

Supplemental materials for

Lavergne M, Rudoler D, Peterson S, et al. Declining comprehensiveness of services delivered by Canadian family physicians is not driven by early-career physicians. *Ann Fam Med.* 2023;21(2):151-156.

Supplemental Appendix 1. Explanation of methods

Setting

In Canada funding and delivery of health care services, including primary care, is within provincial/territorial jurisdiction which provide first-dollar coverage for eligible residents. Payment models for family physicians vary across provinces, but the majority are private providers paid under a fee-for-service remuneration model (1). Shadow billing is required for physicians compensated on capitated or salaried models. All provinces have required two-year family medicine residencies since the early 1990s. We use “family physicians” to include both physicians who have completed a family medicine residency and general practitioners who trained prior to mandatory residencies.

Study design and data sources

Administrative data capturing the billing and shadow billing information submitted by all practicing family physicians were used to describe comprehensiveness of care at two points in time (1999/2000 and 2017/8), the oldest and most recent years for which data comparable across provinces were available at the time of the study, in four Canadian provinces: British Columbia (BC), Manitoba (MB), Ontario (ON), and Nova Scotia (NS). Linked administrative health databases were developed and housed separately in BC (PopDataBC), ON (datasets were linked using unique encoded identifiers and analyzed at ICES), MB (Manitoba Centre for Health Policy), and NS (Health Data Nova Scotia). We accessed similar databases, developed comparable definitions for all variables, and conducted parallel analyses in each province. Further details on these data are published elsewhere (2–10).

Population

We include all family physicians registered with their provincial regulatory colleges and/or who billed the provincial health insurance system for primary care in 1999/2000 and 2017/8 fiscal years. This included physicians paid by fee-for-service and on alternate payment plans. We excluded physicians in either year who had fewer than 100 unique patient contacts (unique combinations of physician, patient, and date, regardless of the number of fee items billed) or had fewer than 50 billing days within the study year, to reduce skewing of results by including physicians with very low service volumes. We also excluded physicians where 80% or more of billing records took place in locations other than an office-based practice, or within a specific service setting or area (defined below). This was intended to focus analysis on physicians in community-based practice with a comparable definition of ‘family physicians’ in both time points.

Measures

Comprehensiveness: We identified seven settings (home, long-term care, emergency department, hospital, obstetrics, surgical assistance, anaesthesiology) and seven service areas (pre/post-natal care, pap testing, mental health, substance use, cancer care, minor surgery, palliative home visits) that could be tracked over time in each of the four study provinces. These align with settings and domains of care in the College of Family Physicians of Canada’s Family Medicine Profile (11) and Residency Training Profile (12) and builds on an approach previously published by Schultz et al. using administrative data, grouping billing codes into activity areas, and selecting a minimum threshold of 7 activity areas to define comprehensive primary care (13). Details on the measurement of each setting and area are provided in Appendix 1.

In each year we determined if each physician had 5 or more patient contacts within each practice setting and area. The number and percent of physicians with 5 or more contacts within each setting and service area across all four provinces are summarized in Appendix 2. We created summary scores by summing the number of settings and service areas that met this threshold for each physician.

Years in practice: We used data from provincial regulatory colleges to classify the physician population based on years in practice (3). Years in practice was defined as year of analysis (1999 or 2017) minus graduation year plus an additional two years to account for time in residency. Year of graduation was not available in all study years in Manitoba, so analysis relied on year first registered with the provincial insurer. As a result, years in practice in that province was truncated at 23 years (as the first year of registration that could be observed was 1973).

Other covariates: We used provincial regulatory college data to determine physician sex (male/female). Urban/rural practice location was assigned based on the Statistics Canada metropolitan influence zone of residence for patients seen by a family physician (14). The label of urban was applied if the majority of contacts occurred in zones 1 to 3, and rural if the majority of contacts occurred in zones 4 to 7. We obtained the location where medical degree (MD) training was obtained (Canada, international, or unknown) in British Columbia, Manitoba and Ontario but not Nova Scotia. Ontario data did not include this information for people graduating after 2012 so we use this information in descriptive analysis only. As a measure of practice volume, we counted the number of patient contacts per year.

Analysis

First, we described the physician population in each province and study year with respect to years in practice, sex, urban/rural practice location, number of annual patient contacts, and location of MD (Canada, international, unknown), presenting numbers and percentages (Supplementary Table 2). We then reported the mean and standard deviation for the number of practice settings and service areas by physician years in practice (Figure 1). Finally, we used generalized estimating equations (GEE) to examine changes in the numbers of settings between 1999/2000 and 2017/8 (poisson distribution and log link). We tested the hypothesis that there was a significant interaction between year and years in practice, adjusting for physician sex, urban/rural practice location, a location of MD (Canada, international, unknown) (Table 1).

We also completed two sensitivity analyses. First, we estimated models with and without statistical adjustment for the number of contacts, as one possible explanation for reduced comprehensiveness is lower total practice volume. Second, we tested that results do not change when using different cut-points for the number of contacts per year in each service setting and area (1 or more and 10 or more). Sensitivity analyses confirmed that findings did not change with different design choices. While different thresholds for number of contacts in each area per physician changed the average number of service areas and settings observed, neither different thresholds nor adjusting for practice volume changed the magnitude or statistical significance for the parameter of interest (the interaction between year and years in practice).

Ethics

This project received research ethics approval from the UBC-SFU Harmonized Behavioural Research Ethics Board (H18-03291), Ontario Tech University Ethics Board (14867), Nova Scotia Health Authority Ethics Board (1023561), and the University of Manitoba Ethics Board (HS23897 (H2020:208)).

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Supplemental Table 1. Measures of comprehensiveness in each of four Canadian provinces

Measure	British Columbia	Manitoba	Ontario	Nova Scotia
Service setting				
Home	Service location: R OR Fee codes: 00103, 00104 (specific to home)	Tariffs: 8561 (specific to home visit)	Service location: H	Service location: HOME or HMHC
Long-Term Care (LTC)	Service location: C OR Fee codes: 00114, 00115, 13114 (specific to LTC)	Date of the visit in the physician claims data occurs after the date of entry in the LTC facility	Service location: L	Service location: NRHM
Emergency Department (ED)	Service location: E OR Fee codes: 01811, 01812, 01813, 01821, 01822, 01823, 01831, 01832, 01833, 01841, 01842, 01843, 96801, 96802, 96803, 96804, 96805, 96811, 96812, 96813, 96814, 96815, 96821, 96822, 96823, 96824, 96825 (specific to emergency care), plus 00105, 00113, 00123, 01200, 01201, 01202, 00129, 00112 (non-ED-specific call-out fee codes limited to when the patient was not in hospital).	OPD indicator: E	Service location: E	Functional centre (FN) =EMCC
Hospital	Service location: P,G,H,I Also limited to dates when the patient was in hospital (admission date <= service date <= separation date)	Limited to dates when the patient was in hospital (admission date <= service date <= separation date)	Service location: I	Service location: HOSP AND Functional centre (FN)=INPT
Obstetrics	Fee codes: 14199, 14104, 14105, 14109, 04104, 04109	Billing Prefix = 3 Diagnosis code (ICD 9): 650, 651 Tariffs: 8509, 8529, 8929, 8806, 8804, 8300, 8301, 8302, 8303, 8304, 8305, 8306, 8307, 8308, 8309, 8316, 8315, 8314, 8313, 8312	Fee codes: P006, P009, P010, P011, P018, P020, P038, P041, P042, P027, P028, P029, P036, P039, P045, P046	Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures code (CCPCODE) =87.98
Surgical assistance	Fee codes: listed in CIHI National Grouping System group 73			Role (RO)=SRAS
Anaesthesiology	Fee codes: listed in CIHI National Grouping System groups 74 and 75			Role (RO)=ANAE

Service area				
Pre/post-natal care	Diagnosis code (ICD 9): 640-648, 760-762, 764-779, V22, V23, V28, 30B-35B, 37B-38B, 670-679, V24, 05A-08A OR Fee codes: 14090, 14091, 14094, 14108, 00119	Diagnosis code (ICD 9): 640-648, 760-762, 764-779, V22, V23, V28, 30B-35B, 37B-38B, 670-679, V24, 05A-08A Tariffs: 4801,4821,4823,8400,8401,8402,8416	Fee codes: P003, P004, P005, P007, A008, A002, A268, A007 billed with diagnosis code 916 (well baby care)	Role (RO) =ANTL and RP=SUBS AND CCPCAT= 'VIST' AND (any of dxcode1/dxcode2/dxcode3 contains 640-648.9, 670-679.9, 760-762, 764-779.9, V22, V23, V24 V28, 30B-35B, 37B-38B AND Service location: OFFICE OR CCPCODE =03.03, 03.04
Pap testing	Fee codes: 14560	Tariffs: 8470,8495,8496,8498, 9795	Fee codes: G365, G394, E430, L713, L733, L812, L678, G681	ccpcat=VADT AND ccpcode=3.26 AND ccpqual=A or C
Mental health	Diagnosis code (ICD 9): 295, 296, 297, 298, 300, 301, 302, 306, 309, 311, 50B, 04A, V60.2, V61.0-3, V62.0, V62.1, V62.3, V62.4, V62.5, V62.8, V62.9	Diagnosis code (ICD 9): 295, 296, 297, 298, 300, 301, 302, 306, 309, 311, 50B, 04A, V60.2, V61.0-3, V62.0, V62.1, V62.3, V62.4, V62.5, V62.8, V62.9	Diagnosis code (OHIP): 295, 296, 297, 298, 300, 301, 302, 306, 309, 311, 897, 898, 899, 900, 901, 902, 904, 905, 906, 909	Diagnosis code (ICD 9): 295, 296, 297, 298, 300, 301, 302, 303, 304, 306, 309, 311, 04A, V60.2, V61.1, V61.2, V61.3, V61.0, V62.3, V62.4, V62.0, V62.1, V62.5, V62.8, V62.9
Substance use	Diagnosis code (ICD 9): 303, 304	Diagnosis code (ICD 9): 303, 304	Diagnosis code (OHIP): 303, 304	Diagnosis code (ICD 9): 303-304
Cancer care	Diagnosis code (ICD 9): 140-239.9	Diagnosis code (ICD 9): 140-239.9	Diagnosis code (OHIP): 140-239.9	Diagnosis code (ICD 9): 140-239.9
Minor surgery	Fee codes: listed in CIHI National Grouping System groups 64-72, excluding the tray fee item if relevant			
Palliative home visits	(Service location: R OR Fee codes: specific to home) AND within 30 days of death (from vital statistics)	Tariffs 8561: specific to home visit within 30 days of death (from Manitoba Health Insurance Registry))	Service location: H AND within 30 days of death (from vital statistics)	Service location: home AND within 30 days of death (from vital statistics)

Note: All provinces included in our data require a minimum of one diagnosis code to be submitted with a claim. Service locations are either derived from fee codes specific to service location, or submitted as an additional field.

Supplemental Table 2. Number (%) of physicians by selected characteristics in 1999/2000 and 2017/8

	British Columbia (BC)		Manitoba (MB)		Ontario (ON)		Nova Scotia (NS)	
	1999/2000	2017/8	1999/2000	2017/8	1999/2000	2017/8	1999/2000	2017/8
All physicians	3,569	4,623	779	1,113	8,305	10,967	692	827
Years in practice								
<10	1,001 (28.0)	1,158 (25.0)	432 (55.5)	664 (59.7)	2051 (24.7)	2674 (24.4)	185 (26.7)	192 (23.2)
10-19	1,160 (32.5)	969 (21.0)	215 (27.6)	207 (18.6)	2670 (32.2)	2128 (19.4)	243 (35.1)	154 (18.6)
20-29 (MB 20+)	967 (27.1)	1,244 (26.9)	132 (16.9)	242 (21.7)	2122 (25.6)	2737 (25.0)	185 (26.7)	224 (27.1)
30+	441 (12.4)	1,252 (27.1)	n/a	n/a	1462 (17.6)	3428 (31.3)	79 (11.4)	258 (31.1)
Sex								
Female	1,083 (30.3)	2,047 (44.3)	221 (28.4)	529 (47.5)	2641 (31.8)	5214 (47.5)	267 (38.6)	416 (50.3)
Male	2,486 (69.7)	2,576 (55.7)	558 (71.6)	584 (52.5)	5664 (68.2)	5753 (52.5)	425 (61.4)	411 (49.7)
Urban/rural								
Urban	3,122 (87.5)	3,992 (86.4)	495 (63.5)	750 (67.4)	7391 (89.0)	9852 (89.8)	548 (79.2)	711 (86.0)
Rural	447 (12.5)	631 (13.6)	284 (36.5)	363 (32.6)	911 (11.0)	1113 (10.2)	144 (20.8)	116 (14.0)
Number of contacts – mean (SD)	5562.8 (2870.3)	4435.6 (2802.3)	5,323.7 (3,236.8)	4,021.1 (3,338.6)	6386.9 (3683.9)	4873.9 (3898.3)	5968.9 (3152.1)	4683.1 (2778.5)
Location of MD								
Canada	2,672 (74.9)	2,888 (62.5)	409 (52.5)	595 (53.5)	6538 (78.7)	6825 (62.2)	n/a	n/a
International	836 (23.4)	1,623 (35.1)	370 (47.5)	516 (46.4)	1761 (21.2)	2799 (25.5)	n/a	n/a
Unknown location of MD	61 (1.7)	112 (2.4)	0 (0.0)	suppressed	6 (0.1)	1343 (12.3)	n/a	n/a

Note: Missing data on place of graduation in Nova Scotia and incomplete data in Ontario
SD=standard deviation, MD=Medical Degree, n/a=not applicable.