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Graduates of northern Ontario family medicine residency programs practise where they train

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Objective: To examine where graduates of the Northeastern Ontario Family Medicine (NOFM) residency program in Sudbury and the Family Medicine North (FMN) program in Thunder Bay practise after graduation, using cross-sectional and longitudinal analyses.

Methods: Data from the Scott's Medical Database were examined. All physicians who graduated from NOFM and FMN between 1993 and 2002 were included in this analysis. Differences in the location of first practice between NOFM and FMN graduates were tested using chi-squared tests. Logistic regression analyses were used to examine the impact of the training program on a physician's first, as well as continuing, practice location.

Results: Between 1993 and 2002, FMN graduates were 4.56 times more likely (95% confidence interval [CI] 2.34–8.90) to practise in rural areas, compared with NOFM graduates, but NOFM graduates were 2.50 times more likely than FMN graduates (95% CI 1.35–4.76) to practise in northern Ontario. There was no statistically significant difference between the graduates of the 2 programs in the likelihood of working in either northern Ontario or a rural area. About two-thirds (67.5%) of all person-years of medical practice provided by NOFM and FMN graduates took place in northern Ontario or rural areas outside the north.

Conclusion: NOFM and FMN have been successful in producing family physicians to work in northern Ontario and rural areas. Results from this study add to the growing evidence from Canada and abroad that rural or northern medical education and training increases the likelihood that the graduates will practise in rural or northern communities.

Objectif : Déterminer, à l'aide d'analyses transversales et longitudinales, où les diplômés du programme de résidence en médecine familiale du nord-est de l'Ontario (MFNO) à Sudbury et ceux du programme de médecine familiale du Nord (MFN) à Thunder Bay pratiquent après avoir obtenu leur diplôme.

Méthodes : On a analysé des données tirées de la Scott's Medical Database. L'analyse a inclus tous les médecins qui ont obtenu leur diplôme des programmes MFNO et MFN entre 1993 et 2002. On a analysé au moyen de tests de chi-carré les différences au niveau du lieu de pratique entre les diplômés du programme MFNO et ceux du programme MFN. Des analyses de régression logistique ont permis de déterminer l'effet du programme de formation sur le premier endroit où un médecin décide de pratiquer et sur celui où il continue de le faire.

Résultats : Entre 1993 et 2002, les diplômés du programme MFN étaient 4,56 fois plus susceptibles de pratiquer dans des régions rurales (intervalle de confiance [IC] à 95 %, 2,34–8,90), comparativement aux diplômés du programme MFNO, mais ces derniers étaient 2,50 fois plus susceptibles que les diplômés du programme MFN de pratiquer dans le nord de l'Ontario (IC à 95 %, 1,35–4,76). Il n'y avait pas de différence statistiquement significative entre les diplômés des deux programmes quant à la probabilité de travailler dans le nord ou dans une région rurale. Environ les deux tiers (67,5 %) du total des années-personnes consacrées à la pratique de la médecine

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par les diplômés des programme MFNO et MFN ont été fournies dans le nord de l'Ontario ou dans des régions rurales ailleurs que dans le nord.
Conclusion : Les programme MFNO et MFN ont réussi à former des médecins de famille qui travaillent dans le nord de l'Ontario et dans les régions rurales. Les résultats de cette étude ajoutent à la masse croissante de données probantes provenant du Canada et de l'étranger qui indiquent que l'éducation et la formation en médecine en milieu rural ou dans le nord augmentent la probabilité que les diplômés pratiquent dans des communautés rurales ou du nord.

Introduction

The mismatch between the geographic distribution of physicians and that of the Canadian population as well as the belief that there are critical shortages of physicians in many rural communities has been noted time and again.[1–5] Governments have used many strategies in recent decades to try to increase the number of rural physicians, mostly through financial incentives, recruitment drives, better access to continuing medical education and rural locum relief programs.[6–8] Another important strategy pursued in some jurisdictions around the world is medical training in rural communities. This is because there is increasing evidence that doctors who are exposed to rural settings while growing up or during medical education are more likely to practise in rural areas, compared with those with an urban background.[9] For example, in 1999 Rourke and colleagues[10] surveyed 484 physicians who were practising in rural and urban areas in Ontario and found that rural physicians were significantly more likely to have had clinical training in a rural setting during medical school. Physicians trained in rural areas are more likely to work in rural areas because, among other things, rural medical education imparts the knowledge and skills necessary to work in challenging rural environments.[11–14]

Like other mostly rural regions, northern Ontario — a vast area with a relatively small and widely dispersed population — has experienced chronic shortages of physicians. Over the last several decades, many programs, such as the Underserviced Area Program, have been introduced in an attempt to encourage more physicians to establish medical practice in northern Ontario. In 1991, the provincial government introduced another important initiative. Two family medicine residency programs — the Northeastern Ontario Family Medicine (NOFM) program in Sudbury and the Family Medicine North (FMN) program in Thunder Bay — were established. The rationale was to increase family medicine residents' exposure to and experience in northern Ontario, including smaller and more remote communities, in the hope that they would consider practising in northern Ontario upon completion of residency training. The mandate of these 2 programs was captured in a 1990 press release issued by the Office of the Premier of Ontario:

> A Northern Ontario residency training program for medical school graduates entering family practice was announced today by Premier David Peterson. . . 'This new program promises to help solve the problem of recruitment and retention of physicians in northern, rural and remote communities,' said Mr. Peterson.[15]

Our study examines, over a 10-year period, at both the start of physicians' careers and in subsequent years, the extent to which these 2 family medicine programs have been successful in producing physicians who enter northern or rural practice. Our study is part of a larger research project, supported by the Canadian Institutes of Health Research. Its goal is to look at the role of rural medical education in Canada in training an adequate supply of rural physicians.

Methods

Study subjects

Our study examines all physicians who graduated from either NOFM or FMN between 1993 and 2002 and is based on a secondary analysis of data from the Scott's Medical Database (SMDB; formerly known as the Southam Medical Database) maintained by the Canadian Institute for Health Information (CIHI). SMDB provides data that can be used to examine a variety of medical workforce issues such as demographic profiles, supply, distribution and migration of Canadian physicians. At the request of the research team, staff at the NOFM and the FMN constructed a registry of all program graduates between 1993 and 2002, which was then sent to CIHI and linked to SMDB by physician name, medical school and medical school graduation year.

After completing this link, CIHI removed the names of the physicians and provided the anonymous data set to the research team. Each physician's practice location was tracked for each year following completion of residency training until 2002, but no attempt was made to identify or contact individual physicians to obtain additional or missing data.

Practice location

We classified physician practice location in 3 ways: urban versus rural, northern Ontario versus outside northern Ontario, and northern Ontario or rural versus urban outside northern Ontario. To determine these classifications, we identified the Census Subdivision (CSD) of each physician's practice based on postal code information in the SMDB. Each CSD was assigned to a Metropolitan Influence Zone (MIZ) category to classify urban and rural practice. Using this definition, rural areas are designated as places with less than 10 000 people and where less than 50% of the work force commutes to work in an urban area.

Recruitment and retention

There were 2 sets of outcomes that correspond to recruitment and retention — the 2 major rural health workforce issues. The first set of outcomes measured the locations of initial year of practice of the graduates. Two definitions of "initial year of practice" were used in light of the fact that many new graduates spend their first 1 or 2 years as locum tenens and that some take additional training in specialized fields: a physician's graduation year from FMN or NOFM plus 1 year and a physician's graduation year plus 2 years.

The second set of outcomes concerned retention — the likelihood of graduates to continue to practise in northern Ontario or rural areas. Typically, retention is understood in terms of the amount of time a physician remains in a particular community. But since this study was more interested in the extent to which a group of physicians practised in certain types of areas, such as northern Ontario or rural communities, and because there was considerable geographic mobility among the family physicians, a new unit of analysis — person-year of medical practice — was introduced. The use of this unit of analysis was also made necessary by the nature of the SMDB data, which were for each physician for each year (as of December 31). One person-year in rural practice, for example, means 1 year of medical practise by a family physician in one or more communities classified as rural, not necessarily in a particular rural location. Needless to say, more recent graduates have fewer person-years than those who started medical practice earlier.

Analyses

Bivariate analyses comparing differences in the location of first practice between NOFM and FMN graduates were conducted using chi-squared tests. Logistic regressions were used to examine the impact of the training program on a physician's first practice location, adjusting for other factors such as the physician's age and sex. To examine the impact of the training program on continuing practice, adjusting for other factors, we conducted logistic regressions on practice location in a given year. We employed generalized estimating equations and a repeated-measures analysis with autoregressive error terms to examine the likelihood of physicians to continue to practise in northern Ontario or rural areas. These analyses, respectively, employed the logistic model (LOGISTIC) and generalized linear model (GENMOD) procedures in SAS 8.1 (SAS Institute Inc., Cary, NC).

This study received research ethics approval from the research ethics committee at the Sunnybrook and Women's Health Sciences Centre.

Results

Of the 203 graduates of the 2 residency programs, 3 graduates were excluded because they were practising in the United States or other foreign countries at the time of the research, and another 6 were excluded because their current medical addresses could not be confirmed in the SMDB or because they had indicated that they did not wish to have their data released.

Table 1 provides descriptive information about the physicians included in this study. The 2 groups of graduates were similar in terms of age and sex distribution and their participation in additional residency training. FMN graduates were much more likely than NOFM graduates to choose a first practice location in a rural area, at both 1 year and 2 years after graduation. NOFM graduates, however, were more likely to choose a first practice location in northern Ontario, but this difference was apparent only at 2 years after graduation. Between two-thirds and three-quarters of NOFM and FMN graduates started practice in either northern

Ontario or in a rural area, and there was no difference between the 2 programs.

Altogether, there were 1117 person-years of medical practice provided by the graduates of the 2 residency programs during the period from 1993 to 2002. Slightly over one-half of all person-years of medical practice took place in northern Ontario and two-thirds of all person-years of practice took place in northern Ontario, in rural areas or both (Fig. 1).

Regression analyses examining choice of practice location (Table 2) confirm the findings in the abovementioned bivariate analyses. FMN graduates were more likely than NOFM graduates to be working in a rural area at both 1 and 2 years after graduation and NOFM graduates were more likely to be working in Northern Ontario at 2 years after graduation. There were no statistically significant differences between the 2 programs in the likelihood of starting practice in a community in either northern Ontario or in a rural area. Physicians' age, sex and additional residency training had no impact on their choice of initial practice location.

Table 2 also presents the results of the multivariate analyses of the likelihood of FMN and NOFM graduates to continue to practise in northern Ontario or rural areas. Similar to the logistic regressions reported above, FMN graduates (odds ratio [OR] 2.98, 95% confidence interval [CI] 1.70–5.23) were more likely to continue practising in rural areas and less likely to continue practising in northern Ontario (OR 0.48, 95% CI 0.29–0.79), compared with NOFM graduates, after controlling for the number of years since completion of residency training. Graduates from both programs were less likely to practise in northern Ontario as time after graduation increased. When the combined outcomes of rural areas and northern Ontario were examined, graduates from both programs were more likely to continue practising in either of these areas (OR 1.11, 95% CI 1.02–1.23) as the number of years after graduation increased.

Discussion

This study examines the extent to which the graduates of 2 northern Ontario-based family medicine residency programs established initial practice and continued to work in northern Ontario and rural areas. There are several noteworthy findings:

1. When initial year of practice was defined as

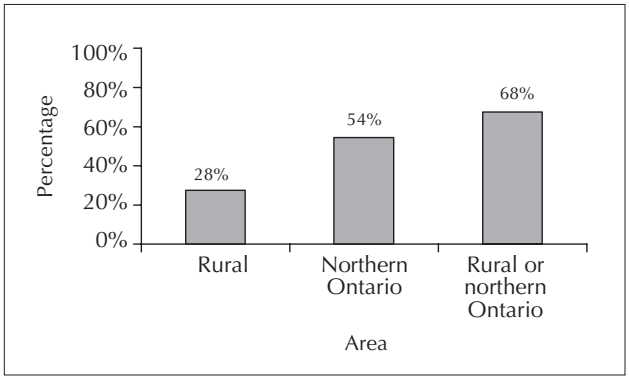


Fig. 1. Percentage of total person-years (measured from the year of graduation to 2002) of medical practice spent in rural areas, northern Ontario, and rural or northern Ontario by Northern Ontario Family Medicine and Family Medicine North graduates (combined), from 1993 to 2002.

Table 1. Characteristics of NOFM and FMN graduates from 1993 to 2002*

	Graduation year + 1			Graduation year + 2		
Characteristic	NOFM, %†	FMN, %†	*p* value	NOFM, %†	FMN, %†	*p* value
Study participants, no.	99	95		87	85	
Female sex	47	52	0.57	47	48	0.88
Average age, yr	30.6	31.1	0.39	30.6	31.1	0.39
Additional year of training	25	23	0.73	22	19	0.62
Location of initial practice						
Rural practice‡ v.	17	47	< 0.001	21	42	0.002
Urban practice	83	53		79	58	
Northern Ontario v.	61	53	0.26	68	46	0.003
Southern Ontario and rest of Canada	39	47		32	54	
Northern Ontario, rural practice or both v.	69	73	0.55	75	67	0.27
Others	31	27		25	33	

NOFM = Northeastern Ontario Family Medicine program; FMN = Family Medicine North program.
*Data source: Scott's Medical Database as well as data from FMN and NOFM.
†Unless otherwise indicated.
‡The definition of the Metropolitan Influenced Zone was used to create this variable.

2 years after graduation, 67% of FMN graduates and 75% of NOFM graduates were practising in either northern Ontario (including both urban and rural communities) or rural areas outside northern Ontario. In other words, about 7 out of 10 graduates established initial medical practice in northern or rural areas.

2. In relation to retention, when northern Ontario and other rural practice locations were considered together, just over two-thirds (68%) of all person-years of medical practice by FMN and NOFM graduates took place in such areas. Some interesting differences between the 2 programs were found; for instance, compared with NOFM graduates, FMN graduates were more likely to practise in rural areas.
3. When examined at 2 years after graduation, NOFM graduates were more likely than FMN graduates to practise in northern Ontario.
4. There was no statistically significant difference between the 2 groups of graduates with respect to where they worked when northern Ontario and other rural locations were considered together and compared with urban locations outside northern Ontario.

The results of this study show that from the perspective of recruitment and retention, the 2 programs have fulfilled, to a large extent, their mandate of training family physicians to work in northern Ontario and other rural areas. It should be noted that although northern Ontario includes several small and mid-sized cities, almost the entire region has been designated by the Underserviced Area Program of the Ontario Ministry of Health and Long-Term Care as "underserviced" for general and family practitioners for an extended period of time.[16] It should also be recalled that the 2 residency programs were established with a view to training family physicians to work in all of northern Ontario, not just in rural or remote communities.

Our results are consistent with the observations made by a recent report on the supply and use of family physician services in Ontario.[17] A key finding of this report was that between 1992 and 1993 and between 2001 and 2002, northern Ontario was the only region of the province with a consistent increase in physician supply. The authors of that report suggested that the NOFM and FMN programs, coupled with other measures, such as incentive grants, bursaries with return-of-service obligations and locum programs, contributed to an increase in physician supply in northern Ontario.

Our results also contribute to the accumulation of research evidence regarding the effects of rural medical education in overcoming the problem of geographic maldistribution of physicians. Policymakers, health care administrators and medical educators need to know the effectiveness of different strategies and programs. This study, along with others conducted in Canada and in other countries, has shown that physicians tend to practise where they train.[18–20] It shows that training physicians in underserved areas can help ameliorate physician maldistribution or shortage situations.

Another interesting finding is the differences between the 2 residency programs when rural practice locations and northern Ontario practice locations were considered separately. As noted earlier, while FMN graduates were more likely to work in rural communities, NOFM graduates were more

Table 2. Factors influencing physicians' likelihood of practising in rural, northern Ontario, or rural or northern Ontario at different times after graduation

	Likelihood 1 year after graduation, OR, 95% CI			Likelihood 2 years after graduation, OR, 95% CI			Likelihood to continue, OR, 95% CI		
Characteristic	Rural area outside northern Ontario	Northern Ontario	Rural or northern Ontario	Rural area outside northern Ontario	Northern Ontario	Rural or northern Ontario	Rural area outside northern Ontario	Northern Ontario	Rural or northern Ontario
FMN program	4.56, 2.34–8.90	0.73, 0.41–1.30	0.83, 0.44–1.54	2.91, 1.47–5.75	0.40, 0.21–0.74	1.42, 0.73–2.78	2.98, 1.70–5.23	0.48, 0.29–0.79	1.38, 0.84–2.28
Male sex	0.96, 0.51–1.84	1.68, 0.94–2.99	1.02, 0.55–1.90	0.96, 0.49–1.89	1.71, 0.91–3.22	0.71, 0.36–1.39	0.88, 0.52–1.50	1.49, 0.91–2.45	0.89, 0.54–1.46
Age	0.93, 0.85–1.03	1.02, 0.95–1.10	1.00, 0.92–1.08	1.00, 0.92–1.08	1.02, 0.94–1.11	1.01, 0.93–1.10	1.01, 0.93–1.09	1.03, 0.97–1.09	0.97, 0.91–1.04
Additional training	1.18, 0.56–2.47	1.14, 0.58–2.24	0.89, 0.43–1.85	1.76, 0.79–3.92	1.54, 0.69–3.43	0.45, 0.17–1.18	0.88, 0.50–1.56	1.32, 0.78–2.22	0.76, 0.42–1.37
Years since completion of residency	NA	NA	NA	NA	NA	NA	1.04, 0.93–1.16	0.86, 0.79–0.94	1.11, 1.02–1.23

OR = odds ratio; CI = confidence interval; FMN = Family Medicine North; NA = not applicable.

likely to work in northern Ontario (including both urban and rural communities). Hutten-Czapski and Thurber[21] reported similar findings. They found that for the period of 1994–98, 51% of FMN graduates were practising in rural areas, compared with only 12% of NOFM graduates. Such divergence in outcomes could be due to differences between the 2 programs in the way the residents are trained. FMN has 6 months of mandatory rural rotations and an option to do an additional 6 months of rural training, with the remaining clinical rotations occurring in Thunder Bay. The NOFM program has 4 months of mandatory rural rotations and an option to do only 2 additional months of rural training, with all other rotations occurring in the urban centres of northeastern Ontario.[22]

The greater likelihood of FMN graduates, compared with NOFM graduates, of practising in rural areas may also be due to the geographic and demographic characteristics of the 2 regions of northern Ontario. FMN is located in northwestern Ontario, which has many rural or remote communities but only 2 urban centres with a population of 10 000 or more (i.e.,Thunder Bay and Kenora). NOFM is located in northeastern Ontario, which has 6 communities with a population of 10 000 or more (i.e., Sudbury, Sault Ste. Marie, North Bay, Timmins, Elliot Lake and the "Tri-town" area of New Liskeard, Haileybury and Cobalt, where the 3 contiguous communities — now renamed Temiskaming Shores — have a combined population of more than 10 000 and are classified as a Census Agglomeration by Statistics Canada). Thus, while about 53% of the residents of northwestern Ontario live in Thunder Bay and Kenora, about 82% of the residents of northeastern Ontario live in the 6 urban centres. Since medical graduates tend to practise where they train, all else being equal, FMN graduates who decide to set up medical practice in northwestern Ontario are more likely to do so in rural or small-town settings, while NOFM graduates are more likely to practise in urban areas if they wish to remain in northeastern Ontario.

Other findings may also have implications for medical educators and policy makers, particularly in relation to medical workforce planning in northern Ontario. First, as shown in Table 2, male physicians appear to be much more likely than female physicians to practise in northern Ontario (ORs range from 1.49 to 1.71). In light of our findings, what are the long-term implications of the feminization of medical education for the north? Second, physicians who have additional training following family medicine residency also appear to be more likely to practise in the north (ORs range from 1.14 to 1.54). Does this mean that northern Ontario should try to encourage family physicians to acquire further training? Although our study provides no answers to these questions, we flag them for further discussion. Third, while the 2 programs have been successful in training family physicians to work in northern Ontario and rural areas, the study shows that not all graduates ended up working in northern or rural communities. Close to one-third of the person-years of medical practice occurred elsewhere. It is important to understand the reasons behind this "loss" to urban centres. A companion study by Pong and associates,[23] which examines why some rural- or northern-trained physicians opted for urban practice, provides some useful insights.

Limitations

This study has several limitations. First, practice locations were based on mailing addresses in the SMDB at a point in time in a given year. Physicians may move within the year or the mailing address may not represent actual practice location. For instance, a physician doing locum work in various small towns in northern Ontario may use his parents' address in Toronto as his mailing address. The magnitude of this problem is not readily known. Further validation of SMDB data on practice locations would be useful.

Second, person-years of medical practice are a somewhat rudimentary measure, owing to another limitation of the SMDB data. Person-year data do not provide any information about changes in practice location that have taken place within the same calendar year because SMDB location data obtained from the CIHI are available only as of December 31 of each year. As an illustration, one would not be able to tell from the data that a physician moved from Thunder Bay to Toronto in February and returned to Thunder Bay in November of the same year. Third, we had no information on other factors that may influence physicians' practice location decisions, which would ideally have been included in the regression analyses. Such factors include background of physicians and their spouses, remuneration, professional support, locum relief, workloads, spousal employment opportunities, community attributes and proximity to family members.[6,24,25] Yet, despite this multitude of factors, the effect the Canadian medical educational system has on practice location is unlikely to be neutral.[21]

Finally, the focus of this study is on the 2 family medicine residency programs in northern Ontario; thus, the generalizability of the findings may be limited to medical education programs similar to FMN and NOFM, and the conclusions may not be applicable to programs that have a much shorter duration of rural or northern exposure. Future studies of a similar nature may consider including a wider range of rural or northern medical education programs. However, by focusing on 2 relatively similar programs, this study has the advantage of ensuring comparability and eliminating possible effects of extraneous factors. The results of this study, while useful from an outcome assessment perspective, would be more meaningful if similar data were available for comparison from urban-based family medicine residency programs. Future studies should consider including one or more comparison groups in the study design.

Conclusion

The FMN and NOFM programs have had good success in achieving their mission of supplying family physicians to underserviced communities. While FMN has had more success at rural placement of graduates and NOFM has had stronger placement in northern Ontario, both programs are equally successful at placing graduates in northern Ontario or rural communities outside the north. The retention of the graduates in northern or rural communities is also impressive, as reflected by the fact that over two-thirds of all person-years of medical practice by graduates of the 2 programs took place in such areas.

This study adds to the growing evidence from Canada and abroad that educating physicians in northern and rural settings increases the likelihood that the graduates will practise in rural or northern communities. Thus, effective rural and northern medical education must be a cornerstone of any long-term physician workforce strategy designed to address the inequitable distribution of medical practitioners in Canada.

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