



Northern Ontario  
School of Medicine  
École de médecine  
du Nord de l'Ontario  
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Item #16

# Activity Report

Dr. Roger Strasser, Dean-CEO

November 15, 2016

It has been a very busy and very productive fall session. The NOSM Board of Directors face to face meeting will be held on November 24 & 25, 2016 in Sudbury Ontario. A full list of Directors and Board Information can be found here: [http://www.nosm.ca/about\\_us/governance/general.aspx?id=5022](http://www.nosm.ca/about_us/governance/general.aspx?id=5022)

## CEPD Accreditation Success

On October 24 & 25<sup>th</sup>, 2016, the Committee on Accreditation for Continuing Medical Education (CACME) began NOSM's CEPD Accreditation Site Visit (ASV). In 2010, the NOSM CEPD program achieved full accreditation including several standards in exemplary compliance. With a six year cycle, it was time for another CEPD Accreditation Site Visit. A team of two accreditors visited NOSM for two days. Many of NOSM faculty and staff members, as well as hospitals/health service partners were involved in the visit. Preparation for this ASV began last year and included a mock site visit in May. The formal process continues with the draft survey report providing an opportunity for the Dean and Associate Dean to correct any inaccuracies. Subsequently, the survey report will be considered at the spring meeting of Committee for Accreditation of Continuing Medical Education (CACME) which means that we are likely to receive formal notification of that CACME's decision late in mid-2017.

## NOSM Medical Student Honoured

On October 3<sup>rd</sup>, third-year NOSM Medical student Angela Cescon, was honoured with the Canadian Medical Hall of Fame award. Angela is a third year student at the NOSM, her master's research was conducted at the Perinatal HIV Research Unit in Soweto, South Africa. Her work focused on missed opportunities for prevention of vertical HIV transmission and was recognized with SFU's Dean of Graduate Studies Convocation Medal. She is an ongoing contributor in the field of clinical epidemiological HIV research in Canada, having co-authored 25 publications and serving as a co-investigator on several national projects.

## Socially Accountable MD Admissions

Consistent with NOSM's social accountability (SA) mandate, the NOSM MD Admissions process is designed to promote selection of Indigenous, Francophone, rural and northern students reflecting the demographics of Northern Ontario. After 10 years, a systematic analysis was undertaken to assess our success. Overall, 3.5% of all qualified applicants (610 of 17,358) were admitted to NOSM between 2006-2015. The percentage varied for all qualified Indigenous and Francophone applicants (11% and 7%, respectively). Overall, 92% of admitted students were from Northern Ontario, 8% were from rural and remote areas from the rest of Canada. In addition, 7% of students were Indigenous and 22% were Francophone. The mean GPA score for students was 3.7 on a 4.0 scale consistent with medical schools across Canada. Based on the overall success rate, the most promoted groups were northern and Indigenous applicants (18% and 11% of qualified applicants have been accepted to the program in the last decade). The rate was lower for Francophone and rural applicants (7% and 6%, respectively).

The MD admissions process is successful in selecting a student body reflective of the needs, demographics and communities of Northern Ontario. The context scoring algorithm assesses and ranks applicants based on geographic, Indigenous and Francophone backgrounds. While continuing to evolve, these tools have proven responsive and effective in allowing NOSM to address its SA mandate. This recruitment success has occurred without lowering academic standards and has helped to ensure that NOSM MD students are well suited to Distributed Community Engaged Learning.

## Be Awesome with NOSM

NOSM has come a long way in a relatively short time. Since 2009, there have been 415 MD graduates of whom 62%, almost double the national average, have chosen family medicine (predominantly rural). 94% of NOSM MD graduates who undertook residency in Northern Ontario are practising in Northern Ontario (see attached). Many NOSM graduates who are practising in Northern Ontario are now NOSM faculty members and some have taken on academic leadership roles with NOSM.

NOSM has so many MD graduates in family medicine residency and practising family physician, as well as family physician faculty members that we hold a celebratory reception entitled "Be Awesome with NOSM" at the Family

Medicine Forum (FMF), the annual conference of the College of Family Physicians of Canada. This year's "Be Awesome with NOSM" reception was on Friday, November 11 in Vancouver.

### **Bruce Power Invests \$5 Million in Health and Environment Research at Northern Ontario School of Medicine**

On November 10<sup>th</sup> 2016, Bruce Power representatives announced a \$5 Million investment in Health and Environment Research at NOSM.

Bruce Power's contributions to NOSM will consist of:

- A \$5 million investment over the next five years to establish the Bruce Power Centre for Health and Environmental Research.
- The renewal of the Bruce Power Chair in Radiation and Health at NOSM, which was established in 2013.
- The provision of a free, clean energy electric car charging station that is open and available to the public, as well as an electric car for conducting research.

The \$1 million in annual funding for five years will be used to continue research that has taken place during the first four years of the existence of the Bruce Power Chair in Radiation and Health, specifically:

- The impact of low-dose radiation on health.
- The environmental impacts of radiation and how they impact health.
- The effects of radiation and diagnostic imaging on fetal programming.
- The effect of radiation on specific species of fish.
- The impact of radiation on Indigenous communities.

"This announcement demonstrates what can be achieved through innovative partnerships. Health, energy, and our environment are directly linked. This new funding will help to expand research functions at Northern Ontario School of Medicine and ensure they're able to undertake the cutting edge work we've all come to expect from their team," said Honourable Glenn Thibeault, Minister of Energy and MPP, Sudbury.

### **NOSM Awards of Education and Scholarship**

On November 14<sup>th</sup> 2016, a call was sent out for nominations for this year's NOSM Awards of Education and Scholarship. NOSM's phenomenal achievements over the last decade are the result of the outstanding contributions by many, many people. This night's program highlights exemplary efforts of faculty members and learners in the pursuit of the School's vision of Innovative Education and Research for a Healthier North.

Nominations are open now for faculty members from all three Divisions in the following categories: Clinical Scholar; Medical Educator; Clinical Teacher; Academic Leader; and Scholar. Learner-nominated categories are: Teacher; Peer Teaching; Scholarly Activity; and Advocate/Leader.

If you as a faculty member or learner have observed excellence in your peers, to submit your nomination before Wednesday, November 30<sup>th</sup> please go to [www.nosm.ca/facultyawards](http://www.nosm.ca/facultyawards)

Award recipients will be acknowledged publicly at Northern Constellations faculty development conference 21-22 April 2017.

**Northern Passages – the latest edition of the Northern Passages can be found here:** Fall 2016  
[\[English\]](#) [\[Français\]](#)

The **Scope** <http://nosm.ca/uploadedFiles/Research/Scope%20Fourth%20Issue%20Web.pdf>

For more news and information visit [www.nosm.ca](http://www.nosm.ca)

Respectfully submitted,

Dr Roger Strasser AM  
 Professor of Rural Health  
 Dean and CEO  
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# Milestones on the social accountability journey

## Family medicine practice locations of Northern Ontario School of Medicine graduates

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### Abstract

**Objective** To assess the effect of different levels of exposure to the Northern Ontario School of Medicine's (NOSM's) distributed medical education programs in northern Ontario on FPs' practice locations.

**Design** Cross-sectional design using longitudinal survey and administrative data.

**Setting** Canada.

**Participants** All 131 Canadian medical graduates who completed FP training in 2011 to 2013 and who completed their undergraduate (UG) medical degree or postgraduate (PG) residency training or both at NOSM.

**Intervention** Exposure to NOSM's medical education program at the UG (n=49) or PG (n=31) level or both (n=51).

**Main outcome measures** Primary practice location in September of 2014.

**Results** Approximately 16% (21 of 129) of FPs were practising in rural northern Ontario, 45% (58 of 129) in urban northern Ontario, and 5% (7 of 129) in rural southern Ontario. Logistic regression found that more rural Canadian background years predicted rural practice in northern Ontario or Ontario, with odds ratios of 1.16 and 1.12, respectively. Northern Canadian background, sex, marital status, and having children did not predict practice location. Completing both UG and PG training at NOSM predicted practising in rural and northern Ontario locations with odds ratios of 4.06 to 48.62.

**Conclusion** Approximately 61% (79 of 129) of Canadian medical graduate FPs who complete at least some of their training at NOSM practise in northern Ontario. Slightly more than a quarter (21 of 79) of these FPs practise in rural northern Ontario. The FPs with more years of rural background or those with greater exposure to NOSM's medical education programs had higher odds of practising in rural northern Ontario. This study shows that NOSM is on the road to reaching one of its social accountability milestones.

### EDITOR'S KEY POINTS

- The Northern Ontario School of Medicine (NOSM) has a social accountability mandate to educate physicians to practise in northern Ontario. This longitudinal tracking study of NOSM medical learners reports on an analysis of primary practice locations in 2014 for Canadian medical graduates (CMGs) trained as FPs.
- Overall, 61% of CMG FPs who completed undergraduate or postgraduate training or both at NOSM were practising in northern Ontario; 22% of CMG FPs were practising in rural Ontario; and 5% were practising in other rural Canadian communities.
- A total of 94% of CMG FPs who completed both their undergraduate and postgraduate training at NOSM were practising in northern Ontario.

This article has been peer reviewed.

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# Un pas vers l'imputabilité sociale

## Les endroits où pratiquent les diplômés en médecine familiale de l'École de médecine du Nord de l'Ontario

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### Résumé

**Objectif** Vérifier l'effet de différents niveaux d'exposition aux programmes de formation médicale de l'École de médecine du Nord de l'Ontario (ÉMNO) sur les endroits où pratiquent les MF.

**Type d'étude** Étude transversale à l'aide d'une enquête longitudinale et de données administratives.

**Contexte** Le Canada.

**Participants** Les 131 médecins de famille canadiens diplômés en 2011, 2012 et 2013 qui avaient suivi leur programme de premier cycle ou de résidence ou les deux à l'ÉMNO.

**Intervention** Avoir suivi le programme de formation médicale de l'ÉMNO durant le premier cycle (n=49), durant la résidence (n=31) ou les deux (n=51).

**Principal paramètre à l'étude** Le premier lieu de pratique en septembre 2014.

**Résultats** Sur 129 participants, 21 (environ 16%) pratiquaient dans une région rurale du Nord de l'Ontario, 58 (45%) en milieu urbain du Nord de l'Ontario et 7 (5%) dans une région rurale du Sud de l'Ontario. La régression logistique a montré que le fait d'avoir passé plus d'années dans une région rurale du Canada permettait de prédire une pratique rurale dans le Nord de l'Ontario ou en Ontario (rapports de cotes de 1,6 et 1,2, respectivement). D'autre part, le fait d'avoir vécu dans le Nord du Canada, le sexe, l'état marital et le fait d'avoir des enfants ne permettaient pas de prédire le lieu de pratique. Par contre, le fait d'avoir suivi le programme de formation de premier cycle ou de résidence à l'ÉMNO permettait de prédire une pratique en milieu rural et dans le Nord de l'Ontario, avec des rapports de cotes variant entre 4,06 et 48,62.

#### POINTS DE REPÈRE DU RÉDACTEUR

• Pour répondre à un objectif d'imputabilité sociale, l'École de médecine du Nord de l'Ontario (ÉMNO) s'est donné le mandat de former des médecins capables de pratiquer dans le Nord de l'Ontario. Cette étude longitudinale pour retracer les étudiants en médecine formés à l'ÉMNO présente une analyse des endroits où, en 2014, les diplômés canadiens en médecine familiale (DCMF) ont commencé leur pratique.

• Dans l'ensemble, 61% des DCMF qui ont complété leur formation des premier et deuxième cycles à l'ÉMNO pratiquaient dans le Nord de l'Ontario; 22% travaillaient en Ontario rural; et 5% dans d'autres communautés rurales au Canada.

• Au total, 94% des DCMF qui ont effectué leurs études de premier et de deuxième cycles à l'ÉMNO pratiquaient dans le Nord de l'Ontario.

Cet article a fait l'objet d'une révision par des pairs.  
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**Conclusion** Environ 61% (79 sur 129) des diplômés canadiens en MF qui avaient suivi au moins une partie de leur formation à l'ÉMNO pratiquent dans le Nord de l'Ontario. Un peu plus du quart de ceux-ci (21 sur 79) pratiquent dans un milieu rural du Nord de l'Ontario. Les MF qui avaient passé plus d'années en milieu rural ou qui avaient eu une meilleure exposition aux programmes de formation médicale de l'ÉMNO avaient de meilleures chances de pratiquer dans un milieu rural du Nord de l'Ontario. Cette étude montre que l'ÉMNO est en voie d'atteindre son objectif d'imputabilité sociale.

The shortage of rural physicians is particularly acute in northern Ontario, where 29% of physicians' practices are in rural areas compared with 39% of the population.<sup>1-4</sup> The Northern Ontario School of Medicine (NOSM) has a social accountability goal to educate physicians to practise in northern Ontario.<sup>5,6</sup> We examined practice location of FPs who received their undergraduate (UG) or postgraduate (PG) medical education or both at NOSM to assess NOSM's success in reaching one of the first milestones on its social accountability journey.

There is emerging global interest in measuring NOSM's success, as NOSM is one of only a few medical schools in the world with an explicit social accountability mandate.<sup>7-11</sup> Evidence from northern Ontario,<sup>12,13</sup> Ontario,<sup>14</sup> and Canada,<sup>15</sup> as well as international reviews,<sup>16-19</sup> shows that if medical schools accept learners who have lived in rural areas and educate them in rural areas in a positive manner, then these learners are more likely to practise in rural locations.

Fulfilling a social accountability mandate is particularly challenging in northern Ontario, where 833 000 people are scattered across 807 000 km<sup>2</sup>.<sup>4</sup> Approximately 56% of the population is clustered in 5 large urban areas (Timmins, North Bay, Sault Ste Marie, Thunder Bay, and Sudbury), each with 43 000 to 161 000 people. Another 5% reside in 3 smaller urban centres of 11 000 to 15 000 people. Northern Ontario also has a higher proportion of 2 cultural-linguistic minority groups relative to the whole province. Indigenous people constitute 14% of the northern Ontario population versus 2% provincially, and Francophones constitute 18% versus 5% provincially.<sup>20,21</sup> Northern Ontarians, particularly indigenous peoples and Francophones, have poorer health status than the average Ontarian.<sup>22-25</sup>

At NOSM, all of northern Ontario is viewed as the campus, and NOSM serves as the Faculty of Medicine for Laurentian University in Sudbury (2011 census metropolitan area population of 161 000) and for Lakehead University in Thunder Bay (122 000)—cities that are located 1000 km apart by road. The NOSM selects academically qualified medical school applicants from northern, rural, indigenous, or Francophone backgrounds to reflect northern Ontario's demographic characteristics.<sup>26</sup> The distributed, community-engaged learning model at NOSM enables skilled clinicians to provide medical learners with education and clinical training in the smaller cities, towns, and communities of northern Ontario, with less dependence on traditional acute care hospitals in urban areas or large regional hospitals.<sup>27,28</sup> Learners provide care to patients with different socioeconomic backgrounds, cultures, and care needs while training in interprofessional settings.

We assessed the overall influence of NOSM's UG admission criteria and UG and PG educational programs on FPs' practice locations. While the international

literature has identified rural background as a predictor of rural practice location,<sup>16-19</sup> it is not known if NOSM's selection process has achieved the desired effect or if other factors (eg, northern background) would be important predictors.

## METHODS

This cross-sectional study of practice location compares UG and PG school groups (described below) as part of a prospective, longitudinal research program.<sup>29</sup> We used data from surveys, NOSM, and medical licensing agencies to predict practice location for NOSM's learners who completed their FP training in 2011 to 2013. Research ethics boards at Laurentian University and Lakehead University provided ethical approval.

### Data collection and participants

We started surveying learners and extracting administrative data in 2005 when NOSM accepted its first cohort of medical students. We distribute voluntary questionnaires to medical learners during their NOSM UG education or NOSM PG residency training.

We categorized learners who completed family medicine programs during 2011 to 2013 ( $n=131$ )—both NOSM UG and NOSM PG ( $n=51$ ); NOSM UG only ( $n=49$ ); and NOSM PG only ( $n=31$ )—to reflect different exposure to NOSM's admission criteria and medical education programs. We excluded FPs who completed training in 2014 ( $n=57$ ) because they would only be 2 to 3 months into full licensed practice or might be pursuing additional training at the time of analysis. We excluded international medical graduates (IMGs) ( $n=29$ ) because their UG training differed from that of Canadian medical graduates (CMGs), and because IMGs were significantly older by 5.6 years ( $t=4.77$ ,  $df=158$ ,  $P<.001$ ) and had a significantly lower proportion of women (24% vs 66%;  $\chi^2=17.51$ ,  $df=1$ ,  $P<.001$ ). In addition, a gap in survey coverage caused by delayed funding meant that key information on rural or northern background, practice intentions, and other variables was not available for IMGs. As well, all IMGs belonged to the NOSM PG-only group, and their data cannot be used to assess different levels of exposure to NOSM programs.

We used NOSM's social accountability mandate to identify 3 overlapping outcomes for primary practice location: rural northern Ontario, northern Ontario, and rural Ontario. We extracted primary practice location in September 2014 from publicly available data on provincial or territorial medical regulatory agencies' websites (eg, College of Physicians and Surgeons of Ontario). We matched practice location (outcome) and locations where the doctor had lived up to age 18 (independent variable) to census subdivisions categorized by

geographic region (eg, northern Ontario, rest of Ontario, other Canadian province or territory, other country). Northern Ontario was defined as the area of 3 (former) northern Ontario district health councils<sup>30</sup> that constitute NOSM's service region. Northern Canada was defined by the respective province or territory's Ministry of Health. We used Statistics Canada's Statistical Area Classification that categorizes census metropolitan areas or census agglomerations as urban and all other census subdivisions as rural.<sup>31</sup>

## Analyses

We defined 3 predictors a priori for the logistic regression models: years lived in rural Canada, years lived in northern Canada, and UG-PG medical school combination. We also analyzed intent to practise rurally, which can be predictive of rural practice,<sup>32,33</sup> and whether the physicians had contracts that bound them to practise initially in a specific area. Other potential predictors included age, marital or partnership status, and presence of children (all at PG entry) and sex, French-language ability, and cultural or linguistic background. These alternative predictors were analyzed with hierarchical log-linear models to identify a subset of predictors with the highest number of significant interactions with practice location. Selected alternative predictors replaced predictors that were non-significant ( $P > .05$ ) in previous logistic regression models. For the population of 131 learners, we excluded cases with missing data, restricted models to 3 predictors and 1 outcome, and used SPSS, version 20, for all analyses.

## RESULTS

We obtained demographic data, practice intentions, and service obligations for 60% (79 of 131) to 100% of practising FPs and primary practice location for 98% (129 of 131) (Tables 1 and 2).<sup>30,31</sup> A total of 16% (21 of 129) of FPs located their primary practices in rural northern Ontario, 45% (58 of 129) practised in urban northern Ontario, and 5% (7 of 129) practised in rural southern Ontario. Of the 29 IMG FPs, 4 (14%) had located in rural Ontario (2 each in the north and south), with most practising in urban areas in northern ( $n=15$ ) and southern ( $n=10$ ) Ontario (Table 2).<sup>30,31</sup>

Increasing number of rural background years was a statistically significant predictor of rural northern Ontario and rural Ontario practice location for CMG FPs, with odds ratios of 1.16 and 1.12, respectively (Table 3). The number of northern Canadian background years did not predict any location. The UG-PG school combination predicted practice location, with the NOSM UG and NOSM PG combination displaying the highest odds ratios: 8.62 for practice in rural northern Ontario, 48.62 for northern Ontario, and 4.06 for rural Ontario.

After controlling for rural background years and UG-PG school, practice contract status (ie, yes, no, unknown) was not a significant predictor of any outcome ( $P > .58$ ) nor was intention to practise in a rural community of 10000 people or less as reported at the end of NOSM UG education ( $P > .17$ ). Alternative predictors (ie, sex, married or partnered or not, presence of children, French-language ability) were not significant ( $P > .05$ ) based on forward selection or backward elimination logistic regression models.

A significantly higher percentage of FPs who went to NOSM for UG plus PG training practised in rural northern Ontario (26%,  $P = .03$ ) or northern Ontario (94%,  $P < .001$ ) compared with those with NOSM UG degrees only (6% and 20%, respectively). Those with NOSM PG training only exhibited an intermediate percentage (Table 4).

Of the 100 FPs who completed at least their UG training at NOSM and went to NOSM or went elsewhere for their PG training, 58% were in northern Ontario, 22% were in rural Ontario, and another 6% were in other rural Canadian communities (Table 4). Approximately 86% of the 80 FPs who went to NOSM for at least their PG training and went to NOSM or elsewhere for their UG medical education were practising in northern Ontario and 26% were in rural Ontario.

## DISCUSSION

### Practice location predictors

More rural Canadian background years predicted rural practice location in northern Ontario or Ontario, which agrees with the literature<sup>16-19</sup> and supports NOSM's UG admission policies. Years of northern background did not predict any practice location after controlling for rural background years and UG-PG school. This was unexpected as the literature suggests, albeit weakly, that growing up in underserved areas might predispose graduates to practise in underserved areas.<sup>18</sup> However, not all areas in northern Canada are underserved and this might dilute any effect. In addition, 59% of FPs had the maximum 18 years of northern background and there might be insufficient variability to differentiate among practice locations.

That NOSM PG education was a strong predictor of a northern Ontario practice location was consistent with a study of earlier family medicine programs in northern Ontario.<sup>13</sup> Further, NOSM UG plus PG medical education also predicted rural practice in northern Ontario or Ontario. Studies from the University of Manitoba<sup>34</sup> and Memorial University of Newfoundland<sup>35</sup> have shown that exposure to both UG and PG medical education at the same school was associated with a higher likelihood of practising in the province or in rural areas. For example, 94% of the 51 CMG FPs who completed both their UG and

**Table 1. Characteristics of practising FPs who finished their PG training in 2011 to 2013 and completed their UG or PG medical education or both at NOSM**

CHARACTERISTIC*	VALUE	N	DATA COVERAGE, %
Age at entry into PG program, y	<ul style="list-style-type: none"> <li>• Mean (SD) = 31 (5.51)</li> <li>• Median = 29</li> <li>• Range = 24–50</li> </ul>	131	100
Female, n (%)	87 (66.4)	131	100
Married or partnered at entry into PG program, n (%)	59 (56.2)	105	80
Had children at entry into PG program, n (%)	33 (34.4)	96	73
Rural Canadian background up to age 18 y	<ul style="list-style-type: none"> <li>• 25th percentile = 0</li> <li>• Median = 5</li> <li>• 75th percentile = 18</li> <li>• Bimodal distribution, n (%): 42 (42.9) had 0 y; 25 (25.5) had 18 y</li> </ul>	98	75
Northern Canada background up to age 18 y	<ul style="list-style-type: none"> <li>• 25th percentile = 11</li> <li>• Median = 18</li> <li>• 75th percentile = 18</li> <li>• Bimodal distribution, n (%): 18 (17.3) had 0 y; 61 (58.7) had 18 y</li> </ul>	104	79
Evidence of ability to communicate in French, n (%)	49 (37.4)	131	100
Indigenous background, n (%)	10 (9.2)	109	83
Intention to practise in a rural community as reported at end of UG training, n (%) <sup>†</sup>	51 (64.6)	79	60
Intention to practise in a northern Ontario community as reported at end of UG training, n (%) <sup>†</sup>	73 (92.4)	79	60
UG-PG medical school, n (%)	<ul style="list-style-type: none"> <li>• NOSM UG and PG: 51 (38.9)</li> <li>• NOSM UG only: 49 (37.4)</li> <li>• NOSM PG only: 31 (23.7)</li> </ul>	131	100
Service contract, n (%) <sup>§</sup>	<ul style="list-style-type: none"> <li>• Yes: 34 (35.8)</li> </ul>	95	73

NOSM—Northern Ontario School of Medicine, PG—postgraduate, UG—undergraduate.

\*Characteristics with less than 98% data coverage were obtained from surveys of NOSM UG or PG trainees.

<sup>†</sup>Strongly or moderately inclined to practise in at least 1 community of population size < 1000, 1000–5000, or 5000–10000.

<sup>†</sup>Strongly or moderately inclined to practise in northeast or northwest Ontario.

<sup>§</sup>The NOSM PG-only group has 22 of 31 missing values.

PG training at NOSM were practising in northern Ontario. By comparison, 76% of FPs and other specialists enrolled as medical students during 1998 to 2009 had located their first practice in Manitoba after UG and PG training at the University of Manitoba.<sup>34</sup> In 2014, 49% of Memorial University of Newfoundland's UG- and PG-trained FPs and other specialists who graduated as medical students during 1973 to 2008 were practising in Newfoundland, with 16% in rural Canada.<sup>35</sup> Approximately 29% of the FPs who completed both UG and PG training at NOSM were practising in rural Ontario.

Our study did not find any significant association between practice location and learners' sex, marital or partnered status, presence or absence of children, French-language ability, intention to practise rurally, or practice contract status. The literature provides varying

evidence: most Canadian studies found no evidence of an association with sex,<sup>13,34,35</sup> with one exception<sup>36</sup>; married or partnered FPs and other specialists were more likely to be practising in rural areas of Manitoba<sup>34</sup>; and systematic literature reviews suggest a positive association between intent to practise rurally and rural practice.<sup>16–18</sup>

### Limitations and strengths

There were systematic differences among UG-PG groups because NOSM UGs, but not necessarily NOSM PGs, were selected to have strong rural or northern backgrounds. Thus, there might be some redundancy when school and background were analyzed together. All groups experienced NOSM's educational programs, and NOSM's training effect might be underestimated. There likely is social desirability bias in self-reported practice

**Table 2. Primary practice location of practising FPs (N = 129 CMGs, N = 29 IMGs) who finished their PG training in 2011 to 2013 and completed their UG or PG medical education or both at NOSM**

PRACTICE LOCATION	NORTHERN ONTARIO*		SOUTHERN ONTARIO		OTHER NORTHERN CANADA		OTHER SOUTHERN CANADA		TOTAL	
	CMG, N (%)	IMG, N	CMG, N (%)	IMG, N	CMG, N (%)	IMG, N	CMG, N (%)	IMG, N	CMG, N (%)	IMG, N
Rural <sup>†</sup>	21 (16.3)	2	7 (5.4)	2	2 (1.6)	0	4 (3.1)	0	34 (26.4)	4
Urban	58 (45.0)	15	23 (17.8)	10	0 (0.0)	0	14 (10.9)	0	95 (73.6)	25
Total	79 (61.2)	17	30 (23.3)	12	2 (1.6)	0	18 (14.0)	0	129 (100.0)	29

CMG—Canadian medical graduate, IMG—international medical graduate, NOSM—Northern Ontario School of Medicine, PG—postgraduate, UG—undergraduate.

\*Northern Ontario was defined by 3 district health council boundaries in 2003<sup>30</sup> and northern Canada was defined in 2014 by the applicable provincial or territorial Ministry of Health.

<sup>†</sup>Rural location was defined in 2011 by Statistics Canada as any census subdivision that was not a census metropolitan area or census agglomeration.<sup>31</sup>

**Table 3. Predicting rural or northern Ontario practice location of practising FPs (97 of 131 CMGs) who finished their PG training in 2011 to 2013 and completed their UG or PG medical education or both at NOSM**

PREDICTOR	$\beta$	STANDARD ERROR ( $\beta$ )	WALD $\chi^2$	P VALUE	OR	95% CI FOR OR
Rural northern Ontario vs other location*						
• Rural background, y	0.15	0.04	11.31	<.01	1.16	1.06–1.27
• Northern Canada background, y	-0.03	0.05	0.30	.58	0.97	0.88–1.08
• NOSM UG only	NA	NA	7.83	.02	1.00	NA
• NOSM PG only	1.84	1.57	1.36	.24	6.27	0.29–136.74
• NOSM UG and PG	2.15	0.77	7.72	<.01	8.62	1.89–39.36
• Constant	-4.17	1.12	13.90	<.001	0.02	NA
Northern Ontario vs other location <sup>†</sup>						
• Rural background, y	-0.005	0.04	0.02	.89	1.00	0.92–1.07
• Northern Canada background, y	0.04	0.05	.064	.43	1.04	0.94–1.16
• NOSM UG only	NA	NA	30.80	<.001	1.00	NA
• NOSM PG only	2.41	1.21	3.98	.05	11.13	1.04–118.84
• NOSM UG and PG	3.88	0.71	30.15	<.001	48.62	12.15–194.48
• Constant	-1.81	0.99	3.38	.07	0.16	NA
Rural Ontario vs other location <sup>§</sup>						
• Rural background, y	0.12	0.04	10.06	<.01	1.12	1.05–1.21
• Northern Canada background, y	-0.01	0.05	0.04	.85	0.99	0.91–1.08
• NOSM UG only	NA	NA	5.20	.07	1.00	NA
• NOSM PG only	0.98	1.41	0.48	.49	2.67	0.17–42.35
• NOSM UG and PG	1.40	0.62	5.19	.02	4.06	1.22–13.59
• Constant	-3.13	0.94	11.15	<.01	0.04	NA

CMG—Canadian medical graduate, NA—not applicable, NOSM—Northern Ontario School of Medicine, OR—odds ratio, PG—postgraduate, UG—undergraduate.

\*Model  $\chi^2_4 = 19.4$ ,  $P < .01$ ; goodness-of-fit test  $\chi^2_6 = 1.3$ ,  $P = .97$ , Nagelkerke  $R^2 = 0.31$ . Correctly classified cases: 84.5% for constant only vs 85.6% for full model. Hosmer-Lemeshow goodness-of-fit test:  $P > .05$  indicated that the model was a good fit with Nagelkerke  $R^2$  interpreted as a pseudo  $R^2$ .

The assumption of linearity in the logit for rural or northern background years was not rejected for any model ( $P > .11$ ).

<sup>†</sup>Model  $\chi^2_4 = 54.3$ ,  $P < .01$ ; goodness-of-fit test  $\chi^2_7 = 6.4$ ,  $P = .50$ , Nagelkerke  $R^2 = 0.58$ . Correctly classified cases: 59.8% for constant only vs 84.5% for full model.

<sup>§</sup>Model  $\chi^2_4 = 14.4$ ,  $P < .01$ ; goodness-of-fit test  $\chi^2_7 = 6.6$ ,  $P = .47$ , Nagelkerke  $R^2 = 0.22$ . Correctly classified cases: 79.4% for constant only vs 81.4% for full model.



**Table 4. Primary practice location by UG–PG training location for practising FPs (N = 129 CMGs) who finished PG training in 2011 to 2013 and completed UG or PG medical education or both at NOSM: A) Rural northern practice location (Pearson  $\chi^2 = 6.90$ , P = .03); B) Northern practice location (Pearson  $\chi^2 = 59.17$ , P < .001); C) Rural practice location (Pearson  $\chi^2 = 3.39$ , P = .19).**

A)				
UG-PG SCHOOL	PRIMARY PRACTICE LOCATION			TOTAL, N (%)
	RURAL NORTHERN ONTARIO, N (%)*	ELSEWHERE, N (%)*	OTHER RURAL NORTHERN CANADA, N (%)†	
NOSM UG and PG	13 (25.5) ↑	38 (74.5) ↓	0 (0.0)	51 (100.0)
NOSM UG only	3 (6.1) ↓	46 (93.9) ↑	2 (4.1)	49 (100.0)
NOSM PG only	5 (17.2)	24 (82.8)	0 (0.0)	29 (100.0)
Total	21 (16.3)	108 (83.7)	2 (1.6)	129 (100.0)
B)				
UG-PG SCHOOL	PRIMARY PRACTICE LOCATION			TOTAL
	NORTHERN ONTARIO, N (%)*	ELSEWHERE, N (%)*	OTHER NORTHERN CANADA, N (%)†	
NOSM UG and PG	48 (94.1) ↑	3 (5.9) ↓	0 (0.0)	51 (100.0)
NOSM UG only	10 (20.4) ↓	39 (79.6) ↑	2 (4.1)	49 (100.0)
NOSM PG only	21 (72.4)	8 (27.6)	0 (0.0)	29 (100.0)
Total	79 (61.2)	50 (38.8)	2 (1.6)	129 (100.0)
C)				
UG-PG SCHOOL	PRIMARY PRACTICE LOCATION			TOTAL
	RURAL ONTARIO, N (%)	ELSEWHERE, N (%)	OTHER RURAL CANADA, N (%)†	
NOSM UG and PG	15 (29.4)	36 (70.6)	0 (0.0)	51 (100.0)
NOSM UG only	7 (14.3)	42 (85.7)	6 (12.2)	49 (100.0)
NOSM PG only	6 (20.7)	23 (79.3)	0 (0.0)	29 (100.0)
Total	28 (21.7)	101 (78.3)	6 (4.7)	129 (100.0)

CMG—Canadian medical graduate, NOSM—Northern Ontario School of Medicine, PG—postgraduate, UG—undergraduate.

\*Arrows indicate that the observed count was significantly higher (↑) or lower (↓) than the expected count based on adjusted standardized Pearson residuals.

†Included in the “elsewhere” category for the  $\chi^2$  tests.

intention, which might peak early in the UG program, and so we used intention just before UG completion. We excluded 29 IMG residents because we did not have key survey data and because their age, sex proportions, and medical education background differed significantly from CMGs. Subsequent studies might investigate why 86% of these IMGs practise in urban areas.

A strength of this study is that basic demographic data and practice location were available for 73% to 100% and 98% of the 131 CMG FPs, respectively. Future studies will assess if practice profile (eg, scope of practice, patient populations) and other practice characteristics (eg, interprofessional care teams) of NOSM-trained physicians will meet northern Ontarians’ needs.

## Conclusion

More than 60% of CMG FPs who completed UG or PG training or both at NOSM had located their medical practices in northern Ontario in 2014. Slightly more than a quarter of these FPs practising in northern Ontario are in

rural communities. The distribution in northern Ontario of FPs who trained at NOSM for UG or PG degrees or both does not yet match the 39% of the population who live in rural areas and so further research is needed into the roles of nature (eg, rural background) and nurture (eg, medical education, incentives) in influencing practice location. However, it is promising that FPs were more likely to practise in rural northern Ontario if they had greater exposure to NOSM’s educational programs. Our study shows that NOSM has increased the number of CMG FPs who practise in rural and northern Ontario and is on the road to reaching one of its main social accountability milestones.

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**Contributors**

**Mr Hogenbirk** contributed to the design of the study and tools; study administration; collection, analysis, and interpretation of data; and writing the paper. **Mr Timony** contributed to the design of the study and tools, administration of the study, data collection and interpretation, and editorial review. **Ms French** contributed to the design of the study and tools, administration of the study, data collection, and editorial review. **Dr Strasser** provided project leadership and contributed to the study design and tools, data collection and interpretation, and editorial review. **Dr Cervin** provided advice on the study design and tools, and contributed to data collection and interpretation and to editorial review. **Dr Graves** provided advice on the study design and tools, and contributed to data collection and interpretation and to editorial review. **Dr Pong** provided project leadership and contributed to the design of the study and tools, and contributed to data collection and interpretation and to editorial review.

**Competing interests**

None declared

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