Vocational training of general practitioners in rural locations is critical for the Australian rural medical workforce

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The known In efforts to reduce the longstanding geographically inequitable distribution of Australian GPs, current policy requires that 50% of GP vocational training (registrar) positions are located in rural or remote areas.

The new We identified a strong association between rural training pathways and subsequent rural practice, and it is intensified by a rural origin effect. Despite some attenuation over time, these associations remained strong up to 5 years after vocational registration.

The implications Ongoing support for rural GP vocational training opportunities and the selection of rural origin medical students are critical components of GP workforce policy.

Abstract

Objective: To investigate associations between general practitioner vocational training location and subsequent practice location, including the effect of rural origin.

Design and participants: Annual panel survey of GPs (from the MABEL study) who completed their vocational training and transitioned to independent practice, 2008–2014.

Main outcome measures: Rural practice location in the 5 years after vocational registration for participants in four primary cohorts: (1) rural origin/rural training; (2) metropolitan origin/rural training; (3) rural origin/metropolitan training; and (4) metropolitan origin/metropolitan training.

Results: During the study period, 610 doctors completed GP vocational training and commenced independent practice. 74–91% of rural origin/rural training cohort GPs remained in rural areas during their first 5 years after completing training, with 61–70% remaining in the same community. Conversely, 87–95% of metropolitan origin/metropolitan training cohort GPs remained in metropolitan areas. GPs from the other two cohorts initially remained in their training location type, but gradually moved towards their origin type. Generalised estimating equation logit models identified a highly significant association between rural training pathways and subsequent rural practice that was sustained for 5 years after vocational registration; it was substantially strengthened when combined with rural origin (cohort 2 *v* cohort 4: odds ratio [OR], 24; 95% CI, 13–43; cohort 1 *v* cohort 4: OR, 52; 95% CI, 24–111).

Conclusion: This study provides new quantitative evidence of strong associations between rural GP vocational training location and subsequent rural practice location, which is strengthened when combined with rural origin. This evidence supports current government policy supporting rural GP vocational training and quotas for medical student selection based on rural origin.

The geographically inequitable distribution of the Australian medical workforce continues, and rural and remote general practitioner positions are largely filled by international medical graduates (IMGs).[1] This dependency persists despite substantial government efforts to stimulate recruitment and retention of Australian-trained GPs in rural areas. Recent government initiatives have included a large increase in the number of federally supported medical school places for students, and supporting medical education and training in rural communities through the Rural Clinical Training and Support (RCTS) program.[1,2] A quota for the proportion of domestic students with a rural background selected by medical schools (at least 25%) has also been introduced, and rural clinical exposure during undergraduate and pre-vocational medical training programs has increased. In addition, Australian policy now requires that 50% of GP vocational (registrar) training occurs outside metropolitan areas.[1] This policy is based chiefly on research that has indicated that a positive educational experience in rural settings, targeted training of GP registrars for rural practice, and clear pathways to rural practice are the most effective incentives for interesting a GP in a rural career.[3,4] Doctors accepted into GP training are selected into either the Rural Pathway or the General (mostly metropolitan) Pathway, with about 50% of candidates allocated to each.[5]

Evidence for the effectiveness of these interventions for increasing rural recruitment and retaining Australian medical graduates in rural areas has accumulated. Ranmuthugala and colleagues[6] reported that evidence for the effectiveness of increased rural exposure during undergraduate medical training on the uptake of rural practice was inconclusive, but Wilkinson and colleagues[7] found that postgraduate rural GP training had a stronger association with rural practice uptake than rural exposure during undergraduate training (although the availability of rural GP postgraduate training was low at the time of this study because the number of rural training positions was limited). More recent empirical data[8-10] and data on intentions collected at training completion[11,12] suggest moderate improvement in the uptake of rural practice by students who have participated in RCTS programs. However, as reported in three literature reviews on the recruitment and retention of medical practitioners in rural areas[3,13,14] and as lamented in a recent letter to the *Medical Journal of Australia*,[15] there remains a large evidence gap as to the effectiveness of rural exposure during vocational training programs. A review of the outcomes of the regionalised Australian General Practice Training Program[16] found that only 27% of former Rural Pathway registrars remained in rural practice after 7 years. In addition, several North American studies have produced limited quantitative evidence of associations between vocational training in a rural primary care setting and subsequent rural practice.[17-20]

The geographic origin of doctors also has an impact on their commencing rural practice, with convincing evidence about a strong link between an individual's rural upbringing and their subsequent decisions about a rural career.[21,22] The consistency of

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the reported association between GPs having a rural background and their choosing a rural career suggests that their origin is a critical factor in making this decision, regardless of vocational training location. Our study therefore aimed to investigate the association between vocational training location and the subsequent choice of practice location for newly registered GPs, including the effect of a rural background.

Methods

This study was based on data from the Medicine in Australia: Balancing Employment and Life (MABEL) study, conducted by the Centre for Research Excellence in Medical Workforce Dynamics (https://mabel.org.au/). MABEL is a national longitudinal survey that collects annual data from a panel of doctors, with a regular small participation top-up. The first wave of the MABEL study (2008) invited the entire medical workforce to participate, and 10 498 doctors (19.4% of the medical population) completed the initial survey, including 17.7% of GPs. There has subsequently been an annual 70–80% study retention rate. Further participants (generally recently graduated, non-specialist hospital doctors or IMGs newly registered in Australia) are added to the MABEL pool each year.

Our study analysed data from MABEL waves 1 to 7 (2008–2014), and was restricted to respondents who had completed their GP vocational training and were transitioning to independent practice. The transition year for a GP was identified from MABEL data on the basis of their participation in GP registrar training and details of newly completed medical qualifications. Data for IMG GPs — defined as those who had completed their initial medical training outside Australia and New Zealand — were analysed separately.

Rural origin and work location

Rural origin was defined for doctors trained in Australia or New Zealand as their having resided for at least 6 years in a rural area before the age of 18 years. Each doctor's work location was geocoded in each MABEL wave to a specific town or suburb, then classified as metropolitan or rural. Rural location was defined as including Australian Standard Geographic Classification Remoteness Areas (ASGC-RA) 2 to 5;[23] it was self-defined for New Zealand-trained doctors. Vocational training location was defined in two ways: as rural or metropolitan by work location in the year the doctor completed their training (final training location), and as an aggregate of work locations in the 2 to 3 years preceding their completion of training.

Statistical analysis

Four cohorts were defined by a combination of origin type and final training location: rural origin/rural training, metropolitan origin/rural training, rural origin/metropolitan training, and metropolitan origin/metropolitan training. For comparison purposes, IMGs were separately divided into two cohorts: rural training and metropolitan training.

A secondary (sensitivity) analysis defined four cohorts by multiple training locations: rural training only; completed training in a rural area, but also had some metropolitan training; completed training in a metropolitan area, but also had some rural training; metropolitan training only.

For each cohort, the proportions of GPs working in rural and metropolitan locations were calculated for each of the first 5 years after they had completed their vocational training. Rurally trained GPs were further classified according to whether they were working in the same or a different rural community from that in which they completed their vocational training; a buffer of 20 kilometres was allowed.

Separate generalised estimating equation (GEE) models with a logit link function and exchangeable correlation structure were used to test associations between vocational training pathways and subsequent work location for the four primary cohorts (non-IMGs only) for each of the 5 years after completing vocational training. Adjustments were made for four additional demographic variables during each particular year: sex, age, living with a partner, and having dependent children. A further variable — whether the GP was rurally bonded (contracted to work for part of their early career in rural locations) in a particular year — was included in each regression model. These models were repeated for the four secondary cohorts, with rural origin as an additional covariate; its multi-year cohort definitions limited analysis to 4 outcome years. All calculations were performed in StataSE 12 (StataCorp).

Ethics approval

The MABEL study was approved by the University of Melbourne Faculty of Business and Economics Human Ethics Advisory Group (reference, 0709559) and the Monash University Standing Committee on Ethics in Research Involving Humans (reference, CF07/1102 – 2007000291).

Results

During the 7-year study period, 610 doctors completed their GP vocational training and commenced in at least one subsequent work location. The demographic characteristics of these GPs are summarised in Box 1. Just under half of the local graduates (ie, those who graduated in Australia) trained in the Rural Pathway, and about one quarter were of rural origin (consistent with current policy requirements for GP training posts and medical student intakes); fewer than 10% were rurally bonded. Most local medical graduates were women, most lived with a partner, and almost 40% had dependent children. The proportions of IMGs who trained in the Rural Pathway, were men, were aged 35 years or more, lived with a partner, or had dependent children were higher than for local medical graduates (Box 1).

1 Demographic characteristics of participating doctors at the time they completed general practitioner vocational training

	Local medical graduates	International medical graduates
Number	467	143
Rural Pathway (year of training completion)	221 (47.3%)	101 (70.6%)
Rural origin	118 (25.3%)	NA
Sex (women)	322 (69.0%)	74 (51.8%)
Age, median	32 years	41 years
Age, ≥ 35 years	153 (32.9%)	125 (89.9%)
Living with a partner	335 (72.7%)	119 (83.2%)
Has dependent children	179 (39.4%)	119 (83.8%)
Rurally bonded	35 (7.5%)	NA

NA = not applicable. Percentages exclude missing data for local medical graduates (age, 2; living with partner, 6; dependent children, 13) and international medical graduates (age, 4; dependent children, 1). ◆

2 Final vocational training location and general practice location for local medical graduates during the first 5 years after completing general practitioner vocational training

Time since completion of training	Location of practice	(1) Rural origin/ rural training	(2) Metropolitan origin/ rural training	(3) Rural origin/ metropolitan training	(4) Metropolitan origin/ metropolitan training
	Number of GPs	78 (17%)	143 (31%)	42 (9%)	204 (44%)
1 year	Same rural	70%	54%	—	—
	Other rural	20%	22%	18%	5%
	Metropolitan	10%	25%	82%	95%
2 years	Same rural	62%	42%	—	—
	Other rural	24%	31%	30%	13%
	Metropolitan	14%	27%	70%	87%
3 years	Same rural	68%	24%	—	—
	Other rural	15%	42%	35%*	11%
	Metropolitan	18%	34%	65%*	89%
4 years	Same rural	61%	25%	—	—
	Other rural	30%	29%	46%*	9%
	Metropolitan	9%	45%	54%*	91%
5 years	Same rural	42%*	15%	—	—
	Other rural	32%*	33%	33%*	9%
	Metropolitan	26%*	52%	67%*	91%

*Groups with fewer than 20 participants. ◆

Box 2 summarises the practice location as an independent GP for the four primary cohorts of local medical graduates for each of the 5 years following their completion of vocational training. There were very strong and sustained associations between final vocational training location type and subsequent practice location for the rural origin/rural training and metropolitan origin/metropolitan training cohorts; 74–91% and 87–95% respectively remained in their origin/training type during their first 5 post-training years. Moreover, 61–70% of the rural origin/rural training cohort practised in the same rural community in which they trained during the first 4 years after completing their vocational training. Outcomes for GPs from cohorts 2 and 3 also showed a clear pattern: initially, these GPs generally remained in their final vocational training location type, but there was subsequently a gradual move in work location toward their origin type. The career patterns of rurally trained IMGs was similar to those of metropolitan origin/rural trained local graduate GPs, with a gradual move in work location toward metropolitan areas during the 5 years after vocational registration (Box 3).

The rural training pathway, regardless of childhood location, was highly significantly associated with subsequent rural practice. The odds of rural practice for each of the rural training cohorts of GPs decreased with time, but a strong and highly significant association was nevertheless retained across the 5 years. Unsurprisingly, rural bonding and rural origin were positively associated with rural practice. Higher age was also associated with rural practice, while there were no consistent statistically significant associations between practising in a rural location and sex, or with having a partner or dependent children (Box 4).

Secondary analysis, using the multiple year training location definition, confirmed the importance of rural training, particularly that of the final GP training year (Box 5).

3 Final vocational training location and general practice location for international medical graduates during the first 5 years after completing general practitioner vocational training

Time since completion of training	Location of practice	Rural training	Metropolitan training
	Number of GPs	101 (71%)	42 (29%)
1 year	Same rural	81%	—
	Other rural	6%	4%
	Metropolitan	13%	96%
2 years	Same rural	57%	—
	Other rural	17%	8%
	Metropolitan	26%	92%
3 years	Same rural	49%	—
	Other rural	10%	0*
	Metropolitan	41%	100%*
4 years	Same rural	45%	—
	Other rural	21%	18%*
	Metropolitan	34%	82%*
5 years	Same rural	53%*	—
	Other rural	7%*	20%*
	Metropolitan	40%*	80%*

*Groups with fewer than 20 participants. ◆

Discussion

We have provided empirical evidence for the contribution of rural vocational training, in combination with the selection of rural origin students, to the Australian rural GP workforce. This is highly significant for rural workforce policy, as the Australian government requires that more than half of Australian GP vocational training positions be located in rural areas; our study allows an opportunity to assess the effect on the workforce of these policies.[1]

We found that training in the rural training pathway and the trainee having a rural background were each strongly associated with early career rural practice. The strength of the association between vocational training location and choosing rural practice remained strong and statistically significant up to 5 years after completing GP training for doctors of either rural or metropolitan origin (primary cohorts 1 and 2). Sustained rural practice was very strongly linked with the combination of a rural origin and rural training, but this cohort alone is unlikely to provide a sustainable rural GP workforce while only 25% of

4 Odds of local medical graduates practising in a rural location during the first 5 years after completing general practitioner vocational training

	Odds ratio (95% confidence interval)				
	1 year post-GP training	2 years post-GP training	3 years post-GP training	4 years post-GP training	5 years post-GP training
Primary cohorts					
(1) Rural origin/rural training	159 (45–558)†	65 (27–158)†	48 (22–102)†	50 (24–106)†	52 (24–111)†
(2) Metropolitan origin/rural training	68 (26–175)†	32 (16–60)†	28 (16–51)†	23 (13–41)†	24 (13–43)†
(3) Rural origin/metropolitan training	2.8 (0.7–11)	2.4 (0.9–6.2)	2.9 (1.2–6.7)*	3.3 (1.5–7.4)†	3.5 (1.5–7.9)†
(4) Metropolitan origin/metropolitan training	1.00	1.00	1.00	1.00	1.00
Age (for each 1-year increase in age)	1.06 (1.00–1.13)*	1.04 (0.99–1.08)	1.04 (1.00–1.08)*	1.05 (1.01–1.08)*	1.04 (1.01–1.08)*
Sex (reference: men)	1.00 (0.48–2.1)	0.9 (0.5–1.6)	1.03 (0.6–1.7)	0.8 (0.5–1.4)	0.8 (0.5–1.4)
Living with a partner	0.8 (0.3–1.9)	0.9 (0.5–1.7)	0.9 (0.5–1.7)	0.98 (0.6–1.7)	0.9 (0.6–1.5)
Has dependent children	1.8 (0.8–4.1)	1.9 (1.06–3.3)*	1.4 (0.9–2.3)	1.3 (0.9–2.0)	1.3 (0.9–1.9)
Rurally bonded	5.1 (1.2–22)*	3.5 (1.1–11)*	3.8 (1.4–11)*	3.7 (1.4–10)*	3.6 (1.3–10)*

Odds ratios from generalised estimating equation (logit) model: *$P < 0.05$; †$P < 0.01$. ◆

Australian-trained doctors are of rural origin, as about 30% of the Australian population live in rural or remote areas.

Most mixed rural/metropolitan origin/training GPs (cohorts 2 and 3) subsequently practised in a same location type as that in which they trained, although some gradually returned to their origin type. Diminution of the pathway effect over time is perhaps expected, as 50% of GP registrar training positions are in rural areas but about 75% of young doctors are of metropolitan origin. Other research has found that work location changes are most likely during early career stages,[24] when personal circumstances, including relationships with spouses and dependents, are more fluid. The secondary analysis confirmed the strong influence of rural training on subsequent rural practice, especially location during the final year of vocational training. Together, these findings suggest that the periods leading up to and immediately following vocational training are critically important windows of opportunity for ensuring that appropriate policies optimise recruitment of GPs for rural practice and their subsequent retention.[25,26]

The largest cohort, metropolitan origin doctors undertaking GP training in metropolitan areas (cohort 4) largely remained in metropolitan practice. Further, there was no evidence that rural origin Australian doctors were more likely than metropolitan origin doctors to choose general practice as their specialty (unpublished MABEL data). Consequently, metropolitan origin doctors continue to remain the major source of non-IMG rural GPs, making cohort 2 (metropolitan origin/rural training) critical for the rural GP workforce. This cohort is nearly twice the size of cohort 1, and the association with rural practice was much stronger than for those in the metropolitan pathway (cohort 4). However, more than 50% of cohort 2 had moved to metropolitan practice after 5 years, further highlighting the importance of targeted retention initiatives focused on this cohort.

The odds of members of the smallest cohort (cohort 3: local medical graduates with a rural background who undertook their training in metropolitan areas) practising in rural areas was three times that for metropolitan origin/metropolitan training GPs, although the

5 Odds of practising in a rural location for each of the 4 years after completing general practitioner training for local medical graduates

	Odds ratio (95% confidence interval)			
	1 year post-GP training	2 years post-GP training	3 years post-GP training	4 years post-GP training
Secondary cohorts				
(1) Rural training only	92 (27–312)†	49 (21–115)†	41 (19–88)†	29 (14–59)†
(2) End training rural, with some metropolitan training	17 (5–58)†	11.6 (4.6–29)†	11.5 (4.9–26)†	9.9 (4.3–23)†
(3) End training metropolitan, with some rural training	0.94 (0.09–9.4)	2.8 (0.8–9.4)	2.9 (1.00–81)	2.7 (0.96–7.9)
(4) Metropolitan training only	1.00	1.00	1.00	1.00
Rural origin	4.1 (1.3–13)*	2.0 (0.9–4.3)	2.1 (1.02–4.1)*	2.5 (1.3–4.9)†
Age (for each 1-year increase in age)	1.2 (1.04–1.3)†	1.08 (1.01–1.16)*	1.07 (1.01–1.14)*	1.05 (1.00–1.12)
Sex (reference: men)	0.9 (0.3–2.4)	0.8 (0.4–1.7)	0.9 (0.5–1.9)	0.8 (0.4–1.5)
Living with a partner	0.6 (0.2–2.1)	1.1 (0.5–2.6)	1.1 (0.5–2.4)	1.07 (0.5–2.1)
Has dependent children	0.6 (0.2–2.0)	1.3 (0.6–2.7)	1.09 (0.6–2.1)	1.02 (0.6–1.8)
Rurally bonded	2.0 (0.4–10)	2.21 (0.6–7.8)	3.8 (1.2–13)*	3.6 (1.1–11)*

Odds ratios from generalised estimating equation (logit) model: *$P < 0.05$, †$P < 0.01$. ◆

association was statistically significant only from 3 years after completing vocational training. However, the odds were much lower than for the rural origin/rural training cohort 1, highlighting the importance of the rural training pathway.

A key limitation of this study is that it cannot establish cause and effect. There is probably a strong self-selection bias, in that the rural training pathway attracts those who are interested in a rural career. Further limitations include the use of a self-selected cohort, the participants of the MABEL survey, who represent 15–18% of all Australian GPs. While the panel design of our study enabled individual tracking of doctors over a 7-year period and application of GEE (logit) modelling, the observed patterns, particularly in the mixed origin/training cohorts, suggest that these doctors have not yet decided on their long term preferred work location, and it is therefore difficult to accurately predict outcomes at, for example, 10 or 20 years. Additionally, vocational training location was primarily defined for the purposes of this study as the location of the trainee in the year they completed their training, as this was considered to be the most influential year for subsequent practice location. Our secondary analysis partially examined this aspect by separately analysing GPs who had undertaken vocational training in a mix of rural and metropolitan locations. Further, our key focus was on the joint effects of rural origin with rural/metropolitan training pathways. This necessitated a focus on GPs who had completed their medical degrees in Australia or New Zealand, despite IMGs comprising a considerable proportion of the rural GP workforce in Australia (more than 50% in some regions). Finally, this study used a binary measure of rurality (metropolitan *v* non-metropolitan) that may not adequately adjust for the substantial heterogeneity in the attractiveness to GPs of different rural and remote Australian locations. It is possible that more nuanced measures of rurality, including multiple levels of remoteness and population size, might have identified different associations for the four cohorts.[27]

Conclusion

Our study analysed the best available Australian longitudinal data about individual GPs to provide new quantitative evidence of a strongly positive association between rural GP vocational training location and subsequent rural practice, even after adjusting for the influence of rural origin. This evidence supports the objectives of existing policies that require at least 50% of GP training to occur in rural locations, and that at least 25% of medical students should be of rural origin. While Australia strives to reduce its reliance on IMG GPs for the rural workforce, this aim requires long term improvements in the rural recruitment and retention of Australian-trained GPs. Ongoing support for rural GP vocational training opportunities is a critical component of rural GP workforce policy in Australia.

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