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Increased self-efficacy is associated with rural career intent in Australian medical students

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Abstract:

Objectives: To investigate medical student's self-efficacy at the time of finishing their Rural Clinical School (RCS) placement and factors associated with self-efficacy. Secondary aims are to explore whether interest levels or self-efficacy are associated with rural or remote career intentions.

Design, Setting & Participants: A cross-sectional study of medical students who had completed their RCS term in 17 Australian universities. Data were derived from the 2013 Federation of Rural Australian Medical Educators (FRAME) evaluation survey. All 732 students who completed their RCS term in 2013 were invited to participate

Primary and Secondary outcome measures: Rural self-efficacy: Six questions to measure self-efficacy beliefs in rural medical practise, based on the sources of self-efficacy described by Bandura. Rural career intention: Students were asked to identify their preferred location for future practice. The options were, Capital or Major City; Inner regional city or large town in Australia; Smaller town - outer regional (; Small rural or remote communities and Very remote centre/area.

Results: Questionnaire responses were analysed from 656 medical students from regional Australia (response rate 89.6%). 83.8% of all students recalled an increase in their interest levels for rural medicine as a result of their RCS experience, however only 26.9% indicated an actual intention to work in a rural area. Bivariate analyses showed female gender ($p=0.003$), rural background ($p<0.001$), an RCS preference for clinical training ($p<0.001$), and general practice intentions ($p=0.004$) were factors associated with higher levels of self-efficacy. Self-efficacy was associated with an increased interest in both rural and remote medical practice ($p<0.001$). Logistic regression analyses showed that self-efficacy was independently associated with increased interest in rural medicine (Odds ratio 1.4 (95% CI 1.3-1.5)) and rural career intent (Odds ratio 1.2 (95% CI 1.1-1.3)). (Model included gender, rural background, preference for RCS, generalist intent, rural practice interest and self-efficacy).

Conclusion: Self-efficacy is associated with increased interest levels for rural medicine and rural medical career intent.

Key words: Rural self-efficacy, rural background, interest level, Rural Clinical School (RCS)

Strength and limitation of this study:

- Currently there is a maldistribution of doctors across urban, rural and remote areas of Australia. We may improve the distribution of future doctors to areas of workforce need by using selection and training processes based on assessing medical student's psychosocial and cognitive factors.
- The study provides valuable information on the association between self-efficacy and rural career intention among medical students, which has not been previously studied.
- Data were derived from the longitudinal tracking study of Federation of Rural Australian Medical Educators (FRAME) of Australian Rural Clinical Schools with consistent definitions, agreed protocols and mechanisms for collecting and reporting data at the national level.
- The study limited by its cross-sectional design. We suggest longitudinal tracking of rural career intentions among medical students on actual and eventual rural practice are evaluated with respect to change in self-efficacy and interest levels.

Introduction:

Australia faces considerable challenges in meeting doctor supply needs. A maldistribution (under supply) of doctors to regional and remote Australia exists. For example, the Australian bureau of statistics estimated in 2011, that the per capita ratio of primary care doctors in major cities was double compared to remote and regional areas[1] There is a need to address and understand career psychosocial motivations for rural and remote practice. Whether career trajectory via earlier educational work experiences can enhance rural or remote clinical career self-efficacy remains unknown.

Self-efficacy is a cognitive structure created by the cumulative learning experiences in a person's life that lead to development of belief or expectation that they can or cannot successfully perform a specific task or activity [2 3]. Self-efficacy as a psychological construct, has been well described in career choice models to explain career behaviours[4 5]. Lent et al[6] and Roger et al[7] have demonstrated that self-efficacy served as an antecedent of outcome expectations, interests and goals for career planning and career exploration in high school and university students. Business individuals demonstrate prior high self-efficacy for entrepreneurial intentions and beliefs before the creation of a new enterprise [8 9]. This suggests intention and actual practice can be associated with prior self-efficacy values for a specific future activity.

Over the past 15 years, the Australian government has invested in a number of large scale national programs to develop medical students training in rural medicine. These programs have included the Rural Undergraduate Support and Co-ordination, University Departments of Rural Health and the Rural Clinical Schools (RCS) programs[10]. The RCS program is the largest in terms of scale, infrastructure development and scope and was launched in 2000 to enable medical students to undertake extended blocks of their clinical training in regional areas. Australian rural clinical schools permit students from either urban or rural backgrounds to attend a rural clinical school campus. Within a medical faculty, Australian rural clinical schools are responsible for delivering a year or more of the clinical medical curriculum in a rural environment, for 25% of medical students[11].

Rural clinical school outcomes and medical student rural career intent have been extensively evaluated and have traditionally focussed on extrinsic outcome factors to predict rural work force outcomes. Extrinsic factors have included previous rural background, gender, scholarships, length of time spent at an RCS and speciality preference as predictors of intended rural practice after graduation. Few studies have addressed psychosocial aspects to rural medical career development. One study has previously investigated the role of personality domains on rural career intentions and showed that the probability of rural preference was greater with higher scores of openness to experience, agreeableness and self-confidence but lower with higher scores on extraversion, autonomy and intraception[12]. On the other hand it has been suggested that the influence of personality factors on human career decision functioning is insufficient. Career interest and self-efficacy expectations have been suggested to influence career choice[13 14] and self-efficacy to mediate the relationship between personality and career interest [15]

Cognitive career theory integration into models of rural career intent has not yet been explored across Australian rural clinical school programs. The longitudinal tracking survey of the Federation of Rural Australian Medical Educators (FRAME), for Australian Rural Clinical Schools has consistent definitions, agreed protocols and mechanisms for collecting and reporting data at a national level [16]. This survey tool provides opportunities for assessing self-efficacy in a rural clinical school environment. The purpose of this study is to investigate medical student's self-efficacy at the time of finishing their Rural Clinical School (RCS) placement and factors associated with self-efficacy (via the FRAME survey) [17]. Secondary aims are to explore whether interest levels or self-efficacy are associated with rural or remote career intentions.

Methods:

Australian Rural Clinical Schools (RCS) and Rural Medical Schools (RMS) have collaborated through the Federation of Australian Medial Educators (FRAME) to develop a national exit questionnaire to collect demographic, educational, experiential and intentional career data from students completing their rural clinical school experience. The survey is an evaluation tool distributed to medical students who had completed their RCS term in all 17 Australian universities each year. In the survey

instrument "FRAME Rural Clinical School Survey 2013" we had included additional questions on rural self-efficacy. All 732 students who had completed their RCS term in 2013 were invited to participate. Ethics approval was obtained for the study from each of the participating universities.

Measurements

Rural self-efficacy: To measure self-efficacy beliefs in rural medical practice, the rural self-efficacy questions were developed. In total, there were 6 questions that measured individual's self-efficacy to practise in rural setting. These questions were developed as there were no previously known measurements for assessing self-efficacy in medical students attending a rural campus, and assessing their intentions toward rural practice intent. The questions were developed based on the five sources of self-efficacy i.e., vicarious learning, verbal persuasion, positive emotional arousal, negative emotional arousal and performance accomplishments (Figure 1)[3] We used questions focused on these sources of self-efficacy to calculate a composite rural medicine self-efficacy score. This score was calculated from the likert scale score of each of the questions. Negative scoring applied to the two negatively (questions 1 and 3) framed questions before calculating the composite score, which could range from 6-30. These questions as a scale demonstrated an internal reliability (Cronbach alpha) of .78 in the present sample. Construct validity was demonstrated with significant correlation with rural career interest and self-efficacy score ($r=0.50$, $p<0.001$).

Table a: Frame survey questions aligned with Bandura's five sources of self-efficacy

Sources of self-efficacy	Questions
Performance accomplishments	Rural practise is too hard
	I have necessary skills to practise in rural setting
Negative emotional arousal	I get a sinking (anxious) feeling when I think of working in rural setting
Positive emotional arousal	I have a strong positive feeling when I think of working in a rural setting
Verbal persuasion	People tell me I should work in a rural setting
Vicarious learning	I see people like me taking up rural clinical practice

Change in interest in rural practice: Retrospectively students evaluated their change in interest for rural medicine as a result of their RCS experience in a 5-point Likert scale. "**My RCS medical experience has increased my interest in pursuing a career in a medical career in regional or rural Australia"** Strongly disagree, somewhat disagree, neutral, somewhat agree, strongly agree. Similarly students accessed their interest in general practice.

Rural career intention: Students were asked to identify their preferred location for future practice. "**In which geographical location within Australia would you most like to practise on completing your training?"** The options were**,** Capital or Major City; Inner regional city or large town in Australia (25,000 - 100,000); Smaller town - outer regional (10,000 - 24,999); Small rural or remote communities (10,000) and Very remote centre/area.

Other variables included in the analyses were gender, rural background, preference for RCS clinical training, and preference for speciality or general practice at entry.

Data analyses:

Data were analysed using the statistical package SPSS v. 21 (SPSS IBM, New York, U.S.A). Descriptive data were examined to determine study variables. Pearson's t-test or one-way ANOVA test was used to determine the factors associated with self-efficacy. Post-hoc LSD analyses were used to understand specific differences between categories. A step-wise logistic regression model was used to analyse the independent association between self-efficacy and interest levels in rural practice at exit from an RCS; likewise, analysed the independent association between self-efficacy and rural career intention. Gender, rural background, and RCS preference, generalist intent, interest and self-efficacy were included in the models as applicable. Cox & Shell R^2were used to show the variance explained by self-efficacy on increased interest and intent in rural practise respectively.

Results:

Data were analysed from 656 medical student respondents (response rate: 89.6%) from regional Australia, 58.8% were female students. The descriptive details of the

study variables are presented in Table 1. The survey results show that 41.9% considered they had come from a rural background. General practice (family medicine) was the intended career in 28.7% of the students. Preference for RCS clinical training as student's first choice was reported to be 65.7%, while a further 16.4% reported the RCS ranking high on their list for clinical training. The results (Figure1) show that 63.4% reported an increased level of interest in General practice as a result of their RCS experience. 83.8% of students reported an increase in their interest levels for rural medicine as a result of their RCS experience, however only 26.9% indicated an actual intention to work in a rural area and even less so in a remote area.

The mean (SD) composite score of the six rural career self-efficacy questions was 22.9 (3.5). The descriptive information of each question is reported in Table 2. Table 3 explores the factors associated with rural self-efficacy. Rural self-efficacy was associated with gender i.e., female students had higher self-efficacy compared to male students (t=-2.9, p=0.003); rural background (t=-5.9, p<0.001); higher preference for RCS clinical training (t=-6.2, p<0.001); and general practice intention at entry to RCS (t=5.5, p=0.004)

Rural self-efficacy was associated with increased interest in general practice (t=-7.2, p<0.001) and increased interest in rural (t=-10.2, p<0.001) or remote practice (t=-7.4, p<0.001). Self-efficacy scores gradually increased based on intention to practice farthest to a Capital city (remote areas) The self-efficacy score at capital city was 21.2 (SD 3.1), whereas the self-efficacy of students intent to practice in small rural or remote areas was 25.2 (SD 3.9) and the difference was statistically significant (t=8.6, p<0.001). However, we note that the number of students actually wishing to practice in a small rural and remote area was a small percentage (7.8%) of the total number of students undertaking the survey.

Table 4 explains the multivariate logistic regression analyses on the effect of self-efficacy in rural career interest and rural career intent. RCS preference (OR 2.1 (95% CI 1.2-3.7)) and self-efficacy (OR 1.4 (95% CI 1.3-1.5)) were independently associated with increased interest in rural medical practise due to RCS training. Cox & Shell R square suggests self-efficacy could explain an additional 10% in predicting students with increased levels of interest in rural practice. Gender OR 1.9 (95% CI

1.2-2.9), rural background OR 2.7 (95% CI 1.8-4.3), preferred RCS OR 2.5 (95% CI 1.2-5.5), general practice intention at entry OR 3.5 (95% CI 2.9-5.5), increase interest due to RCS training OR 2.6 (95%CI 1.1-6.3)were associated with rural intentions. In addition, self-efficacy was independently associated with rural practice intention after adjustment for gender, rural background, preferred RCS, general practise intention at entry, increase interest due to RCS training OR 1.2 (95% CI 1.1-1.3).

Discussion

Previous studies have demonstrated that a rural medical student placements exhibit significant influence on rural career interest and intentions[10]. More recently it has been shown that length of time at a rural clinical school increases rural career interest levels[18]. In the present study we have found that self-efficacy explains 20% of the variance in rural practice interest levels by medical students that have attended an RCS. In the present study both change in interest in rural career and rural self-efficacy were found to be independently associated with rural career intent. Importantly we note in our study that most (> 80%) students developed an increased interest to practice in a rural area, but not for remote and smaller rural areas. This may suggest that self-efficacy increase is greatest in environments where the rural clinical school is located and experiences are associated. In the FRAME survey cohort most RCS's are located typically in larger rural towns and regional cities [11].

Rural background is a strong influence on rural medical practice intent among medical students [19-21]. Students with rural background are more than twice likely to become rural practitioners. In our study, we show rural background is associated with higher rural self-efficacy. Rural exposure via education, recreation and upbringing has been suggested to provide the familiarity, sense of place and community involvement could motivate medical students towards both intended and actual rural careers [22]. This finding is consistent with the self-efficacy literature which describes self-efficacy as a construct that encompasses motivation, adjustment and interest[4 5].

Social– cognitive career theory suggests that vocational interests develop over time, partially as a function of self-efficacy expectations[6]. Several studies have noted a relationship between self-efficacy and career interest levels[23 24]. Among medical students, Bierer et al explained an association between research self-efficacy and

interest in clinical research careers [25]. In our study we have demonstrated a positive relationship between increased self-efficacy and rural practice interest levels in medical students. In evaluation of career behaviour in rural medical education, understanding both student's career interest and self-efficacy is beneficial[26]. Interest level has been poorly studied with respect to Australian medical student's rural educational experiences and career interest or intent for rural practice[18].

Longitudinal rural placement enables students to achieve personal goals, and enhance beliefs and orientation towards the complex personal and professional demands of rural practice[22]. This is paralleled with an incremental increase in rural career intentions, with each additional year of RCS training that students undertake[27]. Further career interest in rural practice may increase after one-year of RCS training [18]. Increased self-efficacy through rural training may explain the increased interest and intention to practice in a rural area. Indeed in the present study we demonstrate that rural career self-efficacy explains additional variance in both rural career interest and career intent. Moreover we found that rural career self-efficacy levels modulate career choice intentions in both rural and urban students. Ultimately there is likely a need to establish whether self-efficacy is an integral part of rural placement curriculum and experience. To do this we suggest that longitudinal tracking of rural career intentions among medical students on actual and eventual rural practice are evaluated with respect to change in self-efficacy and interest levels.

Our study has particular strengths, that include all data were derived from the longitudinal tracking study of Federation of Rural Australian Medical Educators (FRAME) of Australian Rural Clinical Schools. The study survey tool has consistent definitions, agreed protocols and mechanisms for collecting and reporting data at the national level. This is the first time that FRAME survey has had self-efficacy questions introduced. We acknowledge that no previous available questionnaire to measure self-efficacy in medical students attending and learning within a rural clinical school environment exists. We adapted our questions to access self-efficacy based on the five sources of self-efficacy described by Bandura[3] and a Kappa of .78 in the present study shows the items' have good internal consistency for group comparison[28]. Our questions are associated with change in self-interest for rural practice as a function of rural clinical experience. This supports the notion that our self-efficacy questions are indeed assessing social cognitive elements of career intent.

In conclusion, we found students from rural backgrounds to have higher self-efficacy following training at an RCS. These higher levels of self-efficacy were associated with higher levels of career intent to practice in rural areas. We have shown that self-efficacy is associated with increased interest levels for rural medicine and rural medical career intent. Early identification of low self-efficacy in potential RCS students may suggest these students are unlikely to benefit from an RCS experience in terms of enhancing interest in rural medical careers. As we have found students with low self-efficacy upon exit from an RCS are less likely to develop rural career pathway intentions. The concept for developing learning opportunities in more remote areas to increase levels of remote clinical self-efficacy is suggested. This may translate to additional remote rural clinical practice intentions.

Authors' contributions:

VI conducted the analyses of the survey data and formulated the concept for self-efficacy and produced the initial draft;, LW contributed to the manuscript review, survey tool and research discussions;,CM contributed to writing the manuscript, literature review and formulation of hypothesis. All authors supported the design of the paper, reviewed and approved the final manuscript.

Competing Interests

The authors declare no competing interests

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Figure 1: Retrospective evaluation of change in career interest

The figure illustrates medical student's retrospective evaluation of change in interest as a result of RCS experience to practise in regional & rural areas and remote and very remote areas.

Table 1: Characteristics of the sample

Characteristics		N	%
Gender	Male	270	41.2%
	Female	386	58.8%
Rural background	No	371	56.6%
	Yes	275	41.9%
Type of location living longest in Australia	Capital city	290	44.1%
	Major city	75	11.7%
	Regional	112	17.0%
	Rural	70	10.8%
	Small rural	96	15.0%
	Remote	9	1.4%
Preference for RCS for Clinical training	Last choice	29	4.3%
	Low on list	26	4.0%
	Mid-choice	62	9.6%
	High on list	108	16.4%
	First choice	427	65.7%
Preferred location for work	Capital/Major city	249	37.3%
	Regional	226	34.9%
	Rural	125	19.1%
	Small rural	43	6.7%
	Remote	7	1.1%
Career preference at entry to RCS	General Practise	189	28.7%
	Generalist Specialist	276	41.8%
	Sub-Specialist/Others	187	28.2%
Current career preference at exit from RCS	General Practise	118	28.7%
	Generalist Specialist	273	41.6%
	Sub-Specialist/Others	182	27.7%

Percentages may not add up to 100% because of missing data.

Table 2: Self-efficacy in rural practise

Questions	N	Mean (SD)	Strongly disagree/Disagree	Neutral	Strongly agree/Agree
Rural practise is too hard	645	2.06 (0.70)	79.2%	15.7%	5.1%
I have necessary skills to practise in rural setting	644	3.75 (0.73)	6.7%	20.7%	72.6%
I get a sinking (anxious) feeling when I think of working in rural setting	643	1.98 (0.91)	75.6%	18.3%	5.6%
I have a strong positive feeling when I think of working in a rural setting	645	3.83 (0.83)	6.4%	22.6%	69.6%
People tell me I should work in a rural setting	643	3.72 (0.91)	8.9%	28.0%	61.3%
I see people like me taking up rural clinical practice	644	3.66 (0.93)	11.3%	24.5%	62.5%
Mean Composite score	640	22.9 (3.6)			

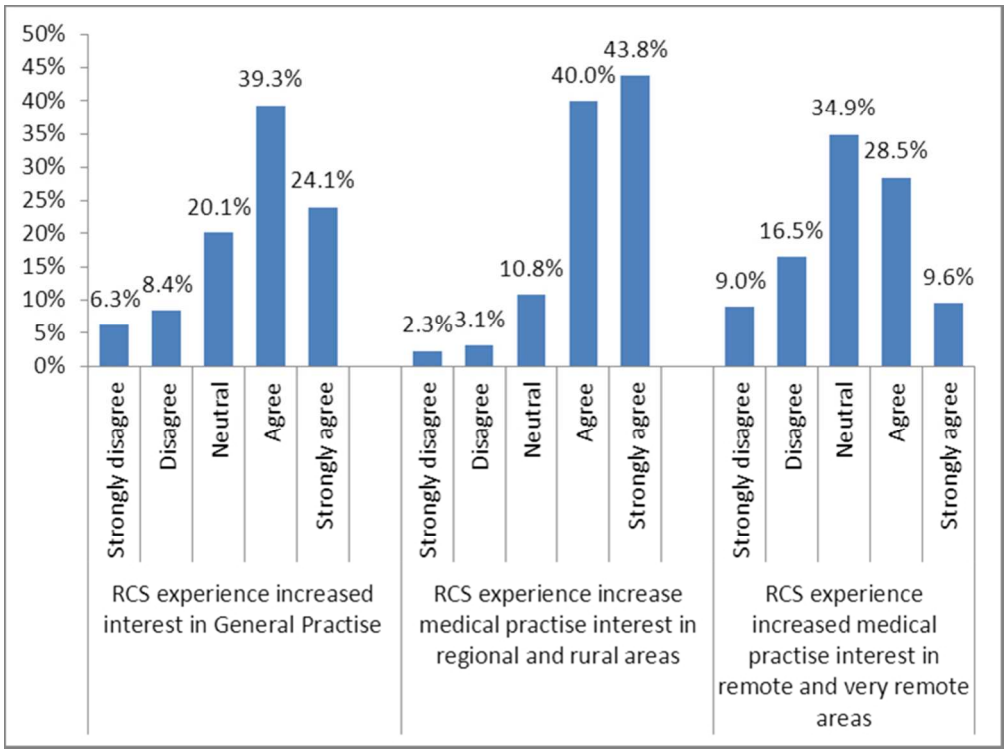
Table 3: Factors associated with self-efficacy in rural practise

		Self-efficacy		
		N	Mean (SD)	t/f (p value)
Gender	Male	264	22.4 (3.3)	-2.9 (0.003)
	Female	376	23.3 (3.6)	
Rural background	No	361	22.2 (3.3)	-5.9 (<0.001)
	Yes	272	23.8 (3.6)	
Type of location living longest in Australia	Capital city/Major city	347	23.1 (3.4)	0.6 (0.63)
	Regional	107	22.8 (3.6)	
	Rural	66	22.6 (4.1)	
	Small rural/remote	105	22.7 (3.3)	
Preference for RCS for Clinical training	Last/ Low/ Mid choice	109	21.1 (3.3)	-6.2 (<0.001)
	First/High on list	524	23.3 (3.4)	
Intended speciality at entry to RCS	General Practise	185	23.5 (3.4)	5.5 (0.004)
	Generalist Specialist	268	22.8 (3.2)	
	Sub-Specialist/Others	183	22.3 (3.7)	
Career Interest				
RCS experience increased interest in General Practice	Strongly disagree/Disagree/Neutral	223	21.6 (3.7)	-7.2 (<0.001)
	Strongly agree/Agree	409	23.6 (3.1)	
RCS experience increased interest in medical practise in regional and rural areas	Strongly disagree/Disagree/Neutral	103	19.9 (3.9)	-10.2 (<0.001)
	Strongly agree/Agree	533	23.5 (3.1)	
RCS experience increased interest in medical practise in remote and very remote areas	Strongly disagree/Disagree/Neutral	388	22.1 (3.6)	-7.4 (<0.001)
	Strongly agree/Agree	246	24.2 (2.9)	
Career Intention				
Preferred location for work at exit from RCS	Capital/Major city	238	21.2 (3.1)	46.7 (<0.001)
	Regional	221	23.3 (3.2)	
	Rural	124	24.7 (2.6)	
	Small rural/ remote	49	25.2 (3.9)	

Table 4: Logistic regression analysis for the effect of self-efficacy on rural career intention

	Increased interest in rural medical practise		Intention to practice in rural areas		
	Model 1	Model 2	Model A	Model B	Model C
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Gender (Female)	1.5 (1.0-2.5)*	1.5 (0.9-2.5)	2.2 (1.4-3.2)**	2.0 (1.3-3.1)*	1.9 (1.2-2.9)*
Rural background	1.3 (0.9-2.2)	1.0 (0.6-1.7)	3.5 (2.4-5.4)**	3.5 (2.3-5.3)**	2.7 (1.8-4.3)**
Preferred RCS	3.4 (2.1-5.6)**	2.1 (1.2-3.7)**	4.3 (2.1-9.0)**	3.6 (1.7-7.7)**	2.5 (1.2-5.5)*
General practise intention at entry	0.8 (0.5-1.3)		3.3 (2.2-4.9)**	3.5 (2.3-5.3)**	3.5 (2.9-5.5)**
Increased interest in rural medical practise				4.2 (1.8-9.3)**	2.6 (1.1-6.3)*
Self-efficacy score		1.4 (1.3-1.5)**			1.2 (1.1-1.3)**
Model Chi-square	29.2	100.8	135.0	147.8	180.7
Cox & Shell R^2	0.04	0.14	0.19	0.21	0.25

*p<0.05, **p<0.001



The figure illustrates medical student's retrospective evaluation of change in interest as a result of RCS experience to practise in regional & rural areas and remote and very remote areas.
217x161mm (96 x 96 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Y
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Y
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Y
Objectives	3	State specific objectives, including any prespecified hypotheses	Y
Methods			
Study design	4	Present key elements of study design early in the paper	Y
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Y
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	Y
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	Y
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Y
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*Y*
Bias	9	Describe any efforts to address potential sources of bias	Y
Study size	10	Explain how the study size was arrived at	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Y
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Y
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	Y
		(*e*) Describe any sensitivity analyses	

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Y
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Y
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	*Y*
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Y
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Y
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	Y
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Y
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Y
Generalisability	21	Discuss the generalisability (external validity) of the study results	
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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The association between self-efficacy, career interest and rural career intent in Australian medical students with rural clinical school experience

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The association between self-efficacy, career interest and rural career intent in Australian medical students with rural clinical school experience

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Abstract:

Objectives: To investigate medical student's self-efficacy at the time of finishing their Rural Clinical School (RCS) placement and factors associated with self-efficacy. Secondary aims are to explore whether interest levels or self-efficacy are associated with rural or remote career intentions.

Design, Setting & Participants: A cross-sectional study of medical students who had completed their RCS term in 17 Australian universities. Data were derived from the 2013 Federation of Rural Australian Medical Educators (FRAME) evaluation survey. Questionnaire responses were analysed from 653 medical students from regional Australia. All 732 students who completed their RCS term in 2013 were invited to participate.

Primary and Secondary outcome measures: Rural self-efficacy: Six questions to measure self-efficacy beliefs in rural medical practise, based on the sources of self-efficacy described by Bandura. Rural career intention: Students were asked to identify their preferred location for future practice. The options were, Capital or Major City; Inner regional city or large town; Smaller town and very remote area.

Results: Questionnaire responses were analysed from 653 medical students from regional Australia (response rate 89.2%). 83.8% of all students recalled an increase in their interest levels for rural medicine as a result of their RCS experience, however only 26.9% indicated an actual intention to work in a rural area. Bivariate analyses showed female gender ($p=0.003$), rural background ($p<0.001$), an RCS preference for clinical training ($p<0.001$), and general practice intentions ($p=0.004$) were factors associated with higher levels of self-efficacy. Logistic regression analyses showed that self-efficacy was independently associated with increased interest in rural medicine (Odds ratio 1.4 (95% CI 1.3-1.5)) and rural career intent (Odds ratio 1.2 (95% CI 1.1-1.3)). (Model included gender, rural background, preference for RCS, generalist intent, rural practice interest and self-efficacy).

Conclusion: Self-efficacy is associated with increased interest levels for rural medicine and rural medical career intent.

Key words: Rural self-efficacy, rural background, interest level, Rural Clinical School (RCS)

Strength and limitation of this study:

- Currently there is a maldistribution of doctors across urban, rural and remote areas of Australia. We may improve the distribution of future doctors to areas of workforce need by using selection and training processes based on assessing medical student's psychosocial and cognitive factors.
- The study provides valuable information on the association between, self-efficacy, career interest and rural career intention among medical students.
- Data were derived from the longitudinal tracking study of Federation of Rural Australian Medical Educators (FRAME) of Australian Rural Clinical Schools with consistent definitions, agreed protocols and mechanisms for collecting and reporting data at the national level.
- The study is limited by its cross-sectional design and therefore causation cannot be inferred.

Introduction:

Australia faces considerable challenges in meeting doctor supply needs. A maldistribution (under supply) of doctors to regional and remote Australia exists. For example, the Australian bureau of statistics estimated in 2011, that the per capita ratio of primary care doctors in major cities was double compared to remote and regional areas[1]. There is a need to address and understand career psychosocial motivations for rural and remote practice. It remains unknown whether earlier educational work experiences can enhance rural or remote clinical career self-efficacy.

Self-efficacy is a cognitive structure created by the cumulative learning experiences in a person's life that lead to development of belief or expectation that they can or cannot successfully perform a specific task or activity [2 3]. Self-efficacy as a psychological construct, has been well described in career choice models to explain career behaviours[4 5]. Lent et al[6] and Roger et al [7] have demonstrated that self-efficacy served as an antecedent of outcome expectations, interests and goals for career planning and career exploration in high school and university students. Business individuals demonstrate prior high self-efficacy for entrepreneurial intentions and beliefs before the creation of a new enterprise [8 9]. This suggests intention and actual practice can be associated with prior self-efficacy values for a specific future activity.

Over the past 15 years, the Australian government has invested in a number of large scale national programs to develop medical students training in rural medicine. These programs have included the Rural Undergraduate Support and Co-ordination, University Departments of Rural Health and the Rural Clinical Schools (RCS) programs[10]. The RCS program is the largest in terms of scale, infrastructure development and scope and was launched in 2000 to enable medical students to undertake extended blocks of their clinical training in regional areas. Australian rural clinical schools permit students from either urban or rural backgrounds to attend a rural clinical school campus. Within a medical faculty, Australian rural clinical schools are responsible for delivering a year or more of the clinical medical curriculum in a rural environment, for 25% of medical students [11].

Rural clinical school outcomes and medical student rural career intent have been extensively evaluated and have traditionally focussed on extrinsic outcome factors to predict rural work force outcomes. Extrinsic factors have included previous rural background, gender, scholarships, length of time spent at an RCS and speciality preference as predictors of intended rural practice after graduation [12 13]. Few studies have addressed psychosocial aspects to rural medical career development. One study has previously investigated the role of personality domains on rural career intentions and showed that the probability of rural preference was greater with higher scores of openness to experience, agreeableness and self-confidence but lower with higher scores on extraversion, autonomy and intraception [14]. On the other hand it has been suggested that the influence of personality factors on human career decision functioning is insufficient. Self-efficacy as a predictor in addition to rural background, rural training, rural and generalist intent has been used in an index to predict rural career choice [15]. Career interest and self-efficacy expectations have been suggested to influence career choice [16 17] and self-efficacy to mediate the relationship between personality and career interest [18].

Across Australian rural clinical school programs, the application of social cognitive career theory on rural medical career intent requires further understanding in the context of a specific rural clinical school experience. . The longitudinal tracking survey of the Federation of Rural Australian Medical Educators (FRAME), for Australian Rural Clinical Schools has consistent definitions, agreed protocols and mechanisms for collecting and reporting data at a national level [19]. This survey tool provides opportunities for assessing self-efficacy in a rural clinical school environment. The purpose of this study is to investigate medical student's self-efficacy at the time of finishing their Rural Clinical School (RCS) placement and factors associated with self-efficacy (via the FRAME survey) [20]. Secondary aims are to explore whether interest levels or self-efficacy are associated with rural or remote career intentions.

Methods:

Australian Rural Clinical Schools (RCS) and Rural Medical Schools (RMS) have collaborated through the Federation of Australian Medical Educators (FRAME) to develop a national exit questionnaire to collect demographic, educational, experiential

and intentional career data from students completing their rural clinical school experience. The survey is an evaluation tool distributed to medical students who had completed their RCS term in all 17 Australian universities each year. In the survey instrument "FRAME Rural Clinical School Survey 2013" we had included additional questions on rural self-efficacy. All 732 students who had completed their RCS term in 2013 were invited to participate. Ethics approval was obtained for the study from each of the participating universities.

Measurements

Rural self-efficacy: To measure self-efficacy beliefs in rural medical practice, the rural self-efficacy questions were developed. In total, there were 6 questions that measured individual's self-efficacy to practise in rural setting. These survey questions were developed as there were no previously known measurements for assessing career self-efficacy in Australian medical students attending a rural campus. The questions were developed based on the five sources of self-efficacy i.e., vicarious learning, verbal persuasion, positive emotional arousal, negative emotional arousal and performance accomplishments (Figure 1) [3]. We used questions focused on these sources of self-efficacy to calculate a composite rural medicine self-efficacy score. This score was calculated from the likert scale score of each of the questions. Negative scoring applied to the two negatively (questions 1 and 3) framed questions before calculating the composite score, which could range from 6-30. These questions as a scale demonstrated an internal reliability (Cronbach alpha) of .78 in the present sample. Construct validity was demonstrated with significant correlation with rural career interest and self-efficacy score ($r=0.50$, $p<0.001$).

Table a: Frame survey questions aligned with Bandura's five sources of self-efficacy

Sources of self-efficacy	Questions
Performance accomplishments	Rural practice is too hard
	I have necessary skills to practice in rural setting
Negative emotional arousal	I get a sinking (anxious) feeling when I think of working in rural setting
Positive emotional arousal	I have a strong positive feeling when I think of working in a rural setting

Verbal persuasion	People tell me I should work in a rural setting
Vicarious learning	I see people like me taking up rural clinical practice

Change in interest in rural practice: Retrospectively students evaluated their change in interest for rural medicine as a result of their RCS experience in a 5-point Likert scale. "**My RCS medical experience has increased my interest in pursuing a career in a medical career in regional or rural Australia"** Strongly disagree, somewhat disagree, neutral, somewhat agree, strongly agree. Similarly students accessed their interest in general practice.

Rural career intention: Students were asked to identify their preferred location for future practice. "**In which geographical location within Australia would you most like to practise on completing your training?"** The options were**,** Capital or Major City; Inner regional city or large town in Australia (25,000 - 100,000); Smaller town - outer regional (10,000 - 24,999); Small rural or remote communities (10,000) and Very remote centre/area.

Other variables included in the analyses were gender, rural background, preference for RCS clinical training, and preference for speciality or general practice at entry.

Data analyses:

Data were analysed using the statistical package SPSS v. 21 (SPSS IBM, New York, U.S.A). Descriptive data were examined to determine study variables. Pearson's t-test or one-way ANOVA test was used to determine the factors associated with self-efficacy. Post-hoc LSD analyses were used to understand specific differences between categories. A step-wise logistic regression model was used to analyse the independent association between self-efficacy and interest levels in rural practice at exit from an RCS; likewise, analysed the independent association between self-efficacy and rural career intention. Gender, rural background, and RCS preference, generalist intent, interest and self-efficacy were included in the models as applicable. Cox & Shell R^2 were used to show the variance explained by self-efficacy on increased interest and intent in rural practise respectively.

Results:

Data were analysed from 653 medical student respondents (response rate: 89.2%) from regional Australia, 58.8% were female students. The descriptive details of the study variables are presented in Table 1. The survey results show that 41.9% considered they had come from a rural background. General practice (family medicine) was the intended career in 28.7% of the students. Preference for RCS clinical training as student's first choice was reported to be 65.7%, while a further 16.4% reported the RCS ranking high on their list for clinical training. The results (Figure1) show that 63.4% reported an increased level of interest in General practice as a result of their RCS experience. 83.8% of students reported an increase in their interest levels for rural medicine as a result of their RCS experience, however only 26.9% indicated an actual intention to work in a rural area and even less so in a remote area.

The mean (SD) composite score of the six rural career self-efficacy questions was 22.9 (3.5). The descriptive information of each question is reported in Table 2. Table 3 explores the factors associated with rural self-efficacy. Rural self-efficacy was associated with gender i.e., female students had higher self-efficacy compared to male students ($t=-2.9$, $p=0.003$); rural background ($t=-5.9$, $p<0.001$); higher preference for RCS clinical training ($t=-6.2$, $p<0.001$); and general practice intention at entry to RCS ($t=5.5$, $p=0.004$)

Rural self-efficacy was associated with increased interest in general practice ($t=-7.2$, $p<0.001$) and increased interest in rural ($t=-10.2$, $p<0.001$) or remote practice ($t=-7.4$, $p<0.001$). Self-efficacy scores gradually increased based on intention to practice farthest to a Capital city (remote areas). The self-efficacy score at capital city was 21.2 (SD 3.1), whereas the self-efficacy of students intent to practice in small rural or remote areas was 25.2 (SD 3.9) and the difference was statistically significant ($t=8.6$, $p<0.001$). However, we note that the number of students actually wishing to practice in a small rural and remote area was a small percentage (7.8%) of the total number of students undertaking the survey.

Table 4 explains the multivariate logistic regression analyses on the effect of self-efficacy in rural career interest and rural career intent. RCS preference (OR 2.1 (95% CI 1.2-3.7)) and self-efficacy (OR 1.4 (95% CI 1.3-1.5)) were independently associated with increased interest in rural medical practise due to RCS training. Cox

& Shell R square suggests self-efficacy could explain an additional 10% in predicting students with increased levels of interest in rural practice. Gender OR 1.9 (95% CI 1.2-2.9), rural background OR 2.7 (95% CI 1.8-4.3), preferred RCS OR 2.5 (95% CI 1.2-5.5), general practice intention at entry OR 3.5 (95% CI 2.9-5.5), increase interest due to RCS training OR 2.6 (95%CI 1.1-6.3)were associated with rural intentions. In addition, self-efficacy was independently associated with rural practice intention after adjustment for gender, rural background, preferred RCS, general practise intention at entry, increase interest due to RCS training OR 1.2 (95% CI 1.1-1.3).

Discussion

Previous studies have demonstrated that a rural medical student placements exhibit significant influence on rural career interest and intentions[10]. More recently it has been shown that length of time at a rural clinical school increases rural career interest levels[21]. In the present study we have found that self-efficacy explains 20% of the variance in rural practice interest levels by medical students that have attended an RCS. In the present study both increased rural career interest levels and rural self-efficacy were found to be independently associated with rural career intent. Importantly we note in our study that most (> 80%) students developed an increased interest to practice in a rural area, but not for remote and smaller rural areas. This may suggest that self-efficacy increase is greatest in environments where the rural clinical school is located and experiences are associated. In the FRAME survey cohort most RCS's are located typically in larger rural towns and regional cities [11].

Rural background is a strong influence on rural medical practice intent among medical students [12 22 23]. Students who have a rural background are more than twice likely to become rural practitioners. In our study, we show rural background is associated with higher rural self-efficacy. Rural exposure via education, recreation and upbringing has been suggested to provide the familiarity, sense of place and community involvement could motivate medical students towards both intended and actual rural careers [24]. This finding is consistent with the self-efficacy literature which describes self-efficacy as a construct that encompasses motivation, adjustment and interest[4 5]. Our study is consistent with previous studies that found close associations between rural background, rural intent and self-efficacy [15 25].

Additionally we show self-efficacy and career interest are associated with rural career intention, independent of the medical student's rural background.

Social– cognitive career theory suggests that vocational interests develop over time, partially as a function of self-efficacy expectations[6]. Several studies have noted a relationship between self-efficacy and career interest levels [26 27]. Among medical students, Bierer et al explained an association between research self-efficacy and interest in clinical research careers [28]. In our study we have demonstrated a positive relationship between increased self-efficacy and rural practice interest levels in medical students. Interest level has been poorly studied with respect to Australian medical student's rural educational experiences and career interest or intent for rural practice [21]. Other studies have attempted to model self-efficacy on medical students with rural backgrounds on rural career intentions in the absence of rural career interest levels [15]. Indeed others have shown an improvement in understanding career intentions by studying both career interest and self-efficacy [26].

Longitudinal rural placement enables students to achieve personal goals, and enhance beliefs and orientation towards the complex personal and professional demands of rural practice [24]. This is paralleled with an incremental increase in rural career intentions, with each additional year of RCS training that students undertake[29]. Further career interest in rural practice may increase after one-year of RCS training [21]. Increased self-efficacy through rural training may explain the increased interest and intention to practice in a rural area. Indeed in the present study we demonstrate that rural career self-efficacy explains additional variance in both rural career interest and career intent. We also found that rural career self-efficacy levels modulate career choice intentions in both rural and urban students. These associations are cross-sectional and could not determine causality. Only students of rural clinical schools participated in the study, therefore generalisation to all medical students should be considered cautiously. Nevertheless there is likely a need to establish whether self-efficacy is an integral part of rural placement curriculum and experience. To do this we suggest that longitudinal tracking of rural career intentions among medical students on actual and eventual rural practice are evaluated, particularly with respect to change in self-efficacy and interest levels.

Our study has particular strengths, that include all data were derived from the longitudinal tracking study of Federation of Rural Australian Medical Educators (FRAME) of Australian Rural Clinical Schools. The study survey tool has consistent definitions, agreed protocols and mechanisms for collecting and reporting data at the national level. This is the first time that FRAME survey has had self-efficacy questions introduced. We acknowledge that no previous questionnaire to measure self-efficacy in our rural medical students has been available that encompasses the five factors of self-efficacy described by Bandura [3] Our adapted survey questions to access self-efficacy produced a Kappa of .78 in the present study, which shows the items' have good internal consistency for group comparison [30]. Our questions are associated with change in self-interest for rural practice as a function of rural clinical experience. This supports the notion that our self-efficacy questions are indeed assessing social cognitive elements of career intent.

In conclusion, we found students from rural backgrounds to have higher self-efficacy following training at a RCS. These higher levels of self-efficacy were associated with higher levels of career intent to practice in rural areas. We have shown that self-efficacy is associated with increased interest levels for rural medicine and rural medical career intent. Early identification of low self-efficacy in potential RCS students may suggest these students are unlikely to benefit from an RCS experience in terms of enhancing interest in rural medical careers. As we have found students with low self-efficacy upon exit from an RCS are less likely to develop rural career pathway intentions. The concept for developing learning opportunities in more remote areas to increase remote clinical self-efficacy is suggested. This may translate to additional remote rural clinical practice intentions.

Authors' contributions:

VI developed the study design and the self-efficacy survey questions which were added to the standard FRAME survey; and analysed the data and drafted the initial version of the manuscript; LW contributed to initial project design, data interpretation, critical revision of the manuscript; CM contributed to initial project design, data interpretation, critical revision of the manuscript. All approved the final manuscript.

Competing Interests

VI is a PhD student in an Australian rural clinical school.

LW has direct leadership responsibilities for a medical student education program in an Australian rural clinical school. Students from her program participated in the FRAME exit survey.

CM has leadership responsibilities for a medical student education program in an Australian rural clinical school.

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Data Sharing: No additional data available

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Figure 1: Retrospective evaluation of change in career interest

The figure illustrates medical student's retrospective evaluation of change in interest as a result of RCS experience to practise in regional & rural areas and remote and very remote areas.

Table 1: Characteristics of the sample

Characteristics		N	%
Gender	Male	269	41.2%
	Female	384	58.8%
Rural background	No	371	57.4%
	Yes	275	42.6%
Type of location living longest in Australia	Capital city	280	43.9%
	Major city	75	11.8%
	Regional	109	17.1%
	Rural	69	10.8%
	Small rural	96	15.0%
	Remote	9	1.4%
Preference for RCS for Clinical training	Last choice	28	4.3%
	Low on list	26	4.0%
	Mid-choice	61	9.4%
	High on list	106	16.4%
	First choice	425	65.8%
Preferred location for work	Capital/Major city	245	37.5%
	Regional	225	34.5%
	Rural	125	19.1%
	Small rural	43	6.6%
	Remote	7	1.1%
Career preference at entry to RCS	General Practise	188	29.1%
	Generalist Specialist	274	42.8%
	Sub-Specialist/Others	185	28.6%
Current career preference at exit from RCS	General Practise	188	28.8%
	Generalist Specialist	273	41.8%
	Sub-Specialist/Others	182	27.9%

Percentages may not add up to 100% because of missing data.

Table 2: Self-efficacy in rural practise

Questions	N	Mean (SD)	Strongly disagree/Disagree	Neutral	Strongly agree/Agree
Rural practise is too hard	645	2.06 (0.70)	79.2%	15.7%	5.1%
I have necessary skills to practise in rural setting	644	3.75 (0.73)	6.7%	20.7%	72.6%
I get a sinking (anxious) feeling when I think of working in rural setting	643	1.98 (0.91)	75.6%	18.3%	5.6%
I have a strong positive feeling when I think of working in a rural setting	645	3.83 (0.83)	6.4%	22.6%	69.6%
People tell me I should work in a rural setting	643	3.72 (0.91)	8.9%	28.0%	61.3%
I see people like me taking up rural clinical practice	644	3.66 (0.93)	11.3%	24.5%	62.5%
Mean Composite score	640	22.9 (3.6)			

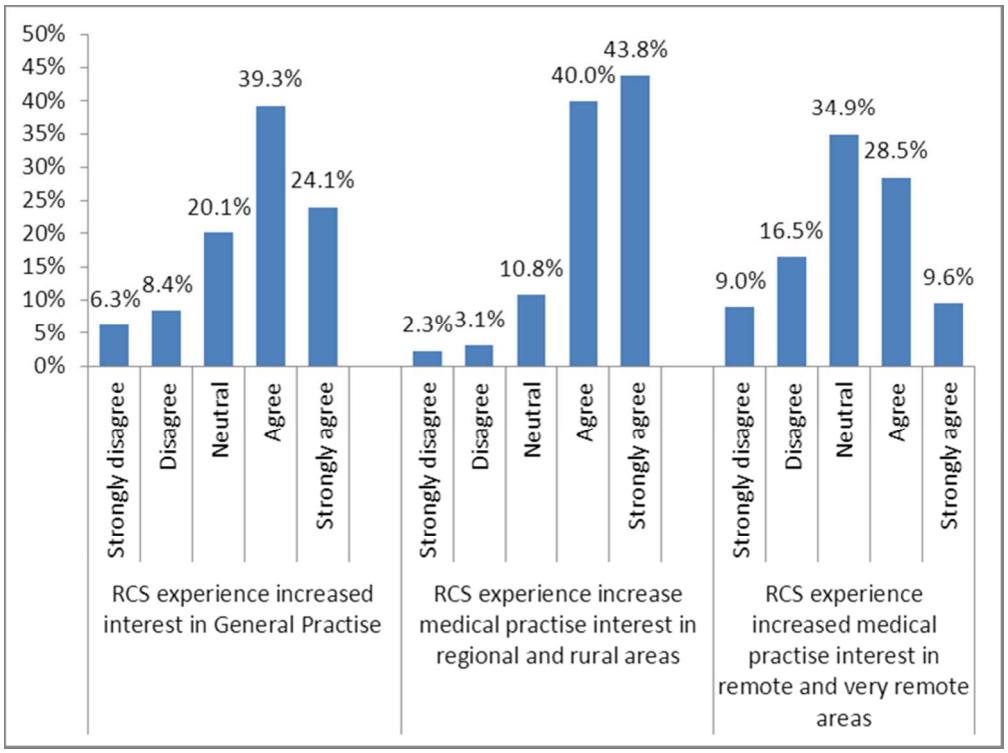
Table 3: Factors associated with self-efficacy in rural practise

		Self-efficacy		
		N	Mean (SD)	t/f (p value)
Gender	Male	264	22.4 (3.3)	-2.9 (0.003)
	Female	376	23.3 (3.6)	
Rural background	No	361	22.2 (3.3)	-5.9 (<0.001)
	Yes	272	23.8 (3.6)	
Type of location living longest in Australia	Capital city/Major city	347	23.1 (3.4)	0.6 (0.63)
	Regional	107	22.8 (3.6)	
	Rural	66	22.6 (4.1)	
	Small rural/remote	105	22.7 (3.3)	
Preference for RCS for Clinical training	Last/ Low/ Mid choice	109	21.1 (3.3)	-6.2 (<0.001)
	First/High on list	524	23.3 (3.4)	
Intended speciality at entry to RCS	General Practise	185	23.5 (3.4)	5.5 (0.004)
	Generalist Specialist	268	22.8 (3.2)	
	Sub-Specialist/Others	183	22.3 (3.7)	
Career Interest				
RCS experience increased interest in General Practice	Strongly disagree/Disagree/Neutral	223	21.6 (3.7)	-7.2 (<0.001)
	Strongly agree/Agree	409	23.6 (3.1)	
RCS experience increased interest in medical practise in regional and rural areas	Strongly disagree/Disagree/Neutral	103	19.9 (3.9)	-10.2 (<0.001)
	Strongly agree/Agree	533	23.5 (3.1)	
RCS experience increased interest in medical practise in remote and very remote areas	Strongly disagree/Disagree/Neutral	388	22.1 (3.6)	-7.4 (<0.001)
	Strongly agree/Agree	246	24.2 (2.9)	
Career Intention				
Preferred location for work at exit from RCS	Capital/Major city	238	21.2 (3.1)	46.7 (<0.001)
	Regional	221	23.3 (3.2)	
	Rural	124	24.7 (2.6)	
	Small rural/ remote	49	25.2 (3.9)	

Table 4: Logistic regression analysis for the effect of self-efficacy on rural career intention

	Increased interest in rural medical practise		Intention to practice in rural areas		
	Model 1	Model 2	Model A	Model B	Model C
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Gender (Female)	1.5 (1.0-2.5)*	1.5 (0.9-2.5)	2.2 (1.4-3.2)**	2.0 (1.3-3.1)*	1.9 (1.2-2.9)*
Rural background	1.3 (0.9-2.2)	1.0 (0.6-1.7)	3.5 (2.4-5.4)**	3.5 (2.3-5.3)**	2.7 (1.8-4.3)**
Preferred RCS	3.4 (2.1-5.6)**	2.1 (1.2-3.7)**	4.3 (2.1-9.0)**	3.6 (1.7-7.7)**	2.5 (1.2-5.5)*
General practise intention at entry	0.8 (0.5-1.3)		3.3 (2.2-4.9)**	3.5 (2.3-5.3)**	3.5 (2.9-5.5)**
Increased interest in rural medical practise				4.2 (1.8-9.3)**	2.6 (1.1-6.3)*
Self-efficacy score		1.4 (1.3-1.5)**			1.2 (1.1-1.3)**
Model Chi-square	29.2	100.8	135.0	147.8	180.7
Cox & Shell R^2	0.04	0.14	0.19	0.21	0.25

*p<0.05, **p<0.001



The figure illustrates medical student's retrospective evaluation of change in interest as a result of RCS experience to practise in regional & rural areas and remote and very remote areas.
217x161mm (96 x 96 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Y
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Y
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Y
Objectives	3	State specific objectives, including any prespecified hypotheses	Y
Methods			
Study design	4	Present key elements of study design early in the paper	Y
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Y
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	Y
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	Y
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Y
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*Y*
Bias	9	Describe any efforts to address potential sources of bias	Y
Study size	10	Explain how the study size was arrived at	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Y
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Y
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	Y
		(*e*) Describe any sensitivity analyses	

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Y
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Y
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	*Y*
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Y
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Y
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	Y
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Y
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Y
Generalisability	21	Discuss the generalisability (external validity) of the study results	
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.