



**THE CONTRIBUTION OF MEDICAL EDUCATION TO
HEALTH HUMAN RESOURCES IN CANADA**

by

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Imagine this scenario:

The provincial funder of medical services is embroiled in a bitter dispute with a community of regionally isolated northern physicians over physician supply and remuneration issues. The government eventually agrees to provide \$10 million targeted solely to physicians in the community, including funding for recruitment and retention. Far from being solved, the crisis comes to a head in the summer of 2000 at a health rally held in the northern regional centre: 7,000 citizens rally to identify a need for a long-term “made in the north” solution to the northern problem of physician supply.

Within a year, a memorandum of agreement is signed between the only medical school in the province and the only university in the north, to develop a program of undergraduate medical education in the north with a mission to contribute to the long-term solution of access to medical services. Two years later admission processes are approved by the southern university senate. Dedicated buildings are built on the two campuses, connected by advanced technology to distribute expertise between the south and the north campuses. A scant three years later, in 2004, the program admits its first students, who will contribute to physician supply in 2010, at the earliest. The stabilizing effects of the distributed program are felt and acknowledged by the health care system and northern community well in advance of the first graduating students entering practice.

1. Introduction

There is growing concern in Canada that there will not be an adequate supply of physicians for the future. This concern is a result of many contributing factors including growth in the overall Canadian population, an aging patient and physician population, and worldwide competition of physician resources, as well as escalating public demand and the increasing complexity of medical care. Universities are playing an important role in addressing these issues through planned expansion of medical undergraduate and postgraduate training, as well as changes in curriculum.

Canadian faculties of medicine have a significant impact on the health human resources of Canada. Specifically, with the projected increases in enrolment in medical schools across Canada, the activities of faculties of medicine will hold an increasing role for health human resource development in Canada. There are 17 faculties of medicine across Canada, expanding from 16 in the year 2004 with the opening of the Northern Ontario School of Medicine. In 2003-2004, the 16 faculties of medicine registered 2,131 students into their MD programs, having graduated 1,663 new physicians in 2003.¹ As stated by the Association of the Faculties of Medicine of Canada (AFMC):

Canadian Medical Schools are in a unique position and are prepared to play a major role in seeking to contribute to the sustainability of the health care system into the future. The relevance of the activities of Medical Schools implies that they, together with governments, the medical profession and other major stakeholders in the health care system, have a systematic approach to addressing

*priority health needs, including issues of access to services, determining and educating the appropriate number and mix of physicians, and facilitating the geographic distribution necessary to meet the needs of the community.*²

This paper describes the primary challenges facing Canadian medical schools, governments, and other stakeholders. It addresses questions such as: What are the physician resource issues in Canada and how are faculties of medicine responding? What physician resource issues can be addressed in part by expansion of and innovations in medical education? What are the challenges faced by stakeholders in implementing these new initiatives? We begin with a description of Health Human Resource (HHR) issues we are facing in Canada, a description of the context in which medical schools operate and the challenges for all stakeholders that this context creates in addressing HHR issues through medical education. This is followed by a broad description of medical school initiatives designed to respond to these issues. We conclude with a discussion of future challenges, opportunities and policy implications.

2. Current Physician HHR Issues in Canada

Canada is a loose confederation with 10 provinces and 3 territories. Some government operations fall under federal jurisdiction, such as immigration, and others such as health and education fall under provincial jurisdiction, thus limiting the opportunity for federal government initiatives and a national integrated approach to physician manpower and health professional education.

Many of the physician HHR issues in Canada are related to its geography. Canada covers 10 million square kilometres, making it the second largest country in the world. The population of Canada is approximately 33 million people. As shown in Figure 1, the major population centres in Canada are strung primarily along the 49th parallel, the southern border with the US. The vast majority of Canadians live within 90 miles of the US border. Depending on which definition is used, estimates of Canada's rural population range between 22% (less than 1,000 people per 400 square km) to 33% (less than 150 people per square kilometre).³ In 2001, 4.4% of Canadians reported having at least some Aboriginal ancestry.⁴

Northern Canada is characterized by vast distances, scattered communities, a resource-based economy, inadequate transportation systems, and a relatively high proportion of Aboriginal peoples living within or close to their traditional territories. It has notably inferior access to health services and significantly poorer health outcomes than urbanized parts of the province.

In 1991, a report to the Federal, Provincial and Territorial Deputy Ministers of Health identified a physician surplus, and proposed multiple solutions for addressing this surplus.⁵ Two recommendations were accepted: a 10% cut in medical school enrolment and reductions in International Medical Graduate (IMG) intake. These measures effectively reduced the number of new entrants to the medical workforce. According to a Canadian Institute of Health Information (CIHI) analysis, 5093 fewer physicians entered practice in Canada after 1993 than what would have been expected if the inflow rates remained at the pre-1993 levels. This decline was due to increased length of training, fewer foreign physicians, and increased retirements.⁶

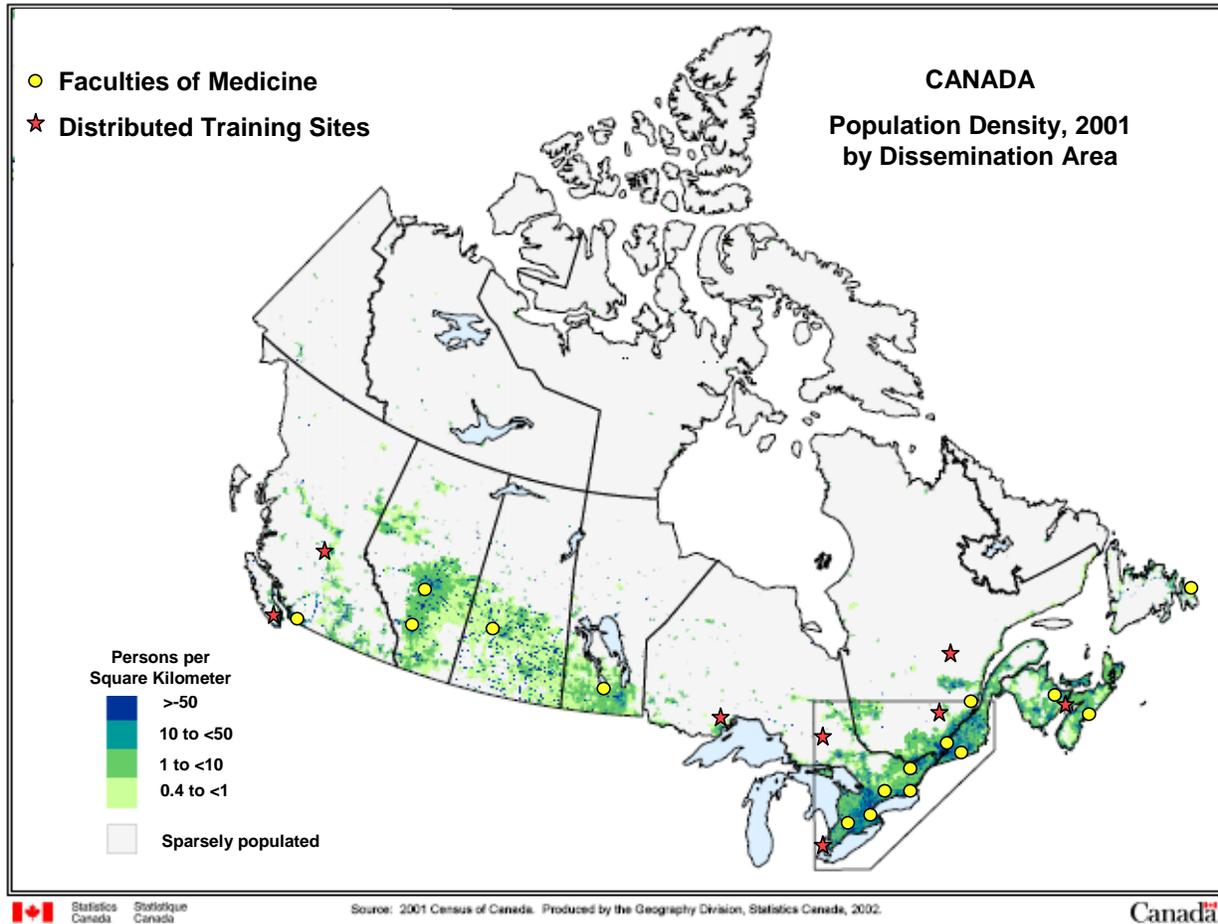


Figure 1: Population Density Map

At roughly the same time, changes were occurring in postgraduate medical education with a re-distribution of residency training programs to specialist programs and the introduction of a two-year pre-licensure training, with little opportunity for trainees to move between generalist and specialist programs. The rotating internship, which had allowed physicians to enter practice as a general practitioner after just one year of postgraduate training, was eliminated. Fewer young physicians took breaks from training while finalizing career plans. This not only immediately decreased the pool of available locum physicians, but also reduced the number of new physicians who would “try” and ultimately stay in primary care, some in rural practice. In comparing the 1989 and 1994 MD cohorts, Thurber and Buske documented a decrease in family/general medicine career choices from 58% in 1989 to 43% in 1994.⁷ This was somewhat offset by the decline in the number of physicians returning to postgraduate education after being in active practice.

An increase in the ratio of specialist to family physician trainees also led to a substantive increase in the number of physicians spending more years in training. Comparing 1993 and 1999 physician cohorts, Thurber found that the average post-MD family/general medicine training went from 1.8 to 2.3 years and from 4.5 to 5.3 years for specialty training, thus increasing the length of time from medical school admission to entry into the workforce.⁸

Most of the increase in the training time for family medicine occurred between 1993 and 1994, (1.8 to 2.1 years) when two-year licensing requirements were instituted. The further increased length of training is due to residents choosing to complete additional family medicine training. At least 40% of family medicine residents now intend to complete a third year of training, which is not required for licensure or certification.⁹ These third year programs are intended to produce enhanced skills in areas such as emergency medicine and care of the elderly. Family physicians that complete this special training tend to narrow their practice scope accordingly; however, these “specialist” family physicians may be addressing physician shortages in the field in which they receive special training and not family practice. There is no program in Canada to enhance the generalist skills of family physicians, for example to prepare a family practice resident for rural practice. Canada has the shortest postgraduate training requirements for family physicians (two years) in comparison with the UK, US, and Australia (three years).

The increase in the average number of years for specialty training results from medical students selecting residencies with longer training times (i.e., not increase in required years of specific programs).⁸ The choices of trainees to complete subspecialty training has led to a decrease in the number of trainees entering generalist specialties from 35% of all Royal College certified individuals in 1995 to 25% in 2004.¹⁰ Over the same time period, a higher proportion of women entered the generalist specialties, further reducing the work capacity of the workforce. Canada is, therefore, facing a significant shortage of generalists, both family physicians and generalist specialists. Overall, one quarter of the decline in total number of new physicians may be attributed to the increased length of postgraduate training completed from 1993 onwards.

These initiatives along with population growth and a change in the physician practice patterns have resulted in emerging physician shortages. While recent health care commissions may debate the extent of the issue, there is general agreement among Canadians that the country is facing an absolute shortage of physicians, and concerns are expressed about the capacity of the educational system to increase rapidly the number of graduating physicians given the length of medical training. There are particular shortages in key areas: in rural, northern and remote areas of Canada; in physicians to support Aboriginal health; in family medicine and general practice; and in specific specialties. It is important that strategies to address the absolute shortages also address the geographic maldistribution of physicians as well as meet the needs of specific populations.

As noted earlier, 4.4% of people in Canada report having Aboriginal ancestry. Aboriginal peoples have the fastest growing birth rates. With poor health status in Aboriginal populations, there have been calls from the Canadian Medical Association (CMA) to increase the number of Aboriginal physicians. Medical schools are being called upon to address this shortage of Aboriginal health care providers. In 1997-1998 there were only a reported 67 Aboriginal physicians practicing in Canada.¹¹ Recently it has been estimated that there are 150 Aboriginal physicians practicing in Canada¹² and efforts aiming to increase the number of Aboriginal students entering and graduating from medical education programs across Canada continue.

Traditionally, Canada has had strong postgraduate educational programs in family medicine, and 40-50% of graduates have traditionally selected a career in family medicine. However, the current trend in Canada, as elsewhere, is a reduction of students choosing family medicine and

other generalist specialties such as general paediatrics, general internal medicine and general surgery. As shown in Figure 2, the number of graduating medical students choosing family medicine has declined from 44% in 1992¹³ to 25% in 2004.¹⁴ The role of medical schools in addressing this disturbing trend is under discussion, and was the subject of a plenary debate at the 2005 National Association of Faculties of Medicine (AFMC) conference.

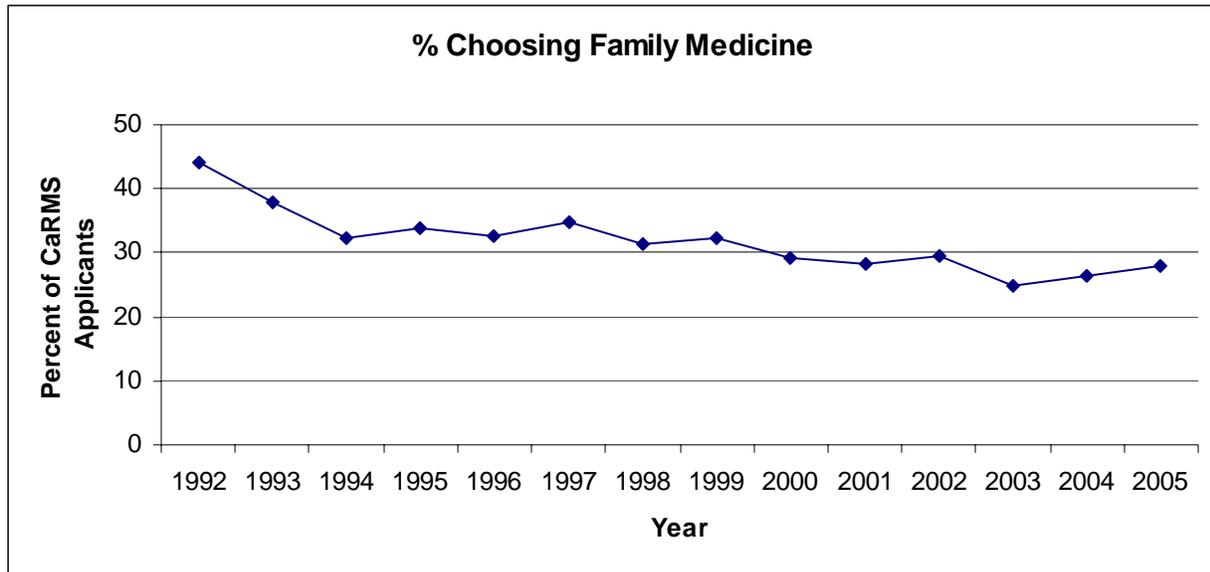


Figure 2: Percent of Canadian Resident Matching Service (CaRMS) first iteration applicants choosing Family Medicine^{13,14}

Finally, the problem of physician shortages cannot be reduced to isolated regions or provinces given the mobility of physicians across Canada. The agreement on national licensing standards also led to portability of licensure across Canada, facilitating the flow of licensed physicians to desirable practice locations. Altogether, 19% of the physicians moved between provinces or outside the country in the eight-year period between 1991 and 1999. Over the ten year time period studied, all provinces both gained physicians from other provinces and had their trainees and graduates move away.¹⁵ Over a ten year time period, there was a gradual move of 9.5% of the physicians to locations outside Canada (mainly the United States).

While medical schools are considering their role in addressing the above challenges, there are also calls for medical schools to influence changes in health care delivery through curriculum and other educational interventions; for example, the call for inter-professional education to influence future inter-professional practice. This is supported by the World Health Organization-framework for social accountability in medical schools, which makes explicit the requirement for curriculum and other activities to be socially accountable. While this vision has been adopted by the Association of Faculties of Medicine, it remains to be fully articulated.

3. Medical Education in Canada: Context and Challenges

There are 17 faculties of medicine in seven provinces, with two provinces (Prince Edward Island and New Brunswick) and three northern territories without medical schools, and five provinces which have only one medical school. Figure 1 shows the location of medical schools in Canada. Canadian medical schools are jointly accredited by the Liaison Committee on Medical Education (LCME) (US) and the Committee on Accreditation of Canadian Medical Schools (CACMS).

Medical education in Canada is graduate entry, and the mean age of a first year medical student is 24.1 years.¹⁶ Most programs require four years of undergraduate education for the MD degree, with the exception of two universities that have three-year programs (McMaster University and the University of Calgary). Traditional curricula include two years of basic science, followed by two years of clinical education. This traditional curriculum has undergone revision over the last decade, with a move to adult learning principles, problem based learning, and integration of clinical and basic sciences across the four years. However, during their first two years, students continue to spend most of their time focusing on basic science education on university campuses, while in their third and fourth years there is a shift to learning clinical reasoning in core disciplines, in health care delivery settings.

During undergraduate preparation, medical students determine their future career early in their fourth year and apply to residency placement across Canada through a matching process. Postgraduate education (residency training) in Family Medicine is two years, and accredited by the College of Family Physicians of Canada (CFPC), while postgraduate specialty training can be anywhere from four to seven years in duration. There are 60 registered specialties with the Royal College of Physicians and Surgeons, which accredits each program. Postgraduate programs are managed through an office of postgraduate education at each medical school, although the individual specialty directors in each specific program have significant authority. Accreditation requirements include both general and program specific standards and address program structure and availability of resources. Physician training occurs in facilities operated by affiliated health authorities (service delivery organizations) and in private offices and is supervised by clinicians who are credentialed to work clinically in the health authorities and who hold an academic appointment with a faculty of medicine.

The total number of postgraduate trainees is linked nationally to the number of undergraduate students in that all faculties are required to provide enough postgraduate entry positions for their current year graduates. Generally, the faculties of medicine are responsible for allocating the number of positions to the various programs but most involve input from ministries of health and health authorities to meet provincial medical human resource needs. In all 13 English-language medical schools, these positions are filled through participation in the Canadian Resident Matching Service (CaRMS), which is driven primarily by applicant choice. The access to positions is protected initially for graduating Canadian medical students. Few positions, other than family medicine, remain open for International Medical Graduates, transfer, or re-entry trainees. In 2005, there were 1508 positions available. After the first iteration, 109 family medicine positions remained unfilled, as compared to 56 specialty positions.¹⁷

4. Challenges Medical Education Faces in Addressing HHRS Resource Needs

Canadian medical schools face significant challenges in training both the right number and the right type of physician. There are currently a range of medical school initiatives aimed at reducing geographic disparities in physician workforce. These include providing training in disciplines and areas that meet current and projected health care needs, and ensuring that trainees are prepared, academically and professionally, to work where health care needs are the greatest. These initiatives require collaboration between university, community, and government stakeholders, as well as substantial new infrastructure and resources.

4.1 The University

Universities large enough and established enough to support a faculty of medicine are based in urban centres in Canada, and are influenced by urban culture. Educational initiatives developed to address rural/remote/northern physician supply include selection and targeted admissions of rural students, mentoring by rural preceptors, and delivery of clinical education in non urban settings.^{18,19} Admissions are both high-threat and high-risk to the university, with appeals and legal proceedings for adverse admission decisions not unusual. Admissions policies and processes must, therefore, be defensible to an urban-based university senate and must not conflict with provincial and federal human rights legislation prohibiting discrimination based on location.

Because medical schools are primarily based in southern urban centres, the provision of clinical education in a rural/remote/northern context requires a distributed program of some kind. The costs related to the management of a distributed program can be considerable. Accreditation at both the undergraduate and postgraduate levels requires central authority and integration of core curriculum and processes between a distributed clinical education setting and the central university program.

Accreditation processes also require adequate resources for any expansion of a program. There must be sufficient resources including teaching faculty, the number and variety of patients, physical and technical resources, as well as the supporting facilities and services necessary to provide the opportunity for all residents in the program to achieve the educational objectives and receive full training as defined by the specialty training requirements in the specialty or subspecialty.²⁰

Medical schools carry a research enterprise, as well as the education of new physicians; faculty recruited to teach medical students are expected to establish a research career with space, cost, and time commitments, which limit their availability for teaching. With some exceptions, tenure and promotion of faculty remains tied to research productivity, including externally funded research grants and publications, not education. Research infrastructure and academic overhead are increasingly accepted by funding agencies as part of a research grant budget. Universities benefit monetarily from these research grants. Not surprisingly, universities and individual faculty are directing much of their energy and support toward the research enterprise. In many

cases, this has led to undergraduate and postgraduate medical education taking a secondary role. Over time, this has resulted in a lack of capacity in current faculty to innovate and implement the new educational programs that are required with the expansion of medical schools.

There is a worldwide shortage of specific faculty expertise required for medical education; for example there is a lack of qualified faculty to teach gross anatomy, a core foundational discipline for medicine. With shortages of PhD-prepared scientists in medical sciences, there is worldwide competition for available scientists, driving up the recruitment funding requirements. The need to revitalize academic medicine is internationally recognized. For example, a recent British Medical Journal article outlined possible scenarios for academic medicine all reflecting the changes in resource needs and anticipated shortages.²¹ Far from being a local Canadian issue, academic faculty are part of an international resource pool and shortages are felt across developed nations.

4.2 Clinical Education

The apprenticeship model, which is a critical aspect of medical education, brings students, residents, and physicians, together in the context of patient care with graduated responsibilities to meet learning objectives. To provide sufficient opportunities for trainees to meet their objectives there must be coordination of trainee numbers, availability of teachers and patient care opportunities. The latter will be affected by the number of patients and by delivery systems of both health care and postgraduate educational programs. In the past, clinical education of physicians focused on the care of hospitalized patients. Learning occurred in the context of hierarchical, geographically located teams headed by attending physicians and including various levels of trainees in a Clinical Training Unit model. Learning is based in university-affiliated teaching centres (Academic Health Centres) and more senior trainees provide additional instruction and supervision of junior colleagues.

While hospital-based care and training remain important, the practice of medicine is increasingly outpatient, ambulatory and community-based. Ambulatory education is important to prepare trainees for future practice and to maximize the available learning opportunities. Some ambulatory experiences are available through publicly run and funded facilities, such as hospital-based teaching clinics, but the majority of ambulatory care occurs in private care settings such as clinicians' private offices. Indirect teaching costs, previously buried in the operating budgets of academic hospitals have become evident in the move to a distributed and increasingly ambulatory training model. This applies to both hospital and physician services.

The change from inpatient to ambulatory management has significantly affected patient care opportunities. Not only have changes occurred in the location and focus of the educational experience, there have also been shifts in the indirect and infrastructure costs related to teaching, identified above, from the hospital programs to individual clinics and physicians. These costs become explicit and are often magnified by the smaller scale of these ambulatory facilities.

Access to ambulatory clinical experience is especially important in the general specialties (i.e., Family Medicine, Paediatrics, Internal Medicine and Psychiatry), because ambulatory and chronic care may compose a substantial part of eventual practice. The problems described above are particularly acute where trainees from several programs need or wish to gain expertise in

small programs with limited patient populations. While patient access to care in new teaching sites is expected to be enhanced over time, clinical teachers, with the dual responsibility of patient care and teaching, may be faced with choosing between reducing patient numbers (and hence timely access to care for patients) or reducing trainee participation. This makes it increasingly difficult to recruit teachers for community-based training. There may also be a lack of ambulatory teaching facilities with additional examination rooms, which are designated as academic space, maintain patient flow, and allow trainees to see patients both in parallel and in conjunction with clinical teachers.

Over the last 25 years, the postgraduate training environment has undergone many changes. Tighter and more formalized accreditation standards have increased the academic content of postgraduate education and funding for the trainees has shifted from hospital funding (and recruitment) to flow through the postgraduate education offices of the universities. On call hours have shifted and been reduced through strikes and other interventions of resident and intern organizations in each province, rebalancing the effective service and education components of the postgraduate trainees. Public accountability, increasing malpractice complaints and concerns about patient safety have increased supervision requirements of postgraduate trainees by licensed clinicians.

During the initial years of undergraduate expansion, there will be a relative lack of senior postgraduate trainees able to supervise the greater number of undergraduate medical students and then junior postgraduate trainees. During this wave of expansion additional teaching responsibilities may land on clinician faculty who are already stretched in providing access to clinical care. In a few programs, the lack of qualified teachers contributes to the overall limit of academic programs to train the desired number of residents. This is evident in programs for which the accreditation standards indicate that trainees in a particular subspecialty rotation **MUST** be supervised by a specialist specifically qualified in that area.

Faculties of medicine also provide postgraduate and other clinical training to physicians whose participation is sponsored by funding sources other than ministries of health, universities and hospitals. This includes residents who are sponsored by a health authority on a return of service contract and visa trainees. Visa trainees usually provide funding to a university for their clinical teaching; however, resource issues are only addressed in a very limited manner by this funding. In Canada, IMG training is expected to increase dramatically in the next decade. However, the issues of finite and competing resources for clinical education remain. The lack of trained and effective clinician educators with available time away from the pressures of patient care during a period of physician shortages, as well as available facilities and infrastructure, and adequate patient base have not been addressed.

Population shifts are also creating challenges in capacity to provide the number of cases required for learning in some areas of medicine. An aging population has resulted in relatively fewer opportunities in paediatric subspecialties and a greater number in those serving a geriatric population. While a general surgeon, urologist or orthopaedic surgeon may serve a predominantly adult population once qualified, he/she still needs to develop an expertise in the relatively limited paediatric population during training. A stagnant birth rate presents a problem for doubling the number of both undergraduate and postgraduate trainees to gain experience in

intra-partum care and presents a particular problem for family medicine trainees. Equally, changes in the burden of illness within a population will change patient care opportunities.

4.3 Health Services Providers

Changes in health care delivery and funding have and will continue to have significant influence on the number and type of patient care opportunities available to trainees. While motivated by a desire to improve patient outcomes and/or achieve cost effective use of limited health care resources, such changes may present unintended obstacles for medical training. Most health service funding formulas from government are population-based with a complexity cost adjustment factor. Adjustments to funding formulas to accommodate teaching of all kinds, including professional development is needed, but politically difficult.

Reductions in length of stay in acute care hospitals have resulted in an in-patient population too ill to be looked after by medical students, and often even postgraduate trainees experience a very short period of treating a patient because of timely discharges into the community. The increase in chronic disease has shifted learning objectives and the necessary patient case mix for learning to a different patient population. Such patients may prefer a direct relationship with their physician, rather than one mediated through changing postgraduate trainees. Medical schools in general have not yet accommodated these changes, so continue a traditional clerkship rotation, which may not be the correct model for effective education in the current clinical context.

4.4 Government Issues

Provincial governments have authority and accountability for both education and health, thus they bear the costs of both the expansion of undergraduate capacity at medical schools and the expansion of postgraduate training that follows. Other strategies to address physician shortages such as integration of IMG's into the Canadian workforce, and development of nurse practitioner programs are also approved and funded by provincial governments. Since 2004, the federal government has put out requests for proposals to the provinces and territories for funding targeted to IMG's, the internationally educated, and health human resource planning. This promotes provincial, territorial, and regional responses; but, limits the possibility of a pan-Canadian approach to health human resource issues.

In the competition for government resources, expansion of undergraduate medical education may be seen as an investment with a very long time to impact. Time from entry to practice is a minimum of five years for the three-year medical schools for a family physician. However, a significant undergraduate expansion is likely to require new facilities to replace aging classrooms, requiring at least a two year lead time before actual expansion of class size.

Governments seek to address physician shortages through incentive programs. In Canada, the balance between individual autonomy and choice, and the greater need of society is carefully sought. To date, programs such as return of service and bonded service have not been a palatable solution for Canadian medical graduates.

While provincial governments bear the costs of expansion of medical education capacity, some provinces have more wealth than others, and in general physician migration in Canada also occurs from the “have-not” provinces to the “have” provinces. The investment in expansion of medical education may, therefore, lead to disappointing results for provinces due to physician mobility.

The new social accountability agenda of medical schools resonates with government, which looks for changes in admissions, curriculum design, and goals to mirror this shift. However, the process of change in universities is slow; for example, curriculum changes require planning, consultation, and then approval through the university senate. Major curriculum reform is a difficult process and changes are often incremental. Further, there is a reluctance to teach practice that is not mirrored in health care settings. Because most of the final years of medical school, and postgraduate training occur in health care settings, the health care system itself is a major teacher, and the “hidden curriculum” of medical schools is embedded in the practice setting. To teach concepts and ways of working that are inconsistent with health care practice places the learner at odds with his/her environment, and creates cognitive dissonance. This is difficult for government officials who have no direct control over curriculum, and look to the new graduates to carry new ideas into the workforce.

5. Current Medical School Initiatives to Address HHR Issues

According to their mandate, faculties of medicine across Canada are responding to health human resource issues with innovations in admissions, education structure and content, and location of programs.

5.1 Rural/Remote/Northern Physician Supply and Capacity Building

Canadian medical schools have a significant history of responding to workforce challenges, of either number or nature of physicians. For example, the University of Sherbrooke in the francophone province of Quebec educates francophone students from New Brunswick, a province without a medical school. McMaster University developed problem based learning (PBL) to develop practitioners with the ability to continue to identify needed knowledge and skills beyond the defined training period. University of Calgary was designed to be a national school, accepting students from across Canada in an accelerated three-year program.

There is evidence that programs offering students experience in rural locations have a positive impact on eventual practice location. One study found that it is not simply exposure to rural practice during training that impacts practice location, but the length of exposure. Another study found those reporting that more than half of their postgraduate training was in a rural area were ten times more likely to be rural physicians.²² More recent approaches to address rural/remote/northern physician shortages in the seventeen medical schools across Canada range across a continuum from mandatory one to two week rural placements, to students being able to spend much of their third and fourth year clerkships in rural or non-metro communities to full geographically distributed programs placed in rural areas, or a free-standing medical school in a northern or rural setting.

Given the above evidence, many initiatives aimed at increasing the number of rural physicians have typically involved efforts to (a) increase the number of rural-raised students admitted to medical school, (b) increase the number of students admitted to medical school whose goals are family and/or rural practice, and (c) increase the time all students spend in rural clerkships/internships for maximum exposure to a rural practice. A key aspect of the recent university and government response to the perceptions of reduced health care access in specific settings is the collaborative development of medical education models that focus on training in rural/remote/northern settings. Although models vary across jurisdictions in their details, all concentrate on building stronger relationships between the government, communities and educational institutions, as well as promoting greater community involvement in the training of health professionals. It has been hypothesized in the medical education literature that the mechanism underlying the effect is that when trained in a rural community, students learn to relate to the community's perspectives and also become advocates for that teaching site's expertise in the community.

Both the opening of the new Northern Ontario School of Medical and the expansion and distribution of the University of British Columbia undergraduate medical program to a geographically separate campus (the University of Northern British Columbia in Prince George), are aimed at addressing the chronic shortage of physicians in northern areas of Canada. Similarly, Alberta has instituted a program (Rural Physician Action Plan) to influence medical students and residents to take advantage of educational opportunities in rural and northern Alberta, with the goal of encouraging the ultimate location of their clinical practices in these areas. The University of Western Ontario has expanded its clinical undergraduate education into underserved eastern rural Ontario, and the University of Sherbrooke in Quebec has operated a distributed clinical education program in francophone New Brunswick. As shown in Figure 1, distributed sites for medical education are located in less densely populated areas in Canada.

While these educational programs are relatively new or just beginning, Canada's experience with educational interventions designed to address rural/remote/northern physician shortages began about 30 years ago with two rural networks for medical education. There are currently five rural networks in Canada that partner with medical schools to place students in rural clerkships as well as coordinate other rural activities. The remaining Canadian faculties of medicine have rural initiatives ranging from less intensive rural weeks to extended rural/non-metro clerkships.

Medical schools vary in their success in producing graduates who settle in rural practice. The top producers of rural physicians, when referencing undergraduate medical education are not necessarily from medical schools in smaller urban centres, suggesting that educational interventions designed to address rural physician shortages can have an effect. For example, as shown in Table 1, the top producer of rural physicians in Canada is located in a large urban area.

Across Canada, provincial governments have implemented support for students and preceptors involved in rural clinical education, which includes bursary support for students in return for rural service after graduation and licensure, as well as incentives for rural service after graduation and licensure. Generally, MD undergraduate bursary programs require one year of rural service per year of bursary support.²³

5.2 Admissions Policies

One of the major strategies to address physician shortages—whether for rural/remote/northern areas or for cultural groups—has been the modification of medical school admissions protocols and providing academic support services. Initiatives have varied depending on the target group for recruitment.

Table 1: Canadian Universities, City Population and Rural Practice by School of MD Training

| University | City | Total census Metro areas (2001) ²⁴ | 1994-1998 Grads 2-Years Post-Residency In Rural Practice ²⁵ | | |
|-----------------------------|-------------|---|--|-----|----------|
| | | | % | n | (total)* |
| Université Laval | Quebec City | 671 889 | 22.1 | 129 | (585) |
| Memorial University of Nfld | St. John's | 172 918 | 17.2 | 35 | (224) |
| Université de Sherbrooke | Longueuil | 348 091 | 15.9 | 65 | (409) |
| University of Manitoba | Winnipeg | 671 274 | 14.4 | 50 | (248) |
| Dalhousie University | Halifax | 359 183 | 13.7 | 43 | (313) |
| University of Saskatchewan | Saskatoon | 225 927 | 13.2 | 30 | (228) |
| University of Ottawa | Ottawa | 1 063 664 | 12.4 | 36 | (290) |
| Univ. of British Columbia | Vancouver | 2 160 000 | 11.9 | 54 | (454) |
| Université de Montréal | Montréal | 3 606 700 | 11.7 | 64 | (701) |
| McMaster University | Hamilton | 490 268 | 11.0 | 40 | (365) |
| University of Calgary | Calgary | 951 395 | 10.0 | 27 | (271) |
| University of Alberta | Edmonton | 937 845 | 9.2 | 43 | (467) |
| Univ. of Western Ontario | London | 432 451 | 9.1 | 36 | (397) |
| McGill University | Montréal | 3 426 350 | 6.5 | 29 | (448) |
| Queen's University | Kingston | 146 838 | 6.2 | 16 | (259) |
| University of Toronto | Toronto | 5 203 600 | 4.9 | 40 | (821) |

*Total is based on all graduates, including urban and rural practicing.

In the Canadian literature, several publications examined the association between variables such as rural background and rural experiences during medical school, and the likelihood of doing rural locums or starting practice in a rural location.²⁶⁻²⁸ One study compared medical schools across the country to determine which institutions were the most likely to graduate physicians who chose to work in rural and remote areas.²⁵ As noted in Table 1, the Université Laval, which is located in an urban area, is the top producer of rural physicians in Canada.

Research in the field of medical education indicates that physicians most likely to establish a practice in a rural/remote area are those who are characterized by being raised in a rural area^{26,29,30} and having first year plans to practice family medicine.³⁰ Easterbrook found that physicians exposed to rural practice training at the undergraduate level were 1.70 times more likely to practice in a rural community immediately after graduation, while residents exposed to rural practice training were 1.84 times more likely to practice in a rural community following graduation. However, when examining current practice location, only the hometown size was

significantly related to practice location, with physicians from towns of less than 10,000 being 2.48 times more likely to choose a rural practice than those from towns larger than 10,000.²⁶ Similarly, Rabinowitz³⁰ concluded that the most effective method of supplying and retaining rural primary care physicians is to select students with a rural background and with freshman year plans for family practice. In a systematic review of studies from the US, Canada and Australia that examined the rural background of rural doctors, it was found that doctors with rural backgrounds are on average twice as likely to work as rural doctors when compared with doctors having an urban background.³¹ Furthermore, another study found that a rural background in both a general practitioner and their partner increased the likelihood of rural practice by six times.³² Despite these research findings, it remains that the majority of those graduating from medical school and practicing in rural areas grew up in urban areas. It is important to continue to identify educational and other recruitment and retention issues related to rural practice.³³

In 2001, only about 10.8% of Canadian medical students had reported living in rural areas at high school graduation³⁴ although 22-33% of Canadians live in rural communities. For example, Ontario's population is 13% rural, but only 7.3% of medical school applicants are from rural settings. However, rural applicants in Ontario are equally likely to be admitted to medical school as urban applicants.³⁵ Of the students offered admission to the new Northern Ontario School of Medicine (as of July 19, 2005), 12.5% are Aboriginal students, 41% have lived in northern urban communities for at least 10 years, 18% are francophone and 17% are bilingual.³⁶

5.3 Aboriginal Students

Initiatives to address the shortage of Aboriginal physicians in Canada include high school outreach, mentoring and support, admissions processes with reserved seats, and support within the program. The linking of these programs creates a "pipeline" approach to address shortages of Aboriginal physicians. The shortage of Aboriginal physicians is noticed particularly in the western provinces of Canada because of the higher ratios of Aboriginal population.

Initiatives in the Western provinces have included an access program for Aboriginal students, federally funded and supported seats, targeted admissions processes, and facilitated access. These initiatives have resulted in a current enrolment of 60 self-declared Aboriginal students across faculties of medicine in western Canada. The new Northern Ontario School of Medicine is expected to attract and admit significant numbers of Aboriginal applicants. As noted above, 12.5% of students offered admission to the Northern Ontario School of Medicine were of Aboriginal descent, as of July 2005.³⁷

In spite of these initiatives designed to increase Aboriginal admissions, there is evidence that policy changes are not sufficient to yield increased numbers of Aboriginal graduates because of a failure to retain sufficient numbers of Aboriginal students at the premedical level. For example, at the University of Saskatchewan in 1998-99, 43.9% of all first-year Aboriginal students in the College of Arts and Science either withdrew or were required to discontinue, compared to the non-Aboriginal average of 20%.³⁸ This has led to programs taking a more comprehensive approach to Aboriginal student retention by including a variety of support services for their students, with positive results.

5.4 Postgraduate Medical Education

Postgraduate programs across Canada are examining some of the issues described above and developing initiatives to address them. Canada's postgraduate family medicine programs have a long history of program development to address shortages in rural family physicians. Specific programs set in rural and northern settings train family physicians in the context of rural medicine, with excellent retention rates in the range of 70-80% following certification.^{39,40} However, of the 711 physicians who graduated from family medicine programs in Canada in 2000, only 75 have entered rural practice as of 2002.¹⁸

The number of rural family medicine residency positions offered in Canada increased from 36 in 1989 to 144 in 2003, and by 2002, 20% of the 712 Canadian family medicine positions were rural residencies.⁴¹ While not all rural positions are filled, the College of Family Physicians of Canada has recently funded Family Practice Interest Groups at every medical school in the hopes of supporting students in their choice of family medicine. Postgraduate family medicine programs also hold "fairs" to interest undergraduate students in their programs.

While rural postgraduate family medicine residencies are expanding, and demonstrate excellent short-term retention, the long-term retention of graduates in rural areas is poor. For example, about 45% of graduates of Université Laval family medicine programs are practicing in rural areas two years post residency, but only about 15% are still in rural areas at ten-year post residency.⁴²

Postgraduate programs in general specialties are also distributing residents outside the usual academic teaching centres. For example, a residency program which is an integrated partnership between the University of Ottawa and the Northeastern Ontario Medical Education Corporation prepares General Surgery specialists for the community setting.⁴³ Core teaching is primarily in an urban area, while clinical rotations cover a wide variety of settings including tertiary subspecialty exposure, as well as secondary care general surgery in both academic urban setting and in community hospitals associated with the program. This kind of distribution has only begun to emerge, but is expected to grow with the increasing distribution of undergraduate education and the accompanying development of distributed academic infrastructure.

5.5 Information and Communications Technology (ICT)

The employment of advanced communication technology to provide high quality medical education to students in all locations is an emerging approach in medical education. The use of advanced communication technology has recently been recommended for emergency medicine as a mechanism for training, even on an international level⁴⁴ and for surgical education as a means to provide quality education within the context of limited instructor time.⁴⁵ In several jurisdictions, for example in northern Ontario, telehealth networks are being used to support postgraduate trainees who are in distributed regional settings. The resident links to the academic program at the academic university centre, which usually occurs once per week. In this way, residents are able to learn clinical care in a more regional context without drawing on the time of regional faculty for academic seminars. These links also reduce resident isolation.

At the undergraduate level, the use of ICT in distributed programs is vital for bridging the geographic distances between campuses. Advanced technology now available can link lecture theatres, histology, and anatomy laboratories so that faculty at any site may deliver a lecture to all distributed sites.⁴⁶ While the initial investment and the costs of ongoing support are significant, the ability to deliver across geographical distance enables for the first time the placement of students at early phases of their medical education into northern regional sites with small partnering university campuses. Early findings from evaluations of these programs suggest that the learning experience from a technology-enabled distributed lecture is as good as that from



Figure 3: Interactive videoconferencing technology supporting a lecture distributed across three sites, UBC MD Undergraduate Program

a live lecture. Preliminary research in specific cases of medical education using a variety of advanced communication technology demonstrates positive effects on learner satisfaction at the continuing professional development level. For example, Dalhousie University Office of Continuing Medical Education established a pilot project with an initial four sites in 1995-1996 that grew to 37 sites by 1999-2000 with a provision of 64 videoconferences and was well-received by faculty and students.⁴⁷

Videoconferencing also facilitates course and curriculum committee and faculty support meetings between urban centers and rural settings, ensuring that rural and regional faculty are full participants in the development and implementation of curriculum. ICT also supports distributed clinical education. The delivery of required academic content across distributed

clinical settings can ameliorate the draw on busy clinicians, ensuring their time and energy is used for clinical bedside teaching and trainee supervision. The advances in telehealth in Canada may soon lead to opportunities for distance precepting; for example, such technology may enable supervision of a postgraduate trainee in a setting outside the usual academic health centres.

6. New Challenges, Opportunities, and Policy Implications

The scenario at the beginning of this paper is based on a series of events that occurred in British Columbia, Canada. It demonstrates the growing community concern regarding an adequate supply of physicians, and the potential for a collaborative approach between government, universities, community-based physicians, and faculties of medicine to address these HHR issues. In preceding sections, we outlined current physician HHR issues for Canada, as well as both the innovations occurring in medical school expansion and the challenges faced by all stakeholders in expanding medical education capacity in Canada. As well as absolute shortages in physicians, Canada is experiencing shortages of physicians in rural, remote and northern settings, in generalist specialties and family practice, and in physician resources for specific populations. Challenges include expanding the capacity for teaching, both in the university and clinical environments. As well as producing more physicians, Canada must produce the right blend of physicians to meet the needs of the population. This includes family physicians, other generalists, northern and rural physicians, physicians capable of working in inter-professional teams, and an Aboriginal workforce. Innovations addressing these issues include rural placements, new admissions processes, community-based models of clinical education, and fully distributed models of medical education. While these innovations are intended to address the current workforce issues, they are placing new pressures on the system and uncovering additional challenges.

The disturbing trend from generalist choices to specialist choices by the younger generation of physicians must be addressed. Health care systems must provide improved recognition to generalists, physician professional organizations must support this, and medical schools must recruit and support generalist physician faculty. The placement of clinical medical education into settings where generalist physicians can provide mentoring and role models must be initiated by universities and supported by a collaboratively developed infrastructure. It requires the involvement of government and clinical service delivery organizations to facilitate this movement of education from the urban specialist core to more distributed settings, and willingness in academic settings to redesign clinical education. The current accepted balance between individual choice and societal need in Canada, which fluctuates and differs from other countries, may need rebalancing, and if so, new policies and processes acceptable to young physicians must be developed.

Clinical service delivery organizations must examine the importance of education of professionals to address their core HHR needs. These publicly-funded organizations have a mandate to operate in a cost effective manner and allocate resources based on their population's immediate care needs. Requirements for increased efficiency in the health care system have negative implications for the training of all health care workers including physicians, because they reduce efficiency of operations. Education may be seen as expendable unless it is a core function with a clear mandate from health service providers. If trainee numbers are to increase, a

certain element of ‘operational inefficiency’ will need to be re-introduced into health care delivery. Clinical care delivery organizations must reinvest in their responsibility to support the production of the future workforce. Policy development and governmental mandate and support are required, while academic programs must examine their educational programs to ensure the most effective use of clinician teachers and clinical settings.

Medical education providers are under pressure from sectors other than clinical service delivery and the production of more Canadian graduates: for example, the initiatives to integrate International Medical Graduates into the Canadian physician workforce, the development of nurse practitioner programs and ongoing professional development programs utilize the same physician human resources as are stretched by the current expansion of medical schools. Lack of integration of competing strategies across sectors will result in a physician educator workforce pulled in many directions, and unable to respond effectively. The clinical pressures that physician educators are under because of physician shortages will further stress the system. A balance between short term strategies and longer term strategies must be sought across these different sectors, with understanding of the competing pressures, and collaboration to reduce the effect.

Postgraduate trainees are choosing to lengthen their training, delaying their formal entry into the workforce. However, senior trainees provide significant service during training, so this may be an artifact of reporting rather than a reflection of actual workload. While postgraduate training in family medicine is shorter than most other areas of the first world, are there strategies other than additional accredited training to build the special skills desired by postgraduate trainees? For example, Continuing Professional Development (CPD) may have a more structured role to play in the transition of trainees from educational programs to practice settings, as well as addressing the development of new skills during practice life. However, CPD in Canada currently operates outside the core missions and funding of the faculties of medicine, and has not yet been effectively brought to the table to impact workforce issues.

While educational strategies to increase recruitment of physicians to rural areas are under development, without an equivalent set of strategies for retention these efforts will be lost. The reduction in the proportion of graduates in rural settings from two years to ten years post graduation clearly suggests that this is not yet being done. There are community and practice factors that influence the likelihood of physicians maintaining their rural practice. The stressors in rural practices are different from urban practices, for example the greater demand for services. Hays⁴¹ developed a model of factors involved in the retention of rural physicians in Queensland, Australia. Professional and community factors were positively associated with retention, while factors negatively related to retention included: workload/after-hours, locum access, management load, and chronic conflict. Hays also identified factors that may trigger leaving a rural practice, these included children entering secondary school and acute personality/hospital clashes. Multiple strategies must be developed through government, university, and local community initiatives to support physicians in small communities across Canada. For example, strategies such as alternate payment plan funding, consensus group decision-making, and recruitment of 50% more physicians than FTE’s required for the population that have stabilized physician services in a small town in northern Ontario should be carefully examined for lessons learned.⁴²

The placement of medical education in community-based settings, and in communities at a distance from the central faculty of medicine raises new challenges. Information and communication technology holds great promise to educate and then support physicians in non-traditional educational environments. The ability to deliver core educational materials to rural settings, to provide distance precepting during patient care in remote regions and to offer ongoing specialist consultation and support for generalist physicians practicing in underserved areas opens new strategies for recruitment and retention. Advanced networks are increasingly available in northern and rural areas of Canada. However, joint planning is required between telehealth networks planned for service delivery to patients and educational networks planned to support practitioners. To date this has not been achieved in Canada, and provision of distance educational support plays a backseat to clinical service delivery. With the development of advanced networks across Canada's northern and remote areas, clearer integrative planning must be developed. This will require the cooperation of different levels of government, including the federal funding initiatives to develop advanced networks for telehealth implementation, which currently does not include health professional education as a part of the delivery framework.

Academic research and policy development has been slow to address issues of the underserved. The development of the Canadian Institutes of Health Research with defined Institutes in Aboriginal Health and Health Services will turn attention to these areas through research initiatives, and may lead to new knowledge that can be utilized in workforce development. Medical education research, however, is generally under funded, and has focused on more general topics such as competency assessment and development of clinical reasoning. Research exploring how and whether students meet core objectives in different settings is just starting. The framework of social accountability for medical schools articulated by AFMC has turned attention to geographically underserved areas. Medical schools must utilize this framework to revitalize their mission, and their parent universities must embrace this mission along with the more traditional research missions. Over time, new needs may emerge that demand equal attention.

While the long-term outcomes (10-15 years) expected from these new investments in medical education is increased health care access in northern, rural, remote, and Aboriginal populations, positive and incremental changes in such outcomes as physician recruitment and retention are anticipated in the shorter term. Innovations may impact on communities in unanticipated ways. There is already some evidence in the literature that educational programs implemented in underserved areas can have a positive impact on physician recruitment and retention. There may be an impact on community dynamics, both psychological and economic, and on the social capital of rural and northern areas of Canada. Similarly, although the number of Aboriginal physicians is still low, programs of admission leading to success for recognized leaders of Aboriginal youth appear to be impacting the aspirations of other students. Exploring these shorter term indicators of success may lead policy-makers and educators to modify and augment current initiatives.

How will we know what initiatives have made contributions to the HHR challenges of Canada? There is currently no strategy in place for evaluating the impact of these strategies. A national collaboration to comprehensively evaluate the different initiatives will provide an evidence base for medical schools, governments, and policy developers that will support planning and decision-making. The identification of best practices for achieving distinct goals will contribute to

Canada's health human resources by providing knowledge to effectively plan and disseminate future programs, thus strengthening the evidence base and capacity for coordinated HHR planning in the academic sector contributing to physician resource.

A complex medical education system operating in a complex environment of health care to address complex issues of physician resources requires collaboration, innovation, and discussion: new partnerships must be forged, with increased understanding of the challenges for all stakeholders. Every challenge outlined above requires multi-sector partnership and collaboration in order to produce effective solutions. No one organization, whether government, university or health care delivery organization can independently address these challenges. In the end, our success in addressing physician HHR issues in Canada will depend on our ability to forge working partnerships between government, university and community sectors. What steps should be taken to ensure that these partnerships are forged and sustained? Are there lessons from other areas related to workforce policy that can provide meaningful direction?

Will the students who are a part of the initiative described in the scenario at the beginning of this paper end up practicing in the northern Canada? While both the expectations and indications suggest so, it will require an ongoing partnership of community, universities, government, and physicians to deliver the promise, and at least a decade to document the anticipated outcomes.

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