THE UNIVERSITY OF MELBOURNE

FACULTY OF BUSINESS & ECONOMICS

Melbourne Institute Working Paper Series

Working Paper No. 13/12

Getting Doctors into the Bush: General Practitioners' Preferences for Rural Location

Anthony Scott, Julia Witt, John Humphreys, Catherine Joyce, Guyonne Kalb, Sung-Hee Jeon and Matthew McGrail

MELBOURNE INSTITUTE®
of Applied Economic and Social Research

Getting Doctors into the Bush: General Practitioners' Preferences for Rural Location*

Anthony Scott[†], Julia Witt[‡], John Humphreys[§], Catherine Joyce[‖], Guyonne Kalb[†], Sung-Hee Jeon[†] and Matthew McGrail[§]

[†] Melbourne Institute of Applied Economic and Social Research, The University of Melbourne

[‡] Department of Economics, University of Manitoba

[§] School of Rural Health, Monash University

[‖] Department of Epidemiology and Preventive Medicine, Monash University

Melbourne Institute Working Paper No. 13/12

ISSN 1328-4991 (Print)

ISSN 1447-5863 (Online)

ISBN 978-0-7340-4273-6

July 2012

* This work was supported by a National Health and Medical Research Council Health Services Research Grant (454799) and the Commonwealth Department of Health and Ageing. The views in this paper are those of the authors alone. We thank the doctors who gave their valuable time to participate in MABEL, and the other members of the MABEL team for data cleaning and comments on drafts of this paper. The study was approved by the University of Melbourne Faculty of Business and Economics Human Ethics Advisory Group (Ref. 0709559) and the Monash University Standing Committee on Ethics in Research Involving Humans (Ref. CF07/1102 - 2007000291). Correspondence: <a.scott@unimelb.edu.au>.

Melbourne Institute of Applied Economic and Social Research
The University of Melbourne
Victoria 3010 Australia
***Telephone* (03) 8344 2100**
***Fax* (03) 8344 2111**
***Email* melb-inst@unimelb.edu.au**
***WWW Address* http://www.melbourneinstitute.com**

Abstract

A key policy issue in many countries is the maldistribution of doctors across geographic areas, which has important effects on equity of access and health care costs. Many government programs and incentive schemes have been established to encourage doctors to practise in rural areas. However, there is little robust evidence of the effectiveness of such incentive schemes. The aim of this study is to examine the preferences of general practitioners (GPs) for rural location using a discrete choice experiment. This is used to estimate the probabilities of moving to a rural area, and the size of financial incentives GPs would require to move there. GPs were asked to choose between two job options or to stay at their current job as part of the Medicine in Australia: Balancing Employment and Life (MABEL) longitudinal survey of doctors. 3,727 GPs completed the experiment. Sixty five per cent of GPs chose to stay where they were in all choices presented to them. Moving to an inland town with less than 5,000 population and reasonable levels of other job characteristics would require incentives equivalent to 64% of current average annual personal earnings ($116,000). Moving to a town with a population between 5,000 and 20,000 people would require incentives of at least 37% of current annual earnings, around $68,000. The size of incentives depend not only on the area but also on the characteristics of the job. The least attractive rural job package would require incentives of at least 130% of annual earnings, around $237,000.

JEL classification: I11, J18, J28, J33, J44, R53

Keywords: Discrete choice experiment, incentives, physicians, primary care, rural

Introduction

A key issue in many countries is shortages of primary care physicians in rural and remote areas. (Lawn et al., 2008; Starfield et al., 2005) Even if a country is thought to have 'enough' doctors overall, they may not be distributed across geographical areas according to health care need. Despite its importance, the delivery of equitable access to medical care is particularly difficult in rural and remote areas, and innovative solutions are often required. Many countries, and Australia is no exception, have a range of policies and schemes to encourage doctors to locate and practise, even if temporarily, in underserved remote and rural areas. These include financial or in-kind incentives, bonded schemes, and a range of other regulatory approaches.

Despite a considerable literature identifying factors that influence the recruitment and retention of doctors in remote and rural areas, to date there exists little rigorous evidence about which incentive schemes or policies are the most effective in increasing the supply of doctors to 'underserved' areas, and more specifically the amount of incentive required to encourage enough doctors to move. A systematic review and meta-analysis of the effect of financial incentives (including direct payments, scholarships, and loans) on recruitment into underserved areas focused mainly on US literature and on medical students and physicians (Barnighausen et al., 2009). The results found some consistent associations between financial incentives and movement to and retention in underserved areas, though study designs were generally of low quality and suffered from selection bias. However, another systematic review of the literature to evaluate the effectiveness of recruitment and retention strategies highlighted the importance of non-financial incentives, in particular for longer-term retention (Buykx et al., 2010). This review emphasized 'bundling' retention incentives over employing single measures, which have proven ineffective, and flexibility in the types of incentives being offered in order to take account of differences in geographic location. Additionally, the review applied several inclusion/exclusion criteria, and only about 10% of articles considered actually met these, again suggesting that much of the existing evidence is either relevant only to specific situations or of poor quality. Another systematic review examined the full range of interventions aimed at increasing the proportion of health professionals practising in rural and underserved areas (Grobler et al., 2009). This Cochrane review applied strict criteria on study design for a paper to be included. No studies were found that met the criteria for inclusion, suggesting that all evidence in this area is of poor quality.

Designing schemes to encourage doctors to locate and remain in remote and rural areas requires an understanding of the various factors that motivate doctors' location decisions. In the absence of data on revealed preferences, discrete choice experiments (DCEs) are increasingly being used to address these issues. There have been eight DCEs published examining the job preferences of doctors (Chomitz et al., 1998; Gosden et al., 2000; Hanson et al., 2010; Hole et al., 2010; Kolstad, 2011; Scott, 2001; Ubach et al., 2003; Wordsworth et al., 2004). Three of these were for GPs (Gosden et al., 2000; Scott, 2001; Wordsworth et al., 2004), although none included geographic location as a specific attribute. Other studies for junior doctors and nurses in developing countries have focussed largely on rural location (Chomitz et al., 1998; Hanson et al., 2010; Hole et al., 2010; Kolstad, 2011).

The aim of this paper is to examine the preferences of GPs for the characteristics of rural practice using a discrete choice experiment. This focuses on the decision to choose between jobs that include geographic location as an attribute. The DCE results are used to examine which attributes of rural jobs are valued the most (and least) by GPs, providing information on where policies should be focused. The probabilities of choosing a range of different rural jobs are also calculated, along with the monetary value (marginal willingness to pay or compensating differentials) of particular attributes. In addition, the paper contributes to the literature on doctors' job preferences in several ways. First, it estimates the total monetary value of different rural job packages (total willingness to pay). The monetary values are expressed in terms of the size of financial incentives that should be offered to encourage GPs to move to a rural area. Second, the DCE includes a 'status quo' option, which is more realistic for respondents. In addition to offering GPs a choice of job A and B, they are offered the option of staying at their current job, whereas most previous published studies have asked respondents to make a 'forced' choice between two types of job (Lagarde et al., 2009). Finally, the study uses the generalised multinomial logit model that accounts for scale as well as taste heterogeneity (Fiebig et al., 2010).

The Australian context

General Practitioners (GPs) in Australia are paid largely by fee-for-service, under the Medicare Benefits Schedule (MBS). In rural and remote areas with small populations, additional payments and different funding models are used to support GPs' small business viability and encourage GPs to work and stay in these areas. In Australia, the number of medical practitioners relative to the overall population is 235/100,000 (Australian Institute of Health and Welfare, 2012). However, this number diminishes significantly with increasing distance from capital cities, ranging from 266/100,000 in major cities to 98.5/100,000 in very remote areas. The problem of ensuring an adequate supply of GPs is further exacerbated by the significantly poorer health status of residents in rural, regional and remote Australia, particularly in indigenous communities, compared to that of residents in metropolitan areas (Australian Institute of Health and Welfare, 1998; Smith et al., 2008).

There are few location restrictions for Australian-trained GPs, and most choose not to work outside capital cities. Recent increases in the numbers of practitioners in rural and remote areas are largely due to the recruitment of International Medical Graduates who are mandated to practise in specific areas of need when they arrive, and now comprise over 40% of the rural medical workforce in many areas (Charles et al., 2004). Medical workforce undersupply in remote and rural areas is influenced by the longer hours of rural practice and on-call (usually increasing with remoteness), the need to offer more complex services and to work in relative professional and social isolation, the need to make capital investments in practice, and until recently the lack of recognition in terms of remuneration (Humphreys et al., 2001). Despite numerous government incentives and programs to increase the supply of medical practitioners in non-metropolitan areas, access to GPs and certain medical specialties remains a particular concern in both rural and remote areas.

GP's in Australia are offered a range of financial and non-financial incentives to practise and stay in rural and remote areas. This additional funding is made available to most non-metropolitan practices, with the amount of funding increasing with remoteness. Note that not all policies provide financial incentive payments directly to GPs, with some targeting rural practices. For example, some policies provide funding to encourage medical students and those in vocational training to spend time in rural areas, since exposure to rural practice has been shown to be associated with working in a rural area (Rabinowitz et al., 2008).

In 2008 when the data for this paper were collected, the availability of funding was determined by the location of current practice as defined by the Rural, Remote and Metropolitan Areas (RRMA) geographic classification that included seven categories ranging from capital cities to small remote areas. Commonwealth funding to support health services and training in rural areas, including those targeting GPs, included 35 separate programs, with funding delivered through a range of government agencies (Auditor General, 2008). This funding did not take account of a range of other schemes provided by state health departments and other agencies. For example, in addition to in-kind support from Divisions of General Practice, Rural Workforce Agencies, and Rural Clinical Schools, funding delivered directly to GPs included one-off infrastructure and training grants, relocation grants (removal expenses and travel), ongoing retention incentives for those already in rural areas, payments to overseas trained doctors, payments to GP Registrars, higher Medicare (fee-for-service) rebates for some GP items, and higher Practice Incentive Program payments according to geographic remoteness.

Since 2008, incentives schemes have been reviewed and consolidated (Department of Health and Ageing, 2008) using a new Australian Standard Geographic Classification – Remoteness Areas (ASGC-RA) system to determine eligibility for some schemes. The main changes for GPs introduced in 2010 were the consolidation of three previous programs into the revised General Practice Rural Incentives Program (GPRIP). The retention scheme for GPs and GP registrars still offer incentive payments that increase according to degree of remoteness, length of service in a rural area, and workload. These payments range between $2,500 and $47,000 per year and start once a GP has spent at least 6 months in an eligible area. The third scheme is a one-off relocation incentive grant, and is available to GP's moving to a more remote location than their current location. Payments up to a maximum of $120,000 (for a move from a capital city) are made in two instalments 12 months after they move. Additional rural incentives are available under the Practice Incentives Program (PIP) that provides a rural loading on total PIP payments of between 15% (large rural centres) and 50% (remote areas less than 5,000 population), depending on geographic remoteness. Medicare also offers some locum assistance for rural GPs. The cost of locum placement and travel costs are subsidized for any rural GP, and urban GPs undertaking emergency medicine training and providing locum placement are paid financial incentives (up to $6,000). The shortcomings and appropriateness of using this ASGC-RA scheme as the basis for resource allocation is currently subject to review by the Australian Senate in 2012.

Data

The discrete choice experiment (DCE) was included in Wave 1 (2008) of the Medicine in Australia: Balancing Employment and Life (MABEL) longitudinal survey of doctors. The survey was sent to the population of 54,750 doctors undertaking clinical practice in Australia, including 22,137 GPs. The overall response rate for MABEL was 19.3% (10,498/54,750). Respondents were broadly representative of the population in terms of age, gender, doctor type, geographic location, and hours worked. Detailed methods of the MABEL survey are provided elsewhere (Joyce et al., 2010).

Invitations to participate in MABEL were distributed by mail in early June 2008. This included a cover letter on university letterhead using personalised participant information and coloured ink, a paper copy of the survey questionnaire, printed in colour, an explanatory statement providing information about the study, in colour, and a reply-paid envelope. Doctors were given the choice of completing an online version through the secure study website, for which they received login details in the invitation letter (Yan et al., 2011). In the eight months prior to the mail-out, the study was publicised through direct contact with more than 100 medical organisations, medical training colleges and providers. Articles on MABEL were included in their newsletters and websites. Prior to mail out, MABEL was formally endorsed by over 31 major medical professional organisations including colleges, rural medical groups and medical educational agencies. These endorsements were indicated on the cover page of the questionnaire, the back of the invite letter, and the study website. Three reminder letters were posted at approximately 4-6 week intervals.

Pre-paid monetary incentives, not conditional on response, have been shown to double response rates (Edwards et al., 2009). Cost considerations precluded use of financial incentives for all participants, but we provided a AUD$100 cheque honorarium payment to 566 doctors (mostly GPs) in very small rural and remote communities (where absolute numbers are small) to maximise response rates for this group, in recognition of both the importance of this group from a policy perspective and the significant time pressures doctors in these regions are known to be under. The response rate for this group was 58.4%.

Development of questionnaire and piloting

The MABEL questionnaire for GPs (including the DCE) included questions relating to job satisfaction and attitudes to work, work setting, hours worked and workload, finances (including earnings and household income), their current geographic location, demographics and qualifications, and family circumstances.

The attributes and levels used in the DCE are shown in Table 1. The DCE was piloted face-to-face or over the phone with 11 GPs in rural and metropolitan locations, mainly in Victoria, to examine face and content validity. The wording of some attributes was refined during the pilot interviews. Two online pilot surveys were conducted on a random sample of doctors (n=100), followed by a third pilot sent to a random sample of 1,091 GPs.

Attributes were selected on the basis of previous literature on factors influencing GP job choice, including those sentinel factors influencing medical workforce recruitment and retention in non-metropolitan areas. The income attribute was presented as a percentage change to capture the wide range of earnings of part time and full time doctors (Scott, 2001). An attribute for hours worked is important as it reflects workload and the labour-leisure trade off, given the recent trend among medical doctors towards working fewer hours in Australia and other countries (Heiligers et al., 2000; Scott, 2005). Percentage changes were used and based on the ranges of average total hours worked per week (Australian Bureau of Statistics, 2002; Australian Institute of Health and Welfare, 2005).

We included an attribute for on-call arrangements since this has been shown to be a key issue for many GPs in terms of onerous working hours (Scott, 2001; Ubach et al., 2003). We used two dimensions: the on-call ratio and the frequency of call outs whilst on-call. The on-call ratio levels were modified following face-to-face pilots, to reflect the ranges that are plausible in different locations.

We included an attribute that specified the geographic location of the job. The characteristics of the town or city where a GP is located, and the lifestyle opportunities that are associated with those characteristics, are important for successful recruitment and retention (Hancock et al., 2009; Humphreys et al., 2002). We combined inland/coastal locations with population size, based on previous research (Humphreys et al., 2002). The distinction between coastal and inland was important given the geography of Australia - a small coastal town may have a better climate and more amenities, associated with that environment and generated through tourism, than an inland town, and this makes coastal towns considerably more attractive (Humphreys et al., 2002). Most cities and several large centres are located on the coast. Additionally, living near the beach has an intrinsic amenity value that we need to distinguish from an inland community, which is unlikely to have the same appeal. We defined a rural town as having a population of 5,000 – 20,000 to keep the group fairly homogeneous in terms of the amenities that are likely be found there. We decided that a population of 5,000 was an appropriate cut-off point for small rural and remote communities, which have the most difficulties in retaining and recruiting doctors. These decisions were based on our expert knowledge of geographical boundaries and typical town sizes in Australia.

Another important issue in choosing to practise in rural areas is the opportunities for professional and social interaction (Humphreys et al., 2002; Joyce et al., 2003; Kamien, 1998; Kurzydlo et al., 2005). In this study, however, only an attribute for social interaction was included, since professional interaction could be accomplished through mediums other than face-to-face, for example email and travel (Kurzydlo et al., 2005; Sweetman et al., 2007).

One issue that all GPs face, but which is exacerbated in rural areas, is the availability of locums so that GPs can take time off (Hays et al., 2003; Humphreys et al., 2002; Joyce et al., 2003; Kamien, 1998). We included an attribute about how easy it is to arrange a locum at short notice.

Support from the nature and mix of the primary health care team with whom the doctor would be working is also important in rural areas. We included an attribute that ranges from a minimum practice team (GP and receptionist), to an extended practice team (including a practice manager, nurses, and allied health professionals). Finally, consultation length was included as a proxy for workload intensity. The levels were based on data from the "Bettering the Evaluation and Care of Health" (BEACH) study and MBS item descriptors (Britt et al., 2004).

Modelling individual choice

In the random utility framework used in our analysis, individuals are presented with a number of alternatives and assumed to choose the alternative with the highest utility (Manski, 1977). The utility of physician *n* from choosing alternative *i* from choice set *j* is:

$$U_{nij} = \beta x_{nij} + \varepsilon_{nij} \qquad (1)$$

$$n = 1,\dots N;\ i = 1,\dots I;\ j = 1,\dots J.$$

where x_{nij} is a *k*-vector of observed attributes of alternative *i*, β is a vector of marginal utilities of the attributes, including the marginal utility of income, and ε_{nij} is i.i.d. extreme value. The model is estimated using the multinomial logit specification with *I* alternatives for each choice set *j* of GP *n*:

$$P(i|X_{nj}) = \frac{e^{(\beta x_{nij}+\varepsilon_{nij})}}{\sum_{i=1}^{I} e^{(\beta x_{nij}+\varepsilon_{nij})}}$$

An experimental design was used to organise the attributes (*x*) and their levels from Table 1 into hypothetical choice sets (*j*) (see example in Appendix A). In our experiment, there are eight attributes, four with three levels, and four with four levels, giving 3^4 x 4^4=20,736 possible scenarios. The statistical software package SAS was used to generate an efficient design using the criterion that minimizes the *D*-error of the coefficients:

$$D\text{-error} = |\Sigma|^{1/K}$$

where Σ is the covariance matrix in the logit model, and K the number of marginal utilities (β's)to be estimated (Carlsson et al., 2002). SAS uses a modified Fedorov candidate-set-search algorithm to find the design with the lowest *D*-error, which was specified to have 36 choice pairs, each with two alternatives, blocked into 4 sets of nine choice pairs. Since the efficiency of the design is derived from the β's of the logit model, and these are not known until the DCE data are collected, the "prior" β values need to be as close to the actual β's as possible. For the pilot survey, we set our 'prior' β values to zero since we did not have any better information at this point. We analysed the data collected from the first two pilot surveys using a multinomial logit model, which allowed us to obtain better (non-zero) β estimates. These were used to generate the design for the third pilot and, since no more changes were made to the number of attributes and levels after this point, subsequently also for the main wave. The most efficient design (among those generated) can be found by comparing *D*-errors and choosing the one with the lowest *D*-error. However, we also wanted to minimize the repetition of certain attribute combinations that respondents might find unrealistic (for example, a 1 in 10 on-call arrangement in small inland or coastal towns, as this was deemed "unlikely" to occur). Note that we were not able to avoid all these combinations nor did we want to since it was not impossible or implausible for these levels to occur together.

Choice context

Since GPs can choose a new job or stay where they are, it was important to include a status quo option 'stay at my current job', in addition to the two new unlabelled job options, 'Job A' and 'Job B'. We also included a 'forced choice' for comparison, where respondents were asked which of Job A and Job B was 'better', though this is not analysed in this paper. The inclusion of the status quo option may mean that information on trade-offs is lost if individuals prefer the status quo for all choices, but this is also more realistic in terms of generating policy-relevant results. However, since all our respondents are GPs active in clinical practice, the status quo can actually be defined for each respondent from other questions in the survey in terms of the attributes included in our DCE. Consequently, we circumvent information loss by constructing a status quo scenario for each respondent that varies across respondents.

In the econometric analysis, then, the status quo was included as a third alternative, and the attributes for the status quo option were constructed based on responses to other questions in the survey. For example, one question in the MABEL questionnaire (Q44) was "Arranging a locum at short notice is usually: (a) Moderately easy, (b) Rather difficult, (c) Very difficult, (d) Not Applicable". The levels (a to c) are worded exactly as they are in the DCE, and so the response to this question was used as the level for the attribute "locum" in the status quo. If the respondent chose "Not Applicable", we searched through responses to other questions to find out, for example, whether the respondent works in a large clinic where locums are not necessary and then assigned the most appropriate level (in this case "Moderately easy" since locums would not present a difficulty). As a result, each respondent had a unique status quo, which has two main implications. We are able to use these data in the analysis as a third alternative with appropriately defined attributes, rather than losing information with each response in which the status quo was chosen. However, constructing the status quo after collecting the data and designing the experiment affects the properties of the design and design efficiency.

Econometric Analysis

The dataset includes each alternative in each choice set as an observation, with each respondent completing up to nine choice sets giving a maximum of 3 x 9 = 27 observations per respondent. Categorical variables were effects coded (i.e. the reference category was coded as a set of -1's rather than 0's) to enable us to examine the extent of status quo bias by using alternative-specific constants (Bech et al., 2005).

The appropriate econometric model is a multinomial logit (MNL). However, the MNL model can be extended in several ways to account for different sources of heterogeneity across respondents. First, preference heterogeneity can be incorporated by allowing one or more of the parameters (β's) in the model to vary across respondents. This relaxes the restrictive assumptions of MNL, and allows for random taste variation. As a result, deviations around a mean are estimated, rather than a coefficient, and the resulting model is a mixed logit (MIXL) model:

$$\beta = \tilde{\beta} + \eta_n$$

$$U_{nij} = (\tilde{\beta} + \eta_n)x_{nij} + \varepsilon_{nij} \quad (2)$$

where $\tilde{\beta}$ is the vector of mean marginal utilities and η_n is the vector of person-specific deviations from the mean marginal utility. This means that there is an individual-specific estimate of the marginal utility of each attribute with a distribution specified by the researcher. Hole and Kolstad (2010) is the only study so far to model unobserved heterogeneity for physicians' job choices using a mixed logit model.

We extend MIXL with the Generalised Multinomial Logit Model (G-MNL) that accounts for the possibility that the preference heterogeneity in the random parameters may also reflect scale heterogeneity: that is the variance of the error terms varies across individuals (Fiebig et al., 2010). Variation in individual coefficients may therefore reflect not only variation in tastes but also differences in error variances (scale). This can be due to a number of factors. At one extreme this can be the result of lexicographic preferences, with little random error for an individual, and therefore high marginal utilities for some attributes (i.e. they are scaled up). At the other extreme, this can be due to randomness of behaviour where the idiosyncratic error term dominates. This is representative of individuals who are very unsure of their choices, or ones who make mistakes and errors because they do not understand the task, so marginal utilities are very low (i.e. they are scaled down). Both situations can be a result of task complexity, where individuals either adopt an heuristic approach (i.e. always choose the alternative with the lowest price) or exhibit random behaviour (Fiebig et al., 2010). Fiebig et al. (2010) argue that the G-MNL model is flexible enough to deal with data from these "extreme" respondents, therefore providing a much better fit to the data. The G-MNL model represents a GP's utility as:

$$U_{nij} = [\sigma_n\tilde{\beta} + \gamma\eta_n + (1-\gamma)\sigma_n\eta_n]x_{nij} + \varepsilon_{nij} \quad (3)$$

where σ_n is the scale (variance) of the error term which varies across individuals. This can influence the mean coefficient, $\tilde{\beta}$, and can also influence the individual-specific coefficients, η_n, depending on γ, a parameter between zero and 1 that is estimated by the model. If $\gamma = 0$, then $\beta_n = \sigma_n(\tilde{\beta} + \eta_n)$ and σ_n influences both $\tilde{\beta}$ and η_n by the same proportion (the G-MNL-II model). If $\gamma = 1$ then $\beta_n = \sigma_n\tilde{\beta} + \eta_n$ and σ_n only influences $\tilde{\beta}$ (the G-MNL-I model). In addition to nesting the G-MNL-I and G-MNL-II, the G-MNL model also nests MIXL and MNL and a scaled MNL model (S-MNL). σ_n is assumed to be log normal with mean 1 and standard deviation τ, or $ln(1, \tau^2)$, where τ is the parameter measuring scale heterogeneity and is estimated by the model: a higher value indicates higher scale heterogeneity. This parameter can be used to test whether scale heterogeneity exists. The preferred model is chosen on the basis of BIC. The models were estimated in LIMDEP version 5 using the GMXL command.

We use the results from our preferred model to calculate:

i) the probability of choosing a range of different rural alternatives,

ii) the size of the monetary incentive package required to compensate a GP who decides to move to a rural area: total willingness to pay (TWTP), and

iii) the size of the compensating differential for a change in the level of a single attribute: marginal willingness to pay (MWTP).

In order to quantify (i) and (ii), eight different hypothetical rural locations were constructed using different combinations of attribute levels. These include four scenarios based on the 'Inland town, population < 5,000' level and four based on the 'Town, population 5,000 – 20,000' level. We also construct the 'least attractive' rural location to provide an upper bound to our estimates of incentives.

The probabilities of choosing the status quo over one of the rural scenarios are calculated using simulation. In terms of the three alternatives (Job A, Job B, status quo), there is no reason to expect a difference in probability for A and B as they are unlabelled and their coefficients are similar. To ease interpretation, the predicted probabilities are simulated over two alternatives, the status quo and Job A. This is used to provide a ranking of the rural alternatives by the probability that they would be chosen, given their attributes.

There is debate in the literature as to how to calculate WTP and CV and their standard errors in random parameter models, due to the requirement to use ratios of random coefficient distributions, which often provides unrealistic estimates (Hole et al., 2010; Scarpa et al., 2008). One solution is to assume a log normal distribution for the income attribute, but this has been shown to produce unreliable estimates of the mean and standard deviation of WTP. Another solution, adopted in this paper, is to assume that the income coefficient is fixed and not random. Tractability in calculating WTP is therefore at the cost of assuming that doctors have the same preferences regarding income.

MWTP is interpreted as the compensating wage differential for a given attribute change. This represents the annual earnings given up (WTP) for moving from the least attractive to the next best level of a single attribute (or a unit change for continuous attributes), or equivalently, the annual earnings required to compensate a GP for moving from the most attractive to the next best level of an attribute. This is given by the ratio of the mean marginal utility of attribute k, to the marginal utility of income (λ) (coefficient of the earnings attribute):

$$MRS_{k\lambda} = \frac{MU_k}{MU_\lambda} = \frac{\beta_k}{\beta_\lambda}$$

This formula is modified because we effects coded our categorical attributes. When variables are effects coded, the reference (omitted) category is coded as a sequence of minus 1's rather than 0's (which is the standard dummy coding). Hence, the marginal utility of moving from the omitted level to another level of the attribute is no longer given by the regression coefficient (or the mean value for our random parameters). With effects coding, each coefficient is interpreted as the absolute level of utility for that attribute level, rather than for a marginal change as is usual with dummy variable coding. The coefficient for the reference (omitted) category can be easily recovered by multiplying the other effects coded coefficients by -1 and summing: $\beta_1 = \sum_{l=2}^{L} \beta_i(-1)$, where l = 1,..,L is the number of levels, and l = *1* is the reference category. The marginal utility from moving from one attribute level to another is then simply the difference between the two relevant coefficients. For attribute k with 3 levels (*l1* to *l3*), with level 1 as the omitted reference category, the marginal utility (MU) of moving from *l1* to *l3* is:

$$MU_{l3-l1} = \beta_{kl3} - (-\beta_{kl2} - \beta_{kl3})$$

And the MRS is then:

$$MRS_{k\lambda} = \frac{\beta_{kl3} - (-\beta_{kl2} - \beta_{kl3})}{\beta_{\lambda}}$$

Where $-\beta_{kl2} - \beta_{kl3}$ is the recovered coefficient of the omitted level 1 of that attribute.

Total willingness to pay is a measure of the monetary compensation (or WTP) if an individual GP chooses a rural option with certainty. This is the monetary value of a specific combination of attribute levels and provides an estimate of the amount of compensation required to move to an area with the specified combination of attribute levels to keep the GP at the same level of utility as in their current job. If a GP moves with certainty, then the monetary value of moving to a rural scenario is given by:

$$TWTP = \sum_{k} \frac{MU_k}{-\beta_{\lambda}} (X_k^0 - X_k^1)$$

Where MU_k is the marginal utility of attribute k (as defined above), β_λ is the marginal utility of income, X_k^0 is the vector of attributes describing scenario 0 (metropolitan area) and X_k^1 is the vector of attributes describing scenario 1 (one of the rural scenarios). This is the formula used in the health economics literature to calculate the total willingness to pay for a good or service. As pointed out by Lancsar and Savage (2004), this is not equal to the compensating variation (CV), i.e. the aggregate welfare gain or loss to the group of GPs from state of the world 1 compared to state of the world 0. However, it does have a meaning in our context as it provides an estimate of the compensation required to move the GP to the rural area while maintaining his or her utility, if a GP chooses this option with certainty. The TWTP is therefore an estimate of the monetary value for an individual GP who chooses to move, whilst the CV is the average monetary value of the move across all GPs, taking into account the probabilities of choosing to move or stay. TWTP can therefore be used as an estimate of the size of the financial incentive package required for the GP to move.

Since we use effects coded dummy variables, we calculate the TWTP of respondents to move from scenario *0* (metro location) to scenario 1 (each of the rural locations of scenarios A to H) as follows:

$$TWTP = \frac{1}{\beta_\lambda} \sum_k (MU_k\ X_k^1 - MU_k\ X_k^0)$$

This reduces to only the differences in coefficients, unless there is also a change in earnings (since all of our variables are categorical variables, and only the earnings variable is continuous). When there is a change in earnings, this is also taken into account using the percent change and earnings coefficient. Since our variables are effects coded, we can recover all coefficients to use in our TWTP calculation as explained earlier.

The metropolitan scenario used in the above calculation has the following attribute levels: no change in earnings or hours; 1-in-10 on-call ratio; city/large regional centre; very good social interactions; arranging a locum on short notice is moderately easy; the practice team includes a GP, receptionist and nurse; and the consultation length is 10 minutes. Comparing this scenario to each of the scenarios A to H involves using only those factors that differ between the metropolitan scenario and the other scenarios. The resulting TWTP is expressed in the percentage of annual earnings and is converted to a dollar amount by multiplying by the weighted average annual income for the respondents in 2008 inflated to 2011 prices using the annual inflation rate for medical services of 4% (AIHW, 2011).

Results

The response rate for GPs was 17.65% (3,873/22,137) with a 99.3% contact rate, and with 25.4% filling out the questionnaire online. The final numbers of GPs who completed at least part of the DCE was 3,727. These were broadly representative of all Australian GPs in terms of age, gender, geographic location, and hours worked (Joyce et al., 2010).

Table 2 shows the number of times each alternative was chosen (out of 3,727 x 9 choice sets = 33,543 choice sets across all respondents), and shows that the status quo was chosen 84.2% of the time. Sixty five percent (2,413) of GPs chose the status quo in all nine choice sets, and so preferred to stay at their current job. This suggests a significant status quo bias and that many GPs are unwilling to move regardless of the characteristics of the jobs presented to them.

Table 3 shows the descriptive statistics of the GPs. The average age is almost 50 years old and 46% are female. Seventy four percent qualified in Australia and 28% are international medical graduates. GPs spent an average of 3.4 years in a rural area before they left school. Mean annual income is $182,181 in 2011 prices. Sixty four percent currently work in a metropolitan area of Australia (as defined by the ASGC remoteness classification).

The results from the GMNL model are shown in Table 4. The model fits the data well, and is preferred to the standard mixed logit according to the BIC (results from the MIXL model are available on request). The statistically significant value of τ in the GMNL model suggests the presence of scale heterogeneity. The model was estimated using 500 Halton draws. Gamma was fixed at 1 and so a GMNL-I model was estimated with the scale heterogeneity influencing only the mean coefficient. When gamma was allowed to vary in the model with 500 draws, the model produced very large standard errors and so gamma was set to 1. In models with fewer than 500 draws gamma was estimated and was close to 1.

The strong preference for the status quo is shown by the large negative coefficients for the two constant terms. The signs and magnitude of the mean coefficients for the effects coded categorical variables in the table are interpreted by comparison to the reference category coefficients, which are calculated from the effects coded coefficients. For example, the utility for no change in hours worked is 0.499 = -(0.299 – 0.798), higher than 0.299 for a 10% decrease in hours, and higher than -0.798 for a 10% increase in hours. On average, GPs therefore prefer no change in hours as this has the highest utility. Also, a 1-in-10 on-call is the most preferred level of on call with utility of 0.957. The least preferred is a 1-in-2 on-call ratio with frequent call-outs. A 1-in-4 on-call ratio with infrequent call-outs is preferred to a 1-in-4 on-call with frequent call-outs, and to a 1-in-2 on-call ratio.

Cities/large regional centres have a utility of 0.221 and are preferred to small inland towns with < 5,000 population, and to large rural towns, though the latter is not statistically significant. Small coastal towns are preferred to cities/large regional centres with a population over 20,000. In addition to their natural environmental amenity, many coastal towns are tourist attractions, and so this is perhaps not very surprising. Very good social interactions and having easy access to locums were associated with higher utility. Very good social interactions (0.57) are preferred to the other levels, and ease of arranging a locum is preferred. A team with a GP, receptionist, nurse and manager was the most preferred, followed by a GP, receptionist and nurse. A full team with allied health had a lower utility (-0.131) and the least preferred option was a GP and receptionist only. The most preferred consultation length was 15 minutes, followed by 20 minutes. Consultation lengths greater than 20 minutes (-0.125) were preferred to a 10 minute visit. Most attributes also show statistically significant heterogeneity across respondents, suggesting that preferences vary across GPs.

Predicted probabilities are shown in Tables 5 and 6. Each Table shows a different set of rural location scenarios: Table 5 is for a small inland town with a population less than 5,000; Table 6 is for a town with a population between 5,000 and 20,000 people. For the scenarios within each location, the attribute levels for social interactions, locums, practice team, and consultation lengths are assumed to be the same across the scenarios. Within each location, the focus is on the impact of changes in earnings, hours worked and on-call, which vary across the scenarios.

The baseline probabilities of 0.919 for the status quo and 0.081 for the alternative Job A represent the predicted average choice probabilities at the mean of each attribute (Tables 5 and 6). These reflect the high probability of GPs choosing the status quo. Comparing the probabilities between inland towns (Table 5) and towns (Table 6), shows that inland town scenarios are less likely to be chosen (Table 5) compared to towns (Table 6). Moving across scenarios within each location increases the predicted probability of choosing each scenario relative to the previous one, which reflects improvements in utility. With respect to the on-call ratio, this is unambiguous: the on-call ratio for the first two scenarios within each location is 1-in-4, frequently called out, and decreases to 1-in-10 for the last two scenarios within each location. Utility is increasing across these scenarios, so, all things equal, a lower on-call ratio is preferred. This is shown by, for example, comparing the predicted probability of choosing scenario C (0.134) to the predicted probability of choosing scenario A (0.089). Alternating changes in earnings and hours across the scenarios shows that a 15% increase in earnings generates more utility than a 10% decrease in hours (shown by, for example, comparing the predicted probability of scenario A (0.089) to that of scenario B (0.117)).

Table 7 shows the marginal willingness-to-pay (the marginal rates of substitution) for each attribute in percentage terms and in dollar amounts. . A negative MWTP implies that respondents would need to be compensated the relevant amount to move from the base level of the attribute to the current level. The largest value is for a change in on-call from 1-in-10 to 1-in-2. Respondents would need to be paid $72,818 for such a change, around 40% of their annual earnings. This seems more important than a 10% increase in hours worked, a move to a small inland town, or very limited social interactions. If hours worked increased by 10% GPs would require an increase in annual earnings of 25.6% or $46,696. Given average hours worked of 34 hours per week in the sample (including part time GPs), the marginal value of an extra hour increase (equal to 2.9% of average hours) would require an hourly wage of $286, assuming 48 weeks worked per year. There is a negative MWTP for a 10% decrease in hours (-$7,191), which is significant at the 5% level, and reflects our earlier finding that GPs prefer their current level of hours worked. Though this is at first counterintuitive, it may suggest that GPs are, on average, currently working at their optimal hours and so prefer no change in hours.

Tables 8 and 9 show the total willingness-to-pay (TWTP) values for each scenario relative to the metropolitan scenario. The monetary values in Tables 8 and 9 can be interpreted as the size of the financial incentive (compensation) required to keep a GP at the same level of utility as in the metropolitan scenario.

TWTP values are negative for all rural inland scenarios (Table 8), reflecting the fact that this location is the least preferred. TWTP ranges in value between -$115,745 (scenario A) and -$32,032 (scenario D), and increases from A to D, in line with the predicted probabilities, which show that respondents prefer a lower on-call ratio to a higher on-call ratio, and an increase in earnings to a decrease in hours. Large decreases in the negative TWTP occur when the on-call ratio decreases, all other things equal.

The first three scenarios for the town location (Table 9) also have a negative TWTP, while the last scenario has a positive TWTP, indicating that respondents are willing to move to a town when the on-call ratio is low and the other attribute levels are favourable, and when the move is coupled with an increase in earnings (scenario H, TWTP = $15,728). They are not willing to move when, instead of an increase in earnings, the move is coupled with a decrease in hours (scenario G, TWTP = -$18,791).

We also calculated the TWTP for the ‘least attractive’ rural scenario compared to the metro scenario. This ‘least attractive’ rural scenario was defined by setting each attribute to its least preferred level (10% increase in hours, 1-in-2 on-call, rural inland, very limited social interactions, very difficult to get locum cover, GP and receptionist only, and a 10 minute consultation length). This was found to have a TWTP of $237,002, or 130% of average annual earnings and provides an upper bound on the minimum size of the financial incentive required if these attributes could not be changed.

Discussion

The paucity of evidence on the costs and effect of policies to encourage doctors to work in remote and rural areas is cause for concern. In the absence of any well-designed studies, we conducted a discrete choice experiment among 3,727 general practitioners in Australia to provide a better understanding of GPs’ preferences for different job attributes and locations. Respondents were given nine choice sets in each of which they had to choose between two hypothetical jobs or staying at their current job (the status quo). 65% of GPs chose their current job for all nine choices and the status quo option was chosen 84% of the time. We calculated predicted probabilities based on the experiment, and these show that 92% of GPs would choose the status quo, and only 8% would choose to work in a rural area. Our results therefore show a strong preference for staying in their current job. This may be because most GPs simply do not want to move, regardless of what other jobs are presented to them. In short, many other factors relating to the GP's family and life may be more important than just the characteristics of the job.

The predicted probabilities of choosing to work in an inland town with a population less than 5,000 were smaller (range 0.089 to 0.176) than for choosing a town with a population between 5,000 and 20,000 (range between 0.138 and 0.225). Total willingness to pay was used as an estimate of the minimum compensation GPs would require to work in a rural area relative to a metropolitan area, and not be worse off. This showed that the compensation depends on the characteristics of the job in the rural area, and how trade-offs are made. For the 'least attractive' rural job according to our attributes, we estimate that a minimum of $237,002 additional annual earnings would be required to pay the average GP. For rural jobs that have 'better' levels of other attributes, the payments required would be smaller. For an inland town with a population less than 5,000, this ranged from $32,032 to $115,745 (or between 17.6% to 63.5% of GPs annual earnings). Given that rural towns with a larger population were more preferred, the size of incentives needed was smaller. For one of these scenarios, GPs preferred the rural to the metropolitan area and would be willing to forgo $15,728 to work there. But for the other three scenarios, the size of incentives ranged from $18,791 to $67,984, or between 10.3% and 37.3% of annual earnings.

The range of the size of the above incentives is large because they depend on the specific attributes of the rural scenario. If on-call is low and hours worked do not change, the job becomes more attractive and the compensation required is less. This may not be helpful to policy makers who design policies for the 'average GP' and the 'average' rural area; making payments dependent on the characteristics of the destination practice may be administratively cumbersome. However, making these incentives depend, more generally, on the type of area and population size (e.g. an inland town with less than 5,000 population) could be feasible and has been suggested in other work (Humphreys et al., 2012).

A previous study using the same MABEL data from 2008 on the determinants of doctors' earnings found that GPs in outer regional and rural areas earned 11% more than GPs in metropolitan areas, representing just over $18,000 on average (Cheng et al., 2011). This adjusts for a range of other factors that influence earnings including many factors in the DCE, such as social interactions, hours worked, on call, and practice size. The figure of $18,000 is therefore within the range of the marginal willingness to pay for working in rural areas that we estimated in Table 7 to be between $14,374 for a town with a population between 5,000 and 20,000, and $29,368 for an inland town with a population of less than 5,000 people,. This provides some validity for our estimates from the DCE, and suggests that the value attached by GPs to working in a rural area from the DCE is similar to what they are actually compensated, after adjusting for other factors.

A strength of the findings is that the size of incentives required to persuade GPs to work in rural areas is based on GPs own preferences and trade-offs amongst factors important in deciding to move into a rural area. In terms of the predicted probabilities, there are no revealed preference data available on the actual proportions of GPs moving into rural areas and so it is not possible to calibrate our results using actual market shares. One may think that our estimates of the predicted probabilities are too high, given the low mobility of GPs and ongoing difficulties in recruitment into rural areas. Our results may not fully account for the transaction costs of moving, particularly for principals who own their own business, though these may partly be accounted for with the inclusion of a status quo option in the choices and reflected by the large alternative-specific constant terms in the models. These may pick up other unobserved characteristics that influence choices.

It would also be useful to examine how preferences, and the size of incentives, vary according to observable GP characteristics, such as whether the GP is currently in a metropolitan area, whether the GP is female, their family circumstances, and whether they are an IMG. However, given the large proportion of GPs choosing the status quo, the inclusion of interaction terms led to unstable and implausible model results due to small cell sizes, and so these models are not presented.

The policy implications of this research will depend on how our estimates of the size of incentives compare with the size of incentives actually received by GPs in areas and jobs with varying characteristics. There are few publically available data on the size of such incentives for the average GP. The only available information is from the website that describes the incentives, which suggests that GPs locating to a rural area for the first time can earn up to $120,000 from the incentive payments available in 2012 (www.doctorconnect.gov.au). This excludes the rural loadings applied in the Practice Incentive Program (PIP). Government incentives schemes deliver revenue to both GPs and practices, with only a proportion of such revenue being taken as personal earnings. This could help explain why the size of the incentives from the DCE may seem relatively small compared to anecdotal evidence from job advertisements that suggest $500,000 plus a range of benefits, such as housing, are being offered. We used an estimate of the average personal earnings (before tax) of GPs, which will be lower than the total revenue GPs receive from their business, which includes practice costs. Most incentive payments are advertised as the revenue paid to a practice or GP, and so are gross payments from which practice costs/expenses need to be deducted. It is perhaps more useful to focus on the percentage of annual earnings, rather than the absolute dollar figures. In terms of interpreting our results, the percentage figures would seem more useful as they can then be applied to estimates of total revenue, though there are no reliable national estimates of this in Australia. This also raises the issue of the purpose of government incentive polices. First, are monies paid to practices to make them financially viable in recognition of the higher than average practice costs that result from rural location and low fee-for-service volume? Because the rural loadings in the Practice Incentive Program are paid to practices, they may be viewed as subsidies for the higher costs of running a practice. Secondly, are payments made to GPs to compensate them for the attributes of the job and environment in rural areas that would otherwise lead to lower utility and influence their decision not to move? Our study has focussed on the latter.

The rigorous methodology underpinning our study provides the first attempt to show how financial incentives and compensation might be calculated, and by which the potential effectiveness of different incentives for the recruitment of rural GPs can be evaluated. Though some of our attributes are not amenable to change, this study provides evidence of the level of compensation required to ‘shift’ current GPs into rural locations that are perceived by some doctors to be less desirable than their existing (invariably metropolitan) locations. Our study also provides measures of the relative importance of key recruitment attributes, and has, for instance, highlighted the strong preference of GPs to minimise their on-call load.

It should be recognised that the issue of recruitment and retention of GPs in rural areas is complex. There is no suggestion here that financial incentives alone will resolve the problem of a rural undersupply. On the contrary, recent research has shown that appropriately supported practices not only provide high levels of professional satisfaction in rural areas (McGrail et al., 2010), but also lessen the importance of the workforce ‘problem’ (Humphreys et al., 2008). What this study demonstrates is that rigorous research can deliver the evidence necessary for policy-makers to formulate incentive programs that are more likely to accord with the requirements of rural practice, and which can act as benchmarks against which they can evaluate their effectiveness in addressing the problem of recruitment of practitioners to ‘difficult-to-service’ rural and remote communities.

Table 1: Attributes and Levels

Attribute	Levels
Earnings	15% increase No change 15% decrease
Hours worked	10% decrease No change 10% increase
On-call arrangements	1 in 10, frequently called out 1 in 4, infrequently called out 1 in 4, frequently called out 1 in 2, frequently called out
Location	City or large regional centre, population > 20,000 Town, population 5,000 – 20,000 Coastal town, population < 5,000 Inland town, population < 5,000
Opportunities for social interactions	Very limited Average Very good
Arranging a locum on short notice is	Moderately easy Rather difficult Very difficult
Practice team	GPs and receptionist GPs, receptionist and nurse GPs, receptionist, nurse and practice manager GPs, receptionist, nurse, practice manager and allied health
Average consultation length	10 minutes 15 minutes 20 minutes > 20 minutes

Table 2: Choice frequencies

Choice	Frequency	Percent
No response	1,493	4.5
Prefer Job A	1,864	5.6
Prefer Job B	1,947	5.8
Stay at current job	28,239	84.2
Total	33,543	

Table 3: Descriptive characteristics of GPs

	mean	sd	min	max	n
Age	49.72	10.78	26	89	3706
Female (=1)	0.46	0.50	0	1	3726
Australian medical school	0.74	0.44	0	1	3727
Years in rural area when young	3.41	6.10	0	18	3412
Annual gross income (2008 prices)	\$162,661	\$111,420	\$1,100	\$1.3m	2964
ASGC remoteness classification:					
Metropolitan	0.640				2,382
Inner regional	0.208				773
Outer regional	0.096				356
Remote	0.037				139
Very remote	0.013				50

Table 4: Regression results

Attribute	Level	GMNL	
		Mean	SD
Earnings		0.051**	-
Hours (no change)	10% decrease	0.299**	0.585**
	10% increase	-0.798**	0.729**
On-Call (1 in 10, frequently)	1 in 2	-1.065**	0.720**
	1 in 4, frequently	-0.409*	0.675**
	1 in 4, infrequently	0.518**	0.500**
Location (City/large regional centre > 20,000)	Inland, < 5,000	-0.439***	0.615**
	Coastal, < 5,000	0.243*	0.722**
	Town, 5,000-20,000	-0.024	0.467**
Social Interactions (Very good)	Very limited	-0.741**	0.510**
	Average	0.171**	0.056
Arranging a locum at short notice (Moderately easy)	Very difficult	-0.306**	0.660**
	Rather difficult	-0.305**	0.528**
Practice Team (GPs, receptionist, nurse, manager and allied health)	GP & receptionist	-0.409**	0.363**
	GP, rec. & nurse	0.167**	0.098**
	GP, rec., nurse & manager	0.373**	0.612**
Consultation Length (> 20 min.)	10 min.	-0.367**	0.489**
	15 min.	0.319**	0.590**
	20 min.	0.173*	0.353**
Constant (Job A)		-3.106***	
Constant (Job B)		-3.400***	
N observations		89,706	
N individuals		3,727	
Log-likelihood		-9542	
Tau		0.691**	
Gamma		1	
Chi-squared (df)		46,618 (41)**	
AIC		19,166	
BIC		19,506	

Notes: **=p>0.0001; *=0.05<p<0.0001

Table 5: Predicted probabilities for 'inland town' scenarios

Rural Inland	Scenario A	Scenario B	Scenario C	Scenario D
Location	Inland town <5000	Inland town <5000	Inland town <5000	Inland town <5000
Earnings	No change	15% increase	No change	15% increase
Hours	10% decrease	No change	10% decrease	No change
On-call	1:4 frequently	1:4 frequently	1:10 frequently	1:10 frequently
Social interaction	Very limited	Very limited	Very limited	Very limited
Locums	Moderately easy	Moderately easy	Moderately easy	Moderately easy
Practice team	Full team	Full team	Full team	Full team
Consultation	15 minutes	15 minutes	15 minutes	15 minutes
Predicted Probabilities:				
Status Quo (0.919)	0.911	0.883	0.866	0.824
Job A (0.081)	0.089	0.117	0.134	0.176

Table 6: Predicted probabilities for 'Town' scenarios

Town	Scenario E	Scenario F	Scenario G	Scenario H
Location	Town 5,000-20,000	Town 5,000-20,000	Town 5,000-20,000	Town 5,000-20,000
Earnings	No change	15% increase	No change	15% increase
Hours	10% decrease	No change	10% decrease	No change
On-call	1:4 frequently	1:4 frequently	1:10 frequently	1:10 frequently
Social interaction	Average	Average	Average	Average
Locums	Moderately easy	Moderately easy	Moderately easy	Moderately easy
Practice team	Full team	Full team	Full team	Full team
Consultation	15 minutes	15 minutes	15 minutes	15 minutes
Predicted Probabilities:				
Status Quo (0.919)	0.862	0.817	0.790	0.725
Job A (0.089)	0.138	0.183	0.210	0.225

Table 7: Marginal willingness to pay

		Percent of annual income			Amount of annual income in 2011 prices		
		MWTP (%)	L 95% CI	U 95% CI	MWTP ($)	L 95% CI	U 95% CI
Hours (no change)	10% decrease	-3.9	-7.6	-0.3	-7191	-13895	-488
	10% increase	-25.6	-30.0	-21.3	-46696	-54654	-38738
On-Call (1 in 10, frequently)	1 in 2	-40.0	-44.3	-35.7	-72818	-80667	-64969
	1 in 4, frequently	-27.0	-30.9	-23.1	-49191	-56236	-42147
	1 in 4, infrequently	-8.7	-11.8	-5.5	-15791	-21496	-10086
Location (City/large regional centre > 20,000)	Inland, < 5,000	-13.0	-16.1	-10.0	-23748	-29368	-18127
	Coastal, < 5,000	0.4	-2.9	3.8	792	-5260	6843
	Town, 5,000-20,000	-4.8	-7.9	-1.8	-8822	-14374	-3271
Social Interactions (Very good)	Very limited	-25.9	-29.2	-22.7	-47228	-53120	-41335
	Average	-7.9	-10.2	-5.6	-14395	-18597	-10192
Arranging a locum at short notice (Moderately easy)	Very difficult	-18.1	-21.2	-15.1	-33055	-38581	-27528
	Rather difficult	-18.1	-21.4	-14.8	-32995	-39073	-26916
Practice Team (GPs, receptionist, nurse, manager and allied health)	GP & receptionist	-12.1	-15.1	-9.2	-22095	-27462	-16727
	GP, rec. & nurse	-7.4	-11.0	-3.8	-13448	-19997	-6900
	GP, rec., nurse & manager	3.3	0.5	6.1	6042	987	11097
Consultation Length (> 20 min.)	10 min.	-5.2	-8.6	-1.8	-9387	-15580	-3194
	15 min.	8.6	4.9	12.3	15680	8998	22362
	20 min.	5.7	2.3	9.1	10401	4135	16667

Table 8: Total willingness to pay for 'inland town' scenarios

Town	Scenario A	Scenario B	Scenario C	Scenario D
Location	Inland town <5000	Inland town <5000	Inland town <5000	Inland town <5000
Earnings	No change	15% increase	No change	15% increase
Hours	10% decrease	No change	10% decrease	No change
On-call	1:4 frequently	1:4 frequently	1:10 frequently	1:10 frequently
Social interaction	Very limited	Very limited	Very limited	Very limited
Locums	Moderately easy	Moderately easy	Moderately easy	Moderately easy
Practice team	Full team	Full team	Full team	Full team
Consultation	15 minutes	15 minutes	15 minutes	15 minutes
TWTP:				
TWTP (% annual earnings)	*-63.5*	*-44.6*	*-36.5*	*-17.6*
TWTP ($)	*-$115,745*	*-$81,225*	*-$66,551*	*-$32,032*

Table 9: Total willingness to pay for 'Town' scenarios

Town	Scenario E	Scenario F	Scenario G	Scenario H
Location	Town 5,000-20,000	Town 5,000-20,000	Town 5,000-20,000	Town 5,000-20,000
Earnings	No change	15% increase	No change	15% increase
Hours	10% decrease	No change	10% decrease	No change
On-call	1:4 frequently	1:4 frequently	1:10 frequently	1:10 frequently
Social interaction	Average	Average	Average	Average
Locums	Moderately easy	Moderately easy	Moderately easy	Moderately easy
Practice team	Full team	Full team	Full team	Full team
Consultation	15 minutes	15 minutes	15 minutes	15 minutes
TWTP:				
TWTP (% annual earnings)	*-37.3*	*-18.4*	*-10.3*	*8.6*
TWTP ($)	*-$67,984*	*-$33,465*	*-$18,791*	*$15,728*

Appendix A: Choice context

Please read the following:

- You are asked to state which of two jobs (A or B) is better.
- You are then asked which job you would choose, including the option of staying in your current job.
- Everything about the jobs you are comparing is the same, except for the characteristics shown below.

Please use the following table to answer questions 5 and 6:

	Job A	Job B
Change in earnings	15% increase	No change
Change in total hours worked	No change	10% increase
On-call arrangements	1 in 4, frequently called out	1 in 2, frequently called out
Location	Coastal town, population < 5,000	City or large regional centre, population > 20,000
Social interactions	Very limited	Very good
Arranging a locum on short notice is	Rather difficult	Moderately easy
The practice team includes	GPs, receptionist and nurse	GPs, receptionist, nurse and practice manager
Average consultation length	15 minutes	> 20 minutes

5. Which job do you think is better? Job A ☐ Job B ☐

6. Which job would you choose? Job A ☐ Job B ☐ Stay at my current job ☐

References

AIHW. (2011). Health expenditure Australia 2009-10 Health and welfare expenditure series no. 46. Cat. no. HWE 55. Canberra: Australian Institute of Health and Welfare.

Auditor General. (2008). Rural and remote health workforce capacity- the contribution made by programs administered by the Department of Health and Ageing. Audit Report No.26 2008–09. Canberra: Australian National Audit Office.

Australian Bureau of Statistics. (2002). Private Medical Practitioners. Report No. 8689.0. Canberra: Australian Bureau of Statistics.

Australian Institute of Health and Welfare. (1998). Health in rural and remote Australia. Canberra: Australian Institute of Health and Welfare.

Australian Institute of Health and Welfare. (2005). Medical Labour Force 2003. Cat No. HWL 42. Canberra: Australian Institute of Health and Welfare.

Australian Institute of Health and Welfare. (2012). Medical labour force 2010. National health workforce Series no. 1. Cat. no. HWL 47. Canberra: Australian Institute of Health and Welfare.

Barnighausen, T., & Bloom, D. (2009). Financial incentives for return of service in underserved areas: a systematic review. *BMC health services research,* 9, 86-86.

Bech, M., & Gyrd-Hansen, D. (2005). Effects coding in discrete choice experiments. *Health Economics,* 14, 1079-1083.

Britt, H., Valenti, L., Miller, G., & Farmer, J. (2004). Determinants of GP billing in Australia: content and time. *Medical Journal of Australia,* 181, 100 - 104.

Buykx, P., Humphreys, J., Wakerman, J., & Pashen, D. (2010). Systematic review of effective retention incentives for health workers in rural and remote areas: towards evidence-based policy. *The Australian Journal Of Rural Health,* 18, 102-109.

Carlsson, F., & Martinsson, P. (2002). Design techniques for stated preference methods in health economics. *Health Economics,* 12, 281 - 294.

Charles, J., Britt, H., & Valenti, L. (2004). The evolution of the general practice workforce in Australia, 1991-2003. *Medical Journal of Australia,* 181.

Cheng, T.C., Scott, A., Jeon, S.-H., Kalb, G., Humphreys, J., & Joyce, C. (2011). What factors influence the earnings of general practitioners and specialists? Evidence from the Medicine in Australia: Balancing Employment and Life survey. *Health Economics*, n/a-n/a.

Chomitz, K., Setiadi, G., Azwar, A., Ismail, M., & Widiyarti. (1998). What do doctors want? Developing Incentives for Doctors to Serve in Indonesia's Rural and Remote Areas. World Bank Policy Research Working Paper #1888. Washingtion DC: World Bank.

Department of Health and Ageing. (2008). Report on the Audit of Health Workforce in Rural and Regional Australia In D.o.H.a. Ageing (Ed.). Canberra: Australian Government Commonwealth of Australia.

Edwards, P., Roberts, I., Clarke, M., DiGuiseppi, C., Wentz, R., Kwan, I., et al. (2009). Methods to increase response to postal and electronic questionnaires. Cochrane Database of Systematic Reviews.

Fiebig, D.G., Keane, M.P., Louviere, J., & Wasi, N. (2010). The Generalized Multinomial Logit Model: Accounting for Scale and Coefficient Heterogeneity. *MARKETING SCIENCE,* 29, 393-421.

Gosden, T., Bowler, I., & Sutton, M. (2000). How do general practitioners choose their practice? Preferences for practice and job characteristics. *Journal of Health Services Research and Policy,* 5, 208 - 213.

Grobler, L., Marais, B., Mabunda, S., Marindi, P., Reuter, H., & Volmink, J. (2009). Interventions for increasingthe proportion of health professionals practising in rural and other underserved areas. Cochrane Database of Systematic Reviews.

Hancock, C., Steinbach, A., Nesbitt, T.S., Adler, S.R., & Auerswald, C.L. (2009). Why doctors choose small towns: A developmental model of rural physician recruitment and retention. *Social Science & Medicine,* 69, 1368-1376.

Hanson, K., & Jack, W. (2010). Incentives Could Induce Ethiopian Doctors And Nurses To Work In Rural Settings. *Health Affairs,* 29, 1452-1460.

Hays, R., Wynd, S., Veitch, C., & Crossland, L. (2003). Getting the Balance Right? GPs Who Chose to Stay in Rural Practice. *Australian Journal of Rural Health,* 11.

Heiligers, P., & Hingstman, L. (2000). Career preferences and the work-family balance in medicine: gender differences among medical specialists. *Social Science and Medicine,* 50.

Hole, A., & Kolstad, J. (2010). Mixed logit estimation of willingness to pay distributions: a comparison of models in preference and WTP space using data from a health-relatedn choice experiment. Working Paper 03/10. Bergen: Department of Economics, University of Bergen.

Humphreys, Jones, J., Jones, M., Hugo, G., Bamford, E., & Taylor, D. (2001). A critical review of rural medical workforce retention in Australia. *Australian Health Review,* 24, 91-102.

Humphreys, Jones, M., Jones, J., & Mara, P. (2002). Workforce retention in rural and remote Australia: determining the factors that influence length of practice. *Medical Journal of Australia,* 173, 472 - 476.

Humphreys, McGrail, M.R., Joyce, C.M., Scott, A., & Kalb, G. (2012). Who should receive recruitment and retention incentives? Improved targeting of rural doctors using medical workforce data. *Australian Journal of Rural Health,* 20, 3-10.

Humphreys, Wakerman, J., Wells R, Kuipers, P., Entwhistle, P., & Jones, M. (2008). Beyond workforce: a systematric solution for primary health service provision in small rural and remote communities. *Medical Journal of Australia,* 188, S77-S80.

Joyce, Scott, A., Jeon, S.-H., Humphreys, J., Kalb, G., Witt, J., et al. (2010). The "Medicine in Australia: Balancing Employment and Life (MABEL)" longitudinal survey - Protocol and baseline data for a prospective cohort study of Australian doctors' workforce participation. *BMC Health Services Research,* 10, 50.

Joyce, Veitch, C., & Crossland, L. (2003). Professional and Social Support Networks of Rural General Practitioners. *Australian Journal of Rural Health,* 11.

Kamien, M. (1998). Staying in or leaving rural practice: 1996 outcomes of rural doctors' 1986 intentions. *Medical Journal of Australia,* 169, 293 - 294.

Kolstad, J.R. (2011). How to make rural jobs more attractive to health workers. Findings from a discrete choice experiment in Tanzania. *Health Economics,* 20, 196-211.

Kurzydlo, A., Casson, C., & Shumack, S. (2005). Reducing professional isolation: Support Scheme for Rural Specialists. *Australasian Journal of Dermatology,* 46, 242 - 245.

Lagarde, M., & Blaauw, D. (2009). A review of the application and contribution of discrete choice experiments to inform human resources policy interventions. *Human Resources for Health,* 7, 62.
Lawn, J.E., Rohde, J., Rifkin, S., Were, M., Paul, V.K., & Chopra, M. (2008). Alma-Ata 30 years on: revolutionary, relevant, and time to revitalise. *Lancet,* 372, 917-927.
Manski, C. (1977). The structure of random utility models. *Theory and Decision,* 8, 229-254.
McGrail, M., Humphreys, J., Scott, A., Joyce, C., & Kalb, G. (2010). Professional satisfaction in general practice: does it vary by size of community? *Medical Journal of Australia,* 193, 94-98.
Rabinowitz, H., Diamond, J., Markham, F., & Wortman, J. (2008). Medical School Programs to Increase the Rural Physician Supply: A Systematic Review and Projected Impact of Widespread Replication. *Academic Medicine,* 83, 235-243.
Scarpa, R., Thiene, M., & Train, K. (2008). Utility in Willingness to Pay Space: A Tool to Address Confounding Random Scale Effects in Destination Choice to the Alps. *American Journal of Agricultural Economics,* 90, 994-1010.
Scott (2001). Eliciting GPs' preferences for pecuniary and non-pecuniary job characteristics. *Journal of Health Economics,* 20, 329-347.
Scott. (2005). Physician productivity in Australia. The 'flat of the curve' and beyond? 9th International Medical Workforce Collaborative Conference. Melbourne.
Smith, K., Humphreys, J., & Wilson, M. (2008). Addressing the health disadvantage of rural populations: How does epidemiological evidence inform rural health policies and research? *Australian Journal of Rural Health,* 16, 56-66.
Starfield, B., Shi, L., & Macinko, J. (2005). Contribution of primary care to health systems and health. *Milbank Quarterly,* 83, 457-502.
Sweetman, G., & Brazil, V. (2007). Education links between the Australian rural and tertiary emergency departments: Videoconference can support a virtual learning community. *Emergency Medicine Australasia,* 19, 176 - 177.
Ubach, C., Scott, A., French, F., Awramenko, M., & Needham, G. (2003). What do hospital consultants value about their jobs? A discrete choice experiment. *British Medical Journal,* 326, 1432.
Wordsworth, S., Skåtun, D., Scott, A., & French, F. (2004). Preferences for general practice jobs: a survey of principals and sessional GPs. *British Journal of General Practice,* 54, 740-746.
Yan, W., Cheng, T., Scott, A., Joyce, C., Humphreys, J., & Kalb, G. (2011). Data Survey. Medicine in Australia: Balancing Employment and Life. *Australian Economic Review,* 44, 102-112.