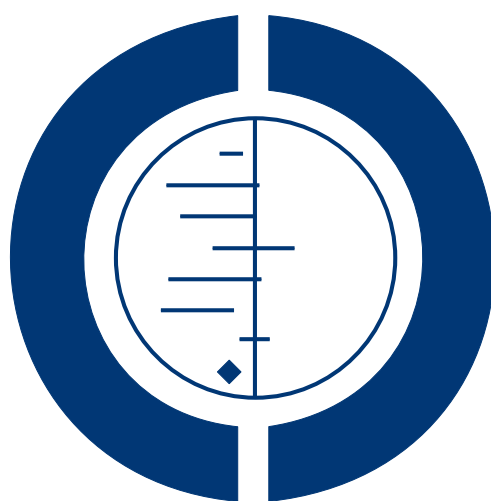


# Interventions for increasing the proportion of health professionals practising in rural and other underserved areas (Review)

Grobler L, Marais BJ, Mabunda SA, Marindi PN, Reuter H, Volmink J



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[Intervention Review]

# Interventions for increasing the proportion of health professionals practising in rural and other underserved areas

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**Editorial group:** Cochrane Effective Practice and Organisation of Care Group.

**Publication status and date:** Edited (no change to conclusions), published in Issue 2, 2009.

**Review content assessed as up-to-date:** 17 September 2007.

**Citation:** Grobler L, Marais BJ, Mabunda SA, Marindi PN, Reuter H, Volmink J. Interventions for increasing the proportion of health professionals practising in rural and other underserved areas. *Cochrane Database of Systematic Reviews* 2009, Issue 1. Art. No.: CD005314. DOI: 10.1002/14651858.CD005314.pub2.

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## ABSTRACT

### Background

The inequitable distribution of health professionals, within and between countries, poses an important obstacle to the achievement of optimal attainable health for all.

### Objectives

To assess the effectiveness of interventions aimed at increasing the proportion of health professionals working in rural and other underserved areas.

### Search strategy

We searched the specialised register of the Cochrane Effective Practice and Organisation of Care Group (up to July 2007), the Cochrane Central Register of Controlled Trials (CENTRAL) and the Database of Abstracts of Reviews of Effectiveness (up to July 2007), MEDLINE (1966 to July 2007), EMBASE (1988 to July 2007), CINAHL (1982 to July 2007) and LILACS (up to July 2007). We also searched reference lists of all papers and relevant reviews identified, and contacted authors of relevant papers regarding any further published or unpublished work.

### Selection criteria

Randomised controlled trials, controlled trials (not strictly randomised), controlled before-after studies and interrupted time series studies evaluating the effects of various interventions (e.g. educational, financial or regulatory strategies) on the recruitment and/or retention of health professionals in under-served areas.

### Data collection and analysis

Two reviewers independently screened titles and abstracts obtained from the search in order to identify potentially relevant studies.

### Main results

No studies met the inclusion criteria.

## Authors' conclusions

There are no studies in which bias and confounding are minimised to support any of the interventions that have been implemented to address the inequitable distribution of health care professionals. Well-designed studies are needed to confirm or refute findings of various observational studies regarding educational, financial, regulatory and supportive interventions that may influence health care professionals' choice to practice in underserved areas. Governments and educators should ensure that where interventions are implemented this is done within the context of a well-planned study so that the true effects of these measures on recruitment and long term retention can be determined in various settings.

## PLAIN LANGUAGE SUMMARY

### Strategies to increase the proportion of health care professionals practising in rural and other underserved areas

In almost all countries around the world, there are fewer health care professionals working in rural and urban underserved areas. In urban areas in Australia, there is one doctor for every 970 people, but in rural areas there is one for every 1328 people. In the United States of America, only 9% of physicians practice in rural areas where 20% of the population live. In low- and middle-income countries the shortage is even greater. This shortage makes it particularly difficult for people in underserved areas to access health services and be healthy.

While some health care professionals choose to work in underserved areas, they are a small minority and strategies are needed to persuade more to do so. A variety of strategies have been adopted including educational, financial, regulatory and supportive strategies. For example, some medical schools try to recruit more people from rural areas in the hope that they will return to those areas to practice. Scholarships, grants, loan repayment schemes, and higher salaries are offered to professionals working in underserved areas. A number of countries have made it mandatory for health care professionals to work for a period of time in underserved areas.

While some of these strategies have shown promise, this review found no well-designed studies to say whether any of these strategies are effective or not. Rigorous studies are needed to evaluate the true effect of these strategies to increase the number of health care professionals working in underserved areas.

## BACKGROUND

### Description of the condition

The World Health Organisation's Health for All policy states that enjoyment of the highest attainable level of health is a fundamental human right to which all citizens are entitled (Strasser 2003; WHR 2003). The shortage of health care professionals in rural and urban under-served areas, in almost all countries around the globe, is an important obstacle to the achievement of this goal and restricts the attainment of the Millenium Development Goals adopted by the United Nations in 2000 (WHR 2003; Dussault 2006).

The absence of well-functioning health services in many parts of the world is partly a result of insufficient numbers of health professionals, but is to a greater extent related to the inequitable distribution of health professionals at a national and international level (Stratton 1995). For example, in the United States of America, only 9% of registered physicians practice in rural areas where

20% of the population live (Ricketts 2000). In rural areas of Australia, the average doctor:patient ratio was reported to be 1:1328, compared to the urban average of 1:970 (Laven 2003a). In low- and middle-income countries inequities in health care service provision are even greater. For instance, in 1996, 46% of the South African population lived in rural areas (Statistics SA 1996) and were served by only 27% of general practitioners; 25% of medical specialists; 7% of dentists; and 6% of psychologists (van Rensburg 1999). In Ghana in 1997, 87% of general physicians worked in urban areas serving only 44% of the population (Dussault 2006). Statistics from Ecuador in 1991 reveal that one doctor was responsible for the care of approximately 3226 people (Cavender 1998). The inequitable distribution of health professionals between countries is also of concern as a high proportion of health workers from economically less developed countries continue to migrate to richer countries (Mullan 2005). Thirty-seven percent of the world's health workers work in the WHO Region of the Americas, which accounts for only 10% of the global burden of disease. The

WHO African Region, with 24% of the global burden of disease, is served by only 3% of the world's health workers. Furthermore, the African continent, with the highest global disease burden, has the lowest density of health professionals (2.3 health professionals per 1000 population) and spends the lowest proportion (29.5%) of government health expenditure on health worker salaries (WHR 2006).

Possible factors contributing to the reduced number of health care professionals in rural and urban underserved areas include demanding working conditions, substandard medical equipment and facilities, inadequate financial remuneration, inadequate opportunities for personal and professional growth, safety concerns, and lack of job opportunities for spouse and educational opportunities for children (Lehman 2008). It has been suggested that a country's ability to recruit and retain health care professionals in underserved areas ultimately depends upon the provision of a stable, rewarding and fulfilling personal and professional environment (Hart 2002), yet the provision of such an environment continues to elude most countries, independent of their income status.

In resource-constrained countries, rural and other underserved areas are generally worst afflicted by problems such as unemployment, poverty, malnutrition, lack of clean drinking water and poor sanitation (Boulle 1997). These factors contribute to the poor health status of people living in these areas (Strasser 2003). The spatial maldistribution of health workers means that those who have the greatest need have the poorest services; thus fulfilling Hart's "inverse care law" (Hart 1971). Recent literature from sub-Saharan Africa shows that treatment of patients with HIV/AIDS has been severely hampered not merely by the lack of financial resources or medical supplies but by the shortage of health care personnel needed to deliver the treatment (WHR 2003). In Uganda, lack of skilled staff at the primary care level is one of the reasons why pregnant women do not utilise community maternity services, but resort to traditional birthing practices, which result in higher rates of maternal mortality (Kyomuhendo 2003).

### Description of the intervention

While some health care professionals choose to work in underserved areas, they remain a small minority and additional strategies are required to persuade more to do so. These strategies can generally be grouped into educational, financial, regulatory and supportive strategies. Based on observational studies that have reported that health care professionals originating from rural areas are more likely to practise in a rural health care environment (Rabinowitz 1993; Rabinowitz 1998; Stearns 2000), the selection criteria of medical schools and universities have, in some instances, been modified to ensure the recruitment of greater numbers of individuals from rural areas. Financial, cultural and academic support is provided during their medical training in the hope that

once qualified they will return to work in rural areas (Crandall 1990; Rabinowitz 2000).

Some medical school curricula specifically involve greater exposure of undergraduate students to underserved areas (Moore 1998) and concentrate on the development of health care skills relevant to these areas (Rabinowitz 1999). Both these factors are believed to influence the choice of health care professionals to practise in rural or under-served areas once qualified (Brooks 2002; Rabinowitz 2001; Tavernier 2003).

Financial mechanisms that have been implemented to reduce inequitable distribution patterns include scholarships and loan repayment schemes, which are linked to service obligations in underserved areas (Pathman 2000; Scammon 1994). In addition, higher salaries for individuals working in the public health sector as well as rural allowances (Reid 2001) and retention grants (Humphreys 2001) have been introduced in some countries, but the effectiveness of these interventions has not been evaluated.

A number of countries have instituted a mandatory period of service in underserved areas in an attempt to distribute health professionals in a more equitable manner (Cavender 1998; Ezenwa 1986; Fadayomi 1984; Reid 2001). Many wealthy countries attempt to address the problem by simply recruiting foreign health care professionals from poorer countries to work in underserved areas (Kiesouw 1996; Reid 2001), ignoring the negative impact on health services in their country of origin.

### Why it is important to do this review

Given the wide array of strategies that have been adopted to influence locality of practice, it is important for educationalists and policy makers to be aware of scientific evidence that supports the effectiveness and impact of various interventions.

## OBJECTIVES

To assess the effectiveness of interventions aimed at increasing the proportion of health care professionals working in rural and other underserved areas.

## METHODS

### Criteria for considering studies for this review

#### Types of studies

Randomised controlled trials, controlled trials (not strictly randomised), controlled before-after studies and interrupted time series studies that have evaluated the effects of various interventions

on at least one of the outcomes listed below. Studies with historical controls and those that did not include a control or comparison group were not considered.

### Types of participants

All qualified health care professionals, for example: doctors (general practitioners and specialists), nurses, occupational therapists, physiotherapists, speech and hearing therapists, pharmacists, dieticians, clinical psychologists and dentists.

### Types of interventions

Educational interventions (e.g. student selection criteria, undergraduate and postgraduate teaching curricula, exposure to rural and urban underserved areas), financial interventions (e.g. undergraduate and postgraduate bursaries/scholarships linked to future practice location, rural allowances, increased public sector salaries), regulatory strategies (e.g. compulsory community service, relaxing work regulations imposed on foreign medical graduates who are willing to work in rural or urban underserved areas) and support strategies (providing adequate professional support and attending to the needs of the practitioners family). We planned to include studies that compared one of the above strategies with either no intervention or an alternative strategy as a control.

### Types of outcome measures

#### Primary outcomes

- The proportion of health care professionals who initially choose to work in rural or urban underserved areas as a consequence of being exposed to the intervention (recruitment).
- The proportion of health care professionals who continue to work in rural or urban underserved areas as a consequence of the intervention (retention).

There are no internationally agreed definitions for what constitutes “rural underserved” and “urban underserved” areas. These terms tend to be relative and their meaning will vary from country to country. Thus, for each study, we intended to accept the definitions as provided by the authors, recording their particular use in the “table of included studies.”

#### Secondary outcomes

- Patient satisfaction with care provided.
- Impact on health status of patients.

### Search methods for identification of studies

#### Electronic searches

- (1) The EPOC Register (and the database of studies awaiting assessment, up to June 2007)
- (2) The Cochrane Central Register of Controlled Trials (CENTRAL) and the Database of Abstracts of Reviews of Effectiveness (up to June 2007)
- (3) MEDLINE (1966 to June 2007), EMBASE (1988 to June 2007), CINAHL (1982 to June 2007) and LILACS (up to June 2007)

Search strategies for electronic databases were developed using the methodological component of the EPOC search strategy combined with selected MeSH terms and free text terms. [Appendix 1](#) shows the terms used in the MEDLINE search strategy. We translated this search strategy into the other databases using the appropriate controlled vocabulary as applicable ([Appendix 2](#); [Appendix 3](#); [Appendix 4](#); [Appendix 5](#); [Appendix 6](#)).

#### Searching other resources

- (4) Searched reference lists of all papers and relevant reviews identified
- (5) Contacted authors of relevant papers regarding any further published or unpublished work

### Data collection and analysis

#### Data extraction and management

Two reviewers (LG and PM or SM) independently screened the titles and abstracts of all articles obtained from the search. Full copies of all reports deemed eligible by either of the reviewers were retrieved for closer inspection. No study met the inclusion criteria set out in the protocol of this review. The methods set out in [Table 1](#) will be applied to any trials that meet the stipulated criteria in the future.

**Table 1. Review Methods**

<b>Study Selection</b>	Two reviewers (LG and PM or SM) will screen the titles and abstracts of all articles obtained from the search. They will independently apply the above selection criteria to determine which studies should be included or excluded. Full copies of all reports deemed eligible by either of the reviewers will be retrieved for closer inspection. Studies that appear to meet the inclusion criteria on the first screening but are later deemed unsuitable for inclusion will be listed in the “table for excluded studies”, together with the reasons for their exclusion. Disagreement between the two reviewers will be resolved through discussion with a third reviewer (JV).
<b>Assessment of methodological quality</b>	The Effective Practice and Organisation of Care Group’s (EPOC) quality checklists for randomised controlled trials (RCT), controlled trials, interrupted time series (ITS) and controlled before-after (CBA) trials will be used to assess all eligible studies. These checklists account for study design, method of randomisation, characteristics of control groups, method of data collection, confounding factors, appropriate statistical methods, selection of outcome variables and risk of bias.
<b>Data extraction</b>	One reviewer (LG) will extract the data and the process will be independently cross-checked and confirmed by a second reviewer (PM or SM). A data extraction form based on those used by the Effective Practice and Organisation of Care (EPOC) review group, but modified for this review, will be used. Data regarding study design, description of the intervention (including process), details about participants (including number in each group), length of intervention and follow-up, and the proportion of health care professionals who choose to work in rural or urban under-served areas. Consensus will be reached by discussion and consultation with a third reviewer, if necessary.
<b>Data analysis</b>	<p>We will analyse the studies separately depending on whether the intervention evaluated was aimed at the initial recruitment or subsequent retention of health professionals.</p> <p>RCTs, CCTs, CBAs</p> <p>Pre-intervention and post-intervention proportions will be reported for both study and control groups. The absolute change from baseline from baseline will be calculated for each group. We will analyse data using the Review Manager (version 4.1). We will pool estimates of effect using relative risk for binary data and weighted mean differences for continuous data. For continuous outcome data that is expressed in different units, we will calculate standardised mean differences.</p> <p>Interrupted time series (ITS)</p> <p>We will calculate relative and absolute mean difference in before and after values. When possible, we will use time series regression analyses to calculate mean change in level and mean change in slope.</p> <p>Meta-analysis</p> <p>Where possible we will conduct a meta analysis on the combined results of homogeneous studies using a random effects model.</p> <p>Sub-group analyses and sensitivity analyses</p> <p>We anticipate significant heterogeneity in study findings related to differences in the intervention type, type of health professional, study setting (rural vs urban underserved), study design and methodological quality.</p> <p>We plan to conduct subgroup analyses based upon:</p> <p>Type of intervention (educational, financial, regulatory)</p> <p>Type of health professional (doctor, dentist, nurse, allied health professional)</p>

**Table 1. Review Methods** (Continued)

	Country income level (high, middle, low) In order to determine how robust and consistent the results are, sensitivity analyses will be conducted based upon study design (RCT vs other) or risk of bias in study (high, medium, low - according to the Effective Practice and Organisation of Care Group's (EPOC) quality checklists).
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experts in the field. The reasons for excluding these studies from the review are stipulated in the [Characteristics of excluded studies](#).

## RESULTS

### Description of studies

See: [Characteristics of excluded studies](#).  
Not applicable.

### Risk of bias in included studies

Not applicable.

### Effects of interventions

A total of 1844 titles and abstracts were inspected for potentially relevant studies. After close inspection of the abstracts, none of the articles met with the inclusion criteria of this systematic review. Four quasi-randomised controlled trials, one controlled trial and one interrupted time series study were brought to our attention by

## DISCUSSION

### Summary of main results

The main finding of this review is that there are currently no well-designed studies in which bias and confounding are minimised to support any of the numerous interventions that have been implemented to address the shortage of health care professionals practicing in underserved areas. Based on assumptions or findings of mostly observational studies policy makers and educators have introduced various strategies aimed at reducing the maldistribution of health care professionals, but the short and/or long term impact of these interventions remains poorly quantified. Our search strategy identified a number of these studies and we decided to provide a brief narrative overview of their main findings below, with further expansion and comment in [Table 2](#).

**Table 2. Examples of current strategies to address the maldistribution of health professionals**

Strategy			Hypothesis	Comments
Educational	Student selection	Geographic origin	Students with a rural origin are more likely to practice in a rural setting	That students with a rural origin are more likely to practice in a rural setting is a consistent finding in several observational studies. It appears to be the single factor most strongly associated with rural practice. Some studies have found that the spouse's background is as important as that of the health professional as a predictor of practice location.



**Table 2. Examples of current strategies to address the maldistribution of health professionals** (Continued)

		Ethnicity	Students from “under-served” populations are more likely to practice in these areas	Students from “under-served” populations are more likely to subsequently practice in these areas has been documented in a study in an inner-city population in the US.
		Gender	Men are more likely to practice rural medicine than women	Men are more likely to practice rural medicine than women is a consistent finding in several observational studies. This finding may change if more accommodating conditions are created for women in these areas. It is important to have female rural doctors in culturally sensitive settings.
		Career intent	Students whose intent at study entry is to practice rural medicine are more likely to do so	Students who expressed an intention at study entry to practice rural medicine found independently predict rural practice in the Physician Shortage Areas Program, but 60% of rural doctors in the US reported no such career intention initially
		Service orientation	Students who report involvement in volunteer activities are more likely to practice rural medicine	In a study conducted at the University of North Carolina it was observed that the students who report involvement in volunteer activities were more likely to become generalists; however, this did not necessarily translate to them practicing in rural areas.

**Table 2. Examples of current strategies to address the maldistribution of health professionals** (Continued)

	Under/post graduate training exposure and location	Undergraduate curriculum content	Emphasizing the importance of rural health issues influences medical students to consider rural practice	Exposing undergraduate students to health care in underserved areas is important to their overall training and development; it would be an added bonus if it is found to encourage them to work in an underserved area subsequently.
		Undergraduate rural exposure	Clinical rotation in a rural setting influences medical students to consider rural practice	Some observational studies have shown that actual clinical exposure (immersion) may be important, although the perceived impact of rural rotations may be biased by self-selection (i.e. those students who do rural rotations would have chosen to do so prior to the intervention)
		Postgraduate generalist fellowships	The availability of generalist fellowships encourages more doctors to enter rural practice Undergraduate students from medical schools that offer generalist fellowships are more likely to become rural doctors	Rural health specialists and family physicians may be more likely to enter rural practice, but there is no evidence that the creation/availability of these specialities actually reduces the rural-urban maldistribution
		Location	Students from medical schools located in rural areas are more likely to practice in a rural setting	There is limited but consistent evidence that rural medical schools produce more rural doctors. However, rural placement may be a surrogate of various other factors, such as rural origin or likelihood to marry someone of rural origin. The establishment of more rural medical schools or satellite

**Table 2. Examples of current strategies to address the maldistribution of health professionals** (Continued)

				campuses warrant further evaluation.
Financial incentives	Bursaries / Scholarships		Providing scholarships with enforceable rural service agreements encourages rural practice	This particular intervention has shown variable success in different countries. Furthermore, these strategies are dependent on the availability of funds to provide scholarships and rural allowances to health professionals working in underserved areas. The long term benefit and cost effectiveness of these strategies requires further investigation.
	Financial compensation		Providing direct financial incentives encourages rural practice	In Canada allowing higher fees in rural areas is believed to have had a positive influence on general practitioner distribution. Reports from low- and middle-income countries have also been positive. The sustainability of these strategies is dependent on the availability of funds to provide scholarships and rural allowances to health professionals working in underserved areas and the long term benefit and cost effectiveness of these strategies requires further investigation.
Regulatory measures	Registration requirement		Requiring that recently qualified doctors perform “community service” in underserved areas will reduce maldistribution	Forced “community service” addresses short term recruitment, but there is concern that it may alienate people from long term rural practice. This strategy should be adopted with great

**Table 2. Examples of current strategies to address the maldistribution of health professionals** (Continued)

				caution as newly graduated medical students are often ill equipped to deal with the lack of professional and personal support in underserved areas. Some may be able to cope but in the absence of adequate guidance and support many have negative experiences that alienate them from future rural practice.
	Pre-requisite for specialization		Requiring that doctors spend a minimum number of years in an underserved area before allowing them to specialize will reduce maldistribution	This intervention has been applied in a number of low- and middle-income countries. It has been criticized in Indonesia for attracting the “wrong type” of doctor to rural areas and for reducing the return on investment placed in specialized training.
	International recruitment		Recruiting foreign doctors and limiting them to rural practice will address staff shortages in these areas	Recruitment of foreign doctors is widely practiced. It does offer a short term solution to importing countries, but often initiates a domino effect in exporting countries, which may worsen global distribution patterns. Long term retention of foreign doctors in underserved areas remains poor. There is, however, a need to respect the right of health professionals to enter the global labour market like any other professional; failure to do so may have a negative impact on those considering health care as a profession.

**Table 2. Examples of current strategies to address the maldistribution of health professionals** (Continued)

Professional and personal support	Professional support		Providing sufficient professional support encourages rural practice	There is some evidence from questionnaire-based surveys supporting this hypothesis. Health professionals need continuous professional stimulation. Attendance at conferences and supporting local academic activities may assist them to keep up to date with new medical developments.
	Personal support		Providing sufficient personal support encourages rural practice	There is some evidence from questionnaire-based surveys which supports this intervention. It is self-evident that providing personal support such as accommodation, meeting the educational needs of children etc is important.

## Educational strategies

### Student selection

Based on evidence from retrospective studies, it is believed that male students with a rural background who intend to practice rural medicine upon entry to medical school are more likely to be recruited to and retained in a rural practice (Rabinowitz 1999; Rabinowitz 2000; Rabinowitz 2001; Western 2000; Woloschuk 2002; Woloschuk 2004). A review of this topic found that rural background was associated with rural practice in 10 of the 12 case-control or retrospective cohort studies assessed (Laven 2003b). While the well known problems of bias and confounding common to all observational studies may limit the validity of these findings, the consistency of the study results have convinced some medical schools to alter their selection criteria for medical students accordingly.

Furthermore, special primary care and rural health programs have been implemented at a number of medical schools. These programs involve special admission for students from rural backgrounds who express an interest in practicing family medicine in a rural area, as well as special curricular components and finan-

cial aid. A number of observational studies have shown an association between these programs and an increase in the number of physicians entering rural practice (Brooks 2002; Moores 1998; Rabinowitz 1999). Furthermore, a recent study showed that a significantly greater number of graduates of the Jefferson Medical College Physician Shortage Area Program (PSAP) were still practicing family medicine in the same rural area more than a decade after graduating compared with graduates who were not exposed to this program (Rabinowitz 2005).

### Under/postgraduate training exposure and location

Studies investigating the effect of rural clerkships/rotations and preceptorships in underserved areas often have “change in student attitudes towards rural practice” or “intention to practice rural” as their outcome measures. While these outcomes may be seen as proxies of recruitment to rural practice, such outcomes do not reflect actual practice location upon graduation. Such outcomes may also be subject to information bias in that the participants may tell the interviewer what the participant thinks the interviewer wants to hear.

A further proxy for practice in an underserved area used in some studies is choice of a primary care or family practice specialty. The impact of a third year family practice clerkship on medical students' choice of family practice as a specialty was investigated in a controlled, longitudinal study (Campos-Outcalt 1999). Graduates' family practice specialty choice was noted for three years before and after the introduction of the clerkship. Family practice specialty choice of graduates from schools that did not have a third year family practice clerkship was used as the control data. There was a significant increase in the number of graduates who chose family practice as a specialty in the three years following the introduction of the clerkship (Campos-Outcalt 1999). In four quasi-randomised controlled trials, medical students who were exposed to an undergraduate primary care clerkship or curriculum track were more likely to choose family practice residencies (Erney 1991; Harris 1982; Herold 1993; Rosenblatt 1979). These studies suffer from the limitation that choice of a primary care or family practice specialty may not equate with practice in rural or underserved areas in all settings.

Between 1979 and 1993 the University of New Mexico School of Medicine offered two different curricular programs - a conventional program and a primary care curriculum (a community-oriented, problem-based program) - during the first two years of medical school. A survey investigating the effect of the primary care curriculum on graduates practice patterns reported that primary care curriculum graduates were significantly more likely to work in medically underserved areas than the conventional program graduates (Mennin 1996). As medical students in this study self-selected their programmes it is not possible to disentangle the effect of the curricular exposure from that of students' prior characteristics.

The Australian government has invested in the establishment of university departments of rural health and rural clinical schools in certain provinces (Wilkinson 2004). A time series analysis evaluated the impact of clinical rotations through rural clinical schools during the third and fourth years of medical training at the University of Queensland. Following the establishment of the rural clinical schools, the number of medical students selecting rural regional hospitals as their preferred site for internship increased; whereas the number of students requesting rural intern employment at institutions without a rural clinical school remained the same during this time period (Wilkinson 2004). It is not known to what extent choice of a rural internship predicts future practice in a rural location.

Evidence from retrospective cohort studies suggests that faculty role models influenced physicians' choice to specialize in family medicine (Campos-Outcalt 1995). However, two prospective controlled observational studies failed to show an effect of instruction by family physician faculty on the students' decision to follow a family practice residency (Allen 1987; Beasley 1993).

## Financial incentives

Government bodies attempt to encourage health care professionals to practice in underserved areas through various financial support-for-service programs (Pathman 1994; Pathman 2004). Evidence regarding the impact of these programs on the recruitment and retention of health care professionals in underserved areas is based on descriptive, cross sectional surveys (Jackson 2003; Pathman 2004) and retrospective cohort studies (Pathman 1992). In one study, obligated physicians were more likely to serve in smaller rural areas compared to non-obligated physicians. Loan repayment, direct incentive and resident-support programs had the highest service completion rates and physician retention rates (Pathman 2004).

Some governments have introduced additional rural allowances in an effort to attract and retain health care professionals in these underserved areas. The effect of rural allowances on the distribution of health professionals is being monitored and evaluated by questionnaire-based surveys (Reid 2004).

## Regulatory strategies

A number of coercive strategies, such as compulsory community service and restricting recruited foreign doctors to rural practice, have been adopted by governments in an attempt to address the shortage of health professionals in medically underserved areas. Compulsory community service has been adopted by countries such as Russia, Mexico, Ecuador, Bolivia, Cuba, Dominican Republic, South Africa and Nigeria. The effectiveness of this strategy has been assessed by descriptive surveys and the results are inconclusive (Cavender 1998; Reid 2001). Although widely practiced, the effect of recruiting foreign doctors to work in underserved areas on the distribution of health professionals, and consequent provision of health services, has not been thoroughly assessed. Coercive strategies may provide short term solutions; however, there is concern that these strategies will alienate people from the profession and underserved areas in particular and thus prove counterproductive.

## Professional and personal support

Questionnaire-based surveys suggest that professional and personal support may also influence health professionals' choice to work in underserved areas. Professional development, ongoing training and style of health service management were important factors influencing retention of health professionals in underserved areas (Kotzee 2006).

## AUTHORS' CONCLUSIONS

## Implications for practice

Despite the absence of reliable evidence, governments and medical schools have implemented numerous strategies aimed at addressing the shortage of health care professionals practicing in underserved areas. Rigorous evaluation of the effectiveness of various strategies is required to determine the true impact of these interventions and to better inform future policy. Inequitable distribution of health care professionals in underserved areas is likely to be a result of multiple factors with complex interactions which may vary across different settings. Interventions will therefore have to be appropriately tailored to meet various needs.

## Implications for research

Observational studies suggest that a number of factors related to student selection criteria, undergraduate and postgraduate training, financial incentives, regulatory measures and personal and professional support may influence health care professionals' choice to practice in underserved areas. Strategies that have shown promise include selection of students with a rural background,

the establishment of university departments and/or teaching clinics in rural areas, rural and scarce skills allowances and enhanced professional and personal support. However, these findings await confirmation or refutation by means of well-designed studies in which bias and confounding are minimized. Future studies should also take into account the different contexts and settings in which the inequitable distribution of health care professionals occur, for example, the type of health care professional, the presiding cultural expectations and social pressures, the type of intervention, the location of the underserved community (i.e. rural versus urban) and the income or development status of the country.

## ACKNOWLEDGEMENTS

We would like to thank the members of the Collaboration for Health Equity through Education and Research (CHEER), South Africa, especially Professors Steve Reid and Ian Couper, for their valuable input during the preparation of this review.

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\* Indicates the major publication for the study

## CHARACTERISTICS OF STUDIES

### Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Erney 1991	Inappropriate outcome: "choice of family practice residency" is not a direct indication of practice location
Harris 1982	Inappropriate outcome: "choice of family practice residency" is not a direct indication of practice location
Herold 1993	Inappropriate outcome: "choice of family practice residency" is not a direct indication of practice location
Mennin 1996	Students self-selected the intervention, thus firm conclusions regarding the influence of the intervention, per se, cannot be made
Rosenblatt 1979	Inappropriate outcome: "choice of family practice residency" is not a direct indication of practice location
Wilkinson 2004	Inappropriate outcome: medical student's choice of internship site. Choice of rural internship does not necessarily predict rural practice after graduation

## DATA AND ANALYSES

This review has no analyses.

## APPENDICES

### Appendix I. Detailed search strategy: Medline

Search Terms
1. exp Health Personnel/ 2. Health Manpower/ 3. manpower.fs. 4. nurse?.tw. 5. (midwives or mid wives or midwifeor mid wife).tw. 6. (physician? or doctor? or practitioner?).tw. 7. dentist?.tw. 8. dental staff.tw. 9. pharmacist\$.tw. 10. dietician?.tw. 11. nutritionist?.tw. 12. psychologist?.tw. 13. occupational therapist?.tw. 14. (physiotherapist? or physical therapist?).tw. 15. speech therapist?.tw. 16. language therapist?.tw. 17. (logopaedist? or logopedist?).tw. 18. speech pathologist?.tw. 19. language pathologist?.tw. 20. audiologist?.tw. 21. internist?.tw. 22. (paediatrician? or pediatrician?).tw. 23. ophthalmologist?.tw. 24. surgeon?.tw. 25. (radiographer? or radiologist?).tw. 26. optometrist?.tw. 27. ((health or healthcare or health care) adj (personnel or worker? or staff or professional? or provider?)).tw. 28. (medical adj (personnel or staff or professional? or worker?)).tw. 29. (nurs\$ adj (personnel or staff or professional? or worker?)).tw. 30. (health manpower or human resources or workforce?).tw. 31. exp Personnel Management/ 32. Resource Allocation/ 33. (((client adj1 staff) or (patient adj1 staff) or (patient adj1 nurse)) adj ratio).tw. 34. ((physician? or doctor? or practitioner? or nurse? or personnel or staff or professional?) adj2 shortage).tw. 35. understaff\$.tw. 36. ((personnel or staff) adj (recruitment or retain\$ or retention or turnover or turn over)).tw.

(Continued)

37. or/1-36
38. Rural Health Services/
39. Medically Underserved Area/
40. Hospitals, Rural/
41. ((rural or remote or nonmetropolitan) adj (health service? or health care or healthcare or medical service? or medical care)).tw.
42. ((rural or remote or nonmetropolitan or underserved or under served or deprived) adj (communit\$ or area? or region? or province?)).tw.
43. (rural adj (setting? or clinic? or hospital?)).tw.
44. shortage area?.tw.
45. (inequitable distribut\$ or maldistribut\$).tw.
46. or/38-45
47. 37 and 46
48. Rural Health/ma [Manpower]
49. 47 or 48
50. randomised controlled trial.pt.
51. controlled clinical trial.pt.
52. random\$.tw.
53. (time adj series).tw.
54. controlled before.tw.
55. or/50-54
56. (pre test or pretest or (posttest or post test)).tw.
57. control\$.tw.
58. 56 and 57
59. 55 or 58
60. Animals/
61. Humans/
62. 60 not (60 and 61)
63. 59 not 62
64. 49 and 63

## Appendix 2. Detailed search strategy: EMBASE

### Search Terms

1. exp Health Care Personnel/
2. Psychologist/
3. nurse?.tw.
4. (midwives or mid wives or midwife or mid wife).tw.
5. (physician? or doctor? or practitioner?).tw.
6. dentist?.tw.
7. dental staff.tw.
8. pharmacist\$.tw.
9. dietician?.tw.
10. nutritionist?.tw.
11. psychologist?.tw.
12. occupational therapist?.tw.

(Continued)

13. (physiotherapist? or physical therapist?).tw.
14. speech therapist?.tw.
15. language therapist?.tw.
16. (logopaedist? or logopedist?).tw.
17. speech pathologist?.tw.
18. language pathologist?.tw.
19. audiologist?.tw.
20. internist?.tw.
21. (paediatrician? or pediatrician?).tw.
22. ophthalmologist?.tw.
23. surgeon?.tw.
24. (radiographer? or radiologist?).tw.
25. optometrist?.tw.
26. ((health or healthcare or health care) adj (personnel or worker? or staff or professional? or provider?)).tw.
27. (medical adj (personnel or staff or professional? or worker?)).tw.
28. (nurs\$ adj (personnel or staff or professional? or worker?)).tw.
29. (health manpower or human resources or workforce?).tw.
30. Manpower Planning/
31. Health Care Personnel Management/
32. Hospital Personnel Management/
33. Resource Allocation/
34. Nurse Patient Ratio/
35. Personnel Shortage/
36. Nursing Shortage/
37. (((client adj1 staff) or (patient adj1 staff) or (patient adj1 nurse)) adj ratio).tw.
38. ((physician? or doctor? or practitioner? or nurse? or personnel or staff or professional?) adj2 shortage).tw.
39. understaff\$.tw.
40. ((personnel or staff) adj (recruitment or retain\$ or retention or turnover or turn over)).tw.
41. or/1-40
42. Rural Health Care/
43. Rural Area/
44. ((rural or remote or nonmetropolitan) adj (health service? or health care or healthcare or medical service? or medical care)).tw.
45. ((rural or remote or nonmetropolitan or underserved or under served or deprived) adj (communit\$ or area? or region? or province?)).tw.
46. (rural adj (setting? or clinic? or hospital?)).tw.
47. shortage area?.tw.
48. (inequitable distribut\$ or maldistribut\$).tw.
49. or/42-48
50. 41 and 49
51. Randomized Controlled Trial/
52. random\$.tw.
53. Time Series Analysis/
54. (time adj series).tw.
55. controlled before.tw.
56. or/51-55
57. (pre test or pretest or post test or posttest).tw.
58. control\$.tw.
59. 57 and 58
60. 56 or 59

(Continued)

61. Nonhuman/  
62. 60 not 61  
63. 50 and 62

### Appendix 3. Detailed search strategy: LILACS

#### Search Terms

physician\$ or doctor\$ or practitioner\$ or nurse\$ or midwife or midwives or dentist\$ or dental staff or pharmacist\$ or dietician\$ or nutritionist\$ or psychologist\$ or occupational therapist\$ or physiotherapist\$ or physical therapist\$ or speech therapist\$ or language therapist\$ or logopaedist\$ or logopedist\$ or speech pathologist\$ or language pathologist\$ or audiologist\$ or internist\$ or paediatrician\$ or pediatrician\$ or ophthalmologist\$ or surgeon\$ or radiographer\$ or radiologist\$ or optometrist\$ or human resources or workforce\$ or manpower or health personnel or healthcare personnel or health care personnel or medical personnel or medical care personnel or health worker\$ or healthcare worker\$ or health care worker\$ or medical worker\$ or medical care worker\$ or health staff or healthcare staff or health care staff or medical staff or medical care staff or health professional\$ or healthcare professional\$ or health care professional\$ or medical professional\$ or medical care professional\$ or health provider\$ or healthcare provider\$ or health care provider\$ or medical provider\$ or medical care provider\$ or personnel shortage or understaff\$ or resource allocation [Words]

AND

rural or remote or nonmetropolitan or non metropolitan or underserved or under served or deprived or shortage area [Words]

AND

((Pt RANDOMIZED CONTROLLED TRIAL OR Pt CONTROLLED CLINICAL TRIAL OR Mh RANDOMIZED CONTROLLED TRIALS OR Mh RANDOM ALLOCATION OR Mh DOUBLE-BLIND METHOD OR Mh SINGLE-BLIND METHOD OR Pt MULTICENTER STUDY) OR ((tw ensaio or tw ensayo or tw trial) and (tw azar or tw acaso or tw placebo or tw control\$ or tw aleat\$ or tw random\$ or (tw duplo and tw cego) or (tw doble and tw ciego) or (tw double and tw blind)) and tw clinic\$) ) AND NOT ((CT ANIMALS OR MH ANIMALS OR CT RABBITS OR CT MICE OR MH RATS OR MH PRIMATES OR MH DOGS OR MH RABBITS OR MH SWINE) AND NOT (CT HUMAN AND CT ANIMALS)) or (time series or controlled before or pre test or pretest or post test or posttest) [Words]

### Appendix 4. Detailed search strategy: EPOC register

#### Search Terms

Basic search. All terms/phrases are connected with OR

health professionals underserved  
health professionals rural  
health professionals shortage areas  
healthcare professionals underserved  
healthcare professionals rural  
healthcare professionals shortage areas  
health personnel underserved  
health personnel rural

(Continued)

health personnel shortage areas  
healthcare personnel underserved  
healthcare personnel rural  
healthcare personnel shortage areas  
staff underserved  
staff rural  
staff shortage areas  
nurses underserved  
nurses rural  
nurses shortage areas  
physicians underserved  
physicians rural  
physicians shortage areas  
manpower underserved  
manpower rural  
manpower shortage areas  
workforce underserved  
workforce rural  
workforce shortage areas  
personnel retain  
personnel retention  
personnel recruitment  
staff retain  
staff retention  
staff recruitment

## Appendix 5. Detailed search strategy: CINAHL

### Search Terms

1. exp Health Personnel/
2. exp Health Manpower/
3. nurse?.tw.
4. (midwives or mid wives or midwife or mid wife).tw.
5. (physician? or doctor? or practitioner?).tw.
6. dentist?.tw.
7. dental staff.tw.
8. pharmacist\$.tw.
9. dietician?.tw.
10. nutritionist?.tw.
11. psychologist?.tw.
12. occupational therapist?.tw.
13. (physiotherapist? or physical therapist?).tw.
14. speech therapist?.tw.
15. language therapist?.tw.
16. (logopaedist? or logopedist?).tw.

(Continued)

17. speech pathologist?.tw.
18. language pathologist?.tw.
19. audiologist?.tw.
20. internist?.tw.
21. (paediatrician? or pediatrician?).tw.
22. ophthalmologist?.tw.
23. surgeon?.tw.
24. (radiographer? or radiologist?).tw.
25. optometrist?.tw.
26. ((health or healthcare or health care) adj (personnel or worker? or staff or professional? or provider?)).tw.
27. (medical adj (personnel or staff or professional? or worker?)).tw.
28. (nurs\$ adj (personnel or staff or professional? or worker?)).tw.
29. (health manpower or human resources or workforce?).tw.
30. exp Personnel Management/
31. Health Resource Allocation/
32. (((client adj1 staff) or (patient adj1 staff) or (patient adj1 nurse)) adj ratio).tw.
33. ((physician? or doctor? or practitioner? or nurse? or personnel or staff or professional?) adj2 shortage).tw.
34. understaff\$.tw.
35. ((personnel or staff) adj (recruitment or retain\$ or retention or turnover or turn over)).tw.
36. or/1-35
37. Rural Health Services/
38. Medically Underserved Area/
39. Rural Areas/
40. Hospitals, Rural/
41. Rural Health Centers/
42. ((rural or remote or nonmetropolitan) adj (health service? or health care or healthcare or medical service? or medical care)).tw.
43. ((rural or remote or nonmetropolitan or underserved or under served or deprived) adj (communit\$ or area? or region? or province?)).tw.
44. (rural adj (setting? or clinic? or hospital?)).tw.
45. shortage area?.tw.
46. (inequitable distribut\$ or maldistribut\$).tw.
47. or/37-46
48. 36 and 47
49. Rural Health Personnel/
50. Rural Health Nursing/
51. 49 or 50
52. 48 or 51
53. Clinical Trial/
54. (controlled adj (study or trial)).tw.
55. random\$.tw.
56. Comparative Studies/
57. exp pretest-posttest design/
58. exp quasi-experimental studies/
59. time series.tw.
60. controlled before.tw.
61. or/53-60
62. (pre test or pretest or post test or posttest).tw.
63. control\$.tw.
64. 62 and 63



(Continued)

65. 61 or 64  
66. 52 and 65

## Appendix 6. Detailed search strategy: CENTRAL

### Search Terms

#1MeSH descriptor Health Personnel explode all trees  
#2MeSH descriptor Health Manpower, this term only  
#3Any MeSH descriptor with qualifier: MA  
#4(nurse\* or midwives or mid NEXT wives or midwife or mid NEXT wife or physician\* or doctor\* or practitioner\* or dentist\* or dental NEXT staff or pharmacist\* or dietician\* or nutritionist\* or psychologist\* or occupational NEXT therapist\* or physiotherapist\* or physical NEXT therapist\* or speech NEXT therapist\* or language NEXT therapist\* or logopaed\* or logoped\* or speech NEXT pathologist\* or language NEXT pathologist\* or audiologist\* or internist\* or paediatrician\* or pediatrician\* or ophthalmologist\* or surgeon\* or radiographer\* or radiologist\* or optometrist\*):ti or (nurse\* or midwives or mid NEXT wives or midwife or mid NEXT wife or physician\* or doctor\* or practitioner\* or dentist\* or dental NEXT staff or pharmacist\* or dietician\* or nutritionist\* or psychologist\* or occupational NEXT therapist\* or physiotherapist\* or physical NEXT therapist\* or speech NEXT therapist\* or language NEXT therapist\* or logopaed\* or logoped\* or speech NEXT pathologist\* or language NEXT pathologist\* or audiologist\* or internist\* or paediatrician\* or pediatrician\* or ophthalmologist\* or surgeon\* or radiographer\* or radiologist\* or optometrist\*):ab  
#5(health or healthcare or health NEXT care) NEXT (personnel or worker\* or staff or professional\* or provider\*):ti or (health or healthcare or health NEXT care) NEXT (personnel or worker\* or staff or professional\* or provider\*):ab  
#6(medical NEXT (personnel or staff or professional\* or worker\*)):ti or (medical NEXT (personnel or staff or professional\* or worker\*)):ab  
#7(nurs\* NEXT (personnel or staff or professional\* or worker\*)):ti or (nurs\* NEXT (personnel or staff or professional\* or worker\*)):ab  
#8(health NEXT manpower or human NEXT resources or workforce\*):ti or (health NEXT manpower or human NEXT resources or workforce\*):ab  
#9MeSH descriptor Personnel Management explode all trees  
#10MeSH descriptor Resource Allocation, this term only  
#11((client NEAR/1 staff) or (patient NEAR/1 staff) or (patient NEAR/1 nurse)) NEXT ratio:ti or ((client NEAR/1 staff) or (patient NEAR/1 staff) or (patient NEAR/1 nurse)) NEXT ratio:ab  
#12(physician\* or doctor\* or practitioner\* or nurse\* or personnel or staff or professional\*) NEAR/2 shortage:ti or (physician\* or doctor\* or practitioner\* or nurse\* or personnel or staff or professional\*) NEAR/2 shortage:ab  
#13(understaff or under NEXT staff\*):ti or (understaff or under NEXT staff\*):ab  
#14(personnel or staff) NEXT (recruitment or retain\* or retention or turnover or turn NEXT over):ti or (personnel or staff) NEXT (recruitment or retain\* or retention or turnover or turn NEXT over):ab  
#15MeSH descriptor Rural Health Services, this term only  
#16MeSH descriptor Medically Underserved Area, this term only  
#17MeSH descriptor Hospitals, Rural, this term only  
#18MeSH descriptor Rural Health, this term only  
#19(rural or remote or nonmetropolitan or non NEXT metropolitan) NEXT (health NEXT service\* or health NEXT care or healthcare or medical NEXT service\* or medical NEXT care):ti or (rural or remote or nonmetropolitan or non NEXT metropolitan) NEXT (health NEXT service\* or health NEXT care or healthcare or medical NEXT service\* or medical NEXT care):ab  
#20(rural or remote or nonmetropolitan or non NEXT metropolitan or underserved or under NEXT served or deprived) NEXT (communit\* or area\* or region\* or province\*):ti or (rural or remote or nonmetropolitan or non NEXT metropolitan or underserved or under NEXT served or deprived) NEXT (communit\* or area\* or region\* or province\*):ab

(Continued)

#21(rural NEXT (setting\* or clinic\* or hospital\*)):ti or (rural NEXT (setting\* or clinic\* or hospital\*)):ab  
#22(shortage NEXT area\*):ti or (shortage NEXT area\*):ab  
#23(inequitable NEXT distribut\* or maldistribut\*):ti or (inequitable NEXT distribut\* or maldistribut\*):ab  
#24(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14)  
#25(#15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23)  
#26(#24 AND #25)

## WHAT'S NEW

Last assessed as up-to-date: 17 September 2007.

Date	Event	Description
17 February 2009	Amended	Plain language summary modified.

## HISTORY

Protocol first published: Issue 2, 2005

Review first published: Issue 1, 2009

Date	Event	Description
12 November 2008	Amended	RevMan5 conversion

## CONTRIBUTIONS OF AUTHORS

Philemon Marindi, Sikhumbizo Mabunda, Helmuth Reuter and Jimmy Volmink assisted Liesl in preparing the review protocol and in searching for background information on the topic. Liesl, together with Phil and Sikhumbuzo screened search results for relevant articles and Jimmy Volmink was consulted in the case of disagreements arising from this process. Input from Helmuth Reuter, Ben Marais and Jimmy Volmink was integral in completing the review.

## **DECLARATIONS OF INTEREST**

None known.

## **SOURCES OF SUPPORT**

### **Internal sources**

- University of Cape Town, South Africa.
- University of Stellenbosch, South Africa.
- Medical Research Council, South Africa.

### **External sources**

- Cochrane Public Health and Health Professionals Field, South Africa.
- Collaboration for Health Equity through Education and Research (CHEER), South Africa.

## **INDEX TERMS**

### **Medical Subject Headings (MeSH)**

\*Health Manpower; \*Medically Underserved Area; \*Rural Health

### **MeSH check words**

Humans