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TABLE OF CONTENTS

HEADER	1
ABSTRACT	1
PLAIN LANGUAGE SUMMARY	2
BACKGROUND	2
OBJECTIVES	3
METHODS	3
RESULTS	5
Figure 1.	6
DISCUSSION	8
AUTHORS' CONCLUSIONS	9
ACKNOWLEDGEMENTS	10
REFERENCES	10
CHARACTERISTICS OF STUDIES	11
DATA AND ANALYSES	15
ADDITIONAL TABLES	15
APPENDICES	15
HISTORY	22
CONTRIBUTIONS OF AUTHORS	22
DECLARATIONS OF INTEREST	23
SOURCES OF SUPPORT	23
DIFFERENCES BETWEEN PROTOCOL AND REVIEW	23
INDEX TERMS	23

[Intervention Review]

Effects of changes in the pre-licensure education of health workers on health-worker supply

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ABSTRACT

Background

The current and projected crisis because of a shortage of health workers in low and middle-income countries (LMICs) requires that effective strategies for expanding the numbers of health workers are quickly identified in order to inform action by policymakers, educators, and health managers.

Objectives

To assess the effect of changes in the pre-licensure education of health professionals on health-worker supply.

Search methods

We searched the Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* 2007, Issue 3), EMBASE, Ovid (1980 to week 3, October 2007), MEDLINE, Ovid (1950 to week 3, October 2007), CINAHL (October 2007), LILACS (week 4, November 2007), ERIC (1966 to week 3, February 2008), and Sociological Abstracts (October 2007). We searched WHO (WHOLIS) (February 2008), World Bank, Google Scholar, and human resources on health-related websites to obtain grey literature. Key experts in human resources for health were contacted to identify unpublished studies. The reference lists of included studies were searched for additional articles.

Selection criteria

Randomised controlled trials, non-randomised controlled trials, controlled before and after studies, and interrupted time-series studies that measured increased numbers of health workers ultimately available for recruitment into the health workforce or improved patient to health professional ratios as their primary outcomes were considered. Although the focus of the review was on LMIC, we included studies regardless of where they were done.

Data collection and analysis

Heterogeneity between the two included studies precluded meta-analysis; therefore, data were presented separately for each study.

Effects of changes in the pre-licensure education of health workers on health-worker supply (Review)

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Main results

Two studies of the 7880 identified from searching the electronic databases met the inclusion criteria. Both studies were controlled before and after studies, of moderate to high risk of bias, that explored the effects of interventions to improve retention of minority groups in health professional training institutions. These studies reported that an intervention comprising of a package of student support activities including social, academic, and career guidance and mentorship resulted in an increase in the number of minority students who enrolled and graduated from health training institutions.

Authors' conclusions

The evidence to estimate the likely effects of interventions in pre-licensure education to increase health-worker supply is generally insufficient or unavailable, particularly in LMICs. Promising innovations from a high-income country include providing financial support to health professional students or introducing mechanisms to identify and encourage potential students and offering support to 'at risk' students. These and other promising interventions should be evaluated in LMIC.

PLAIN LANGUAGE SUMMARY

Academic support, career guidance, and social support might increase student enrollment and reduce drop-out rates among 'at-risk' health professional students

A comprehensive package comprising career guidance, mentoring, and academic, social and financial support may result in increased graduation rates among health professional students at risk of dropping out of study. Further research could focus on determining the magnitude of student drop-out rates in health professional training institutions, identifying the students at risk of dropping out, and determining the applicability of western-based innovations in low and middle-income countries. Evaluation of ongoing and planned interventions in pre-licensure education of health professionals is important.

BACKGROUND

The current global shortage of health workers, estimated at around 4.5 million in 2006, presents an enormous challenge to many countries with regard to achieving the health-related Millennium Development Goals (MDGs) by the year 2015 (WHO 2006b). The challenge is greatest in Sub-Saharan Africa, which has 11% of the world's population, 24% of the global burden of disease, but only 3% of the world's health workers (WHO 2006b). In some African countries the estimated need is in the tens of thousands yet current production per year falls far below what is required to fill these gaps within the required time (Wyss 2004). The education of health workers is a costly undertaking, both in terms of its long duration and the demand for resources in the form of educational facilities and academic staff. The WHO estimates that for the average country it would cost up to USD 136 million per year (based on 2004 prices) to step up the production of doctors, nurses, and midwives by 2015 in order to meet existing population to health provider target ratios (WHO 2006a).

Description of the condition

In a report based on a global overview of human resources, the Joint Learning Initiative (JLI) noted that addressing the challenge of human resources for health would require increased investment in education and an environment in which policymakers can begin to see human resources in the health sector as a key social investment that demands effective resource allocation. JLI, therefore, recommended that the period from 2006 to 2015 should be designated as 'The Decade of Human Resources for Health' (JLI 2004). As countries take up the call to increase their production of health workers, it is imperative that innovative and sustainable approaches to educating human resources for health (HRH) be identified. This review set out to identify well evaluated pre-licensure innovations that aim to increase the number of health workers completing their education with a particular interest in identifying effective strategies that could be of relevance to low and middle-income countries (LMICs).

Some countries have attempted to increase or decrease the number of health professionals by respectively favouring or limiting the recruitment of graduates of foreign health professional schools.

For instance, the United States used pre-certification board examinations to either increase or limit the entry of foreign medical graduates intending to practice in the USA (Akl 2007).

Description of the intervention

The numbers enrolled into health professional training institutions like medical schools and nursing schools partly depend on the number of schools available and their intake capacity. Policies and regulatory mechanisms affect numbers of health workers trained (Kessel 1970). These mechanisms, when applied, may increase or reduce the numbers of health workers produced. Attempts made by professional associations to regulate the output of health professionals from training schools have been said to be the main cause of certain health-worker shortages. For instance, the American Medical Association attempted to limit the number of physicians produced in the 1940s by closing down schools and limiting intakes for existing schools. This policy was said to have been driven by economic interests aimed at causing a shortage of physicians to ensure profitable physician practice (Kessel 1970).

How the intervention might work

After enrollment into health professional schools, it is a major goal for educators and policymakers to ensure that students complete their education. Apart from providing financial support to students and schools (Dusansky 1985; Dusansky 1986) efforts have been made to identify students at risk of dropping out so that additional support strategies can be implemented. The support strategies have included student counselling, psychosocial support, remedial courses, tutoring systems, mentoring and curriculum changes, among other things (Jeffreys 2001; Lockie 1999).

Why it is important to do this review

To step up the number of health workers through training, global efforts need to consider all the issues raised above. For policymakers and training institutions in resource-constrained LMICs the use of evidence to make sound decisions regarding effective interventions to increase the numbers of health workers produced is an important starting point. Little is known, however, about the effects of these interventions and a review of the existing literature on educational interventions could provide useful insights. In order to contribute information that could inform policy, this systematic review sought to assess the effects of interventions targeted at three levels, as described above, that is: a) increasing capacity of schools, b) reducing student attrition, and c) increasing recruitment from other countries.

OBJECTIVES

The objective of this systematic review was to assess the effect of changes in the pre-licensure education of health professionals on health-worker supply.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised controlled trials and non-randomised controlled trials were considered for inclusion. Non-randomised trials included controlled before and after studies and interrupted time series studies. Controlled before and after studies were considered if pre and post-intervention periods for the study and control groups were the same and the choice of control site was appropriate. Interrupted time series analyses were considered if the point in time when the intervention occurred was clearly defined and there were at least three or more data points before and after the intervention.

Types of participants

Health professional students prior to licensure for all licensed health professions. Categories considered included students in, or completing, training in institutions to become physicians, nurses, midwives, nursing assistants, pharmacists, physiotherapists, occupational therapists, dentists, dental assistants, laboratory technicians, dispensers, medical assistants or clinical officers, and radiographers. Non-professional (lay) health workers, nurse aides, and community or village health workers, and other professions that do not undergo licensure were excluded.

Types of interventions

We included studies covering any change in the education of health professionals prior to their becoming licensed that could potentially affect the number of health workers ultimately available for recruitment into the health workforce. Three categories of interventions were considered.

1. Interventions that could increase the capacity of schools

- (a) Opening new schools - including new policies on licensing of private schools
- (b) Expanding the capacity of existing schools (AAMC 2007)
- (c) Increasing the size of entry classes (Salsberg 2006)
- (d) Providing educational subsidies to students or to schools (Rich 1993)

- (e) Reducing the length of training ([Pabst 1995](#))
- (f) Reducing educational requirements
- (g) Introducing distance, part-time, and modular study

2. Interventions that could reduce the loss of students (and increase the likelihood that students will graduate)

- (a) Change selection criteria and processes
- (b) Affirmative action initiatives which promote enrolment of females, males, or minority groups ([AMWAC 2000a](#); [Salsberg 2002](#))
- (c) Changes in curriculum content, duration, and examination systems ([AMWAC 2000b](#))
- (d) Financial incentives (penalties or rewards targeted at schools or students), reductions in school-fee structures, and provision of student loans or subsidies ([Copeman 1979](#))
- (e) Buddy systems, counselling, and other support measures for students
- (f) Guaranteed jobs upon graduation

3. Interventions that could increase recruitment from other countries

- (a) Providing funds for training outside the country ([Broadhead 2002](#))
 - (b) Recognising prior learning
- Studies of changes in post-graduate training and continuing education were excluded.

Types of outcome measures

Primary outcomes

The studies considered for inclusion in this review were those that measured increased numbers of health workers ultimately available for recruitment into the health workforce or improved population to health professional ratios as their primary outcome.

Secondary outcomes

Secondary outcomes included measurements of changes across specialties (for example, primary care versus secondary care) or retention in the country for 10 years after graduation. Studies that did not include at least one of these primary or secondary outcomes were excluded.

Search methods for identification of studies

Electronic searches

We searched the following electronic databases for primary studies.

- Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* 2007, Issue 3), see [Appendix 7](#).
- MEDLINE, Ovid (1950 to week 3, October 2007), see [Appendix 1](#).
- EMBASE, Ovid (1980 to week 3, October 2007), see [Appendix 2](#).
- CINAHL (searched 16th October 2007), see [Appendix 3](#).
- LILACS (searched 29th November 2007), see [Appendix 4](#).
- Sociological Abstracts (searched 19th October 2007), see [Appendix 5](#).
- ERIC (1966 to week 3, February 2008), see [Appendix 6](#).

The search strategies for identifying primary studies incorporated the methodological component of the Cochrane Effective Practice and Organisation of Care Group (EPOC) search strategy combined with selected index terms and free text terms. We adapted the MEDLINE search strategy for the other databases using the appropriate controlled vocabulary.

Other resources: WHO (WHOLIS) (February 2008); World Bank; and Google Scholar.

The following health-related websites were searched for grey literature on human resources:

- www.hrresources.org;
- www.human-resources-health.com;
- www.globalhealthtrust.org;
- www.hrsa.org;
- www.fip.org/hr/
- www.oecd.org/document/
- <http://erc.msh.org>.

Searching other resources

1. Reference lists: reference lists of the included studies were searched.
2. Cited references: references to studies that have cited any of the included studies were searched using the ISI Science and Social Science Citation Index.
3. Contacting experts: experts in human resources for health and collaborators from around the world were contacted and we requested them to provide names of persons or institutions that might have expert knowledge regarding relevant publications.

Data collection and analysis

Studies retrieved from the search were uploaded onto Reference Manager and screened for duplicates. The inclusion and exclusion criteria were then independently applied by two review authors (SNK and ER). Electronic searching yielded 7880 studies, of which 1660 were duplicates. There were seven articles that we considered merited further scrutiny and full articles were retrieved.

Selection of studies

The inclusion and exclusion criteria were again applied independently by two review authors (SNK and ER). Only two articles met our inclusion criteria. No article from the reference lists of these two articles met the inclusion criteria. The grey literature search, relevant websites, and contacting experts in the field did not yield any eligible articles. The two eligible papers were controlled before and after studies on the effects of retention strategies (Hesser 1993; Hesser 1996).

Data extraction and management

Data extraction was done independently by two review authors (SNK and ER) using modified EPOC data extraction forms. Data on both relative and absolute changes and statistical significance were recorded. The heterogeneity among the studies with regard to study populations precluded meta-analysis; therefore, findings for each study were presented separately.

Assessment of risk of bias in included studies

The risk of bias in the two studies was assessed independently by SNK and ER using standardised EPOC risk of bias criteria for controlled before and after studies.

Measures of treatment effect

Effects of the intervention were measured based on changes in absolute numbers and relative change (percentage change).

Assessment of heterogeneity

Assessment of heterogeneity could not be conducted for the two studies.

Subgroup analysis and investigation of heterogeneity

No subgroup analysis was conducted.

Sensitivity analysis

No sensitivity analysis was conducted.

RESULTS

Description of studies

See: [Characteristics of included studies](#); [Characteristics of excluded studies](#).

Overall, 7880 publications were identified from the electronic searches conducted from October 2007 to February 2008. After applying the inclusion criteria, seven studies warranted closer scrutiny and, therefore, full articles were retrieved for these. Three studies appeared to meet our inclusion criteria for study type, population, intervention, and outcome at this screening stage. One of the studies (Lockie 1999) was excluded on the basis of having an unacceptably high risk of bias. Only two studies were included in this review. Both studies were controlled before and after studies, with moderate to high risk of bias, that explored the effects of interventions to improve retention of minority groups in health professional training institutions.

Results of the search

We searched the following electronic databases: CENTRAL (yielded 784 hits), MEDLINE (1944 hits), EMBASE (2543 hits), CINAHL (1291 hits), LILACS (600 hits), ERIC (245 hits), and Sociological Abstracts (1000 hits).

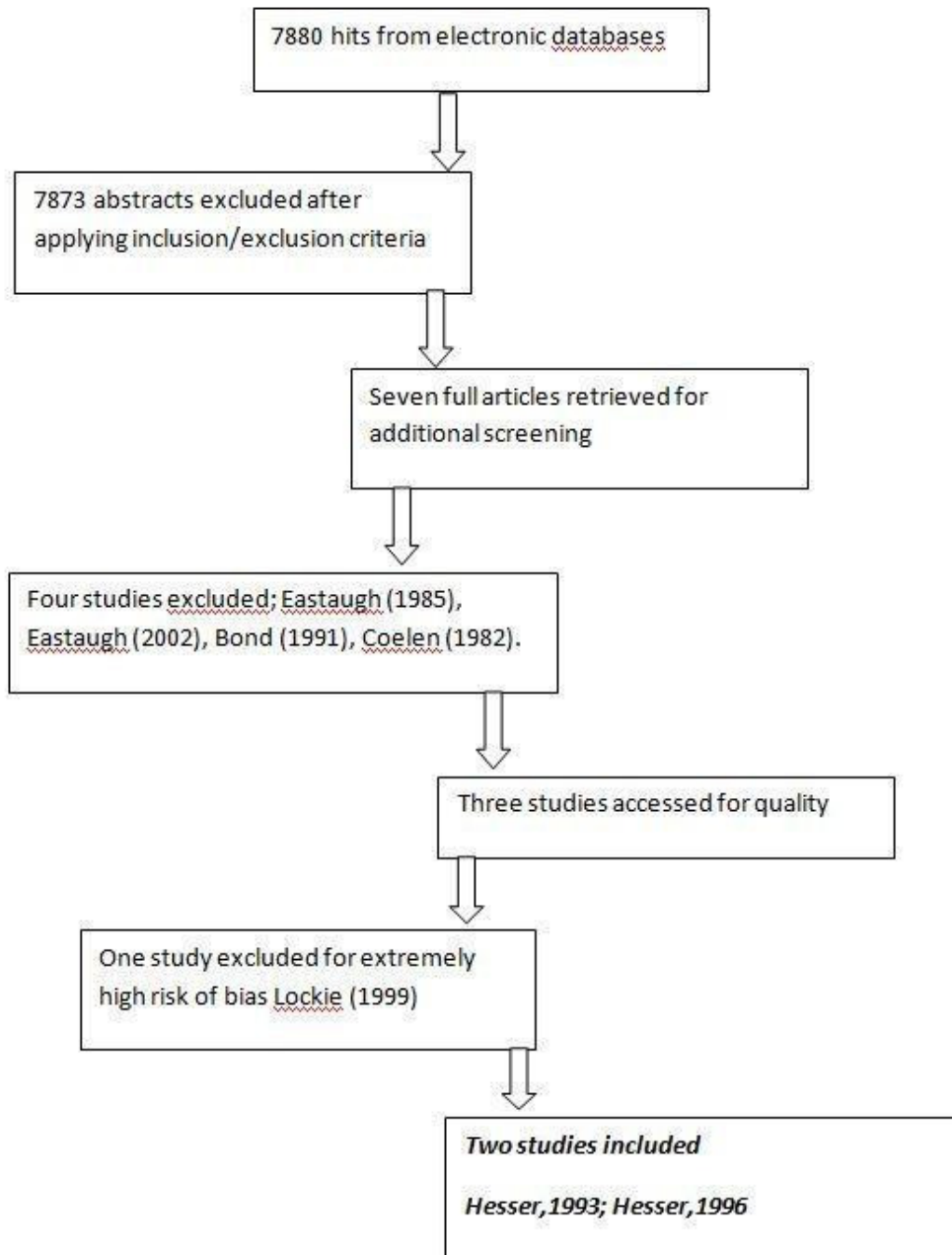
We searched WHO (WHOLIS), World Bank, Google Scholar, health-related web sites for grey literature on human resources but no additional studies were identified.

Five key experts in human resources for health, from South Africa, WHO, Ghana, USA, and Uganda, were contacted between October 2007 and February 2008 in order to identify any unpublished studies. No additional studies were identified.

Reference lists of included studies were searched for additional articles but no additional studies were identified.

A quorum flow chart illustrating the results of the search is shown in [Figure 1](#).

Figure 1.



Included studies

Hesser 1993

This study was based in Georgia, USA. The intervention, a Minority Academic Advising Program (MAAP) implemented in 1984, comprised a package of support activities including academic, personal, financial, and vocational advising; skills building; mentorships; supplementary training; and annual evaluations (Hesser 1993). An MAAP intervention group (n = 129) comprised black students enrolled for allied health sciences degrees between the years 1984 and 1988 and the pre-MAAP comparison group (n = 89) was from 1978 to 1982. A concurrent comparison group of 1884 non-black students was used to take into account effects due to secular changes.

Hesser 1996

This study applied the same comprehensive package (MAAP) described above. However, the study participants were a homogeneous group of students enrolled for a baccalaureate degree in nursing: from 1984 to 1988 for the MAAP intervention group (n = 76), and from 1978 to 1982 for the pre-MAAP comparison group (n = 38). A comparison group of 608 students was used to take into account effects due to secular changes.

Excluded studies

Bond 1991

Coelen 1982

Eastaugh 1985

Eastaugh 2004

Lockie 1999

Risk of bias in included studies

The risk of bias for all included studies was independently assessed by two authors (SNK and ER) using criteria suggested by EPOC for assessing the risk of bias of CBAs (see EPOC Data collection checklist <http://www.epoc.cochrane.org/Files/Website/Reviewer%20Resources/Data%20Collection%20Checklist%20-%20EPOC%20-%202007-Feb-27.doc>): concealment of allocation, follow up of professionals, follow up of patients or episodes of care, blinded assessment of primary outcome(s), baseline measurement, reliable primary outcome measure(s), and protection against contamination. An overall rating (low, moderate, or high risk of bias) was assigned based on these criteria. As a rule of thumb, studies were assigned a rating of low risk of bias if the first three criteria were scored as done, and there were no important concerns related to the last three criteria; moderate if one or two criteria were scored as not clear or not done; and high if more than two criteria were scored as not clear or not done. Any discrepancies in

ratings were resolved by discussion and the involvement of a third author (GWP).

Effects of interventions

Given the different study populations in the two studies, it was impossible to combine the findings. Hesser 1993 comprised a study population of allied health sciences students who included those undertaking courses in: dental hygiene, dental laboratory technology, health information management, medical technology, occupational therapy, physical therapy, physician assistantcy, radiologic technology, and respiratory therapy. These courses had different durations, which may therefore have influenced the outcome, retention to graduation (RTG). In addition, the students' prior level of exposure or experience in health-related education was not described. Since prior exposure to health-related education might influence the length of subsequent training, findings from this study were not combined with those of Hesser 1996, which included only junior-level nursing students with no prior exposure to health-related training or experience. Each study was discussed on its own merits.

1. Hesser 1993

The study found a 45% relative increase in the total number of black allied health sciences students enrolled during the MAAP period. For male students there was a 48% relative increase (from 21 to 31) while for female students the increase was 43% (from 901 to 938). However, the non-black student numbers decreased from 763 to 711 (8%). The overall population of school of allied health sciences black students increased by 5% after MAAP. Retention to graduation increased from 72% pre-MAAP to 83% with MAAP, closely approaching significance (P = 0.051). The statistically significant 14% relative difference in retention to graduation (P < 0.0002) between the sample group and the comparison group (black = 72%, non-black = 86%) in the pre-MAAP period and the lack of statistical significance in these two groups (2.5%) in the MAAP period (black = 83.3% and non-black = 85.5%) indicated that the retention of black students increased relative to that of non-black students.

2. Hesser 1996

In this study the MAAP period successfully increased the number of minority students retained to graduation (74 out of 76, 97.3% graduating) as compared to the pre-MAAP group (35 out of 38, 92.1% graduating); the relative increase was 5.2%. However, this change was not statistically significant. The MAAP period had significantly more black students (76 of 355, or 21%) compared to the pre-MAAP period (38 of 367, or 10%), perhaps indicating that the MAAP programme enhanced the enrolment of black students.

DISCUSSION

A major finding of this review is that there is a paucity of rigorous studies that have evaluated pre-licensure interventions aimed at increasing the supply of health workers. However, even if the criteria were broadened to include less rigorous study designs, not much research has been done in this area. Moreover, our broad search strategy, covering a diverse number of interventions, found only two studies evaluating strategies to reduce attrition (and increase the number of students retained to graduation). Both eligible studies used controlled before and after designs and were based in the USA. The major limitation of before and after study designs is that it is difficult to attribute the change to a particular intervention. It is particularly disappointing that there were no studies using an interrupted time series design. Studies employing this design would be practical, using routinely collected data, and could potentially yield more reliable evidence on the effects of pre-licensure interventions and the supply of health workers. The urgent need to increase health workers in most LMICs is well recognised. However, it was surprising that this critical subject has not attracted enough attention to commission studies that employ rigorous study designs. Moreover, the evidence from the studies included in this review may not be completely applicable to LMICs because the USA has much better infrastructure and resources to support these kinds of programmes.

Evidence on reducing attrition

The two included studies were by the same lead author (Hesser 1993; Hesser 1996), on the same intervention (academic advising for minorities), and during the same time period. They only differed in the target group (allied health sciences, and nursing). According to Hesser et al, a package of interventions including career guidance, academic advising, mentoring, providing remedial courses and personal, social and financial support was able to increase the number of minority students (or students at risk of dropping out) who graduated. The Hesser 1993 study recorded statistically significant positive increases in the proportion of students enrolled and graduating due to the intervention (MAAP). This study had a high risk of bias, considering that it grouped together nine cadres of allied health sciences available in the university and had missing data in the comparison groups (Hesser et al 1993). In the Hesser et al (1996) study, the MAAP period successfully increased the number of minority students retained to graduation (74 out of 76, absolute change $n = 2$, relative increase 2.6%) as compared to the pre-MAAP group (35 out of 38, absolute change $n = 3$, relative increase 7.9%). However, this increase was not statistically significant. This may indicate that evidence from these two studies is insufficient for estimating the likely effects of these interventions on promoting retention of minority students. Another weakness of these studies is the fact that they had complex interventions and it is not possible to determine the

relative contributions of the various components of the interventions. However, educational systems, particularly for health professionals, are complex and are affected by sociocultural, political, and economic realities including regulatory oversight, professional rivalry, and the social norms of a country (Badgley 1971; Kessel 1970). It is likely that complex interventions are needed to increase the supply of health professionals. Nonetheless, future studies would be more informative if they included process evaluations that could provide insights into why interventions did or did not have the intended effects, the contribution of various components of complex interventions, and possible unintended effects. Moreover, the costs of the various activities in the MAAP intervention were not reported and it is worth noting that in the Hesser 1996 study the coordination and evaluation of MAAP was by pre-existing 'Student Education Enrichment Program' (SEEP) coordinators, highlighting a potential overlap in effects between the two programmes.

Evidence on increasing recruitment

According to Hesser et al (1996), the 'Minority Academic Advising Program' resulted in significantly more black students (76 of 355, or 21%) enrolled compared to the pre-MAAP period (38 of 367, or 10%), indicating that enrollments of black students were enhanced by the MAAP program. The subject of how to get more people to enter the health professional training programmes in the first place is of utmost importance (Badgley 1971; Feldbaum 1977). There may be a pool of interested and potentially eligible applicants who are hampered by barriers of educational quality in the high schools or are simply uninformed about prospects of pursuing careers in the health professions (Lewis 2002). Innovative strategies to improve high-school students' knowledge about prospective careers in the health sector have been associated with increases in entry class sizes and performance at entry (Bond 1991; Brewer 1979). However, the effect on enrolment cannot be easily attributed to the intervention in either of these two studies because they were uncontrolled before and after studies.

Perhaps of more importance to LMICs, considering the estimated costs of educating health workers, is the issue of financing education of human resources in health (WHO 2006b). Unfortunately no eligible studies on financial interventions were identified. However, financial support goes beyond providing scholarships to ensuring adequate academic staff numbers, facilities, and educational resources. Schools receiving financial support may utilise it in a variety of ways, ranging from increasing recruitment of students, intensifying the training of the same number of students already in the schools to engaging in more community services, raising faculty salaries and the expansion and capacity of existing facilities (Eastaugh 1985). Allocating funds for training future health workers is not enough. Policies should clearly identify the areas where the funds will be used and in what proportions. For a given country, these costs would depend mostly on which cadre in the

health workforce is needed, and in what numbers. This should be a major concern for health planners and training institutions as they make decisions on how to address the current shortage of human resources in health.

Overall completeness and applicability of evidence

The findings from this review are that a comprehensive package of support activities and career guidance can enhance enrolment and reduce the number of health professional trainees who drop out of training. However, this evidence is based on interventions from a country with a developed economy and which does not have the resource constraints faced by countries in developing economies; the findings may not be applicable in these latter settings. In addition to this, the diversity of this intervention makes it difficult to determine to which extent a particular component of the intervention contributed to the overall effect of the intervention. Other potentially beneficial interventions, for which no evidence was found, include interventions that could increase the capacity of schools such as the opening of new schools or expanding the capacity of existing schools, and increasing the size of entry classes. No evidence was identified from the literature on the potential effects of reducing length of training, reducing educational requirements, or introducing part-time or modular study. However, with regard to changing entry requirements, one study that analysed recruitment and graduation trends among minorities found that an intervention that emphasised the importance of medical careers, targeted at junior and senior high-school students, resulted in increased numbers of minority students enrolling and completing health-related training (Brewer 1979). Another study (Bond 1991) reported that providing supplementary pre-medical school training and support resulted in increased recruitment of students. No evidence was identified regarding the effect of providing financial subsidies; however, one excluded study based on economic modelling revealed that providing financial subsidies to nurses and training institutions for nurses led to an increase in the number of nurses who enrolled and graduated from nurse training institutions (Eastaugh 1985; Eastaugh 2004). No evidence was identified on the effects of changes in selection criteria for recruitment into training institutions or on the effect of employing affirmative action to improve recruitment of minorities on the supply of health professionals. Neither was evidence identified regarding the effects due to changes in curriculum content or examination systems; or guaranteed jobs on completion. There was no evidence found on measures that could increase recruitment from other countries, such as providing training abroad or recognising prior learning; however, one study which did not meet our inclusion criteria noted that providing financial support to train students in other countries might be helpful (Navin 1977). Table 1 in the 'Additional tables' section summarises the studies identified.

Quality of the evidence

For Hesser 1993, the quality of evidence was low to very low. Although the study had baseline measurements, follow up, and a reliable outcome measure of retention to graduation (RTG), data on the performance of participants was incomplete. However, it is unlikely that this could have an effect on retention to graduation since those data were available. Furthermore, the lack of blinded assessment of outcome would not be likely to change the outcomes, which in this case were measured retrospectively. Still, the possibility of overestimating the effect of the intervention cannot be ignored since, prior to MAAP, there was a Student Education Enrichment Program (SEEP) which offered minority retention activities. The fact that MAAP supplemented SEEP activities might imply that its effect may be less than what was measured. Another limitation is that the study participants were non-homogeneous in terms of program affiliation and college experience, making the results less comparable. Hence the evidence from this study is of low quality.

For Hesser 1996, the evidence was of very low quality. The intervention group and the control groups were comparable and the lack of blinded assessment was not likely to introduce bias as the findings were evaluated retrospectively. However, as in the previous study, the existence of SEEP might to some extent have had an impact on RTG as well.

Potential biases in the review process

There is a possibility that some existing grey literature documenting evaluations of changes in pre-licensure education could have been missed in our review. This is especially likely because in many of the low and middle income countries official reports may never be published or made accessible to those outside the institution, government ministry, or agency .

Agreements and disagreements with other studies or reviews

None were identified.

AUTHORS' CONCLUSIONS

Implications for practice

We found only two studies of interventions to improve retention of students, which focussed on American minority groups identified to be at higher risk of dropping out of school. The results of these studies suggest one way by which attrition of students in training might be reduced. In order for policymakers to use these findings, students at risk would need to be identified and

targeted for this kind of intervention. The scope and intensity of such an intervention would then be dictated by the prevalence of attrition of health professional students from training institutions in LMICs. There is little evidence from rigorous evaluations to guide practice.

Implications for research

Two decades ago, Tysinger and Whiteside found, after reviewing the literature, that few studies used rigorous methods to evaluate educational interventions (Tysinger 1987). They concluded that more attention should be given to such research. We found a similar lack of rigorous evaluations of the effects of pre-licensure interventions on the supply of health professionals, and their cost. There is an urgent need to evaluate strategies to increase the numbers of students enrolling and graduating from health professional schools in LMICs, and the quality of education received within the constraints of infrastructure limitations that are characteristic of these countries. Randomised controlled trials or interrupted time series studies would be most appropriate for such evaluations. Given the enormous needs and the magnitude of the resources invested in pre-licensure educa-

tion, “both politically, in terms of being accountable to those who fund the system, and ethically, in terms of making sure that you make the best use possible of available resources, evaluation is absolutely critical” (Dr Julio Frenk, Mexico’s former Minister of Health) <http://www.kunnskapsenteret.no/index.php?back=2&artikkelid=1030> (Moynihan 2008).

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CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Hesser 1993

Methods	The study evaluated the Minority Academic Advising Program (MAAP) using a controlled before and after study design whereby graduation numbers in one group of allied health sciences students enrolling before the interventions (1978-1982) was compared to those graduating after the intervention (1984-1988)
Participants	Allied health sciences students, which included those undertaking courses in: dental hygiene, dental laboratory technology, health information management, medical technology, occupational therapy, physical therapy, physician assistancy, radiologic technology, and respiratory therapy
Interventions	Organisational interventions included: special advice programs for at-risk minority students, which provided financial, social, personal, academic, vocational counselling Fall orientation was provided in addition to an eight-week pre-matriculation program for minority students Referral assistance for minority students and quarterly advice meetings Mentors and role models made presentations to minority students
Outcomes	Retention to graduation: the numbers of health professional students who ultimately graduated or completed their studies
Notes	

Risk of bias

Item	Authors' judgement	Description
Baseline measurement?	Yes	Data was collected on enrolment and graduation (retention to graduation) before the intervention
Blinded assessment of primary outcome?	No	Retrospective data was used to evaluate the effects of MAAP. There was no blinded assessment
Protection against contamination?	No	The existence of a 'Student Education Enrichment Program' (SEEP) before MAAP might have contributed to the effects seen in this evaluation study
Reliable primary outcome?	Yes	The outcome 'retention to graduation' is a reliable outcome.

Hesser 1993 (Continued)

Follow up of participants?	Yes	All participants enrolled were followed up until they graduated unless they dropped out
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Hesser 1996

Methods	The study evaluated the Minority Academic Advising Program (MAAP) using a controlled before and after study design whereby graduation numbers in one group of nursing students enrolling before the interventions (1978-1982) was compared to those graduating after the intervention (1984-1988)
Participants	Junior-level nursing students.
Interventions	Organisational interventions included: special advice programs for at-risk minority students, which provided financial, social, personal, academic, vocational counselling Fall orientation was provided in addition to an eight-week pre-matriculation program for minority students Referral assistance for minority students and quarterly advice meetings Mentors and role models made presentations to minority students
Outcomes	Retention to graduation: the numbers of health professional students who ultimately graduated or completed their studies
Notes	

Risk of bias

Item	Authors' judgement	Description
Baseline measurement?	Yes	Data was collected on enrolment and graduation (retention to graduation) before the intervention
Blinded assessment of primary outcome?	No	Retrospective data was used to evaluate the effects of MAAP. There was no blinded assessment
Protection against contamination?	No	The existence of SEEP before MAAP might have contributed to the effects seen in this evaluation study
Reliable primary outcome?	Yes	The outcome 'retention to graduation' is a reliable outcome.
Follow up of participants?	Yes	All participants enrolled were followed up until they graduated unless they dropped out

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

Study	Reason for exclusion
Bond 1991	This was an uncontrolled before and after study.
Coelen 1982	This was a modelling study that used multiple regression analyses to assess the effects of financial subsidies on nurse training
Eastaugh 1985	This was a modelling study that used multiple regression analyses to assess the effects of financial subsidies on nurse training
Eastaugh 2004	This was a modelling study that used multiple regression analyses to assess the effects of financial subsidies on nurse training
Lockie 1999	This was a controlled before and after study of unacceptably low quality. The participants self-selected into the intervention group and the intervention and control groups were not comparable at the baseline; therefore, the results were most likely due to differences in the two groups at the baseline

DATA AND ANALYSES

This review has no analyses.

ADDITIONAL TABLES

Table 1. The availability of eligible studies (or the lack thereof) in the three intervention categories

Intervention category	Studies eligible	Comments
<p>1. Interventions that could increase the capacity of schools</p> <p>(a) Open new schools - including new policies on licensing of private schools</p> <p>(b) Expand capacity of existing schools</p> <p>(c) Increase the size of entry classes</p> <p>(d) Provide educational subsidies to students or to schools</p> <p>(e) Reduce the length of training</p> <p>(f) Reduce educational requirements</p> <p>(g) Introduce distance/part-time/modular study</p>	<p><i>No eligible study was identified in this category</i></p>	
<p>2. Interventions that could reduce the loss of students (increase likelihood that students will graduate)</p> <p>(a) Change selection criteria/processes</p> <p>(b) Affirmative action promoting enrolment or retention of minority groups</p> <p>(c) Changes in curriculum content, duration and examination systems</p> <p>(d) Financial incentives (penalties or rewards targeted at schools or students), reductions in school fees structure, and provision of student loans/subsidies</p> <p>(e) Buddy systems/counselling/support systems for students</p> <p>(f) Guaranteed jobs upon graduation</p>	<p>None identified (Hesser et al 1993; Hesser et al 1996)</p> <p>None identified</p> <p>None identified (Hesser et al, 1993), (Hesser et al 1996)</p> <p>None identified</p>	<p>One uncontrolled before and after study (Bond 1991) found that interventions targeted at high school going students can enhance interest in the medical profession (in this case pharmacy) improved enrolment and performance at college level</p> <p>Regarding financial incentives/subsidies and loans, three modelling studies on the effect of financial aid in increasing the supply of nurses showed that student loans and subsidies can increase numbers trained (Coelen 1982; Eastaugh 1985;2002)</p>
<p>3. The following interventions could increase recruitment from outside of countries</p> <p>(a) Provide funds for training outside the country</p> <p>(b) Recognise prior learning</p>	<p>None identified in this category</p> <p>None identified in this category</p>	

APPENDICES

Appendix I. MEDLINE search strategy

- 1.Students/
- 2.Students, Public Health/
- 3.Students, Health Occupations/
- 4.Students, Premedical/
- 5.Student Dropouts/
- 6.((student? or school) adj2 dropout?).tw.
- 7.exp Health Personnel/
- 8.((health or health care or healthcare or medical) adj (staff or personnel or provider? or professional?)).tw.
- 9.((health or health care or healthcare or medical or nurs\$ or premedical) adj student?).tw.
- 10.or/1-9
- 11.“Fellowships and Scholarships”/
- 12.Training Support/
- 13.Health Planning Support/
- 14.Financing, Government/
- 15.Financing, Organized/
- 16.Financial Support/
- 17.“Personnel Selection”/
- 18.Education/
- 19.Education, Distance/
- 20.Education, Medical/
- 21.Education, Clinical/
- 22.Education, Medical, Undergraduate/
- 23.Education, Nursing/
- 24.Education, Nursing, Baccalaureate/
- 25.Education, Nursing, Associate/
- 26.Education, Nursing, Diploma Programs/
- 27.Education, Pharmacy/
- 28.Education, Dental/
- 29.Education Professional/
- 30.Curriculum/
- 31.(stipend? or grant? or loan? or fellowship? or scholarship? or subsidy or subsidies).tw.
- 32.((financ\$ or training) adj3 support\$).tw.
- 33.(male and nurs\$ and education).tw.
- 34.(male and nurs\$ and training).tw.
- 35.(female doctor? and (education or training)).tw.
- 36.(female medical doctor? and (education or training)).tw.
- 37.(accelerate and (education or training)).tw.
- 38.((recruit\$ or enrol\$ or retain\$) and (education or training)).tw.
- 39.(school? and (closure or close or closing or merge\$)).tw.
- 40.(((medical or nurs\$) adj school?) and curricul\$).tw.
- 41.affirmative action?.tw.
- 42.(distan\$ education or module? study or student counselling or part time stud\$).tw.
- 43.(undergraduate and education).tw.
- 44.(under graduate and education).tw.
- 45.(baccalaureate and education).tw.
- 46.((basic or pre service or preservice or pre licensure) adj2 education).tw.
- 47.or/11-46
- 48.randomized controlled trial.pt.
- 49.controlled clinical trial.pt.

- 50.random\$.tw.
- 51.(time adj series).tw.
- 52.controlled before.tw.
- 53.or/47-52
- 54.(pre test or pretest or (posttest or post test)).tw.
- 55.control\$.tw.
- 56.53 and 55
- 57.53 or 56
- 58.Animals/
- 59.Humans/
- 60.58 not (58 and 59)
- 61.57 not 60
- 62.10 and 47 and 61

Appendix 2. EMBASE search strategy

- 1. exp Medical Student/
- 2. Nursing Student/
- 3. exp Paramedical Student/
- 4. Baccalaureate Nursing Student/
- 5. Education/
- 6. Health Education/
- 7. Medical Education/
- 8. Dental Health Education/
- 9. Dental Education/
- 10. Allied Health Education/
- 11. Nursing Education/
- 12. Vocational Education/
- 13. Curriculum/
- 14. Affirmative Action/
- 15. ((health or health care or healthcare or medical or nurs\$ or premedical) adj student?).tw.
- 16. (stipend? or grant? or loan? or fellowship? or scholarship? or subsidy or subsidies).tw.
- 17. ((financ\$ or training) adj3 support\$.tw.
- 18. (male and nurs\$ and education).tw.
- 19. (male and nurs\$ and training).tw.
- 20. (female doctor? and (education or training)).tw.
- 21. (female medical doctor? and (education or training)).tw.
- 22. (accelerate and (education or training)).tw.
- 23. ((recruit\$ or enrol\$ or retain\$) and (education or training)).tw.
- 24. (medical school? and (closure or close or closing or merge\$)).tw.
- 25. (((medical or nurs\$) adj school?) and curricul\$).tw.
- 26. affirmative action?.tw.
- 27. (distan\$ education or distan\$ learning or module? study or student counselling or student counseling or part time stud\$).tw.
- 28. clinical education.tw.
- 29. (undergraduate or under graduate).tw.
- 30. (baccalaureate or bachelor\$ degree?).tw.
- 31. ((basic or pre service or preservice or pre licensure) adj2 education).tw.
- 32. or/1-31
- 33. exp Health Care Personnel/
- 34. Health Care Manpower/
- 35. ((health or health care or healthcare or medical) adj (staff or personnel or provider? or professional? or worker?)).tw.
- 36. (health adj2 (manpower or workforce? or work force? or human resource?)).tw.

37. ((student? or school) adj2 dropout?).tw.
38. ((student? or school) adj2 dropping out).tw.
39. (student adj (attrition or retention)).tw.
40. or/33-39
41. Randomized Controlled Trial/
42. random\$.tw.
43. Time Series Analysis/
44. (time adj series).tw.
45. controlled before.tw.
46. or/41-45
47. (pre test or pretest or post test or posttest).tw.
48. control\$.tw.
49. 47 and 48
50. 46 or 49
51. nonhuman/
52. 50 not 51
53. 32 and 40 and 52

Appendix 3. CINAHL search strategy

1. Students/
2. Students, Pre-Nursing/
3. exp Students, Health Occupations/
4. ((health or health care or healthcare or medical or nurs\$ or premedical) adj student?).tw.
5. Financial Support/
6. Grants/
7. Training Support, Financial/
8. Scholarships/
9. Financing, Government/
10. Personnel Selection/
11. Affirmative Action/
12. Curriculum/
13. Education/
14. Health Education/
15. Dental Health Education/
16. Education, Health Sciences/
17. Education, Associate/
18. Education, Nursing, Associate/
19. Education, Baccalaureate/
20. Education, Nursing, Baccalaureate/
21. Education, Premedical/
22. Part Time Study/
23. Education, Dental/
24. Education, Medical/
25. Education, Midwifery/
26. Education, Nursing/
27. Education, Pharmacy/
28. Vocational Education/
29. (stipend? or grant? or loan? or fellowship? or scholarship? or subsidy or subsidies).tw.
30. ((financ\$ or training) adj3 support\$).tw.
31. (male and nurs\$ and education).tw.

32. (male and nurs\$ and training).tw.
33. (female doctor? and (education or training)).tw.
34. (female medical doctor? and (education or training)).tw.
35. (accelerate and (education or training)).tw.
36. ((recruit\$ or enrol\$ or retain\$) and (education or training)).tw.
37. (school? and (closure or close or closing or merge\$)).tw.
38. (((medical or nurs\$) adj school?) and curricul\$).tw.
39. affirmative action?.tw.
40. (distan\$ education or distan\$ learning or module? study or student counselling or student counseling or part time stud\$).tw.
41. clinical education.tw.
42. (undergraduate or under graduate).tw.
43. (baccalaureate or bachelor\$ degree?).tw.
44. ((basic or pre service or preservice or pre licensure) adj2 education).tw.
45. or/1-44
46. exp Health Personnel/
47. Health Manpower/
48. Student Dropouts/
49. Student Retention/
50. (student adj (attrition or retention)).tw.
51. ((health or health care or healthcare or medical) adj (staff or personnel or provider? or professional? or worker?)).tw.
52. (health adj2 (manpower or workforce? or work force? or human resource?)).tw.
53. ((student? or school) adj2 dropout?).tw.
54. ((student? or school) adj2 dropping out).tw.
55. or/46-54
56. Clinical Trial/
57. (controlled adj (study or trial)).tw.
58. random\$.tw.
59. Comparative Studies/
60. exp Pretest-Posttest Design/
61. exp Quasi-Experimental Studies/
62. time series.tw.
63. controlled before.tw.
64. or/56-63
65. (pre test or pretest or post test or posttest).tw.
66. control\$.tw.
67. 65 and 66
68. 64 or 67
69. 45 and 55 and 68

Appendix 4. LILACs search strategy

((student\$ or Estudiant\$ or estudiant\$) and (dropout\$ or Evasão or Abandon\$)) or ((health or salud or medical or medico or medica or saude) and (personal or Pessoal or staff or personnel or provider\$ or professional or profesional or Profission\$)) or ((health or salud or medical or medico or medica or saude) and (personal or Pessoal or staff or personnel or provider\$ or professional or profesional or Profission\$)) or ((health or salud or medical or medico or medica or saude or enfermer\$ or nurse or Enfermeir\$ or premedical or medicina) and (student\$ or Estudiant\$ or estudiant\$)) [Palavras] or ([MH]"Students" or [MH]"Students, Public Health" or [MH]"Students, Health Occupations" or [MH]"Students, Premedical" or [MH]"Student Dropouts" or [MH]"Health Personnel")

AND

((estipend\$ or donacion or subvencion or beca or doação or subvenção or stipend\$ or grant\$ or loan\$ or fellowship\$ or scholarship\$ or subsidy or subsidies) or ((financ\$ or training or entrenam\$ or treinam\$ or adestram\$ or adiestram\$) and (support\$ or soporte or apoyo or sustento or ajuda or apoio or auxílio or manutenção or acostamento)) or ((nurs\$ or enfermer\$ or enfermeir\$ or doctor or accelerate or aceler\$ or recruit\$ or enrol\$ or retain\$ or reclut\$ or reten\$ or recruit\$) and (educacion or educação or education or training or entrenam\$ or treinam\$ or adestram\$ or adiestram\$)) or ((escuela\$ or escola\$ or school\$) and (closure or close or closing or merge\$ or cierre or clausura or fusion\$ or encerrament\$ or fecho or mistura\$)) or ((medical or medico or medica or saude or enfermer\$ or nurse or Enfermeir\$ or nurs\$) and (escuela\$ or escola\$ or school\$) and (curricul\$)) or ((affirmative and action\$) or (accion and afirmativa) or (ação and afirmativ\$)) or ((distan\$ and (education or educacion or educação)) or (modul\$ and (study or estudio or estudo)) or ((student\$ or Estudiant\$ or estudiant\$) and (counselling or counseling or consejo or aconseja\$)) and (part time or tiempo parcial or tempo parcial)) or ((undergraduate or pregrad\$ or pre grad\$ or baccalaureate) and (education or educacion or educação)) or ((basic or pre service or preservice or pre licensure or pre licenciatura or prelicenciatura) and (education or educacion or educação)) or ([MH]"Fellowships and Scholarships" or "Training Support" or "Health Planning Support" or "Financing, Government" or "Financial Support" or "Personnel Selection" or "Education" or "Education, Distance" or "Education, Medical" or "Education, Nursing" or "Education, Nursing, Baccalaureate" or "Education, Nursing, Associate" or "Education, Nursing, Diploma Programs" or "Education, Pharmacy" or "Education, Dental" or "Education, Professional" or "Curriculum")

AND

CT COMPARATIVE STUDY or random\$ or intervention\$ or intervencion or intervenção or control\$

Appendix 5. Sociological Abstracts search strategy

(KW=(Time Series Analysis or Comparative Analysis or Intervention or random* or control* or intervention* or clinical study or clinical trial or time series or pretest or pre test or posttest or post test or quasi experimental)) and (KW=("health professions" or "human resources" or "labor supply" or "labor force" or "dentists" or "midwifery" or "nurses" or "paramedical personnel" or "physicians" or "psychiatrists" or "psychologists" or "therapists" or "dropouts" or health staff or health personnel or health provider* or health professional* or health worker* or healthcare staff or healthcare personnel or healthcare provider* or healthcare professional* or healthcare worker* or medical staff or medical personnel or medical provider* or medical professional* or medical worker* or nurs* staff or nurs* personnel or nurs* provider* or nurs* professional* or nurs* worker* or manpower or work force or workforce or student dropout* or dropping out or student attrition or student retention)) and (KW=("students" or "medical students" or "baccalaureate degrees" or "undergraduate programs" or "undergraduate students" or "professional training" or "courses" or "workshops courses" or "education" or "curriculum" or "distance education" or "educational policy" or "educational programs" or "vocational education" or "financial support" or "enrollment" or "fellowships and scholarships" or "scholarship" or "grants" or "loans" or "sponsorship" or "subsidies" or "human capital" or "affirmative action" or student* or baccalaureate or bachelor* degree* or undergraduate or under graduate or education or distant learning or distance learning or course* or enrolment or fellowship* or scholarship* or grant* or loan* or subsidy or basic education or pre service education or pre licensure education or module stud* or student counselling or student counseling or affirmative action*))

Appendix 6. ERIC search strategy

Query: (KW=random* or KW=intervention* or KW=control* or KW=evaluat*)
and

(DE=school funds or DE=student financial aid or DE=student loan
programs

or DE=grants or DE=incentive grants or DE=tuition or DE=tuition grants
or

DE=fellowships or DE=scholarships or DE=dropout programs or DE=dropout
prevention or DE=continuation students or DE=experimental curriculum or
DE=school restructuring or DE=enrollment influences or DE=enrolment
management or DE=selective admission or DE=student recruitment or

DE=marketing of education or DE=access to education or DE=educational opportunities or DE=educational policy or DE=educational innovation or DE=educational change or DE=educational supply or DE=affirmative action)

and (((KW=student or KW=students) and (KW=health or KW=medical) and (DE=labor supply or DE=labor force or DE=human resources or DE=human capital)) OR ((KW=student or KW=students) and (DE=health personnel or DE=allied health personnel or DE=dental assistants or DE=dental hygienists or DE=dental technicians or DE=dietitians or DE=emergency medical technicians or DE=environmental technicians or DE=home health aides or DE=medical assistants or DE=medical laboratory assistants or DE=medical record administrators or DE=medical record technicians or DE=medical technologists or DE=nurses aides or DE=occupational therapy assistants or DE=optometrists or DE=physical therapy aides or DE=physicians assistants or DE=psychiatric aides or DE=radiologic technologists or DE=speech language pathologists or DE=surgical technicians or DE=therapists or DE=occupational therapists or DE=physical therapists or DE=dentists or DE=hospital personnel or DE=medical consultants or DE=mental health workers or DE=psychiatrists or DE=school psychologists or DE=nurses or DE=nurse practitioners or DE=school nurses or DE=pharmacists or DE=physicians or DE=foreign medical graduates or DE=psychologists)) OR ((KW=health or KW=medical) and (DE=undergraduate students or DE=bachelors degrees or DE=dropouts)) OR (DE=nursing students or DE=medical students or DE=premedical students or DE=dental students))

Appendix 7. CENTRAL search strategy

- #1 MeSH descriptor Health Personnel explode all trees with qualifier: ED
- #2 MeSH descriptor Students, this term only
- #3 MeSH descriptor Students, Public Health, this term only
- #4 MeSH descriptor Students, Health Occupations, this term only
- #5 MeSH descriptor Students, Premedical, this term only
- #6 MeSH descriptor Training Support, this term only
- #7 MeSH descriptor Health Planning Support, this term only
- #8 MeSH descriptor Financing, Government, this term only
- #9 MeSH descriptor Financing, Organized, this term only
- #10 MeSH descriptor Financial Support, this term only
- #11 MeSH descriptor Personnel Selection, this term only
- #12 MeSH descriptor Education, this term only
- #13 MeSH descriptor Education, Distance, this term only
- #14 MeSH descriptor Education, Medical, this term only
- #15 MeSH descriptor Education, Medical, Undergraduate, this term only
- #16 MeSH descriptor Education, Nursing, this term only
- #17 MeSH descriptor Education, Nursing, Baccalaureate, this term only
- #18 MeSH descriptor Education, Nursing, Associate, this term only
- #19 MeSH descriptor Education, Nursing, Diploma Programs, this term only
- #20 MeSH descriptor Education, Pharmacy, this term only

- #21 MeSH descriptor Education, Dental, this term only
- #22 MeSH descriptor Education, Professional, this term only
- #23 MeSH descriptor Curriculum, this term only
- #24 (health or healthcare or medical or nurs* or premedical) NEXT student*:ti or (health or healthcare or medical or nurs* or premedical) NEXT student*:ab
- #25 (stipend* or grant* or loan* or fellowship* or scholarship* or subsidy or subsidies):ti or (stipend* or grant* or loan* or fellowship* or scholarship* or subsidy or subsidies):ab
- #26 (financ* or training) NEAR/3 support*:ti or (financ* or training) NEAR/3 support*:ab
- #27 (male and nurs* and education):ti or (male and nurs* and education):ab
- #28 (male and nurs* and training):ti or (male and nurs* and training):ab
- #29 (female doctor*) and (education or training):ti or (female doctor*) and (education or training):ab
- #30 (female NEXT medical NEXT doctor*) and (education or training):ti or (female NEXT medical NEXT doctor*) and (education or training):ab
- #31 (accelerate and (education or training)):ti or (accelerate and (education or training)):ab
- #32 (recruit* or enrol* or retain*) and (education or training):ti or (recruit* or enrol* or retain*) and (education or training):ab
- #33 (school* and (closure or close or closing or merge*)):ti or (school* and (closure or close or closing or merge*)):ab
- #34 ((medical or nurs*) NEXT school*) and curricular*:ti or ((medical or nurs*) NEXT school*) and curricular*:ab
- #35 (affirmative NEXT action*):ti or (affirmative NEXT action*):ab
- #36 (distan* NEXT education or distan* NEXT learning or module* NEXT study or student NEXT counselling or student NEXT counseling or part NEXT time NEXT stud* or clinical NEXT education):ti or (distan* NEXT education or distan* NEXT learning or module* NEXT study or student NEXT counselling or student NEXT counseling or part NEXT time NEXT stud* or clinical NEXT education):ab
- #37 (undergraduate or under NEXT graduate):ti or (undergraduate or under NEXT graduate):ab
- #38 (baccalaureate or bachelor* NEXT degree*):ti or (baccalaureate or bachelor* NEXT degree*):ab
- #39 (basic or pre NEXT service or preservice or pre NEXT licensure) NEAR/2 education:ti or (basic or pre NEXT service or preservice or pre NEXT licensure) NEAR/2 education:ab
- #40 (#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 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39)
- #41 MeSH descriptor Health Personnel explode all trees
- #42 MeSH descriptor Health Manpower, this term only
- #43 MeSH descriptor Student Dropouts, this term only
- #44 (health or healthcare or medical or nurs*) NEXT (staff or personnel or provider* or professional* or worker*):ti or (health or healthcare or medical or nurs*) NEXT (staff or personnel or provider* or professional* or worker*):ab
- #45 (health NEAR/2 (manpower or workforce* or work NEXT force* or human NEXT resource*)):ti or (health NEAR/2 (manpower or workforce* or work NEXT force* or human NEXT resource*)):ab
- #46 (student* or school) NEAR/2 (dropout* or "dropping out"):ti or (student* or school) NEAR/2 (dropout* or "dropping out"):ab
- #47 (student NEXT (attrition or retention)):ti or (student NEXT (attrition or retention)):ab
- #48 (#41 OR #42 OR #43 OR #44 OR #45 OR #46 OR #47)
- #49 (#40 AND #48)

HISTORY

Protocol first published: Issue 1, 2008

Review first published: Issue 2, 2009

CONTRIBUTIONS OF AUTHORS

GW Pariyo: lead author of the review.

SN Kiwanuka: conducted part of the literature search, screening of articles, extraction of data, and worked substantially on drafting and refining the review.

E Rutebemberwa: participated in the article-screening process, extraction of data, and drafting the review.

F Ssengooba: provided substantial input on the review draft.

Olico Okui: provided substantial input on the review draft.

DECLARATIONS OF INTEREST

None known

SOURCES OF SUPPORT

Internal sources

- Makerere University School of Public Health, Uganda.

Institutional support in terms of hosting the Centre for Systematic Reviews on Human Resources for Health.

External sources

- WHO, Alliance for Health Policy and Systems Research (AHPSR), Switzerland.

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- Cochrane Effective Practice and Organisation of Care Group, Norway.

Technical support in conducting a Cochrane review.

- Methodology Centre for Systematic Reviews in Health Systems Research, Chile.

Technical support in conducting systematic review.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

Handsearching of journals was not conducted due to not being able to access relevant journals.

INDEX TERMS

Medical Subject Headings (MeSH)

*Career Choice; *Health Manpower; *Minority Groups; Health Personnel [*education]; Vocational Guidance [*methods]

MeSH check words

Humans