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ORIGINAL RESEARCH

Nature and nurture in the family physician's choice of practice location

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ABSTRACT

Introduction: An understanding of the contextual, professional, and personal factors that affect choice of practice location for physicians is needed to support successful strategies in addressing geographic maldistribution of physicians. This study compared two categories of predictors of family practice location in non-metropolitan areas among undergraduate medical students: individual characteristics (nature), and the rural program component of their training program (nurture). The study aimed to identify factors that predict the location of practice 2 years post-residency training and determine the predictive value of combining nature and nurture variables using administrative data from two undergraduate medical education programs.

Methods: Databases were developed from available administrative sources for a retrospective analysis of two undergraduate medical education programs in Canada: Université de Sherbrooke (UdeS) and University of British Columbia (UBC). Both schools have a strong mandate to evaluate the impact of their programs on physician distribution. The dependent variable was location of practice 2 years after completing postgraduate training in family medicine. Independent variables included individual and program characteristics. Separate analyses were conducted for each program using multiple logistic regression.

Results: The nature and nurture variables considered in the models explained only 21% to 27% of the variance in the eventual location of practice of family physician graduates. For UdeS, having an address in a rural/small-town environment at application to medical school (OR=2.61, 95% CI: 1.24-6.06) and for UBC, location of high school in a rural/small town (OR=4.03, 95% CI: 1.05-15.41), both increased the chances of practicing in a non-metropolitan area. For UdeS the nurture variable (ie length of clerkship in a non-metropolitan area) was the most significant predictor (OR=1.14, 95% CI: 1.067-1.22). For both medical schools,

adding a single nurture variable to the model using only nature variables significantly increased the amount of variation accounted for in predicting location of practice in non-metropolitan areas.

Conclusions: Aspects of graduates' rural background increase the chances of practicing in a non-metropolitan area. A third-year clerkship experience in a rural area may increase the chances of non-metropolitan practice. Although the total variation predicted by both nature and nurture variables in this study was small, adding a nurture variable significantly improves the prediction of individuals who will practice in a non-metropolitan area. The fact that total variation predicted was small is likely to be due to the limitations of the administrative databases used. Different strategies are being implemented in each university to improve the quality of existing administrative databases, as well as to collect relevant data about intent-to-practice, training characteristics, and the attitudes, beliefs and backgrounds of students.

Key words: Canada, family physicians, medical education, rural practice.

Introduction

The shortage of physicians in rural and remote regions of Canada is expected to worsen over time due to many factors, including the retirement of a large number of doctors, the feminization of the profession and a narrowing of the family physician's scope of practice[1,2]. Understanding the contextual, professional and personal factors that affect the choice of practice location for physicians will contribute to a better understanding of how to develop the physician workforce and delineate more successful strategies to address geographical maldistribution of physicians[3].

The choice of type and location of practice is a complex process that has been subject to numerous studies, particularly in Canada, USA and Australia, countries which share issues of physician maldistribution and regional shortages[4-7]. Bilodeau and Leduc[5] proposed that the choice of the location of practice is composed of three distinct processes with different determinants and dynamics: attraction, establishment and retention in the practice location. The first process, attraction, is defined as a positive attitude towards medical practice in remote or isolated regions that does not necessarily lead to settling into practice there. The establishment process follows the attracting process and is the decision about practice location. Finally, retention or continuation of medical practice in a rural or remote location over time is a choice to persist practicing in that setting, based on personal experience.

A qualitative study of physicians in outlying regions of Quebec reported that different factors play a role in each of the three processes described by Bilodeau and Leduc[5]. Familiarity with the rural environment, family links, and presence of relatives (physician or spouses) were related to attracting and establishing physicians in outlying regions[8]. In another qualitative study, conducted in Alberta, the authors found that many residents training in the rural stream had no long-term plans to establish a rural practice[9].

There is evidence that some personal and training factors predict a physician's location of practice[10]. Personal factors such as exposure to rural environments during childhood (rural background), rural background of spouse, sex, age, ethnicity, and father's educational status have been explored in several studies with different degrees of association to location of practice[5-7,11]. Brooks et al[6] identified characteristics that are present prior to medical school as 'nature', and the aspects related to the medical training (curricula, faculty, rotations, medical school mission etc) that potentially foster the attraction of students toward some specific type of practice as 'nurture'.

Several studies explored 'nature' factors associated with rural or urban practice of family physicians (FPs) in Canada. Easterbrook et al[12] conducted a cross-sectional survey of 159 FPs who graduated from a Canadian medical school and found that physicians raised in rural communities were 2.3 times more likely to practice in rural areas than those from non-rural communities. No other independent variable in this study was a significant predictor of rural practice[12]. Similarly, a later study[13] reported that physicians with a rural background were 2.5 times more likely to be engaged in rural practice than their urban-raised peers. A cross-sectional study of 507 physicians practicing in Ontario[14] found that rural physicians compared with urban physicians were more likely to have a rural background. Chan et al[15] studied 382 FPs established in rural areas across Canada and found that physicians raised in rural areas were more likely than those raised in urban areas to have some interest in a rural practice at the start and the end of medical training, while physicians raised in urban areas were more likely to state that rural training was the most influential factor in the choice of a rural practice.

'Nurture', including characteristics of medical schools and training programs, have been studied mostly in the context of exposure to underserved areas during under and postgraduate medical education and curricula[6,16-23]. Medical training programs usually include clerkships and rotations in rural, remote or underserved areas. However, within the same program, these can be elective or can take place at different time, resulting in a large array of individual trajectories[24]. In the literature, nonetheless, there is a convergence towards the importance of duration (longer than 2 months) and type of exposure (long-term rotations, fixed base), suggesting a dose-response relationship[25,26].

The purpose of this study was to compare two categories of predictors of establishing a rural family practice using undergraduate medical student's individual characteristics (nature) and participation in a rural program component of their training program (nurture) using institutional administrative data. Aims were to identify similarities and differences in factors that predict practice 2 years post-residency training and to determine the predictive value of combining nature and nurture variables using data from two undergraduate medical education programs in Canada.

Methods

Design

To address the questions of interest, a retrospective study was conducted using administrative data available from the Université de Sherbrooke (UdeS) and the University of British Columbia (UBC). Although the two medical schools are situated in different provinces, each within a unique cultural, institutional, and government context, both have a strong mandate to evaluate the impact of their programs on physician distribution and are collaborating to identify methodologies to achieve this goal.

Students' personal data and undergraduate MD program data were retrieved from the faculties of medicine and registrar's offices. Postgraduate program and practice location data were accessed from the Canadian Post-MD Education Registry (CAPER; www.caper.ca), and linked to individual data. This study was approved by the UBC and UdeS Behavioural Research Ethics Boards.

Study sites

The population studied included all physicians that were registered in the undergraduate medical programs (MD program) between 1995 and 2000 (N=780 UdeS; N=936 UBC), whose postgraduate training was in family medicine and took place between 2000 and 2006 (n=218 UdeS, n=237 UBC) and for which an address of practice in the CAPER registry was available 2 years after their postgraduate training (n=180 UdeS, n=194 UBC).

Dependent variable

The dependent variable was the location of practice 2 years after completing postgraduate training: a Canadian non-metropolitan area versus a Canadian metropolitan area or another country. Practicing in a non-metropolitan area was defined as having a practice address located in a municipality with less than 100 000 inhabitants[27,28]. All other practice addresses were identified as 'not practicing in non-metropolitan area'. In the context of the healthcare system where most specialized care is concentrated in metropolitan areas (>100 000 inhabitants), it is legitimate to use the definition of non-metropolitan area as a proxy of rural area.

Dissemination areas (DA; the smallest geographical unit of census data available) were used from the 2001 Canadian Population Census as a proxy for address[29]. The Postal Codes Conversion File[30] allowed matching each DA with a category of the Statistical Area Classification that classifies postal code areas according to the population of the urban core[27,28].

Independent variables

The independent variables represent physician individual characteristics and program components identified in the literature as potentially related to the choice of a location of practice, and available at the two institutions represented in the study. Because the aim was to explore the predictive power of equivalent variables in two different contexts, only variables that were similar across both universities were used. Variables that differed were not included in the analysis.

Individual characteristics in the analysis included sex; age at admission to the MD program; location of the high school (UBC) or the premedical college (UdeS); preadmission academic performance ('Cote de rendement global' for UdeS, overall undergraduate grade point average [GPA] for UBC); and the location of the student address in admission forms. The academic degree at admission to the MD Program was important to UdeS, given their provincial general and vocational education post-secondary educational program, a system exclusive to Quebec. Thus, degree at admission to the MD program was coded for UdeS (ie college/university). In BC, there is no comparable system, and this variable was not considered for the UBC analyses. Academic performance in each of the program years (ie years 1–4) was converted to a standardized score. High school/college and home addresses at admission were coded as: 1 = metropolitan area (municipality with 100 000 inhabitants or more), 2 = medium/small city (municipality with 10 000–99 999 inhabitants), 3 = rural/small town (municipality with <10 000 inhabitants) or 4 = country other than Canada[27].

A programmatic variable (nurture) was included in the analysis to capture student exposure to non-metropolitan environments during year 3 clerkships. For UdeS this variable was the number of weeks spent in clerkships in non-metropolitan areas (ie municipalities under 100 000 inhabitants). At UdeS students chose the location of mandatory and elective clerkships among program-approved placements. For UBC, a comparable variable represented the location of a mandatory four-week community-based year 3 clerkship. Using a lottery system, students select a clerkship from underserved, widely dispersed geographical locations, including some inner city locations. The location of UBC clerkships was categorized according to the Statistical Area Classification: 1 = metropolitan areas (municipalities with ≥100 000 inhabitants), 2 = medium/small city (municipality with 10 000–99 999 inhabitants), 3 = rural/small town (Census Subdivision with <10 000 inhabitants), 4 = Territories (Yukon, Northwest and Nunavut Canadian territories).

Statistical analysis

Given the differences in variable definitions and data available at the two institutions in the study, separate analyses were conducted and results were conceptually interpreted to identify similarities and differences. Descriptive statistics were produced for each university and comparisons made between family practice physicians in

non-metropolitan locations and in 'other' locations using χ^2 analysis. Univariate logistic regressions were conducted to identify variables significantly associated with location of practice.

Because the sample size was relatively small for both universities, multiple logistic regression models were performed using the independent variables statistically significant at $p<0.10$ from univariate analyses and the hypothesis that factors related to training program characteristics (ie nurture) are important predictors. Age and sex were included in all models. Individual student characteristics (nature) were included in the first model and the training program variable (nurture) was added to the second model to determine any change in the variance predicted. Chi-square was calculated to determine if there was a significant difference in R^2 between the nature and nature *plus* nurture models.

Results

Université de Sherbrooke

Descriptive data for the UdeS is provided (Table 1). Of the 180 FPs training between 1995 and 2006, 69 (38%) had established a practice in a non-metropolitan area 2 years after exiting residency. Family physicians established in non-metropolitan and in 'other' areas were similar for the majority of variables. A higher proportion of FPs practicing in non-metropolitan areas had a rural/small town address at the time of application to medical school (27.5%) compared with those practicing in other areas (12.6%; $p=0.036$). Similarly, a higher proportion of those practicing in non-metropolitan areas had attended a rural/small town high school as compared with those who were practicing in other areas (21.7% vs 15.3%, respectively; $p=0.068$). There was also a significant difference in the number of weeks FPs practicing in non-metropolitan areas had spent in non-metropolitan clerkships ($p<0.0001$, Kolmogorov Smirnov test). The median for those who had established a practice in a non-metropolitan location spent was 7.7 weeks in a non-metropolitan clerkship as compared with 3.9 weeks among those who were practicing in other areas.

Univariate logistic regressions found three variables with significant associations to location of practice ($p<0.05$). The academic performance for years 1 and 2 also showed some statistical significance ($p<0.10$) in the association to location of practice (Table 2). Age at admission and sex were included in the multiple logistic regressions, along with these five variables. The model developed with the individual variables explained 10% of the variability ($R^2= 0.101$, $n=176$, Table 3) while the model developed adding the program variable, the nurture predictor, explained 21% of the variability ($R^2=0.211$, $n=176$; Table 4). For the nature plus nurture model, the single nurture variable (length of clerkship in a non-metropolitan area) was the most important predictor (OR=1.14, 95% CI: 1.067-1.22), the odds of establishing a practice in a non-metropolitan location increasing by 14% for each week of clerkship spent in non-metropolitan areas. Just one nature predictor had a significant effect: having an address in a rural/small-town environment at the time of application to the medical school increases more than twice the chances of practicing in a non-metropolitan area (OR=2.61, 95% CI: 1.24-6.06). This predictor conserves an independent and significant effect when the nature predictor is taken into account.

University of British Columbia

Descriptive data from the UBC program is provided (Table 5). Of the 194 FPs training between 1995 and 2006, 59 (30%) had established a practice in a non-metropolitan area 2 years after exiting residency. Family physicians established in non-metropolitan and 'other' areas were similar for the majority of variables examined. None of the students who completed the mandatory year 3 clerkship in a metropolitan area were likely to establish a practice in a non-metropolitan area (χ^2 $p=0.011$, Cramer's $V=0.011$).

Table 1: Description of Université de Sherbrooke population studied

Variable	Family physicians		
	In non-metropolitan areas *n*=69 (38.3%)	**In other areas *n*=111(61.7%)**	**All *N*=180 (100%)**
Age at admission – years, median	19	19	19
Sex – *n* (%)			
Female	49 (71.0)	82 (73.9)	131 (72.8)
Male	20 (29.0)	29 (26.1)	49 (27.2)
Location of high school** – *n* (%)			
Metropolitan area	29 (42.0)	69 (62.2)	98 (54.4)
Medium/small city	9 (13.0)	10 (9.0)	19 (10.6)
Rural/small town	15 (21.7)	17 (15.3)	32 (17.8)
Without data	16 (23.2)	15 (13.5)	31 (17.2)
Pre-admission academic performance (median)	35.95	35.61	35.77
Academic degree at admission – *n* (%)			
College	63 (91.3)	97 (87.4)	160 (88.9)
University	6 (8.7)	14 (12.6)	20 (11.1)
Address at application* – *n* (%)			
Metropolitan areas	39 (56.5)	85 (76.6)	124 (68.9)
Medium/small city	9 (13.0)	10 (9.0)	19 (10.6)
Rural/small town	19 (27.5)	14 (12.6)	33 (18.3)
Other country	2 (2.9)	2 (1.8)	4 (2.2)
Academic performance (median)			
Year 1	0.23	-0.11	-0.03
Year 2	0.17	-0.17	-0.03
Year 3	0.11	0.05	0.11
Year 4	-0.10	-0.16	-0.15
Time spent in non-metropolitan location clerkship – weeks, median***	7.7	3.96	3.9

*Significant difference X^2= 8.54 p=0.036; **significant difference X^2= 7.12 p=0.068; ***significant difference, Kolmogorov-Smirnov z=2.315, p<0.0001.

Univariate logistic regressions found one variable, location of high school, to have a significant association with location of practice (p<0.05). Year 3 academic performance showed some statistical significance (p<0.10) in the association to the dependent variable (Table 6). Age at admission and sex were included in the multiple logistic regressions, along with these two variables. The model developed with only the individual variables (nature) explained 16% of data variability (R^2=0.16, n=190; Table 7). Because the contribution of the year 3 mandatory clerkship (nurture) in predicting location of practice was to be examined, this variable was included in the second model. It was found that 27% of the variability in the location of practice was predicted (R^2=0.27, n=125; Table 8) by adding this single nurture variable. An R^2 difference test was performed to assess the R^2 difference between the nature only and the nature plus nurture models indicated a statistically significant increase in R^2 in the nature plus nurture model (F (3,180) = 9.49; p<0.001). For the nature plus nurture model, those who attended high school in a rural/small town were four times more likely to practice in a non-metropolitan area (OR= 4.03, 95% CI: 1.05-15.41). The odds of establishing a practice in a non-metropolitan location decreased by almost half for students placed in a medium/small city for their year 3 community-based clerkship as compared to those placed in a Rural/small town area (OR=0.40, 95% CI: 0.17-0.93). The model did not converge for the metropolitan area variable, likely due to missing data and small sample size.

Table 2: Univariate logistic models for MD graduates from Université de Sherbrooke

Variable	*N*	B	SE	Wald statistic	*p*	OR	95 CI
Age (years)	180	0.0077	0.0484	0.0253	0.8736	1.008	0.916-1.108
Sex	180						
Male (Ref)		–	–	–	–	Ref	
Female		0.1433	0.3422	0.1755	0.6753	0.866	0.443-1.694
Pre-admission academic performance (CRG)	164	0.2879	0.1869	2.3745	0.1233	1.334	0.925-1.924
Location of high school	149				0.111		
Metropolitan area (Ref)		–	–	–	–	Ref	
Medium/small city		0.7614	0.5100	2.2292	0.1354	2.141	0.788-5.818
Rural/small town		0.7416	0.4177	3.1526	0.0758	2.099	0.926-4.760
Address at application to MD program	180				0.0411		
Metropolitan area (Ref)		–	–	–	–	Ref	
Medium/small city		0.6737	0.4985	1.8263	0.1766	1.961	0.738-5.211
Rural/small town		0.7791	1.0185	7.2823	0.0070	2.958	1.346-6.501
Other country		1.0844	0.4018	0.5851	0.4443	2.179	0.296-16.044
Academic performance							
Year 1	176	0.3513	0.1807	3.7802	0.0519	1.421	0.997-2.025
Year 2	176	0.3046	0.1739	3.0687	0.0798	1.356	0.964-1.907
Year 3	179	0.3919	0.1849	4.4938	0.0340	1.480	1.030-2.126
Year 4	179	0.1829	0.1650	1.2288	0.2676	1.201	0.869-1.659
Time spent in non-metropolitan location clerkship	180	0.1431	0.0330	18.8132	<.0001	1.154	1.082-1.231

Ref, Reference.

Table 3: Nature predictors of the location of practice in non-metropolitan areas for family physicians from Université de Sherbrooke (*N*=176), R^2=0.101

Variable†	B	SE	Wald statistic	*p*	OR	95 CI
Age	0.00875	0.0890	0.0096	0.9218	1.009	0.847-1.201
Sex						
Male	--	--	--	--	Ref	
Female	-0.2826	0.3693	0.5854	0.4442	0.754	0.366-1.555
Address at application to MD program						
Metropolitan area	--	--	--	--	Ref	
Medium/small city	0.7528	0.5152	2.1349	0.1440	2.123	0.773-5.827
Rural/small town	1.0016	0.4119	5.9141	0.0150	2.723	1.215-6.104
Other country	0.7951	1.5091	0.2776	0.5983	2.215	0.115-42.65
Academic performance						
Year 1	0.2457	0.2757	0.7945	0.3728	1.279	0.745-2.195
Year 2	-0.1058	0.3090	0.1173	0.7320	0.900	0.491-1.648
Year 3	0.3152	0.2506	1.5823	0.2084	1.371	0.839-2.240

Ref, Reference.
†Variables with univariate *p* >0.10 eliminated from the model, except age at admission and sex.

Table 4: Nature and nurture predictors of the location of practice in non-metropolitan areas for family physicians from Université de Sherbrooke (N=176), R^2=0.211

Variable†	B	SE	Wald statistic	*p*	OR	95 CI
Age	0.0195	0.0951	0.0419	0.8378	1.020	0.846-1.229
Sex						
Male	--	--	--	--	Ref	
Female	-0.2873	0.3886	0.5467	0.4597	0.750	0.350-1.607
Address at application to MD program						
Metropolitan area	--	--	--	--	Ref	
Medium/small city	0.5229	0.5490	0.9072	0.3409	1.687	0.575-4.948
Rural/small town	0.9595	0.4301	4.9760	0.0257	2.610	1.124-6.065
Other country	0.7232	1.6409	0.1942	0.6594	2.061	0.083-51.38
Academic performance						
Year 1	0.2964	0.2908	1.0384	0.3082	1.345	0.761-2.378
Year 2	-0.2850	0.3300	0.7458	0.3878	0.752	0.394-1.436
Year 3	0.3054	0.2565	1.4176	0.2338	1.357	0.821-2.244
Time spent in non-metropolitan location clerkship	0.1325	0.0347	14.6054	0.0001	1.142	1.067-1.222

Ref, Reference.
†Variables with univariate p >0.10 eliminated from the model, except age at admission and sex.

Table 5: Description of the University of British Columbia population studied

Variable	Family physicians		
	In non-metropolitan locations n=59 (30.41%)	In other locations n=135 (69.59%)	All N=194 (100%)
Age at admission – years, median	23	23	23
Sex – *n* (%)			
Female	39 (66.10)	96 (71.11)	135 (69.59)
Male	20 (33.90)	39 (28.89)	59 (30.41)
Location of high school* – *n* (%)			
Metropolitan areas	23 (38.98)¶	89 (65.93)	112 (57.73)
Medium/Small city	16 (27.12)	26 (19.26)	42 (21.65)
Rural/Small town	10 (16.95)	10 (7.41)	20 (10.31)
Other country	10 (16.95)	10 (7.41)	20 (10.31)
Pre-admission academic performance (median)	82.60 (n=53)	82.89 (n=116)	82.70 (n=174)
Address at application** – *n* (%)			
Metropolitan areas	47 (79.66)	114 (84.44)	161 (82.99)
Medium/small city	5 (8.47)	16 (11.85)	21 (10.82)
Rural/small town	7 (11.86)†	4 (2.96)	11 (5.67)
Academic performance – median			
Year 1	0.23	-0.03	0.01
Year 2	0.02	-0.01	-0.01
Year 3	0.17	-0.10	0.01
Year 4	0.02	-0.03	0.00
Location of mandatory Year 3 community-based clerkship*** – *n* (%)			
Metropolitan areas	0¶	12 (8.89)	12 (6.19)
Medium/small city	16 (27.12)	43 (31.85)	59 (30.41)
Rural/small town	25 (42.37)	29 (21.48)	54 (27.84)
Territories	1 (1.69)	2 (1.48)	3 (1.55)
Missing data	17 (28.81)	49 (36.30)	66 (34.02)

*Significant difference, χ^2= 13.59, p = 0.004, Cramer's V = 0.265; **significant difference, χ^2= 6.26, p = 0.044, Cramer's V = 0.180; *** significant difference, χ^2= 11.18, p = 0.011, Cramer's V = 0.296.
†Indicates a value statistically higher than expected (based on standardized residuals); ¶Indicates a value statistically lower than expected (based on standardized residuals).

Table 6: Univariate logistic models for MD graduates from University of British Columbia

Variable	*N*	B	SE	Wald statistic	*p*	OR	95 CI
Age (years)	194	0.07	0.05	2.15	0.142	1.07	0.98-1.18
Sex	194						
Male (Ref)		–	–	–	–	Ref	
Female		-0.23	0.33	0.49	0.486	0.79	0.41-1.53
Pre-admission academic performance (GPA)	169	-0.02	0.04	0.18	0.675	0.98	0.91-1.07
Location of high school	194			12.95	0.005		
Metropolitan area (Ref)		–	–	–	–	Ref	–
Medium/small city		0.87	0.40	4.84	0.028	2.38	1.10-5.16
Rural/small town		1.35	0.51	7.19	0.007	3.87	1.44-10.41
Other		1.35	0.51	7.19	0.007	3.87	1.44-10.41
Address at application to MD program	194			5.44	0.142		
Metropolitan area (Ref)		–	–	–	–	Ref	
Medium/small city		-0.28	0.54	0.26	0.608	0.76	0.26-2.19
Rural/small town		1.45	0.65	4.94	0.026	4.25	1.19-15.18
Academic performance							
Year 1	194	0.06	0.16	0.15	0.703	1.06	0.78-1.45
Year 2	194	0.05	0.16	0.11	0.744	1.05	0.77-1.43
Year 3	194	0.30	0.17	3.08	0.079	1.35	0.97-1.89
Year 4	194	0.18	0.17	1.11	0.292	1.20	0.86-1.67
Location of mandatory Year 3 community-based clerkship	128			4.42	0.219		
Rural/small town (Ref)		–	–	–	–	Ref	
Rural/small town vs Metropolitan area†		–	–	–	–	–	–
Rural/small town vs Medium/small city		-0.84	0.40	4.41	0.036	0.43	0.20-0.95
Rural/small town vs Territory		-0.55	1.26	0.19	0.664	0.58	0.05-6.78

Ref, Reference.
†Model did not converge.

Table 7: Nature predictors of the location of practice in non-metropolitan areas for family physicians from University of British Columbia (*N*=190), R^2=0.16

Variable†	B	SE	Wald statistic	*p*	OR	95 CI
Age (years)	0.11	0.06	3.90	0.048	1.12	1.00-1.25
Sex						
Male	–	–	–	–	Ref	
Female	-0.27	0.37	0.56	0.455	0.76	0.37-1.56
Location of high school						
Metropolitan area	–	–	–	–	Ref	
Medium/small city	0.86	0.41	4.46	0.035	2.37	1.06-5.30
Rural/small town	1.37	0.52	7.09	0.008	3.95	1.44-10.84
Other	1.57	0.55	8.22	0.004	4.82	1.64-14.11
Academic performance Year 3	0.41	0.20	4.26	0.039	1.51	1.02-2.22

Ref, Reference.
†Variables with univariate p >0.10 eliminated from the model, except age at admission and sex.

Table 8: Nature and nurture predictors of location of practice in non-metropolitan areas for family physicians from University of British Columbia (N=125), R^2=0.27

Variable†	B	SE	Wald statistic	*p*	OR	95 CI
Age (years)	0.11	0.07	2.41	0.120	1.11	0.97-1.27
Sex						
Male	–	–	–	–	Ref	
Female	-0.62	0.45	1.89	0.169	0.54	0.22-1.30
Location of high school						
Metropolitan area	–	–	–	–	Ref	
Medium/small city	0.75	0.50	2.24	0.135	2.12	0.79-5.70
Rural/small town	1.39	0.68	4.15	0.042	4.03	1.05-15.41
Other	1.34	0.75	3.19	0.074	3.83	0.88-16.70
Academic performance Year 3	0.17	0.25	0.48	0.489	1.19	0.73-1.95
Location of mandatory Year 3 community-based clerkship						
Rural/small town	–	–	–	–	Ref	
Metropolitan area¶	--	--	--	--	--	--
Medium/small city	-0.92	0.44	4.48	0.034	0.40	0.17-0.93
Territory	-0.36	1.29	0.08	0.782	0.70	0.06-8.70

†Variables with univariate p >0.10 eliminated from the model, except age at admission and sex. ¶Model did not converge.

Discussion

Adding a single nurture variable (ie component of training program) to the model using only nature variables (ie individual characteristics) significantly increased the amount of variation accounted for in predicting practice in non-metropolitan areas in the two medical schools. The finding that nature variables associated to rural or non-metropolitan backgrounds increases the chances of practicing in rural or non-metropolitan areas is consistent with previous research[5,12-14]. The length of clerkships in non-metropolitan areas (nurture) was the strongest predictor of the location of practice for UdeS independent of the other variables, reflecting the nurture effect highlighted by Brooks et al[6]. This was supported by the UBC finding that location of UBC's mandatory year 3 community-based clerkship showed some relationship to location of practice, despite the small sample size. Although there is agreement that undergraduate rural experience can influence the choices made by students about practice location[31], there is little evidence about the required length for this effect. At the postgraduate level, the threshold length of rural experience for impact on location choice was found to be 6 months in two separate family medicine studies[14,32]. A clerkship length of 6 weeks has been identified as a threshold to improve student educational and personal experiences in rural areas[25], which may indeed lead students to choose longer rural experiences in their postgraduate training. As Ballance et al[33] concluded in their review of the literature on factors that influence rural practice location, although 'nature' variables such as rural background are important factors, programs that encourage and reinforce rural practice are necessary to support students at both the undergraduate and postgraduate level.

The comparability of results from both universities is restricted by the differences in the provincial context and also because some of the variables result from different methods of collection and describe different program components. Despite this, it is interesting to note that both schools found similar results for nature variables. For UdeS, having an address in a rural/small-town environment at application to medical school and for UBC, location of high school in a rural/small town, increased the chances of practicing in a non-metropolitan area. For UdeS the nurture variable (ie length of clerkship in a non-metropolitan area)

was the most significant predictor. This was not the case for UBC which is likely to be due to the small sample size; however, UBC results did indicate that the location of the mandatory year 3 community-based clerkship in a medium/small city, as compared to those placed in a Rural/small town area, decreased the chances of practicing in a non-metropolitan area. Further research is necessary to determine if this finding extends to clerkships in metropolitan areas.

The nature and nurture variables considered in the models explained only 21% to 27% of the variance in FPs' location of practice. This suggests that the study design could be improved by increasing the number of variables explored in this study that were not included in the models, because these data are not available through the universities' administrative databases (eg background, beliefs, intentions and internal models of the physicians). Another important reason for the poor fit of models is that contextual factors such as the structure of health systems in each province were not included in the models (because appropriate data was not available). Finally, a measure of postgraduate training was not included, which would most likely have improved the predictability of the model.

Even if the loss to follow up was less than 20% at both sites, the quality and availability of detailed administrative data on students and medical programs at each university was insufficient to respond to the need for tracking long-term outcomes in medical education. For example, at both universities it required months to locate, gather and 'clean' the data, and build a centralized database. Lack of consistency of variable definitions over the years available was challenging. At UBC the amount of missing data meant there was an inadequate sample size for the final model. It also resulted in wide confidence intervals which comprised the precision of data. As a consequence, different strategies are being implemented in each university to improve the quality of existing databases, as well as to collect relevant data about intent to practice, training characteristics, and attitudes, beliefs and backgrounds of students.

Based on the experience of conducting this work, the authors have begun to develop centralized databases that track students from admission to practice and are exploring the use of Scott's Medical Database[34] to access information about location of practice to track long-term outcomes. At the same time the authors believe it is important to explore mechanisms for sharing and accessing data with other national and regional organizations working toward the same goal. There is increasing interest in addressing long-term outcomes in medical education. These questions cannot be answered by a single institution. New models of research should explore the development of longitudinal databases among collaborating schools[35]. Further work needs to be done to explore how institutional databases, such as the ones described in this article, can be merged.

Despite the limitations of this study, it contributes to the knowledge of factors associated with FPs choosing to locate in non-metropolitan areas in two provinces. Using complementary approaches from two provinces increases the credibility of findings.

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