Relocation choices of Australian General Practitioners

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Abstract

The aim of this paper is to examine the relocation choices of Australian General Practitioner (GPs) using data from the first ten waves of the *Medicine in Australia: Balancing Employment and Life* (MABEL) dataset. Unlike previous research on this topic, our focus extends to the role of household-related variables and broader socioeconomic conditions influencing relocation decisions. We find that changes in a GP's work arrangements, particularly in the acquisition of on-call duties as well as deterioration in the area's living conditions are associated with an increase in the probability of relocation, particularly rural-to-city relocations. Our findings demonstrate that the channel through which individual and professional circumstances lead to relocations is more nuanced than straightforward changes in earnings or workload. They also focus on individual-level factors on relocation decisions are less pronounced in comparison to changes in the overall attractiveness of the location in question.

JEL Codes:
Keywords: relocation choices, Australian General practitioners, panel data

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Introduction

The shortage of rural doctors and the uneven distribution of general practitioners has been a recurring theme in research and policy discussions in Australia over the past two decades (Department of Health, 2016). Furthermore, given the concentration of the Australian population along coastal cities and the logistical difficulties of travel, meeting the medical needs of its rural population[1] has been a unique challenge for Australia despite an adequate or, in certain instances, oversupply of doctors in the city areas (Health Workforce Australia, 2014). According to the Australian Institute of Health and Welfare (2015), the number of medical practitioner FTE per 100,000 population has consistently been lower in rural regions by a factor of approximately 1.6 as compared to the major cities.

Several initiatives have been implemented by policy makers to address this inequity in medical care access in rural areas. These include the *Bonded Medical Scheme* (whereby qualifying medical students would have their university tuition covered if they agreed to work in rural areas designated as experiencing doctor shortages for a minimum period of time (Department of Health, 2017)); and the recruitment of foreign trained doctors under similar stipulation (McGrail *et al*., 2017). However, these policies have not proven to be long-term solutions as evidenced by the continuing efforts of policy makers to address this issue (see McGrail *et al*., 2017; Department of Health, 2016).

Against this backdrop, the aim of this paper is to use the longitudinal *Medicine in Australia: Balancing Employment and Life* (MABEL) dataset to examine the relocation choices of General Practitioners (GPs) in Australia, focusing on the role of household related factors, specifically children's education, partner's employment and housing prices. The MABEL dataset is a yearly survey of Australian medical professionals that provides comprehensive information on a range of doctors' attitudes to work, job characteristics, work settings, household finances and circumstances (Taylor, *et al*., 2016). One of MABEL's stated aims is –

> To better understand how changes in personal and professional circumstances influence the decision to stay in, or leave, rural and remote areas (*Medicine in Australia: Balancing Employment and Life*, 2017)

Since the availability of the MABEL dataset, research has focused on an exploration of the roles played by factors such as job satisfaction, work activity, and rural/non-metro background in influencing doctor's location selection, retention and mobility. The focus of previous research from Australia on the retention rates and mobility

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1 For convenience, the term 'rural' is used in this paper to encompass 'regional', 'rural' and 'remote' areas as defined by the Australian Bureau of Statistics' (ABS) *Australian Standard Geographic Classification (ASGC) Remoteness Structure* (ABS 2011).

patterns of Australian General practitioners (GPs) has been on job satisfaction (Joyce and Wang, 2015), role of age-profiles (Mu, 2015), career stage (McGrail and Russell, 2016; McGrail and Humphreys, 2015) and job satisfaction (O'Sullivan *et al*., 2017). While all the above studies have used the MABEL dataset that we use in this paper, with the exception of McGrail and Humphreys (2015) and McGrail and Russell's (2016), their analysis is cross-sectional with one wave of the MABEL dataset.

Specifically, McGrail and Humphreys (2015) examine the issue of medical workforce maldistribution in rural areas in terms of doctors' mobility patterns. Using five waves of the MABEL data, they find that: (i) On average, GPs have a mobility rate of 4.6 per cent between 2008 and 2012 based on the seven-category Modified Monash Model scale, (ii) there is no association between mobility and variables such as gender and family status, (iii) age and duration of stay play a large role; (iv) younger GPs who have been in their current locations for less than three years are most likely to relocate; and (iv) the observed rate (per year) of moving from a metro to non-metro region is 1 in 75, in contrast to 1 in 31 in the reverse direction.

O'Sullivan *et al*. (2017) use the 2014 MABEL survey to examine the association between job satisfaction and geographical location for medical specialists. They find no relationship between job satisfaction and location selection and hypothesise that it is due to self-selection.

McGrail and Russell's (2016) study uses the panel MABEL dataset from 2008 to 2013 to explore the association between a medical professional's career stage and rural employment. They find that gender has no effect in the likelihood of working in a rural area; that rural origin is positively and significantly associated with rural practice; and of the graduates who choose to become GPs, proportionally fewer at early and establishing career stages work rurally relative to those at a later career stage. Similarly, Joyce and Wang (2015) use the 2011 MABEL to identify patterns of job satisfaction, and Mu (2015) examines a complementary question by looking at the location decisions of GPs with respect to their age profiles.

Finally, McIsaac *et al*. (2019) examine the role of financial factors in Australian GPs' mobility and location choices. The authors find that, even when a financial incentive is present, established GPs are not mobile generally. This suggests that location choice is multifaceted and financial considerations are but one aspect. The explanatory variables used in McIsaac *et al*. (2019) help to inform the selection of potential regressors in this paper.

Our paper contributes to knowledge in three important ways. Firstly, we hypothesise that the decision to relocate or otherwise is typically made in a household context and not on an individual basis. In other words, households' location choice is based on maximising the utility of all household members, subject to both monetary and non-monetary constraints. This is drawing on previous theoretical models which have proposed that relocation decisions are typically made taking into account the household circumstances (Pingle, 2006; López-Ospina, Cortés, and Martínez, 2017; Shapira, Gayle, and Graham, 2019). Secondly, in the Australian context, housing typically represents the largest household asset. Therefore, relocation decisions will invariably take into account the relative attractiveness of the area. In this respect, we use the Socio-Economic Indexes for Areas (SEIFA) that has been developed by the Australian Bureau of Statistics (https://www.abs.gov.au/websitedbs/censushome.nsf/home/seifa). The SEIFA uses the census to rank areas in Australia according to their relative socioeconomic advantage and disadvantage, which allows us to account for socioeconomic changes in an area including changes in housing prices. Thirdly, we use the panel aspect of the ten wave dataset to provide a more nuanced view of changes in GP relocation over time, by accounting for unobserved household specific factors.

The rest of the paper is organised as follows. In Section 2, we describe the data used in the empirical analyses. This is followed by Section 3 where we describe the Empirical strategy. Section 4 describes our results, and Section 5 presents the main conclusions.

Data

The data for this analysis come from the *Medicine in Australia: Balancing Employment and Life* (MABEL) dataset. MABEL is a large, yearly longitudinal survey of Australian doctors beginning from 2008 that is collected and maintained by Melbourne Institute: Applied Economic and Social Research at the University of Melbourne. The MABEL panel survey sought to facilitate and promote research into the Australian medical labour market including its composition, trends in labour supply, work-life balance issues and effects from policy changes (The University of Melbourne, 2018). The data has a large sample size and its respondents are representative of the wider Australian medical community with respect to age, location, doctor type and other attributes (Szawlowski *et al.*, 2019).

The first wave, conducted in June 2008 comprised of 10,498 medical practitioners from the Australian Medical Publishing Company's (AMPCo) database. Between waves, participant attrition was dealt with through the addition of top-up samples, most often new graduates and international workers. Whilst the top-up samples help maintain a consistent sample size, given MABEL is the only panel survey of medical practitioners internationally, it provides a unique opportunity to study changes over time.

The focus of our study is on primary care doctors, i.e. general practitioners (GPs). Our sample includes 7,744 individual GPs across ten waves from 2008 to 2017. On average, each GP participated in 4.2 waves and each wave consists of 3,204 GPs. There are a total of 32,221 GP-Wave observations.

Our sampling strategy requires, first, that the GPs are in clinical practice at the time of survey and, second, that there are no non-responses on questions critical to our analysis (such as practice location, gender, marital status, earnings, work hours and years in practice).

Outcome Variables

We construct four outcome variables for our empirical analysis: (i) I(Rural) – a binary variable which takes on a value of 0 if the GP's main practice at wave t is inner regional or outer regional, remote or very remote; and 1 otherwise. This outcome variable is used to evaluate the correlations between locality and the covariates for a given point in time; (ii) Number of Relocations is a continuous variable that records the number of relocations a GP experiences during his/her survey years. This variable ranges from 0 to 4, inclusive. This outcome variable is used to assess the relationship between relocation frequencies and the covariates across time; (iii) I(Relocation) is the binary version of Number of Relocations, where 1 equates to one or more relocations and 0 otherwise. This variable is used as a robustness check given the small number of GPs who experienced more than one relocation. Finally, (iv) Relocation at t is a categorical variable that records the direction of relocation at wave t with respect to the preceding year. Specifically, Relocation at t records "City → Rural" if I(Rural) refer to Rural at wave t and City at wave t-1; it similarly records "Rural → City" if the reverse is true; otherwise it records "No change". This variable is most granular by operating at the GP-wave level and is the main outcome variable is the subsequent causal analysis.

The relocation information is taken from the Australian Standard Geographical Classification (ASGC) (Australian Bureau of Statistics 2018b) which contains three location categories[2]: (i) major city, (ii) inner regional and (iii) outer regional, remote or very remote. In our sample, across all person years, the majority of doctors (62 per cent) reside in a major city, 22 per cent reside in an inner regional area and 16 per cent reside in areas classified as outer regional, remote or very remote (Table 1).

Table 1. ASGC classification of main place of work

ASGC classification of main place of work	Frequency	%
Major city	20,016	62.12
Inner regional	7,157	22.21
Outer regional, Remote or Very Remote	5,048	15.67
Total	32,221	100

Source: MABEL, authors' calculations.

2 The inability to further distinguish between states and territories or to attain more granular classification (e.g. at the postcode or suburb level) limit the scope of this analysis.

The transition probabilities presented in Table 2 reveal a low incidence of relocation between different ASGCs (Table 2, Panel A). For example, in any given year between 2008 and 2017, 98 per cent of GPs in major cities did not relocate in the following year. This low mobility rate also applies to GPs in regional or remote areas. From Table 2 (Panel A), we further observe that 91 per cent in each group remained at their location from one year to the next.

It is important to reiterate that relocation, as defined in this paper, refers to a relocation between different classification levels of ASGC. A GP who moves from Sydney to Melbourne for example (both locations are classified as “major city”) would not register as having relocated. Therefore, relocation here can be interpreted as a ‘major relocation’ involving a transition from a metropolitan to a rural area, or vice versa.

Table 2. Transition probabilities

Panel A: Transition probability of relocations (original ASGC classifications)

	At wave t+1:		
At wave t:	Major city	Inner regional	Outer regional, Remote or Very Remote
Major city	97.53	1.55	0.92
Inner regional	6.35	91.18	2.47
Outer regional, Remote or Very Remote	5.26	3.59	91.15

Panel A: Transition probability of relocations (combined ASGC classifications)

	At wave t+1:	
At wave t:	City	Rural
City	97.53	2.47
Rural	5.9	94.1

Source: MABEL, authors’ calculations.

Using I(Rural), we observe only 2.5 per cent of the sample records a city to rural relocation in a given year. Further, based on the transition probabilities, a GP is 2.4 times more likely to relocate from a rural to a city area than the reverse. This is consistent with the qualitative observations concerning the difficulty of supplying GPs to rural areas – not only are they reluctant to work there in the first place but they are also, on average, more likely to leave for the cities even when they are already practising in rural areas (Table 2, Panel B).

Table 3 (Panel A) presents the outcome variable Number of Relocations, by displaying the total number of relocations per GPs across all survey years, irrespective of direction. Table 3 (Panel B) displays the frequency of city-to-rural versus rural-to-city relocations in a given year in the full sample. This is the outcome variable Relocation at t.

Table 3. Relocation trends

Panel A: Overall number of relocations		
Overall no. relocations	Frequency	%
0	6,996	90.34
1	609	7.86
2	117	1.51
3	14	0.18
4	8	0.1
Total	7,744	100
Panel B: City to rural vs. Rural to city relocations		
Relocation at t-location at t vs t-1	Frequency	%
No relocation	31,304	97.15
City-->Rural	379	1.18
Rural-->City	538	1.67
	32,221	100

Source: MABEL, authors' calculations.

From Table 3, we observe that on average the yearly incidence of relocation is exceedingly low. On average, only 1.2 per cent of GPs movements are from city to rural, and 1.7 per cent move in the opposite direction. Although not an exact comparison, for context, the ABS' measure of overall internal migration that is nearest to our definition suggests a steady annual rate of 5 per cent from 2006 to 2016 (Australian Bureau of Statistics, 2018a).

Explanatory variables

In Table 4 we present the descriptive statistics for all the variables included in our empirical analysis. From Table 4 we observe that about 95 per cent are Australian citizens, 22 per cent have an overseas qualification, 86 per cent of GPs are married and 58 per cent have at least one dependent child, demonstrating that the question of relocation may be more appropriately regarded as a decision made within a household rather than by an individual.

In our sample 51 per cent of GPs are female, and the average respondent is well established with more than two decades of work experience (with a standard deviation of one decade). Interestingly, while 80 per cent report satisfaction with current workload, a greater 85 per cent would like to change the hours of work – suggesting that the majority of GPs would likely prefer a decrease in work hours even though there is no widespread discontentment at the current average workload.

As previously mentioned we use the SEIFA Index (Australian Bureau of Statistics, 2011), a relative measure constructed by the ABS to rank areas in terms of their relative socioeconomic advantage and disadvantage. SEIFA indexes use five yearly census data including data on income, education, employment, occupation and housing. The distribution is then divided into ten deciles using Principle Component Analysis (PCA). As previously highlighted, these factors are likely to be significant in determining the decision to relocate.

From Table 4 we observe a reasonably even distribution of GPs by SEIFA deciles, but the highest number of GPs reside in the bottom two deciles. In terms of workload, nearly 80 per cent of the sample appears to be satisfied with their overall workload but a vast majority would like to change their workload (85 per cent). Furthermore, around 40 per cent of the GPs report being on call, 32 per cent work in an area of workforce shortage, and 13.7 per cent are subject to location restrictions.

Table 4. Descriptive Statistics

Variable	Mean / % per category	St. Dev.	Sample size
Married (%)	85.91	34.79	31,369
Female (%)	50.58	50.00	32,221
Has children (%)	57.95	49.36	32,221
Career stage (years)	24.29	12.38	31,590
Weekly workload (hrs)	37.93	14.16	32,221
Age group: under 35 (%)	12.38	32.93	31,459
Age group: 35-39 (%)	11.11	31.43	31,459
Age group: 40-44 (%)	11.98	32.47	31,459
Age group: 45-49 (%)	13.78	34.47	31,459
Age group: 50-54 (%)	15.75	36.43	31,459
Age group: 55-59 (%)	14.87	35.58	31,459
Age group: 60-64 (%)	10.37	30.49	31,459
Age group: 65-69 (%)	5.31	22.43	31,459
Age group: 70 or above (%)	4.45	20.61	31,459
Satisfied with work hours (%)	79.95	40.04	31,926
Would like to change hours of work (%)	85.03	97.07	31,878
On-call (%)	40.19	49.03	31,687
Receives subsidies (%)	14.90	35.61	30,848
Australian citizen (%)	95.54	20.64	31,197
Overseas medical qualification (%)	22.14	41.52	32,221
Fellowship of the Royal Australian College of General Practitioners (%)	53.38	49.89	32,221
Fellowship of the Australian College of Rural and Remote Medicine (%)	7.34	26.07	32,221
Subject to location restriction (%)	13.71	34.40	31,255
Work in a district of workforce shortage (%)	32.13	46.70	31,806
Overall satisfied with occupation (%)	89.43	30.75	31,920
Do not have many friends/family in current location (%)	27.58	44.69	29,946
Easy to pursue hobbies in current location (%)	59.61	49.07	30,636
No. sick days in past year	2.29	5.9	30,213
No. holiday weeks in past year	4.59	2.77	31,502
No. GPs per 1,000 population at SLA level	1.53	2	31,948
SEIFA Index of relative Socio-Economic Advantage and Disadvantage – 1st decile (%)	16.75	37.35	32,180
SEIFA Index – 2nd decile (%)	13.25	33.90	32,180
SEIFA Index – 3rd decile (%)	9.46	29.27	32,180
SEIFA Index – 4th decile (%)	10.63	30.82	32,180
SEIFA Index – 5th decile (%)	9.30	29.04	32,180
SEIFA Index – 6th decile (%)	9.64	29.51	32,180
SEIFA Index – 7th decile (%)	9.62	29.49	32,180
SEIFA Index – 8th decile (%)	7.87	26.93	32,180
SEIFA Index – 9th decile (%)	6.59	24.81	32,180
SEIFA Index – 10th decile (%)	6.90	25.34	32,180

Source: MABEL 2008-2017

Table 5 breaks down selected control variables by rural-city distinction. There are relatively more female (54 per cent) relative to male GPs (46 per cent). This trend is reversed in rural areas with 45 per cent of GPs being female compared to 55 per cent for male GPs. There is little difference in the marital status of GPs or having dependent children between rural and city GPs. Both the median (40 hours) and average (41 hours) weekly work hours are higher in rural areas by approximately 4 hours, respectively, relative to cities.

Around 28 per cent of GPs in rural areas are trained overseas (using graduation from a non-Australian university as a proxy for potential work visa restrictions). This figure is 10 percentage points higher than in city areas. This is likely associated with visa conditions as mandated by initiatives such as the federal government's Stronger Rural Health Strategy (Department of Health, 2019).

There are minor differences in the proportion of GPs who have attained Fellowship of the Royal Australian College of General Practitioners in cities (54 per cent) compared to those in rural areas (52 per cent).

Table 5. Descriptive Statistics by Locality

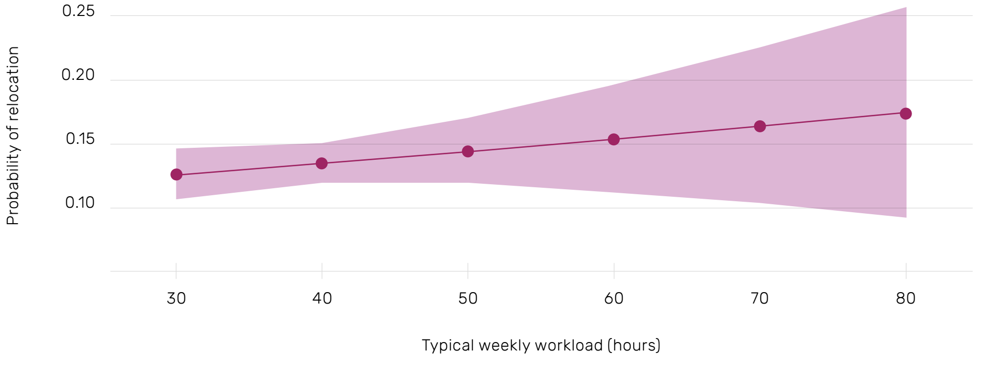
		1(female)	1(married)	1(children)	tenure (yrs)	workload (hrs)	1(overseas)
City	*mean*	0.54	0.86	0.57	25.35	36.05	0.18
	median	1	1	1	26	36	0
	SD	0.5	0.35	0.5	12.43	13.77	0.39
Rural	*mean*	0.45	0.86	0.6	22.54	41.01	0.28
	median	0	1	1	22	40	0
	SD	0.5	0.35	0.49	12.09	14.25	0.45

		1(FRACGP)	1(FACRRM)	1(on-call)	Log earnings (10k)
City	*mean*	0.54	0.02	0.26	18.7
	median	1	0	0	15.5
	SD	0.5	0.14	0.44	13.28
Rural	*mean*	0.52	0.16	0.63	22.09
	median	1	0	1	18.6
	SD	0.5	0.37	0.48	14.71

In contrast, as would be expected, more GPs in rural areas have attained a Fellowship of the Australian College of Rural and Remote Medicine (16 per cent) as compared to GPs in cities (2 per cent). A significant difference is the relative proportions of GPs who are on-call. A substantially higher proportion of rural GPs have on-call responsibilities (63 per cent). This is 2.4 times higher than the 26 per cent of city GPs who have reported on-call responsibilities. Notably, GPs in rural areas have higher earnings, with an average rural GP earning AUD$220,000 per year as compared to a yearly average of AUD$187,000 for city based GPs. It should, however, be noted that with a standard deviation between AUD$147,000 and AUD$133,000, there is a great deal of variability in earnings.

Figures 1-3 present the probability of relocation by workload, earnings and age. As expected, the probability of relocation is positively associated with workload and age, but negatively associated with earnings.

Figure 1: Probability of relocation by workload



From Figure 2 we observe that the log-transformed current earnings exhibit a negative, linear relationship with the outcome variable I(Relocation). This would suggest that rural location is high in the early stages of a GP's career, dropping as their earnings increase. This is consistent with Figure 3 where the city to rural relocation probability increases for the under 35 years age-group, suggesting that they may be new migrants required to practise in rural areas. Between ages 35-45 years, we observe a decline in city-rural relocation, and from age 60 onwards we observe that the probability of city to rural relocation is over 50 per cent suggesting a life-style choice among older GPs.

Figure 2: Probability of city-to-rural relocation by earnings

Figure 3: Probability of city-to-rural relocation by age groups

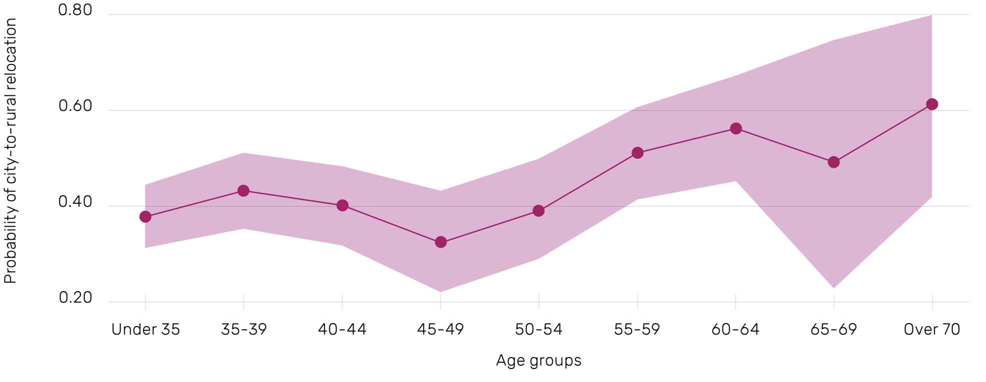


Table 6 presents descriptive statistics by relocation choices (no change, city to rural and rural to city) for key explanatory variables.

Table 6. Descriptive Statistics by Relocation directions

		1(female)	1(married)	1(children)	tenure (yrs)	workload (hrs)	1(overseas)
No change	*mean*	0.5	0.86	0.58	24.44	37.93	0.22
	median	1	1	1	25	39	0
	SD	0.5	0.35	0.49	12.35	14.16	0.41
City→Rural	*mean*	0.58	0.82	0.5	18.9	38.07	0.17
	median	1	1	1	15	39	0
	SD	0.49	0.39	0.5	13.15	15.16	0.37
Rural→City	*mean*	0.5	0.85	0.6	19.12	37.7	0.34
	median	1	1	1	17	39	0
	SD	0.5	0.35	0.49	11.63	13.05	0.47

		1(FRACGP)	1(FACRRM)	1(on-call)	Log earnings (10k)	1(Principal)
No change	*mean*	0.53	0.07	0.4	20.04	0.25
	median	1	0	0	16.65	0
	SD	0.5	0.26	0.49	13.98	0.43
City→Rural	*mean*	0.52	0.05	0.46	17.85	0.08
	median	1	0	0	15	0
	SD	0.5	0.22	0.5	11.46	0.28
Rural→City	*mean*	0.64	0.07	0.21	19.15	0.06
	median	1	0	0	16.9	0
	SD	0.48	0.25	0.41	13.44	0.24

		1(Unpredictable hrs)	1(friends)	1(hobbies)	c(sick wks)	c(holiday wks)
No change	*mean*	0.21	0.27	0.6	2.29	4.59
	median	0	0	1	0	4
	SD	0.41	0.45	0.49	5.9	2.76
City→Rural	*mean*	0.22	0.42	0.51	2.85	4.62
	median	0	0	1	1	4
	SD	0.42	0.49	0.5	6.97	3.25
Rural→City	*mean*	0.13	0.33	0.57	2.25	4.5
	median	0	0	1	1	4
	SD	0.34	0.47	0.5	4.88	3.31

Half of the GPs who relocated from city-to-rural areas in a given year had dependent children. In comparison, 60 per cent of GPs with dependent children moved from a rural location to a city. On average, tenure is higher for GPs with no relocation at 24 years versus otherwise at 20 years.

We observe that 17 per cent of city-to-rural relocations are GPs who received their basic medical training overseas. The percentage is twice as high at 34 per cent for rural-to-city relocations. The latter group may consist of GPs who have completed their mandatory rural stays after migrating to Australia. This may explain why rural retention remains a persistent challenge.

Notably, 46 per cent of city-to-rural relocations have on-call duties as compared to 21 per cent of rural-to-city relocations. This is not a causal factor to relocate, rather it reflects the fact that rural GPs are more likely to be on-call. Furthermore, 25 per cent of GPs with no relocation are principals at their clinics. As one would expect, this is substantially higher than GPs who did relocate (8 and 6 per cent are principals for city-to-rural and rural-to-city, respectively). This suggests that well established GPs are relatively less likely to relocate. Finally, for city-to-rural relocations, we observe a higher proportion of GPs who report unpredictable work hours and having limited social circle (22 and 42 per cent versus 13 and 33 per cent for rural-to-city relocations).

Empirical strategy

The aim of our paper is to understand the relocation choices of the Australian GP population. Although our sample contains a homogenous sample of individuals – qualified primary care doctors in Australia – it is nonetheless difficult to assume that each individual's unobserved time-invariant component is unrelated to his/her other observed personal characteristics.

Analyses I – Correlational study

We estimate a *Population-averaged Logit* model for panel data, as only population-averaged models give consistent estimates of population-averaged marginal effects (StataCorp, 2019). In contrast to cluster-specific estimators, it does not fully specify the distribution of the population – in this context, this translates to asking how the *average* GP with a change in one causal variable compares to the *average* GP with no such change with respect to his/her decision to relocate. Although our sample contains a homogenous sample of individuals – qualified primary care doctors in Australia – it is nonetheless difficult to assume that each individual's unobserved time-invariant component is unrelated to his/her other observed personal characteristics.

As such, before estimating a Population-averaged Logit model, we begin by conducting a Hausman test between fixed effects and random effects logit models for panel data. If the Hausman test indicates evidence of a relationship between the unobserved time-invariant components and the regressors, then regressors used in the Mundlak regression[3] are added in the population-averaged logit to ensure consistency. The Hausman tests (chi-square of 18.68 and a corresponding p-value at 0.4775) favours the random effects model over the fixed-effects model.

3 This is an random effects approach that includes individual-specific time averages of time-varying regressors (which would otherwise be eliminated in a fixed-effects model).

We therefore implement a population-averaged logit model using the same set of regressions as the random effects model. A population-averaged model is more appropriate than a random-effect model because we are interested in the association between selected characteristics and rural practice for the *average* general practitioner (Sribney, 2005). Specifically, we fit a generalised linear model with a Logit link function and a binomial distributional family for the outcome variable. We follow the standard specification and impose an equal within-group correlation structure (i.e. assume observations on a given physician are more correlated than those between different GPs)

$$logit[E(y_{it})] = (\boldsymbol{x_i} + \boldsymbol{z_{ik}})_{\boldsymbol{t}}\beta \qquad y \sim Bernoulli$$

$\boldsymbol{x_i}$ represents regressors specific to GP i (e.g. age group, Fellowship to RACGP) and $\boldsymbol{z_{ik}}$ represents the regressor pertaining to GP i and the area k of her practice (as reflected in ABS' SEIFA score). To facilitate more intuitive interpretations, following Wulff (2015) we calculate the average marginal effects for each regressor. The predicted probability that GP i will choose location j is denoted as p_{ij}:

$$p_{ij} = prob(y_i = j|\boldsymbol{x_i}, \boldsymbol{z_{ik}}) = \frac{e^{(\boldsymbol{x_i}+\boldsymbol{z_{ik}})^T\boldsymbol{\beta_j}}}{\sum_j e^{(\boldsymbol{x_i}+\boldsymbol{z_{ik}})^T\boldsymbol{\beta_j}}}$$

Where $\boldsymbol{\beta_j}$ is the coefficient vector that contains both the intercept coefficient and slope coefficients. To simplify notation, we collapse $\boldsymbol{x_i} + \boldsymbol{z_{ik}}$ into $\boldsymbol{x_i}$ in subsequent equations. For identification, we set $j = 0$ as the base outcome. Therefore, the predicted probability for city is given by:

$$p_{ij} = prob(y_i = 0|\boldsymbol{x_i}) = \frac{1}{1 + \sum_{j\neq 0} e^{\boldsymbol{x_i^T\beta_j}}}$$

and the predicted probability for rural relocation is given by:

$$p_{ij} = prob(y_i = 1|\boldsymbol{x_i}) = \frac{e^{\boldsymbol{x_i^T\beta_j}}}{1 + \sum_{j\neq 0} e^{\boldsymbol{x_i^T\beta_j}}}$$

We convert the predicted probability into marginal effects (ME_{ij}). For example, for a continuous regressor k (e.g. changes in weekly work hours), this is given by:

$$ME_{ij} = \frac{\partial p_{ij}}{\partial x_{ik}} = p_{ij}\left[\beta_{kj} - \sum_{m=1}^{j} \beta_{km} \cdot prob(y = m|\boldsymbol{x_i})\right]$$

For a discrete regressor k (e.g. changes in on-call status)

$$ME_{ij} = \frac{\Delta p_{ij}}{\Delta x_{ik}} = prob\left(y = m \middle| \boldsymbol{x_{i,g \neq k}}, x_{ik} = 1\right) - prob\left(y = m \middle| \boldsymbol{x_{i,g \neq k}}, x_{ik} = 0\right)$$

We then compute the average marginal effects (AME_{ij}):

$$AME_{ij} = \frac{1}{n}\sum_{i=1}^{n} ME_{ij}$$

i. City vs Rural practice

We use a Population-averaged logit model to estimate the probability of a GP practising in a city or rural area based on the outcome variable I(Rural). The regressors include an expanded list with variables from the above descriptive summaries[4]. Variables of particular interest are: (i) Weekly workload, (ii) Annual gross earnings, (iii) On-call status, (iv) Self-reported job satisfaction, and (v) Socioeconomic index of workplace locality. Variables (i) and (ii) are continuous, (iii) and (iv) are binary and (v) is ordinal[5]. The first four variables are at the individual level and the last variable is at the broader locality level. We hypothesise that these variables are critical with respect to relocations. However, given the weighty nature of these decisions, it is unlikely for a change in, say, on-call status to lead to a relocation within the same year. As such, we add three lagged values for each of these variables.

ii. Relocation vs No change

Next we examine if there are systematic differences in covariates between GPs with at least one relocation versus no relocation. We use cluster-robust standard errors at the individual level. Note that we do not distinguish the direction of relocation in this regression.

iii. City-to-rural vs Rural-to-city relocations

Finally, we examine if there are systematic differences in covariates between GPs who relocated from city-to-rural relative to those who relocated from rural-to-city. A shortcoming of our analysis is that we are unable to satisfactorily account for GPs who switch between rural and city location multiple times during the survey years.

4 Due to the high collinearity between age group and tenure, we omit tenure to ensure model convergence.

5 They are treated as continuous in regression following the practice that "everything is linear to a first-order approximation" (Williams 2017).

Analyses II – Panel data analysis

The main outcome variable in our causal analysis is Relocation at t which contains the following categories: *No change*, *City-to-rural* and *Rural-to-city*. Based on the Hausman test from Analyses I, we fit a random-effects multinomial logit model with *No change* as the base category. This model produces valid estimates even in the presence of unobserved heterogeneity at the GP level (StataCorp 2021, 322–24). We apply robust standard errors and impose a shared covariance structure to ensure estimation convergence.

Our aim is to identify if GPs are more likely to relocate from city-to-rural or rural-to-city given changes in the postulated causal variables. Our equation of interest is:

$$U_{ijt} = \boldsymbol{X}_{it}\beta_j + u_{ij} + \epsilon_{ijt}$$

Where i refers to the i^{th} GP, j refers to the categories of *No change*, *City-to-rural* and *Rural-to-city* and t refers to the survey year. U_{ijt} is the latent utility, $\boldsymbol{X}_{it}\beta_j$ is its observed component and u_{ij} is the panel-level heterogeneity term. The inclusion of u_{ij} is a significant advantage of this panel data version of the logit model over its more common cross-sectional version by capturing the dependence of decisions made over time by the same GPs.

The multinomial logit model assumes a standard Gumbel distribution for the observation-level error term ϵ_{ijt}. It follows that the model is specified as

$$\Pr\left(y_{it} = m \middle| \boldsymbol{X}_{it}, \beta_j, u_{ij}\right) = Cumulative\ Logit\left(y_{it} = m, \boldsymbol{X}_{it}\beta_j + u_{ij}\right) =$$

$$= \begin{cases} \dfrac{1}{1 + \sum_{j \neq No\ change}^{J} \exp\left(\boldsymbol{X}_{it}\beta_j + u_{ij}\right)} & \text{if m=No change} \\ \dfrac{\exp(\boldsymbol{X}_{it}\beta_m + u_{im})}{1 + \sum_{j \neq No\ change}^{J} \exp\left(\boldsymbol{X}_{it}\beta_j + u_{ij}\right)} & \text{if m=\{City-to-rural, Rural-to-city\}} \end{cases}$$

Results

The main results from our empirical estimations are presented in Tables 7- 11. While Table 7 presents the results from the correlation analysis, Tables 8 -13 present panel data results.

Results from correlation analyses

Table 7 – column 1 present the average marginal effects from the Population-averaged logit model with robust standard errors for the outcome variable I(Rural), while Col (2) and Col (3) present the average marginal effects for the outcome variables I(Relocation) and I(city-to-rural relocation), respectively.

We do not observe any statistically significant association between changes in workload with location. On the other hand, being on-call is statistically significant and is strongly correlated with rural practice. Having on-call duties is positively associated with a 17.1 percentage point higher likelihood of rural practice; but the magnitude of the coefficients decrease to 4.2, 4.0 and 2.4 percentage points in the lagged years, respectively.

We find limited association with self-reported job satisfaction. The variable overall satisfaction with occupation is statistically significant and positively signed only in the rural sample for the current year and three years prior to the survey by 6.6 and 2.4 percentage points, respectively. In terms of broader socioeconomic indicators, we observe that improvements in the current year on ABS' SEIFA index is negatively associated with likelihood of rural practice by 4.1 percentage points. The correlations with prior years are statistically significant, but the size of the effects are smaller. Notably, respondent's marital status and number of children are not statistically significant in any of the three estimations.

Table 7: Correlational analyses

Marginal effects	I(Rural) (1)	I(Relocation) (2)	I(City-to-rural) (3)
Weekly workload (hrs)			
at t	0.001(0.000)	0.001(0.001)	0.001(0.002)
at t-1	0.000 (0.000)	0.000 (0.000)	
at t-2	0.000 (0.000)	0.000 (0.000)	
at t-3	0.000 (0.000)	0.000 (0.001)	
Log (Annual earning ($10,000))			
at t	0.002 (0.007)	0.029**(0.012)	-0.035 (0.036)
at t-1	0.001(0.006)	-0.002 (0.010)	
at t-2	0.004(0.006)	-0.014(0.010)	
at t-3	-0.006 (0.006)	-0.032***(0.011)	
On-call [1 = yes, 0 = no]			
at t	0.171***(0.020)	0.000(0.019)	0.226***(0.038)
at t-1	0.042***(0.008)	0.008 (0.012)	
at t-2	0.040***(0.007)	-0.008(0.011)	
at t-3	0.024***(0.008)	0.018(0.012)	
Overall satisfied with occupation [1 = yes, 0 = no]			
at t	0.066***(0.020)	-0.036 (0.039)	0.078(0.050)
at t-1	0.011(0.009)	-0.021(0.015)	
at t-2	0.009(0.009)	0.011(0.012)	
at t-3	0.024***(0.008)	-0.002(0.016)	
SEIFA Index of relative Socio-Economic Advantage and Disadvantage (10 deciles)			
at t	-0.041***(0.004)	0.005(0.004)	-0.062***(0.005)
at t-1	-0.004*(0.002)	-0.001(0.003)	
at t-2	-0.008***(0.002)	0.000(0.003)	
at t-3	-0.008***(0.002)	-0.010***(0.004)	
Female [1 = yes, 0 = no]	0.022(0.017)	-0.026(0.019)	0.081**(0.036)
Married [1 = yes, 0 = no]	0.001(0.018)	-0.011(0.023)	-0.013(0.048)
Has children [1 = yes, 0 = no]	-0.001(0.009)	-0.028(0.017)	0.002(0.039)
Age groups			
under 35	0.061**(0.026)	0.146***(0.042)	(Base)
35-39	0.078***(0.021)	0.118***(0.034)	0.052(0.053)
40-44	0.053***(0.019)	0.069**(0.028)	0.021(0.056)
45-49	0.033**(0.013)	0.001(0.022)	-0.056(0.066)
50-54	0.011(0.010)	-0.008(0.019)	0.013(0.067)
55-59	(Base)	(Base)	0.130(0.059)
60-64	0.035***(0.014)	0.030 (0.022)	0.182(0.067)
65-69	0.039**(0.019)	-0.020(0.026)	0.108(0.138)
70 or above	-0.006(0.024)	0.026(0.044)	0.230(0.103)
Overseas medical qualification	0.032*(0.018)	0.021(0.022)	-0.116***(0.043)
Fellowship of the Royal Australian College of General Practitioners	0.010(0.014)	0.028(0.018)	-0.030(0.035)
Fellowship of the Australian College of Rural and Remote Medicine	0.260***(0.031)	0.008(0.031)	-0.111*(0.060)
Subject to location restriction [1 = yes, 0 = no]	0.076***(0.022)	0.036(0.028)	0.018(0.048)
Work in a district of workforce shortage	0.073***(0.011)	0.024(0.015)	0.127***(0.035)
Consider work hours to be unpredictable	0.022***(0.007)	0.003(0.016)	0.052(0.045)
Weekly no. patients seen	-0.000***(0.000)	0.000(0.000)	-0.001**(0.000)
Principal/Partner at clinic [1 = yes, 0 = no]	-0.010(0.010)	-0.079***(0.016)	-0.060(0.075)

Table 7: continued

Do not have many friends/family in current location	0.012*(0.007)	0.019(0.014)	0.042(0.035)
Easy to pursue hobbies in current location	-0.012**(0.005)	-0.013(0.013)	-0.038(0.034)
No. sick days in past year	0.000(0.000)	-0.001(0.001)	0.003(0.002)
No. holiday weeks in past year	0.003**(0.001)	-0.004(0.003)	-0.001(0.005)
Waves			
2010	(N/A - lagged variables)	(N/A - lagged variables)	0.039(0.071)
2011	(N/A - lagged variables)	(N/A - lagged variables)	0.004(0.065)
2012	0.032***(0.006)	0.008(0.007)	0.057(0.068)
2013	0.030***(0.007)	0.018**(0.009)	0.077(0.072)
2014	0.029***(0.007)	0.017(0.011)	0.067(0.068)
2015	0.036***(0.009)	0.044***(0.013)	0.123*(0.071)
2016	0.043***(0.010)	0.014(0.014)	-0.040(0.076)
2017	0.0278***(0.011)	0.042***(0.014)	0.087(0.075)
N= 32221			

Notes: ***, ** and * denote statistical significance at 1%, 5% and 10%. Standard errors are in parentheses.

It is worth noting that for each of these variables whose association with rural practice is statistically significant at the 5 per cent level, the signs of their current and lagged values are identical.

Among the other regressors, age groups are correlated with rural practice. Relative to the most populous 55-59 years old age group, younger cohorts from under 35 to 45-49 years old have a higher likelihood of relocation, of the order of 3.0 to 7.8 percentage points. Similarly, being in the older cohorts of 60-69 years is also positively correlated with rural residence by 3.5 to 5.9 percentage points. We also observe that GPs with an overseas medical qualification are 3.2 percentage points more likely to practise rurally.

These estimates offer qualified support for the hypothesis that older GPs are more likely to choose to work rurally as a lifestyle choice. However, they do not support the assertion that younger GPs do not respond to policy incentives to relocate rurally (see e.g. Gair, 2021). Lastly, bordering on the tautological, we see that GPs who are subject to location restrictions and/or work in a DWS (district of workforce shortage of medical practitioners) are, respectively, 7.6 and 7.3 percentage points more likely to work rurally.

In summary, on-call status and the socioeconomic conditions of the area are most highly correlated with the likelihood of practising in a rural or city clinic. According to the marginal effects in Table 7 – Column 2, we observe no statistical relationship between workload, on-call status and job satisfaction (current or lagged values) with the likelihood of relocation.

These findings are also consistent with Figure 3, where we observe that the probability of relocation is highest for those aged below 35 years. After a sharp decline in relocation probability, we observe a slight increase between the ages of 55-59.

Importantly, a rise in living standards in the locality three years prior (as measured by a unit increase in ABS' SEIFA Index of Relative Socio-Economic Advantage and Disadvantage) is associated with a decrease of 1.0 percentage point in the propensity to relocate.

In summary, the main insight from Table 7 – Column 2 is the absence of individual level covariates in influencing changes in the propensity to relocate, whereas changes in an area's living standard may prompt relocation decisions in later years.

We also examined if there were systematic differences in covariates between GPs who relocated from city-to-rural relative to those who relocated from rural-to-city[6]. These results are reported in Table 7 – Column 3. We cluster-robust standard errors at the individual level and remove lagged variables due to the smaller sample. There are no statistically significant relationships with respect to workload, earnings or job satisfaction.

A change from having no on-call duties to acquiring this responsibility is correlated with an increase in the probability moving from city-to-rural by 22.6 percentage points. This highlights the wider range of activities GPs in rural practices are expected to perform. In contrast, an increase in the SEIFA index is correlated with a decrease in the probability of moving from city-to-rural areas by 6.2 percentage points. Overall, changes in the area's standard of living (SEIFA index) are significantly associated with each of the three outcome variables in Table 7.

Panel data estimation results

The main estimation results from the panel data analysis are presented in Table 8. Qualitatively we observe a number of interesting patterns for relocation, relative to the base category of *No change*. For example, relative to a male GP, the relative risk of a female GP relocating from a rural-to-city area is expected to decrease by a factor of 0.392. Similarly, the relative risk of an overseas trained GP relocating from a rural-to-city location is higher by a factor of 2.608 times. GPs with dependent children are less likely to relocate from city-to-rural.

6 A shortcoming is that we are not satisfactorily accounting for GPs who switch between rural and city location multiple times during the survey years.

Table 8: Random effects multinomial logit model estimations

Relative Risk Ratios	City-to-Rural	Rural-to-City
Weekly workload (hrs)		
at t	1.045**(0.021)	1.017(0.016)
at t-1	0.962*(0.021)	0.996(0.016)
at t-2	1.024(0.02)	1.039**(0.017)
at t-3	0.984(0.022)	0.964*(0.018)
Log (Annual earning ($10,000))		
at t	1.135(0.568)	0.802(0.330)
at t-1	0.640(0.268)	0.635(0.237)
at t-2	2.266*(0.949)	0.657(0.254)
at t-3	0.468*(0.211)	0.774(0.245)
On-call [1 = yes, 0 = no]		
at t	0.877(0.391)	0.442* (0.209)
at t-1	1.928 (1.082)	4.378***(1.722)
at t-2	0.924 (0.42)	0.881 (0.351)
at t-3	0.503 (0.256)	1.491 (0.559)
Overall satisfied with occupation [1 = yes, 0 = no]		
at t	4.953**(3.539)	0.527(0.232)
at t-1	0.458*(0.209)	0.662(0.254)
at t-2	0.844(0.435)	1.114(0.581)
at t-3	0.986(0.513)	0.954(0.540)
SEIFA Index of relative Socio-Economic Advantage and Disadvantage (10 deciles)		
at t	0.392***(0.048)	2.139***(0.216)
at t-1	2.102***(0.207)	0.554***(0.070)
at t-2	0.925(0.083)	0.831(0.117)
at t-3	1.081(0.118)	0.869(0.097)
Female [1 = yes, 0 = no]	0.840(0.287)	0.392***(0.130)
Married [1 = yes, 0 = no]	1.055(0.464)	1.543(0.675)
Has children [1 = yes, 0 = no]	0.526**(0.180)	0.647(0.195)
Overseas medical qualification [1 = yes, 0 = no]	0.514(0.310)	2.608***(0.752)
Fellowship of the Royal Australian College of General Practitioners [1 = yes, 0 = no]	0.973(0.339)	1.466(0.510)
Fellowship of the Australian College of Rural and Remote Medicine [1 = yes, 0 = no]	0.520(0.259)	0.588(0.235)
Subject to location restriction [1 = yes, 0 = no]	2.267(1.438)	0.579(0.248)
Work in a district of workforce shortage [1 = yes, 0 = no]	2.912***(0.901)	1.509(0.458)
Consider work hours to be unpredictable [1 = yes, 0 = no]	0.921(0.327)	0.544(0.225)
Weekly no. patients seen	0.995(0.003)	1.002**(0.001)
Principal/Partner at clinic [1 = yes, 0 = no]	0.608(0.206)	0.382**(0.177)
Do not have many friends/family in current location [1 = yes, 0 = no]	1.309(0.430)	0.936(0.310)
Easy to pursue hobbies in current location [1 = yes, 0 = no]	0.850(0.294)	1.545(0.457)
No. sick days in past year	1.030*(0.017)	0.983(0.026)
No. holiday weeks in past year	0.971(0.073)	1.038(0.056)
Age groups included Waves included N= 7744	YES	YES

Notes: Dependent variable is *Relocation at t*. The base category is *No change*. Figures in parentheses denote robust standard errors. *p<0.1, **p<0.05, ***p<0.01

We further observe that many of our variables of interest are statistically significant, including their lagged values. To enable a more intuitive quantitative interpretation than the relative risk ratios, we present the marginal effects for our variables of interest in Tables 9 – 13. In Table 9 we present estimation results for the percentage change in the average probability of relocation (from city-to rural and from rural-to-city) in response to an increase in workload per week.

Assuming linearity in extrapolating the estimated probability, we observe, for example, that an increase of ten hours per week is positively associated with an increase of 0.097 percentage points in city-to-rural relocation and 0.126 percentage points in rural-to-city relocation in the current year. Overall, however, workload changes alone are not statistically significant in relocation decisions. Even a change on the order of a quarter of the average weekly work hours does not induce meaningful changes in relocation probabilities during the current or future years.

Table 9. Marginal effects: Increase in working hours

Change in average probability of city-to-rural relocation (%)	Increase of ten work hours per week
Current year	0.097
One year prior	-0.284*
Two years prior	0.172
Three years prior	-0.115
Change in average probability of rural-to-city relocation (%)	Increase of ten work hours per week
Current year	0.126
One year prior	-0.034
Two years prior	0.336**
Three years prior	-0.322*

Table 10. Marginal effects: Increase in earnings

Change in average probability of city-to-rural relocation (%)	Increase of ln(10k) in earnings
Current year	-0.170
One year prior	-0.322
Two years prior	0.613*
Three years prior	-0.558*
Change in average probability of rural-to-city relocation (%)	Increase of ln(10k) in earnings
Current year	-1.21***
One year prior	-0.399
Two years prior	-0.391
Three years prior	-0.217

Similarly, in Table 10, we present estimates of the influence of an increase in earnings on the average probability of a relocation. The only statistically significant association detected is that an increase in earnings in the current year decreases the chances of rural-to-city relocation. Similar to workload changes, the size of the estimated effects in earnings' changes are small in magnitude and mostly statistically insignificant indicating that this variable has limited influence in inducing relocation decisions. For example, an increase of AUD$10,000 decreases the probability of rural-to-city relocation by a mere 0.30 (e^(-1.21)) per cent.

Table 11. Marginal effects: On-call duties

	Has on-call	No on-call
Change in average probability of city-to-rural relocation (%)		
Current year	0.862***	1.057***
One year prior	1.291***	0.803***
Two years prior	1.167***	1.280***
Three years prior	1.414***	1.043***
Average probability of rural-to-city relocation (%)		
Current year	1.682***	0.828***
One year prior	2.320***	0.784***
Two years prior	0.925***	0.981***
Three years prior	0.717***	1.233***

From Table 11, we observe that on-call status is strongly correlated with relocation probabilities during all current and lagged years. Notably, for one-period lagged variable, the probability of relocation in either direction is higher if the GP has on-call duties than otherwise. That is, an acquisition of on-call responsibilities leads to an increased likelihood of relocation in the following year. This is particularly marked for rural-to-city relocation in which the probability of relocation is higher by 1.536 percentage points among those with on-call responsibilities. This may be owing to the already greater range of tasks rural GPs are responsible for. In contrast to the relationship between on-call duties and workload, we conclude it is not the number of work hours *per se* that may lead to relocation considerations but the arrangement of these hours.

Table 12. Marginal effects: Improvements in self-reported job satisfaction

	Satisfied	Otherwise
Average probability of city-to-rural relocation (%)		
Current year	0.967***	0.573*
One year prior	0.890***	1.619**
Two years prior	0.944***	1.078**
Three years prior	0.957***	0.966**
Average probability of rural-to-city relocation (%)		
Current year	1.120***	2.333**
One year prior	1.173***	1.566***
Two years prior	1.231***	1.134**
Three years prior	1.214***	1.257**

Specifically, self-reported job satisfaction may be considered a “catch all” variable that can reflect any number of factors deemed important to the GP that are not adequately captured by the other explanatory variables. From the results presented in Table 12 we observe that the variable ‘self-reported job satisfaction’ is highly correlated with relocation decisions in the current and lagged years. Importantly we observe that a GP who reports greater job satisfaction is, in general, less likely to relocate relative to one who is dissatisfied. This difference is most pronounced for current year’s rural-to-city relocation in which the probability is lower by 1.213 percentage points. Further, self-satisfied GPs are more likely to move from rural-to-city after a lag of two years relative to those GPs who report lower levels of self-satisfaction.

Table 13. Marginal effects: Improvements in socioeconomic conditions

	Increase of 1 unit on index
Change in average probability of city-to-rural relocation (%)	
Current year	-1.414***
One year prior	0.561***
Two years prior	-0.055
Three years prior	0.060
Change in average probability of rural-to-city relocation (%)	
Current year	-1.368**
One year prior	-0.543***
Two years prior	-0.165
Three years prior	-1.275

Finally, in Table 13 we consider the role of changes in SEIFA of the locality that the GPs live in at the time of the survey. A unit improvement in the SEIFA index is associated with a decrease of 1.414 and 1.368 percentage points in the probability of city-to-rural and rural-to-city relocations, respectively. It is a notable finding that changes in the SEIFA index affects the probability of relocation in both directions – conversely showing that a deterioration in living standards prompts a relocation, irrespective of the initial location.

In comparison to the previous marginal effects, and considering the impersonal nature of this variable, the effect sizes associated with the SEIFA index are remarkably large. This strengthens the findings from Analyses I. Our analysis shows that relative to personal factors, the socioeconomic conditions of the area play a large part in influencing relocation decisions.

Conclusions

The focus of academic and policy discussions on Australian GPs' location choices has been on the role of key individual and profession-specific characteristics. Policy initiatives to improve rural doctor shortages have sought to design tailored incentive packages focusing on profession and individual specific characteristics. Using ten waves from the *Medicine in Australia: Balancing Employment and Life* dataset, we examined the relative importance of a range of factors which may motivate Australian general practitioners to relocate from one workplace location type to another – for example, from a city to a rural region or vice versa.

Our paper contributes to the literature on work location choices of primary health care providers. Specifically, our focus is on the role of changes in socioeconomic conditions in the local area, household factors and a more nuanced treatment of workload arrangements. We find that changes in the living standards of an area – as captured by ABS' SEIFA index – have a comparatively larger influence on the probability of relocation than individual level GP-specific factors. We also find that acquiring on-call responsibilities increases relocation probability in the following year, particularly for rural-to-city relocations. On the other hand, even large changes in work hours and earnings play a limited role in relocation choices. Our results further show that the policy to attract overseas trained GPs to rural areas has had some success. However, it appears that GPs aged between 35 – 45 years have a lower probability of relocating to rural areas. Our estimates also show that GPs with children have a lower relative risk of relocating from city-to-rural areas. Ultimately, rural practice is also seen as a lifestyle choice with older GPs significantly more likely to relocate.

Our findings show that the channel through which individual and professional circumstances lead to relocations is more nuanced than simply changes in earnings or workload. They also demonstrate that individual level factors play a smaller role on relocation decisions relative to changes in the overall attractiveness of the location in question. This is because rarely are such decisions made in isolation; instead, relocation choices are typically made as a family such that the impacts on one's spouse or children are also non-negligible determinants.

Using a panel data model and delineating the direction of relocation (city-to-rural and vice versa), our findings differ in parts from O'Sullivan *et al*. (2017) and McGrail and Russell (2016) which find limited association between job satisfaction and location choice or mobility patterns. Our interpretation that personal circumstances exert relatively weaker influences because of broader locational and socioeconomic considerations is, in principle, consistent with McGrail and Humphreys' (2015) finding that there is no association between GP mobility and family status depending on the exact scope as defined in 'family status'. This analysis has built and improved upon existing research by incorporating a longer panel data as well as implementing more rigorous econometrics methods.

We note that a limitation of our analysis is the inability to further distinguish between states and territories or to attain more granular classification (e.g. at the postcode or suburb level).

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