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# Are medical students influenced by preceptors in making career choices, and if so how? A systematic review

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## ABSTRACT

**Introduction:** Increasingly medical students undertake clinical training in distributed learning environments. The driving factor for this is predominantly to address medical workforce shortages. In these environments students are often taught by private practitioners, residents, house staff and registrars, as well as faculty. Through a mix of short- and long-term preceptorships, clerkships and rotations, medical students are exposed to a wider range of preceptors, mentors and role models than has traditionally been the case. The aim of this systematic review was to understand if and how medical students' career choices are influenced by their interactions with preceptors.

**Method:** A search of Ovid Medline, Scopus, ISI Web of Science, PubMed, Eric and CIBNAL was undertaken. The search was structured around the key terms: Medical Student, Career Choice and Preceptor, and variants of these terms. Search limits were set to English-language publications between 1995 and 2010.

**Results:** A total of 36 articles met the selection criteria from the 533 citations sourced from the search. Required preceptorships as short as 3 weeks' duration influence the career choice of students when they rate the preceptor as a high quality teacher. Preceptors who are judged (by students) as high quality teachers have the greatest influence on student career choice by up to four-fold. When students judged a preceptor as being a negative role model, a poor teacher or lacking discipline specific knowledge they will turn away from that field. The positive influence of relationships between preceptors and students on career choice is strongest where

there is continuity of preceptors, continuity of care, and continuity of patient interactions. The longer the duration of the preceptorship the greater the influence on student career choice, particularly in primary care environments.

**Conclusion:** This review adds to the literature by identifying how differing components and combinations of components of a preceptorship influence medical student career choices. Multiple components of the preceptorship combined have a greater influence. In free choice, longitudinal integrated clerkships' duration of placement and continuity relationships with preceptors have the greatest influence on medical students in pursuing a primary care career. This information informs medical schools, curriculum designers and policy-makers in reforming medical education to address workforce shortages.

**Key words:** career choice, medical students, preceptors, systematic review.

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## Introduction

Medical students are increasingly being taught in distributed educational settings<sup>1-8</sup>. That is, educational settings distant from the main tertiary teaching settings. Distributed educational settings can be situated in rural, regional or outer urban areas. There are several factors which have contributed to this educational shift in the last 10 to 15 years, including the recognition that community settings are excellent learning environments<sup>5,9-11</sup>, increasing numbers of medical school places<sup>12-14</sup> and a recognition of the limitations for the teaching medical students in tertiary institutions. Finally, and most importantly, governments are trying to address the global rural doctor shortage with the ultimate aim of improving the health status of those in rural communities<sup>15-19</sup>.

In distributed learning environments medical students are often taught by private practitioners, residents, house staff and registrars as well as faculty. Through a mix of short and long term preceptorships, clerkships and rotations medical students are exposed to a wider range of preceptors, mentors and role models than has been the case traditionally.

### Definitions

In this review Walters definition of a preceptor is used<sup>20</sup>. A preceptor is defined as the clinician with whom the medical student is working and who has responsibility for the student's learning and the patients' care and safety.

In the USA and Canada, the term 'clerkship' and 'preceptorship' are used interchangeably. The terms are used to describe the discipline specific placements that medical students undertake in their clinical training years. In these clinical placements, preceptors are responsible for both student teaching and patient safety.

In this review 'career choice' refers to the actual career of medical school graduates in retrospective studies. In prospective studies 'career choice' can only be interpreted as 'career intent'.

In this review, a Longitudinal Integrated Clerkship (LIC) has to meet the agreed international definition as determined by the Consortium of Longitudinal Integrated Clerkships (CLIC)<sup>21</sup>. An LIC must have the following common core elements:

1. Medical students participate in the comprehensive care of patients over time.
2. Medical students have continuing learning relationships with these patients' clinicians.
3. Medical students meet, through these experiences, the majority of the year's core clinical competencies across multiple disciplines simultaneously.

## Methods

### Inclusion and exclusion criteria

To be included in the review, literature had to be published in the English language, from any country, between the years 1995 and

2010, and focus on undergraduate or graduate entry medical programs. Opinion pieces or commentaries where no evidence was presented were excluded from the review.

## Search strategy

The search was structured around the key terms Medical Student, Career Choice and Preceptor and variants of these terms. Search limits were set to English-language publications between 1995 and 2010. The year 1995 was chosen because this was when research started to appear in the Australian literature from the programs funded by the Australian Government to address the rural doctor workforce shortage in early the 1990s.

The search structure was slightly different in each search depending on the limitations of the individual database. The search included Ovid Medline, Scopus, ISI Web of Science, PubMed, Eric and CIHNAL data bases.

A hand search of journal articles accumulated by the author from previous research endeavours was conducted using the same search criteria. A hand search of grey literature including reports, newsletters and program evaluations found 2 articles. All articles meeting the selection criteria were snowballed to capture additional literature. These snowballed articles were subjected to the same search criteria.

## Results

### Search

The combined searches from Ovid, Scopus, Web of Knowledge, Eric CINAHL, and Pub Med resulted in 408 citations. The authors own library resulted in 22 articles being selected for review. Snowballing from these 430 articles produced 101 articles. A hand search of books, reports and journal articles held in the Flinders University Rural Clinical School was conducted. These were read and 2 articles were found that met the search criteria. This resulted in 533 articles selected for review; 29 articles were subsequently removed because of duplication. After reviewing all titles, 193 articles were removed from the search as the titles did

not indicate relevance to the aims of this study. Abstracts from the remaining 311 articles were read, resulting in the rejection of 201 articles. The remaining 110 full articles were read and 36 were selected for the final review based on their relevance to the review question: 'In what ways are medical students influenced in making their career choice through experiences with preceptors'. A flow diagram shows articles selected for review (Fig1).

### Quality assessment

An inter-coder reliability test was performed by comparing two different assessments of one article<sup>17</sup> in two separate studies using the Campos-Outcalt et al's (CO) quality rating system<sup>22</sup>. There was concordance between Thistlethwaite et al<sup>16</sup> and this reviewer in assessing Veitch et al<sup>17</sup>. The quality ratings of the articles in this review and Thistlethwaite et al's ranged between 8 and 41/70 with an average of 23. Both reviews ascribe the low rating to the fact that that few studies were conducted with a theoretical base and the validity and reliability of questionnaires was rarely mentioned. The quality rating was applied to all the articles selected for the final review to test the strength of the findings.

The characteristics of the articles in the final review are shown (Table 1). Twenty-five of the articles in this review are retrospective articles where career choice has been determined. Of the Australian articles, 3 articles and both program evaluations refer to the same program. A synthesis of the data in each of the articles obtained from the systematic review is presented (Table 2). The factors influencing career choice found in the five previously published reviews of the literature found in the search is presented (Table 3).

### Analysis of the literature

The literature is grouped by common themes. First, by length of placement; second, by discipline either primary care or as a distinct 'other' discipline; and third, as a required or free choice placement. An analysis of the influence of preceptors within these groups is presented. Finally, an analysis of the five previously published reviews is presented. Some studies are discussed multiple times under these different groupings.

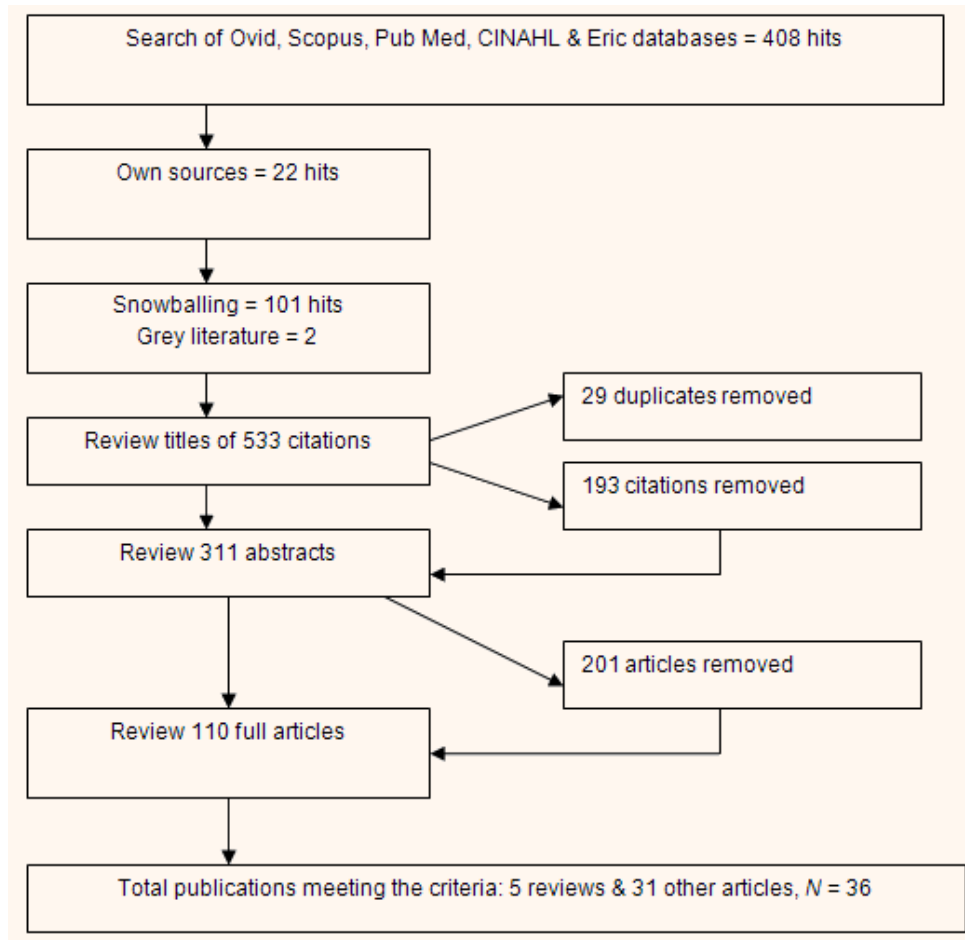


Figure 1: Flow diagram showing articles selected for review.

Table 1: Characteristics of articles in the review, according to country<sup>1,7-9,15,17,22-47</sup>

Country	Characteristic					
	Program evaluation	Review	Published paper	Total	Retrospective	Prospective
Australia	2 [23, 24]	–	5 [1, 9, 17, 25, 51]	7	5 [9, 17, 23, 25, 51]	1 [24]
USA	5 [26-30]	5 [22, 31-34]	16 [7, 15, 35-48]	26	19 [7, 22, 27, 28, 29, 31, 32, 33, 34, 36, 37, 38, 39, 41, 42, 43, 45, 46, 47]	5 [30, 35, 40, 44, 48]
Other	1 [8]	–	2 [49, 50]	3	1 [49]	2 [8, 50]
Total	8	5	23	36	–	–

Table 2: Data synthesis articles obtained from systematic review<sup>1,8,9,15,17,23-47</sup>

Author, Year, Country [Ref]	Type of clinical placement, Duration Discipline	Sample, Population, Response rate	Methodology, Method Context	Main findings	Limitations	C-O Quality rating
Worley P 2002 Australia [1]			Descriptive research paper		Descriptive research paper	Score N/A
Norris TE 2009 USA [7]	Integrated core disciplines	Multiple institutions 17 99%	Qualitative Online survey Retrospective	Survey of CLIC programs worldwide. Fifteen institutions have active LICs. Two programs began before 1995. The median clerkship length is 40 weeks the core clinical contents are medicine, surgery, paediatrics, and O&G. Limited outcomes data suggest that students who participate in these programs are more likely to enter primary care careers.	Lack of a standardized evaluation tool	15
Poole P et al 2010 New Zealand [8]	LIC Rural >8 weeks Integrated core disciplines	1 institution 20 99%	Quantitative Cohort Prospective	Inaugural evaluation of the CBME program.	First year Inconclusive evidence, one institution, small sample, selection bias	12
Stagg P et al 2009 Australia [9]	LIC Rural >8 weeks Integrated core disciplines	1 institution 86 53%	Mixed Cohort Retrospective	Online survey and interviews. Key influences on making a rural pathway choice are the longitudinal placements, clinical teachers both GPs and specialists. 12/86 reported the PRCC confirmed their career choice. 8/86 urban respondents reported PRCC GP clinical teachers as influencing them to undertake rural GP careers. Limited by small sample size and cohort status	1 institution, small sample size, possible self selection bias as respondents knew researcher	17
Rabinowitz H et al 2001 USA. [15]	LIC Rural >8 weeks Integrated core disciplines	1 institution 3414 99%	Systematic Review Retrospective	3414 graduates from 1978 to1993 including 220 PSAP graduates. Participation in the PSAP was the only independent predictive factor of retention for all classes (OR, 4.7; 95% CI, 2.0-11.2; p = 0.001		41

Table 2 cont'd

Author, Year, Country [Ref]	Type of clinical placement, Duration Discipline	Sample, Population, Response rate	Methodology, Method Context	Main findings	Limitations	C-O Quality rating
Veitch C et al 2006 Australia [17]	LIC Rural >8 weeks Integrated core disciplines	1 institution 122 87%	Quantitative Cohort Retrospective	2 cohorts of approximately 60 students each. Career aspirations changed appreciably between 2001 and 2005: the number of undecided students had halved, the numbers interested in general practice had reduced by one-third, the numbers considering surgery had reduced to one-third, and none was considering paediatrics at exit. Conversely, the number considering emergency medicine had almost doubled and more than doubled for O&G. Student initiated survey.	1 institution	19
Oswald N 2002 Australia [23]	LIC Rural >8 weeks Integrated core disciplines	1 institution	Project evaluation	Career pathways being followed by 85% of PRCC graduates are compatible with or lead directly to rural careers.	Project evaluation	Score N/A
Couper I 2006 Australia [24]	LIC Rural >8 weeks Integrated core disciplines	1 institution	Project evaluation	PRCC, FMC and NTCS PRCC projected career location outside urban = 58%. FMC projected career location outside urban = 16%. NTCS projected career location outside urban = 75%. Choosing to study rurally does not preclude an inclination to specialise	Project evaluation	0
Eley D et al 2009 Australia [25]	LIC Rural >8 weeks Integrated core disciplines	1 institution 180 69%	Quantitative Online Survey Retrospective	Year 3 and/or year 4 LIC. UQRCS had a positive effect on interest and desire to work rurally (29%). Factors included mentors arranging own experience and role models. Years 3 and 4 combined has greatest effect.	Limited to one institution, is the first of a longitudinal program. Not clear if the role models and mentors are also the preceptors	19
Wartman S et al 2001 USA [26]	Interdisciplinary Generalist Curriculum, other		Project evaluation	16 recommendations to support a Interdisciplinary Generalist Curriculum	Project evaluation	Score N/A

Table 2 cont'd

Author, Year, Country [Ref]	Type of clinical placement, Duration Discipline	Sample, Population, Response rate	Methodology, Method Context	Main findings	Limitations	C-O Quality rating
Nieman 2004 USA [27]	Preceptorship >2, ≤ 8 weeks Family practice	Multiple institutions 10 506 96%	Quantitative Survey Retrospective	Nine graduating classes from 1992 to 2000, show 1667 (66.2% of 2517) students who chose a primary care specialty after participating in TSFPPP. At the same time, there were 4231 students (55.9% of 7564 graduates) who chose one of the primary care specialties without participating in the TSFPPP. The % of students with TSFPPP experiences who chose one of the four primary care specialties were: 27.9% family practice, 21.8% internal medicine, 9.3% paediatrics, and 7.2% O&G. In comparison, 15.7% of non-participants chose family practice, 21.8% chose internal medicine, 12% chose paediatrics, and 6.4% chose O&G. Major TSFPPP contribution to increased primary care residency choices was due to the increased choices of family practice residencies.	Project evaluation	Score N/A
Ogur B et al 2007 USA [28]	Clerkship >8 weeks Integrated core disciplines	1 institution	Mixed Survey Retrospective	Longitudinal integrated clerkship 3 goals: 1. Follow patients through full episodes of care. 2. Students principally taught by faculty. Continuous longitudinal relationships with faculty educators who are preceptors and mentors. 3. Students exposed to a wide range of core clinical problems.	Project evaluation	Score N/A
Lang F et al 2005 USA [29]	Preceptorship >2, ≤ 8 weeks Multidisciplinary primary care	Multiple institutions 157	Quantitative Evaluation Retrospective	From 1985 to 2004, Appalachian Preceptorship Program students have rotated with 49 preceptors in 40 clinical sites, including university-supported clinics, private practices, and community health centres. 82% of the 157 participants who matched before 2004 had selected residencies in primary care, with 60% entering family medicine.	Project evaluation	Score N/A



Table 2 cont'd

Author, Year, Country [Ref]	Type of clinical placement, Duration Discipline	Sample, Population, Response rate	Methodology, Method Context	Main findings	Limitations	C-O Quality rating
Corbett E et al 2002 USA [30]	Preceptorship < 2 weeks Primary care	1 institution 406 89%	Quantitative Survey Prospective	A significant relationship was found between career interest change and career choice at graduation. A significant relationship was found between the comparison of career interest before vs after the preceptorship and career choice at graduation ( $p = 0.001$ ). This applied to each of the 3 medical school classes individually and also to the group as a whole.	Not generalisable as only 1 institution. Asked for career choice at graduation - this may change from 2nd year. When survey was undertaken	8
Wamsley MA et al 2009 USA [35]	Outpatient attachment < 2 weeks	1 institution 12 100%	Quantitative Interview Prospective	Preceptor and supervising doctor used interchangeably. Continuity in outpatients x 22 half-days. Students report experience as beneficial for support and career guidance, received mentorship and some preceptors were role models.	Weak evidence based on small numbers and 1 institution and no evidence to matching in a primary care specialty.	12
Jospe N et al 2001 USA [36]	Clerkship 5-23 days Pediatrics	Multiple institutions 883 85%	Quantitative Survey Retrospective	"Feelings" about paediatrics as a career choice rose during the clerkship from neutral (mean score, 2.83 of a possible 5) to positive (mean score, 2.14) and the frequency of strongly positive feelings rose from 9.2% to 28.6%. regression analysis examining associations between student feelings toward paediatrics as a career at the end of the clerkship and the questions posed. By far, the biggest factor was the inpatient experience: the patients and the residents with whom the students worked during their ward month, which confirms earlier results. It should be noted that although the ward attending (specialist) received a high average rating there was no correlation between the ward attending (specialist) rating and career choice, whereas there was a modest but significant ( $p = 0.006$ ) correlation of the rating of the private preceptor with interest in a paediatric career.	There may be self selection bias in the second survey (1997/98) which had 5 medical schools which had changed their preceptor programs since the first survey of 11 medical schools in 1992/93.	22

Table 2 cont'd

Author, Year, Country [Ref]	Type of clinical placement, Duration Discipline	Sample, Population, Response rate	Methodology, Method Context	Main findings	Limitations	C-O Quality rating
Connelly MT 2003 USA [37]	Not stated Primary care	Multiple institutions 121/126 medical schools	Mixed Survey Retrospective	26% and 24% intend to enter primary care in 1994 and 1997 respectively. 57% and 46% intend to specialise in same years. Nationally representative data suggest primary care role models, peer encouragement, house staff encouragement and faculty encouragement are critical to career choice decision making. Supports the "stage of training" effect	Not stated if the primary care role models, peer encouragement, house staff encouragement and faculty encouragement are the principle teachers/preceptors.	32
Campos-Outcalt D, & Senf J 1999 USA [38]	Multiple clerkships Length not stated Primary Care	Multiple institutions 121 of 126 medical schools	Quantitative Survey Retrospective	National 9 year study of 3rd year clerkship. Establishing a department of family medicine increases the number of graduates entering family practice. A required 3rd year family medicine clerkship increases the proportion of graduate going into family practice by 2.36% in private schools and 2.07% in public schools.		31
Arora V 2006 USA [39]	Clerkship. >2– ≤8 weeks Primary care	Multiple institutions 751 54%	Quantitative Survey Retrospective	Based on 6 academic teaching centres. 75% of respondents matched to GIM within 2 years. 28% of these undertook a GIM residency. When adjusted for pre clerkship interest 2 factors were associated with a career in GIM ( $p= 0.01$ ) specialists and teaching.	Varying responses rates from each site may have caused sampling bias, retrospective reporting at the end of the clerkship could affect validity of these responses	18
Elnicki DM et al 1999 [40]	LIC >8 weeks Integrated core disciplines	1 institution 588 63%	Quantitative Cohort Prospective	54 in PIM, 3 control groups. PIMS scored higher academically and more likely to achieve honours than combined non PIMs. More likely to match into Internal Medicine residencies than control groups. $p = <0.01$	Single institution, rejected PIM group small may have obscured some differences. Direct correlation to the preceptor influence is suggested but no empirical evidence provided.	21

Table 2 cont'd

Author, Year, Country [Ref]	Type of clinical placement, Duration Discipline	Sample, Population, Response rate	Methodology, Method Context	Main findings	Limitations	C-O Quality rating
Gazewood J et al 2002 USA [41]	Clerkship >2, ≤8 weeks family physician clerkship or a general internist clerkship	1 institution 489 95%	Quantitative Cohort Retrospective	There was no significant difference in the proportion of students who chose a generalist career between the groups assigned to preceptors of different specialties. The stratified analysis indicated no significant effect of preceptor assignment on generalist career choice in any single year and no differences between years ( $\chi^2=1.88$ , $df=3$ , $p>0.10$ ). The logistic regression analysis also showed no association between preceptor assignment and generalist career choice after controlling for potential confounding variables.	Limited to 1 institution	23
Huggett KN et al 2008 USA [42]	Clerkship >8 weeks Randomly assigned to paediatrics, family medicine or internal medicine	1 institution 120 100%	Qualitative Journal review Retrospective	Required urban clerkship in 2nd year. Preceptors are defined as physician teachers. Absence of discussion of career related issues reinforced negative assumptions about primary care. Qualitative study with primary focus on effectiveness of preceptors but found that preceptor involvement may affect students' decisions to pursue primary care careers.	Review of learning journals. The large number of students are all in one class at same medical school	16
Levy BT 2001 USA [43]	Preceptorship Rural >2, ≤ 8 weeks	1 institution 969 94%	Mixed Cohort Retrospective	Required 3rd year FPP, studied over 6 years. 29% of FPP matched into family practice using univariate analysis. Elective, MECO 4-12 weeks. MECO program was a significant and positive indicator of matching into family practice. Students who rated the education value of the preceptorship experience were 2.9 times more likely to match into family practice.	Students from one public school	36
Malloy E et al 2008 USA [44]	Clerkship >2, ≤ 8 weeks Psychiatry	1 institution 98 84%	Quantitative Survey Prospective	3rd year clerkship. CAP. High CAP exposure group x 3 increased interest in a CAP career than low CAP exposure group. Significant association with inpatient exposure to increase interest in psychiatry and child psychiatry.	Lack of pre rotation survey may make responses prone to recall bias. Does not account for pre existing intrinsic factors. 1 institution. Implied association of preceptor influence	18

Table 2 cont'd

Author, Year, Country [Ref]	Type of clinical placement, Duration Discipline	Sample, Population, Response rate	Methodology, Method Context	Main findings	Limitations	C-O Quality rating
Musunuru S et al 2007 USA [45]	Clerkship >8 weeks Surgery	Multiple institutions 704 100%	Quantitative Survey Retrospective	704 student evaluations on 108 clerkship residents. Medical students who eventually pursued surgical residency training were exposed to surgical residents who were more effective clinical teachers, role models, and overall residents. Students exposed to the highest-rated residents were more likely to pursue surgical residency training compared with students exposed to the least effective residents (12% vs 4.9%, $p = 0.022$ ). Approximately 12% of students exposed to the top 20 resident educators pursued the field of surgery; only 4.9% of the other students pursued surgical careers ( $p = 0.022$ ). Students consider residents as their primary teachers		19
O'Herrin JK et al 2004 USA [46]	Clerkship >2, ≤ 8 weeks Surgery	1 institution 84 98%	Quantitative Survey Retrospective	Pre- and post-survey results matched to residency choice, 14% matched. 40% increased interest in surgical career, 15% decreased interest and 37% no change. ANOVA and $\chi^2$ tests	Limited to one institution	19
Schwartz MD et al 1995 USA. [47]	Clerkship Length not stated Multiple clerkships	16 medical schools 1650 76%	Quantitative Survey Retrospective	An ambulatory rotation is strongly associated with positive perceptions of, attraction to, and choice of a career in internal medicine. Thirty percent of the students who did ambulatory rotations planned internal medicine careers, compared with 19% of the students who had no rotation (OR = 1.8, 95% CI, 1.3 to 2.4, $p = 0.0001$ ). This association was of similar magnitudes for students completing required rotations (OR = 1.6, 95% CI 1.2 to 2.2, $p = 0.002$ )	This is an old study which only just meets the time limits criteria of the search. Identification of the factors that make a 'good' ambulatory rotation of not defined. Factors which influenced students towards or away from a career included the medical clerkship experience and the learning climate. Whilst preceptors are part of this climate they were not singled out.	31

Table 2 cont'd

Author, Year, Country [Ref]	Type of clinical placement, Duration Discipline	Sample, Population, Response rate	Methodology, Method Context	Main findings	Limitations	C-O Quality rating
Cochran A et al 2003 USA [48]	Clerkship, >2, ≤ 8 weeks Surgery	1 institution 98 95%	Qualitative Survey Prospective	Required clerkship. Interest in surgery as a career did not change significantly during the clerkship ( $p=0.218$ ) and students impressions of surgeons' collegial behaviour and commitment to teaching deteriorated significantly during the clerkship.	1 year at a single institution, may have selection bias, temporal bias as survey was done in last 3 days of clerkship	16
Loriot Y et al 2010 France [49]	Oncology length not stated	National study Multiple institutions 61 72%	Mixed Cohort Retrospective	83% Reported undergraduate experience influenced them to choose oncology. 62% made this decision in undergraduate training.	Weak evidence even though it is the first French national study	8
Mihalynuk T 2006 Canada [50]	Clerkship <2 weeks	1 institution 113 98%	Qualitative Analysis of Assignments Prospective	Free choice clerkship elective. Preliminary evidence of a relationship between the clerkship experience and career choice. Qualitative study.	Analysis of assignments, students could send assignment to preceptor, few took this option. Prospective nature means actual choice is not known	20
Worley P et al 2008 Australia [51]	LIC Rural >8 weeks Integrated core disciplines	2 institutions 150 43%	Mixed Survey Retrospective	PRCC and NTCS graduates are more likely to choose rural career paths than graduates from FMC. OR 19.1 (95% CI, 3.4 - 106.3); $p < 0.001$	Limited by 2 institution.	21

CAP, Child and Adolescent Psychiatry; CBME, Community Based Medical Education; CLIC, Consortium of Longitudinal Integrated Clerkships; C-O, Campos-Outcalt; FMC, Flinders Medical Centre; FPP, family practice preceptorship; GIM, general internal medicine; LIC, longitudinal integrated clerkship; MECO, medical education community orientation; N/A, not applicable; NTCS, Northern Territory Clinical School; O&G, obstetrics and gynaecology; PIM, preceptorship internal medicine; PRCC, Parallel Rural Community Curriculum; PSAP, Physician Shortage Area Program; TSFPPP, Texas Statewide Family Practice Preceptor Program; UQRCS, University of Queensland Rural Clinical School.

### Influence of preceptors in clinical placements of 8 weeks' duration or less

Eleven articles described clinical placements less than 8 weeks duration; these are referred to as 'clerkships'. The clerkships varied in length from 5 days<sup>32</sup> to 8 weeks<sup>27,35-37,39,40,42-44,46</sup>.

There is evidence that primary care preceptorships of 2–8 weeks duration do influence medical students' career choices. The 9 year study of 10 081 students from 8 Texas medical schools compared workforce outcomes from students participating in the Texas State-wide Family Practice Preceptorship Program<sup>27</sup> and non-

Texas State-wide Family Practice Preceptorship Program participants. The study shows the programs efficacy as a family practice workforce strategy. Neiman reported that the proportion of students choosing family practice residencies among Texas State-wide Family Practice Preceptorship Program participants was significantly greater than among non-participants. In all, 27.9% of Texas State-wide Family Practice Preceptorship Program participants chose family practice (OR, 4.98; 95% CI, 3.75–6.68) compared with 15.7% of non-participants who chose family practice. Neiman did undertake a qualitative analysis of students' perception of the preceptorship but this is not reported in this article.

Table 3: Systematic reviews-factors influencing career choice<sup>22,48-51</sup>

Factors	Systematic review detail				
	Campos-Outcalt D et al [22] 1995 USA	Barshes NR et al [31] 2004 USA	Rabinowitz HK et al [32] 2008 USA	Senf J et al [33] 2003 USA	Sambunjak D et al [34] 2006 USA
No. articles in final review	85 papers 1984-1993	66 papers	7 papers, 3 internet sites from 6 medical schools	36 papers	42 papers
Review type	Review and quality assessment	Contemporary review	Systematic review	Literature review	Systematic review
Targeted medical school programs	LIC programs at WWAMI. University of New Mexico primary career curriculum, Jefferson Medical School PSAP, Illinois Medical School. Number of graduates practicing family medicine increasing		LIC programs at RPAP, University of Minnesota. University of Minnesota Duluth. UPP, Michigan State University. PSAP, Jefferson Medical School. RMED State University of new York. RMED State University of Illinois Measurements of program outcomes and retention rates.	4 studies report targeted programs increasing number of primary care graduates	
Individual curriculum components	Required clinical rotations in 3rd and/or 4th year	73% of medical students undecided on specialty choice and 80% of students who change their choice during 3rd year clerkships eventually choose specialties experienced in the first half of 3rd year. 79% influenced by faculty during clerkship		1st and 2nd year curricula has no influence on career choice. Required clinical rotations in 3rd and/or 4th year.	
Role models in medical school	Role models influence choice. Difficult to determine if role models have a preceptorship role	Medical students encouraged by role models are less likely to be discouraged by lifestyle, time commitments, call schedules and length of residency.		Proportion of faculty who are in family medicine is positively related to student choice of family medicine. Negative role models change students away from family medicine	Mentorship and its relationship to career development. Some confusion as precepting and mentoring are used interchangeably in some instances
Student personality		Students interested in surgery have particular traits/personality factors		Little new knowledge about personality types and choosing family medicine	

LIC, Longitudinal Integrated Clerkship; PSAP, Physician Shortage Area Program; RMED, Rural Medical Education Program; RPAP, Rural Physician Associate Program; UPP, University Partnership Program; WWAMI, Washington, Wyoming, Alaska, Montana, Idaho.

The study by Levy<sup>39</sup> sought to understand how the quality of a 3 week required family medicine preceptorship (as determined by the student) influenced career choice. Students who rated the education value of the required preceptorship experience high or very high were 2.9 times more likely to match into family practice. In both articles how the specific influence of preceptors is exerted is unclear.

Arora's study of 6 academic teaching centres found that 75% of respondents matched to General Internal Medicine within 2 years of which 28% of these undertook a General Internal Medicine residency<sup>35</sup>. Student satisfaction with preceptor characteristics such as availability, relationships, clinical excellence and quality of teaching were associated with a career in General Internal Medicine (GIM;  $p=0.01$ ). Arora found that for each 1 point increase in overall student satisfaction (on a 5 point Lickert scale) students were almost 4 times as likely to pursue a GIM career ( $p < 0.001$ ) (p 473)<sup>35</sup>.

Similarly, both faculty and resident interactions are reported as influencing career choice in the pre- and post-survey results of the study by O'Herrin et al<sup>43</sup>. They argue that it is the (perceived) quality of preceptorship, including role modelling which is most influential. In the study by Schwartz et al<sup>44</sup> of 16 medical schools it was found that an ambulatory rotation is strongly associated with positive perceptions of, attraction to, and choice of a career in internal medicine. Schwartz et al note that the perceived satisfaction of the residents that students were exposed to in the ambulatory rotation exerted a powerful influence on career choice. Students with an initial interest in internal medicine were more likely to 'switch' away from their earlier decision if they were not highly satisfied with their rotation ( $p=0.002$ ) compared with students who were highly satisfied with their rotation.

Jospe et al<sup>32</sup>, Elnicki et al<sup>36</sup>, Malloy et al<sup>40</sup>, and Mihalynuk<sup>46</sup> show modest evidence of a relationship between the clerkship experience and career choice. However, there is no evidence to support the thesis that the preceptors are the cause of the influence or evidence of how the influence is excerpted. Gazewood et al<sup>37</sup> and Cochran et al<sup>44</sup> found no evidence of preceptor influence on career choice ( $p > 0.10$  and  $p=0.218$ , respectively).

Negative preceptor influence on future career choice was found by Cochran et al who reported that students' impressions of surgeons' collegial behaviour including perceived disrespect for other physicians and commitment to teaching deteriorated during the clerkship<sup>44</sup>.

### Influence of preceptors in clinical placements longer than 8 weeks' duration

Ten of the 13 articles that describe clinical placements longer than 8 weeks are of LIC. These are analysed under their own heading<sup>7-9,15,17,23-25,28,47</sup>.

Medical students are influenced in their career choice by preceptors they judge as being more effective clinical teachers and role models<sup>38,41</sup>. In the retrospective study by Musunurus et al, 2632 student evaluations of 108 surgical clerkship residents were researched. Medical students taught by the highest-rated residents were more likely to pursue surgical residency training compared with students taught by the least effective residents (12% vs 4.9%,  $p=0.022$ ). Approximately 12% of students taught by the top 20 resident educators pursued surgical careers.

In a much smaller study, Hugget<sup>38</sup> argued that students begin clinical experiences with sophisticated definitions of professional expertise and specific expectations of professionalism and knowledge from their preceptors. He argued that this is significant because students closely associate professional expertise with good teaching. He did not, however, link this specifically to career choice, rather an absence of discussion of career related issues by preceptors reinforced negative assumptions about primary care.

At the University of Iowa, Levy found that students who rated a 4-12 week elective in a community based hospital as high or very high were significantly more likely to go into family practice (OR 2.9)<sup>39</sup>. Interest in family practice after the elective increased ( $p=0.003$ ) and remained high ( $p=0.020$ ). Levy proposes that the influence of preceptors may be critical for those students who enter medicine with a low interest in family medicine.

## Influence of preceptors in longitudinal integrated clerkships

Ten articles were classified by the author as concerning LICs<sup>7-9,15,17,23-25,28,47</sup>.

Extended LICs with continuity relationships with preceptors may affect career choice<sup>25</sup>. Eley et al reported that time spent in a rural educational environment was the most commonly cited response from students contributing to an interest in practicing rurally. In this 2 year LIC, students referred to their preceptors as mentors and role models and they were positively associated with students making a rural career choice. Eley et al suggested that the 2 year rural education program has a more positive effect on workforce outcomes than the 12 month programs at the same institution.

Students have reported changing their career choices from one discipline to another and from urban to rural locations as a result of preceptor influences in LIC programs<sup>9,17</sup>, and some rural origin students report that preceptor influence confirmed their career choice<sup>9,15</sup>. Students cited the positive influence of teachers, both GPs and specialists, as key influences on making a rural pathway career choice<sup>7-9,15,17,23-25,28,47</sup>.

Ogur et al<sup>28</sup> found that longitudinal relationships with faculty preceptors provided time for students to develop connections leading to meaningful mentorship. The goal of this pilot program was to facilitate the learning of core skills and knowledge regardless of specialty interest and, therefore, no evidence was provided to link the continuity experience with preceptors to career choice.

## Influence of preceptors in primary care clerkships

Many short primary care clerkships have been established with the aim of influencing student career choice in order to fill workforce shortages and improve health outcomes. Fourteen studies were situated within the disciplines of primary care<sup>8,9,15,17,25,27,29-31,33,37</sup>.

Connelly et al defined a primary care physician as one practicing in general internal medicine, general pediatrics, family practice, or general practice<sup>33</sup>. In the USA, primary care also includes obstetrics/gynaecology<sup>29</sup>. In Australia, primary care is provided by

GPs. Primary care clerkships occur in private general practices<sup>8,9,15,17,25,29,30</sup>, university medical centres<sup>17,29,36</sup>, community health centres<sup>8,29,36</sup>, community hospitals<sup>8,9,15,25</sup>, ambulatory settings<sup>15,27,37</sup>, primary care outpatients<sup>32</sup> and inpatient general internal medicine rotations<sup>35</sup>.

Preceptors in short primary care preceptorships do influence medical students' career choices. This is evidenced in several extended studies that show the efficacy of primary care preceptorships as a workforce strategy<sup>27,34,39</sup>. Campos-Outcalt and Senf stated 'implementing a required third year family practice clerkship led to an immediate, significant increase in the proportion of students choosing family practice'<sup>34</sup>. The mean proportion of students choosing family practice increased by 2.6% above control groups in public schools (95% CI = 1.06, 3.65 and 2.07% in private schools (95% CI, -2.58, 6.73). The specific influence of the preceptors is implied.

In a national study in the USA, Connelly concluded that the effect of having a primary care role model (preceptor) in fourth year of medical school was associated with more than 3 times greater odds of planning to practice in primary care. Connelly concluded that the combined effect of a positive primary care role model (preceptor) and time (continuing positive support into residency) can result in medical students pursuing a career in primary by a factor of 6.6<sup>33</sup>.

Short, one-week community preceptorship showed little evidence of stimulating students to consider generalist careers<sup>30,37</sup> and no direct link from the preceptors to career choice was presented. Similar results were found in Wamsley et al qualitative study in which students experienced a continuity outpatient experience over 22 half-days. Students reported the experience as beneficial for the support and career guidance that they received and for mentorship and role modelling<sup>31</sup>.

## Influence of preceptors in other discipline specific clerkships

Most discipline specific clerkships occur in a tertiary teaching institutions and are of a shorter duration than the LICs. Many have been established with the aim of influencing student career choice in order to fill workforce shortages and improve health outcomes.



There were 7 studies situated within the various disciplines of interdisciplinary<sup>26</sup>, paediatrics<sup>32</sup>, psychiatry<sup>40</sup>, surgery<sup>41,42,44</sup>, and oncology<sup>45</sup> in this review.

The quality of the preceptor/teaching clinician (as determined by the student) appeared particularly important to students in determining whether to choose a surgical career<sup>41,42,44</sup>. Medical students taught by the highest-rated residents were more likely to pursue surgical residency training compared with students taught by the least effective residents<sup>41</sup>. Negative influences of surgical preceptors were found to 'turn off' students from pursuing surgical careers. Negative influences included disrespect by surgeons for other clinicians, not promoting surgery as a possible career to students and, not actively teaching students<sup>41,42,44</sup>.

Similarly Jospe et al found that students rated pediatric clerkships in private offices as an excellent learning experience resulting in an increased interest in pursuing a paediatric career ( $p=0.006$ )<sup>32</sup>.

Increased interest in discipline specific careers after clerkships is evident<sup>40,42,45</sup>. O'Herrin et al reported an increased interest in pursuing a surgical career after a surgical clerkship. Contributing to this change was number of cases that students participated which was ranked as the highest influencing factor (95%) and resident interaction was ranked second (85%)<sup>42</sup>. While student interactions with residents was identified as a contributor to this change, what those interactions were and how they exerted influence was not stated. Malloy et al found students were three times more likely to pursue child and adolescent psychiatry than a control group (44). The influence of preceptors on these results is inferred but not explicitly stated. Similarly, in the only European study, Loriet et al<sup>45</sup> stated that 83% of respondents reported that undergraduate experience influenced them to choose oncology and that 62% made this decision during undergraduate training. However, the direct influence of preceptors was not evidenced.

There is one interdisciplinary study in this review, the 9 year Interdisciplinary Generalist Curriculum Project<sup>26</sup>. In their recommendations for curricular change from a national perspective, Wartman et al made 16 recommendations to support continuity with preceptors and patients to support education and workforce outcomes.

## Influence of preceptors in required or free choice clinical placements

Three articles identify clerkships as a required component of the curriculum<sup>38,39,44</sup>. At the time of publication, the study by Levy was the first study that specifically examined how the quality of a required family medicine preceptorship (as determined by the student) added to the predictability of students matching into family medicine<sup>39</sup>. Students who rated the education value of the required preceptorship experience highly were 2.9 times more likely to match into family practice.

Levy studied the effect of an elective community based preceptorship at the same institution as the required family practice preceptorship<sup>39</sup>. The elective preceptorship experience was a significant and positive indicator of matching into family practice. Interest in family practice after the elective increased ( $p=0.003$ ) and remained high ( $p=0.020$ ). Levy argued that this study provides indirect evidence of the influence of preceptors on career choice specifically for those students not initially interested in family medicine. In contrast, Cochran et al<sup>44</sup> and Huggett et al<sup>38</sup> both supported the view that required clerkships are less effective as a workforce strategy than free choice programs.

## Analysis of previously published reviews

The 1995 review and quality assessment of 85 articles by Campus Outcalt et al looked at the effect of medical school curricula, role models and federal funding on the specialty choice of medical students<sup>22</sup>. Campus Outcalt concluded that LICs such as the Washington, Wyoming, Alaska, Montana, Idaho (WWAMI) program, the University of New Mexico Primary Career Curriculum, Jefferson Medical School Physician Shortage Area program (PSAP) and the program at Illinois Medical School do influence student career choice. He believes educational context and role models are influential but did not state if the role models were also preceptors.

Barshes' contemporary review of factors central to medical student specialty choice found that half of medical students maintain their original career choice preference throughout medical school<sup>48</sup>. He contended that the importance of mentors and role models are fundamental to students' career decision-

making. He noted that influential role models and mentors include teaching specialists and residents as well as faculty. The influence can be both positive and negative especially in the field of surgery where 'badmouthing' and negative interactions by surgeons with patients and colleagues turns students away from the field<sup>48</sup>.

Rabinowitz et al reported on 10 studies from 6 programs which have the primary goal of increasing the supply of rural doctors<sup>49</sup>. The 6 programs are the Rural Physician Associate Program at the University of Minnesota, the University of Minnesota Duluth program, the Upper Peninsula Program at the Michigan State University, the Physician Area Shortage program at Jefferson Medical School, the Rural Medical Education Program at the State University of New York and the Rural Medical Education Program at the State University of Illinois. The review looked at the programs from the perspective of the educational intervention. As educational interventions with the goal of increasing the supply of rural doctors these programs are undeniably successful with between 53% and 64% of graduates practising rurally.

Senf reviewed 36 articles on family medicine practice choices<sup>50</sup>. Senf found that in a 4 year medical program, 1st and 2nd year curricula has no influence on career choice. Senf supports the view that required clinical rotations in 3rd and/or 4th year had most influence on student career choice. Senf reported that all studies that examined the influence of role models on student career choice found that negative role models were more influential than positive role models. Negative role models resulted in students switching away from their original career choice.

Sambunjak et al specifically looked at the influence of role modelling in career choice and career development in a review of 42 articles<sup>51</sup>. They commented that although mentorship is acknowledged as being an important influence on medical student career choice there is little detail on how the mentorship works.

A limitation of this study is that of self-selection of students to study in a LIC. Some LICs are known to be free choice through the admissions policy<sup>9,47</sup>. This is a variable which needs to be taken into account when analysing student career choice as it could bias the outcome of the program. This has been noted by Couper et al<sup>52</sup> and also by Pathman et al<sup>53</sup>. However, in some articles in this

review it was unclear if the preceptorships were free choice or required.

The influence of role models and mentors is referred to throughout the articles in this review but no definition is given, leaving this open to reader interpretation<sup>22,25,31,38,41,42,48,50,51</sup>.

## Discussion

The systematic review sought to understand if and how, medical students are influenced in making their career choice by preceptors in a clinical setting. The nomenclature used to describe the act of precepting differs across and within geographical boundaries. Regardless of the term used (role model, physician teacher, mentor, preceptor etc), this review has shown that those clinicians with the dual responsibility of teaching and being responsible for the patients in the clinical setting do influence medical students' career choices.

Students begin clinical experiences with sophisticated expectations of professional expertise, professionalism and knowledge transfer from preceptors. Students' perceptions of professional expertise is closely linked to students assessing the preceptor as a good teacher and rating the educational value of the preceptorship highly. Preceptors who are judged to be high quality teachers have the greatest influence on student career choice. Student satisfaction with high quality teaching by preceptors can increase career choice by up to four-fold. Students who rate the quality teaching by preceptors as poor are influenced away from that discipline.

There is evidence that the perceived quality of teaching in short preceptorships of 2–8 weeks' duration in primary care do influence medical students' career choices. Positive workforce outcomes have been attributed to the perceived quality of preceptor teaching. There is no evidence to link positive preceptor influence on career choice in similarly short clerkships in surgery, psychiatry and pediatrics although negatives influences are reported. Surgical clerkships longer than 8 weeks' duration have been found to be predictive of student career choice in surgery when students perceive the preceptors as high quality teachers

Worley cites interpersonal relationships as one of the four critical relationships in community based medical education programs<sup>1</sup>.

How students perceive interpersonal relationships between preceptors and patients, preceptors and peers and preceptors and themselves influences career choice positively and negatively.

The positive influence of relationships between preceptors and students on career choice is strongest where there is continuity. Hirsh et al described LIC as 'rooted in the principles of modern learning theory with continuity as the guiding principle'<sup>54</sup>. This finding is supported by the LICs in this review. The evidence supports timing preceptorships/clerkships in the principal clinical years in order to foster relationships with preceptors that can influence career choice. First and second year clinical curricula interventions have no influence on career choice.

Preceptors, teaching specialists and residents as well as faculty are often mentors and role models to students. Positive mentoring and role modelling has the ability to influence students in their career choice. However, negative role modelling will influence students away from the discipline in which they are studying, particularly in short placements. Mentorship was acknowledged as having an important influence on medical student career choice, however there was little detail in this literature on how the mentorship works.

There is evidence to conclude that preceptors in free choice preceptorships have a stronger influence on career choice than those in required placements. A positive influence on student career choice exists when students perceive the preceptors to be of a high quality in a required preceptorship, and they ascribe a high rating to the education value of the placement.

## Conclusion

This review adds to the literature by identifying how different components and combinations of components of a clinical preceptorship influence medical student career choice. When multiple factors of the preceptorship are combined they have a greater influence.

The retrospective studies in this review provide evidence that curricula innovation, such as distributed learning environments which support medical student's continuity with preceptors and

patients influence workforce outcomes positively. This influence is evident in LICs.

As governments globally strive to improve the health status of those in their communities, understanding what influences medical students to practise in underserved areas becomes paramount. In parallel to political pressures, medical schools are charged with the task of educating physicians who are capable of and willing to serve in those areas of greatest need. This review adds to the understanding of both curriculum designers and policy-makers who are faced with the task of addressing health workforce shortages.

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