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# Features of physician services databases in Canada

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## Abstract

**Introduction:** Physician services databases (PSDs) are a valuable resource for research and surveillance in Canada. However, because the provinces and territories collect and maintain separate databases, data elements are not standardized. This study compared major features of PSDs.

**Methods:** The primary source was a survey of key informants that collected information about years of data, patient/provider characteristics, database inclusions/exclusions, coding of diagnoses, procedures and service locations. Data from the Canadian Institute for Health Information's (CIHI) National Physician Database were used to examine physician remuneration methods, which may affect PSD completeness. Survey data were obtained for nine provinces and two territories.

**Results:** Most databases contained post-1990 records. Diagnoses were frequently recorded using ICD-9 codes. Other coding systems differed across jurisdictions and time, although all PSDs identified in-hospital services and distinguished family medicine from other specialties. Capture of non-fee-for-service records varied and CIHI data revealed an increasing proportion of non-fee-for-service physicians over time.

**Conclusion:** Further research is needed to investigate the potential effects of PSD differences on comparability of findings from pan-Canadian studies.

**Keywords:** *administrative health databases, physician services, medical insurance programs, International Classification of Diseases*

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## Introduction

Administrative health data, which are collected to monitor and manage health systems, are a rich resource for research and surveillance in Canada. The data are obtained from multiple sectors including health insurance registration systems, inpatient facilities, emergency departments, medical services plans, vital statistics files and prescription drug systems. Increasingly, administrative data are being used to conduct pan-Canadian studies on population health and the

use of health services. For example, the Public Health Agency of Canada's Canadian Chronic Disease Surveillance System uses diagnoses recorded in hospital and physician records to estimate prevalence and incidence for such conditions as diabetes and hypertension for all Canadian provinces and territories.<sup>1-3</sup> Multi-province chronic disease studies using administrative data have also been undertaken for rheumatic diseases, inflammatory bowel disease and mental disorders,<sup>4-6</sup> and are underway for other conditions, including hypertension.<sup>7</sup> Administrative health

data are appealing for research and surveillance because they provide an economical alternative to primary data collection, encompass entire populations and span multiple years.

Despite the many advantages of administrative health data, their use is not without challenges. Canada has a system of universal health care, but the delivery of services is a provincial and territorial responsibility. The collection and management of most administrative data are undertaken using information systems developed for each province and territory, which may contribute to a lack of standardization and harmonization in how the data are collected and recorded. Exceptions are the national hospital databases developed by the Canadian Institute for Health Information (CIHI), including the Discharge Abstract Database and the Hospital Morbidity Database, which use a common abstraction form and quality evaluation methodology.

Data quality is a relevant research topic in today's environment, where large databases are frequently used for decision making and policy development.<sup>8</sup> Researchers, epidemiologists and decision makers interested in undertaking pan-Canadian studies could benefit from results of comparisons of administrative health data from different jurisdictions. Information about features of these data can facilitate developing quality evaluation methodologies and research protocols to investigate the potential impact of differences on study findings. Physician services databases (PSDs), which contain billing records or claims for physician

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contacts with patients, are particularly important for chronic disease research and surveillance. They are a source of diagnosis and procedure information for outpatient visits, and contain information about contacts with both primary care and specialist physicians. Given this background, the purpose of this study was to compare major features of PSDs in Canada's provinces and territories. A paper on this topic is critical to establishing a baseline level of scientific knowledge. Further, this article will likely remain relevant for some time because many database features, including first year of data accessible to researchers, International Classification of Diseases (ICD) version, number of diagnosis fields, specificity of diagnosis fields and availability of information about out-of-province services, are unlikely to change quickly; in fact, they have been static in several provinces and territories over recent years.

## Methods

The primary source of data for this study was a survey, emailed to key informants from all provinces and territories, to collect information about selected features of PSDs. Published CIHI reports were a secondary source of data, and were used to collect information about the ways physicians are remunerated, a factor that can affect completeness of PSDs.<sup>8</sup>

Key informants were primarily identified from the membership of the Hypertension Outcomes and Surveillance Team (HOST),<sup>9</sup> a subgroup of the Canadian Hypertension Education Program Outcomes Research Task Force (CHEP-ORTF). HOST includes approximately 20 researchers, analysts and government representatives from British Columbia, Alberta, Saskatchewan, Manitoba, Ontario and Quebec as well as from the Public Health Agency of Canada and Statistics Canada. Members of HOST have expertise in health services or population health research or surveillance using administrative data. In those provinces or territories that have no HOST member, we contacted HOST collaborators, individuals employed by ministries of health who facilitate access to administrative data and documentation for research purposes. Up

to two individuals from each province and territory were contacted to participate in the study.

Study investigators developed the survey based on earlier research on features of administrative health data.<sup>10</sup> The survey included questions about the years of data available for researcher access and the availability and contents of fields for patient and provider information, patient diagnosis and procedure codes, out-of-province services and services of providers paid by non-fee-for-service methods. Physician fee schedules were also consulted as a source of information about remuneration methods.<sup>11</sup> Open-ended response categories were used for all survey questions.

Key informants were initially contacted in June 2010. Follow-up questions and online documentation about PSDs was used to clarify responses and to develop additional questions. A second round of questionnaires was sent to the key informants in November 2010 to obtain more detailed information about PSD features.

Secondary data published by CIHI were used to compile additional information about non-fee-for-service (i.e. alternate clinical) providers and payments.<sup>12-14</sup> The data were from reports based on the National Physician Database, which contains aggregate physician payment data from provincial and territories medical services plans. Information about the National Physician Databases and the data collection methodology was previously published.<sup>12,15</sup>

Ethics approval for the HOST project, which includes the extraction and analysis of administrative health data from the provinces and territories and the collection and reporting of documentation associated with the administrative health data, was obtained from the University of Calgary Research Ethics Board (Ethics Review #E188889). The analysis of publicly available data from CIHI did not require ethics approval.

## Results

Key informants from all provinces and territories except New Brunswick responded to the survey, though only

partial information was available from the Northwest Territories. As a result, New Brunswick and Northwest Territories were excluded from the analysis of the survey data.

### *PSD availability*

The survey results indicate that PSDs in Canada contain records from as early as 1970 (see Table 1); the range for the first accessible year of data was 24 years. The Manitoba and Saskatchewan databases contain the oldest records, from the early 1970s. Databases for four provinces hold records from the 1980s. However, Quebec and Alberta reported that some of the earliest records were not easily accessed because they were archived and/or in a format different to more recent records. The other provinces and territories reported that their databases contained records from the 1990s.

### *Patient and provider information*

The survey results also revealed that all PSDs contain unique patient and provider identifiers (Table 1). With appropriate permissions, these identifiers can be used to link the databases to other sources. For example, linkage to a population registry file can be used to obtain dates of coverage by provincial health insurance plans, residence information (e.g. postal code or geographic area), birthdates or age, and sex.

All databases also record provider specialty. The number of specialist categories reported by respondents ranged from about 25 to more than 80. However, broad groupings of family medicine, medical specialties, and surgical specialties were identified in the categories provided by all provinces and territories. At the same time, there was a heterogeneous mix of provider specialties in the "other" category. Depending on the jurisdiction, this category could include nurse practitioners, midwives, pharmacists or other allied health professionals. Most respondents indicated that provider specialty was assigned by each jurisdiction's medical services plan at the time the service record was submitted for payment.

**TABLE 1**  
**Major features of physician services databases by province or territory: data availability, patient, provider**

Province/ Territory	First year of data accessible to researchers	Patient identifier	Patient demographics <sup>a</sup>	Provider identifier	Provider categories and specialties
British Columbia	1990	✓	✓	✓	50+ categories from family medicine, medical, surgical, other. Multiple specialty fields defined.
Alberta	1982; data prior to 1994 are in a different format	✓	✓	✓	60+ categories from family medicine, medical, surgical, other. Specialty defined by the payment plan.
Saskatchewan	1971	✓	✓	✓	70+ categories from family medicine, medical, surgical, other. Specialty defined by physician certification.
Manitoba	1970	✓	✓	✓	80+ categories from family medicine, medical, surgical, other. Multiple specialty fields defined.
Ontario	1991	✓	✓	✓	35+ categories from family medicine, medical, surgical, other. Multiple specialty fields defined.
Quebec	1983; data prior to 1996 are in a different format	✓	✓	✓	One field distinguishes family physicians from specialists. A second field identifies the type of specialty. 60+ categories are identified from family medicine, medical, surgical, other. Specialty defined by physician training.
Prince Edward Island	1983; Data prior to 1996 are archived	✓	✓	✓	45+ specialty code descriptions within family medicine, medical, surgical, other. Specialty defined by the services provided.
Nova Scotia	1989	✓	✓	✓	50+ categories from family medicine, medical, surgical, other. Billing specialty and main specialty defined.
Newfoundland and Labrador	1995	✓	✓	✓	80+ categories from family medicine, medical, surgical, other. Specialty defined by physician training.
Yukon	1995	✓	✓	✓	25+ categories from family medicine, medical, surgical. Specialty defined by physician certification.
Nunavut	1999	✓	✓	✓	Approximately 70% of records are coded as generalist or specialist physician. The remaining records are missing information about physician specialty.

**Note:** Incomplete or no survey data was available for New Brunswick and Northwest Territories. As a result, these were excluded from the analysis.

<sup>a</sup> Includes date of birth or age, sex, location of residence (e.g. postal code, health region or county)

### Diagnosis and procedure information

Table 2 shows information about diagnosis and procedure codes, as identified by the survey respondents. ICD codes were used to record the majority of diagnoses in all jurisdictions. In Saskatchewan and Manitoba, ICD-8\* diagnosis codes were primarily used in the 1970s. Three jurisdictions, Manitoba, Alberta and Nunavut, use ICD-9-CM codes†. In Yukon, diagnoses are recorded using ICD-9‡ codes as well as a free-form text format. In Ontario, data contain both ICD-8 and ICD-9 codes, although neither system is used in its entirety. In Saskatchewan, not all ICD-9 codes are used to assign diagnosis.

Respondents from all but three provinces reported that a single diagnosis is recorded for each claim in their PSDs.

For British Columbia, up to three diagnosis fields may be present on some of the claim records. Nova Scotia's database contains three diagnosis codes for selected years. Alberta's database also contains three diagnosis fields, although respondents noted that the second and third fields were not consistently coded in all records. The Yukon and Nunavut databases contain multiple diagnosis fields.

Diagnosis codes were recorded with different degrees of specificity, with three-digit codes being most common. While procedural information was most commonly identified from service fee codes, other procedure coding systems were adopted, including the Canadian Classification of Procedures in both Nova Scotia and Alberta.

### Location of services

Survey respondents reported that not all PSDs contain a field or fields to identify location of service (see Table 3); service fee codes and billing location are sometimes required to ascertain service location. However, in all provinces and territories, it is possible to distinguish in-hospital services from those provided in other locations.

### PSD inclusions and exclusions

Table 3 also contains survey information about records from out-of-province providers. Respondents from four provinces (Newfoundland and Labrador, Nova Scotia, Manitoba, and British Columbia) reported that these records were contained in a separate database. For

\* International Classification of Diseases, Eighth Revision.

† International Classification of Diseases, Ninth Revision, Clinical Modification.

‡ International Classification of Diseases, Ninth Revision.

**TABLE 2**  
**Major features of physician services databases in Canada: diagnoses and procedures**

Province/ Territory	ICD version	Number of diagnosis fields	Specificity of diagnosis codes (number of digits)	Source of procedure information	Other information about diagnosis/ procedure fields
British Columbia	ICD-9	Most claims contain 1 code, but some primary care physicians record up to 3	Up to 5, but 3 digits are the most common	Fee codes	ICD-9-CM codes are also found in some claims. Some diagnosis codes are specific to the provincial medical services plan.
Alberta	ICD-9-CM	3 (1 before 1994)	Up to 5, but the 5 <sup>th</sup> digit is not well recorded; 3-digit codes were used before 1994	Canadian Classification of Procedures	
Saskatchewan	ICD-8 until 1978, then ICD-9	1	3	Fee codes	Some diagnostic codes assigned by the province are also used and some ICD-9 codes (including all E-codes and selected other codes) are not used.
Manitoba	ICD-8 until 1979, then ICD-9-CM	1	3	ICD-9-CM and fee codes	
Ontario	Hybrid of ICD-8 and ICD-9	1	3; a 1-digit suffix is added for physiotherapy and chiropractic codes	Fee codes	Not all ICD-8 and -9 diagnosis codes are found in the database.
Quebec	ICD-9	1	4	Province-specific codes	
Prince Edward Island	ICD-9	1	3, except for E-codes and V-codes, which are 5 digits	ICD-9 and fee codes	
Nova Scotia	ICD-9	3 (1 before 1997)	Up to 5; 3-digit codes are the most common and were used before 1997	Modified version of CCP. A single code is recorded	Some E-codes are captured in an "injury diagnosis" field, but the capture rate or completeness is not known.
Newfoundland and Labrador	ICD-9	1	3	Fee codes	
Yukon	ICD-9 + text	2 before 2006, unlimited since then	Up to 5 but most records use only 4	Fee codes	
Nunavut	ICD-9-CM	11	5	None	The databases support the collection of procedure codes, but this information is not currently captured.

**Abbreviations:** E-codes, external cause of injury codes; ICD-8, International Classification of Diseases, Eighth Revision; ICD-9, International Classification of Diseases, Ninth Revision; ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification; V-codes, supplemental codes.

**Note:** Incomplete or no survey data was available for New Brunswick and Northwest Territories. As a result, these were excluded from the analysis.

the remaining provinces and territories, respondents noted that a specific code or field within the PSD could be used to identify out-of-province records.

The collection of records from fee-for-service and non-fee-for-service physicians was the final topic of inquiry. With the exception of Newfoundland and Labrador and of Quebec, respondents indicated that PSDs in all jurisdictions contain records of services provided by non-fee-for-service physicians. However, respondents also indicated that the completeness of capture of records from non-fee-for-service physicians was not consistently known. This might be due to changes in medical service plans over time and/or a lack of documentation about alternate payment plans. Respondents from six jurisdictions reported that PSDs contain a field to distinguish records submitted by fee-for-service physicians from those

submitted by non-fee-for-service physicians. In three provinces, information from a provider registry is needed to distinguish these two types of records.

### **CIHI data on physician remuneration methods**

The secondary data from CIHI were used to investigate physician remuneration methods across jurisdictions, which may affect the completeness of PSDs. Data from the territories were not consistently available and are therefore not reported. In Figure 1, the percentage of full-time equivalent physicians remunerated by non-fee-for-service (i.e. alternate clinical) payment methods are reported for fiscal years 1999/2000 and 2005/2006; the last year is the most recent available from CIHI. This percentage increased in all provinces, except for British Columbia and for

Newfoundland and Labrador. The largest absolute increase occurred in New Brunswick (17.3%) and Prince Edward Island (15.0%). When the data from the four Atlantic provinces were combined, the percentage of full-time equivalent physicians remunerated by alternate clinical payments rose from 20.3% to 25.6%. Saskatchewan also saw a large absolute increase (6.5%). Figure 2 provides data about alternative clinical payments to physicians in fiscal years 1999/2000 and 2008/2009. Overall, payments in the four Atlantic provinces increased from 23.8% to 39.8%. Large increases between the two study years were also observed in Ontario and Saskatchewan.

## **Discussion**

We identified only one other published paper that systematically documented the features of PSDs in Canada; it focused on

**TABLE 3**  
**Major features of physician services databases in Canada: service location and completeness**

Province/ Territory	Location of service categories	Out-of-province services	Shadow-billed records	Shadow-billing indicator
British Columbia	Province and out-of-country locations are identified. Service locations including hospitals and clinics are available from 1990.	Recorded in a separate database	Yes, but completeness is unknown	Yes. As of 1999 shadow-billed claims can be identified using a flag.
Alberta	Service locations are identified from address information.	Identified in one field in the database	Yes, but completeness is unknown	Yes
Saskatchewan	Office, hospital inpatient, hospital outpatient, home, other, location not indicated, emergency room physician. Fee codes are also used to identify services provided in hospital. Location of services became a required field in the 1980s, but the exact date is not known. This field is not validated.	Identified by a field in the database	Yes, but completeness is unknown	Yes
Manitoba	Hospital location categories are identified in one field. Services to other locations, including personal care homes and patient home are identified from fee codes. Clinic locations are identified from the billing location.	Collected in a separate database. Available since 1993/1994	Yes, but completeness is unknown	No. Shadow-billed claims can be identified using information contained in the provider registry.
Ontario	In the current data, there is no field for location of service. Locations are identified from fee codes and/or institution numbers. A hospital master number is recorded for services provided in hospital.	Identified by a numeric code in the database or by the fee code or physician number	Yes, but completeness is unknown	Yes
Quebec	Two primary locations: private cabinet (e.g. office/clinic) and establishment (e.g. hospital). For establishments, there are 40+ location categories including private firms, hospitals, laboratory diagnostic radiology, office of physiotherapy, home centres for children and youth, federal agencies, universities, private clinics, private labs orthotics-prosthetics, detention centres.	Identified by a numeric code in the database	No	No
Prince Edward Island	25 codes are currently used: office, home visit, inpatient, outpatient, other office, day surgery, specialty clinic, community care facility, other site, UPEI clinic, detox centres, First Patient, inpatient radiology, night clinic, outpatient radiology, visiting specialist in Prince County Hospital, visiting specialist in Queen Elizabeth hospital, Saturday/Sunday office, radiology, provider in any facility type, radiology emergency, walk-in clinic, public dental facility, private dental facility, public health hygienist.	Identified by a numeric code in the database	Yes, but completeness is unknown. Effective July 1, 2008, the Clinical Work Incentive (an incentive to shadow bill) was introduced, at which time shadow-billing has become more complete	No. Shadow-billed claims can be identified from the physician billing or specialty number.
Nova Scotia	Office, correctional centre, home hospital care, patient's home, hospital, nursing home. Hospital locations include detox, emergency, intensive care, inpatient, neonatal unit, outpatient.	Collected in a separate database	Yes, but completeness is unknown	Yes, from 1997 onward.
Newfoundland and Labrador	Home, office, inpatient, outpatient, emergency department.	Collected in a separate database	No	No
Yukon	Office/practitioner office, patient's home, hospital inpatient, hospital outpatient, lab, surgery specialty clinic, community care facility, other, out of town clinic, nursing home, injection, anesthesia, assist surgery, admit, maternity, jail.	Identified in one field in the database	Yes, but completeness is unknown	Yes
Nunavut	No field for location of service.	Identified by a numeric code in the database	No	No

**Abbreviation:** UPEI, University of Prince Edward Island.

**Note:** Incomplete or no survey data was available for New Brunswick and Northwest Territories. As a result, these were excluded from the analysis.

the Saskatchewan database.<sup>16</sup> However, previous research that compared prescription drug administrative databases in several Canadian provinces found differences in patient, provider and drug features.<sup>10</sup> These findings are consistent with the findings of the current study, which revealed heterogeneity in many features of PSDs in Canada, including the years of available data, classification of provider

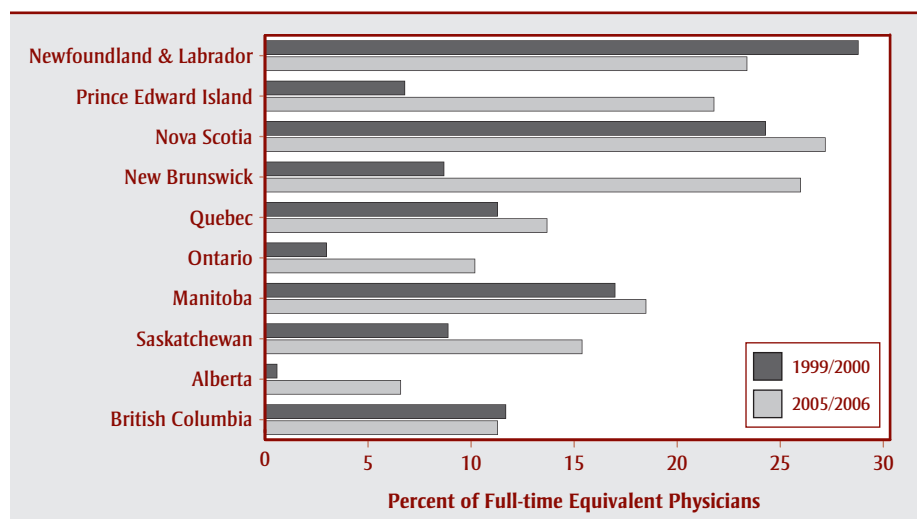
specialty, database inclusions and exclusions, and coding of diagnoses, procedures and service locations.

PSDs have a tremendous potential to benefit population health and health services research and surveillance initiatives in Canada. The Canadian Chronic Disease Surveillance System uses administrative health databases to provide

comparable, longitudinal data on chronic disease prevalence and incidence. This is used to support provincial and territorial surveillance efforts. Statistic Canada's Longitudinal Health and Administrative Data Initiative links administrative health databases with population health survey data, including data from the National Population Health Survey and Canadian Community Health Survey, to facilitate



**FIGURE 1**  
Full-time equivalent physicians receiving non-fee-for-service  
(alternate clinical) payments, by province, 1999/2000 and 2005/2006



Source: Canadian Institute for Health Information.<sup>13,14</sup>

pan-Canadian research about determinants of health, health outcomes and their relationships.<sup>17</sup>

However, differences in PSDs across Canada are an important consideration for comparability of the findings from research and surveillance studies. Changes in disease prevalence estimates over time may be due, in part, to measurement artifact arising from changes in ICD coding systems rather than true change in the population distribution of disease.<sup>18</sup> The incomplete capture of services by non-fee-for-service physicians may result in biased estimates of trends over time and differences across health regions.<sup>19</sup> The number of years of available data might influence the results of studies about duration of disease exposure and time to disease onset.<sup>20</sup> Text diagnosis fields, such as those found in the Yukon PSD, may require the use of data mining techniques to assign diagnosis codes,<sup>21</sup> a different methodology than would be used in other jurisdictions to ascertain disease cases.

Some studies may not be feasible for all Canadian provinces and territories because of the differences in data coding systems. For example, some forms of arthritis cannot be identified using the first three digits of ICD-9.<sup>22</sup> Ontario and Saskatchewan PSDs do not contain all codes from either the ICD-8 or ICD-9 systems; incomplete codes may result

in missing observations. Heterogeneity in coding systems may affect the consistent identification of some types of procedures, such as casting or immobilization procedures, which are used to ascertain fracture cases<sup>23,24</sup> or endoscopy or colonoscopy procedures, which have been the focus of previous pan-Canadian research.<sup>11</sup>

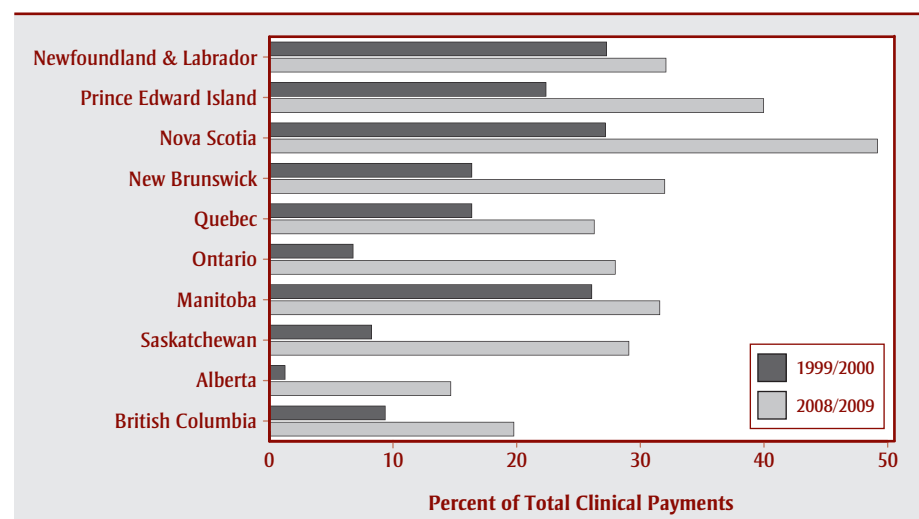
### Strengths and limitations of the study

While our study is the first to document and report the features of PSDs from many provinces and territories, it does have

some limitations. The study relied on a purposive sample; the key informants may not have had complete information about features of PSDs over time or across the geographic regions of a province or territory. A second limitation is that the quality of the data associated with different features was not investigated.<sup>25</sup> For example, this study did not examine accuracy or completeness of fields containing location of service codes.

Our study suggests a rich set of opportunities to examine further the use and comparability of PSDs in pan-Canadian research and surveillance initiatives. Previous research about the potential bias caused by the length of the observation period and incompleteness of data on prevalence and incidence estimation has often focused on cancer registries and on data from a single jurisdiction.<sup>26,27</sup> Computer simulation and statistical modeling techniques that have been proposed to estimate or adjust for these effects<sup>28,29</sup> could be extended to multiple jurisdictions. Methodological investigations about the utility of other administrative databases, such as prescription drug databases, to estimate the completeness of PSDs for chronic disease surveillance<sup>8</sup> could also be used for comparisons across many jurisdictions. A recent study about methods to ascertain chronic disease cases in administrative health databases emphasized the need to assess the validity of diagnosis codes

**FIGURE 2**  
Non-fee-for-service (alternate clinical) payments to physicians,  
by province, 1999/2000 and 2008/2009



Source: Canadian Institute for Health Information.<sup>12</sup>

across populations and over time to ensure the generalizability of case-detection algorithms.<sup>30</sup> There are other features of PSDs that require investigation, including data access procedures, service fee codes, and processes for data linkage. For example, substantial differences have been observed in service fees for colonoscopy and endoscopy using provincial and territorial fee schedules.<sup>11</sup> There may also be differences in the types of procedures and services for which fee codes have been developed. While there are an increasing number of studies that link PSDs to other administrative, clinical and population-based survey data sources,<sup>31-33</sup> we did not consider how the capability to conduct these linkages might vary across provinces and territories.

In summary, this study has demonstrated differences across provinces and territories in a number of PSDs features. This may affect the comparability of pan-Canadian research and surveillance. Studies that investigate the potential impact of these differences will benefit Canadian researchers, epidemiologists and health care decision makers.

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