



What evidence-based undergraduate interventions promote rural health?

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Abstract

Aims This article identifies published reports of medical undergraduate rural programmes from international medical schools and investigates the features making these programmes successful in recruiting and retaining rural physicians.

Method Literature review.

Results Ten successful programmes were identified. Common features included selective admission, curricular focus on primary care/family medicine, community-based teaching, and community/rural preceptorship. A strong association exists between rural background of the student and choice of both a rural career and a career in primary care. Medical students of rural origin with an initial interest in a generalist career are significantly more likely to enter rural practice. Community preceptorship with its high staff:student ratio has been effective in influencing students' career choices.

Conclusions The effectiveness of a medical undergraduate rural programme in preparing and recruiting physicians for rural practice does not occur with one isolated strategy but with a chronological sequence of interventions. The most effective programmes consider both pre-medical school and medical school educational factors. Medical schools would need to implement a combination of these strategies when designing a programme to maximise success.

New Zealand's economy depends largely on agricultural industries; it has been stated that rural New Zealand is the barometer of our economy and rural health care is an indicator and predictor of the future health care in New Zealand.¹ Furthermore, rural health care is difficult and expensive to provide. New Zealand Government rural and primary care health policy documents released in the last three years have recommended changes^{2,3} and initiatives in an attempt to address this difficulty.⁴

New Zealand has a rural doctor shortage crisis that is not unique to this country.⁵⁻⁷ The problem has existed for years and the future does not look promising with only 1% of medical students at the Christchurch School of Medicine indicating they would practise rurally.^{8,9}

General practitioners (GPs) constitute the main medical workforce in rural New Zealand, and some of the reasons given for rural practice being unattractive have been identified:¹⁰⁻¹⁴

- Lack of locum relief for both holidays and continuing medical education (CME),
- Lack of quality CME opportunities,
- Heavy on-call and usual workload,

- Non-clinical administrative responsibilities,
- Professional isolation from specialised medical and other health professional support, and
- Social and cultural isolation for medical families and lack of ideal educational opportunities for school-aged children

Significantly, the current shortage of rural GPs has made conditions more difficult for the rural GPs remaining.¹²

The New Zealand general practice workforce is maldistributed in terms of geographic location and specialty choice. Only 4.2% of New Zealand-trained GPs' main work location at 17 years post-graduation was in minor urban, rural, and coastal areas (0–9,999 population)¹⁵ where 23% of New Zealanders lived (according to the 2001 Census). On the other hand, over 95% of New Zealand-trained GPs worked mainly in main urban and secondary urban areas (10,000+ population)¹⁵ where only 77% of New Zealanders resided.

New Zealand relies heavily on foreign-trained GPs^{12,16,17} to service its rural population, but it has to compete hard with the international market for the diminishing supply¹⁶ of rural doctors. It is essential for New Zealand to produce a healthy supply of rural doctors domestically.

The literature describes three main factors related to rural recruitment and retention:

- Pre-medical school factors, such as rural upbringing and initial specialty preference,
- Medical undergraduate education, and
- Postgraduate residency training.¹⁸

Recruitment is defined as 'enrolment of primary care physicians into rural practice' and retention relates to the 'length of time in either the original rural community or any other subsequent rural location'.¹⁸

Undergraduate medical education plays a significant role in recruiting and retaining rural physicians,¹⁸ and the New Zealand Ministry of Health has requested that New Zealand medical schools assist with the recruitment of more young doctors to practise in under-served rural areas of New Zealand.

If the medical schools in New Zealand are to develop programmes that will encourage an interest in rural practice and subsequent recruitment, then it is important to evaluate present successful programmes. Effectiveness of any such programme must be determined by an unbiased, evidence-based examination of the interventions that work and those that do not. The main question to answer is '*what can medical schools do to increase the supply of rural physicians?*' The Medical Council of New Zealand commissioned the answer to this question through its summer studentship sponsorship programme. The full report is available from the Medical Council of New Zealand on request, and the following is a summary of the findings.

Method

A literature search was the sole methodology of this research project. Articles most suitable for this research were selected from a wide range of sources based on the

title, content, nature (editorial, letter, opinion, original study, and review article), year published, and country of publication. The search initially selected publications from Australia, Canada, and the United States because, similar to New Zealand, they were English-speaking countries that had comparable medical education systems and areas of remote geography. However any other countries with long-standing, well-evaluated programmes were considered as well. Email communication with international organisations, medical schools, and local and international rural medicine academics was used to inquire about updates of the programme or to request further information on imminent publications describing more recent evaluation data.

Inclusion criteria used to rate success included:

- The duration of the programme (greater than or equal to 12 months),
- Number of years of operation (greater than or equal to 10 years),
- The extensiveness of evaluation of the programme,
- Frequency of citation by other studies, and
- Programme features and statistical analysis of the original studies by personnel involved in the programme.

Information was collected from the following databases:

- Ovid MEDLINE and EMBASE
Rural health, rural medicine, undergraduate medical education, curriculum and rural medical school were used as key words in searches.
- General GOOGLE internet search engine
GOOGLE was used to search for both international and New Zealand information, including websites for specific undergraduate rural programmes.
- Email communication with international organisations, medical schools, and local and international rural medicine personnel.
- A manual search of the New Zealand Medical Journal website, and previous paper-based issues
New Zealand rural healthcare information was retrieved from the *New Zealand Medical Journal*, from both paper-based (before 7/7/2002) and electronic issues (7/7/2002 and after).
- Email communication with New Zealand organisations
Statistics New Zealand and the Medical Council of New Zealand were contacted for the New Zealand workforce information.
- References from relevant articles
Further articles were obtained from the reference sections of relevant articles.

Results

A total of 107 references, published between 1961 and 2001, were collected relevant to the topic. Of the 32 email contacts made, 20 replies were received and, of these 20 replies, 15 produced useful information and/or further links to requested information.

A total of 22 original articles were published on 10 successful medical undergraduate courses/programmes (five programmes had more than one articles published on them) to demonstrate the favourable outcomes of the strategies implemented by individual programmes. These programmes are listed in Table 1.¹⁹⁻⁴⁰ The specific features of each programme and the key findings are found in Table 2.

Measures used by the authors (of the 22 original articles) to assess outcomes of success in these 10 programmes included practice location, specialty selection, rural practice and under-served area locations, doctor:population ratio, residency choice, gender differences, physician distribution according to area of upbringing, physician intention of settlement, contract completion, influence of clinical campus location on practice location, population of hometown, and influence on practice location.

Eight of the 10 programmes are based in the United States, one in Japan, and one in Norway. Many of these programmes have been in operation for two to three decades and have all been well evaluated. While the United States has contributed the most evidence on this topic, not all interventions within an American setting can be directly transferable to a New Zealand setting. Evidence of the effectiveness of Australian and Canadian programmes is presently not available, as the introduction of educational strategies to redress the physician maldistribution has only occurred in the last decade.

(See Table 1 and Table 2 below.)

Table 1. Identified rural medical programmes

PROGRAM & COMMENCEMENT YEAR	UNIVERSITY	LOCATION	PROGRAM LENGTH	ENTRY	REFERENCES
WWAMI (1971)	University of Washington School of Medicine	Washington, Wyoming, Alaska, Montana, Idaho states	4 years	Post-graduate entry	19-22
Rural Physician Associate Program (1971)	University of Minnesota Medical School and University of Minnesota Duluth School of Medicine	Minnesota state	9-12 months clinical education program	Post-graduate entry	23-24
Duluth School of Medicine (1971)	University of Minnesota	Minnesota state	2 years	Post-graduate entry	25
Tromsø School of Medicine (1972)	University of Tromsø School of Medicine	Tromsø, Norway	7 years	Under-graduate entry	26
Jichi Medical School (1972)	Jichi Medical School	Tochigi, Japan	6 years at JMS 2-3 years postgraduate training at home prefecture	Under-graduate entry	27
Upper Peninsula Medical Education Program (1974)	Michigan State University College of Human Medicine	Michigan state	4 years	Post-graduate entry	28
Physician Shortage Area Program (1974)	Thomas Jefferson University, Jefferson Medical College	Pennsylvania state	4 years	Post-graduate entry	29-34
Primary Care Curriculum (1979)	University of New Mexico School of Medicine	New Mexico state	4 years	Post-graduate entry	35-36
Rural Health Scholars Program (1993)	Brody School of Medicine at East Carolina University and the University of North Carolina School of Medicine	North Carolina state	3 years	Post-graduate entry	37
Rural Medical Education Program (1993)	University of Illinois College of Medicine	Illinois state	4 years	Post-graduate entry	38-40

Table 2. Features and outcomes of identified programmes

PROGRAM	STATED GOALS	FEATURES	KEY FINDINGS	
			MEASURE	OUTCOME
WWAMI	<p>“Increase the number of students... from the states of Washington, Alaska, Montana and Idaho.”²⁰</p> <p>“Increase the number of students being trained for careers in primary care...”</p> <p>“Place physicians in areas of need.”</p> <p>“Bring the resources of the Medical Center in Seattle to the communities throughout the four states that have need of them.”</p> <p>“Accomplish the programmatic goals without new capital construction.”</p>	<p>Decentralised teaching</p> <p>Rural student selection</p>	Practice location ²⁰	23% of the graduates with WAMI experience versus 13% of all US physicians practiced in nonmetropolitan areas where 24% of the US population resided.
			Specialty selection ²⁰	61% of the graduates with WAMI experience versus 35% of all US physicians practiced primary care medicine; ideally 50% of all physicians would be in primary care.
Rural Physician Associate Program	<p>“... to influence students to practise medicine in rural Minnesota and its region; to help students experience the work and life-style of doctors and their families in rural setting; to teach them to be independent learners and problem-solvers; to give them confidence and proficiency in primary health and disease care; and to help them develop sensitivity and awareness of other elements in patient care besides biological and procedural medicine...”²³</p>	<p>Voluntary program with screened entry</p> <p>Rural preceptorship</p> <p>Decentralised teaching in the rural setting</p> <p>Financial aid</p> <p>Run by the Department of Family Practice and Community Health</p>	Rural Practice ^{23,24}	<p>57% of the RPAP graduates, majority of which were in Minnesota and/or in communities of 10,000 or less.</p> <p>This overall percentage is lower than for 1971-75 (80%) because graduates after 1975 spent 2 additional years in residencies, which spent in urban areas counteracted the effect of RPAP.</p>
			Doctor : Population ratio ^{23,24}	1:2,500 or better in all 87 counties in Minnesota for the first time ever.
			NBME I & II ^{23,24}	Compared with non-RPAP students, RPAP students scored lower in NBME-I but higher in NBME-II, demonstrating greater improvement in scores.

			Specialty selection and practice location ^{23,24}	74% of all RPAP graduates were in primary care and 63.5% in family practice. 88.6% of the RPAP graduates remaining in Minnesota were in primary care, 71% in family practice, 58.8% in rural areas, 68% were in communities of 25,000 or less.
Duluth School of Medicine	"... increasing the number of well-trained physicians entering family medicine and who will practice in rural and non-urban settings." ²⁵	Preferential admission The Department of Family Medicine is responsible for all clinical education and a major part of non-clinical education Community-based clinical teaching Community Family Practice preceptorship	Residency choice ²⁵	69% of all UMD graduates entered primary care residencies, 53% entered family medicine residencies.
			Practice location ²⁵	54% of all practicing UMD graduates worked in communities of less than 30,000, 40% in communities of less than 20,000. 58.4% of all practicing alumni were in Minnesota, another 16.2% were in neighbouring states.
			Gender differences ²⁵	About 50% of all male and female graduates were in rural practice.
			Retention ²⁵	More than 80% of all UMD graduates remained in the same community they selected after their training.
Tromsø School of Medicine	"the establishment of a university in Tromsø... would recruit students who, after graduation, would be willing to stay in the north and thus enhance the quality of health services in these areas." ²⁶	Rural location of the school Quota arrangement for number of northern students admitted (recruitment of rural students at least 50%)	Physician distribution ²⁶	56.1% of physicians in northern Norway, 43.9% in southern Norway.

			Physician distribution according to area where they grew up ²⁶	82% of those grew up in the north were currently practising in the north.
			Physician intention of settlement ²⁶	73.1% of those who grew up in the north had settled or intended to settle in the north.
Jichi Medical School	"... to train doctors with clinical skills and a commitment to rural practice combined with the goal of making progress in medical science and promoting community health." ²⁷	Financial aid Home prefecture recruitment scheme Non-urban location Management by prefectures and support from national government	Contract completion ²⁷	93% of the first 9 graduating classes completed 9 years of contracted work. 96% of all JMS graduates had completed their contracts.
			Practice location ²⁷	67% of the first 9 graduating classes remained in the prefecture where they returned after graduation. 33% of the first 9 graduating classes remained in rural areas. 42% of all JMS graduates remained in rural areas.
Upper Peninsula Medical Education Program	"to improve the physician supply in rural areas of Michigan by training students in a rural, practice-based setting." ²⁸	Decentralised teaching Preferential admission of rural students Preceptorship Extensive family medicine and primary care experience	Specialty choice ²⁸	46.5% of the Upper Peninsula graduates versus 30% of the downstate graduates versus 13% of all US physicians practiced family medicine.
			Family medicine experience ²⁸	64% of the UP graduates versus 29% of the downstate graduates reported positive experiences leading to choice of primary care specialties.
			Role model influence ²⁸	79% of the UP graduates versus 49% of the downstate graduates reported important influence of role model in choice of specialty.

			Responsibility for patient care ²⁸	68% of the UP graduates versus 33 of the downstate graduates reported a high level of direct patient care responsibility.
			Population of practice community ²⁸	50% of the UP graduates versus 40% of the downstate graduates versus 13% of all US physicians practiced rurally.
			Influence of clinical campus location on practice location ²⁸	61% of the UP graduates versus 16% of the downstate graduates reported a positive influence of medical school location on preference for rural practice locations.
			Population of hometown ²⁸	78% of the UP graduates versus 28% of the downstate graduates had come from towns with populations less than 50,000.
			Influence of hometown size on practice location ²⁸	43% of the UP graduates versus 26% of the downstate graduates reported a preference to practice in a town of similar size to their hometowns.
Physician Shortage Area Program	"preferentially admits medical school applicants from rural backgrounds who intend to practice family medicine in rural and underserved areas." ³¹	<ul style="list-style-type: none"> Preferential admission Curricular emphasis on family medicine Rural family medicine preceptorship Rural clerkship Student commitment to family medicine residency Financial aid 	Specialty choice in 1996 ³³	52% of the PSAP graduates (1978-1991) versus 13% of the non-PSAP graduates were in family medicine.
			Practice location in 1996 ³³	<p>34% of the PSAP graduates (1978-1991) versus 11% of the non-PSAP graduates were in rural areas.</p> <p>30% of the PSAP graduates (1978-1991) versus 9% of the non-PSAP graduates were in physician-shortage areas.</p>

			Specialty and practice location in 1996 ³³	21% of the PSAP graduates (1978-1991) versus 2% of the non-PSAP graduates had combined a career in family medicine with a practice location in a rural area. 19% of the PSAP graduates (1978-1991) versus 2% of the non-PSAP graduates had combined a career in family medicine with a practice location in a physician-shortage area.
Primary Care Curriculum	"to equip graduates with skills in self-directed, lifelong learning, and to attract students to careers in primary care in rural and other underserved areas." ^{35,36}	Clinical problem-based, student-centered, small-group learning Community-oriented learning (including rural clerkship and preceptorship)	NBME-I performances ^{35,36}	PCC students scored lower compared with conventional-track students.
			NBME-II ^{35,36}	PCC students scored higher compared with conventional-track students.
			Third-year clinical rotation subscores ^{35,36}	PCC students scored higher compared with conventional-track students.
			Distress level ^{35,36}	PCC students had a lower level of stress compared with conventional-track students.
			Retention of interest in family medicine ^{35,36}	42% of the PCC students versus 29% of the conventional-track students who were interested in family medicine at orientation were more likely to retain this interest at graduation.
			Career preference shift ^{35,36}	39% of the PCC students versus 14% of the conventional-track students were more likely to switch career preferences to family medicine from other specialties by graduation.
			Primary care physicians ^{35,36}	49% of the PCC graduates versus 41% of the conventional-track graduates considered themselves primary care physicians.
			Family medicine physicians ^{35,36}	42% of the PCC graduates versus 26% of the conventional-track graduates practiced family medicine.

			Practice in underserved areas ^{35,36}	37% of the PCC graduates versus 10% of the conventional-track graduates practiced in underserved areas
			Uncollected bills ^{35,36}	24% of the PCC graduates versus 18% of the conventional-track graduates had uncollected bills.
Rural Health Scholars Program	"to develop a cadre of primary care physicians-leaders to work in rural, underserved areas of North Carolina." ³⁷	Enrichment program Selective recruitment Preceptorship and clinical rotations in rural, underserved areas Close staff-student contact throughout course and residency	Residency programs in primary care ³⁷	More RHSP students matched into primary care residencies compared with students from comparison groups.
			Residency in family medicine ³⁷	More RHSP students matched into family medicine residencies compared with students from comparison groups.
			Residency programs in community hospitals ³⁷	More RHSP students matched into residency programs in community hospitals compared with students from comparison groups.
Rural Medical Education Program	"... to select students who possess traits indicative of success in eventual rural family practice." ⁴⁰ "... producing family physicians for rural Illinois."	Enrichment program Preferential admission Curricular emphasis on family medicine Student/peer support Preceptorship in the rural setting	Rural representation ⁴⁰	Students represent 64% of Illinois' rural counties with a mean hometown size < 7,700 and 87% from designated rural counties.
			Family practice residencies and primary care ⁴⁰	82% in primary care and 69% of RMED alumni in family practice residencies.

Discussion

Selective admission, curricular emphasis on primary care/family medicine, decentralised/community-based teaching, and preceptorship have been found to be the four common features that seem to have made the ten identified undergraduate rural programmes successful.

Selective/preferential admission or affirmative action for students of rural origin is a strategy developed as a consequence of extensive research evidence demonstrating a strong association between rural background and graduates' choice of rural careers. The strongest relationship with non-urban practice is a non-urban background of doctors (and their spouses)^{31,41-44,45} and a career in primary care.^{31,43,44,46,47} Because of these observations, successful schools have developed selection policies specifically to admit students with rural ties and an interest in family practice.

Students of rural origins have also demonstrated more positive attitudes towards postgraduate training and careers in rural regions^{48-50,51} which may explain the strong association between rural origin and rural practice location. One follow-up study, of Jefferson Medical College graduates, showed that graduates with rural backgrounds who did not have a special curriculum were still more likely than other graduates to enter rural practice.³⁴ As expected however, those graduates with rural backgrounds, an interest in family medicine, and a special curriculum were the most likely to enter rural practice.³⁴

Rabinowitz has evaluated the differential effect of rural background, admission policy and curriculum on subsequent choice of rural career.³⁴ Admission policies were found to be more powerful than curriculum characteristics. From the data provided in this study, we found that the numbers needed to 'teach' in a special curriculum to result in one extra rural practitioner is 17. In contrast, the number needed to 'admit' (under revised admission criteria to result in one extra rural practitioner) is six. Clearly therefore, there are powerful factors acting outside the control of medical schools that influence a choice of rural practice.

Currently, rural students are under-represented at the Otago Medical School.⁵² If society and the government are seriously committed to increasing the rural supply of doctors, then the discussions to change admission policies and curriculum should involve ideas on how to increase the number of rural students studying medicine.

An emphasis on primary care throughout all years of the curriculum is believed to contribute significantly towards producing primary care physicians for rural areas. It has also been found that a programme that offers longitudinal primary care experiences is associated with more students choosing primary care careers.⁵³ Even though undergraduate rural rotations do not prepare for rural living, they can prepare for rural practice if they are of three months or longer in duration.⁵¹

Medical schools in Australia and Canada have been moving towards offering decentralised and community-based teaching^{5,6} after such strategies have demonstrated success in the United States,^{20-25,28-36,39,40} Japan,²⁷ and Norway.²⁶ It has been found that the rural location of a medical school is strongly associated with the number of rural physicians it produces and that the more rural a medical school's location, the more graduates of that school would enter rural practice.⁴⁷

Delivering undergraduate medical education in a rural area provides more benefit than just the production of rural physicians. Students are exposed to more patients and hands-on experiences, and they gain a holistic education in a primary care-based environment where they can integrate the impact of an illness or condition on the patient, their family, and the community.^{36,54–57,58}

In 2000, the Dunedin School of Medicine through Te Waipounamu Rural Health Unit established a 7-week rural attachment as part of its 5th year undergraduate programme. The students were exposed to patients in the community practice and rural hospitals. Findings from a survey of the students, before and after the attachment, resulted in more students considering rural general practice as a career choice, increased the stated likelihood of students entering rural general practice, increased the number of students viewing rural general practice positively, and increased the students' awareness of rural general practice as a distinct discipline. And confirming overseas findings, students of rural origin also indicated a higher likelihood of entering rural general practice than their urban colleagues.⁵⁹

The University of Auckland School of Medicine, and the other schools within the University of Otago, have now established similar initiatives where students spend at least 4 weeks in rural areas as part of their general practice teaching. Currently no data have been published on the outcomes of these initiatives.

Preceptorship or mentorship in primary care during rural clerkships is another strategy shared by several model programmes. Teaching in the rural setting is generally achieved at the primary care doctor's office and having the doctor act as the student's educational facilitator. Students develop clinical and communication skills under the guidance of the preceptor. It is under this informal, friendly, and high staff-student contact environment⁵⁷ that the medical student matures. Preceptors have also been found to be influential in students' career choices and this, combined with the excellent preceptorship teaching,^{37,57} is likely to have contributed to the success of the rural programmes. Herein lies a paradox—success requires a high teacher:student ratio—something that any student in any setting might benefit from. However, the rural setting is now characterised by overworked practitioners. Would they have the spare capacity to provide this high quality contact if the numbers of students were increased?

'Effectiveness (of a programme) is not with one isolated strategy but a chronological sequence of interventions'. (Personal communication: Whiteside C, University of British Columbia.) This review of the literature has demonstrated one important lesson: any new model implemented as a solution to the rural doctor shortage requires long-term planning by university institutions with a commitment to the vision and a recognition that numerous interventions at various stages of the educational process are required. An integration of different strategies will maximise success. Special admission policies combined with a customised curriculum and a preceptorship at a decentralised teaching post are certainly features that should be taken into consideration when designing a programme to help redistribute doctors into rural areas.

All these interventions however come at a cost. Brooks and colleagues have said it well—'*policies for staffing rural areas with primary care physicians should be aimed at both selecting the right students and giving them during their formal training the*

curriculum and then experiences that are needed to succeed in primary care in rural settings'.⁵³ Therefore, the recent initiative to increase places for rural medical students is an important step in the right direction. As well as strategies at the undergraduate level, medicine should be promoted as a career to high school rural students at the pre-medical school level, and rural training should be implemented to prepare graduates for small-town living at the postgraduate level.

While beyond the scope of this review, these coordinated strategies also need to examine incentives to retain doctors already working within rural settings. Introducing reform to construct a sustainable New Zealand rural medical workforce is not easy and it requires time and patience, though tempered with a sense of urgency. With careful planning and a long-term vision, the end result, long overdue, should be successful.

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