

Trends in Providing Out-of-Office, Urgent After-Hours, and On-Call Care in British Columbia

Lindsay Hedden, PhD¹

M. Ruth Lavergne, PhD²

Kimberlyn M. McGrail, PhD³

Michael R. Law, PhD³

Ivy L. Bourgeault, PhD⁴

Rita McCracken, MD, PhD⁵

Morris L. Barer, PhD³

¹Centre for Clinical Epidemiology and Evaluation, Research Pavilion, Vancouver General Hospital, Vancouver, British Columbia, Canada

²Faculty of Health Sciences, Simon Fraser University, Burnaby, British Columbia, Canada

³Centre for Health Services and Policy Research, University of British Columbia, Vancouver, British Columbia, Canada

⁴Telfer School of Management, University of Ottawa, Ottawa, Ontario, Canada

⁵Department of Family Practice, University of British Columbia, Vancouver, British Columbia, Canada

ABSTRACT

PURPOSE Providing care in alternative (non-office) locations and outside office hours are important elements of access and comprehensiveness of primary care. We examined the trends in and determinants of the services provided in a cohort of primary care physicians in British Columbia, Canada.

METHODS We used physician-level payments for all primary care physicians practicing in British Columbia from 2006-2007 through 2011-2012. We examined the association between physician demographics and practice characteristics and payment for care in alternative locations and after hours across rural, urban, and metropolitan areas using longitudinal mixed-effects models.

RESULTS The proportion of physicians who provided care in alternative locations and after hours declined significantly during the period, in rural, urban, and metropolitan practices. Declines ranged from 5% for long-term care facility visits to 22% for after-hours care. Female physicians, and those in the oldest age category, had lower odds of providing care at alternative locations and for urgent after-hours care. Compared with those practicing in metropolitan centers, physicians working in rural areas had significantly higher odds of providing care both in alternative locations and after hours.

CONCLUSION Care provided in non-office locations and after office hours declined significantly during the study period. Jurisdictions where providing these services are not mandated, and where similar workforce demographic shifts are occurring, may experience similar accessibility challenges.

Ann Fam Med 2019;17:116-124. <https://doi.org/10.1370/afm.2366>.

INTRODUCTION

Achieving high quality and patient-centered care requires health care system structures that support physician service delivery outside regular office hours and away from regular office locations. For example, when urgent care is required after hours, access to a primary care provider can support improved continuity and reduce costly emergency department visits.¹⁻³ The United States and Canada, however, are the least likely among Organization for Economic Cooperation and Development nations to offer after-hours access arrangements (35% of American and 45% of Canadian practices).⁴⁻⁶ Sixty-three percent of Canadians and 51% of Americans report that they find it very or somewhat difficult to get care after hours without going to an emergency department.⁷ Furthermore, increasing frailty in the community underlines the importance of providing care at patients' homes and in long-term care facilities as well as in hospitals, and emergency departments.⁸ This need will continue to grow as the population ages.

Understanding who is and is not providing these services is critical; however, evidence is limited. The studies that exist suggest that care provision in non-office locations by primary care physicians may be declining⁹⁻¹²; these studies, however, are based on cross-sectional survey data. They did not capture trends over time among the same cohort of providers, nor differences between rural, urban, and metropolitan practices, and also may be subject to recall and selection biases.



Conflicts of interest: authors report none.

CORRESPONDING AUTHOR

Lindsay Hedden, PhD
Centre for Clinical Epidemiology and Evaluation
Research Pavilion, Vancouver General Hospital
717 – 828 West 10th Avenue
Vancouver, BC V6T 1Z3
lindsay.hedden@ubc.ca

Participation in on-call arrangements, and practice in alternative locations are not mandated in British Columbia (BC). However, as part of their *Professional Standards and Guidelines*, the College of Physicians and Surgeons of BC (the physician licensing body in BC) states that it is "a physician's ethical, professional and legal obligation to provide appropriate ongoing and after-hours coverage for all patients under his or her care".¹³ Broad policy statements also support the provision of comprehensive primary care in multiple locations,¹⁴ and there have been some specific efforts to financially incentivize provision of care in alternative locations and after hours, as well as to participate in on-call rota.¹²

In this longitudinal population-based analysis we examine the trends in and determinants of care provided in non-office locations, after hours, and on-call rota participation among primary care physicians in BC. We compare patterns across rural, urban, and metropolitan areas.

METHODS

Primary care physicians in Canada are typically small business operators remunerated under a fee-for-service model with total fees negotiated between the physician medical association (Doctors of BC) and the BC Ministry of Health. Alternative payments, such as salary or sessional agreements, make up less than 20% of payments.¹⁵ Physicians are clinically autonomous, and have discretion over the organization and location of their practices.¹⁶

Approach and Data Sources

This study used linked, longitudinal, deidentified administrative data from the BC Ministry of Health and the College of Physicians and Surgeons of BC accessed through Population Data BC for the period of April 1, 2006 through March 31, 2012.¹⁷ We used the Medical Services Plan physician payment file to track all fee-for-service payments for each physician.¹⁸ We linked this with the alternative payment plan database, which contains records on all non-fee-for-service payments to physicians (eg, salary, service contracts, sessional fees).¹⁹ We adjusted all fees and payments in both files to 2012 levels to adjust for any fee or payment level changes. This created a payment variable that is a reliable proxy for levels of service provision. We obtained patient age, sex, location of residence, and neighborhood socioeconomic status from the Medical Services Plan consolidation file²⁰ and chronic conditions status from the Medical Services Plan payment and hospital separations data.²¹

Our study cohort included all physicians with a primary care specialty who were paid for clinical care deliv-

ery (>\$0) in at least 1 of the 7 study years, and whose payments were at least in part fee-for-service. Physicians whose remuneration was 100% non-fee-for-service were excluded as our outcomes of interest are not measurable using the alternative payment plan database.

Outcome Measures

Care in Alternative Locations

We identified visits/consultations in patients' homes, long-term care facilities, emergency departments, and acute-care hospitals (outside emergency departments) in the fee-for-service data by location codes attached to services rendered.²² We also examined consultations provided at any alternative location (by year). Locations included patients' homes, long-term care facilities, emergency departments and acute-care hospitals, diagnostic facilities, mental health centers, community locations (eg, school), or other.

After-Hours Care and On-Call Participation

We identified urgent after-hours care in the fee-for-service payment data by the presence of a premium applied to payments when care is provided outside regular office hours.²² Annual payments for time spent on call were assigned to each physician in the alternative payment plan database.¹⁹

Explanatory Variables

Physician demographic covariates included age (in 10-year groupings), sex, location of training (Canada or international), and practice rurality (metropolitan, urban, or rural) defined using an existing validated rubric.²³ In addition, we included a set of variables that characterize a physician's patient population, including the proportion of each physician's patient contacts with: women; individuals aged 65 years and over; individuals in the lowest socioeconomic quintile; and individuals with significant morbidity, assessed using Johns Hopkins' Aggregated Diagnostic Groupings.^{24,25}

Statistical Analyses

We used the χ^2 test for differences in payments for visits at alternative locations (home, hospital, emergency department, and long-term care facilities), urgent after-hours care, and time on call, across rural, urban, and metropolitan practice areas, and by study year. We used analysis of variances to examine variation across physician demographic variables, and patient population characteristics.

Payments for care provided in each alternative location (individually, and a composite measure of *no alternative locations*), urgent after hours, and on-call programs were modeled as dichotomous variables using mixed effects, multivariate logistic models. Recogniz-

ing that rural primary care practice differs substantially from urban and metropolitan practice, we elected to stratify our models by rurality.^{26,27} We included physician sex, other physician demographics, proportion of total clinical income received through the alternative payment plan, and a random effect for subject level residuals under a first-order autoregressive correlation matrix in each model. We expected some variation in payments for care provided in non-office locations and after office hours associated with the characteristics of a physician's patient population, and therefore incorporated these variables in those models as well.

As a sensitivity analysis, we assessed the proportion of physicians' overall payments related to care delivered at alternative locations and examined whether or not this changed over the study period using a mixed effects linear model with a logit-transformed outcome and the same set of independent variables listed above. This addresses the question of whether fewer physi-

cians taking on out-of-office care is offset by increases in the amount of out-of-office provision by those physicians who do provide those services.

All analyses were completed using SAS version 9.2 (SAS Institute, Inc).

RESULTS

We included 6,531 primary care physicians who received clinical service payments in at least 1 study year (Table 1). A total of 38% (n = 2,449) of the physicians self-identified as women, and 30% (n = 1,913) trained internationally. In 2011-2012, physicians were on average aged 51 years, and 16% (n = 871) of those who were active practiced in a rural area.

Eighty-five percent of physicians provided services in at least 1 alternative location in at least 1 study year. A majority of physicians provided at least 1: home visit (56%); long-term care facility visit

Table 1. Physician Demographics

Characteristic	All Study Years (n = 6,531)	2011-2012 by Area (n = 5,436)			
		Rural (n = 871)	Urban (n = 1,386)	Metropolitan (n = 3,179)	Total (n = 5,436)
Sex, No. (%) ^a					
Female	2,449 (37.5)	312 (35.8)	499 (36.0)	1,249 (40.2)	2,090 (38.4)
Male	4,082 (62.5)	559 (64.8)	887 (64.0)	1,900 (59.8)	3,346 (61.6)
Age, mean (SD), y ^b	...	47.8 (11.2)	50.9 (11.3)	51.0 (11.6)	50.6 (11.5)
Age-group, No. (%), y ^c					
<35	...	115 (13.2)	119 (8.6)	310 (9.8)	544 (10.0)
35-<45	...	250 (28.7)	289 (20.9)	619 (19.5)	1,158 (21.3)
45-<55	...	248 (28.5)	449 (32.4)	1012 (31.8)	1,709 (31.4)
55-<65	...	196 (22.5)	369 (26.6)	827 (26.0)	1,392 (25.6)
≥65	...	62 (7.1)	160 (11.5)	411 (12.9)	633 (11.6)
Trained internationally, No. (%) ^d	1,913 (29.9)	305 (35.7)	427 (31.9)	808 (26.1)	1,550 (29.1)
Average compensation, mean (SD), Can\$					
Fee-for-service payments ^e	170,569 (140,779)	197,595 (138,096)	195,828 (128,348)	190,046 (145,446)	192,730 (138,096)
APP payments ^f	31,538 (57,049)	44,942 (57,637)	34,280 (60,347)	31,647 (59,966)	34,449 (59,872)
Location of OOO visits pro- vided, No. (%)					
Home ^g	3,627 (55.5)	382 (43.9)	580 (41.9)	904 (28.4)	1,866 (34.3)
Long-term care facility ^h	3,629 (55.6)	489 (56.1)	791 (57.1)	991 (31.2)	2,271 (41.8)
Emergency department ⁱ	3,330 (51.0)	594 (68.2)	618 (44.6)	574 (18.1)	1,786 (32.9)
Hospital (non-emergency) ^j	5,123 (78.4)	734 (84.3)	1,022 (73.7)	1,640 (51.6)	3,396 (62.5)
Provided OOO visits at any location, No. (%) ^k	5,555 (85.1)	802 (92.1)	1,195 (86.2)	2,100 (66.1)	4,097 (75.4)
After-hours contacts, No. (%) ^l	4,190 (64.2)	637 (74.7)	716 (52.8)	990 (32.7)	2,343 (44.7)
On-call participation, No. (%) ^m	2,731 (41.8)	568 (65.2)	501 (36.2)	540 (17.0)	1,609 (29.6)

APP = alternative payment plan; OOO = out-of-office.

Note: Statistical tests for differences in outcome by type of area of practice location, 2011-2012 only (P < .05).

^a $\chi^2 = 10.4$, P = .006

^e F = 17.0, P < .0001

^h $\chi^2 = 354.1$, P < .0001

^k $\chi^2 = 367.3$, P < .0001

^b F = 29.0, P < .0001

^f F = 1.45, P = .2353

ⁱ $\chi^2 = 895.2$, P < .0001

^l $\chi^2 = 523.4$, P < .0001

^c $\chi^2 = 66.3$, P < .0001 χ^2

^g $\chi^2 = 118.9$, P < .0001

^j $\chi^2 = 412.2$, P < .0001

^m $\chi^2 = 801.3$, P < .0001

^d Frequency missing: 133; $\chi^2 = 36.85$, P < .0001

(56%); emergency department visit (51%); and non-emergency department hospital visit (78%) at some point during the study period. Most (64%) were paid for urgent after-hours services, and 42% participated in an on-call arrangement. Physicians located in rural areas were more likely to provide care at all alternative locations and after hours.

Care provided out-of-office and after-hours declined over the study period (Figures 1 and 2). Declines ranged from 5% for visits to long-term care facilities to 22% for the provision of urgent after-hours care.

Multivariate Results

Payment for Care Provided in Alternative Locations

Adjusting for physician demographic and patient factors, care provided at home, hospital, and emergency departments declined over the study period in all practice areas, while care provided at long-term care facilities declined in urban areas only. The proportion of physicians' care provided at alternative locations declined in urban and metropolitan areas but did not change in rural areas (Supplemental Table 1, available at <http://www.AnnFamMed.org/content/17/2/116/suppl/DC1/>.)

Across all areas, female physicians had significantly lower odds of providing out-of-office care in patient homes, long-term care facilities, emergency departments, hospitals, or overall (Table 2). Physicians in successively older age strata had lower odds of providing emergency department visits and hospital visits, and those aged over 65 years had lower odds of providing home and long-term care facility visits. Compared with physicians aged younger than 35 years, physicians aged 35 to <65 years had higher odds of providing home visits. Training location

Figure 1. Percentage of cohort providing home, long-term care, hospital, or emergency department visits by study year.

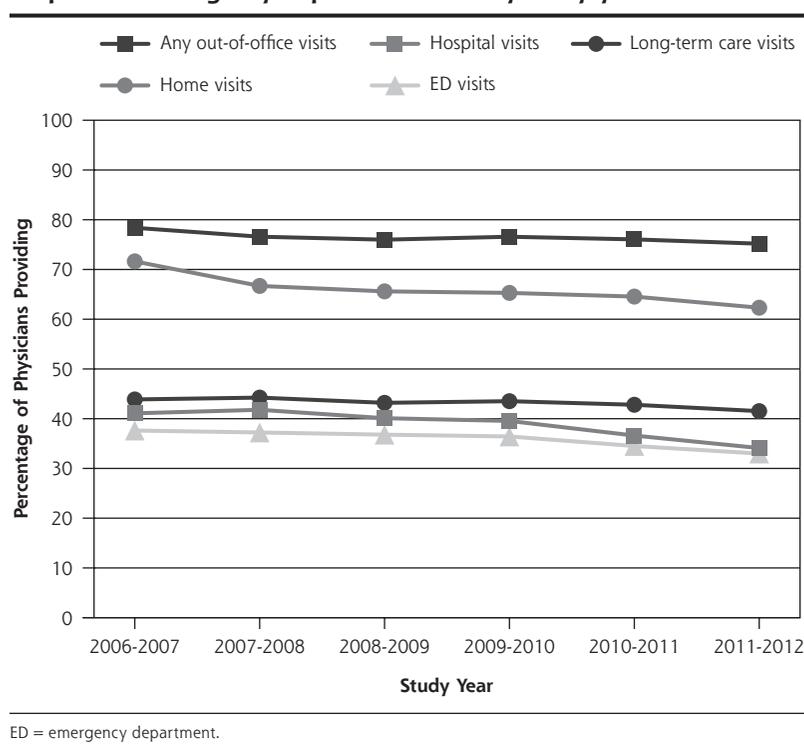


Figure 2. Percentage of cohort providing after-hours care and on-call support by year.

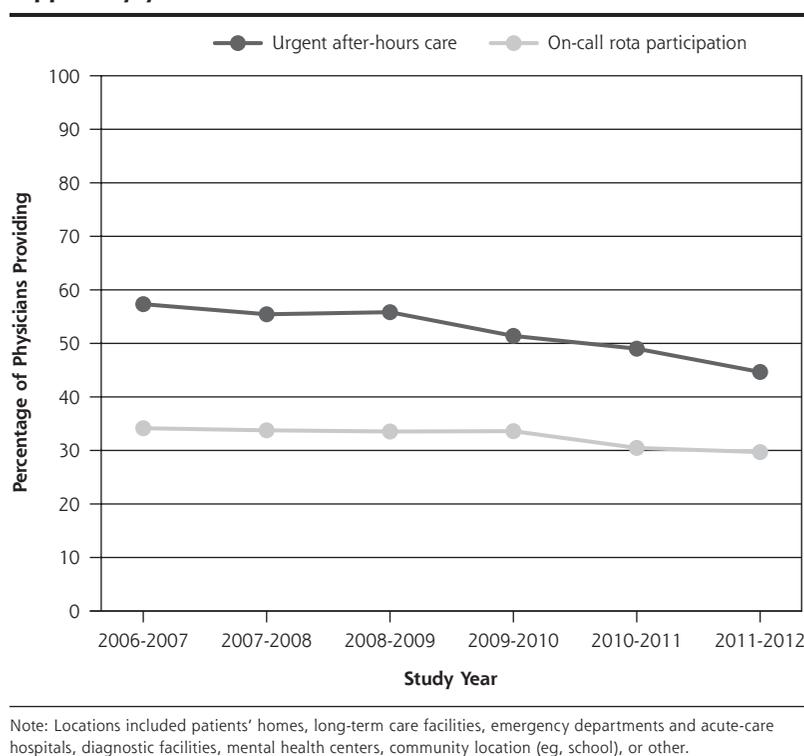


Table 2. Logistic Modeling Results for the Provision of Out-of-Office Care

Characteristic	Model 1: Rural OR (95% CI)	Model 2: Urban OR (95% CI)	Model 3: Metropolitan OR (95% CI)
Panel A: Any out-of-office care			
Sex (female)	0.29 (0.21-0.40) ^a	0.53 (0.43-0.66) ^a	0.65 (0.59-0.72) ^a
Year	0.95 (0.88-1.03)	0.92 (0.87-0.96) ^b	0.94 (0.92-0.96) ^a
Age, y			
35-<45	0.58 (0.33-1.03)	0.92 (0.66-1.28)	0.95 (0.83-1.09)
45-<55	0.30 (0.17-0.52) ^a	0.72 (0.52-1.00) ^c	1.04 (0.91-1.19)
55-<65	0.22 (0.13-0.40) ^a	0.56 (0.40-0.79) ^b	0.78 (0.68-0.90) ^b
≥65	0.08 (0.04-0.16) ^a	0.24 (0.16-0.34) ^a	0.39 (0.33-0.46) ^a
Training (international)	1.64 (1.20-2.24) ^c	0.84 (0.70-1.00)	0.98 (0.90-1.07)
Proportion APP	1.20 (0.71-2.03)	7.22 (4.49-11.60) ^a	1.47 (1.24-1.74) ^a
Proportion female	47.47 (15.68-143.70) ^a	27.42 (11.77-63.87) ^a	5.46 (3.89-7.65) ^a
Proportion aged ≥65 y	79.89 (24.36-261.94) ^a	114.13 (54.11-240.69) ^a	168.95 (121.50-234.93) ^a
Proportion >1 Chronic ADGs	72.68 (23.17-227.99) ^a	56.99 (24.53-132.44) ^a	14.46 (10.73-19.50) ^a
Proportion low SES	0.01 (0.01-0.03) ^a	1.84 (0.79-4.29)	0.22 (0.16-0.32) ^a
Panel B: Home visits			
Sex (female)	0.66 (0.53-0.82) ^b	0.66 (0.55-0.79) ^a	0.66 (0.58-0.75) ^a
Year (continuous)	0.93 (0.89-0.97) ^b	0.91 (0.88-0.94) ^a	0.92 (0.90-0.94) ^a
Age, y			
35-<45	1.27 (0.99-1.61)	1.03 (0.83-1.29)	1.30 (1.09-1.55) ^c
45-<55	1.50 (1.16-1.94) ^c	1.23 (0.98-1.54)	1.87 (1.57-2.23) ^a
55-<65	1.64 (1.24-2.17) ^b	1.27 (1.00-1.62)	2.01 (1.68-2.41) ^a
≥65	0.68 (0.46-1.01)	0.67 (0.50-0.90) ^c	1.39 (1.12-1.72) ^c
Training (international)	0.97 (0.81-1.16)	0.95 (0.82-1.10)	0.94 (0.84-1.05)
Proportion APP	0.13 (0.08-0.19) ^a	0.24 (0.18-0.33) ^a	0.24 (0.20-0.29) ^a
Proportion female	2.46 (1.11-5.48) ^c	3.54 (1.74-7.21) ^b	1.90 (1.26-2.86) ^b
Proportion aged ≥65 y	18.52 (9.41-36.46) ^a	43.81 (25.57-75.06) ^a	12.34 (9.03-16.87) ^a
Proportion >1 chronic ADGs	2.15 (0.99-4.65)	0.20 (0.10-0.39) ^a	0.66 (0.46-0.94) ^c
Proportion low SES	0.26 (0.13-0.51) ^a	0.92 (0.47-1.83)	0.33 (0.21-0.51) ^a
Panel C: Long-term care visits			
Sex (female)	0.58 (0.46-0.75) ^a	0.69 (0.57-0.84) ^b	0.58 (0.46-0.75) ^a
Year (continuous)	0.98 (0.94-1.03)	0.96 (0.93-1.00) ^c	0.98 (0.94-1.03)
Age, y			
35-<45	1.16 (0.90-1.50)	0.77 (0.62-0.96) ^c	1.16 (0.90-1.50)
45-<55	1.03 (0.78-1.36)	0.82 (0.65-1.03)	1.03 (0.78-1.36)
55-<65	0.80 (0.59-1.09)	0.74 (0.57-0.95) ^c	0.80 (0.59-1.09)
≥65	0.47 (0.31-0.73) ^b	0.42 (0.31-0.57) ^a	0.47 (0.31-0.73) ^b
Training (international)	1.18 (0.95-1.45)	1.16 (0.98-1.38)	1.18 (0.95-1.45)
Proportion APP	0.13 (0.08-0.19) ^a	0.27 (0.20-0.36) ^a	0.13 (0.08-0.19) ^a
Proportion female	7.96 (3.34-18.94) ^a	4.65 (2.36-9.14) ^a	7.96 (3.34-18.94) ^a
Proportion aged ≥65 y	100.32 (45.47-221.36) ^a	90.86 (51.98-158.82) ^a	100.32 (45.47-221.36) ^a
Proportion >1 chronic ADGs	1.84 (0.80-4.22)	0.53 (0.29-0.98) ^c	1.84 (0.80-4.22)
Proportion low SES	0.19 (0.09-0.40) ^a	7.46 (3.78-14.74) ^a	0.19 (0.09-0.40) ^a

continues

ADG = aggregated diagnostic groupings; APP = alternative payment plan; OR = odds ratio; SES = socioeconomic status.

^a P < .0001

^b P < .001

^c P < .05

did not appear to affect the odds of providing home, long-term care facility, or hospital visits; however, physicians who trained outside of Canada had higher odds of providing emergency department visits, and out-of-office care overall, but only in rural areas.

The characteristics of primary care physicians' patient populations were influential predictors of care provided in alternative locations. Physicians whose practices included a larger proportion of contacts with female patients had higher odds of providing

Table 2. Logistic Modeling Results for the Provision of Out-of-Office Care (continued)

Characteristic	Model 1: Rural OR (95% CI)	Model 2: Urban OR (95% CI)	Model 3: Metropolitan OR (95% CI)
Panel D: Emergency department visits			
Sex (female)	0.49 (0.38-0.62) ^a	0.53 (0.44-0.64) ^a	0.59 (0.51-0.67) ^a
Year	0.95 (0.91-0.99) ^c	0.96 (0.93-0.99) ^c	0.93 (0.91-0.95) ^a
Age, y			
35-<45	0.70 (0.53-0.93) ^c	0.60 (0.48-0.75) ^a	0.67 (0.58-0.78) ^a
45-<55	0.56 (0.41-0.76) ^b	0.44 (0.35-0.55) ^a	0.58 (0.49-0.68) ^a
55-<65	0.36 (0.26-0.50) ^a	0.35 (0.27-0.44) ^a	0.45 (0.38-0.54) ^a
≥65	0.18 (0.12-0.28) ^a	0.20 (0.14-0.27) ^a	0.30 (0.24-0.38) ^a
Training (international)	1.35 (1.08-1.68) ^c	0.86 (0.73-1.01)	0.89 (0.77-1.02)
Proportion APP	1.58 (1.10-2.29) ^c	4.36 (3.30-5.77) ^a	1.33 (1.14-1.57) ^b
Proportion female	1.98 (1.01-3.89) ^c	0.89 (0.48-1.65)	1.20 (0.85-1.69)
Proportion aged ≥65 y	0.42 (0.22-0.81) ^c	0.59 (0.36-0.96) ^c	0.61 (0.46-0.81) ^b
Proportion >1 chronic ADGs	3.79 (1.94-7.39) ^a	4.05 (2.28-7.20) ^a	3.93 (2.85-5.41) ^a
Proportion low SES	0.37 (0.20-0.67) ^c	1.67 (0.87-3.19)	0.53 (0.36-0.79) ^c
Panel E: Hospital visits			
Sex (female)	0.29 (0.22-0.37)	0.58 (0.49-0.68) ^a	0.67 (0.61-0.74) ^a
Year (continuous)	0.89 (0.84-0.94) ^b	0.87 (0.84-0.90) ^a	0.90 (0.88-0.92) ^a
Age, y			
35-<45	0.73 (0.50-1.07)	0.77 (0.60-0.98) ^c	0.77 (0.67-0.87) ^a
45-<55	0.47 (0.32-0.68) ^a	0.56 (0.44-0.71) ^a	0.90 (0.80-1.03)
55-<65	0.31 (0.21-0.46) ^a	0.56 (0.44-0.73) ^a	0.64 (0.56-0.73) ^a
≥65	0.10 (0.06-0.17) ^a	0.25 (0.19-0.33) ^a	0.36 (0.31-0.42) ^a
Training (international)	1.05 (0.84-1.31)	0.94 (0.82-1.07)	1.04 (0.96-1.12)
Proportion APP	0.10 (0.07-0.15) ^a	0.62 (0.47-0.81) ^b	0.81 (0.69-0.95) ^c
Proportion female	106.55 (39.46-287.72) ^a	38.00 (19.25-75.02) ^a	18.77 (13.43-26.23) ^a
Proportion aged ≥65 y	21.90 (8.78-54.66) ^a	12.11 (7.19-20.41) ^a	37.81 (29.15-49.04) ^a
Proportion >1 chronic ADGs	260.50 (92.55-733.19) ^a	49.72 (25.39-97.39) ^a	14.89 (11.22-19.75) ^a
Proportion low SES	0.05 (0.02-0.10) ^a	2.71 (1.42-5.17) ^c	0.21 (0.15-0.30) ^a

ADG = aggregated diagnostic groupings; APP = alternative payment plan; OR = odds ratio; SES = socioeconomic status.

^a $P < .0001$

^b $P < .001$

^c $P < .05$

care at any out-of-office location and at homes, long-term care facilities, emergency departments (in rural areas only), and hospitals. Physicians whose practices included more visits with patients aged over 65 years had higher odds of providing care at home, long-term care facilities, and hospitals but had lower odds of providing care in emergency departments. Physicians who saw a higher proportion of chronically ill patients had higher odds of providing care in emergency departments and hospitals across all areas, higher odds of providing care in long-term care facilities in urban areas only, and lower odds of providing home visits in rural and metropolitan areas. Physicians whose practices included a larger proportion of visits with individuals in the lowest neighborhood socioeconomic status quintile had lower odds of providing care in hospitals, long-term care facilities, homes, and emergency departments in rural and metropolitan areas but not in urban areas.

Urgent After-Hours Care

The proportion of physicians who received payment for urgent after-hours care or for participation in on-call rota declined significantly over the study period across all areas (Table 3). Female physicians were less likely to provide urgent after-hours care or participate in on-call rota. Physicians in successively older age categories also had lower odds of on-call rota participation, and those aged 55 years and older had lower odds of providing urgent after-hours care. Internationally trained physicians had lower odds of providing urgent after-hours care compared with those trained in Canada, but only in metropolitan areas. They had higher odds of participating in on-call rota in rural and urban areas.

Physicians whose practices included a larger proportion of contacts with female patients had lower odds of providing after-hours care across all areas, and higher odds of participating in on-call rota but only in

metropolitan areas. Physicians who saw more individuals aged over 65 years had higher odds of providing urgent after-hours care across all areas, and also on-call rota participation but only in metropolitan areas. Physicians whose practices included a larger proportion of patients with chronic illness had higher odds of providing urgent after-hours care and participating in on-call rota. Those who saw more individuals in the lowest socioeconomic status neighborhood quintile had significantly lower odds of providing after-hours care in rural and metropolitan areas, and higher odds of on-call participation in urban areas.

DISCUSSION

The provision of care in alternative locations or after hours, and participation in on-call rota declined in BC from 2006 through 2012. The decline of care provided in patient homes and long-term care facilities is of particular concern given that an increasing proportion of the population will be moving into age groups where visits in these locations is important for quality primary care. It is also of note that these declines occurred in the context of substantial financial incentives.¹²

Female physicians and those in the oldest age category (aged ≥65 years) were less likely to provide services at the 4 alternative locations. These results point to increasing accessibility challenges in the future, and are of concern for other jurisdictions (such as the United States) where physician demographics are shifting.^{15,28,29} Additionally, physicians whose practices included relatively high proportions of contacts with individuals in the lowest neighborhood socioeconomic status quintile were significantly less likely to provide care in alternative locations or after hours. This trend may reflect the fact that patients living in lower income areas are more likely to attend care at strict fee-for-service clinics rather than team-based patient

medical homes, the latter of which are more likely to offer after-hours access.³⁰

The extent of the decline, as well as the sociodemographic predictors of provision, varied by practice location, supporting existing literature on the substantial differences between rural and metropolitan practice, with rural primary care physicians providing a broader range of clinical care.^{27,31,32} This may be the result of either necessity, desire, or both. The presence of hospitalist physicians in metropolitan and some urban areas may explain differences between rural, urban, and metropolitan areas in terms of care provided in emergency departments and inpatient facilities. In the absence of hospitalists, there is a larger need for rural-based physicians to provide these ser-

Table 3. Logistic Modeling Results for the Provision of After-hours Care and On-call Participation

Characteristic	Model 1: Rural OR (95% CI)	Model 2: Urban OR (95% CI)	Model 3: Metropolitan OR (95% CI)
Panel A: Urgent After-Hours Care			
Sex (female)	0.46 (0.35-0.59) ^a	0.54 (0.45-0.65) ^a	0.66 (0.58-0.75) ^a
Year	0.94 (0.90-0.98) ^c	0.89 (0.86-0.91) ^a	0.87 (0.85-0.89) ^a
Age, y			
35-<45	0.77 (0.57-1.04)	0.69 (0.55-0.86) ^c	0.8 (0.69-0.92) ^c
45-<55	0.75 (0.55-1.04)	0.56 (0.44-0.71) ^a	1.02 (0.88-1.18)
55-<65	0.42 (0.30-0.59) ^a	0.47 (0.37-0.61) ^a	0.94 (0.80-1.10)
≥65	0.23 (0.15-0.36) ^a	0.3 (0.22-0.41) ^a	0.71 (0.59-0.86) ^b
Training (international)	1.22 (0.97-1.55)	0.98 (0.83-1.15)	0.86 (0.76-0.97) ^c
Proportion APP	0.41 (0.29-0.58) ^a	0.89 (0.69-1.16)	0.63 (0.54-0.73) ^a
Proportion female	6.43 (3.15-13.14) ^a	3.67 (2.02-6.69) ^a	2.82 (2.03-3.91) ^a
Proportion aged ≥65 y	5.5 (2.69-11.22) ^a	2.66 (1.64-4.30) ^a	3.27 (2.51-4.27) ^a
Proportion >1 chronic ADGs	4.44 (2.18-9.04) ^a	2.45 (1.40-4.28) ^c	1.86 (1.39-2.50) ^a
Proportion low SES	0.24 (0.13-0.46) ^a	1.71 (0.92-3.21)	0.39 (0.27-0.57) ^a
Panel B: On-call rota participation			
Sex (female)	0.56 (0.43-0.73) ^a	0.59 (0.48-0.72) ^a	0.81 (0.70-0.94) ^c
Year (continuous)	0.93 (0.90-0.97) ^b	0.96 (0.93-0.98) ^c	0.93 (0.91-0.95) ^a
Age, y			
35-<45	0.84 (0.66-1.07)	0.78 (0.65-0.94) ^c	0.73 (0.64-0.84) ^a
45-<55	0.77 (0.58-1.01)	0.63 (0.51-0.78) ^a	0.67 (0.58-0.79) ^a
55-<65	0.44 (0.33-0.60) ^a	0.47 (0.37-0.59) ^a	0.47 (0.40-0.56) ^a
≥65	0.16 (0.10-0.24) ^a	0.3 (0.22-0.40) ^a	0.32 (0.25-0.40) ^a
Training (international)	1.3 (1.03-1.64) ^c	1.33 (1.12-1.59) ^c	1.08 (0.93-1.26)
Proportion APP	5.51 (3.76-8.06) ^a	4.35 (3.46-5.46) ^a	2.16 (1.89-2.46) ^a
Proportion female	0.75 (0.39-1.44)	1.39 (0.84-2.32)	1.38 (1.04-1.84) ^c
Proportion aged ≥65 y	1.36 (0.71-2.60)	1.29 (0.83-2.02)	1.35 (1.04-1.74) ^c
Proportion >1 chronic ADGs	2.6 (1.41-4.83) ^c	5.54 (3.45-8.89) ^a	3.02 (2.29-3.99) ^a
Proportion low SES	0.45 (0.25-0.82) ^c	3.18 (1.80-5.64) ^a	0.77 (0.56-1.08)

ADG = aggregated diagnostic groupings; APP = alternative payment plan; OR = odds ratio; SES = socioeconomic status.

^a P < .0001

^b P < .001

^c P < .05

vices. Alternatively, it's possible that the reduction of participation in care provision in hospitals led to an increase in the number of hospitalist physicians hired in some areas.

The model, style, and scope of practice of individual physicians is multifactorial and dependent on a host of structural, system, organization, and personal factors such as geography, remuneration, resource availability, training, intentions, and others.³³ An exploration of the rationale for why physicians choose to provide out-of-office or after-hours services is beyond the scope of this analysis but should be the subject of future research. It is increasingly clear that financial incentives will not produce desired outcomes,^{12,34} so understanding decision-making and practice-style choices must inform future policy innovations.

One limitation of this study is that we were only able to extend the analysis to the end of the 2011-2012 fiscal year to capture non-fee-for-service and on-call payment data. We are not aware, however, of any significant policy, payment, or workforce demographic shifts that occurred following the end of our study period that would have altered the trends we observed here.

Our measure of after-hours care is necessarily incomplete, reflecting only specific financial incentives provided for urgent care provision. We were unable to measure standard clinic operations that occur outside of regular business hours as these are not uniquely identified within the payment data. Furthermore, the central on-call reimbursement program has been designed to pay physicians to be available to respond to emergency care needs of patients other than their own, and some physicians have raised concerns about confusion in how to access those payments.³⁵ Lastly, throughout this paper we have been referring to service provision using underlying payment data. Physician services are fully publicly covered in BC and submitted claims for care provision are rarely permanently rejected; instead, they may be temporarily declined due to billing errors, and then subsequently accepted upon correction. Therefore, we expect that any difference between payment and provision is small and would create random noise in the data rather than bias.

Provision of primary care services outside of physicians' offices and regular office hours declined in BC across rural, urban, and metropolitan areas during our study period. This trend points to increasing primary care accessibility challenges in future, both within Canada and elsewhere.

To read or post commentaries in response to this article, see it online at <http://www.AnnFamMed.org/content/17/2/116>.

Key words: primary health care; physicians; primary care; after-hours care; British Columbia; cohort studies

Submitted April 3, 2018; submitted, revised, October 23, 2018; accepted December 17, 2018.

Funding support: This study was supported by a Canadian Institutes of Health Research Doctoral Fellowship Award. Dr Law received salary support through a Canada Research Chair in Access to Medicines and a Michael Smith Foundation for Health Research Scholar Award.

Acknowledgments: All inferences, opinions, and conclusions drawn in this manuscript are those of the authors, and do not reflect the opinions or policies of the Data Stewards. We obtained ethics approval for this study from the University of British Columbia Behavioral Research Ethics Board.

Supplemental Materials: Available at <http://www.AnnFamMed.org/content/17/2/116/suppl/DC1>.

References

- Piehl MD, Clemens CJ, Joines JD. "Narrowing the Gap": decreasing emergency department use by children enrolled in the Medicaid program by improving access to primary care. *Arch Pediatr Adolesc Med*. 2000;154(8):791-795. <http://www.ncbi.nlm.nih.gov/pubmed/10922275>. Accessed Jul 18, 2017.
- Lowe RA, Localio AR, Schwarz DF, et al. Association between primary care practice characteristics and emergency department use in a medicaid managed care organization. *Med Care*. 2005;43(8):792-800. <http://www.ncbi.nlm.nih.gov/pubmed/16034293>. Accessed Jul 18, 2017.
- Margolius D, Bodenheimer T. Redesigning after-hours primary care. *Ann Intern Med*. 2011;155(2):131-132.
- Schoen C, Osborn R, Squires D, Doty M, Pierson R, Applebaum S. New 2011 survey of patients with complex care needs in eleven countries finds that care is often poorly coordinated. *Health Aff (Millwood)*. 2011;30(12):2437-2448.
- Schoen C, Osborn R, Squires D, et al. A survey of primary care doctors in ten countries shows progress in use of health information technology, less in other areas. *Health Aff (Millwood)*. 2012;31(12):2805-2816.
- Berchet C, Nader C. *The Organisation of Out-of-Hours Primary Care in OECD Countries*. Paris, France: OECD Publishing; 2016. doi: 10.1787/5jlr3cbzqw23-en.
- Commonwealth Fund. *2016 Commonwealth Fund International Health Policy Survey of Adults*. <https://www.commonwealthfund.org/publications/surveys/2016/nov/2016-commonwealth-fund-international-health-policy-survey-adults>. Published Nov 16, 2016. Accessed Mar 20, 2018.
- McGregor MJ. Promising practices in long-term residential care: where do physicians fit in (or don't they)? *J Can Stud*. 2016;50(2):299-320.
- Chan BTB. The declining comprehensiveness of primary care. *CMAJ*. 2002;166(4):429-434. <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=993516&tool=pmcentrez&rendertype=abstr>. Accessed Feb 22, 2013.
- Bass MJ, McWhinney IR, Stewart M, Grindrod A. Changing face of family practice. *Can Fam Physician*. 1998;44:2143-2149. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2277911/>. Accessed May 15, 2015.
- Chan B. supply of physicians' services in Ontario. *Hosp Q*. 1999-2000;3(2):17.
- Lavergne MR, Peterson S, McKendry R, Sivananthan S, McGrail K. Full-service family practice in British Columbia: policy interventions and trends in practice, 1991-2010. *Health Policy*. 2014;9(4):32-47. <http://europepmc.org/articles/pmc4749884>. Published Apr 2014. Accessed Jan 23, 2015.

13. College of Physicians and Surgeons of British Columbia. *College of Physicians and Surgeons of British Columbia Professional Standards and Guidelines: After-Hours Coverage*. <https://www.cpsbc.ca/for-physicians/college-connector/2015-V03-02/04>. 2013.
14. British Columbia Ministry of Health. *Primary and Community Care in BC: A Strategic Policy Framework*. <http://www.health.gov.bc.ca/library/publications/year/2015/primary-and-community-care-policy-paper.pdf>. Published 2015.
15. Hedden L. *Beyond Full-Time Equivalents: Gender Differences in Activity and Practice Patterns for BC's Primary Care Physicians* [Doctoral thesis]. Vancouver: The University of British Columbia; 2015.
16. Hutchison B, Levesque J-F, Strumpf E, Coyle N. Primary health care in Canada: systems in motion. *Milbank Q*. 2011;89(2):256-288.
17. College of Physicians and Surgeons of British Columbia. Medical Services Plan Physician Database. <https://www.popdata.bc.ca>. Published 2013.
18. British Columbia Ministry of Health. Medical Services Plan (MSP) Payment Information File. V2. <https://www.popdata.bc.ca/data/health/msp>. Published 2013.
19. British Columbia Ministry of Health. Alternative Payments Program. <http://www.popdata.bc.ca/data>. Published 2013.
20. British Columbia Ministry of Health. Consolidation File (MSP Registration & Premium Billing). V2. <http://www.popdata.bc.ca/data>. Published 2013.
21. Canadian Institute for Health Information. Discharge Abstract Database (Hospital Separations). <http://www.popdata.bc.ca/data>. Published 2011.
22. Lavergne R, Mcgrail K, Peterson S, Sivanathan S, Mckendry R, Mooney D. Defining and Measuring Full Service Family Practice in BC, 1991–2006. <https://open.library.ubc.ca/cIRcle/collections/facultyresearchandpublications/52383/items/1.0048527>. Published Aug 31, 2013.
23. Statistics Canada. CMA and CA: Detailed definition. <http://www.statcan.gc.ca/pub/92-195-x/2011001/geo/cma-rmr/def-eng.htm>. Published 2015. Accessed Jun 27, 2017.
24. Johns Hopkins University. About the ACG System. http://www.acg.jhsph.org/index.php?option=com_content&view=article&id=46&Itemid=366. Published 2012. Accessed Dec 6, 2013.
25. Health Services Research and Development Centre at Johns Hopkins University. *The Johns Hopkins ACG System: Technical Reference Guide, Version 10.0*. Baltimore, MD: Johns Hopkins University; 2011.
26. The Canadian Medical Association. Rural and urban practices – Where they differ and where they don't. *Physician Data Cent Bull*. 2014;1-5.
27. Weeks WB, Wallace AE. Rural-urban differences in primary care physicians' practice patterns, characteristics, and incomes. *J Rural Health*. 2008;24(2):161-170.
28. Dall T, West T, Chakrabarti R, Iacobucci W. *The Complexities of Physician Supply and Demand: Projections from 2013 to 2025 Final Report Association of American Medical Colleges*. <https://www.aamc.org/download/426248/data/thecomplexitiesofphysiciansupplyanddemandprojectionsfrom2013to2025.pdf>. Published Mar 2015.
29. The American Association of Medical Colleges. *Distribution of Residents by Specialty, 2003 Compared to 2013*. https://www.aamc.org/download/411784/data/2014_table2.pdf. Published 2013.
30. Kiran T, Kopp A, Glazier RH. Those left behind from voluntary medical home reforms in Ontario, Canada. *Ann Fam Med*. 2016;14(6):517-525.
31. Baldwin LM, Hart LG, West PA, Norris TE, Gore E, Schneeweiss R. Two decades of experience in the University of Washington Family Medicine Residency Network: practice differences between graduates in rural and urban locations. *J Rural Health*. 1995;11(1):60-72. 10.1111/j.1748-0361.1995.tb00397.x.
32. Wenghofer EF, Kam SM, Timony PE, Strasser R, Sutinen J. Geographic variation in FP and GP scope of practice in Ontario. *Can Fam Physician*. 2018;64(6):274-282.
33. Wong E, Stewart M. Predicting the scope of practice of family physicians. *Can Fam Physician*. 2010;56(6):e219-e225. <http://www.cfp.ca/content/56/6/e219.full>.
34. Lavergne MR, Law MR, Peterson S, et al. A population-based analysis of incentive payments to primary care physicians for the care of patients with complex disease. *CMAJ*. 2016;188(15):E375-E383.
35. Frechette R, Moore R, Harris EJ, Webb A, Karimuddin A. Report of the MOCAP Redesign Panel. <https://www2.gov.bc.ca/assets/gov/health/practitioner-pro/mocap-redesign-panel-report-14-05-2013.pdf>. Published May 14, 2013.