components for remuneration of clinical services. These are:

1. Funding to regional boards for clinical services under arrangements in which boards have discretion regarding specific uses of the funds.
2. Contractual payments
3. Payment arrangements that incorporate both alternative remuneration and fee-for-services |
Chapter Three: **EXPLORING PHYSICIAN SPECIALIST RESPONSE RATES TO WEB-BASED SURVEYS**

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**Objective:** To explore survey response rates among physician specialists in a large metropolitan Canadian city
3.1 Abstract

**Background:** Survey research in healthcare is an important tool to collect information about healthcare delivery, service use and overall issues relating to quality of care. Unfortunately, physicians are often a group with low survey response rates and little research has looked at response rates among physician specialists. For these reasons, the purpose of this project was to explore survey response rates among physician specialists in a large metropolitan Canadian city.

**Methods:** As part of a larger project to look at physician payment plans, an online survey about medical billing practices was distributed to 904 physicians from various medical specialties. The primary method for physicians to complete the survey was via the Internet using a well-known and established survey company (www.surveymonkey.com). Multiple methods were used to encourage survey response such as individual personalized email invitations, multiple reminders, and a draw for three gift certificate prizes to increase response rates. Descriptive statistics were used to assess response rates and reasons for non-response.

**Results:** Overall survey response rate was 35.0%. Response rates varied by specialty: Neurology/neurosurgery (46.6%); internal medicine (42.9%); general surgery (29.6%); pediatrics (29.2%); and psychiatry (27.1%). Non-respondents listed lack of time/survey burden as the main reason for not responding to our survey.

**Conclusions:** Our survey results provide a look into the challenges of collecting healthcare research where response rates to surveys are often low. The findings presented here should help researchers in planning future survey based studies. Findings from this study and others suggest
smaller monetary incentives for each individual may be a more appropriate way to increase response rates.
3.2 Methods

3.2.1 Physicians’ survey

Survey design: The initial three-page survey was reviewed and refined for content validity by a working group of eight senior researchers and practicing physicians from various medical and surgical specialties [see below]. The refinement process included a content review from all stakeholders listed as co-investigators for the project.

The final survey gathered information regarding physicians’ billing status (fee-for-service, FFS v. alternative payment plan, 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. The email survey design and layout included two pages of questions. The primary method of accessing and completing the survey was via the Internet using a well-known and established survey company (www.surveymonkey.com). The survey company hosted and collected the survey data and only participants who were sent the email could connect to the hyperlink and respond to the questionnaire. However, if physicians had trouble accessing or completing the online survey, a paper version could be requested by mail or fax.

Survey participants: 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. Also their specialty was a potential confounding factor for shadow billing behaviour and the groups had a large number of registered physicians in Calgary, Alberta.

Inclusion criteria were: 1) physicians employed and practicing in 2009; 2) on an APP or FFS payment plan and; 3) providing inpatient or outpatient (i.e. clinic) services at one of the four acute care hospitals in the city where the study took place. Exclusion criteria were: 1) general
practitioners (as the majority are remunerated by FFS system and did not fit into the scope or budget of our study) and; 2) medical trainees (i.e. medical students, residents, and fellows) as the majority of them do not submit billings.

Respondent Sampling: The survey sampling frame was generated using a list of physicians from the 2008 Canadian Medical Directory. In Alberta, there were approximately 400 internists (intensive care physicians were included with internists), 300 surgeons, 170 pediatricians, and 140 psychiatrists in Calgary based on the 2008 Canadian Medical Directory. In Calgary, the original list included 1012 physicians, their clinic/hospital appointment, specialty, as well as contact information. Because the contact information on the list is not updated regularly, the information (i.e. phone, address, email) and specialty was further verified through the latest faculty/department contact lists, and physician contact directories posted on websites of Alberta Health Services, hospitals and the College of Physicians of Alberta website. After the verification of contact information, 108 physicians were excluded due to incorrect contact information or unavailable contact information. The final population of physicians targeted included 904 physicians (324 internists and ICU physicians, 58 neurologists/neurosurgeons, 171 pediatricians, 118 psychiatrists and 233 general surgeons).

3.2.2 Survey administration and recruitment strategy

Survey process: A website containing the project information, investigators’ contact information, and a link to the survey was developed. Meetings were held with department heads for each medical/surgical group to discuss the study and obtain letters of support. Meetings and presentations promoting the survey were also organized with the various medical departments. All the initial email invitations contained a link to the study website which provided further information regarding the study and research team, and a link to access the survey. Additionally,
all emails contained the eligibility criteria for participating physicians, the opening and closing dates for access to the survey, and a unique identification number for each participant.

The main strategy to promote the website and survey was to involve key individuals (i.e. influential physicians from each medical group included in the study) to facilitate, encourage, and support their colleagues, department heads, and other physicians to complete the survey. The emails were addressed and sent individually to each physician by name, thereby avoiding any issues with confidentiality which can be a challenge with mass emailing lists. Emails were also sent using personalized subject headings. The key physicians who were supporting the promotion of the survey authorized their names to be used in the subject heading (i.e. Dr. X is asking for your help). Supporting physicians’ names used in the subject heading were representative of all the medical departments/specialties involved in the study.

The goal of using a familiar physician’s name to personalize the invitation was to add peer influence and to increase the likelihood of physicians reading the email and consenting to participate. A generic subject heading listing the funding body (i.e. xxx funded research project) was also used in cases where the use of an individual physician’s name was not deemed appropriate. All responding inquiries or comments were directed primarily to the lead research coordinator and physician co-investigators. Physicians were given the opportunity to submit their unique study ID number with the submission of their survey, and by doing so their names were entered into a one-time draw for three $200.00 (Canadian) gift certificates to a local bookstore.

Finally, after the allotted time period passed to respond to the initial survey invite, a secondary survey was sent to all eligible non-respondents asking them to identify the reasons for not participating in the original survey. The actual question that was sent via email was “In a few
words or sentences, please indicate why you were unable or unwilling to complete the survey.”

Physician specialist responses were gathered qualitatively.

### 3.2.3 Statistical analysis

Descriptive statistics were used to describe specialty response rates and reasons for non-response in current case study. Chi-square analysis (p-value <0.05) was used to examine differences between specialists by demographic characteristics or payment plan group. We compiled results from a secondary survey examining physicians’ reasons for non-response and categorized comments into five broader themes based on degrees of commonality within responses. All statistical analyses were conducted using Stata IC, Version 12 (StataCorp LP, College Station, TX).

### 3.3 Results

**Initial physician survey:** Of the 904 eligible physicians contacted, 317 eligible physicians responded to the survey, for an overall response rate of 35.0%. Table 3-1 outlines the baseline demographic characteristics of the survey respondents. A large proportion of respondents were male (55.1%) between the ages of 40 and 59 (51%) and many (44.6%) had been in practice for more than 15 years (44.6%), with only 18.3% in practice less than 5 years. Many physicians (47.7%) were remunerated on a full-time APP plan while 38.9% were paid on a FFS plan (see Table 3-1).

Table 3-2 outlines the characteristics of physician survey respondents by type of payment plan. Internal medicine specialists on a full-time APP plan had highest rates of response (54%, p-value <0.01), followed by internal medicine (ICU and neurology were collapsed into internal medicine for this table) specialists on a part-time APP plan (38.6%) and surgery (35.3%) and
internal medicine (35.3%) specialists on a FFS plan. Psychiatrists on both full-time APP (8.7%) and FFS (9.2%) plans and had the lowest response rates to the survey. Physician specialists aged 40-59 years were on APP part-time (63.3%) and full-time (51%) plans. FFS physicians (46.2%) in the 40-59 years of age category had the highest level of response. Male physician specialists had statistically significantly higher levels of response across all payment plans (APP full 51.7%; APP part 54.5%; FFS 59.7%) compared to their female counterparts. Finally, physician specialists with more than 15 years in practicing had the highest level of response. Part-time APP physicians (50%) had the highest response rate followed by FFS (47%) and full-time APP physicians (41%).

The response rates by timing of reminders for the medical specialty groups are shown in Table 3-3. Internal medicine (33.6%) and neurology/neurosurgery (34.5%) had the highest response rates following the 1st follow-up/reminder email. Following the 2nd follow-up/reminder email, general surgery and pediatrics response rates increased the most. Overall final response rates obtained by specialties were: Neurology/neurosurgery (46.6%), internal medicine (42.9%), general surgery (29.6%), pediatrics (29.2%) and psychiatry (27.1%).

Of the physicians who responded to the initial survey, 82.6% (262/317) provided their unique identification number to be entered into the lottery draw.

**Follow up survey of non-respondents:** Sixty-three physicians responded to the secondary survey aimed at exploring reasons for non-response, for a response rate of 11.8% (n=63/533). Of those who responded to the follow-up survey (n=63), 70.5% were males and 29.5% were females. Respondents for this follow-up survey were from the following specialties: Internal medicine (34.2%), general surgery (27.8%), neurology/neurosurgery (0.03%), pediatrics (18.2%) and psychiatry (16.9%). Reasons for non-response were survey burden, with 60.3% of
respondents reporting that there were too many survey requests and they lacked the time to complete them; 15.9% believed they were not eligible; 12.7% had no interest or saw no benefit to completing the survey; 7.9% felt the survey was asking information which was too private; and 3.2% did not know their billing mechanism in order to complete the survey. It should be noted that in the current study, a handful of physicians (n=5) responded unfavorably to the offer of a lottery draw incentive, finding it offensive and unethical.

3.4 Discussion

We conducted an online survey using a personalized invitation email strategy (with web-based survey) in addition to various other recruitment methods (multiple follow-up/reminders, lottery draw). These strategies have been used in prior survey studies to increase physician response rates [83, 84]. The 35.0% response rate for our own survey was lower than anticipated, but in view of the sensitive nature of the topic under investigation, it was not unexpected. Our response rate is still higher or comparable to similar studies using email as a distribution mode among physician specialists [85, 86].

The sensitive nature of our topic (i.e. physician billing practices) and the time-period during which our survey was conducted most likely contributed to a lower response rate. Survey research shows that survey topics which are sensitive in nature (i.e. personal, confidential issues) are likely to affect response rates in web surveys [87, 88]. According to several meta-analyses, the salience of a topic is one of the most important factors that influence response rates in both mail and web surveys [88-92]. The contract renewal period for all physicians on APPs occurred during the months in which our survey opened. This may have affected response rates, as physicians may have been cautious about consenting to have their billing practices reviewed for the purposes of our study, as the contract renewal process directly examined the quality of
physician’s billing submissions. Despite this challenge, many of the responding physicians contacted us to ask questions about our study after the initial survey invitation, indicating they were interested in our study topic and requested having the results sent to them. In one case, a face-to-face interview was set up with a physician to discuss the details of the study. Given our project resources, email was the most efficient, inexpensive and timely manner of contacting survey participants. Tracking, managing, and organizing the incoming data was simple and was ideal for the short project timeframe.

Results from studies of previous web-based surveys indicate similar trends in response rates to the current study. In one meta-analyses, the mean response rate for 68 web-based surveys reported in 49 studies was 39.6% [92], similar to our current findings. In Kellerman et al. [93], the response rates for general practitioners and specialists were 40.1% (186/464) and 49.6% (235/474), respectively. Response rates among physician specialists vary within the literature [94]. In one study, a mail survey, pediatricians had higher response rates compared to general practitioners, internists and obstetrics-gynecologists and were also the least sensitive to the timing of the incentive [94]. In the current study, internal medicine and pediatrics had some of the most longstanding alternative payment programs (i.e. established in 2003-2005), which may have lessened the concern of physician specialists in responding to a survey about billing behaviors making them more likely to respond compared to the other specialties. This also could have introduced a response bias in that those who had been in an APP longer were more familiar with their program and were more likely to respond to our survey. These would also likely be physicians who are more engaged in the billing process and thus have already adopted APP billing processes compared to other specialists who are not as engaged in an APP program.
Among published studies involving physician as respondents, survey response rates seem to be most influenced by the use of individual monetary incentives [95-97]. For example, a US study found that the provision of a small ($2.00) monetary incentive sent to each physician invited to participate, yielded a substantially greater response rate (56.0% vs. 44.0 %) than the lottery draw of a larger, one-time, cash incentive [98]. It has been proposed that in order to achieve the response rates needed to validate health care policy-related research using survey methodology, the offer of monetary incentives may become a necessary part of the research process [99, 100]. A recent Canadian study examining the use of a substantial monetary lottery incentive among physicians did not find that financial incentives improved response rates. In fact, response rates were lower in the following year (35.9% in 2004, 31.6% in 2007) [101]. In a study examining prepaid incentives to physician specialists, the response rate was 52.1% for physicians who received a $20 check versus 67.8% for physicians who received a $50 check (P<0.001) [102]. As physicians become increasingly burdened with surveys, studies suggest larger incentives may be necessary to engage potential respondents and thus maximize response rate [102]. There is therefore conflicting evidence but in general, based on previous findings, individual smaller financial incentives for each respondent seem to be more effective at increasing initial buy-in from participants, and may be superior to large, one-time lottery draws. However, since we did not include a comparison group of individual who received small financial incentives, this finding was not confirmed in our study. Additionally it is important to note, that a handful of physicians (n=5) responded to the offer of a lottery draw incentive unfavorably. Similar studies have found negative responses to incentives [103, 104], although not to the point of withdrawing from the study. In the case of the current study, the physicians declined to participate as a result of being offered a personal incentive.
The timing of follow up reminders has also been shown to increase response rates. However, recommendations regarding the timing of follow up and frequency of follow up reminders vary substantially in the literature [105]. Our study was associated with an increase in response rates by medical or surgical specialty after each follow-up/reminder; however, no clear pattern surfaced as to which timeframe (1st week, 3rd week) is most ideal to increase response rates. Our results suggest that at least one follow-up reminder may prove beneficial in increasing response rates [106, 107]. More recently, research suggests that too many reminders may be viewed as possible harassment of potential respondents [108]. Future research should focus on the ideal number and nature of reminders and specifically, how much is too much.

Researchers must always explore and address the bias associated with non-response. Physicians who responded to our follow up survey (11.8%) displayed similar patterns or characteristics of response across gender and specialty. However, beyond these two characteristics, we were not able to compare or contrast other factors that may have influenced certain physicians to respond versus non-respondents. Kellerman and Herold [93] outline the reasons why responding and non-responding physicians tend to share similar characteristics. Physicians as a group are more homogeneous regarding knowledge, training, and attitudes. However there various factors related to behaviour that may not be as associated with willingness to respond or survey content [93].

In the current study, it is important to recognize that non-respondents may differ from participating physicians in ways we were unable to assess and is noted as a possible response bias issue. The main reason for initial non-response in our study was survey burden, with a lack of time to complete them (60.3%). Physicians commonly acknowledge that too many survey requests and growing constraints on their time limit their ability to participate in multiple,
concurrent survey-based studies [109]. Given the demands on their time, survey topic or salience must be relevant and the survey must present a benefit to physicians in order for them to participate. Studies show physicians are interested in endorsing certain aspects of research where the opportunity to enact quality improvement and contribute to clinical knowledge is evident [110].

It was hypothesized that using personalized email subject headings with the names of key physicians who were supporting the promotion of the survey (i.e. Dr. X is asking for your help) would help bolster participation. As with mail surveys, previous literature indicates using personalized correspondence is apparently associated with higher response rates for electronic surveys [92]. However, this also may have led to response bias in the likelihood of increased participation of physicians in certain specialties (i.e. if the respondent was familiar with the physician who was promoting study). However, a generic subject heading listing the funding body (i.e. xxx funded research project) was also used in cases where the use of an individual physician’s name was not deemed appropriate. The authors feel this bias would not have affected the results in a significant fashion, especially given the low response rate.

It is important to discuss other possible limitations of our study. Firstly, 108 physicians were excluded due to incorrect contact information or unavailable contact information, resulting in possible selection bias. Secondly, there is always the possibility that an email will be identified as “spam mail” when using email as a contact method, possibly further reducing the response rate. Thirdly, we only used one survey mode (i.e. email) which may have limited our response rate. Other limitations included the lack of a comparison group to establish whether our personal survey method enhanced response rates. As there were no controlled groups to compare various interventions that may be associated with improved response rate, it is not possible to
firmly establish definite drivers of the degree of response observed in this study. However, we attempted to explore the different reasons for non-responses among physicians in our survey. Finally, the survey was limited to one large metropolitan city in Canada; thus, the findings may not be generalizable to other geographical locations, or to general practitioners or physicians in training.

3.5 Conclusions

In conclusion, our online survey response rate of 35.0% remains comparable to response rates from previously published physician specialist survey-based studies. The response rate in the current study was likely influenced by the sensitive survey topic, but it is likely that specialties (i.e. pediatrics, neurology and internal medicine) with longstanding APP programs were more likely to respond as they had more experience with billing within that program. Future survey studies are needed to determine the ideal methodology based on survey topics for physician specialists. This study shares some of the challenges and successes of conducting survey research among multiple physician specialties, where advancement in successful survey recruitment methods is necessary.
Table 3.1 Demographic characteristics of survey respondents

<table>
<thead>
<tr>
<th>Physician specialty</th>
<th>Physicians (%) of 312</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery</td>
<td>28.2</td>
</tr>
<tr>
<td>Internal medicine*</td>
<td>44.6</td>
</tr>
<tr>
<td>Paediatrics</td>
<td>18.0</td>
</tr>
<tr>
<td>Psychiatry</td>
<td>9.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age*</th>
<th>Physicians (%) of 312</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-39 years</td>
<td>22.1</td>
</tr>
<tr>
<td>40-59 years</td>
<td>51.0</td>
</tr>
<tr>
<td>More than 59 years</td>
<td>9.6</td>
</tr>
<tr>
<td>Missing data</td>
<td>17.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex*</th>
<th>Physicians (%) of 312</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>55.1</td>
</tr>
<tr>
<td>Female</td>
<td>27.6</td>
</tr>
<tr>
<td>Missing data</td>
<td>17.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length of practice</th>
<th>Physicians (%) of 312</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5 year</td>
<td>18.3</td>
</tr>
<tr>
<td>5-14 years</td>
<td>37.2</td>
</tr>
<tr>
<td>≥15 years</td>
<td>44.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Payment Plan</th>
<th>Physicians (%) of 312</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fee-for-Service</td>
<td>38.1</td>
</tr>
<tr>
<td>Alternative Payment Plan (Part)*</td>
<td>14.1</td>
</tr>
<tr>
<td>Alternative Payment Plan (Full)*</td>
<td>47.7</td>
</tr>
</tbody>
</table>

*Note: Alternative Payment Program (APP), Fee-For-Service Payment Program (FFS), Intensivists and neurology were combined with the internal medicine group
*Age percentage calculated among individuals with non-missing data; 54 individuals (17.3% of total sample) did not provide information.
*Sex percentage calculated among individuals with non-missing data; 54 individuals (17.3% of total sample) did not provide information.
Table 3.2 Characteristics of physician specialists by payment program

<table>
<thead>
<tr>
<th></th>
<th>*FFS (% of 119)</th>
<th>*Part APP (% of 49)</th>
<th>*Full APP (% of 149)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of physicians</td>
<td>38.9</td>
<td>14.1</td>
<td>47.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surgery</td>
<td>Internal medicine</td>
<td>Paediatrics</td>
<td>Psychiatry</td>
</tr>
<tr>
<td></td>
<td>35.3</td>
<td>35.3</td>
<td>20.2</td>
<td>9.2</td>
</tr>
<tr>
<td></td>
<td>27.3</td>
<td>38.6</td>
<td>22.7</td>
<td>11.4</td>
</tr>
<tr>
<td></td>
<td>22.8</td>
<td>54.0</td>
<td>14.8</td>
<td>8.7</td>
</tr>
<tr>
<td>Age*</td>
<td>30-39 years</td>
<td>40-59 years</td>
<td>More than 59 years</td>
<td>Missing data</td>
</tr>
<tr>
<td></td>
<td>22.7</td>
<td>46.2</td>
<td>9.2</td>
<td>21.8</td>
</tr>
<tr>
<td></td>
<td>15.9</td>
<td>63.3</td>
<td>2.2</td>
<td>18.2</td>
</tr>
<tr>
<td></td>
<td>23.5</td>
<td>51.0</td>
<td>12.1</td>
<td>13.4</td>
</tr>
<tr>
<td></td>
<td>0.174</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex*</td>
<td>Male</td>
<td>Female</td>
<td>Missing data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>59.7</td>
<td>18.5</td>
<td>21.8</td>
<td>54.5</td>
</tr>
<tr>
<td></td>
<td>54.5</td>
<td>27.3</td>
<td>18.2</td>
<td>51.7</td>
</tr>
<tr>
<td></td>
<td>51.7</td>
<td>34.9</td>
<td>13.4</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Length of practice</td>
<td>&lt;5 year</td>
<td>5-14 years</td>
<td>\geq 15 years</td>
<td></td>
</tr>
<tr>
<td></td>
<td>37.0</td>
<td>16.0</td>
<td>47.0</td>
<td>38.6</td>
</tr>
<tr>
<td></td>
<td>38.6</td>
<td>11.4</td>
<td>50.0</td>
<td>36.9</td>
</tr>
<tr>
<td></td>
<td>22.1</td>
<td>41.0</td>
<td>41.0</td>
<td>0.456</td>
</tr>
</tbody>
</table>

*Note: Alternative Payment Program (APP), Fee-For-Service Payment Program (FFS),
*Age percentage calculated among individuals with non-missing data; 54 individuals (17.3\% of total sample) did not provide information.
* Sex percentage calculated among individuals with non-missing data; 54 individuals (17.3\% of total sample) did not provide information.
Table 3.3 Shadow billing survey response rates per medical specialty

<table>
<thead>
<tr>
<th>Medical Specialty</th>
<th>Internal Medicine</th>
<th>Neurology/Neurosurgery</th>
<th>Pediatrics</th>
<th>Psychiatry</th>
<th>General Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total ( n = 324 ) N (%)</td>
<td>Total ( n = 58 ) N (%)</td>
<td>Total ( n = 171 ) N (%)</td>
<td>Total ( n = 118 ) N (%)</td>
<td>Total ( n = 233 ) N (%)</td>
</tr>
<tr>
<td><strong>Response rate after 1(^{st}) email follow up (1 week)</strong></td>
<td>109 (33.6%)</td>
<td>20 (34.5%)</td>
<td>12 (7.0%)</td>
<td>9 (7.6%)</td>
<td>31 (13.3%)</td>
</tr>
<tr>
<td><strong>Response rate after 2(^{nd}) follow up (3-4 week)</strong></td>
<td>134 (41.4%)</td>
<td>25 (43.1%)</td>
<td>50 (29.2%)</td>
<td>22 (18.6%)</td>
<td>66 (28.3%)</td>
</tr>
<tr>
<td><strong>Total response rate (%)</strong></td>
<td>139 (42.9%)</td>
<td>27 (46.6%)</td>
<td>50 (29.2%)</td>
<td>32 (27.1%)</td>
<td>69 (29.6%)</td>
</tr>
</tbody>
</table>

*Overall response rate was 35.0% (317/904), total response rate (%) row is a result of additive responses from first and second email follow up reminders.*
Chapter Four: EFFECT OF PHYSICIAN SPECIALIST ALTERNATIVE PLANS ON ADMINISTRATIVE DATA IN CALGARY: A VALIDATION STUDY

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Carolyn DeCoster PhD, RN, Data Integration, Measurement and Reporting, Alberta Health Services, Calgary, Alberta,
Objective: To determine the proportion of claims submitted by physician specialists using FFS and APP, and to identify and compare the validity of information coded in physician billing claims submitted by these specialists in Calgary.
4.1 Abstract

**Background:** There are concerns that physician alternative payment plan (APP) programs may be associated with erosion of data quality, given that physicians are paid regardless of whether claims are submitted. Our objective was to determine the proportion of claims submitted by physician specialists using fee-for-service (FFS) and APP, and to examine the validity of information coded in physician billing claims submitted by these specialists in Calgary.

**Methods:** We conducted a survey of physician specialists to determine their payment plan status and obtained consent to use their physician claims data from 4 acute care hospitals in Calgary. Inpatient and emergency department services were identified from the Discharge Abstract Database for Alberta (Canadian Institute for Health Information) and the Alberta Ambulatory Care Classification System database. We linked services to claims by Alberta physicians from 2002 to 2009 by using unique patient and physician identifiers. After identifying the proportion of claims submitted, we reviewed inpatient charts to determine the completeness of submissions as defined by positive predictive value.

**Results:** Of 182 physicians who responded to the survey, 94 (51.6%) were on an FFS plan exclusively while 51 (28.0%) were on an APP plan exclusively. Overall completeness of physician submissions for claims was 91.8% for FFS physicians and 90.0% for APP physicians. Submission proportions varied by medical specialty (surgery: 92.4% for FFS v. 88.6% for APP; internal medicine: 94.1% v. 91.3%);
neurology: 95.1% v. 91.0%; and pediatrics: 95.1% v. 89.3%). Among claims submitted, the positive predictive values for medical conditions were 87.8% for FFS and 85.0% for alternative payment.

Conclusions: Overall submission rates and accuracy in recording diagnoses by physicians who used both plans were 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. These findings show that the implementation of APP in Alberta may not have had an impact on the quality of physician claims data.
4.2 Methods

4.2.1 Setting

We recruited alternative payment (APP) and fee-for-service (FFS) physician specialists from a broad range of specialties (see below) practicing at four adult and pediatric acute care hospitals in Calgary, Canada between January 1, 2002 and December 31, 2009. To generate a baseline sample, an online survey of Calgary physicians was conducted to determine physician APP, FFS and blended status and to obtain consent to use their claims data (see Chapter Three). We extracted claims submitted by each consenting physician to determine rates of submissions and validated the claims diagnoses through clinical chart review (see statistical methods for more details regarding validation).

4.2.2 Outcomes and sources of data

Administrative data from the DAD and the Ambulatory Care Classification System (ACCS) were linked with the physician survey using physicians’ unique identifiers. In Canada, the DAD and inpatient emergency department data are coded using a rigorous and standardized system. This is because coding professionals already have a rich international system of coding standards and education; therefore, the DAD is thought to have high-quality and valid health data [16]. These data are not impacted by physician payment programs. A study evaluating physician claims data found high face validity; however, further validation work is still needed to assess provincial variation in the quality of these data [4]. We extracted all services provided by these physicians as the most responsible physicians from January 1, 2002 to Dec 31, 2009. The linked records formed the denominator (i.e. ‘standard reference’; number of services provided by physicians). It is important to note, some of the medical specialities did not join an APP until 2003-2004 (e.g. internal medicine).
We verified the physicians’ unique identifiers within the Alberta Health Care Insurance Plan Physician Claims Database and then linked the extracted DAD and ACCS services to Alberta physician claims from January 1, 2002 to May 31, 2009 using unique patient identifiers (i.e. Personal Health Number), service location, service date and PRAC ID to identify the numerator (i.e. total number of services claimed by physicians). In Canada, every citizen is covered by universal health care coverage whether or not they can afford health care. The insurance registry, which is updated regularly, contains the name, date of birth, and postal code for all individuals eligible to receive health care services and is considered a proxy for census data. It is considered highly valid.

4.2.3 Chart review

A total of 55 physicians were randomly chosen (24 FFS, 31 APP) for this chart review. Random numbers were assigned to each claim within the dataset. The claims were then sorted by this random number in ascending order. We selected the first 10-19 sorted claims from each stratum, resulting in a total of 1115 claims.

Corresponding inpatient charts for the sampled claims were located using a combination of the hospital ID, patient chart number, personal health number, admission date and physician PRAC ID. Outpatient charts were not reviewed due to the complexity of the outpatient setting and clerical difficulties in obtaining patient charts in these settings. Two chart reviewers underwent training in the data extraction process. In the training session, the definition of study variables was discussed and 20 charts were reviewed by both reviewers together to identify any issues with interpretation of coding or medical terminology. A sample of 30 charts was then reviewed independently by both reviewers for consensus agreement. Reviewers agreed upon 29 of the 30 charts on diagnoses (97% agreement).
Finally, the reviewers extracted data independently for evidence of the diagnoses submitted in physician claims through an examination of the entire chart up to the date of the claim (i.e. medical service date). Administrative data are typically coded using the International Classification of Disease (ICD). In physician claims, diagnoses during the study period were coded using the ICD-9, Alberta modification. The physician claims database contains up to three diagnoses. However, about 95% claims records contain only one diagnosis. Thus we verified the diagnosis coded in the first coding field. Reviewers recorded the diagnosis and extracted additional medical notes from the chart and then determined whether there was a match in the chart review and the ICD-9 diagnosis in the physician claims data.

4.2.4 Statistical analysis

The unit of analysis was the “physician service” provided by physicians who participated in the survey and who consented to data linkage. Descriptive statistics were used to report physician characteristics, submission rate (proportion) and validity of the claims diagnosis by payment status, type of service, and medical specialty. Chi-square tests (p-value <0.05) were used to assess differences between three payment plans.

To calculate the claims submission rate, the number of services claimed by physicians was divided by that of services provided by physicians. The positive predictive value (PPV) for ICD-9 diagnosis submitted by physicians was calculated accepting the chart review data as a ‘reference standard’. PPV determines the extent to which a diagnosis present in the ICD-9 claims data was also present in the chart review data. The PPV was used to assess the overall validity of the chart review data compared to the ICD-9 claims data.
4.3 Results

Of 904 physicians surveyed, 317 consented to have their medical services linked to their claims data (35% response rate). Of the 317 consenting physicians, 38.1% were on a FFS plan, 14.1% were part of an APP and 47.8% were only on an APP. From these 317 physicians, 182 unique physicians PRAC IDs were linked with DAD and ACCS. We were only able to link 182 out of the 317 unique PRAC IDs likely because a wrong or inaccurate PRAC ID was provided by physicians in the original survey. Of the 182 physicians whose data were linked, 51 were APP physicians, 94 were FFS physicians and 37 were on a blended model.

Of the FFS physicians, 77.9% were male; 57.4% were age 40-59 and 44.1% practiced ≥15 years (see Table 4-1). Of the APP physicians, 61.4% were male; 40.9% had practiced for 5-14 years and 67.1% specialized in internal medicine.

We analysed 149,380 services provided by 182 physicians (see Table 4-2). The overall submission claims rate was 90.0% for APP physicians, 95.6% for blended and 91.8% for FFS physicians. For FFS physicians, psychiatry (97.0%) had the highest submission rate followed by neurology/neurosurgery (95.1%), paediatrics (95.1%), internal medicine (94.1%), and surgery (92.4%). For APP physicians, the submission rate varied by specialty from a high of 91.3% for internal medicine and a low of 88.6% for surgery. For APP physicians, the proportion of submitted claims was significantly higher when an incentive was provided (93.6% vs. 89.4%, p-value <0.001). 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% before the change to alternative payment to 90.1% after changing to alternative payment (Table 4-3).

Of the 1115 charts requested for review, 849 were included, 447 (52.6%) for FFS physicians and 402 (47.3%) for APP physicians (Table 4-4). 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%) with a statistically significant difference (p-value <0.001).

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%).

4.4 Discussion

4.4.1 Main findings

We analysed physician claims submitted by Alberta specialists for inpatient and emergency department services and found that in Alberta APP physician specialists submitted statistically fewer medical service claims than FFS physician specialists; however the vast majority of claims were submitted in both groups and the accuracy of diagnostic coding of these claims was also high. In Canada, hospital and emergency discharge abstract administrative data are coded by professional health record coders. These data are not impacted by physician payment programs. However, physician claims are coded by physicians themselves or billing clerks who are not professional coders.

In this study, a slight decrease in the overall rate of submission after APP implementation was found 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 during the time period studied. As such, our study provides evidence to support the ongoing use of specialist physician claims data for disease surveillance, to determine allocation of health care funds, to track service volume and to assess and monitor patient outcomes.

We found that overall submission rates across payment programs were high, and that the difference between FFS and APP physicians was only about 2% (APP: 90% vs. FFS: 91.8%). When restricting our sample to APP physicians only and looking at pre and post APP submission rates, there was a slight but statistically significant decrease in frequency of submission (Pre-APP: 95.6% vs Post-APP: 90.1%).

We assumed that submission rates would be close to 100% for FFS physicians, however, rates were closer to 90%. Potential explanations that could account for missing billing submissions include physicians or administrative staff forgetting to submit a claim, rejected claims and inaccurate data linkage. Additionally, since the majority of Albertans (i.e. 80%) [111] visit family doctors or general practitioners (GP) who are on FFS plans as opposed to physician specialists on APPs, the impact of non-submission of claims from APP physician specialists may have little impact on chronic disease surveillance (i.e. missing diagnosis from APP specialists could be captured by GP claims).

The use of alternate care providers may offer an explanation in the APP pre-post difference in billing submissions. Alternative payment schemes often reinforce the use of alternative team members, or other allied health care professionals in addition to the most responsible provider. This allows for more comprehensive care, better access and continuity of
care under the model. This may also in part explain the decrease in billing claims from the APP specialists, thus enabling another pathway of care (i.e. nurse practitioner).

4.4.2 Comparison with other studies

Many provincial APP programs based at teaching hospitals utilize incentive-based programs to motivate physicians to submit billings. Our results suggest that such incentives may be effective. For example in some divisions or departments in Ontario and Alberta, APP physicians who do not submit the recommended quota of shadow billings based on their expected patient workload annually face a potential withholding (e.g. 15%) of their yearly earnings [68, 81]. This is also determined by internally reviewing physicians’ shadow billing submissions for the year compared to other physicians within their specialty with a similar expected workload [112]. Similarly, in Nova Scotia, to ensure complete and accurate submission of shadow billing information, the value of shadow billing data is periodically compared to total payments under the physician’s APP contract [112]. Unfortunately, departmental or provincial incentives have not really been carefully evaluated to date [80].

Our findings imply that shadow billing policies appear to be effective at improving claim submission rates. APP physicians who were aware of departmental incentives had a higher rate of claims submissions (93.6%) compared to APP physicians who were unaware of departmental incentives (89.4%). As such, our study supports the monitoring of shadow billing incentive programs to preserve the overall quality of physician claims data.

4.4.3 Limitations

Our study has several limitations. Firstly, we only surveyed physician specialists and did not survey GPs as the majority of GPs in Alberta are on FFS programs. Therefore, our findings
may not be generalizable to GPs in Alberta or other Canadian provinces. Another limitation is the limited response rate to our survey that only represented approximately 50% of physician billing data. Thus our findings are limited to a smaller pool of physician claims data and may not be generalizable to all physician claims data given the inherent bias of the sample (i.e. small, physician specialists). Secondly, we focused on inpatient and emergency room claims records and did not analyze outpatient records. Private or outpatient clinic physicians may display different billing behaviors. Thirdly, we only calculated PPV and did not report other estimates, including sensitivity, specificity and negative predictive value. We also did not assess predictors of non-submission due to a lack of statistical power. Prediction models to identify physicians who are less likely to submit shadow claims should be developed in the future. The models would be helpful to promote billing claim submissions among targeted physicians. Additionally, it is important to note that in this case, the PPV does not necessarily reflect the patient actually having the disease in question. It shows the proportion of services provided by physicians that was billed. Fourthly, we surveyed urban area physicians, not rural based physicians. However, only a small proportion of specialists are practicing in rural areas. Finally, the results may not be applicable to countries with different health care systems or different physician remuneration models.

4.4.4 Conclusions and implications for practice and future research

The findings from this study offer exploratory insight into one of the largest and richest sources of Canadian administrative health data. Our analyses show for our specific sample frame, the overall claims submission rates for both APP and FFS physician specialists are high, as is the validity of diagnostic coding. These findings suggest that contrary to popular beliefs, the implementation of APP physician payment programs in Alberta may not have as much of an
impact on the frequency of physician claims submitted. Since Alberta uses shadow billing incentive programs, future research is needed to determine whether incentive programs should be considered in other provinces or nationally for ongoing use of physician claims data. Additionally, there should be ongoing vigilance with respect to completeness and frequency of physician claims submitted, regardless of physician payment systems.
Table 4.1 Characteristics of physicians involved in the survey, by payment programs

<table>
<thead>
<tr>
<th>Proportion of physicians</th>
<th>*FFS (% of 94)</th>
<th>*Blended (% of 37)</th>
<th>*APP (% of 51)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of physicians</td>
<td>51.6</td>
<td>20.3</td>
<td>28.0</td>
<td></td>
</tr>
</tbody>
</table>

**Physician specialty**

<table>
<thead>
<tr>
<th>Specialty</th>
<th>*FFS (%)</th>
<th>*Blended (%)</th>
<th>*APP (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery</td>
<td>36 (38.2)</td>
<td>(10) 27</td>
<td>6 (11.8)</td>
<td></td>
</tr>
<tr>
<td>Internal medicine</td>
<td>22 (22.3)</td>
<td>(9) 24.3</td>
<td>34 (66.7)</td>
<td></td>
</tr>
<tr>
<td>Neurology/Neurosurgery</td>
<td>-</td>
<td>(2) 5.4</td>
<td>1 (2.0)</td>
<td></td>
</tr>
<tr>
<td>Paediatrics</td>
<td>7 (7.4)</td>
<td>(7) 18.9</td>
<td>9 (17.6)</td>
<td></td>
</tr>
<tr>
<td>Psychiatry</td>
<td>19 (20.2)</td>
<td>(5) 13.5</td>
<td>-</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Others</td>
<td>11 (11.7)</td>
<td>(4) 10.8</td>
<td>1 (2.0)</td>
<td></td>
</tr>
</tbody>
</table>

**Are you obligated or recommended to shadow bill?**

<table>
<thead>
<tr>
<th>Obligation</th>
<th>*FFS (%)</th>
<th>*Blended (%)</th>
<th>*APP (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes obligated</td>
<td>-</td>
<td>23 (62.2)</td>
<td>48 (94.1)</td>
<td></td>
</tr>
<tr>
<td>Yes, it is recommended</td>
<td>-</td>
<td>1 (2.7)</td>
<td>2 (3.9)</td>
<td></td>
</tr>
<tr>
<td>No/Unsure</td>
<td>-</td>
<td>13 (35.1)</td>
<td>1 (2.0)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**If your program or department has an APP, does it use any type of incentives to promote the use of shadow billing?**

<table>
<thead>
<tr>
<th>Incentive Type</th>
<th>*FFS (%)</th>
<th>*Blended (%)</th>
<th>*APP (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>-</td>
<td>3 (8.1)</td>
<td>7 (13.7)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>-</td>
<td>27 (73.0)</td>
<td>39 (76.5)</td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>-</td>
<td>7 (18.9)</td>
<td>5 (9.8)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**Age**

<table>
<thead>
<tr>
<th>Age Category</th>
<th>*FFS (%)</th>
<th>*Blended (%)</th>
<th>*APP (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-39 years</td>
<td>29 (30.8)</td>
<td>10 (27.0)</td>
<td>14 (27.4)</td>
<td></td>
</tr>
<tr>
<td>40-59 years</td>
<td>54 (57.4)</td>
<td>27 (73.0)</td>
<td>31 (60.8)</td>
<td></td>
</tr>
<tr>
<td>≥59 years</td>
<td>11 (11.7)</td>
<td>0.0</td>
<td>6 (11.8)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**Sex**

<table>
<thead>
<tr>
<th>Sex Category</th>
<th>*FFS (%)</th>
<th>*Blended (%)</th>
<th>*APP (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>73 (77.3)</td>
<td>28 (75.7)</td>
<td>31 (60.8)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>21 (22.3)</td>
<td>9 (24.3)</td>
<td>20 (39.2)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**Length of time in practice**

<table>
<thead>
<tr>
<th>Practice Category</th>
<th>*FFS (%)</th>
<th>*Blended (%)</th>
<th>*APP (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5 year</td>
<td>14 (15.0)</td>
<td>7 (18.9)</td>
<td>10 (19.6)</td>
<td></td>
</tr>
<tr>
<td>5-14 years</td>
<td>39 (41.5)</td>
<td>13 (35.1)</td>
<td>21 (41.2)</td>
<td></td>
</tr>
<tr>
<td>≥15 years</td>
<td>42 (44.7)</td>
<td>17 (46.0)</td>
<td>20 (30.9)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Note: Alternative Payment Program (APP), Fee-For-Service Payment Program (FFS), Blended (FFS and APP)
<table>
<thead>
<tr>
<th>Table 4.2 Physician submission claims rate (services claimed/services provided) by payment plan type</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>FFS</em> No. of services provided</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Overall claims</td>
</tr>
<tr>
<td>Physician Specialty</td>
</tr>
<tr>
<td>Surgery</td>
</tr>
<tr>
<td>Internal medicine</td>
</tr>
<tr>
<td>Neurology/Neurosurgery</td>
</tr>
<tr>
<td>Paediatrics</td>
</tr>
<tr>
<td>Psychiatry</td>
</tr>
<tr>
<td>Others</td>
</tr>
<tr>
<td>Are you obligated or recommended to shadow bill?</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>If your program or department has an APP, does it use any type of incentives to promote the use of shadow billing?</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Physician Age</td>
</tr>
<tr>
<td>&lt;40</td>
</tr>
<tr>
<td>40-59</td>
</tr>
<tr>
<td>≥60</td>
</tr>
<tr>
<td>Sex</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Length of time in practice</td>
</tr>
<tr>
<td>&lt;5 year</td>
</tr>
<tr>
<td>5-14</td>
</tr>
<tr>
<td>≥15</td>
</tr>
</tbody>
</table>

*Note: Alternative Payment Program (APP), Fee-For-Service Payment Program (FFS), Blended (FFS and APP)*
Table 4.3 Submission claims rate for services provided by physicians whose payment program changed from FFS to an alternative payment plan (APP)

<table>
<thead>
<tr>
<th>Physician specialty</th>
<th>*Pre-APP N (%)</th>
<th>*Post-APP N (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of services provided</td>
<td>No. of services claimed (claims rate)</td>
<td>No. of services provided</td>
</tr>
<tr>
<td>Overall claims</td>
<td>20093 (95.6)</td>
<td>19 209</td>
<td>13040 (90.1)</td>
</tr>
<tr>
<td>Surgery</td>
<td>3313 (95.0)</td>
<td>3148</td>
<td>1243 (93.9)</td>
</tr>
<tr>
<td>Internal medicine</td>
<td>3997 (94.2)</td>
<td>3766</td>
<td>5400 (90.0)</td>
</tr>
<tr>
<td>Neurology/Neurosurgery</td>
<td>166 (96.0)</td>
<td>159</td>
<td>24 (96.0)</td>
</tr>
<tr>
<td>Paediatrics</td>
<td>12617 (96.3)</td>
<td>12 150</td>
<td>6373 (89.4)</td>
</tr>
</tbody>
</table>

*Note: Alternative Payment Program (APP), Fee-For-Service Payment Program (FFS)*
Table 4.4 Comparison of physician-submitted claims with diagnoses recorded on patient charts (n=849), by positive predictive value (PPV)

<table>
<thead>
<tr>
<th>Number of claims</th>
<th>*Claims filled out by FFS physicians n=447</th>
<th>*Claims filled out by APP physicians n=402</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of claims submitted</td>
<td>PPV %</td>
<td>No. of claims submitted</td>
</tr>
<tr>
<td>Overall</td>
<td>389</td>
<td>87.0%</td>
<td>345</td>
</tr>
<tr>
<td>Physician specialty</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgery</td>
<td>240</td>
<td>90.0%</td>
<td>11</td>
</tr>
<tr>
<td>Internal medicine</td>
<td>91</td>
<td>76.5%</td>
<td>176</td>
</tr>
<tr>
<td>Neurology/Neurosurgery</td>
<td>--</td>
<td>--</td>
<td>82</td>
</tr>
<tr>
<td>Paediatrics</td>
<td>28</td>
<td>82.4%</td>
<td>76</td>
</tr>
<tr>
<td>Psychiatry</td>
<td>30</td>
<td>100%</td>
<td>--</td>
</tr>
</tbody>
</table>

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

* We did not report PPV for other specialties, such as ICU physicians, hospitalists and psychiatrists
Chapter Five: IMPACTS OF ALTERNATIVE PAYMENT PLAN BILLING CLAIMS ON HYPERTENSION PREVALENCE, MORTALITY AND CARDIOVASCULAR DISEASE HOSPITALIZATION ESTIMATES IN ALBERTA, CANADA

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Tom Noseworthy MD, FRCPC, Department of Community Health Sciences, University of Calgary, Calgary, Alberta, Canada

Carolyn DeCoster PhD, RN, Data Integration, Measurement and Reporting, Alberta Health Services, Calgary, Alberta, Canada

Norman R Campbell MD, FRCPC, Department of Community Health Sciences, University of Calgary, Calgary, Alberta, Canada

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Hude Quan MD, PhD, Department of Community Health Sciences, University of Calgary, Calgary, Alberta, Canada

Objective: To examine the impact of APPs on hypertension prevalence, cardiovascular disease hospitalization and mortality in Alberta if physicians do not submit shadow billing
5.1 Abstract

*Background:* In Canada, physician claims data are often used for surveillance of chronic conditions such as hypertension. Fee-for-service (FFS) physicians submit claims in order to be paid whereas physicians on alternative payment plans (APP) receive payment even if they do not submit a billing claim. There are concerns nationally that APPs are associated with decreased billing claims submission resulting in suboptimal data quality. We examined the impact of APPs on hypertension prevalence, mortality and cardiovascular (CVD) disease estimates in Alberta.

*Methods:* The following administrative databases were used for this study: Alberta Health Care Insurance Plan registry; discharge abstract data; physician claims and; vital statistics. Patients with hypertension (>20 years) between April 1, 2004 and March 31, 2009 were defined based on a validated algorithm. Hypertension cases were stratified into FFS and APP billings. Descriptive statistics, all-cause mortality and CVD-related hospitalizations were reported for both the FFS and APP groups.

*Results:* In total, 613,844 adult hypertensive cases were identified using the validated case definition. The majority of hypertension cases (99.4%) were identified using FFS billings. Among FFS, overall hypertension prevalence was 22.2% and the effect of APP billing estimates (0.13%) on hypertension prevalence was small. All-cause mortality (33.8/per 1000 person years, 95% CI 33.6-34) was higher for FFS than APP billings (19.0/per 1000 person years, 95% CI 16.6-21.8). A similar pattern was seen for CVD admissions.

*Conclusions:* The impact of non-submission of APP claims (i.e. shadow billings) on disease estimates and outcomes appear to be minor during the study periods examined, however
variations in mortality and cardiovascular hospitalization rates warrant further investigation with updated data.
5.2 Methods

5.2.1 Data sources

The following health administrative databases from Alberta, Canada were used in this study: 1) Alberta Health Care Insurance Plan registry, which is updated regularly, contains name, date of birth, sex, and postal code for all individuals eligible to receive health care services, and is considered a proxy for census data; 2) Discharge Abstract Database (DAD); 3) Physician claims database which contains billing information (i.e. shadow billing flag) that includes a unique patient identifier, a unique physician identifier, up to 3 International Classification of Disease (ICD) ICD-9 diagnosis codes, 1 procedure code, provider specialty and function centre type indicating where the service was provided and; 4) Vital Statistics database includes information on demographic characteristics, date of death and causes of death.

5.2.2 Study population

Patients were included if they had hypertension and were aged 20 years and older between April 1, 2004 and March 31, 2009 (fiscal years 2004 to 2009) in Alberta, Canada. Hypertension cases were identified using a validated case definition: ICD-9 codes (401.x, 402.x, 403.x, 404.x, or 405.x) and ICD-10 codes (I10.x, I11.x, I12.x, I13.x or I15.x) [20, 56]. This case definition has a sensitivity of 75%, specificity of 94%, positive predictive value (PPV) of 81%, and negative predictive value (NPV) of 92% [20, 56]. The first date of hospital admission or physician service for hypertension in the study period was assigned to each patient as the
diagnosis date. We excluded patients who were non-Alberta residents, were less than 20 years of age or had gestational hypertension.

5.3 *Defining cases for alternative payment plans (APP shadow billing) and FFS*

All records in the physician claims data were stratified using the “shadow billing” flag/indicator that is recorded in the administrative database. We defined hypertension cases using shadow billing claims only (APP group) and then using fee-for-service (FFS) claims separately (FFS-group, see Figure 5-1). For patients who were present in both groups, we classified them in the FFS group.

5.3.1 *Study variables*

The age and sex at the date of hypertension diagnosis was generated using health registry data. A measure of socioeconomic status and income quintile was assigned using 2001 Statistics Canada Census data. Specifically, median household income for each Census dissemination area, the smallest geographic unit for which Census data are released, was linked to each patient’s postal code assigned using the Statistics Canada Postal Code Conversion file. Rural and urban status was also defined using census data. The Charlson comorbidities [113] were derived from the DAD and physician claims database in the year prior to the hypertension diagnosis using a validated algorithm. Development of cardiovascular disease (CVD) events was defined as the occurrence of hospitalization for myocardial infarction, heart failure or stroke, using DAD and a validated ICD coding algorithm [113]. Time to death after hypertension diagnosis was assessed from vital statistics data.
5.3.2 Statistical analysis

Descriptive statistics for age group, sex, income quintile, rural/urban geographical location, death status and comorbidities were reported and Chi-square tests (p-value < 0.05) were used to test differences between FFS and APP groups.

We calculated annual prevalence of hypertension for 5 years (fiscal years 2004/05 to 2008/09) using the population registered in the provincial health registry aged more than 20 years old as the denominator and defined hypertension cases (i.e. date of diagnosis) per year as the numerator, and hypertension prevalence was compared between FFS and APP groups. Those who died or moved out of province at the time of the study time frame were censored from the prevalence calculation. The all-cause mortality and CVD admission rates (per 1000 person-years) among those diagnosed with hypertension were calculated with 95% confidence intervals for FFS and APP groups. All statistical analyses were conducted using SAS (Version 9.4).

5.4 Results

A total of 613,844 adults with hypertension were included in the 5-year study period (see Table 5-1). The majority of patients (99.4%, n=610,167) were identified through FFS claims, with only a minor portion of patients (0.6%, n=3677) captured solely from APP claims.

Hypertension prevalence for patients captured with FFS claims was 22.2% (n=610167) compared to solely APP claims (0.13%, n=3677) (see Table 5-2). For the FFS group, prevalence was slightly higher among females (22.7%) than among males (21.8%) and increased with age (36.9% in ages 55 to 65, 62.0% in ages 65 to 75 and 71.9% in those aged greater than 75 years).

In 2004, hypertension prevalence among FFS claims was 13.4% compared to 0.07% for APP claims (see Table 5-3). The prevalence in the FFS group increased annually starting at
13.4% in 2004, 17.0% in 2006 and 19.3% in 2009. In the APP claims, hypertension prevalence increased from 0.07% in 2004, to 0.09% in 2006 and 0.13% in 2009.

All-cause mortality (33.8/1000 person years, 95%CI: 33.6-34) and CVD admissions (40.6/1000 person years, 95%CI: 40.4-40.9) in the FFS group were higher than that in the APP group (mortality 19.0/1000 person years, 95%CI: 16.6-21.8 and CVD 8.0/1000 person years, 95%CI: 6.4-9.8) (see Table 5-4). This difference, higher mortality and CVD admission rates among FFS claims versus APP cases was consistent across sex, income, comorbidities, geographical location, except for age (the rate of mortality in patients aged 75 and greater:
163.8/1000 person years, 95%CI: 132.4-202.6 in APP group vs. 95.1/1000 person years, 95%CI: 94.3-96 for FFS group).

5.5 Discussion

We analysed claims submitted by Alberta physicians for services in a defined cohort of hypertensive patients and found a very small percentage of hypertension cases (0.60%) were identified only using APP claims (i.e. shadow billings). These findings indicate that the impact of shadow billing on disease estimates for hypertension at this time would be minor if APP physicians did not submit shadow billings in Alberta, though this could change as more and more physicians join APPs in the future. However, the frequency of hypertension outcomes examined (i.e. mortality and CVD hospitalization rates) was significantly higher among the FFS group than the APP group.

The primary reason there was a lower amount of APP (i.e. shadow billings) encounters identified is likely that patients who have hypertension are mostly followed by family medicine practitioners or general practitioners (GP) [114]. Additionally, the majority of these physicians were on a FFS plan during our study period in Alberta. Close to 80% of patients [111] visit their
GP at least once a year and GPs are the ones who primarily manage hypertension [115]. Thus the impact of non-submission of claims from APP physician specialists had little impact on hypertension disease surveillance during the study period analysed [4, 116].

Importantly, we also found that the prevalence of hypertension among both FFS and APP groups is increasing annually and with age, and was associated with geographical location such as living in rural areas. Our findings are consistent with a number of earlier studies [111, 117-119]. For example, a prior study found that the overall prevalence of hypertension in Canada from 1998 to 2008 was high and increasing, with a reported prevalence in Western Canada in 2008 at 19.6% [120]. Our study shows a very similar prevalence of hypertension in 2009 (i.e. 19.3%) in the FFS group, reinforcing our conclusions that in Alberta the impact of non-submissions from APP physicians is minimal and may not impact our ability to track and monitor chronic diseases such as hypertension defined using physician claims data.

Alternatively, our study found that estimates of mortality and CVD related mortality may be affected by APP claims. We defined hypertension using the DAD and physician claims. Inpatients are likely sicker than outpatients. Since DAD data are collected by professional coders, they are not at risk to be impacted by changes in billing frequency due to implementation of new physician payment plans such as physician claims data are. Hypertension cases defined by the DAD were classified into the FFS group. As such, hypertensive patients who were seen by APP specialists (such as APP physicians in internal medicine, surgery, neurology) during their hospitalization were captured by the DAD and grouped within the FFS claims group. Only claims identified from physician claims data as solely APP (n1= APP, see Figure 5-1) would have been categorized as such. Therefore, the FFS group (n2=n3=n4=FFS) were likely sicker and had poorer outcomes than the APP group in our study.
Our findings mirror Canadian data showing that certain subgroups of hypertensive patients are more likely to be at risk of dying due to various factors. For example, individuals at higher risk of mortality or CVD related mortality include those who are older (i.e. 75 and greater), lower socioeconomic status and have CVD related comorbidities [111, 120, 121]. We hypothesized that the reason for the higher mortality rates among the APP claims for patients aged 65 and 75 years is that this group may be more likely to be admitted to hospitals where they are more likely to be seen by APP specialist physicians.

During the time period analysed (fiscal years 2004-2009), our study shows that data loss associated with non-submission of shadow billings was minimal (similar prevalence rate to recorded prevalence rate for Alberta) and did not appear to influence the overall completeness of claims being submitted in Alberta. Our study provides evidence for the ongoing use of Alberta physician claims for disease surveillance, however further exploration of these data is necessary, particularly in regards to the assessment of outcomes.

Alberta is one of several Canadian provinces that require APP physicians to submit shadow bills to account for the services they provide [4, 78, 82]. This may help explain why there is limited data loss (i.e. lost shadow billings) with the implementation of APPs. Shadow billing incentive-based programs may affect the completeness of claims submitted by APP physicians. However, we suspect there is a large amount of variation across provinces with regard to monitoring and evaluation of shadow billing submissions within physician claims data. Furthermore, given that we analysed 5 years of data (fiscal years 2004-2009), it is likely that the findings may differ now that the majority of APP programs in Alberta have been in effect for over a decade. This highlights the need for updated data in order to examine the current influence of APP programs on physician billings in Alberta.
The difficulty in establishing whether a physician was on an APP plan was a significant challenge in this study using the current methodology. The time frame in which the datasets were analysed was during the initial implementation of APPs in Alberta and there was a lack of consistency in how APP physicians were “tagged” or captured in physician claims data. Alberta Health put into place an “S” designation for those shadow billing, however the uptake on this variable was not validated in the early 2000s. Thus in order to try and establish a methodology that captured those APP physicians, though not ideal, we grouped physicians based on the “S” flag that we felt would fit APP billing patterns.

Our study has several limitations. Firstly, our analysis is limited to Alberta physician claims data and therefore may not be generalizable to other Canadian provinces given there is variation across provinces and territories in shadow billings and in the proportion of APP physicians by speciality. Secondly, we were not able to quantify the amount of non-submissions from APP physicians (i.e. if physicians did not submit their shadow billings) and thus cannot validate this loss of clinical information or the accuracy of the shadow billing in physician claims data. Thirdly, these findings may not be generalizable to acute conditions that are not managed primarily by GPs such as myocardial infarction. Fourthly, an analysis of more recent data (i.e. 2009-2015) needs to be conducted, especially given the rapid growth of APP programs in Alberta and in Canada. Finally, we were unable to look at variations across or within specialties as this is not a data feature available within the dataset we examined. Future research may examine how physician characteristics influence billing submissions.

5.6 Conclusions

Our analyses found that a limited number of hypertension claims submitted were identified only using APP, shadow billing claims (i.e. possible claims from APP physicians).
With such a small portion of claims that are submitted as “shadow billings” in Alberta, Canada, during the study time period, the likelihood of significant data loss due to non-submission of claims is relatively minor and for hypertension disease surveillance purposes, likely insignificant. However, new methods to validate APP status and shadow billing among physician claims data in Alberta is crucial. Updated data analysis on acute conditions and development of statistical methods to adjust for under-estimates of chronic diseases are necessary to adequately understand the effects of APP programs on administrative data.
Table 5.1 Demographics of hypertension cohort grouped by FFS or APP claims in Alberta, Canada (2004-2009)*

<table>
<thead>
<tr>
<th>Group</th>
<th>APP only</th>
<th></th>
<th>FFS only</th>
<th></th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N of patients</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Total</td>
<td>613844</td>
<td>3677</td>
<td>0.60</td>
<td>610167</td>
<td>99.40</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>299002</td>
<td>1880</td>
<td>0.63</td>
<td>297122</td>
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</tr>
<tr>
<td>F</td>
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<td>1797</td>
<td>0.57</td>
<td>313045</td>
<td>99.43</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;35</td>
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<td>235</td>
<td>1.17</td>
<td>19915</td>
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</tr>
<tr>
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<tr>
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<td>918</td>
<td>0.73</td>
<td>124954</td>
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<tr>
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<td>147587</td>
<td>948</td>
<td>0.64</td>
<td>146639</td>
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</tr>
<tr>
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<td>673</td>
<td>0.50</td>
<td>133096</td>
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</tr>
<tr>
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<td>121176</td>
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<td>107669</td>
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<td>0.59</td>
<td>97677</td>
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<tr>
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<td>34316</td>
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<td>34122</td>
<td>99.43</td>
</tr>
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<td>Region</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Rural</td>
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<td>775</td>
<td>0.62</td>
<td>124071</td>
<td>99.38</td>
</tr>
<tr>
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<td>451974</td>
<td>99.40</td>
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<td>194</td>
<td>0.57</td>
<td>34122</td>
<td>99.43</td>
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<td>Comorbidities</td>
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<td></td>
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<td>388253</td>
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</tr>
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<td>0.64</td>
<td>127689</td>
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</tr>
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<td>Others</td>
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<td>514</td>
<td>0.54</td>
<td>94225</td>
<td>99.46</td>
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</table>

* DAD and physician claims data
Table 5.2 Overall hypertension prevalence (%) by demographic factors grouped by FFS and APP claims in Alberta, Canada (2004-2009)*

<table>
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<tr>
<th></th>
<th>APP</th>
<th>FFS</th>
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<tr>
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<td>N</td>
<td>Proportion (%)</td>
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<tr>
<td><strong>Total</strong></td>
<td>3677</td>
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</tr>
<tr>
<td><strong>Gender</strong></td>
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<td></td>
</tr>
<tr>
<td>M</td>
<td>1880</td>
<td>0.14</td>
</tr>
<tr>
<td>F</td>
<td>1797</td>
<td>0.13</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
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<td></td>
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</tr>
<tr>
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<td>487</td>
<td>0.09</td>
</tr>
<tr>
<td>45~</td>
<td>918</td>
<td>0.16</td>
</tr>
<tr>
<td>55~</td>
<td>948</td>
<td>0.24</td>
</tr>
<tr>
<td>65~</td>
<td>673</td>
<td>0.31</td>
</tr>
<tr>
<td>75~</td>
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<td>0.23</td>
</tr>
<tr>
<td><strong>Income</strong></td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>813</td>
<td>0.17</td>
</tr>
<tr>
<td>2</td>
<td>729</td>
<td>0.16</td>
</tr>
<tr>
<td>3</td>
<td>755</td>
<td>0.16</td>
</tr>
<tr>
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<td>605</td>
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<td>0.12</td>
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<tr>
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<td>~</td>
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</tbody>
</table>

*Populations missing for rural/urban regions
Table 5.3 Yearly prevalence trends among hypertension cohort grouped by FFS and APP claims by fiscal years in Alberta, Canada (2004-2009)*

<table>
<thead>
<tr>
<th>Year</th>
<th>APP N</th>
<th>Proportion (%)</th>
<th>FFS N</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>1578</td>
<td>0.07</td>
<td>313768</td>
<td>13.41</td>
</tr>
<tr>
<td>2005</td>
<td>2016</td>
<td>0.08</td>
<td>376203</td>
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</tr>
<tr>
<td>2006</td>
<td>2253</td>
<td>0.09</td>
<td>423027</td>
<td>17.01</td>
</tr>
<tr>
<td>2007</td>
<td>2566</td>
<td>0.10</td>
<td>461600</td>
<td>18.02</td>
</tr>
<tr>
<td>2008</td>
<td>2970</td>
<td>0.11</td>
<td>494387</td>
<td>18.6</td>
</tr>
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<td>2009</td>
<td>3452</td>
<td>0.13</td>
<td>529334</td>
<td>19.28</td>
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</tbody>
</table>

*Individuals were censored due to death or moving out of province
Table 5.4 Mortality and cardiovascular disease admission rate (per 1000 person-years) with 95% confidence interval (95% CI) among cohort grouped by FFS and APP claims

<table>
<thead>
<tr>
<th>Claim Type</th>
<th>Mortality for APP claims*</th>
<th>Mortality for FFS claims*</th>
<th>CVD admission rate for APP claims*</th>
<th>CVD admission rate for FFS claims*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>19.0 (16.6-21.8)</td>
<td>33.8 (33.6-34)</td>
<td>8.0 (6.4-9.8)</td>
<td>40.6 (40.4-40.9)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>16.1 (13.1-19.8)</td>
<td>32.2 (31.9-32.5)</td>
<td>5.7 (4.8-6.1)</td>
<td>34.8 (34.4-35.1)</td>
</tr>
<tr>
<td>F</td>
<td>22 (18.4-26.3)</td>
<td>35.6 (35.2-35.9)</td>
<td>10.2 (7.9-13.3)</td>
<td>47.5 (47.1-47.9)</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;35</td>
<td>5.7 (2.4-13.6)</td>
<td>14.8 (14-15.7)</td>
<td>3.4 (1.1-10.6)</td>
<td>5.1 (4.7-5.7)</td>
</tr>
<tr>
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<td>11.8 (11.3-12.2)</td>
<td>4.3 (2.1-8.5)</td>
<td>9.6 (9.2-10)</td>
</tr>
<tr>
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<td>8.2 (5.5-12.1)</td>
<td>13.8 (13.5-14.1)</td>
<td>4.6 (2.7-7.8)</td>
<td>16.4 (16-16.7)</td>
</tr>
<tr>
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<td>10.7 (7.6-15.2)</td>
<td>19.5 (19.2-19.9)</td>
<td>6.8 (4.4-10.5)</td>
<td>26.6 (26.2-27)</td>
</tr>
<tr>
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<td>33.7 (25.8-44.1)</td>
<td>30.9 (30.5-31.4)</td>
<td>8.8 (5.2-14.9)</td>
<td>48.1 (47.5-48.7)</td>
</tr>
<tr>
<td>75~</td>
<td>163.8 (132.4-202.6)</td>
<td>95.1 (94.3-96)</td>
<td>54.1 (37.1-78.9)</td>
<td>113.4 (112.3-114.5)</td>
</tr>
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</tr>
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<td>42.9 (42.3-43.4)</td>
<td>17.8 (11.8-26.8)</td>
<td>55.1 (54.4-55.8)</td>
</tr>
<tr>
<td>2</td>
<td>22 (17.1-28.3)</td>
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<td>9.9 (6.8-14.4)</td>
<td>45.4 (44.7-46)</td>
</tr>
<tr>
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<td>8.4 (4.4-16.1)</td>
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<tr>
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</tr>
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<tr>
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<td>69.9 (69.1-70.7)</td>
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<td>37.6 (37.3-38.3)</td>
<td>6.9 (3.7-12.9)</td>
<td>32.8 (32.2-33.4)</td>
</tr>
</tbody>
</table>

* APP (alternative payment plan), FFS (fee-for-service), CVD (cardiovascular disease)
Figure 5.1 Flowchart of hypertensive cases for APP and FFS billings

* DAD, Discharge Abstract Database, GP, General Practitioner, HTN = Hypertension, INT (S) = Internal Medicine (specialists), SB = Shadow Billing
* N1 represents the segments of claims solely representing a “shadow billing” claims (i.e. physician specialists)
Chapter Six: **POLICIES TO OPTIMIZE PHYSICIAN BILLING DATA IN ACADEMIC ALTERNATIVE RELATIONSHIP PAYMENT PLANS: PRACTICES AND PERSPECTIVES**

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Hude Quan MD, PhD, Department of Community Health Sciences, University of Calgary, Calgary, Alberta, Canada Tom Noseworthy MD, FRCPC, Department of Community Health Sciences, University of Calgary, Calgary, Alberta, Canada

Carolyn DeCoster PhD, RN, Data Integration, Measurement and Reporting, Alberta Health Services, Calgary, Alberta,

Nathalie Jetté MD, FRCPC, Departments of Clinical Neurosciences and Hotchkiss Brain Institute and Community Health Sciences and Institute for Public Health, University of Calgary, Calgary, Alberta, Canada

**Objective:** To determine existing policies for incentivizing physician billing practices in Canada
6.1 Abstract

Background: Changes in physician reimbursement policies may hinder the collection of billing claims in administrative databases. Alternative payment plans (APP) use incentive- or punitive-based tools to motivate physicians to submit billing claims called shadow billings; however, these incentives are not well documented. We conducted a nationwide survey with both open and closed-ended questions and face-to-face interviews in Alberta, Canada to determine existing policies for incentivizing physician billing practices.

Methods: Mail and online surveys were sent out to academic administrators in British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, New Brunswick, Prince Edward Island and Newfoundland and Labrador, Canada. Quebec, Northwest Territories, Nunavut and Yukon were not included as they do not shadow bill. Face-to-face interviews were conducted in the province of Alberta with academic leaders, administrators and government stakeholders. Data were summarized using content and descriptive analysis and grouped by question type.

Results: In total, there were 46 respondents (15 interviews, 31 mail/online) for an overall response rate of 42.9%. Descriptive and content analysis revealed three important perspectives, grouped at the level of individual physician and at academic/leadership, and government stakeholders. Within these themes, findings were further categorized as either (a) instruments or tools to promote physician billing in academic APPs, (b) physicians’ perspectives about shadow billing and, (c) academic department heads and government employees’ perspectives about shadow billing.
Conclusions: According to the majority of respondents, financial disincentives appear to be the most effective mechanism to motivate academic APP physicians to submit their billings. However, it is necessary going forward to achieve commonly defined and agreed methods of operationalizing core accountability frameworks (i.e. accountability reporting, work plan evidence, financial reporting, and scope of service delivery) for each province and existing academic APPs.
6.2 Methods

6.2.1 Data collection

Interview guide

The interview guide and survey used in this study were based on a previous design from the first study (Chapter 3) and were refined throughout the interview process with academic leaders, administrators and government stakeholders in Alberta. This is often done with qualitative interviews. This is different than piloting an interview guide, after collecting data, the researchers return to analyzing and coding data, and use the insights from that analysis process to inform the next iteration of data collection. This allows for the expansion of new categories and themes to be developed, often referred to as a constant comparison processes [122]. The questionnaire included three pages of questions. Online surveys were gathered through a well-known and reputable survey company (https://www.formstack.com).

Survey participants

Our survey targeted individuals in academic leadership and administrative positions [i.e. deans of medicine or academic department leaders from one of five medical specialties (i.e. Internal Medicine, Surgery, Neurology, Pediatrics, Psychiatry)] at Canadian teaching hospitals. Government or hospital stakeholders working in areas related to physician fee reimbursement or specific branches of provincial government (e.g. Alberta Health, Alberta Health Services) were also included to identify additional interventions or policies to promote shadow billing.

Inclusion criteria for participants were: 1) physicians employed and practicing in Canada on an APP or FFS payment plan affiliated with an academic or teaching hospital and/or 2) provincial government staff or departmental managers who work within a remuneration branch and have held their current or related appointment for two or more years. Exclusion criteria were:
1) general practitioners and 2) medical trainees (i.e. medical students, residents or fellows), as the majority of them do not submit billings.

**Respondent sampling:** The survey sampling population was generated using a list of the latest faculty/department contacts, physician contact directories posted on websites of provincial health authorities (i.e. Alberta Health Services), hospitals, and the Royal College of Physicians and Surgeons of Canada website. Additionally, participants were purposively recruited using snowball sampling methods whereby existing study participants recruit future participants on behalf of the researcher from their acquaintances [123].

### 6.2.2 Survey procedure

**Mailing survey process:** Each mailed survey package contained an invitational letter, paper-based interview guide (see Figure 6-2), and a return envelope with paid postage included. The invitational letter provided information regarding the study and research team, a unique identification number for each participant, and a link to the online version of the survey. Survey respondents were given a 3-4 week timeline to respond (mailed versions), depending on when they received the letter (i.e. surveys sent to different locations or provinces in Canada may have arrived on different days/weeks).

**Online/emailing survey process:** After the initial paper-based surveys were mailed, email invitations were sent to each of the survey respondents who also received a mail survey. The email invitation contained study information, a unique identification number for each participant, and an online link to access the survey.

Mail and online surveys were sent out to physicians in British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, New Brunswick, Prince Edward Island and Newfoundland.
and Labrador. Quebec, Northwest Territories, Nunavut and Yukon were not included as unlike those aforementioned, they do not shadow bill or do not have established academic teaching hospitals where academic APPs exist.

**Face-to-face interview survey process:** In addition to sending both mail and online surveys across Canada, we also conducted 15 face-to-face interviews with academic leaders, administrators and government stakeholders.

Departments at the University of Calgary and the University of Alberta have several academic APPs, which currently include: medical specialties/subspecialties (e.g. Pediatrics, Internal Medicine, Neurology); a surgical subspecialty (e.g. Neurosurgery); a rehabilitation specialty (e.g. Physical Medicine and Rehabilitation); and primary care specialty (e.g. Family Medicine). The remaining departments, such as psychiatry and some areas of surgery, remain on a FFS model or blended type of model (e.g. both capitation and FFS features within a plan). Participants were recruited through the researchers’ professional contacts and through contact information provided on the websites of various organizations listed above. Participants were sent an informal invitation by email and if the participant agreed, a meeting was scheduled. Prior to the interview, each participant was sent the survey guide and completed an informed consent form in person. Participant interviews were conducted by the principal author (CC) at the individual’s location of work. The interviews ranged from 21:29 minutes to 58:42 minutes and were recorded at participating physician offices. The surveys were completed from September 1, 2015 to October 10, 2015.
6.2.3 Data analysis

Responses by mail and email submission were summarized using descriptive and content analysis grouped by question type. Due to the different nature of the responses, software analysis such as Nvivo was not used. For the analysis of face-to-face interviews, audio files were reviewed by the interviewer and responses to open-ended questions were recorded, coded, and analysed. These were then compared and triangulated with findings from the mail and online survey submissions. Data analysis and data collection occurred concurrently [123, 124] through use of the constant comparison method (i.e. going back and forth between data collection and analysis), which allowed the researcher to inductively develop a theory by categorizing, coding, delineating categories, and connecting them [125].

Inductive analysis involves discovering patterns, themes, and categories in the data [123]. The interviewer took notes prior to interviews during meetings with participants and also during the recorded interviews. These notes were used to ensure that all relevant data were captured (i.e. all questions answered), which assisted in forming themes. Themes were first developed through coding, i.e. identifying words, sentences, and/or paragraphs that consistently emerged or that were particularly meaningful. Grouping similar themes into categories allowed the researcher to make interpretations about what the categories meant [124]. Considered together, these categories comprised the themes presented below. Similar themes across individuals were then grouped together as a basic coding schema. The lead researcher (CC), supervisors and committee members met in order to refine the analysis and generate the qualitative summaries.
6.3 Results

6.3.1 Participant characteristics

Of the 102 individuals who were selected, 10 were removed from the mail/email list due to incorrect/inaccurate contact information (see Figure 6-1). An additional 15 individuals were contacted for face-to-face interviews, and all 15 agreed to participate (13 APP, 2 FFS). There were 41 respondents (15 interviews, 31 mail/online for a response rate of 42.9%, 46/107). The majority of respondents were male (85%) and were in the 40-59 year of age category (71.7%) (see Table 6-1). A large proportion of physician participants had been in practice for more than 15 years (84.8%), with less than 5.0% in practice less than 5 years. Physician respondents from this survey worked in internal medicine (28.3%), surgery (30.4%), pediatrics (19.6%), neurology (10.9%), and psychiatry (10.9%). Three face-to-face interview participants were administrators who worked for a hospital or government stakeholder (i.e. Alberta Health Services) and the remaining 12 participants were physician department heads within a university clinical department.

6.3.2 Descriptive and content analysis

Descriptive and content analysis revealed three important perspectives, grouped at the level of individual physician, academic/leadership, and government stakeholders. Within these themes, findings were further categorized as either (a) instruments or tools to promote physician billing in academic APPs, (b) physicians’ perspectives about shadow billing and, (c) academic department heads and government employees’ perspectives about shadow billing. Results are organized according to these three categories.
6.3.3 Instruments or tools to promote physician billing in academic APPs

1) Incentives through performance threshold targets: Once physicians exceed their targeted “threshold,” a portion of the shadow billing claims (i.e. money) is paid back to the physician. Variations in threshold targets exist across specialties, academic institutions and provinces. The “thresholds” can be defined in three primary ways: 1) based on a proportion of clinical full-time equivalents (FTEs); 2) based on provincial draw rates for certain specialties (i.e. pediatrics in Alberta); and 3) based on previously established proportions of FFS billing estimates (i.e. threshold is within 15-20% of that FFS target).

2) Provision of billing/administrative clerks funded by academic APP model: This incentive varies from province to province. For example, in Alberta and Ontario funding provisions within the academic APP budget allow for certain medical specialties/departments to hire billing clerks and administrative assistants to submit billing for academic APP physicians.

3) Provincial and departmental billing education seminars: This educational program varies from department to department. Pediatrics and internal medicine in Alberta hold billing education seminars (i.e. 1-2 hour sessions) where billing clerks educate academic APP physician members on processes regarding shadow billing for a specific condition to increase overall billing effectiveness and efficiency (see Figure 6-2). The Alberta Medical Association provides billing seminars to member physicians (open to all types of payment plan physicians). Seminars usually last two hours and give tips on how to avoid inappropriate billing specific to FFS and APP models.

4) Disincentives through income or payment at risk: This was the most cited of tools used to promote shadow billing across Canada. This discipline payment model recognizes unsatisfactory (quality) and unacceptable (quantity) billings submitted, as per faculty evaluation or
departmental review. Generally, a total of 15% of total annual payments is at risk and withheld until the end of the fiscal year in this event. From the physicians’ perspective, it appears this type of disincentive seems to be the most useful tool to motivate physicians to submit their shadow bills. One physician’s description of the process for those who do not submit their shadow bills corroborated this finding. He said:

Yes, in our department we have a management committee and appeal committee [for clarification purpose: i.e. lost shadow billing claims], go before the committee… penalize the physician…Income withholding, income at risk. Hitting the physician in the pocket book is the best way to motivate physicians.

On the surface, financial holdbacks appear to be an effective motivator, however many physicians indicated that while these policies and regulations exist, they are rarely used. For example, P3 said:

…as an independent contractor there are no bonuses, there’s nothing built in where you get more if you do more work. You can remove the physician from the academic APP, within the contract there is a provision for the removal of person from the contract. Never seen a case where this occurs.

If a physician does not meet their expected yearly target of shadow billings, they may receive decreased compensation or a readjustment of their FTE. This is a formalized process whereby the physician would meet with their department/division head and an academic APP committee would decide on a possible outcome. This tool is not inherently positive or negative (depending on the context), as it may be a result of changes to clinical practices, increased/decreased
academic, teaching or administrative duties, or personal issues (e.g. maternity leave, sick leave, sabbatical).

6.3.4 Physicians’ perspectives about shadow billing

1) Shadow billing provided a mechanism for physicians to demonstrate to their ‘payers’ that they deliver the clinical services set out in their contractual agreements.

Participant 9 (“P9”) discusses this, saying:

…it’s about accountability… our paymasters want to know what the clinical percentage of our time is, billing is one of the metrics we use to demonstrate this.

Shadow billing appears to create a mechanism for accountability in the delivery of clinical care set out by academic departments, specialties and academic APP contracts. P3 describes this system as “…a check and balance system…” similar to a FFS system, which also allows for comparison between previous FFS activity and academic APP productivity. In this way, shadow billing mimics the accountability of a FFS model and most respondents agreed that, similar to a FFS model, this is how they would get paid.

Participants also seemed concerned about loss of the academic APP model and contract without a metric or tool like shadow billing to prove that physicians deliver the clinical services set out in their contracts. For example, P5 explains, “Shadow billing keeps us updated, it is the main way to keep the academic APP contract.” However, discussed in a later theme, many respondents share their belief of needing to move past shadow billing as the only widely used clinical metric/tool for a performance measure in academic APPs. P13 describes it as:
…delayed gratification. The more billings you do, this will drive [how] future negotiations are done to reset the base for the draw rate for the academic APP, it will influence the remuneration at that point.

Many respondents agreed that regardless of their views of shadow billing, it would be a complete loss and step in the wrong direction to lose the academic APP models.

2) Shadow billing also allowed physicians to track their own clinical work and better understand their patient population. The type of information on a typical shadow bill claim can also be used for secondary purposes (i.e. administrative data) and is useful in that sense for government purposes. It is important to note, however, that only a minor proportion of respondents identified this as an enabling factor. For example, one physician from Alberta explained that:

> It provides Alberta Health ... [with information] about services provided, what are the types of services provided, the diagnosis codes, where, date, information that we can use for disease surveillance, secondary purposes.

The majority of physicians described being too busy and focused on patient care to care about billing. For example, P14, a FFS physician states that “…the overarching philosophy is not to fill out bills; it’s to spend time with complex patients.”

P85 explained that shadow billing for him was a waste of time, specifically that “…it’s a waste of physician time collecting patient data.”

At the department/academic leadership level, however, this finding is somewhat disputed as academic leaders and department/division leaders acknowledge the necessity and value of submitting billing claims from their members.
3) Physicians were uncertain about the effectiveness of the tools or instruments used to motivate APP physicians to shadow bill.

Overall there appears to be issues related to governance and unclear definitions on expected targets for shadow billing. Additionally, complexity in the fee schedule system also appears to make shadow billing harder for academic APP physicians. One example of an incentive, such as performance threshold target, was described by a physician from Alberta who said: “…if you’ve billed (i.e. met threshold) then you go into that pool…If you perform above expectations, then you receive a bonus (i.e. $5000) per year.” Another example of an incentive that seemed to be used was billing seminars (P6):

Yes, the incentive is we have billing seminars, we have meetings with members from AMA and discuss billing submissions. Being aware of code fee modifiers… having support to focus billing. Use general codes, have a cheat sheet that outlines common codes.

In contrast, when asked about incentives P12, a pediatric specialist, explained:

No, nothing to motivate them…Do this for hospitalists for FFS billing, after certain threshold, recover a certain amount of that billing. There hasn't been any reason to provide an incentive for peds (i.e. pediatrics) physicians…counting on each individual physician measures of clinical activity, outpatient counts are a bit more reflective however, inpatient consult services are difficult to capture because of complexity of care.

P2 said:

Useful? There needs to be accountability on all sides, where is the leadership? What is the margin of expectations? Effectiveness is
questionable. Government does not set clear expectations on what shadow billing should be, also there is complexity in the fee schedule system… many occasions where members complain there is missing billing codes so they don't have codes to account for certain types of services. All parties have to be at the table.

4) Shadow billing as an inaccurate measure or proxy based on a FFS payment model.

Most physicians believe shadow billing is likely an underestimate of clinical activity. For example P11 discusses the issue of using shadow billing as an outcome measure in an academic APP model, she says:

Shadow billing is based on FFS model, this is flawed methodology (i.e. volume based). Why use it? Physicians may have no idea what they are shadow billing or how they rate across divisions, this is different in departments [so] this needs to be the same across departments.

A further example came from P113, who said:

Shadow billing does not accurately reflect clinical activities in many cases… primarily an underestimation of clinical work… perception that people are not doing as much clinical work as they should be; however they are most likely doing more than reflected.

Many of the participants felt that moving beyond the use of shadow billing as a performance metric is critical and absolutely necessary to improve the development of any new provincial academic APP framework. When asked to further elaborate on the challenges of using shadow billing in an academic APP model, one respondent said: “…we are not getting paid as academic APPs members to bill, need a different metric.”
5) Increasingly time consuming due to complex use of fee codes.

Constraining factors for physicians to complete their shadow billings is they consider it time consuming and difficult given the increasing complexity of the Schedule of Medical Benefits fee schedule (SOMB). In Alberta, the SOMB lists all health services that physicians are able to bill for and the rules that govern billing. To date, physician claims data uses the International Classification of Diseases (ICD) ICD-9 system which uses numeric codes (i.e. 001–999) and has up to three ICD-9 diagnostic codes fields and one procedure code (using the Canadian Classification of Procedures) [4].

Participants described physician billing as having become very complex with new additions to the fee code schedule and added code modifiers. It is challenging for physicians to remember every possible code in order to match their billings to the actual or ‘true’ medical services provided (i.e. time spent calling family members, consult calls with pharmacist are services which are generally not billed for, but occur in the normal day-to-day). For example, P7 stated: “It’s a hassle and it’s becoming hard to remember all the codes.” P112 listed the fee code as an excessively time consuming process and one of the disadvantages of shadow billing.

While acknowledging that fee code reimbursement was time consuming, some physicians felt that as long there was an established documentation process for each physician encounter, shadow billing should be a relatively regular action that a physician must do with discipline and consistency. For example, P3 explained: “…Nothing, it’s time consuming for physicians, but with the right system setup, shadow billing should not be hard. There are funds from academic APPs for billing clerks.”

It appears that perspectives on physician billing ultimately depends on the individuals and their practice habits. Thus, while a large portion of physicians did perceive billing as a time
consuming affair, other physicians also described the billing process as a well-ingrained reflex that becomes habitual if one is consistent and regimented about it.

6.3.5 Academic departmental heads and government employees’ perspectives on shadow billing

The provision of shadow billing provides a mechanism for each department head to demonstrate to the hospital and provincial governing bodies (i.e. Alberta Health/AHS) and funding sources, that physicians are meeting their contractual agreements. P5, an academic APP provincial program representative discussed this, saying: “Shadow billing is one way to see the description of the types of patients docs see… from a government perspective, we need to be able to track the money.” When asked to elaborate further on why physician billing is a required action in academic APPs, he said it was, “…good for doctors, in FFS model this is how you would get paid. This is the way financial evaluation for the government [occurs]. It is input and output for government.” Similarly, when asked why physicians should submit their shadow bills, even when they are not paid for their time to do so, P12—a departmental head physician, said: “Then why should we pay you? If I can’t see or determine how much clinical activity you do, how do I know you’ve done it?”

Academic department heads also realized the limitations and problems related to shadow billing. For example, P2 stated:

It is imperfect because it doesn’t count all the clinical activity one does.

There are problems of people who don’t shadow bill at all or very little, but this may not be reflective of billing activities and it doesn’t account for changes in billing... If we maximized our billing it is to our benefit to do
it, but if we actually billed as much as we do—then this would surpass the amount of money into academic APPs.

Many academic department heads acknowledge that shadow billing is more of a “place holder” requirement or policy. When asked about the advantages to shadow billing, P122, a department head in Alberta said: “This doesn't matter for 85-90% of docs, who still do the work whether it is reflected in the billings or not. It’s hard to get docs to want to do this.” Similarly, P15, a government employee described that it is “…operationally difficult to ensure compliance and from a management perspective, it’s not really useful.” When asked to elaborate, they explained, “From my perspective, shadow billing is a very incompletely used tool even when it is required.”

Academic APPs create consistent and predictable cost patterns for physician compensation and workforce planning. A government employee, P11 explained:

…the positive aspects from a government’s perspective is that all academic APP models have formally enrolled members that are capped by certain specialties and receive a certain or given amount depending on a variety of factors (i.e. demonstrate value for money across the four pillars of clinical Service, Education, Research, and Leadership & Administration). It’s not like FFS model, where any and all physicians can just join up and work; we have a set contract with a specific amount to members.
6.3.6 Variations in governance

In Alberta, variations in departmental approaches to the implementation of academic APPs have led to intra-provincial competition within medical disciplines arising from compensation inequities. Mitigating this competition through a common compensation principles framework was identified as a primary challenge by government and academic management respondents. For example, P12, a department head, explained that: “there are elephants in the room that no one seems to have acknowledged yet.” When asked to elaborate, he said:

Well… for example what's the definition of an FTE? (218 (days) 10-hour days per year), not counting 10 days of CME (paid for), not counting 4 weeks vacation and 12 stat holidays, and not counting after-hours on call is part of it. Is that in scope or out of scope? Other plans do include that ‘in scope.’

There appears to be differences in plans in what would be considered “in scope” and “out of scope.” This can vary by how many holidays a physician receives, how benefits are rolled out, and what the definition of a full time equivalent (FTE) is. This has led to a common “have and have not” term that most physicians who were interviewed agreed upon when describing inequities in the implementation of the plans between provinces and cities. P7 described that “The plans need to be transparent and equitable, eliminate the differences or ‘perceived differences’.”

All participants who were interviewed agreed that if shadow billing is not reflective of the services provided, there then needs to be another tool put into place. P120, a government employee said:
Shadow billing is designed more for fear of the ‘data from the paymasters,’ it’s the only alternative to nothing. We should be doing better, [knowing] what outcomes are desirable to each patient population and specialty, how to structure data systems to capture. Shadow billing was supposed to be a bridge until we get to the other side, but no one is working on the other side of that bridge.

6.4 Discussion

We administered a Canadian survey and conducted interviews in Alberta, Canada among academic physician leaders from teaching hospitals who were practicing APP or FFS members and government stakeholders. In total, there were 46 respondents (15 interviews, 31 mail/online) for an overall response rate of 42.9%. Three primary themes were found (1) instruments or tools to promote physician billing in academic APPs, (2) physicians’ perspectives about shadow billing and, (3) academic department heads and government employees’ perspectives about shadow billing.

The benefits of an academic APP, from a funding compensation viewpoint, are that it allows for a consistent and predictable pattern of costs related to physician compensation. However, the main issue to consider is that to have consistent cost predictions, one must have a consistent submission of physician billings in order to track provision of physician services. Tracking of shadow billings ensures that what is being paid for in the model or individual services agreement (ISA) is actually provided. Unfortunately, this appears problematic as there are massive variations in governance (i.e. “in scope” v. “out of scope”) and funding policies
across Canada, especially in Alberta, related to under-submissions or non-submissions of shadow billings.

Respondents discussed the presence of incentives and disincentives and the tools utilized to promote physician billing; however, in practice the majority of these were rarely used and inadequately governed beyond the departmental level. When asked about disincentives, the most common or frequently described tool was “income or payment at risk.” Findings from this study indicate that disincentives were most commonly used to motivate physicians to submit their billings. Previous research substantiates our study’s findings in that incentives are commonly used to influence physician behaviour such as shared groups savings or residual profit sharing [24, 126, 127]. However since the early 2000s, authors like Reschovksy et al.[126] have stated “the precise methods by which physicians are compensated and whether physicians perceive that these arrangements motivate them to alter their treatment patterns are not well understood.” This question underscores the need to better understand how physician payment and the use financial incentives affects physicians’ behaviour.

The caveat to using financial incentives to motivate physician behaviour change is that the policies have to be enforced and governed on an ongoing basis. When policies act as mere “placeholders” and are put on a shelf so to speak, they can be forgotten and ineffective. An alternative to the punitive type of financial disincentive is to focus on performance threshold targets, where physicians are reimbursed or redistributed a portion of their billings (i.e. 15%). This practice is done in the FFS payment system and blended funding systems. The organizational structure of an academic APP makes it difficult to design an intervention that is ethically reasonable with regard to financial incentives, which creates difficulty when
establishing the most effective tool that can be used to motivate physicians to submit their billings.

Other studies in the literature indicate that individual physician billing behaviors may be affected by specific financial incentives, which are influenced by a broader set of rules or regulations [126]. Use of financial incentives can differ in how strongly they apply to an individual physician and can sometimes have contradictory or negative influences on physician behavior [126]. Thus in regards to shadow billing policies, creating financial disincentives may work for some physicians but not for others. Many studies often fail to distinguish payment to the medical group from payment to the individual physician and in literature that does examine direct physician payment methods while controlling for group incentives, the evidence varies [126, 128, 129].

Our study found that accountability is the underlying reason for submission of shadow bills regardless of the respondents we surveyed or interviewed (i.e. physician, academic, government). In this way, shadow billing mimics the accountability of a FFS model. Most respondents agreed that, similar to a FFS model, this is how they would get paid. However, there is a clear lack of governance and there is variation regarding how targets for shadow billings are determined. Additionally, the majority of respondents perceive shadow billing as an imperfect tool to measure clinical activity, as it does not accurately reflect the amount of clinical work done by physicians, which most physicians believe in an underestimate of their clinical activity.

Similar to the individual physician level issues, academic department heads also recognize the limitations and problems related to shadow billing. It appears there are mixed perspectives about having to enforce shadow billing policies, while still taking into account their managerial roles and accountability to the university, hospital or the government. Many of the
participants felt the need to move beyond the use of shadow billing as a performance metric and highlighted the absolute necessity of this to improve in the development of any new provincial academic APP framework. Using shadow billing as the only metric or quality indicator tool within academic APP models is not sufficient. To illustrate this point, over the past 17 years, CIHI has reported on over 80 health and/or health care quality indicators (44). Thus to assess the adequacy, efficiency and quality of health care within the broad Canadian health system, more than one tool or metric is used. The same applies to assessing the quality and completeness of an administrative dataset such as physician claims. The diversity of payment plans and its effects on billing data requires the use of more than one tool to verify shadow billing submissions.

Findings from this study highlight the need to develop new metrics and approaches to capture clinical encounters between patient and physician, such as clinical information systems (e.g. electronic health records, or EHR). Even with the rapid development of EHRs, one quote from a participant truly highlights the need for better data quality and systems that allow for high quality data to be gathered: “Shadow billing was supposed to be a bridge until we get to the other side, but no one is working on the other side of that bridge.”

Results from the current study indicate the following. First, many academic department heads monitor performance measure outcomes in their own departments, such as number of patients seen, procedures done, complexities of patients, and models of care. They also track the workloads of their physicians; however, they acknowledge that shadow billing is more of a “place holder” requirement or policy than one that is actually implemented. Additionally, academic department heads receive little to no feedback or input on how they are doing compared to other departments, specialties, teaching universities, regions or provinces. This speaks specifically to a lack of governance and alignment among all parties involved and has led
to variations in academic department approaches to the implementation of academic APPs. As a result, intra-provincial competition now exists within disciplines arising from compensation inequities (i.e. the have and have not). From the perspective of government and academic management, mitigating intra-provincial competition through a common compensation principles framework is a primary challenge [78].

In Alberta specifically, the development of the provincial academic APP framework is meant to provide a solution to the overarching priority need for and momentum towards a truly integrated, innovative, streamlined, and seamless provincial health system [78]. However, there are underlying nuances to the many specialties that require specific considerations built into an APP framework. For example, family medicine compared to many acute care specialties (i.e. neurology, pediatrics) have different practice and patient populations. These differences create challenges in the creation of a provincial or centralized framework. Thus the development and success of Alberta’s provincial academic APP remain to be seen. However, with the proper alignment between physicians, academic administrators and ministries of health, it may be possible. Respondents highlighted the need for clear alignment among academic departmental plans between all of those involved in order for this plan to be successful. If the gap between physicians and payers can be bridged and a standardized plan can be developed, the overall success of shadow billing promotion programs will survive and be renewed. However, many questions remain as to whether all specialties need an APP, clinical or academic. In summary, major challenges pertaining to physician billing included accountability measures, governance issues, issues related to tools or instruments to promote physician billing, and shadow billing as an imperfect tool to measure clinical activity.
Our study has several limitations. Firstly, we only surveyed physician specialists and did not survey general practitioners, as the majority of general practitioners in Alberta are on FFS programs. Therefore, our findings may not be generalizable to GPs or to physicians in countries outside of Canada. Secondly, our results included a mix of survey and face-to-face interviews with the majority of responses coming from Alberta. This potentially could bias the findings so that results may not be generalizable to other provinces. However, the surveys from outside of Alberta were consistent and complimentary with those in Alberta. Thirdly, we had a small number of female respondents who were less than 5 years in practice. This might have biased our results. Fourthly, ten physicians were excluded due to incorrect contact information or unavailable contact information, resulting in possible selection bias.

6.5 Conclusions

Our study supports the development of provincial and national shadow billing incentive programs to preserve the completeness of physician claims data. Financial disincentives appear to be the most effective mechanism to motivate physicians within an academic APP to submit their billings. However, it is necessary to achieve commonly defined and agreed methods of operationalizing core frameworks (i.e. accountability reporting, work plan evidence, financial reporting, and scope of service delivery) for each province and existing academic APPs. It is also important to create a common set of standards and governance rules that align with medical faculties that have academic APPs.
Table 6.1 Characteristics of the respondents

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<thead>
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<th>Survey characteristics</th>
<th>Respondents (% of 46)</th>
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<tbody>
<tr>
<td><strong>Physician specialty</strong></td>
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<td>Psychiatry</td>
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**Is the option available in your department or program to operate under an APP?**
- Yes: 76.1%
- No: 17.4%
- Missing*: 6.5%

**Are APP members required to submit shadow billing claims?**
- Yes: 67.4%
- No: 13.0%
- Unsure: 4.3%
- Not applicable: 15.3%

**If your program or department has an APP, does it use any type of incentives to promote the use of shadow billing?**
- Yes: 37.0%
- No: 34.7%
- Unsure: 13.0%
- Not applicable: 15.3%

**Are there repercussions to members/physicians if they do not submit their shadow bills?**
- Yes: 37.0%
- No: 34.6%
- Unsure: 13.0%
- Not Applicable: 15.2%

**How long have you been practicing as a physician?**
- Less than 5 years: 4.3%
<table>
<thead>
<tr>
<th>Age Range</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-15 years</td>
<td>10.9%</td>
</tr>
<tr>
<td>More than 15 years</td>
<td>84.8%</td>
</tr>
</tbody>
</table>

**What is your gender?**

- Male: 84.8%
- Female: 15.2%

**What is your age?**

- Less than 30 years: 4.3%
- 30-39 years: 6.5%
- 40-59 years: 71.7%
- Greater than 59 years: 23.9%

**Which province do you work primarily in?**

- British Columbia: 4.4%
- Alberta: 52.2%
- Saskatchewan: 0.0%
- Manitoba: 4.4%
- Ontario: 22.2%
- New Brunswick: 0.0%
- Prince Edward Island: 0.0%
- Newfoundland and Labrador: 11.1%
- Nova Scotia: 6.7%

*Quebec, Northwest Territories, Nunavut and Yukon were not included as these provinces may not shadow bill or do not have established academic teaching hospitals where academic APP programs exist.*
Figure 6.1 Response rates among survey respondents by mail, email and face-to-face

A  N of individuals originally contacted
Mail /Email  Face-to-Face
(98)  (2)

B  N of individuals recruited as secondary contacts (result of snowball sampling)
Mail/Email  Face-to-Face
(4)  (13)

C  N of individuals who received requests survey
Mail/Email  Face-to-Face
(102)  (15)

D  N of individuals who completed survey
*Mail/Email  Face-to-Face
(24 Mail, 7 Email)  (15)

Mail/Email R^{DRC} = 31/102 (30.4%)
Face-to-Face R^{DRC} = 15/15 (100%)
Overall RR = 46/107 (42.9%)
**Figure 6.2 Academic alternate relationship plan interview guide**

Note: These interview questions have been derived from (a) initial results from the peer-reviewed and grey literature scans and b) discussions with physicians and health care stakeholders.

**These questions will cover your current/past occupations and relevant training experience**

1. Briefly describe your role and responsibilities with [name of hospital or organization]. How long have you occupied this position?

2. What is your background? What about education opportunities and previous jobs that may be relevant to your current position?

**These following questions will examine your knowledge and perceptions of AAPPs**

1. An alternative payment plan (APP, ARP, AFP) is a payment agreement where physicians receive a salary or a set wage instead of being paid per procedure or clinical visit completed.

   Is the option available in your department or program to operate under an alternative payment plan?

2. IF you answered YES to Q1, do you know in which year your department or division APP/ARP started?

3. Traditionally, physicians are paid by submitting fee for service claims. **Shadow billing** is an administrative process whereby physicians on APP submit service provision information using provincial/territorial fee codes; however payment is not directly linked to the services reported.

   Are your department/division members who are under an ARP program required to submit shadow billing claims?

4. What is the main purpose of shadow billing in your department?

5. How does your department determine the yearly amount of shadow billing claims expected from physicians?

6. Does your department use any type of incentives to promote the use of shadow billing?

   ➢ Please describe the type of incentive that your department uses? (e.g. personal income increases tied to shadow billing)
7. Are there any repercussions to members/physicians if they do not submit their shadow billing claims?
   ➢ IF YES, please describe

8. What do you see as the advantages of shadow billing?

9. What do you see as the disadvantages of shadow billing?

10. What are your thoughts about the implementation of academic alternate relationship plans?

11. Are you aware of any formal evaluations for ARP programs in Alberta? If no, what types of indicators or evaluation components do you think would be important?

12. Aside from shadow billing incentives, are there any other policies or incentives related to ARPs that you may be aware of?

13. Finally, if you could make any changes or suggestions specific to ARP’s what would they be?

14. If you are a practicing physician, what is your medical specialty?
    Surgery ☐
    Internal Medicine (includes cardiology, neurology, ICU) ☐
    Pediatrics (Hospitalists) ☐ (Emergency) ☐ (Subspecialty) ☐
    Psychiatry ☐
    If other, please specify ________________________________

15. How long have you been in practice as a physician?
    Less than 5 years ☐
    5 to 15 years ☐
    More than 15 years ☐

16. What is your gender?
    Male ☐
    Female ☐

17. What is your age?
Less than 30 years ☐
30 to 39 years ☐
40 to 59 years ☐
Greater than 59 years ☐

18. Do you know any additional individuals who would be knowledgeable regarding this topic and would be willing to share their views?

THE END!

We thank you for your input regarding this topic and we greatly appreciate you taking the time to complete this survey. Your feedback is valuable in advancing our knowledge regarding Alternative Payment Plan relationships.

Nathalie Jetté, MD, FRCPC (principal investigator)
Hude Quan, MPH, MD, PhD (principal investigator)
Ceara Cunningham, MA, PhD (c) (graduate student)
Chapter Seven: OVERALL SYNTHESIS, CONCLUSIONS AND FUTURE RESEARCH

Ceara Tess Cunningham MA, Department of Community Health Sciences, University of Calgary, Calgary, Alberta, Canada
With the widespread use of administrative health data for research, the accuracy and completeness of these data have become vital. The validity of physician claims data is being questioned with the recent introduction of different payment models for physicians across Canada. The overall purpose of this thesis was to assess how different types of remuneration plans (i.e. fee-for-service, FFS v. alternative payment plans, APP) have impacted physician billing submissions, chronic disease estimates and what can be done to improve the quality of billing submissions at a national and provincial level. To achieve the thesis objectives, four studies were conducted using various methodologies.

Our first study explored differences in physician payment plans among physician specialists. A survey was designed to gather demographic and billing information from physician specialists in FFS and APPs and gain consent from individual physicians to utilize their billing claims data. The online survey response rate of 35.0% remains comparable to response rates from previously published physician specialist survey-based studies [130]. The response rate in the current study was likely influenced by the sensitive survey topic, but it is likely that specialties with longstanding APP programs (i.e. pediatrics and internal medicine) were more likely to respond as they had more experience with billing within that program [130].

Our second study examined the proportion of claims submitted by APP and FFS physicians and identified and compared the validity of information coded in physician billing claims submitted by APP and FFS physicians in Calgary, Alberta. The study showed that overall submission rates and accuracy in recording diagnoses by physicians who used both plans were high.

Our third study estimated hypertension prevalence, mortality and cardiovascular disease (CVD) admission rates from APP and FFS physician billings in Alberta, Canada
under the assumption that APP physicians were not consistently submitting shadow billing in Alberta. Our analyses found a very small percentage of hypertension claims submitted that were flagged as shadow billing claims (i.e. possible claims from APP physicians).

In our final study, we conducted a national survey and face-to-face interviews in Alberta, Canada to determine existing policies for incentivizing and promoting physician billing practices. Financial disincentives appear to be most effective as a mechanism to motivate physicians within an academic APPs to submit their billings. However, it is necessary in moving forward to achieve commonly defined and agreed methods of operationalizing and standardizing plans for each province and existing academic APPs.

7.1 Is the quality and validity of physician claims affected by non-submission of shadow billings in Alberta?

Our research indicates that in Alberta, APP physician specialists submitted less complete medical service claims than FFS physicians but nearly all claims were submitted by APP and FFS physicians. In addition, the accuracy of diagnostic codes in physician specialist claims was high. We also analysed submitted Alberta physician specialist claims for services in a defined cohort of hypertensive patients, and found a very small percentage of hypertension cases (0.60%) were identified only from APP claims. Despite these results, reporting systems for shadow billing in the provinces of Alberta, British Columbia, and Saskatchewan are not standardized and health researchers need to account for these differences [75]. This could lead to large differences in the completeness and accuracy of data within physician claims databases across provinces. For example, a previous study [76] reported that 23.7% of diabetes diagnoses were missing from
non-fee-for-service (i.e. APP) physician billing claims in Ontario. Similarly, according to the Canadian Chronic Disease Surveillance System (CCDSS) which uses physician claims and hospital discharge abstract data to monitor chronic disease [66], the Canadian age-standardized prevalence rate of health services utilization for mental illness remained relatively stable from 1996/97 to 2009/10 [47]. However, in 2001/02 and 2002/03, there was a small peak in the prevalence, after which the rate declined to a level similar to that in 1996/97; while this change in trend may reflect a slight reduction in the number of people seeking treatment for mental illness, it could also reflect changes in remuneration models [47]. As such the erosion of data due to shadow billing is a growing concern that has not been adequately explored in other provinces.

7.2 What policies can be used to motivate APP physicians to submit their billings?

Alberta is one of several Canadian provinces that requires APP physicians to submit shadow bills to account for the services they provide [4, 78, 82]. This may explain why current study findings demonstrate minimal data loss associated with the implementation of APPs. Shadow billing monitoring has the potential to improve the quality and completeness of claims submitted by physicians. Our findings reinforce this notion. APP physicians who were aware of departmental incentives had a higher rate of claims submissions (93.6%) compared to APP physicians who were unaware of departmental incentives (89.4%). However, these incentives are not well documented in the literature and vary across provinces [4, 13, 78].

Our study found that disincentives appeared to be the most common mechanism to motivate physician specialists to submit their billings. More often in the literature, physician incentive-based programs are common in primary care settings in Canada, the United States and
the United Kingdom [131-134]. These programs generally involve linking incentive-based payments for physicians that lead to a practice-based, inter-disciplinary team approach rather than a solo-based physician approach [133]. Additionally, incentive payments were initially implemented for general practitioners (GP) to provide enhanced, guidelines-based care to patients with chronic conditions [132]. In Canada, similar to the primary care setting, alternate forms of funding models can also support physician specialists and members of a care team to best serve the patient in timely manner through the use of incentive-based payments [78]. Thus in actual practice, pay-for-performance often refers to payments for conducting certain process-related activities or reaching certain care targets or performance indicators (i.e. shadow billing submission, patient rostering, patient paneling) [134].

Thus, do incentive-based initiatives for physicians in alternate models of remuneration enhance the delivery of health care and overall quality? Findings from the literature suggest that incentive-based payments have led to mixed results across various countries and in Canada [134-136]. However, research suggests that incentive-based payments can and do avoid costs to the health care system by enhancing team-based approaches to care [131], increasing health care innovation and in general reducing patients’ utilization of more costly hospital services [134].

Given these findings, efforts to implement any type of intervention to affect an individual physician’s performance have often been met with failure [137]. This is most likely because special features of a physician’s background make their practice behaviour changes complex. As such there is growing recognition that the success of an intervention may depend on an individual physician’s readiness to change [138, 139]. Thus researchers are currently working to improve this situation, and to develop the science and technology of behaviour change and make this useful to those designing interventions and planning policy [140]. For example, Michie and
colleagues [140] conducted a systematic review and proposed a new framework for designing behaviour change in the health care setting. At the centre is a behaviour system involving three essential conditions: capability, opportunity, and motivation (COM-B system). This forms the hub of a behaviour change wheel (BCW). The BCW (See figure 7-1) is being developed into a theory and evidence-based tool allowing a range of users to design and select interventions and policies (i.e. education, persuasion, incentives, disincentives). The BCW was used reliably to characterise interventions within the English Department of Health's 2010 tobacco control strategy and the National Institute of Health and Clinical Excellence's guidance on reducing obesity [140]. A framework that emphasizes physician change as multi-factorial, with stage-appropriate intervention, tailored to each physician’s readiness to change may be more successful than past approaches [137].

Finally, this study highlights the need to move beyond the use of shadow billing as a performance metric and move towards a universal EHR system that is accessible online from separate, interoperable automated systems within an electronic network [35]. Using shadow billing as the only metric or quality indicator tool within the academic APP model is not sufficient. Additionally, academic department heads within teaching medical schools receive little to no feedback or input from their governing health bodies as to how they should design their models, how they are doing compared to other departments, specialties, teaching universities, or regions and provinces. This issue speaks specifically to a lack of governance and alignment between all parties involved and has led to variations in departmental approaches to the implementation of academic APPs.
7.3 Future research

Despite the fact that findings from this thesis seem to demonstrate minimal data loss due to non-submission of shadow billings amongst alternative payment plans (APP) physicians in Alberta, it is important to study shadow billing status in other Canadian provinces and territories. While understanding the magnitude of non-submission, statistical methods for adjusting underestimated prevalence and incidence should be developed. For example simulation studies and prediction modeling could be employed [141, 142].

Our research focused on inpatient and emergency room claims records and not outpatient records. Private or outpatient clinic physicians may display different billing behavior. Thus outpatient records should be included in future studies to examine differences in billing submissions between APP and FFS physicians. Also looking at the burden of hypertension, we only analysed 5 years of data (fiscal years 2004-2009), it is possible that trends could be different more recently now that the majority of APP programs in Alberta have been in effect for over a decade now. Therefore, up-to-date assessment of prevalence and outcome measures (i.e. mortality) are needed to fill this knowledge gap, as well as the addition of other chronic conditions such as diabetes, epilepsy and cardiovascular disease and acute conditions such as myocardial infarction.

Finally, in Alberta specifically, the development of a provincial academic APP framework is meant to provide a solution to the overarching priority need for and momentum towards a truly integrated, innovative, streamlined, and seamless provincial health system [78]. Future research on the types of evaluation frameworks that can guide the development and evolution of this type of contract for physicians is critical. This research will provide insight into other types of measurable indicators that could be used as a proxy for shadow billing claims.
7.4 Conclusions

Our study provides important exploratory information into whether APP and FFS payment systems may create gaps in the frequency and quality of claims in Alberta. Nearly all claims were submitted by FFS and APP physicians and the accuracy of diagnostic coding of these claims is high. A small percentage of hypertension cases would have been missing if APP physicians had not submitted claims. Financial disincentives appear to be most effective tool to motivate billing submissions. However, future studies in other Canadian provinces should be conducted to better understand the impact of APP reimbursement programs on physician billing behavior and on disease estimates and outcomes using administrative data nationally.
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Neil Castil
Customer Services Executive
Open Research Group
Figure 7.1 Depiction of the behaviour change wheel [140]
References

1. Canadian Institute for Health Information. Approaches for calculating average clinical payments per physician using detailed alternative payment data. 2015. Ottawa, Canada.


56. Quan H et al. For the Hypertension Outcome and Surveillance Team of Hypertension Canada Education Programs. Validation of a case definition to define hypertension using administrative data. Hypertension, 2009. 54:1423-1428.


117. Walker RL et al. For the Hypertension Outcome and Surveillance Team. Relationship between primary care physician visits and hospital/emergency use for uncomplicated


