

Context counts: training health workers in and for rural and remote areas

Roger Strasser^a & Andre-Jacques Neusy^b

Abstract Access to well trained and motivated health workers is the major rural health issue. Without local access, it is unlikely that people in rural and remote communities will be able to achieve the Millennium Development Goals. Studies in many countries have shown that the three factors most strongly associated with entering rural practice are: (i) a rural background; (ii) positive clinical and educational experiences in rural settings as part of undergraduate medical education; and (iii) targeted training for rural practice at the postgraduate level. This paper presents evidence for policy initiatives involving the training of medical students from, in and for rural and remote areas. We give examples of medical schools in different regions of the world that are using an evidence-based and context-driven educational approach to producing skilled and motivated health workers. We demonstrate how context influences the design and implementation of different rural education programmes. Successful programmes have overcome major obstacles including negative assumptions and attitudes, and limitations of human, physical, educational and financial resources. Training rural health workers in the rural setting is likely to result in greatly improved recruitment and retention of skilled health-care providers in rural underserved areas with consequent improvement in access to health care for the local communities.

الترجمة العربية لهذه الخلاصة في نهاية النص الكامل لهذه المقالة. Al final del artículo se facilita una traducción al español. Une traduction en français de ce résumé figure à la fin de l'article.

Introduction

Despite the substantial differences between developing and developed countries, the key themes in rural health are the same around the world. Access is the major rural health issue. Even in countries where the majority of the population lives in rural areas, the resources are concentrated in the cities. All countries have difficulties with transport, communication, services and resources, and they all face the challenge of shortages of health-care providers in rural and remote areas.¹ This paper outlines how medical schools in different regions of the world are using an evidence-based and context-driven approach to training health workers for rural and remote areas. We give examples of how context influences the design and implementation of different rural education programmes and highlight major challenges to success.

The importance of rural training

Training for rural practice has become critically important in the context of continuing serious shortages of doctors and other health workers in rural areas and recognition that “the overflow effect” does not happen. Producing more health-care providers and expecting the excess to spill over from the cities into rural areas has been shown not to solve the rural medical workforce shortage.² In fact, no single strategy is likely to be successful. Rather, multiple strategies are required at different levels of education and training each of which have a small effect and contribute to an overall substantial change.³ One key series of initiatives that has been shown to be effective involves rural-based medical education.^{4–7}

To appreciate the requirements of rural training, it is necessary to understand rural communities, their health service needs and the nature of rural practice. There are a series of key param-

eters that provide the framework which determines the structure and function of rural health services, how rural practitioners work and the nature of rural practice. These parameters or “rural realities” are: geography and demography; the rural culture; rural morbidity and mortality patterns; resource limitations; and workforce shortages.⁸

Since the mid-1980s, research evidence has been accumulating regarding the specific range of knowledge and skills required by rural practitioners. This has led to the inclusion of specific curriculum content on rural health and rural practice in undergraduate medical programmes and in rural-based family medicine residency programmes.^{8–10} When compared to their metropolitan counterparts, rural practitioners carry a heavier workload, provide a wider range of services and carry a higher level of clinical responsibility in relative professional isolation.¹¹ These characteristics hold true for all rural practitioners whether they are doctors, nurses, pharmacists or other health workers. Also, as rural practitioners are members of the community that they serve, they have a significant public health role that may range from issues such as clean water and sanitation to community health education.

Initially, the development of rural clinical placements by medical schools was driven by the workforce imperative, i.e. the serious shortfall of practitioners that creates an urgency to improve recruitment. The expectation was that experience in rural settings would encourage a future interest in rural practice. Subsequently research evidence demonstrated that this expectation was justified. Studies have shown that the three factors most strongly associated with entering rural practice are: (i) a rural background; (ii) positive clinical and educational experiences in rural settings as part of undergraduate medical education; (iii) targeted training for rural practice at the postgraduate level.^{7,12–20} In addition, there is evidence that academic involve-

^a Northern Ontario School of Medicine, 935 Ramsey Lake Road, Sudbury, Ontario, ON, P3E 2C6, Canada.

^b Training for Health Equity Network (THEnet), Brussels, Belgium.

Correspondence to Roger Strasser (e-mail: roger.strasser@normed.ca).

(Submitted: 28 September 2009 – Revised version received: 9 February 2010 – Accepted: 18 March 2010 – Published online: 13 August 2010)

ment (teaching and research) is both a retention and recruitment factor for physicians.^{6,20,21}

In response to the shortage of rural doctors, various medical schools across the world have developed innovative approaches to producing doctors with the knowledge, skills and commitment to practice in underserved, rural and remote regions.^{22–25} In general, evaluation of rural clinical placements has demonstrated that the rural setting provides a high-quality clinical learning environment that is of potential value to all medical students.²⁶ Specifically, rural clinical education provides more “hands on” experience for students such that they are exposed to a wide range of common health problems and develop greater procedural competence.²⁷

Training for Health Equity

THEnet (Training for Health Equity network), is a group of eight medical schools worldwide that have been established with a social accountability mandate. The World Health Organization (WHO) defines the social accountability of medical schools as “the obligation to direct their education, research and service activities towards addressing the priority health concerns of the community, region and the nation that they have a mandate to serve”.²⁸

Essentially, THEnet is a collaborative network of need and outcome-driven medical schools in neglected, rural and remote regions of Africa, Asia, Australia, Latin America and North America with a core mission to increase the number, quality, retention and performance of health professionals in underserved communities.²⁹ Member schools recruit students from, and produce doctors for, underserved communities. Although THEnet schools operate in different contexts and employ somewhat different strategies, they share the following core principles: (i) health and social needs of targeted communities guide education, research and service programmes; (ii) students are recruited from the communities with the greatest health care needs; (iii) programmes are located within or in close proximity to the communities they serve; (iv) much of the learning takes place in the community instead of predominantly in university and hospital settings; (v) the curriculum integrates basic and clinical sciences with population health and

social sciences; and early clinical contact increases the relevance and value of theoretical learning; (vi) pedagogical methodologies are student-centred, problem and service-based and supported by information technology; (vii) community-based practitioners are recruited and trained as teachers and mentors; (viii) partnering with the health system aims to produce locally relevant competencies; (ix) faculty and programmes emphasize and model commitment to public service.^{30,31}

Flinders University School of Medicine (Australia), Northern Ontario School of Medicine (Canada) and Zambonga School of Medicine (the Philippines) are three members of THEnet whose experience is illustrative of successful elements of rural based, socially accountable medical education.

Flinders University School of Medicine

In the mid 1990s, Flinders University in South Australia pioneered a form of rural community-based medical education in which a group of students complete their core clinical learning based in rural family practice.³² Through the Parallel Rural Community Curriculum (PRCC), students undertake the third year of a four-year medical programme based in family practice and live in a rural community for the whole year. The learning objectives are the same as for third-year students in the city teaching hospital. Students cover the major clinical disciplines in medicine (internal medicine, surgery, paediatrics, etc), however, rather than learning these clinical disciplines in sequential blocks (known as clerkships rotations), the students learn all these clinical disciplines in parallel for the whole year. The PRCC has been studied closely and found to provide learning experiences which are equivalent to, if not better than, clinical learning in the metropolitan teaching hospital.³³ Specifically, PRCC students consistently outperform their colleagues based in city teaching hospitals in the end-of-year examinations.³⁴ In addition, PRCC students were found to have a higher level of confidence and competence and a broader range of clinical knowledge and skills when compared with their metropolitan counterparts.²⁷ After 12 years, 70% of PRCC graduates are practising in rural locations.³⁵

Northern Ontario School of Medicine

Although part of Ontario, the most populous province in Canada, Northern Ontario is geographically vast with different economic and social characteristics from the southern part of the province; 60% of the population lives in rural and remote areas with a diversity of communities and cultures, most notably aboriginal and francophone.^{36–41} Recognizing that medical graduates who have grown up in a rural area are more likely to practice in rural settings, the Government of Ontario decided in 2001 to establish a new medical school with a social accountability mandate to contribute to improving the health of the people and communities of Northern Ontario.³⁹ The Northern Ontario School of Medicine (NOSM) is a joint initiative of Laurentian University, Sudbury and Lakehead University, Thunder Bay, which are more than 1000 km apart. NOSM is a rural, community-based medical school which actively seeks to recruit students from Northern Ontario or from similar northern, rural, remote, aboriginal or francophone backgrounds. The holistic, cohesive curriculum relies heavily on electronic communications to support “distributed community engaged learning”. In the classroom and in clinical settings, students explore cases from the perspective of physicians in Northern Ontario. Clinical education takes place in a wide range of community and health service settings, so that the students experience the diversity of communities and cultures in Northern Ontario. NOSM graduates are expected to be skilled physicians ready and able to undertake postgraduate training anywhere, but with a special affinity for and comfort with pursuing training and clinical practice in Northern Ontario.⁴⁰

Through community engagement, communities are actively involved in hosting students and contributing to their educative experience. The School has a particular focus on developing collaborative relationships with rural, remote, aboriginal and francophone communities and organizations, as well as the larger urban centres of Northern Ontario. These relationships are fostered through the Aboriginal Reference Group, the Francophone Reference Group, Local NOSM Groups, and a vast network of formal affiliation agreements and memo-

randa of understanding. The communities become as much a part of the School as the university campuses in Thunder Bay and Sudbury. A study of the socio-economic impact of the NOSM⁴² has shown: new economic activity across Northern Ontario that is more than double the School's budget; and optimism about the future among community participants which they attribute to NOSM.

Consistent with its social accountability mandate, NOSM seeks to reflect the population distribution of Northern Ontario in each medical school class. The selection and admissions process accepts applicants with diverse academic backgrounds in both the sciences and humanities, and favours applicants who meet the academic standards and come from northern, rural, remote, aboriginal or francophone backgrounds. Since the first medical student intake in 2005, there have been around 2000 applicants for 56 places each year. Up to 90% of each class is from Northern Ontario, with 40–50% of students from rural and remote areas, and substantial inclusion of aboriginal (8%) and francophone (20%) students. The class mean grade point average each year has been approximately 3.7 on a four-point scale, which indicates that the academic standard of the students is comparable with that of other Canadian medical schools.²⁴

The inaugural class of 56 medical students began their studies in 2005 and graduated in 2009. This class was the only Canadian medical school class for more than 10 years in which all students matched to residency programmes in the first round of national residency match and was placed in the top 30% in the national Medical Council of Canada examinations. These results demonstrate that NOSM students compare favourably to students from other schools in Canada. Seventy percent of NOSM graduates are training in predominantly rural family medicine and the others are training in various other specialties and subspecialties. Follow-up studies of family medicine residency graduates from Northern Ontario show that 67.5% of the graduates are practising in Northern Ontario or similar rural areas.⁴³

Essentially, NOSM recruits students from the local underserved rural area, provides them with medical education in the Northern Ontario context and then supports local medical graduates

through continuing education and faculty development for their teaching role.³⁹ The shortage of faculty willing to take a position in medical schools in underserved regions remains a challenge. This has led to the development of new models of clinical education that turn the constraints of the existing health system into teaching opportunities. NOSM has extended the culture of teaching beyond the traditional teaching hospitals and campus into family practice and other community clinical settings. Community-based health practitioners are recruited as faculty with support and training provided by NOSM. Embedding students in family-practice settings ensures that they are exposed to the full spectrum of medical conditions that occur in the community.

Zamboanga School of Medicine

Zamboanga School of Medicine in the Philippines operates on similar principles with many similarities to NOSM, but with much greater resource constraints. Zamboanga is the regional centre for Western Mindanao and the Sulu Archipelago, which is one of the most underserved areas in the Pacific region. Like NOSM, the Zamboanga School of Medicine was established through a university-community partnership with a social accountability mandate and its own board. The medical programme of the Zamboanga School of Medicine is similar to that of NOSM. Its students come predominantly from the local region and undertake an integrated curriculum with classroom-based learning in small groups and enhanced problem-based learning. First year students have clinical and community exposure with a focus on learning about the community context and population health. Clinical learning in the community setting continues throughout the programme with students spending much of their fourth year in small rural communities.⁴⁴ The Zamboanga School of Medicine admitted its first students in 1994 and is very successful as measured by the fact that Zamboanga students' performance on the national board examination is consistently above the national average and that more than 90% of its graduates are continuing their training and clinical practice within the region. This is particularly remarkable in the Philippines where many new medical graduates leave

to work abroad as soon as they graduate. In the South Mindanao region, the infant mortality rate has declined from 75 per 1000 births in 1995 to 10 per 1000 births in 2003,⁴⁵ a change which may be attributed in part to the medical school.

Challenges

The major obstacles to the success of rural community-based medical education are related to social attitudes, resources and the health system. Commonly, there is an assumption that activities undertaken in rural and remote areas are "second-class" or of a lesser standard than in major urban centres. This attitude is magnified within the health profession in which the predominant assumption is that specialists and subspecialists are of greater value or superior to generalists. In addition, there is the assumption since Flexner's report was published in 1910 that urban teaching hospitals are the right place for medical education.⁴⁶ As outlined already, there is considerable evidence that these assumptions and attitudes are unjustified. Nevertheless, a stronger evidence base is needed to convince policy-makers and challenge the conventional approach to medical education. THEnet schools are developing and testing joint evaluation tools to assess the quality, outcome and impact of socially accountable medical education programmes in different parts of the world.

Resource limitations are another major challenge, particularly in low-income countries. Human resource constraints include not only shortages of health-care providers, but also variability in the clinical skills and the teaching skills of available rural practitioners. Limitations of physical resources include poor quality or nonexistent hospitals/health services, erratic equipment and supplies, and lack of suitable housing for student health workers. In addition, education resources such as teaching aids, library support and broadband internet access are often limited. All of these resource constraints are magnified by limited funding, including little or no funding for dedicated teaching, educational infrastructure or communications technology.

The success of this education approach also requires active involvement of the health system and the wider communities. Where these are lacking, health education in and for underserved rural

communities is likely to struggle. Active health system and community involvement helps student health workers feel “at home” in the host community and so they are much more likely to return to pursue their future careers.

Conclusion

There are several key considerations in developing and implementing successful rural-based training. The first is to recognize that context counts. Particularly with prolonged clinical attachments, students become members of the health team and active contributors to health care. This enhances the students’ clinical confidence and competence, and ensures that their clinical knowledge and skills are embedded in the local setting. Another key

consideration is active community participation. Communities have a critical role not only in providing social support for students, but also in contributing to the students understanding and knowledge of the local social determinants of health.

Other key considerations revolve around ensuring high standards of clinical and educational experiences for the students that meet accreditation standards and ensure comparable performance on national board exams. It is important to maintain a focus on the social accountability mandate and translate that into a clear vision and mission that guide the development and implementation of the curriculum and education programme. Particularly in the early establishment phase, it is important to establish targets and benchmarks that are based on the

rural reality, and avoid being measured against indicators developed in the large urban hospital setting. This is truly a “horses for courses” situation. In this context, there is a case for introducing accreditation standards that measure social accountability.⁴⁷

Based on the experience in Northern Ontario, Zamboanga and the other member schools of THEnet, training rural health workers in the rural setting greatly improves recruitment and retention of skilled health-care providers in rural underserved areas with consequent improvement in access to health care for the local communities. ■

Competing interests: None declared.

ملخص

للمحتوى أهميته: تدريب العاملين الصحيين في المناطق الريفية والمناطق النائية ومن أجلها

الكلية الطبية في مختلف أقاليم العالم التي تستخدم الأسلوب التعليمي المسند بالبيانات والموجه السياق من أجل تخريج عاملين صحيين متمرسين ومهرة ويتحلون بروح الحماسة. كما ويوضح الباحثون كيف يمكن للمحتوى أن يؤثر على تصميم مختلف برامج التعليم والتثقيف الريفي وعلى تنفيذها. وقد استطاعت البرامج الناجحة أن تقضي على العقبات الأساسية والتي تمثلت في الافتراضات والمواقف السلبية، وقصور الموارد البشرية، والمادية، والتعليمية والمالية. إن تدريب العاملين الصحيين الريفيين في المواقع الريفية يمكنه أن يؤدي إلى تحسن كبير في أساليب التوظيف واستبقاء مقدمي رعاية صحية مهرة، وذلك في الأماكن الريفية التي تعاني من نقص الخدمات، ومن ثم، تحسن سبل وصول المجتمعات المحلية إلى الرعاية الصحية.

يعد الوصول إلى العاملين الصحيين المدربين جيدا والذين يتحلون بروح الحماسة قضية أساسية من قضايا الصحة في المناطق الريفية. وبدون سبل الوصول المحلية لن يكون في مقدار السكان في المجتمعات الريفية والمجتمعات النائية أن ينجحوا في تحقيق المرامي الإيمائية للألفية. ولقد بينت الدراسات التي أجريت في العديد من البلدان أن هناك ثلاثة عوامل تتراعى بشدة مع إدخال الممارسات الريفية وتتمثل في: (أ) الخلفية الريفية، (ب) الخبرة السريرية والتعليمية الإيجابية في المناطق الريفية بوصفها جزءا من التعليم الطبي الأكاديمي، و (ج) التدريب الذي ينصب على الممارسات الريفية في المرحلة ما بعد التخرج. وتقدم هذه الورقة بيانات للمبادرات السياسية تشتمل على إلحاق طلبة الطب الذين هم من أصل ريفي أو من المناطق النائية، بالتدريب في هذه المناطق ومن أجلها. ويقدم الباحثون أمثلة حول

Résumé

De l'importance du contexte: la formation de professionnels de la santé dans et pour les zones rurales et isolées

Pouvoir faire appel à des professionnels de la santé correctement formés et motivés est la question majeure de la santé rurale. Sans un accès local, il est peu probable que les membres des communautés rurales et isolées puissent atteindre les objectifs du Millénaire pour le développement (OMD). Des études menées dans de nombreux pays ont montré que les trois facteurs les plus fortement associés à une implantation médicale en milieu rural sont: (i) des origines rurales; (ii) des expériences cliniques et pédagogiques positives dans des situations rurales intégrées au cycle des études médicales; et (iii) une formation ciblée sur la pratique rurale au niveau postdoctoral. Cet article témoigne des initiatives politiques impliquant la formation des étudiants en médecine issus, vivant et destinés aux régions rurales et isolées. Nous donnons des exemples d'écoles de

médecine dans différentes régions du monde, qui utilisent une approche pédagogique contextuelle et fondée sur l'expérience clinique afin de former des professionnels de la santé qualifiés et motivés. Nous démontrons la façon dont le contexte influence le projet et la mise en application des différents programmes d'éducation ruraux. Les programmes couronnés de succès ont vaincu les obstacles majeurs, y compris les idées préconçues et les attitudes négatives, ainsi que les limitations de ressources humaines, physiques, pédagogiques et financières. La formation de professionnels de la santé ruraux en milieu rural devrait nettement améliorer le recrutement et retenir les prestataires de soins de santé qualifiés dans les régions rurales mal desservies, entraînant un meilleur accès aux soins médicaux pour les communautés locales.

Resumen

La importancia del entorno: formación de profesionales de la salud en y para áreas rurales alejadas

El acceso a los profesionales de la salud con una buena formación y disposición es uno de los retos sanitarios más importantes en el entorno rural. Sin el acceso local, es poco probable que los integrantes de las comunidades rurales alejadas puedan alcanzar los Objetivos de Desarrollo del Milenio. Diversos estudios llevados a cabo en numerosos países han reflejado que los tres factores que más influyen a la hora de optar por el ejercicio de la profesión en un entorno rural son: (a) la experiencia en el entorno rural; (b) las experiencias clínicas y formativas positivas en entornos rurales durante la formación médica universitaria; y (c) la formación especializada sobre el ejercicio de la profesión en entornos rurales durante los años de especialización. Este artículo presenta los datos de las iniciativas políticas relacionadas con la formación de los estudiantes de medicina, procedentes de entornos rurales alejados, en

esos entornos y para ejercer su profesión en ellos. Ofrecemos ejemplos de las facultades de medicina de diversas regiones del mundo que emplean un enfoque educativo basado en los hechos y orientado hacia el entorno, para formar profesionales de la salud capacitados y motivados. También demostramos cómo influye el entorno en el diseño y la aplicación de los distintos programas educativos rurales. Los programas adecuados superaron importantes obstáculos, como los prejuicios y las actitudes negativas, además de las limitaciones en cuanto a los recursos humanos, físicos, educativos y económicos. La formación de profesionales sanitarios en entornos rurales facilitará la contratación y la permanencia del personal sanitario capacitado en zonas rurales y marginadas, mejorando de este modo el acceso de las comunidades locales a la atención sanitaria.

References

1. Strasser R. Rural health around the world: challenges and solutions. *Fam Pract* 2003;20:457–63. doi:10.1093/fampra/cm9422 PMID:12876121
2. Rosenman SJ, Batman GJ. Trends in general practitioner distribution from 1984 to 1989. *Aust J Public Health* 1992;16:84–8. doi:10.1111/j.1753-6405.1992.tb00031.x PMID:1627719
3. Barer ML, Stoddart GL. Toward integrated medical resource policies for Canada: 8. Geographic distribution of physicians. *CMAJ* 1992;147:617–23. PMID:1521207
4. Rosenblatt RA, Whitcomb ME, Cullen TJ, Lishner DM, Hart LG. Which medical schools produce rural physicians? *JAMA* 1992;268:1559–65. doi:10.1001/jama.268.12.1559 PMID:1308662
5. Rourke JTB, Incitti F, Rourke LL, Kennard M. Keeping family physicians in rural practice. Solutions favoured by rural physicians and family medicine residents. *Can Fam Physician* 2003;49:1142–9. PMID:14526866
6. Tesson G, Curran VR, Strasser RP, Pong RW. Adapting medical education to meet the physician recruitment needs of rural and remote regions in Canada, the US and Australia. In: *National health workforce assessment of the past and agenda for the future*. Rotem A, Perfilieva G, Dal Poz MR, Doan BDH. Paris: Centre de Sociologie et de Démographie Médicales; 2006.
7. Wilson NW, Couper ID, De Vries E, Reid S, Fish T, Marais BJ. A critical review of interventions to redress the inequitable distribution of healthcare professionals to rural and remote areas. *Rural Remote Health* 2009;9:1060. PMID:19530891
8. Strasser R. Training for rural practice: lessons from Australia. In: *Carl Moore Lecture, McMaster University, Hamilton, ON, Canada, April 2001*. Available from: http://fammedmcmaster.ca/faculty/development/carl_moore_lectureship/lecture_2001.pdf [accessed 9 August 2010].
9. Hays R, Sen Gupta T. Ruralising medical curricula: the importance of context in problem design. *Aust J Rural Health* 2003;11:15–7. doi:10.1046/j.1440-1584.2003.00483.x PMID:12603441
10. Working group on postgraduate education for rural family practice. *Postgraduate education for rural family practice: vision and recommendations for the new millennium*. Mississauga: College of Family Physicians of Canada; 1999.
11. Hogenbirk JC, Wang F, Pong RW, Tesson G, Strasser RP. *Nature of rural medical practice in Canada: an analysis of the 2001 National Family Physician Survey*. Sudbury: Centre for Rural and Northern Health Research, Laurentian University; 2004.
12. Rabinowitz HK, Diamond JJ, Markham FW, Wortman JR. Medical school programs to increase the rural physician supply: a systematic review and projected impact of widespread replication. *Acad Med* 2008;83:235–43. doi:10.1097/ACM.0b013e318163789b PMID:18316867
13. Glasser M, Hunsaker M, Sweet K, MacDowell M, Meurer M. A comprehensive medical education program response to rural primary care needs. *Acad Med* 2008;83:952–61. doi:10.1097/ACM.0b013e3181850a02 PMID:18820528
14. Brooks RG, Walsh M, Mardon RE, Lewis M, Clawson A. The roles of nature and nurture in the recruitment and retention of primary care physicians in rural areas: a review of the literature. *Acad Med* 2002;77:790–8. doi:10.1097/00001888-200208000-00008 PMID:12176692
15. Chan BTB, Degani N, Crichton T, Pong RW, Rourke JTB, Goertzen J et al. Factors influencing family physicians to enter rural practice: does rural or urban background make a difference? *Can Fam Physician* 2005;51:1246–7. PMID:16926939
16. Dunbabin JS, Levitt L. Rural origin and rural medical exposure: their impact on the rural and remote medical workforce in Australia. *Rural Remote Health* 2003;3:212. PMID:15877502
17. Easterbrook M, Godwin M, Wilson R, Hodgetts G, Brown G, Pong RW et al. Rural background and clinical rural rotations during medical training: effect on practice location. *CMAJ* 1999;160:1159–63. PMID:10234346
18. Wang L. A comparison of metropolitan and rural medical schools in China: which schools provide rural physicians? *Aust J Rural Health* 2002;10:94–8. PMID:12047503
19. Wilkinson D, Laven G, Pratt N, Beilby J. Impact of undergraduate and postgraduate rural training, and medical school entry criteria on rural practice among Australian general practitioners: national study of 2414 doctors. *Med Educ* 2003;37:809–14. doi:10.1046/j.1365-2923.2003.01596.x PMID:12950945
20. Curran VR, Rourke JTB. The role of medical education in the recruitment and retention of rural physicians. *Med Teach* 2004;26:265–72. doi:10.1080/0142159042000192055 PMID:15203506
21. Hartley S, Macfarlane F, Gantley M, Murray E. Influence on general practitioners of teaching undergraduates: qualitative study of London general practitioner teachers. *BMJ* 1999;319:1168–71. PMID:10541508
22. Tesson G, Strasser R, Pong RW, Curran V. Advances in rural medical education in three countries: Canada, The United States and Australia. *Rural Remote Health* 2005;5:397. PMID:16283826
23. Matsumoto M, Inoue K, Kajii E. A contract-based training system for rural physicians: follow-up of Jichi Medical University graduates (1978–2006). *J Rural Health* 2008;24:360–8. doi:10.1111/j.1748-0361.2008.00182.x PMID:19007390
24. Strasser R, Lanphear J. The Northern Ontario School of Medicine: responding to the Needs of the People and Communities of Northern Ontario. *Educ Health (Abingdon)* 2008;20. PMID:19967640
25. Longombe AO. Medical schools in rural areas—necessity or aberration? *Rural Remote Health* 2009;9:1131. PMID:19653801
26. Worley PS, Prideaux DJ, Strasser RP, Silagy CA, Magarey JA. Why we should teach undergraduate medical students in rural communities. *Med J Aust* 2000. a172:615–7. PMID:10914111

27. Worley PS, Strasser RP, Prideaux DJ. Can medical students learn specialist disciplines based in rural practice: lessons from students' self reported experience and competence. *Rural Remote Health* 2004;4:338. PMID:15887993
28. Boelen C. Prospects for change in medical education in the twenty-first century. *Acad Med* 1995;70(Suppl):S21–8. discussion S29–31 doi:10.1097/00001888-199507000-00017 PMID:7626157
29. THEnet: Training for Health Equity Network [Internet site] Available from: www.thenetcommunity.org [accessed 9 August 2010].
30. Palsdottir B, Neusy A-J, Reed G. Building the evidence base: networking innovative socially accountable medical education programmes. *Education for Health* 2008;21:2. Available from: <http://www.educationforhealth.net> accessed 9 August 2010].
31. Neusy A-J, Palsdottir B. A roundtable of innovative leaders in medical education. *MEDICC Rev* 2008;10:420–4.
32. Worley PS, Silagy CA, Prideaux DJ, Newble D, Jones A. The parallel rural community curriculum: an integrated clinical curriculum based in rural general practice. *Med Educ* 2000;34:558–65. doi:10.1046/j.1365-2923.2000.00668.x PMID:10886639
33. Worley PS, Prideaux DJ, Strasser RP, March R, Worley E. What do medical students actually do on clinical rotations? *Med Teach* 2004;26:594–8. doi:10.1080/01421590412331285397 PMID:15763847
34. Worley PS, Esterman A, Prideaux DJ. Cohort study of examination performance of undergraduate medical students learning in community settings. *BMJ* 2004;328:207–9. doi:10.1136/bmj.328.7433.207 PMID:14739189
35. Worley P. Flinders University School of Medicine, Northern Territory, Australia: achieving educational excellence along with a sustainable rural medical workforce. *MEDICC Rev* 2008;10:30–4.
36. Ontario Ministry of Northern Development and Mines. *Northern Ontario Overview*. Toronto: Government of Ontario Publications; 2004.
37. Bains N, Dall K, Hay C, Pacey M, Sarkella J, Ward M. *Population health profile: North East LHIN*. Toronto: Government of Ontario Publications; 2004.
38. Bains N, Dall K, Hay C, Pacey M, Sarkella J, Ward M. *Population health profile: North West LHIN*. Toronto: Government of Ontario Publications; 2004.
39. Tesson G, Hudson G, Strasser R. *The making of the Northern Ontario School of Medicine: a case study in medical education*. Montreal: McGill Queens University Press; 2009.
40. Strasser RP, Lanphear JH, McCready WG, Topps MH, Hunt DD, Matte MC. Canada's new medical school: The Northern Ontario School of Medicine: social accountability through distributed community engaged learning. *Acad Med* 2009;84:1459–64. doi:10.1097/ACM.0b013e3181b6c5d7 PMID:19881443
41. Strasser S, Strasser RP. The Northern Ontario School of Medicine: a long-term strategy to enhance the rural medical workforce. *Cah Social Demogr Med* 2007;47:469–89. PMID:18251460
42. Centre for Rural and Northern Health Research. Exploring the socio-economic impact of the Northern Ontario School of Medicine [Final report]. Thunder Bay & Sudbury: Lakehead University & Laurentian University; 2009.
43. Heng D, Pong RW, Chan BT, Degani N, Crichton T, Goertzen J et al. Graduates of northern Ontario family medicine residency programs practise where they train. *Can J Rural Med* 2007;12:146–52. PMID:17662174
44. Zamboanga Medical School Foundation [Internet site]. Available from: <http://som.adzu.edu.ph/info/?page=About%20Us> [accessed 9 August 2010].
45. Cristobal F. Creating a new rural focused medical school: the Asian experience. In: *7th Wonca World Conference on Rural Health, Seattle, USA, 2006*.
46. Boelen C. A new paradigm for medical schools a century after Flexner's report. *Bull World Health Organ* 2002;80:592–3. PMID:12163925
47. Boelen C, Woollard B. Social accountability and accreditation: a new frontier for educational institutions. *Med Educ* 2009;43:887–94. doi:10.1111/j.1365-2923.2009.03413.x PMID:19709014