The Impact of Primary Care Clinic and Family Physician Continuity on Patient Health Outcomes: A Retrospective Analysis From Alberta, Canada

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ABSTRACT

PURPOSE Continuity of care is broadly associated with better patient health outcomes. The relative contributions of continuity with an individual physician and with a practice, however, have not generally been distinguished. This retrospective observational study examined the impact of continuity of care for patients seen at their main clinic but by different family physicians.

METHODS We analyzed linked health administrative data from 2015-2018 from Alberta, Canada to explore the association of physician and clinic continuity with rates of emergency department (ED) visits and hospitalizations across varying levels of patient complexity. Physician continuity was calculated using the known provider of care index and clinic continuity with an analogous measure. We developed zero-inflated negative binomial models to assess the association of each with all-cause ED visits and hospitalizations.

RESULTS High physician continuity was associated with lower ED use across all levels of patient complexity and with fewer hospitalizations for highly complex patients. Broadly, no (0%) clinic continuity was associated with increased use and complete (100%) clinic continuity with decreased use, with the largest effect seen for the most complex patients. Levels of clinic continuity between 1% and 50% were generally associated with slightly higher use, and levels of 51% to 99% with slightly lower use.

CONCLUSIONS The best health care outcomes (measured by ED visits and hospitalizations) are associated with consistently seeing one's own primary family physician or seeing a clinic partner when that physician is unavailable. The effect of partial clinic continuity appears complex and requires additional research. These results provide some reassurance for part-time and shared practices, and guidance for primary care workforce policy makers.

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VISUAL ABSTRACT

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INTRODUCTION

The ideal provision of primary care is based on a longitudinal relationship between a patient and a family physician (FP), referred to as relational continuity.[1] Research has shown that relational continuity is associated with better patient care[2,3]; reduced overuse of procedures, hospitalizations, and emergency department (ED) visits[4,5]; lower costs[6]; and higher levels of patient satisfaction.[7]

The trend toward part-time practice in family medicine has been growing for more than 20 years in both the United States and Canada.[8,9] As a result, patients are likely to receive care from more than one FP within the same clinic. There is extensive literature on usual source of care, and Atlas et al[10] did find that connection to a specific physician rather than to the practice was beneficial in a small academic network; however, overall, little is known specifically about the effect of community primary care clinic continuity, separate from individual FP continuity. Bazemore et al[11] concluded their recent extensive review of the continuity literature with a call for research on that question.

In this study, we explored the impact of primary care clinic continuity, distinct from FP relational continuity, on patient health outcomes in Alberta, Canada. The results of this analysis aim to inform policy decisions addressing the growing shortage of primary care.[12]

METHODS

Study Design and Setting

We conducted a retrospective cross-sectional study of all FPs and their patients in Alberta, Canada during 2015-2018 to explore the associations of physician continuity and primary care clinic continuity with patient health outcomes (all-cause ED visits and hospital admissions). In 2018, there were approximately 4,900 general practitioners (GPs) and FPs for 4.3 million Albertans.[13,14] Like ministries in other Canadian provinces, the province of Alberta Ministry of Health (Alberta Health) pays for all medically required services provided by a physician under the Alberta Health Care Insurance Plan as part of a single-payer system.[15] The health system is divided into 5 geographic zones for operations.[16] FP remuneration is predominantly fee-for-service.[17] Approval for this study was obtained from the Conjoint Health Ethics Research Board Certificate (No. REB17 to 1301) at the University of Calgary.

Study Cohort

All physicians on the provincial FP/GP register in Alberta who were compensated through fee-for-service billing in the years 2015-2018 were included if they had evidence of billing in each fiscal year examined. All patients (adults and children) were included if there was billing evidence of at least 3 visits over the 3-year study period. Physician claims were linked to all patient visits made to community FPs, ED visits, and hospital admissions for the period April 1, 2015 to March 31, 2018.

The most responsible FP for each patient was determined based on a 5-step method developed by the Health Quality Council of Alberta[18] (Supplemental Appendix 1). The 3-year study period was specified because it is the frame used for that 5-step method. This method infers a type of attachment between a patient and FP and allowed us to generate proxy panels for each physician. It is based on the billing codes used for outpatient primary care, and hence excludes most focused-care practitioners, except for those caring for the elderly. We excluded obstetrics because of its unique characteristics: it involves large numbers of preplanned visits often spread across a group and almost always results in hospitalization, so it is not informative with respect to our question.

We then randomly selected 1.2 million of the remaining patients and associated all FPs who provided care for them for the analyses below. We used this approach for feasibility, as the time to run analysis with more than 4 million patients became excessive, and the sample was so large that statistical power was not an issue.

Continuity

Family physician continuity was calculated using the known provider of care (KPC) index[19]: the total number of visits each patient made to their paneled FP divided by their total number of primary care visits to any FP. We used a 3-year window and required a patient to have 3 visits in that time interval to be included. The KPC index was coded both as a continuous variable and as a categorical variable. Low continuity was categorized as 0% to 40% of visits to the attached FP, moderate continuity as 41% to 80% of visits, and high continuity as 81% to 100% of visits.[20]

Clinic continuity was similarly calculated as the proportion of a patient's visits to a different FP who practiced at the same main facility (vs at another practice, at an urgent care center, etc) and was called the group care rate (GCR). On the basis of the GCR, clinic continuity for each patient was categorized as NA (not applicable, as the patient had a 100% KPC index with no opportunity for group care), none (0%, always went elsewhere if not seeing their FP), low (1% to 50%), high (51% to 99%), and complete (100%, always saw one of their FP's partners if not seeing their own FP).

Outcome Measures

All patients were linked, using their provincial health care number, to the National Ambulatory Care Classification System to identify all-cause ED visits (visits to an ED or an urgent care center) made within the study period. This system is used in Canada for collecting and reporting on all levels of ambulatory care including that provided at EDs and urgent care centers. Patients were also linked to the discharge abstract database to identify all-cause hospitalizations during the study period.

Confounding Variables

We controlled for average daily patient volume per physician (ascertained using all patients, not only those belonging to the study cohort). Patient characteristics controlled for were age, total visits in the study period, rurality, and complexity level. Patient complexity was determined by applying the clinical risk grouper (CRG) methodology, which classifies patients into 1 of 9 levels of complexity (1 being least complex and 9 being the most) (Supplemental Appendix 2) based on prior disease diagnosis and health system use.[21] For our study, we collapsed these levels into 3 groups to capture clinically similar complexity levels: complexity that was low (CRG of 1-2), moderate (3-4), or high (5-9).

Geographic Zones and Rural-Urban Location

We explored geographic influences by both zone and the rural-urban location. Alberta Health Services divides the province into 5 zones (South, Calgary, Central, Edmonton, and North), for both operations and planning. We also used the Alberta Health Services' rural-urban continuum to categorize patient location into large city (which we termed "metro"), small city/town ("urban"), and rural/remote ("rural") for our multivariate models.

Statistical Analysis

Analyses were conducted with R version 4.2.2 (R Project for Statistical Computing). We used descriptive statistics to compare groups starting with patient, clinical, and demographic

characteristics across continuity levels using χ^2 tests for proportions and *t* tests for means. Univariate incidence rates of our outcomes, ED visits and hospitalizations, were calculated with exact CIs, where the incidence rates were calculated as the number of events divided by years of exposure. We repeated the same analysis for clinic continuity.

Both ED visits and hospitalizations are discrete events that occur (per patient) in an approximately Poisson distribution, but the mean and variance are not equal, and the number of patients having no (zero) encounters is large. We therefore used zero-inflated negative binomial models to determine the associations of physician continuity (KPC index) and clinic continuity (GCR) with rates of all-cause ED visits and all-cause hospitalizations.

Two models were estimated, one for each outcome, using the group with a GCR of 0% (no clinic continuity) as the referent. We first estimated models with interaction terms between patient complexity (CRG) and the continuity measures, to determine whether the effect of continuity was modified by complexity, and the final models were stratified by complexity only if it modified the effect of continuity. We computed intraclass correlation coefficients to determine whether our CIs would be meaningfully affected by a clustering effect within physicians. The negative binomial portion of the models are reported; the logistic portion included only age as a predictor and did not add inferential value to our analysis. Incidence rate ratios were calculated, while adjusting for FP and patient characteristics as detailed above. All analyses were conducted at the patient level.

RESULTS

Patient Characteristics

Table 1 shows characteristics for the entire patient cohort. Forty-four percent of patients were male and 56% were female. Because of Alberta's privacy rules, we were provided with age in 5-year incremental categories; the median age was 50 years. Most patients had a moderate level of continuity (45.6%) or high level of continuity (47.9%) with a single FP; the remaining 6.5% had a low level.

Univariate Analysis

Physician Continuity

Table 1 also shows patient characteristics broken out by physician continuity level (KPC index). Patients with high physician continuity tended to be more complex (CRG = 5-9) and older (median age = 55 years), whereas those with lower continuity were healthier. We observed the expected trend toward fewer ED visits with higher physician continuity; however, the number of hospitalizations was equivalent across KPC index levels. In absolute terms, although rural areas were slightly overrepresented in the high continuity group, overall, physician continuity did not differ markedly between metropolitan areas, urban areas (towns/small cities), and rural areas.

Clinic Continuity

Table 2 shows patient characteristics broken out by clinic continuity level (GCR). This continuity was distributed bimodally, as is evident in the first line of the table. Both patients who always saw their own FP (the NA group) and those who did not but if not always saw a partner (the complete or 100% group) tended to be older. Patients with no clinic continuity (0% GCR) tended to be low complexity. Those in Alberta's large metropolitan areas, both Zone 2 (the City of Calgary and area) and Zone 4 (the City of Edmonton) tended toward no clinic continuity more than those in towns and smaller cities. Rural residents tended toward higher clinic continuity; in particular, rural residents accounted for more than a quarter of the 100% GCR category, vs less than 20% in all other GCR categories. Patients with higher levels of clinic continuity had, on average, fewer ED visits and hospitalizations than peers with lower levels, except that those with no continuity were similar to those with high continuity. Higher GCRs were associated with larger group practices.

Multivariate Analysis

Table 3 presents the results of multivariate analysis (the zero-inflated negative binomial models). For both ED visits and hospitalizations, the effect of clinic continuity (GCR) did differ substantially by patient complexity (CRG); therefore, the models are stratified by complexity. The intraclass correlation coefficients were 0.19 for ED visits and 0.05 for hospitalizations.* For completeness, we undertook hierarchical modeling for ED visits to confirm there was no appreciable clustering effect (Supplemental Appendix 3); there was no difference, so the simpler models are presented here. Higher physician continuity (KPC index) was associated with lower ED use at all levels of patients complexity and lower hospital use for patients with high complexity.

The effect of clinic continuity was not linear, with a similar pattern seen for ED visits and hospitalizations. The strongest association with reduced ED visits and hospitalizations was for patients who always saw either their own FP or one of her/his partners, that is, the NA (100% KPC index) group and the complete/100% GCR group, respectively; in addition, the patients always seeing their own FP showed the lowest ED and hospital use except among those with low complexity (CRG 1-2). The effect was greatest among the highest complexity group. Low clinic continuity (1%-50% GCR) was consistently associated with higher ED or hospital use than no clinic continuity (0% GCR). High clinic continuity (51%-99% GCR) was associated with lower ED and hospital use, with a single exception (CRG 3-4 for hospitalizations).

*When observations (in this case, patients) are clustered (eg, into practices), they are not truly statistically independent and thus power calculations and significance levels based only on the number of observations can be overly optimistic. Intraclass correlation is a measure of that effect. Substantial intraclass correlation, greater than 0.15-0.20, suggests that statistical modeling may have to adjust for clustering effects.

DISCUSSION

Key Findings

In this retrospective observational study from Alberta, Canada, we documented that relational continuity with an FP (captured by the KPC index) was associated with reduced all-cause ED visits and hospitalizations. This effect of physician continuity was expected based on previous literature. Importantly, although it was strongest among complex and

Table 1. Patient Characteristics Overall and by Physician Continuity

Characteristic	Overall (N = 1,200,000)	Physician Continuity[a]			*P* Value
		Low (n = 77,870)	Moderate (n = 547,680)	High (n = 574,450)	
Gender, No. (%)					
Female	669,046 (55.8)	46,757 (60.0)	315,585 (57.6)	306,704 (53.4)	< .001
Male	530,954 (44.2)	31,113 (40.0)	232,095 (42.4)	267,746 (46.6)	< .001
Age, median (IQR), y	50 (30-65)	35 (25-50)	45 (25-60)	55 (35-70)	< .001
Complexity level,[b] No. (%)					< .001
1-2	732,890 (61.1)	54,310 (69.7)	353,939 (64.6)	324,641 (56.5)	
2-3	200,003 (16.7)	11,935 (15.3)	89,671 (16.4)	98,397 (17.1)	
5-9	267,107 (22.3)	11,625 (14.9)	104,070 (19.0)	151,412 (26.4)	
Geographic zone, No. (%)					< .001
1 (South)	94,052 (7.8)	3,655 (4.7)	35,198 (6.4)	55,199 (9.6)	
2 (Calgary and area)	468,776 (39.1)	33,598 (43.1)	227,555 (41.5)	207,623 (36.1)	
3 (Central)	128,221 (10.7)	12,788 (16.4)	60,457 (11.0)	54,976 (9.6)	
4 (Edmonton)	410,881 (34.2)	22,812 (29.3)	184,383 (33.7)	203,686 (35.5)	
5 (North)	98,070 (8.2)	5,017 (6.4)	40,087 (7.3)	52,966 (9.2)	
Location, No. (%)					
Metro	841,715 (70.1)	53,855 (69.2)	394,632 (72.1)	393,228 (68.5)	
Rural	211,445 (17.6)	13,261 (17.0)	90,496 (16.5)	107,688 (18.7)	
Urban	146,840 (12.2)	10,754 (13.8)	62,552 (11.4)	73,534 (12.8)	
Physician continuity,[a] No. (%)					
Low	77,870 (6.5)	77,870 (100.0)	0 (0.0)	0 (0.0)	< .001
Moderate	547,680 (45.6)	0 (0.0)	547,680 (100.0)	0 (0.0)	< .001
High	574,450 (47.9)	0 (0.0)	0 (0.0)	574,450 (100.0)	< .001
GCR, mean (SD), %	42 (41)	53 (31)	41 (40)	41 (45)	< .001
Clinic continuity,[c] No. (%)					
None	350,180 (29.2)	5,944 (7.6)	194,120 (35.4)	150,116 (26.1)	< .001
NA	247,403 (20.6)	0 (0.0)	0 (0.0)	247,403 (43.1)	< .001
Low	167,033 (13.9)	28,322 (36.4)	112,401 (20.5)	26,310 (4.6)	< .001
High	190,633 (15.9)	31,577 (40.6)	123,284 (22.5)	35,772 (6.2)	
Complete	244,751 (20.4)	12,027 (15.4)	117,875 (21.5)	114,849 (20.0)	
Total visits/patient in study period, mean (SD)	14.0 (12.7)	13.4 (11.5)	13.7 (12.1)	14.4 (13.3)	< .001
Physician patient volume per day,[d] mean (SD)	29.4 (13.8)	27.8 (12.5)	28.5 (13.5)	30.5 (14.3)	< .001
ED visits during study period					
Number/patient, mean (SD)	2.3 (4.5)	2.8 (5.2)	2.4 (4.6)	2.1 (4.4)	< .001
Patients with none, No. (%)	462,781 (38.6)	25,423 (32.6)	200,998 (36.7)	236,360 (41.1)	< .001
Number/patient among those with ≥1, mean (SD)	3.7 (5.3)	4.2 (5.9)	3.7 (5.3)	3.6 (5.3)	< .001
Hospitalizations during study period					
Number/patient, mean (SD)	0.3 (0.8)	0.3 (0.8)	0.3 (0.8)	0.3 (0.8)	.02
Patients with none, No. (%)	974,793 (81.2)	62,689 (80.5)	443,307 (80.9)	468,797 (81.6)	< .001

ED = emergency department; CRG = clinical risk grouper; GCR = group care rate; IQR = interquartile range; KPC = known provider of care; NA = not applicable; UPC = usual provider of care.

[a] Based on KPC index. Low = 0%-40% of visits were to the attached family physician; moderate = 41%-80% of visits; high = 81%-100% of visits.
[b] Based on CGR.
[c] Based on GCR. None = 0% (always went elsewhere if not seeing their FP); NA = always saw their own FP (KPC index of 100% with no opportunity for group care); low = 1%-50%; high = 51%-99%; complete = 100% (always saw one of their FP's partners if not their own FP).
[d] For the physician associated with the patient.

older patients, it had significant impact on ED use even among the young and healthy. Physician continuity was the dominant continuity effect, as is evident from the 100% KPC cells in Table 3.

Clinic continuity (captured by the GCR) as a distinct finding had a similar albeit less dramatic effect than physician continuity. Always seeing another FP in the same practice, if not seeing one's own, seemed clearly beneficial. By isolating the effect of clinic continuity, these results offer new evidence to support this model of care from both a patient and a health system perspective. From our findings, further focused research is needed to better understand why patients who received low levels of group care were slightly disadvantaged. To that end, the data we currently have access to do not allow us to confidently attribute each ED visit or hospitalization to either a partner or an outside physician. We therefore cannot infer whether the apparent disadvantage to lower clinic continuity is from seeing a partner or from those

Table 2. Patient Characteristics by Clinic Continuity

Characteristic	Clinic Continuity[a]					*P* Value
	None	NA	Low	High	Complete	
Patients, No. (%)	350,180 (29.2)	247,403 (20.6)	167,033 (13.9)	190,633 (15.9)	244,751 (20.4)	
Age, median (IQR), y	45 (30-60)	55 (35-65)	45 (30-60)	45 (30-60)	50 (30-65)	<.001
Sex, No. (%)						
Male	152,080 (43.4)	124,704 (50.4)	62,516 (37.4)	78,314 (41.1)	113,340 (46.3)	<.001
Female	198,100 (56.6)	122,699 (49.6)	104,517 (62.6)	112,319 (58.9)	131,411 (53.7)	
Complexity level,[b] No. (%)						<.001
1-2	221,631 (63.3)	159,360 (64.4)	88,637 (53.1)	113,142 (59.4)	150,120 (61.3)	
3-4	59,613 (17.0)	35,793 (14.5)	33,753 (20.2)	33,368 (17.5)	37,476 (15.3)	
5-9	68,936 (19.7)	52,250 (21.1)	44,643 (26.7)	44,123 (23.1)	57,155 (23.4)	
Geographic zone, No. (%)						…
1 (South)	21,586 (6.2)	25,355 (10.2)	10,366 (6.2)	13,606 (7.1)	23,139 (9.5)	
2 (Calgary and area)	154,541 (44.1)	83,350 (33.7)	76,004 (45.5)	76,540 (40.2)	78,341 (32.0)	
3 (Central)	26,995 (7.7)	23,805 (9.6)	19,041 (11.4)	24,525 (12.9)	33,855 (13.8)	
4 (Edmonton)	119,370 (34.1)	89,076 (36.0)	53,328 (31.9)	63,725 (33.4)	85,382 (34.9)	
5 (North)	27,688 (7.9)	25,817 (10.4)	8,294 (5.0)	12,237 (6.4)	24,034 (9.8)	
Location						…
Metro	265,873 (75.9)	164,938 (66.7)	124,912 (74.8)	133,617 (70.1)	152,375 (62.3)	
Urban	42,142 (12.0)	34,370 (13.9)	17,285 (10.3)	23,466 (12.3)	29,577 (12.1)	
Rural	42,165 (12.0)	48,095 (19.4)	24,836 (14.9)	33,550 (17.6)	62,799 (25.7)	
Physician continuity,[c] No. (%)						<.001
Low	5,944 (1.7)	0 (0.0)	28,322 (17.0)	31,577 (16.6)	12,027 (4.9)	
Moderate	194,120 (55.4)	0 (0.0)	112,401 (67.3)	123,284 (64.7)	117,875 (48.2)	
High	150,116 (42.9)	247,403 (100.0)	26,310 (15.8)	35,772 (18.8)	114,849 (46.9)	
Total visits/patient, mean (SD)	13.5 (11.5)	10.2 (8.5)	20.2 (17.1)	16.1 (14.4)	12.7 (10.8)	<.001
Physician patient volume/day,[d] median (IQR)	27.2 (20.4-37.5)	27.5 (20.9-38.0)	25.7 (19.4-34.6)	25.2 (19.1-34.3)	25.1 (19.1-34.2)	<.001
ED visits during study period						
Number/patient, mean (SD)	2.2 (4.3)	1.5 (3.2)	3.3 (6.0)	2.7 (5.3)	2.0 (4.1)	<.001
Patients with none, No. (%)	128,849 (36.8)	122,561 (49.5)	46,630 (27.9)	62,078 (32.6)	102,663 (41.9)	<.001
Number/patient among those with ≥1, mean (SD)	3.6 (4.9)	3.0 (3.9)	4.6 (6.6)	4.0 (6.0)	3.5 (4.8)	<.001
Hospitalizations during study period						
Number/patient, mean (SD)	0.3 (0.8)	0.2 (0.6)	0.5 (1.1)	0.3 (0.9)	0.2 (0.7)	<.001
Patients with none, No. (%)	282,855 (80.8)	213,299 (86.2)	123,288 (73.8)	149,748 (78.6)	205,603 (84.0)	<.001
Number/patient among those with ≥1, mean (SD)	1.5 (1.2)	1.4 (1.0)	1.7 (1.6)	1.6 (1.4)	1.5 (1.0)	<.001

ED = emergency department; CRG = clinical risk grouper; FP = family physician; GCR = group care rate; IQR = interquartile range; KPC = known provider of care; NA = not applicable.

Note: See Table 1 footnotes for category definitions.

[a] Based on GCR.
[b] Based on CRG.
[c] Based on KPC index.
[d] For the physician associated with the patient.

Table 3. Associations of Physician Continuity and Clinic Continuity With ED and Hospital Use, by Patient Complexity[a]

	ED Visits, Incidence Rate Ratio (95% CI)			Hospitalizations, Incidence Rate Ratio (95% CI)		
Characteristic	Low Complexity	Moderate Complexity	High Complexity	Low Complexity	Moderate Complexity	High Complexity
Physician continuity[b]	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)
Clinic continuity[c]						
NA	0.81 (0.80-0.81)	0.79 (0.78-0.81)	0.68 (0.67-0.70)	0.77 (0.75-0.78)	0.67 (0.66-0.68)	0.78 (0.76-0.79)
None	Ref	Ref	Ref	Ref	Ref	Ref
Low	1.04 (1.03-1.06)	1.05 (1.04-1.07)	1.04 (1.02-1.06)	1.12 (1.10-1.14)	1.11 (1.07-1.15)	1.10 (1.08-1.13)
High	0.94 (0.93-0.95)	0.97 (0.95-0.99)	0.94 (0.92-0.95)	0.97 (0.95-0.98)	1.02 (0.99-1.06)	0.97 (0.95-0.99)
Complete	0.79 (0.78-0.80)	0.81 (0.80-0.83)	0.72 (0.71-0.73)	0.77 (0.75-0.78)	0.83 (0.80-0.86)	0.69 (0.67-0.70)
Sex, male	1.10 (1.09-1.11)	0.98 (0.97-1.00)	1.07 (1.06-1.08)	0.86 (0.84-0.89)	1.01 (1.01-1.01)	1.03 (1.01-1.05)
Age, per 5 years	0.98 (0.98-0.98)	1.00 (0.99-1.00)	1.00 (1.00-1.00)	0.93 (0.93-0.93)	1.01 (1.03-1.14)	1.03 (1.03-1.04)
Total visits, per visit	1.05 (1.05-1.05)	1.03 (1.03-1.03)	1.02 (1.02-1.02)	1.05 (1.05-1.05)	1.02 (1.02-1.02)	1.02 (1.02-1.02)
Physician visit volume, per patient/day	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)
Location						
Metro	Ref	Ref	Ref	Ref	Ref	Ref
Urban	1.41 (1.39-1.42)	1.44 (1.42-1.47)	1.28 (1.26-1.30)	1.41 (1.38-1.43)	1.36 (1.31-1.40)	1.35 (1.32-1.38)
Rural	2.68 (2.66-2.70)	2.46 (2.42-2.50)	2.33 (2.30-2.36)	1.76 (1.73-1.78)	1.65 (1.60-1.69)	1.74 (1.70-1.77)

CRG = clinical risk grouper; ED = emergency department; FP = family physician; GCR = group care rate; KPC = known provider of care; NA = not applicable; Ref = reference group.

Note: Adjusted for sex, age, visits in study period, average physician patient volume per day, and location.

[a] Based on CRG. Low = 1-2; moderate = 3-4; high = 5-9.
[b] Per 1% increase in KPC index.
[c] Based on GCR; see Table 1 footnotes for category definitions.

instances where a partner is not seen. Our next step is to seek access to data to make that distinction.

The value of 100% clinic continuity is likely attributable to a number of factors that have been shown to improve quality and health outcomes.[22] For example, the vast majority of FPs in Alberta who practice together in the same community clinic will also share access to electronic health records for the patients they care for, providing for informational and management continuity. FPs working in the same clinic are more likely to engage in direct communication, which is richer and more comprehensive than what is available in a common electronic health record.[23] Finally, there may be a team effect of seeing the same nurses, medical assistants, and other professionals, despite seeing a different FP in the same clinic.

Implications

From a health system perspective, our results offer evidence to guide provincial policy makers in addressing the shortage of primary care services. Rather than investing in the "Band-Aid fix" of urgent care centers some politicians advocate, investment in structural supports and policies (ie, additional support staff, payment system reforms) for primary care clinics that offer, at a minimum, cross-coverage and shared practices among multiple FPs will likely deliver superior outcomes and lower costs. These findings also provide a degree of reassurance about the increasing trend toward part-time practice in primary care noted in the introduction.

From a patient perspective, our results suggest that patients are best served by consistently seeing their own FP and, if they cannot do so, consistently seeing a partner. Relational continuity has been shown to be highly valued by FPs in parts of the world, but varies depending on the patient cohort surveyed.[7,24] The limited supply and suboptimal distribution of FPs amid a growing population makes it impossible at present to ensure that every Canadian can access this type of FP relationship.[25] The results from our study, however, offer some reassurance that clinic continuity is also of value to patient health.

Our future work will aim to explore the effect of intermediate levels of group care noted above, as well as factors such as the number of patients attached to all of the FPs practicing in the clinic, the number and mix of part-time and full-time FPs, the clinic location, and the length of time patients are cared for by a clinic team.

Limitations

Our study has several limitations, including the KPC index, which does not account for the fact that patients may vary in the total number of visits they make to an FP or primary care clinic. We addressed that shortcoming by including only patients who had 3 or more visits in the 3-year window and incorporating total visits in our models. The KPC index does not consider the influence and nature of the patient-physician relationship or the length of that relationship

(which is associated with better communication, development of trust, and improved patient health outcomes). Our study's cross-sectional design poses some inherent risks with the lack of randomization of patients and clinicians in this context. There is also some confounding potential between the outcome of hospitalization and the independent variable of patient complexity (CRG), which includes hospital use in its calculation. Ideally, a randomized controlled trial would resolve these issues. That would be both extremely expensive and operationally impractical at the necessary scale, however, and at least in Canada, would likely not be deemed ethically permissible. Although we can demonstrate clear-cut associations, causality cannot be proven.

Furthermore, we did not explore in detail the number of FPs working in a clinic as a covariate within our models. We also did not explore weekly or seasonal/yearly work patterns to highlight some context of the work patterns for each FP. From our data, we were unable to clearly identify whether FP locum coverage (a common practice in Canada) was in place to maintain access for the patient; this coverage is often an important component of rural and remote care. Our data did not allow us to fully exclude certain types of focused practice—some sports medicine and addiction medicine visits, for example—but these are relatively few in number and unlikely to impact our results.

Conclusions

It appears best to always see one's own FP, or if that is not possible, to see one of the FP's partners. These results fill an important gap in the existing literature on continuity of care and offer additional perspective on the future design of and investment in community primary care.

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Key words: continuity of care; primary care; patient health outcomes; known provider; physician-patient relationship; patient care team; group practice; part-time; health workforce; health policy; physician shortage area; delivery of health care; office visits; appointments and schedules; community health planning

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Supplemental materials

References

1. Wall EM. Continuity of care and family medicine: definition, determinants, and relationship to outcome. *J Fam Pract*. 1981;13(5):655-664.
2. Blewett LA, Johnson PJ, Lee B, Scal PB. When a usual source of care and usual provider matter: adult prevention and screening services. *J Gen Intern Med*. 2008;23(9):1354-1360. 10.1007/s11606-008-0659-0
3. Hansen RA, Voils CI, Farley JF, et al. Prescriber continuity and medication adherence for complex patients. *Ann Pharmacother*. 2015;49(3):293-302. 10.1177/1060028014563266
4. Hussey PS, Schneider EC, Rudin RS, Fox DS, Lai J, Pollack CE. Continuity and the costs of care for chronic disease. *JAMA Intern Med*. 2014;174(5):742-748. 10.1001/jamainternmed.2014.245
5. Romano MJ, Segal JB, Pollack CE. The association between continuity of care and the overuse of medical procedures. *JAMA Intern Med*. 2015;175(7):1148-1154. 10.1001/jamainternmed.2015.1340
6. Hollander MJ, Kadlec H. Financial implications of the continuity of primary care. *Perm J*. 2015;19(1):4-10. 10.7812/TPP/14-107
7. Saultz JW, Albedaiwi W. Interpersonal continuity of care and patient satisfaction: a critical review. *Ann Fam Med*. 2004;2(5):445-451. 10.1370/afm.91
8. Bodenheimer T, Haq C, Lehmann W. Continuity and access in the era of part-time practice. *Ann Fam Med*. 2018;16(4):359-360. 10.1370/afm.2267
9. Canadian Institute for Health Information. Physicians. Accessed Dec 20, 2023. Published Oct 26, 2023. https://www.cihi.ca/en/physicians
10. Atlas SJ, Grant RW, Ferris TG, Chang Y, Barry MJ. Patient-physician connectedness and quality of primary care. *Ann Intern Med*. 2009;150(5):325-335. 10.7326/0003-4819-150-5-200903030-00008
11. Bazemore A, Merenstein Z, Handler L, Saultz JW. The impact of interpersonal continuity of primary care on health care costs and use: a critical review. *Ann Fam Med*. 2023;21(3):274-279. 10.1370/afm.2961
12. McDonald T, Hart Szostakiwskyj J, Green, LA. The supply of primary care physicians in Alberta 2018-2022 – a dire description. *CHP J*. 2023. https://www.canadianhealthpolicy.com/download-article/3691/0/
13. College of Physicians and Surgeons of Alberta. *2018 Annual Report. Navigating Social Change*. Published 2019. Accessed Apr 19, 2024. https://cpsa.ca/wp-content/uploads/2022/11/CPSA-2018-annual-report.pdf
14. Statistics Canada. *Canada at a Glance: 2019*. Accessed Apr 19, 2024. https://www150.statcan.gc.ca/n1/en/pub/12-581-x/12-581-x2019001-eng.pdf
15. Government of Alberta. Health care services covered in Alberta. Accessed Mar 20, 2023. https://www.alberta.ca/ahcip-what-is-covered.aspx
16. Alberta Health Services. Official Standard Geographic Areas. Accessed Dec 20, 2023. Updated Jan 2018. https://open.alberta.ca/dataset/a14b50c9-94b2-4024-8ee5-c13fb70abb4a/resource/70fd0f2c-5a7c-45a3-bdaa-e1b4f4c5d9a4/download/official-standard-geographic-area-document.pdf
17. Canadian Institute for Health Information. National Physician Database Historical Payments — Data Tables. Accessed Dec 20, 2023. Published 2021. https://www.cihi.ca/en/national-physician-database-metadata
18. Health Quality Council Alberta. Panel identification algorithm 2019. Accessed Dec 20, 2023. https://hqca.ca/wp-content/uploads/2019/03/algorithm.png
19. Ejlertsson G, Berg S. Continuity of care in health care teams. A comparison of continuity measures and organisational solutions. *Scand J Prim Health Care*. 1985;3(2):79-85. 10.3109/02813438509013921
20. Canadian Institute of Health Information. *Continuity of Care With Family Medicine Physician: Why It Matters*. CIHI; 2015.
21. Hughes JS, Averill RF, Eisenhandler J, et al. Clinical Risk Groups (CRGs): a classification system for risk-adjusted capitation-based payment and health care management. *Med Care*. 2004;42(1):81-90. 10.1097/01.mlr.0000102367.93252.70
22. Starfield B, Simborg D, Johns C, Horn S. Coordination of care and its relationship to continuity and medical records. *Med Care*. 1977;15(11):929-938. 10.1097/00005650-197711000-00007
23. Kringos DS, Boerma WG, Hutchinson A, van der Zee J, Groenewegen PP. The breadth of primary care: a systematic literature review of its core dimensions. *BMC Health Serv Res*. 2010;10:65. 10.1186/1472-6963-10-65
24. Stokes T, Tarrant C, Mainous AG III, Schers H, Freeman G, Baker R. Continuity of care: is the personal doctor still important? A survey of general practitioners and family physicians in England and Wales, the United States, and The Netherlands. *Ann Fam Med*. 2005;3(4):353-359. 10.1370/afm.351
25. GoC Health Fact Sheets. Primary health care providers, 2019. Statistics Canada. Accessed Dec 20, 2023. Published Oct 22, 2020. https://www150.statcan.gc.ca/n1/en/catalogue/82-625-X202000100004