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The economic contribution of the Northern Ontario School of Medicine to communities participating in distributed medical education

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Introduction: The economic contribution of medical schools to major urban centres can be substantial, but there is little information on the contribution to the economy of participating communities made by schools that provide education and training away from major cities and academic health science centres. We sought to assess the economic contribution of the Northern Ontario School of Medicine (NOSM) to northern Ontario communities participating in NOSM's distributed medical education programs.
Methods: We developed a local economic model and used actual expenditures from 2007/08 to assess the economic contribution of NOSM to communities in northern Ontario. We also estimated the economic contribution of medical students or residents participating in different programs in communities away from the university campuses. To explore broader economic effects, we conducted semistructured interviews with leaders in education, health care and politics in northern Ontario.
Results: The total economic contribution to northern Ontario was $67.1 million based on $36.3 million in spending by NOSM and $1.0 million spent by students. Economic contributions were greatest in the university campus cities of Thunder Bay ($26.7 million) and Sudbury ($30.4 million), and $0.8–$1.2 million accrued to the next 3 largest population centres. Communities might realize an economic contribution of $7300–$103 900 per pair of medical learners per placement. Several of the 59 interviewees remarked that the dollar amount could be small to moderate but had broader economic implications.
Conclusion: Distributed medical education at the NOSM resulted in a substantial economic contribution to participating communities.

Introduction : Les écoles de médecine peuvent apporter des avantages économiques importants aux grands centres urbains. On n'en sait guère toutefois sur l'apport économique, pour les communautés participantes, des écoles qui offrent des cours et de la formation hors des grandes villes et loin des centres universitaires des sciences de la santé. Nous avons voulu évaluer la contribution économique de l'École de médecine du Nord de l'Ontario (EMNO) aux communautés qui participent à ses programmes d'apprentissage distribué.
Méthodes : Nous avons créé un modèle économique local et utilisé les dépenses réelles de 2007/08 pour évaluer l'apport économique de l'EMNO aux communautés du Nord de l'Ontario. Nous avons aussi estimé l'apport économique des étudiants en médecine ou des médecins résidents qui participent aux divers programmes offerts dans les communautés éloignées des campus de l'université. Enfin, pour explorer les répercussions économiques plus vastes, nous avons effectué des entrevues semi-structurées auprès de chefs de file des milieux de l'éducation, des soins de santé et de la politique dans le Nord de l'Ontario.
Résultats : L'apport économique total de l'EMNO s'est chiffré à 67,1 millions de dollars (dépenses de l'École, 36,3 millions; dépenses des étudiants, 1,0 million). L'apport économique a été le plus important pour les villes qui hébergent un campus de l'université, soit Thunder Bay (26,7 millions) et Sudbury (30,4 millions), les 3 centres

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suivants en importance bénéficiant d'un apport de 0,8 à 1,2 million de dollars. Les communautés peuvent réaliser des bénéfices économiques de 7 300 $ à 103 900 $ par paire d'apprenants en médecine par placement. Plusieurs des 59 personnes interviewées ont souligné que le montant des contributions, en argent, peut être assez petit ou moyen, mais que les répercussions économiques se font sentir à plus grande échelle.

Conclusion : L'éducation médicale distribuée à l'EMNO a apporté une contribution économique substantielle aux communautés participantes.

INTRODUCTION

The economic contribution of medical schools can be considerable. However, little information exists on the contribution to host cities; most assessments estimate contribution at the state or provincial level. For example, the Faculty of Medicine and Dentistry at the University of Alberta contributed an estimated $1.2 billion to the province of Alberta in 2011/12.[1] In 2013, the economic contribution to Canada of Canadian medical schools and affiliated teaching hospitals was estimated at $66.1 billion.[2]

Studies on Canadian universities (with or without medical schools) have estimated the economic contribution to the university campus cities,[3] and the contribution to satellite campuses is anticipated, though not yet demonstrated.[4] Schools that provide distributed medical education programs (i.e., education and training away from urban areas and academic health science centres) can expect to make an economic contribution in multiple communities.[5,6] For example, Montana's component of the Washington, Wyoming, Alaska, Montana and Idaho (WWAMI) medical education program contributed an estimated US$18 million to the state in 2010, of which US$2.9 million went to state-wide clinical teaching sites.[7]

The Northern Ontario School of Medicine (NOSM), which started training medical students in 2005, was established with a social accountability mandate to help improve the health of the people of northern Ontario.[8] With a population of 803 866 distributed over 802 725 km^2, northern Ontario has 6% of Ontario's population and 90% of its land base.[9] Northern Ontario, relative to the province, has a higher proportion of Aboriginal (14% v. 2%) and francophone (24% v. 5%) people.[10,11] Northern Ontario's economy is largely resource-based, and the population has lower socioeconomic characteristics and worse health status than the rest of the province.[12] Many parts of northern Ontario have chronic shortages of doctors and other health professionals.[13]

The Northern Ontario School of Medicine has campuses at Lakehead University in Thunder Bay (population 120 000) and Laurentian University in Sudbury (population 160 000), which are 1000 km apart by road. Developed through a community consultative process, the NOSM medical degree curriculum is grounded in the health context of northern Ontario, organized around 5 themes (northern and rural health, personal and professional aspects of medical practice, social and population health, foundations of medicine, and clinical skills)[8] and uses electronic communications and community partnerships to support NOSM's model of distributed, community-engaged learning. There is an emphasis on interprofessional education and integrated clinical learning that takes place in more than 70 communities and many different health service settings,[14] so that students personally experience a diversity of communities and cultures.[8] In the third year, all students undertake a longitudinal integrated clerkship based in family practice. Third-year students achieve learning objectives that cover the same 6 core clinical disciplines as in the traditional clerkship blocks (surgery, internal medicine, children's health, women's health, mental health and family medicine [plus emergency medicine]) while living in one of a dozen or so large rural or small urban communities in northern Ontario, away from the university campuses.

Learners, educators and support personnel stay in northern Ontario communities from 4 to 30 weeks per year, and their spending, as well as NOSM spending, contributes to the local economy. Communities host NOSM workshops, conferences and committee meetings, which inject dollars into the local economy and may have additional benefits.

Previous work examined the overall socioeconomic contribution of NOSM to northern Ontario.[15] This paper takes a detailed look at NOSM's economic contribution in northern Ontario communities according to the number and type of educational programs as well as population size.

METHODS

Contribution based on actual spending

We developed a local economic model founded on economic base theory[16–19] to estimate the economic contribution of NOSM to northern Ontario communities. We estimated economic contribution, as defined by Watson and colleagues[17] as total dollars attributed to all current economic activity associated with NOSM. An estimate of total economic activity was appropriate because NOSM created new programs, such as the undergraduate medical education program, and redeveloped existing programs, such as postgraduate medical education programs formerly administered by the Northeastern Ontario Medical Education Corporation and the Northwestern Ontario Medical Program.

Salaries and benefits, spending on travel, supplies and services, stipends paid to preceptors, spending by learners and research expenditures were included. We excluded costs of construction and renovations so that we could estimate the ongoing impact rather than the one-time start-up impact. Visitor spending was excluded because we reasoned that NOSM would attract only a few visitors to northern Ontario. Other travel spending was already included. Spending by host universities of Lakehead and Laurentian were excluded because these monies do not flow through the medical school.

Spending location was based on the mailing address of the employee or vendor. To estimate spending within communities, we acquired NOSM expenditure data for fiscal year 2007/08 and program participation data for fiscal year 2007/08 to fiscal year 2009/10 for 128 geographic place names in northern Ontario. These place names were matched to 100 census subdivisions, which are equivalent to municipalities,[20,21] and for which we obtained 2006 population estimates. Economic contributions were calculated for all census subdivisions, but we focused on those that had expenditure and program data.

We estimated direct economic effects[19] from labour expenditures. Indirect economic effects were estimated as the spending and re-spending in the area by NOSM's suppliers. Monies that left the area (i.e., leakage) were not available to be re-spent and so spending in each round diminished, with the cumulative amount estimated by the economic multiplier. Induced economic effects were estimated as spending by people employed by NOSM or NOSM's suppliers and subsequent re-spending in the area, with corrections for leakage.

The total economic contribution comprised direct, indirect and induced contributions,[19] and was estimated with multipliers calculated from a population-sensitive equation developed for all communities in Ontario and used previously to estimate the economic contribution of health care facilities in Sudbury.[22] Multipliers were similar to those used in other studies of economic contribution in Ontario[22–24] and were built on a minimum requirements approach.[18,19]

Contribution based on estimated spending

We developed program-specific estimates for expenses, such as housing, food and incidentals, preceptor stipends/honoraria and administrative support, to estimate the economic contribution of medical learners as they spend time in northern Ontario communities, away from the university campuses. We calculated the impact for each of the 4 undergraduate years and a typical postgraduate placement, thereby allowing a community to estimate an economic contribution based on program(s) (e.g., undergraduate year 1, postgraduate year 1) in a given year.

The Northern Ontario School of Medicine places pairs of learners in each community, and the models reflect this arrangement. We estimated the percentage of local spending to adjust for leakage. For example, rent may be paid to landlords who reside in other communities. We assumed a minimum of 40% local spending in the smaller communities and typically 80% in the larger communities. The school's spending and portion of total spending varied by program type and location.

To explore the broader economic effects, we conducted semistructured interviews with leaders in education, health care and politics from northern Ontario communities. Potential interviewees were selected as those who would be aware of the impact that NOSM has on northern Ontario, ensuring that a range of occupations and roles were represented and that a number of communities were chosen to maximize diversity of opinion. Interviews, conducted in 2008/09, were transcribed with the permission of interviewees. Transcripts were searched for comments on the positive or negative economic effect of NOSM. Social impacts were described in a previous report.[15]

The Research Ethics Boards of Lakehead and Laurentian Universities gave ethical approval for this study.

RESULTS

Economic contribution

We estimated the economic contribution to 62 communities in northern Ontario and conducted semi-structured interviews with 59 leaders in education, health care and politics from 20 communities in northern Ontario. In 2007/08, NOSM had expenditures of $38.2 million, of which $36.3 million (95%) was spent in northern Ontario.[15] We estimated that medical students at NOSM spent an additional $1.0 million in northern Ontario. The total economic contribution of NOSM in 2007/08 to northern Ontario was estimated at $67.1 million. Economic contribution was greatest in Sudbury ($30.4 million) and Thunder Bay ($26.7 million), where the university campuses are located (Table 1). An annual estimated economic contribution of $10.0 million was spread throughout the rest of northern Ontario, of which $0.8–$1.2 million accrued to the 3 next largest population centres.

In general, the number of educational programs, NOSM expenditure and contribution all increased with increasing size of the community population (Fig. 1). One community with a population of just over 5000 had total spending in excess of $200 000, placing it above the general trend. This community serves as a major health care referral centre for many smaller communities, and this greater activity was reflected in higher spending.

Using built-up estimates of spending by NOSM and learners, we estimated an economic contribution ranging from $7300 to $103 900 per pair of learners per placement (Table 2). The 30-week Comprehensive Community Clerkship resulted in the largest economic contribution per placement. Multiple placements are possible for other program years and the total annual economic contribution in a community would be higher.

Broader economic effects

Several interviewees remarked that the economic contribution in small communities and midsized cities could be small to moderate in terms of actual dollars, but had broader economic implications. Most interviewees expressed tempered optimism that training medical learners in these northern communities would improve recruitment and retention of physicians and other health care providers. Some early anecdotal evidence from the media and comments from colleagues suggests that a few of the clinical teachers had come to the community specifically to teach and a few learners who had trained in the community had returned there to practise.

Several interviewees noted that adding a physician or other professional to a community brought new

Table 1. Total spending, economic contribution and participation in selected programs at the Northern Ontario School of Medicine in fiscal year 2007/08 in the 5 largest cities in northern Ontario

Variable	Timmins	North Bay	Sault Ste. Marie	Thunder Bay	Sudbury
2006 census population	42 997	63 424	80 098	122 907	158 258
Total spending, $*	541 000	608 000	724 000	15 528 000	16 981 000
Multiplier†	1.45	1.54	1.60	1.72	1.79
Economic contribution, $*	784 000	935 000	1 157 000	26 710 000	30 395 000
Comprehensive Community Clerkship	Yes	Yes	Yes	—	—
Specialty training from the CFPC‡	Yes	Yes	Yes	Yes	Yes
Specialty training from the RCPSC	Yes	Yes	Yes	Yes	Yes
Rehabilitation Studies program‡	Yes	Yes	Yes	Yes	Yes
Northern Ontario Dietetic Internship Program‡	Yes	—	Yes	Yes	Yes

CFPC = College of Family Physicians of Canada; RCPSC = Royal College of Physicians and Surgeons of Canada.
*All dollar values were rounded to the nearest thousand.
†Multipliers derived from population size using the formula by McCracken et al.[22]
‡Sites where these programs were offered in 2009/10, which may differ from 2007/08.

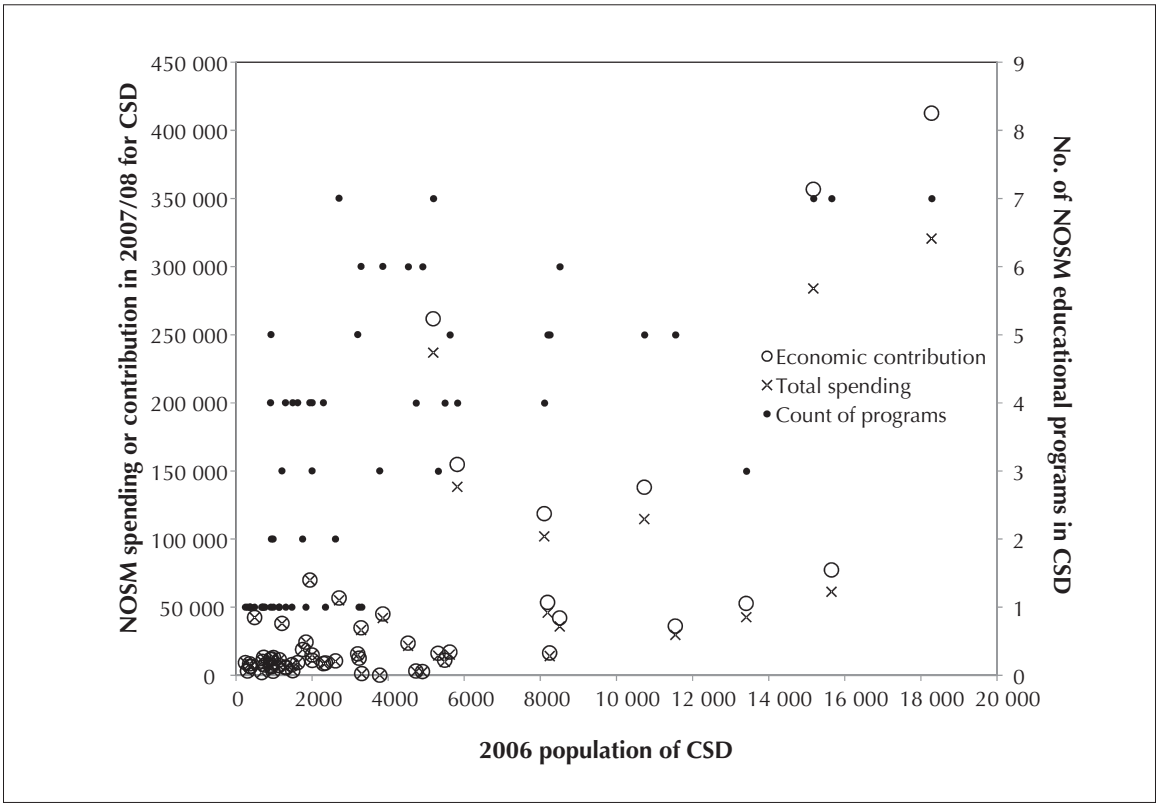


Fig. 1. Total spending, estimated economic contribution and number of educational programs of the Northern Ontario School of Medicine (NOSM) in fiscal year 2007/08 for 57 census subdivisions (CSDs) in northern Ontario. (Five CSDs with a population > 40 000 and spending > $400 000 were excluded to improve resolution at lower population size.)

Table 2. Estimated economic contribution to northern Ontario communities of 2 undergraduate medical students in years 1–4 and 2 postgraduate residents*†

Variable	UGY1 students	UGY2 students	UGY3 students	UGY4 students	Postgraduate residents
Course description	Two first-year undergraduate students spend 4 wk in an Aboriginal community in northern Ontario	Two second-year students complete two 4-wk placements in small rural/remote northern Ontario communities	Two third-year students spend 30 wk completing the CCC in a host community in northern Ontario§	Two fourth-year students spend a 4-wk elective in a larger community¶	Clinical learning placements for 2 residents occur in northern Ontario communities for an average of 8 wk¶
Learner spending, $	400	6 200	7 200	3 100	6 200
NOSM spending, $	10 400	6 100	68 200	2 200	4 400
Total local spending, $	10 800	12 300	75 400	5 300	10 600
Community population size	2 500 (assumed)	2 500 (assumed)	30 300 (average of 10 CCC sites: range 5 200–80 100)	30 300 (assumed equal to CCC sites)	30 300 (assumed equal to CCC sites)
Estimated economic contribution, $‡	11 000	12 500	103 900	7 300	14 600

CCC = Comprehensive Community Clerkship; NOSM = Northern Ontario School of Medicine; UGY = undergraduate year.
*Excludes economic contribution to Sudbury and Thunder Bay.
†All dollar values were rounded to the nearest hundred.
‡Based on multipliers derived from population size using the formula by McCracken et al.[22]
§In 2007/08, there were 10 CCC sites.
¶Multiple placements were possible.

short-term (e.g., construction and renovations) and long-term (e.g., office supplies, groceries, housing, staff wages) spending. A senior business leader stated that

> when you come here from Toronto, Mississauga, Hamilton [or] wherever … you give up a home in a certain price range, and … housing costs [here] are the lowest in the world, so … now you have a wonderful home but you have money left over, [so] you are spending it on granite top counters [and] upscale bathroom fixtures.

In other words, professionals have higher disposable incomes that offer opportunities for local businesses.

Interviewees identified other economic benefits. For instance, a senior administrator at a community hospital remarked that the ability "to get more physicians to town … allows businesses to find [our town] attractive, because they need to have their employees cared for." An Aboriginal leader noted that "there seems to be more attention paid to the health needs of people in the north because of the med school. And as a result of that, we're starting to see more resources being filtered to specific areas … like diabetes." The arrival of the medical school was considered by many as a way to stimulate, reinvigorate or reinforce other educational and research initiatives.

New learners, teachers or practitioners, as well as new dollars, in combination with existing and developing infrastructure and skills, were believed by several interviewees to provide stimulus for other business opportunities and innovation. For instance, a senior hospital administrator said that getting a medical school "will help us in terms of bringing industry and other things into the north, and attracting different kinds of things that maybe we might not have been able to [get] before."

Diversifying the economy by recruiting more professionals to work in medicine, health or academia was considered beneficial by many respondents. Recruiting spouses, who may be professionals in other fields such as law or engineering, was considered a bonus. The caveat is that spouses needed to be gainfully employed in their fields, which can be a challenge for any community in northern Ontario. Many interviewees thought that every new professional recruited to their communities made it easier to recruit and retain other professionals.

Several interviewees noted that new provincial government funding covered most of the costs associated with NOSM activities. As well, a few interviewees remarked that NOSM activities by themselves were no guarantee of future benefits. The combined message suggests that additional funding and other forms of support, including time and resources invested by the community, were required to fully realize the benefits.

DISCUSSION

The economic contribution of NOSM to northern Ontario was estimated to be $67.1 million in 2007/08 with 85% going to Sudbury and Thunder Bay. The total annual economic contribution in other communities in northern Ontario was $10.0 million. This compares favourably to the US$7.2 million from Montana's part of the WWAMI medical education program that accrues to statewide clinical teaching sites and other communities away from the main campus in Bozeman.[7]

Total spending and NOSM's portion thereof depended on the program type and location. At the community level, the economic contribution of NOSM's educational programs generally increased with increased population size. Although larger communities may have the capacity to participate in more activities than smaller communities, small communities still benefited. For instance, Aboriginal, remote or rural communities, typically with 5000 or fewer people, may realize a minimum economic contribution of $11 000–$12 500 per year by helping to train pairs of first- or second-year undergraduates. Some communities were involved in more activities than their population size alone would predict. This higher level of participation may be because a community is located close to other communities, serves as a local health care referral centre or invests more resources in NOSM activities.

Research in Australia demonstrated a net cost to preceptors' practice for undergraduate medical students, but a net benefit for more advanced medical learners.[25] In a related study, Laurence and colleagues[26] found that rural practices experienced a net financial loss if they taught general practice registrars (doctors), whereas urban practices realized a net gain. Hudson and colleagues[27] found that there was a positive financial benefit to a preceptor's practice after about 2 months into a 12-month integrated community-based clerkship in the third undergraduate year. Lesko and colleagues[28] found that the family medicine residency training program offered by the University of Washington had a net positive financial benefit on preceptors' practices, though some practices showed a net cost. Comparable data were lacking for Canada, and it is not clear if the findings would apply to northern Ontario given differences in the funding of medical care and medical education.

In the opinion of many interviewees, the total economic effect may be much greater than the dollar value insofar as new economic opportunities were identified as an actual or incidental consequence of a community's participation in NOSM's activities. Toomey and colleagues[29] report similar perceptions from community leaders in a study on the potential impact of a distributed medical school on Prince George, BC, and the surrounding area. Evidence from the literature suggests that there are positive outcomes for students, clinicians and communities, particularly in the case of longer placements.[30,31] But, as many interviewees noted, participation in NOSM activities may require additional resources and a commitment by the community to ensure that the activities and other initiatives are fully supported.

Limitations

One limitation of our study was that the data were from fiscal year 2007/08, when NOSM was in its third year after start-up. As such, reported expenditures may not reflect a fully operational medical school. In addition, NOSM was in the process of assuming responsibility for existing postgraduate medical education programs while other programs (e.g., the Northern Ontario Dietetic Internship Program) were in development. As well, model estimates do not include the cost of construction or renovation. Therefore, the reported economic contributions based on spending are likely to be underestimates. However, our built-up estimates for all undergraduate years and a typical postgraduate placement may be more indicative of the economic contribution of a fully operational school. Plans are underway to update the economic assessment, identify actual socioeconomic benefits and costs in communities and in medical practice groups in northern Ontario.

CONCLUSION

Our results show that the impact of distributed medical education extends beyond the production of doctors and other health professionals. When considering the cost of medical education, it may be instructive to examine the broader socioeconomic impact in addition to the level of government expenditure per learner. In the case of northern Ontario, the provincial government's contribution to NOSM translated into a substantial economic contribution and largely positive socioeconomic benefit to participating communities and for the region as a whole.

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