

Editor's key points

- ▶ There is a persistent shortage of rural family physicians in Canada and worldwide, and previous research suggests that those who are most likely to practise in rural settings come from rural backgrounds.
- ▶ This study suggests that a stated interest in rural family medicine at entry into medical school is the strongest predictor of later rural family practice. Rural schooling, older age, being in a relationship, having a societal orientation, and desiring a varied scope of practice also predict eventual practice in a rural setting.
- ▶ This has potential implications for who should be targeted for mentoring around rural family practice opportunities. Pipeline-to-practice programs should target those who state an interest in rural family medicine early in their careers, in addition to individuals from rural backgrounds.

Predictors of rural family medicine practice in Canada

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Abstract

Objective To examine the attributes of Canadian medical students at matriculation that predicted later practice in a rural location, with the goal of enhancing evidence-based approaches to increasing the numbers of rural family physicians.

Design Demographic, attitudinal, and career choice data were collected from medical students at matriculation. Students were followed prospectively, and these data were linked to postresidency practice location.

Setting Eight Canadian medical schools.

Participants Study participants were 15 classes of medical students entering medical school between 2002 and 2004.

Main outcome measures Backward stepwise logistic regression analysis was used to identify the entry characteristics that predicted postresidency practice as a rural family physician.

Results Data from 1542 students were analyzed. A strong association was found between career interest in rural family medicine at entry into medical school and postresidency rural practice as a family physician. Logistic regression analysis that did not include entry career interest found older age, being in a relationship, having completed school in a rural community, having a societal orientation, and expressing a desire for a varied scope of practice to be predictive of practising in a rural location. When entry career interest in a rural setting was included in the multivariate model, only this variable and older age predicted postresidency rural family practice.

Conclusion This study identified a number of demographic and attitudinal variables at medical school entry that predict postresidency practice in a rural setting. These results suggest multiple potential areas where the pipeline to rural family practice can be further supported in order to address the shortage of rural family physicians.

Les prédicteurs d'une pratique de médecine familiale en région rurale

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Résumé

Objectif Étudier les caractéristiques des étudiants en médecine canadiens en début de parcours qui permettraient de prévoir une pratique ultérieure en milieu rural, et ce, dans le but de favoriser l'adoption de mesures fondées sur des données probantes afin d'accroître le nombre des médecins de famille en milieu rural.

Type d'étude On a recueilli les données démographiques, les attitudes et les choix de carrière d'étudiants en médecine au début de leur cours. On a suivi des étudiants de façon prospective et les données obtenues ont été mises en relation avec l'endroit de leur pratique après la résidence.

Contexte Huit facultés de médecine canadiennes.

Participants Quinze classes d'étudiants en médecine ayant débuté leur cours entre 2002 et 2004.

Principaux paramètres à l'étude À l'aide d'une analyse de régression logistique progressant à rebours, on a déterminé chez des étudiants débutant en médecine les caractéristiques qui permettent de prévoir une pratique comme médecin de famille en milieu rural.

Résultats On a analysé les données de 1542 étudiants. On a observé une importante relation entre l'intérêt manifesté par un étudiant débutant en médecine pour une pratique comme médecin de famille en région rurale et le fait d'adopter ce type de pratique une fois diplômé. L'analyse de régression logistique ne présentant pas ce type d'intérêt a trouvé que le fait d'être plus âgé, d'être en relation avec quelqu'un du milieu, d'avoir fait ses études dans une communauté rurale, d'être intéressé par l'aspect social de la profession et de préférer une pratique plus diversifiée étaient aussi des prédicteurs d'une pratique rurale. Lorsqu'on incluait l'intérêt manifesté en début de carrière à l'égard du milieu rural, cette variable et le fait d'être plus âgé étaient les seuls prédicteurs d'une pratique rurale en médecine familiale après la diplomation.

Conclusion Cette étude a trouvé qu'un certain nombre de variables d'ordre démographique ainsi que certaines attitudes manifestées par l'étudiant au début du cours de médecine étaient des prédicteurs d'une éventuelle pratique en milieu rural après la diplomation. Ces résultats laissent entendre qu'il est possible de mieux utiliser des programmes spéciaux conduisant à une pratique rurale en médecine familiale de façon à corriger la pénurie de médecins de famille en milieu rural.

Points de repère du rédacteur

► Au Canada comme ailleurs dans le monde, le nombre de médecins de famille en région rurale est généralement insuffisant et certaines études laissent entendre que les personnes qui sont le plus susceptibles d'opter pour ce genre de pratique proviennent d'un milieu rural.

► Cette étude avance que le meilleur prédicteur d'une pratique ultérieure en région rurale est le fait d'avoir manifesté un intérêt pour une telle carrière au tout début du cours de médecine. Parmi les autres prédicteurs, mentionnons le fait d'avoir été à l'école en région rurale, d'être plus âgé, d'être en relation depuis longtemps avec quelqu'un du milieu, d'avoir un intérêt particulier pour l'aspect sociétal de la profession et de vouloir avoir un champ de pratique plus étendu.

► Cela a des répercussions potentielles quant aux étudiants qu'on devrait cibler pour des programmes de mentorat liés aux possibilités de pratique familiale en milieu rural. Des programmes spéciaux menant à ce type de pratique (Pipeline-to-practice) devraient être utilisés auprès des personnes qui manifestent un intérêt pour la médecine familiale rurale tôt dans leur carrière en plus de celles qui proviennent du milieu rural.

The rural physician shortages and the maldistribution of family physicians and specialists in Canada, the United States, and Australia have been well documented.¹⁻⁴ In Canada, while more than 18% of the population resides in rural areas, only 8.5% of Canadian physicians practise rurally, and 1 in 7 plans to leave rural practice within the next 2 years.^{4,5} The proportion of Canadian medical school graduates choosing to practise rural family medicine (FM) is approximately 16%, which is insufficient to meet demand.⁶ But this can depend heavily on where students trained and whether they had rural ties before medical school. For example, of the alumni from the Northern Ontario School of Medicine—91% of whom originate from northern Ontario—69% choose to practise in the region and 22% choose remote rural settings.⁷

Previous research investigating predictors of a career in rural medicine suggests that a rural background, time spent in a rural setting, and the intention to practise in a rural setting are predictive.⁸⁻¹⁰ However, there is still a paucity of longitudinal prospective studies investigating factors that predict at medical school entry which medical students are most likely to practise rurally.¹¹ In addition, most of the predictive studies of career choice do not employ multivariate analyses. To our knowledge there have been no studies carried out in the Canadian context that investigate attributes and interests of medical students at matriculation and determine their relationship with later rural family practice.^{3,12}

This study sought to define the demographic, attitudinal, and career choice variables at medical school entry that predict rural FM practice using a prospective longitudinal cohort of Canadian medical students. In doing so, our objective is to highlight strategies to address the shortage of family physicians practising in rural settings, particularly in light of a 2016 background paper addressing Canadian rural medical education, training, and practice.⁷

— Methods —

Between 2002 and 2004 we sent requests for study participation to undergraduate medical faculty at 16 Canadian medical schools. A total of 8 schools opted to participate. We distributed the survey to first-year students in 15 different classes. Surveys were administered in the first 2 weeks of classes, and responses were collected within 2 months of survey distribution. All first-year medical students were eligible to participate, with the exception of international students.

The survey consisted of 41 items with questions selected based on an extensive literature review and consultation process. The final questionnaire was informed by feedback from focus groups and a pilot survey administered to medical students.¹³ The survey asked students to consider 9 career options: emergency medicine, urban FM, rural FM, internal medicine, obstetrics and

gynecology, pediatrics, psychiatry, surgery, and “other” (students choosing this option were asked to specify). Students were asked to indicate which options they were interested in as a possible career and to rank their top 3 career choices. Using a 5-point Likert scale, ranging from 1 (no influence) to 5 (important influence), students were then asked to indicate the extent to which their career interests were influenced by the 27 different items. The survey also collected sociodemographic data. Participation was voluntary and participants could choose to opt out at any time. While participants were encouraged to include their names on their survey, they could choose to remain anonymous, thus precluding follow-up and their inclusion in longitudinal analysis.

In August 2013 the data collected from students at baseline were linked with their most recently available practice location information using a multi-step procedure. Data were first linked, where possible, to listings in the 2013 Scott’s Medical Database, an online database containing information about Canadian physicians’ areas of practice and geographic distribution. Physicians’ names, schools, and years of graduation were used to make accurate matches. For those who were not successfully linked, the process was repeated using the 2012 Scott’s Medical Database list, followed by the 2011 and 2010 Scott’s Medical Database lists in turn. Subsequently, provincial medical college directories were consulted for information, and finally an Internet search was performed to determine practice location. The assumption was made that students who did not appear in any of these sources were still in their residency and thus training as specialists, were practising in a different country, or had pursued a different career; this group was not followed any further. The decision was made to include only those who completed FM training because these physicians comprise most of those working in rural areas. The practice addresses identified by this process were then classified according to rural and small town codes, a set of Canada-wide definitions of rurality developed by Statistics Canada.¹⁴

In the rare cases where data were missing, data points were substituted with the mean value for that variable.

Demographic associations with practice type (rural FM vs other medicine) were identified using *t* tests for continuous variables and χ^2 tests for categorical variables. Principal components factor analysis was performed to condense the 27 attitudinal career influences into a smaller number of coherent factors; these factors were then named according to their component variables. Items that demonstrated a minimum factor loading of 0.6 factors with an eigenvalue greater than 1 were retained. Then *t* tests were used to identify differences in the resulting attitudinal factors and ungrouped attitudinal items according to practice type and location. Variables identified by bivariate analyses as being

statistically significantly associated with postresidency rural FM practice were entered into backward stepwise logistic regression analyses to identify their relative predictive strength of this career choice. We considered $P < .05$ to be statistically significant. All statistical analyses were performed in IBM SPSS, version 22.

This project was approved by the Behavioural Research Ethics Board at the University of British Columbia in Vancouver.

— Results —

A total of 2070 students from 15 participating classes were invited to participate in the study, with data from 1542 students contributing to the final analysis (Figure 1).

Despite a net loss of interest in a rural FM career between medical school entry ($n = 184$, 11.9%) and postresidency practice ($n = 88$, 5.7%), a strong association was found between rural FM as the top choice of career at medical school entry and a postresidency career in a rural setting ($\chi^2_1 = 93.15$, $P < .0005$). Of the 88 physicians practising rural FM after completing their residency, 39 (44.3%) had named rural FM as their top choice of career at medical school entry (Table 1). When factor analysis was performed on the 27 attitudinal variables influencing career choice, 6 factors containing 20 of these variables were identified. We named the factors according to their component variables (Table 2). Together, the 6 factors collectively explained 53.4% of variance in the responses. Seven items failed to load on any of the factors and were included as separate variables in the subsequent analyses. A positive correlation existed between a career choice in rural FM and the factors “societal orientation” ($r = 0.09$) and “varied scope of practice” ($r = 0.12$). A negative correlation existed between a career choice in rural FM and “prestige” ($r = -0.05$) and “hospital orientation” ($r = -0.06$). The factors “medical lifestyle” and “role model” were not associated with a rural FM career choice.

Bivariate analysis found 4 of 6 of these factors and 4 of 7 of the individual attitudinal items, as well as several demographic variables, to be significantly associated with type and location of postresidency medical practice (Table 3).

Logistic regression analysis that did not include stated career interest in rural FM at matriculation identified 5 variables that predicted postresidency rural FM practice: older age, being in a long-term relationship, completing school in a rural community, having a societal orientation, and expressing a desire for a varied scope of practice (Table 4). When students’ stated career interest in rural FM at medical school entry, either as their top choice of career or as a career they were considering but not as their top choice, was included in the model, this variable and age were the only 2 predictors of postresidency rural FM practice (Table 4).

— Discussion —

Our study found a strong association between an initial interest in rural FM at matriculation and later practice in a rural setting among Canadian medical students. Growing up in a rural community, older age, being in a long-term relationship, having a societal orientation, and desiring a varied scope of practice predicted postresidency rural family practice. Medical students stating that rural FM was their first-choice career were more than 10 times as likely as those who had not considered it an option to be practising rural FM after graduation, and those who had considered it at all were twice as likely as those who had not considered it an option to eventually practise as a rural family physician.

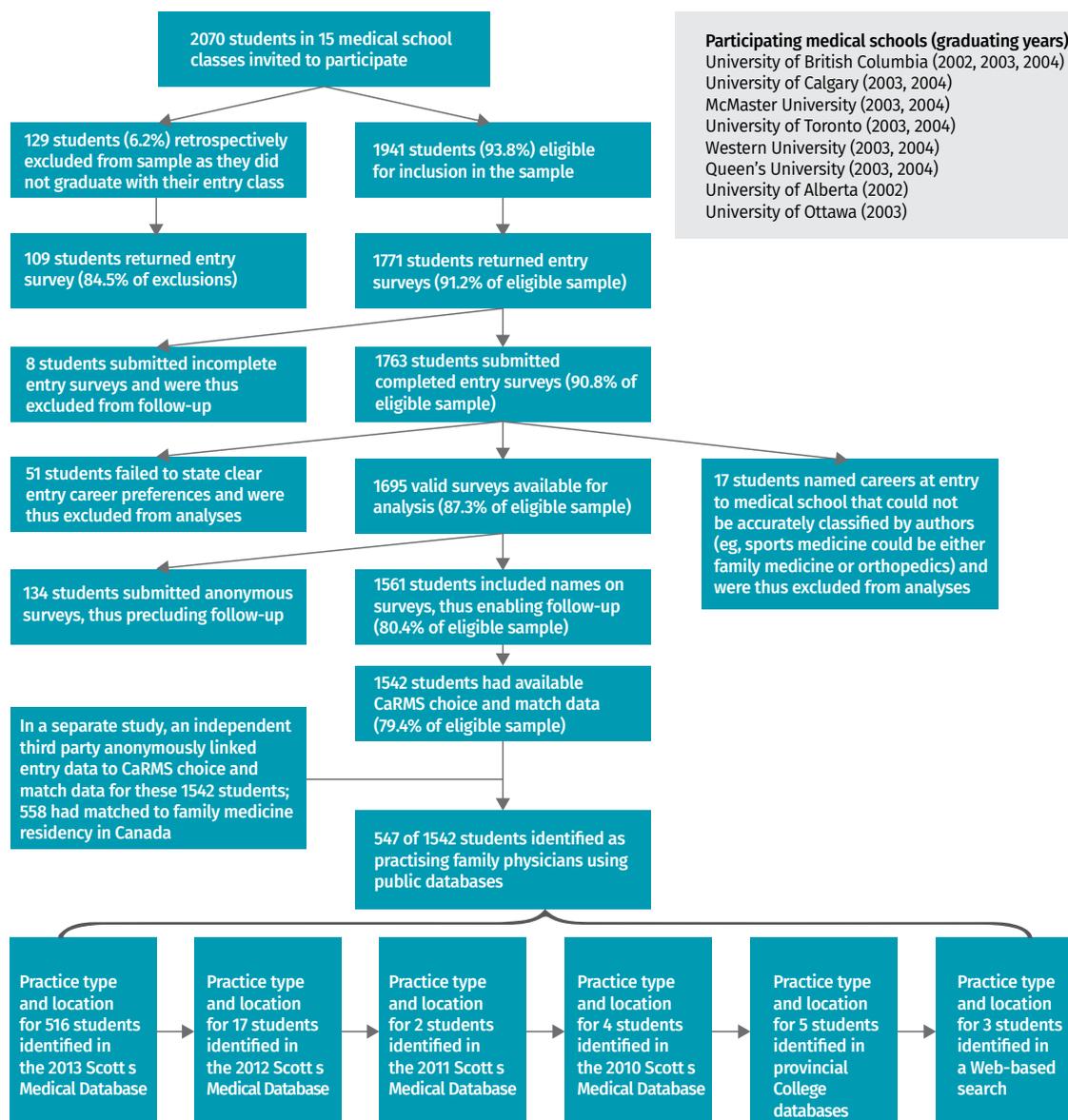
Our findings support the literature from other countries that suggests an interest in rural FM early in medical training is one of the most important factors predicting later practice in a rural setting.^{11,15-18} Interestingly, despite strong bivariate associations with rural practice location, the proportion of childhood spent in a rural community and having rural ties were not predictive of postresidency rural family practice in multivariate regression, likely owing to the very high correlation between these variables and completion of school in a rural community. While completion of school in a rural community, being older, being in a long-term relationship, having a societal orientation, and desiring a varied scope of practice predicted postresidency rural family practice, these variables were much less important predictors than a stated interest in rural FM.

This strong association, as demonstrated by an odds ratio of 10.03 for a stated interest in rural FM and later rural family practice, lends support to the importance of pipeline programs that encourage students who have an interest in rural medicine to apply to medical school. Pipeline programs work as early as elementary school and continue to exert their influence throughout high school, undergraduate training, medical school, and residency.¹⁹ Currently, many of these programs are targeted at individuals with a connection to rural settings; however, it is possible we must broaden our conception of pipeline programs to include students from all settings who indicate an interest in practising rurally and ensure they are carefully mentored and supported.

Our results might assist those seeking to increase the number of students accepted into medical school who will go on to practise in rural settings. Schools with a mandate to increase the number of rural family physicians might consider actively seeking out applicants interested in rural FM and encouraging them to apply. This needs to be done carefully, as not to encourage those who will overstate an interest in rural FM if it is thought to provide an admissions advantage.

We identified associations between older age and relationship status at medical school entry and later rural family practice. Other studies, including one

Figure 1. Recruitment and follow-up of cohort



CaRMS—Canadian Resident Matching Service.

Canadian study, have also shown older age to be predictive of rural practice, marking a potential trend.^{3,17,20-22} Our study is the first to suggest that being in a relationship at matriculation is predictive of future rural practice.²³⁻²⁵ In the context of a pipeline model, recruitment targeting those who are older and in relationships might include information aimed at helping entire families make the transition to rural life.

Societal orientation is a factor that encompasses an interest in health promotion, long-term relationships

with patients, and practising medicine in a community setting; these are many of the tenets underlying the practice of FM. An earlier study with the same cohort demonstrated that students with a societal orientation were interested in later practising in rural settings, but our study is the first to demonstrate that it is actually predictive of rural practice.²⁶

Finally, it is well known that rural physicians tend to have a wide scope of practice,^{27,28} and previous research has shown that an interest in generalism and greater

Table 1. Associations between entry career interests and postresidency practice: N 1542.

POSTRESIDENCY CAREER	PREFERRED CAREER AT ENTRY TO MEDICAL SCHOOL	
	RURAL FM, N 184	NONRURAL MEDICINE, N 1358
Rural FM, n = 88		
• No. practising rural FM	39	49
• Practising rural FM, %	44.3	55.7
• Preferred career at entry group practising rural FM, %	21.2	3.6
Nonrural medicine, n = 1454		
• No. practising nonrural medicine	145	1309
• Practising nonrural medicine, %	10.0	90.0
• Preferred career at entry group practising nonrural medicine, %	78.8	96.4

FM—family medicine.

Table 2. Factors derived from analysis of survey responses to underlying attitudinal variables

FACTORS AND ITEMS*	LOADING [†]	MEAN (SD) SCORE [‡]	EIGENVALUE [§]	CRONBACH α
Factor 1: medical lifestyle			3.20	0.83
• Flexibility outside of medicine	0.802	3.65 (1.11)		
• Acceptable hours of practice	0.784	3.41 (1.25)		
• Flexibility inside of medicine	0.756	3.84 (1.03)		
• Acceptable on-call schedule	0.742	3.34 (1.21)		
• Keeping options open	0.681	3.58 (1.09)		
Factor 2: societal orientation			2.79	0.73
• Health promotion important	0.692	3.63 (1.17)		
• Long-term relationship with patients	0.679	3.31 (1.23)		
• Focus on patients in the community	0.681	3.32 (1.23)		
• Social commitment	0.637	3.29 (1.26)		
Factor 3: prestige			2.67	0.72
• High income potential	0.752	2.16 (1.17)		
• Adequate income to eliminate debt	0.708	2.14 (1.31)		
• Status among colleagues	0.694	1.91 (1.05)		
• Stable and secure future	0.636	1.79 (1.10)		
Factor 4: hospital orientation			2.31	0.68
• Focus on urgent care	0.758	2.95 (1.25)		
• Focus on in-hospital care	0.726	2.88 (1.29)		
• Results of interventions immediately available	0.679	3.08 (1.23)		
Factor 5: scope of practice [¶]			1.74	-0.50
• Wide variety of patient problems	-0.701	3.61 (1.89)		
• Narrow variety of patient problems	0.820	2.74 (1.27)		
Factor 6: role model [¶]			1.71	0.59
• Meaningful past experience with a physician	0.847	2.96 (1.45)		
• Emulate a physician	0.856	2.51 (1.43)		

*Additional items not loading onto any factor included good match to this career, interesting patient population, focus on nonurgent care, dislike for uncertainty, prefer medical to social problems, research interest, and short postgraduate training; these were included as separate variables in the subsequent analyses.

[†]Loading represents the correlation between the item and the overall factor.

[‡]Items were rated on a 5-point Likert scale ranging from 1 (no influence) to 5 (important influence).

[§]Eigenvalues measure the variance of the factor.

^{||}Cronbach α measures internal consistency of test scores, with a "high" α indicating an underlying construct.

[¶]There are only 2 component items in these factors; the r value is given as r α under these conditions.

Table 3. Demographic and attitudinal associations with postgraduate career choice

VARIABLES	POSTRESIDENCY CAREER		P VALUE
	RURAL FM, N 88	NONRURAL MEDICINE, N 1454	
Demographic variables			
• Mean age, y	26.1	23.9	<.005
• Female sex, %	51.1	58.2	.194
• Single relationship status, %	51.1	72.1	<.005
• Parents received postgraduate education, %	33.0	45.3	.024
• Postgraduate education before medicine, %	22.7	17.8	.245
• Premedical science background, %	88.5	91.4	.358
• Premedical arts background, %	17.2	9.4	.018
• Family or friends in FM, %	20.5	20.6	.968
• Family or friends in any field of medicine, %	35.2	39.2	.458
• Home town population <50 000, %	42.0	20.3	<.005
• Rural childhood (>50% of childhood spent in rural setting), %	39.8	20.7	<.005
• Rural family ties, %	58.0	34.9	<.005
Attitudinal factors, mean score*			
• Factor 1: medical lifestyle	3.62	3.56	.552
• Factor 2: societal orientation	3.72	3.37	<.005
• Factor 3: prestige	1.82	2.01	.044
• Factor 4: hospital orientation	2.72	2.99	.012
• Factor 5: varied scope of practice	2.86	2.73	.350
• Factor 6: role model	3.93	3.40	<.005
Attitudinal items, mean score*			
• Good match to this career	2.17	2.18	.934
• Interesting patient population	4.42	4.26	.088
• Focus on nonurgent care	2.78	2.66	.330
• Dislike for uncertainty	1.90	2.16	.006
• Prefer medical to social problems	2.20	2.56	.016
• Research interests	2.03	2.40	.006
• Short postgraduate training	2.24	1.88	.005

FM—family medicine.

*Mean score on the 5-point Likert scale ranging from 1 (no influence) to 5 (important influence).

breadth of practice tend to be associated with an interest in practising rurally.^{11,26} We are the first to demonstrate that medical students interested in treating a comprehensive set of patient presentations are more likely to go on to practise in rural settings.

While our study was designed to identify variables at medical school entry that predict rural practice, there are other experiences that students have during medical school—such as rural clinical rotations—that might also influence the likelihood of practising in a rural setting.^{29,30}

Limitations

Not all regions of Canada were included in our study, and therefore our findings might not be fully generalizable to all Canadian medical schools, particularly those in the Maritimes and Quebec. Also, the total number of individuals in our cohort who chose rural practice is likely

lower than the national average because these provinces were not represented.⁶ Additionally, our follow-up period was 9 to 11 years after starting medical school, and for some individuals in our cohort this meant that they were tracked for 2 or fewer years after completing training.

While our study identified a number of factors that predict postresidency practice location, the factors identified only explain 53.4% of the variance in responses. Future research might be able to identify the source of the unexplained variance we identified. Our results also showed a loss of interest in rural medicine between medical school entry and postresidency practice, with 78.8% of those stating an interest in rural FM not subsequently practising rurally (**Table 1**). Future research might also be able to explain this loss of interest in rural practice from matriculation through to practice, as this phenomenon has not been well studied.

Table 4. Multivariate logistic regression analysis of factors found to be significantly associated with postresidency practice in rural FM

VARIABLES	THOSE IN RURAL FM POSTRESIDENCY	CRUDE OR (95% CI)	ADJUSTED OR* (95% CI) EXCLUDING ENTRY CAREER CHOICE	ADJUSTED OR† (95% CI) INCLUDING ENTRY CAREER CHOICE
Rural FM career interest at medical school entry, n (%)				
• Not considered	16 (2.2)	1.0‡	NA	1.0‡
• First choice	39 (21.2)	11.92 (6.48-21.88)	NA	10.03 (5.29-19.03)
• Considered but not first choice	33 (5.2)	2.43 (1.32-4.46)	NA	2.42 (1.30-4.52)
Mean (SD) age, [§] y	26.1 (5.0)	1.14 (1.09-1.19)	1.09 (1.03-1.14)	1.07 (1.02-1.13)
Hometown population, n (%)				
• > 50 000	51 (4.2)	1.0‡	1.0‡	NA
• < 50 000	37 (11.1)	2.85 (1.83-4.44)	2.37 (1.49-3.75)	NA
Relationship status, n (%)				
• Single	45 (4.1)	1.0‡	1.0‡	NA
• Married or equivalent	43 (9.6)	2.48 (1.61-3.82)	1.69 (1.05-2.73)	NA
Factor 2: societal orientation, [§] mean (SD) score	3.7 (0.9)	1.57 (1.22-2.03)	1.31 (1.00-1.72)	NA
Factor 5: varied scope of practice, [§] mean (SD) score	3.9 (1.0)	1.69 (1.34-2.13)	1.39 (1.09-1.77)	NA

FM—family medicine, NA—not applicable, OR—odds ratio.

*In 67.9% of cases, the model correctly classified whether or not a student went on to practise rural FM after residency (specificity of 67.8% and sensitivity of 70.1%).

†In 76.2% of cases, the model correctly classified whether or not a student went on to practise rural FM after residency (specificity of 76.9% and sensitivity of 65.5%).

‡Reference category.

§For continuous variables, each unit increase (year of age or unit on the Likert scale) is associated with the stated increase in the OR. The Likert scale ranged from 1 (no influence) to 5 (important influence).

It is unclear whether early practice in a rural setting is predictive of long-term retention in a rural community, as new medical graduates often seek temporary locums that do not reflect their long-term practice location. Our results, therefore, might not represent an ongoing commitment to practising in a rural setting. Longer follow-up of this or similar cohorts is needed.

Conclusion

This study identified a number of demographic and attitudinal variables at medical school entry that predict postresidency practice in a rural setting. The strongest predictor was interest in rural FM at matriculation, with other predictors being completion of school in a rural community, older age, being in a relationship, having a societal orientation, and expressing a desire for a varied scope of practice. Our results might help medical schools improve targeted engagement with medical students bound for rural careers as part of rural pipeline-to-practice programs. 

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Contributors

Drs Scott, Wright, and **Brenneis** and **Ms Gowans** conceived of the design of the study. **Drs Scott, Wright,** and **Brenneis** acquired data for the study. **Ms Gowans** carried out the bulk of statistical analysis and interpretation of the data. **Dr Mitra** made substantive contributions to the interpretation of the data and the creation of the manuscript. All other authors provided administrative and technical support as well as critical input to the manuscript. **Dr Scott** is listed as the last author as he took the lead in supporting the first author in the creation of this manuscript. All authors give approval to the version of the manuscript submitted.

Competing interests

None declared

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