

***Title: Predictors of High Volume GP Practices in Alberta  
(Study Type: Health Services Research)***

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**Competing Interests:** The authors have no competing interests to declare.

**Funding:** A small grant was accepted from the University of Alberta, Northern Academic Family Research Fund for the purpose of purchasing the data used in this analysis.

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**Abstract**

**Background:** Alberta is considering capping daily fee-for-service physician billings, but little is known about high-volume practice in Alberta and its impact on patient health outcomes. We conducted a descriptive analysis of current general practitioner (GP) patient volumes and billing practices in relation to associated practitioner demographics.

**Methods:** We modeled the independent associations of practitioner characteristics including full vs. part-time practice, gender, years in practice, geographic location, and international medical graduate (IMG) status with high-volume (> 50 visits/day) practice using general practice billing data from 2011 to 2016. Use of various service codes was compared by GP volume status adjusting for physician demographics and geographic parameters.

**Results:** Physicians longer in practice (OR 1.04 per year,  $z = 5.40$ ) and IMGs (OR 1.91,  $z = 4.29$ ) were more likely, and female physicians (OR 0.14,  $z = -5.44$ ) less likely, to exceed 50 patient visits/day. Rural practice location was negatively associated with high volume (OR 0.83,  $z = -2.75$ ) when controlling for administrative zone within the province. Zone 5, the north, was associated with high volume practice (OR 1.95,  $z = 2.19$ ). Less than full time practice was prevalent (53%). High volume GPs avoided service codes reflecting longer visit times, except for the most lucrative code for complex patients.

**Conclusions:** These results can inform policy-makers when considering payment system changes. Our next step is to examine the association of high-volume practice with outcomes important to patients, such as evidence of treatment failures (ED visits and hospitalizations) for conditions sensitive to primary care management.

## Introduction

In Alberta, several primary care reforms have been undertaken in recent years. As part of this effort, primary care remuneration policies in Alberta are currently under review. Alternative payment models including blended capitation and a daily billing cap are being considered; the latter has been introduced in British Columbia. Both would discourage high-volume (> 50 patients/day) practice, but little is known about high-volume practice and its impact on patient outcomes. Economic theory might suggest that under a FFS payment system, GPs would be inclined to see more patients and avoid using time intense billing codes, potentially affecting the quality of care.

Gaining further understanding of the demographics of high volume GPs and their billing patterns in Alberta, with its predominantly fee for service payment system, is an important first step in addressing the need for increased transparency and accountability for physician services.

Quality of care is not easily measured, nor observed, whereas the quantity of health services can be observed, but often does not correlate with quality outcomes (Wright, 2013). The few Canadian studies on high volume GPs have suggested that the number of patients seen does not always equate to the provision of quality care (Chan, Anderson, & Theriault, 1998) (Hutchinson & Foley, 1999).

There has been limited published work investigating the billing behavior of high volume GPs in the Canadian context. Work in the United States found that high volume practice providers tended to be more 'efficient' as denoted by shorter appointment times along with fewer scheduled visits for preventative care. These practice characteristics, however, came at the expense of well care services delivered, reduced levels of patient satisfaction, and negative effects on physician patient relationship (Zyzanski, Stange, Langa, & Flocke, 1998). High volume provision of care may not facilitate patient-provider links that are associated with enhanced continuity of care and health outcomes (Starfield et al., 2005).

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Understanding the demographics and variation in billing patterns of high volume GPs will also set the groundwork to examine health outcomes in these practices. This study uses provincial administrative health data to explore the relationship between patient volume and physician characteristics and their choice of health service fee codes.

**1. Methods:**

*2.1 Study Cohort*

All fee-for-service GPs in Alberta practicing between 2011 and 2016 are included in this study.

*2.2 Data Sources*

*2.2.1 Alberta Health Physician Claims Data*

Provincial administrative physician claims data were obtained from Alberta Health for all physicians billing fee-for-service under GP service codes for the period April 1<sup>st</sup> 2011 to March 30<sup>th</sup> 2016. The main service delivery site was identified for each GP from the billing information.

*2.2.2 General Practitioner Demographics and Clinic Characteristics*

A second dataset containing GP demographic characteristics including provider sex, years since medical school graduation, and country of medical school origin was obtained from the College of Physicians and Surgeons of Alberta.

*2.3 Data Variables*

*2.3.1 Physician's Average Patient Volume*

The first of 13 'rolling' periods of 90 service days, beginning April 01<sup>st</sup> 2011 were considered in this analysis. Average Patient Volume was calculated over these 90 days with service claims for each physician. The average daily patient visit volume was calculated for GPs with more than 10 and fewer than 100 claims per day. Duplicate visits were

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4 included in the total average daily visit volume, as these typically represent repeat visits in  
5 the same day, i.e., genuine clinical activity.  
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### 8 9 *2.3.2 Physician Full-Time Status*

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11 A full-time GP was defined as having evidence of billing for service provided on 90  
12 calendar days within six months. It was assumed that a full-time doctor works 4.5 to 5  
13 service days per week (21-22 weekdays per month or 120-132 service days over the course  
14 of 6 months). Those GPs requiring more than 6 months to reach 90 days of service were  
15 considered non-full-time.  
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### 20 21 *2.3.3 High and non-High Volume Physicians*

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23 High volume was defined as 50 or more patients billed per service day on average. Non-  
24 high volume was defined as having billed 49 patients or less per service day.  
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### 28 29 *2.3.4 GP billing codes*

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31 An expert panel of GPs identified a set of fee codes they believed to be used extensively by  
32 high-volume and rural physicians, along with commonly-used time-sensitive codes. The ten  
33 codes chosen for study represented approximately 95% of the total number of claims  
34 submitted by GPs in Alberta in 2011 (Table 1).  
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2.3.5. *Alberta Geographic Zones and Population Values*

The Province of Alberta is divided into five zones for health administration and into the Rural-Urban Continuum for planning and analytical purposes. The Rural-Urban Continuum represents seven designated areas, ranging from metro centers to rural remote, across the province (See Appendix Table A1) (Alberta Health Services, 2014). Although both Zones and the Rural-Urban Continuum are considered in this analysis, Figure 1 is the Alberta Health Services Zone map, depicting the above zones and health delivery sites.

2.4 *Analytical Software*

Data tables from the administrative data set from Alberta Health, as well as the demographic data from the College of Physicians and Surgeons of Alberta were imported into an SQL database (PostgreSQL 9.5, [www.postgresql.org](http://www.postgresql.org)). These data were linked by Alberta Health to the GPs contained in the claims data, anonymized, and returned to us for analysis. The analysis was conducted with Stata 13 ([www.stata.com](http://www.stata.com)). The unit of analysis was the physician.

2.5 *Analytical Approach*

Descriptive statistics were used to summarize demographic characteristics of high and low volume GPs by part-time status, average patient volumes, years in practice, provider sex, geographic zone, the urban-rural continuum, and distribution of fee codes used.

A logistic regression model was then used to determine the association between GP high volume status and GP demographic characteristics, as well as billing patterns. The independent variables included provider sex, full-time status, the interaction between those two, years in practice, country of medical school graduation (denoting IMG), provider service geographic location (the five geographic zones), and an ordinal scale of rurality from 0 to 6 representing Alberta Health Services’ characterizations of practice sites. The 10 billing codes identified in Table 1 were described in univariate analyses and two-sample

t-tests compared their use between high- and non-high-volume physicians. Finally, general linear regressions were used to examine the associations between the codes and high-volume status adjusting for provider sex and age (years in practice), patient age, IMG status, rurality and zone.

## 2.6 Sensitivity Analysis

A second logistic regression was conducted using a second ninety service day period, beginning April 01<sup>st</sup> 2013 (P2) to ensure that the findings were not sensitive to the P1 time period. Two alternative definitions of high volume, greater than 60 and greater than 70 patients per day, were also used in further sensitivity analyses.

## 2. Results

### 3.1. Descriptive analysis

#### 3.1.1 Physician Demographic Characteristics

There were 3465 GPs identified in Alberta for this study. Most worked in the two main metropolitan centers (Edmonton and Calgary) and there was a slightly higher percentage of male GPs (58%) compared to female (42%). Approximately 80% were urban or metropolitan and 20% were rural providers. There were 1629 GPs (47%) who worked full-time, and 1836 who worked non-full time (53%).

Using the predetermined definition of high volume we identified 233 GPs, of whom 158 were full-time and 75 were non-full-time providers (see Table 2). High volume GPs were more likely to work full time, and have more years in practice.

#### 3.1.2 Physician Billing Patterns

Billing patterns of the 10 identified fee codes differed across low and high volume GPs (Table 3). The proportion of high volume provider billings devoted to limited assessments was higher than for low volume providers. Conversely, the proportion of high volume

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providers billing comprehensive assessments, as well as mental health and long term care assessments, was significantly lower than for low volume providers.

*3.2. Association between high volume status and GP demographics and billing patterns*

Results of the logistic model are presented in Table 4. Years in practice and male sex were both positively associated with being a high volume GP, but full time status was not significantly associated with high volume status after adjusting for other characteristics. However, the interaction term between provider sex and full time status was significant, with an odds ratio for high-volume practice for full-time female providers of 4.6 vs. part-time. The part-time/full-time disparity was greater for women than men.

After controlling for other demographic factors, rural GPs were found to be less likely to be high volume. GP zone of practice was also a significant predictor of high volume practice. Specifically, physicians in zone 5 (Northern Alberta) were more likely to be high volume than in any other zone. Other zones did not differ significantly from one another.

High volume GPs avoided fee codes that are time sensitive, after adjusting for other demographic factors, at the 5% level of significance (See Table 3). These included comprehensive patient and time modifier codes, and after hours care.

*3.3 Sensitivity analyses:*

The logistic regression was re-run using the second ninety service day period (P2) and no significant differences were found. The regression was re-run using 60 and 70 visits/day as the definition of high volume. The only difference found was that at 70 visits/day the effect of provider gender and the gender x fulltime interaction could not be tested, as there were no female physicians at that volume.



### 3. Interpretation

This study finds that a small proportion of GPs (7%) would be considered high volume under a 50-patient-per-day policy. There were significant demographic differences between high- and non-high-volume GPs in Alberta. In particular, high volume GPs typically had more years in practice, were more likely to be male, work full-time, live in Northern Alberta, and be an IMG. Billing patterns differed in the expected directions for high as compared to non-high volume providers.

Chan *et al.* in 1998 examined billing patterns of GP providers with an annual billing total of \$400,000 or more. These high billing providers were more likely to be male and a foreign medical graduate and living in areas of low physician supply. We similarly found male providers, IMGs, and those in the area of lowest supply (zone 5) were more likely to be high volume.

A slight majority (53%) of GPs in Alberta practice non-full time. This finding is mirrored in other work; in general, there has been a decrease in the total number of hours physicians' services are being offered over the past few decades (Staiger, Auerbach, & Buerhaus, 2010). A cohort analysis of family physicians for the period 1982 to 2003 indicated a sixteen percent reduction in direct patient hours provided per week (Crossley, Hurley, & Jeon, 2009). That study specifically noted the effect in male family physicians regardless of their age. Our study results indicated that part-time practice was common in AB, even among high volume providers, although high volume practice by part-time women was uncommon.

The average number years of practice for our cohort 22 years for non-high volume and 28 years for high volume GP (See Table 2). Others have found that family physicians tend to work more in the early part of their careers than the later part (Sarma et al., 2011), although this finding appears to vary to depending on the cohort examined (Watson et al., 2006) (Buske, 2004). It is possible that our results diverge in Alberta because we have observed a

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specific cohort effect. Economic factors such as the 2008 recession may have influenced time to retirement for GPs longer in practice.

Rurality was not found to be associated with high volume practice in this study. Rural physicians' workloads tend to differ from their urban colleagues and involve a broader scope of practice and longer work hours, but that may not necessarily translate into a higher volume of patients (Matthews. R.; Humphreys, 2012; Incitti, Rourke, Rourke, & Kennard, 2003; McGrail, 2012; Norton, Dunn, & Soberman, 1994;.McGrail, 2012). There was however a specific geographic effect of Zone 5, representing Northern Alberta (Alberta Health Services, 2015). This area comprises 448500 km<sup>2</sup>, 325 GPs (Government of Alberta, 2015) and a population of about 480,000. It is possible that GPs working in this part of the province have higher volume practices out of necessity, depending on the supply of clinician resources or local clinic contractual obligations. Conversely, the northern zone may simply disproportionately attract high-volume GPs because it provides more opportunity for their preferred scope and practice style.

A key finding of this study was that high volume GPs tended to avoid service codes that denoted longer visit times, and hence might negatively impact their overall patient volume. This is consistent with the behavioral effects expected of a fee for service system (Gosden et al., 2000). Interestingly, the exception to this was the use of the complex fee code (03.04J) by high volume providers. Both the comprehensive and complex visits require more GP time and are scheduled, but complex visits can be largely completed by a nurse and signed off by GPs. Similarly, the use of time-modifier codes (denoting additional time spent with patients) was negatively associated with high volume care, in keeping with our hypothesis.

This study should be interpreted in light of the following limitations. First, as our data were de-identified we were not able to examine details of practice structure, nor were we able to explore elements of the Medical Home model (PCPCC, 20007). Second, it was difficult to characterize the medical complexity of patients, a known shortcoming of this

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4 type of analysis (Katz, Halas, Dillon, & Sloshower, 2012). Our definition of full time  
5 differed from CIHI's (CIHI, 2017) measure based on dollars billed, because a high-volume  
6 part-time GP could easily bill enough to be misclassified as full-time by that method.  
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10 The findings of this study are based on a very large provincial cohort of GPs, and shed  
11 important light on the billing patterns and demographics of high volume GPs in the  
12 Canadian context. Many questions remain in regards to their practice patterns,  
13 demographics and the type of patients they serve. Physician resource planners, training  
14 residents and GPs alike, will also be interested in the number of GPs who are not working  
15 full-time based on our definition.  
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22 Our next step is to examine the association of high-volume practice with outcomes  
23 important to patients, such as evidence of treatment failures (ED visits and hospitalizations)  
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Table 1: Description of GP Fee Codes				
Variable Name	GP Service Codes	Description	Cost per code	Frequency
				(% of total all GPs)
Limited Assessment Fee	03.03A	Limited Assessment -History and physical examination body system relevant to patient's presenting health issue, with appropriate advice to patient and provision of a health records.	\$37	51%
Comprehensive Fee	03.04A	Comprehensive Assessment-History and complete physical examination based on patient's condition including appropriate advice and provision of a health record.	\$103	5%
Mental Health Assessment Fee	08.19G	Mental Health Assessment	\$47	3%
After Hours Fee	03.01AA	After hours fee	\$22-44	<1%
Long Term Care Fee	03.03D	Long term care admission	\$110	<1%
Hospital Admission	03.03C	Hospital admission	\$128	<1%
Complex Fee	03.04J	Development, documentation, and administration of a comprehensive annual care plan for a patient with complex needs	\$188	<1%
Pap Fee	13.99BA (now 13.99BC)	Pap Smear	\$28	<2%
Time Modifier 1	CMPG01	Used with 03.03A visit (15-24 min)	\$18	17%
Time Modifier 2	CMPG02	Used with 03.03A (25-34 min)	\$36	5%
NOTE: Information taken from the Alberta Medical Association Fee Navigator website (Alberta Medical Association, 2016/2017)				

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Table 2: Alberta GPs by High Volume, Full-time Status and Average Years in Practice				
Demographic	High Volume		Non High Volume	
	Full Time	Non-Full Time	Full time	Non-Full time
Number of GPs	158	75	1471	1761
Total	233		3232	
Average years in practice	28.5		22.3	
	27.63		21.17	

Confidential



**Table 3: Percent of service code use by non-high volume and high volume providers.**

<b><u>Code</u></b>	<b><u>Total</u></b>		<b><i>Non-High Volume</i></b>		<b><i>High Volume</i></b>	
	<b><u>Obs.</u></b>	<b><u>Mean (SD)</u></b>	<b><u>Obs.</u></b>	<b><u>Mean (SD)</u></b>	<b><u>Obs.</u></b>	<b><u>Mean (SD)</u></b>
Limited Fee (03.03A)	3465	51.8 (27.9)	3239	51.4(27.7)	226	57.3 (29.1)
After Hrs Fee* (03.01AA)	3465	6.6 (10.9)	3239	6.7(11.0)	226	*5.2 (9.3)
Comprehensive Fee (03.04A)	3465	5.4 (6.0)	3239	5.3(6.0)	226	4.8(5.7)
Complex Fee* (03.04J)	3465	0.4 (1.1)	3239	0.4(1.1)	226	*0.7 (1.3)
Long Term Care Fee (03.03.D)	3465	3.1(10.3)	3239	3.2(10.4)	226	2.5 (8.0)
Hospital Adm. 03.04C	3465	0.4(1.1)	3239	0.4 (1.1)	226	0.4 (0.8)
Mental Health Fee (08.19G)	3465	1.2(2.9)	3239	1.22(2.8)	226	0.6 (1.3)
Pap Fee (13.99BA)	3465	1.3 (2.9)	3239	1.3(2.9)	226	0.8 (2.0)
Time Modifier1 CMPG01*	3465	17.1 (15.1)	3239	17.7 (15.2)	226	*9.4 (11.4)
Time Modifier2 CMPG02*	3465	5.2 (7.0)	3239	5.5 (7.1)	226	*1.7 (3.7)

*Note: \* Denotes difference between high and low volume when adjusting for covariates.*

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Table 4: Logistic Regression -- physician demographics associated with High Volume					
Logistic regression Number of Observations = 3465 Prob > chi2 = 0.000                      Pseudo R2 = 0.19                      LR chi² (8) = 309.94 Log likelihood = -680.46					
	Odds Ratio	95% Confidence Interval		z	P > z
Female	0.14	0.068	0.28	-5.44	0
Fulltime	1.21	0.87	1.68	1.14	0.25
Female*Fulltime	4.62	2.02	10.56	3.63	0
Years in practice	1.04	1.02	1.05	5.42	0
Patient average age	0.99	0.98	1.01	-0.99	0.32
Zone 2	0.70	0.41	1.20	-1.31	0.19
Zone 3	0.53	0.27	1.05	-1.80	0.072
Zone 4	0.88	0.52	1.50	-0.46	0.64
Zone 5	1.95	1.06	3.58	2.16	0.031
Rurality	0.87	0.79	0.95	-2.94	0.003
IMG	1.89	1.40	2.54	4.16	0
Constant	0.063	0.026	0.15	-6.23	0

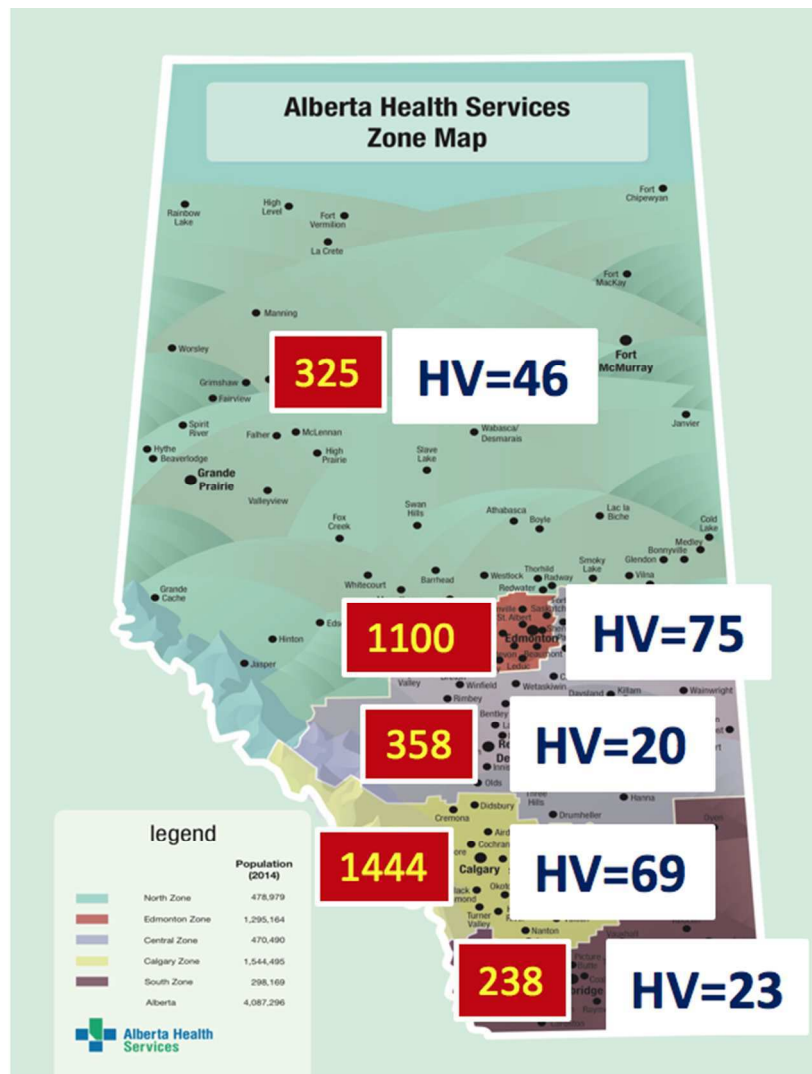


Figure 1: Alberta Health Services Zone (1-5) Map depicting the number of GPs in red boxes and the number of high volume GPs in white boxes.

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Appendix 1

Appendix Table A1: Alberta Health Services Urban Continuum Area Definition	
Main Delivery Site	Description
Urban	5 major urban centres with populations > 25,000 but less and 500,000 (Grand Prairie, Fort McMurray, Red Deer, Lethbridge, Medicine Hat)
Moderate Urban	Local Geographic areas surrounding the 5 urban centres. These areas are typically considered rural given that their populations are low and the Local Geographic areas do not define these areas properly
Metro	Population greater than 500,000. Calgary and Edmonton proper
Moderate Metro	Defined by AHS Local Geography areas immediately surrounding Calgary and Edmonton. These are deemed as commuter communities (live outside of Calgary/Edmonton but commute to Calgary/Edmonton for work and business)
Rural Centre Area	Population of 10,000 to less than 25,000 population (Brooks, Canmore, Wetaskiwin, Camrose, Lloydminster, Cold Lake)
Rural	Populations less than 10,000 and up to 200 kilometres from a Metro or Urban centre. These include towns, villages, hamlets, and agricultural areas
Rural Remote	Greater than 200 kilometres from a Metro or Urban centre. Industries tend to include oil & gas, forestry, hunting/trapping, tourism and sometimes pockets of agriculture

(Alberta Health Services, 2014).