

Title:

Who should receive recruitment and retention incentives? Improved targeting of rural doctors using medical workforce data

Authors: John S Humphreys¹, Matthew R McGrail², Catherine M Joyce³, Anthony Scott⁴, Guyonne Kalb⁴

¹Centre of Research Excellence in Rural and Remote Primary Health Care and School of Rural Health, Monash University, PO Box 666, Bendigo, VIC, 3552

²Centre of Research Excellence in Rural and Remote Primary Health Care and School of Rural Health, Monash University, Gippsland Medical School Northways Rd, Churchill, VIC, 3842

³Department of Epidemiology & Preventive Medicine, Monash University, 6th Floor, The Alfred Centre, 99 Commercial Road, Melbourne, VIC, 3004

⁴Melbourne Institute of Applied Economic and Social Research, The University of Melbourne, Level 6, Alan Gilbert Building, 161 Barry Street, The University of Melbourne, VIC, 3010

Corresponding Author:

Prof John S Humphreys,
Monash University, School of Rural Health
PO Box 666, Bendigo, VIC, 3552
Ph: 03 5440 9081
Fax: 03 5440 9080
Email: john.humphreys@monash.edu

Author contributions:

JH 35%, MM 35%, CJ 10%, AS 10%, GK 10%

Short Title:

Improved targeting of rural incentives

Title:

Who should receive recruitment and retention incentives? Improved targeting of rural doctors using medical workforce data

Abstract:

Objective: To define an improved classification for allocating incentives to support the recruitment and retention of doctors in rural Australia.

Design and setting: Geo-coded data (N=3636 GPs) from the national *Medicine in Australia: Balancing Employment and Life* (MABEL) study were used to examine variation in four professional indicators (total hours worked, public hospital work, on call after-hours, and difficulty taking time off) and two non-professional indicators (partner employment and schooling opportunities) known to be related to difficulties with recruitment and retention.

Main outcome measures: Association of six sentinel indicators for GPs with practice location and population size of community

Results: Four distinct homogeneous population size groups were identified (0-5000, 5001-15,000, 15,001-50,000 and >50,000). Although geographical remoteness (measured using Australian Standard Geographical Classification – Remoteness Areas (ASGC-RA) was statistically associated with all six indicators ($p < 0.001$), population size provided a more sensitive measure in directing where recruitment and retention incentives should be provided. A new 6-level rurality classification is proposed, based on a combination of four population size groups and the five ASGC-RA levels. A significant increase in statistical association is measured in four of six indicators (and a slight increase in one indicator) using the new 6-level classification versus the existing ASGC-RA classification.

Conclusions: This new 6-level geographical classification provides a better basis for equitable resource allocation of recruitment and retention incentives to doctors based on the attractiveness of non-metropolitan communities, both professionally and non-professionally, as places to work and live.

Keywords:

Rurality, Geographical classifications, ASGC-Remoteness Area, Resource allocation, Equity

What is already known on this subject?

- Specific rural health workforce programs are required to ensure an adequate supply and appropriate distribution of health workers and services to rural and remote communities.
- Given limited resources, effective targeting of these specific programs requires geographical classifications that are sensitive to small-area differences.
- Current classifications, particularly the ASGC-RA classification, have significant shortcomings in relation to resource allocation because they fail to maximise between-group differences and they fail to minimise within-group differences.

What does this study add?

- Using medical data for six sentinel professional and non-professional indicators, geographical differences of attractiveness between rural and remote communities as places to work and live have been measured and validated.
- Evidence that a classification based predominantly on town size rather than location (remoteness) is significantly more sensitive to small-area geographical differences relevant to workforce supply.
- A proposed new 6-level geographical classification provides a more equitable basis for the allocation of recruitment and retention incentives targeting rural and remote doctors.

Introduction

Globally, people living in rural and remote areas experience poorer health outcomes than their metropolitan counterparts, with residents continuing to face difficulties in accessing medical care largely due to an acute shortage of medical practitioners¹⁻³. In order to address the recruitment and retention problems that contribute to the medical workforce in rural areas, governments around the world have implemented a range of incentives⁴⁻⁷. Unfortunately there is little evidence of the effectiveness of incentives in improving workforce supply in rural areas⁸.

Much is known about the factors that contribute to difficulties associated with recruitment and retention of rural doctors (including practice complexity, workload, on-call and non-professional factors relating to social and family circumstances) and the need to strategically 'bundle' recruitment and retention incentives ^{7,9-15}. To be effective, medical workforce incentives must address these factors.

Incentive programs should also define and target eligibility appropriately, so that public resources are allocated efficiently and effectively. Thus, incentives should differentiate between doctors most in need of specific recruitment and retention support and those who choose to practice in existing well-supported practice and community environments. From the government's point of view, incentives are wasted if they are provided to doctors who are willing to go to, or remain in, a particular location without them. From the doctor's point of view, it is important to have equitable allocation of incentives, such that doctors practising in 'like' circumstances are eligible for 'like' incentives. Unfortunately, in Australia, there is increasing evidence that incentive funding to redress rural and remote workforce shortages is not being distributed equitably or effectively ¹⁶. This is largely due to shortcomings associated with the existing classification, used to define the eligibility of doctors for incentives, which does not take any account of factors known to influence medical workforce recruitment and retention.

One challenge associated with using these factors is that they are measured at the level of individual doctors. However, if these factors correlate with reliably-measured, locality-based characteristics, then they can be used to inform the design of incentive programs. This paper aims (a) to examine whether defined professional and non-professional factors known to influence recruitment and retention of doctors in rural areas are associated with town size (population) and remoteness; and (b) to use the findings of these analyses to construct a more equitable classification for defining eligibility for rural workforce incentives.

Background

Historically, the Australian Government has adopted various rural-urban classifications to define the eligibility of medical practitioners for specific recruitment and retention incentives. Three different taxonomies have been used to guide such resource allocation - the Rural, Remote and Metropolitan Area (RRMA) classification, the Accessibility/Remoteness Index of Australia (ARIA), and the Australian Standard Geographical Classification – Remoteness Area (ASGC-RA) ¹⁷. To date, insufficient attention has been paid within each classification to the criteria by which incentives should be allocated, and to developing a taxonomy that differentiates geographical variation so that the between-group differences far exceed any within-group differences. Because these classifications were based on ‘geography’ without regard to factors that influence rural medical workforce recruitment and retention, each has been characterised by significant shortcomings ¹⁸.

The Australian Government’s *Rural Health Workforce Strategy* currently provides \$134.4 million of additional financial support for rural doctors based on the ASGC-RA classification, with workforce incentives supposedly scaled or geared “to provide greatest benefits to the most remote communities where there is the greatest need” ¹⁹. In reality, use of ASGC-RA as the main health policy tool defining the eligibility of doctors for recruitment and retention incentives is seriously flawed as it does not account for ‘need’, particularly within its Inner Regional (ASGC-2) and Outer Regional (ASGC-3) categories, where doctors are eligible for the same incentives even though the communities within which they practise and the nature of their activity are very different. In particular, ASGC-RA ignores population size, a factor which influences GPs’ decisions to take-up rural practice and how long to remain there. Despite these recognised shortcomings, the Australian Government has resisted the adoption of an alternative allocation scheme to the current ASGC-RA classification ¹⁶.

Methods

We use data from the *Medicine in Australia: Balancing Employment and Life* (MABEL) study. MABEL is the largest longitudinal survey of the Australian medical workforce. Its primary aim is to investigate labour supply decisions and their determinants among Australian doctors.

The study methods and baseline characteristics are discussed in detail in Joyce *et al.* (2010). Copies of the MABEL questionnaire are available from: <https://mabel.org.au/mabelq.html>. The overall response rate for wave 1 was 19.36% of the Australian population of doctors with 10,498 doctors in the baseline cohort. This comprises 3,906 GPs (including 241 GP registrars), 4,596 specialists, 1,072 specialists-in-training and 924 hospital non-specialists. The full MABEL wave 1 cohort is representative of the national medical workforce. Comparisons made on gender, age, doctor type, geography and hours worked confirmed that there was no systematic non-response bias within our large cohort ²⁰. MABEL was approved by the University of Melbourne Faculty of Economics and Commerce Human Ethics Advisory Group and the Monash University Standing Committee on Ethics in Research Involving Humans.

For this study, only data from GPs are included, with 3636 usable responses after excluding GP Registrars from all analyses and those with missing geographical data (n=29). Wave 1 data from MABEL allow us to examine the role of professional and non-professional characteristics pertaining to the recruitment and retention of medical practitioners, and most importantly, how they vary spatially to assist in allocating resources designed to support recruitment and retention.

Building upon evidence of how the “complexity” of activities undertaken by doctors varies geographically ²¹, six validated sentinel indicators from MABEL data were mapped against workplace location. Four professional indicators and two non-professional indicators were selected on the basis of their known importance in attracting workforce or influencing length of stay. While procedural activity at public hospitals is known to be attractive to some rural GPs, long hours, excessive on-call and difficulty in getting time off are known deterrents of rural practice ²²⁻²⁵. Similarly, lack of employment opportunities for (de-facto) spouses and inadequate educational facilities locally are important considerations or triggers for leaving rural practice ²³. Other recruitment and retention indicators (opportunities for continuing medical education, availability of peer support, and availability of locums) were tested and

shown to be far less significant in discriminating geographically. The six sentinel indicators selected on the basis of international evidence were:

1. *Total Hours* = Total hours worked in their usual week (excluding after hours on-call);
2. *Public Hospital* = whether the GP undertakes work in a public hospital;
3. *On-call* = whether the GP is called out to attend patients two or more times (per week) after hours;
4. *Time-off* = whether it is difficult for the GP to take time off ;
5. *Partner Employment* = whether there are good employment opportunities locally for the GP's partner;
6. *Schooling* = whether the choice of schools locally is adequate.

The last two indicators (positively worded in the MABEL survey) were reverse coded for consistent direction of responses across all six indicators. Each GP was geo-coded so their responses could be mapped to a community, defined by the Australian Bureau of Statistic's Urban Centre / Locality.

Statistical analysis was performed using PASW Statistics 18.0 (SPSS Inc, Chicago, Ill, USA). The significance of association between five of the six indicators and each community's population size and designated remoteness (ASGC-RA) was measured using the linear-by-linear (ordinal) association test (Chi-Square test with 1 degree of freedom), while total hours (continuous outcome) and population size was measured using Spearman's Rho test of ordinal correlation. ASGC-1 data were not included in statistical testing of association because they are all considered similar to metropolitan centres.

Results

Table 1 shows a significant and consistent association between remoteness (using ASGC-RA) and our six key indicators ($p < 0.001$); however, it does not reveal the complete picture. ASGC-2 and ASGC-3 categories consist of a wide range of different rural communities varying greatly in population size and composition. Using MABEL data, we further tested the homogeneity of our six indicators within ASGC-2 and ASGC-3 categories (that is, whether

the indicators are significantly associated with population size, after first accounting for remoteness). Table 2 shows that there is a significant variation by community size in both 'inner' and 'outer regional' ASGC-RA groups, with all indicators trending upwards with decreasing population size, highlighting that even after accounting for remoteness, these sentinel indicators are mostly strongly associated with population size.

[Table 1 here]

[Table 2 here]

Figure 1 displays the association between our six indicators and population size alone, independent of ASGC-RA. All indicators increase (becoming more problematic within that locality) as population size decreases. Four broad population size groupings, which minimise 'within-group' variation whilst also maximising 'between-group' variation, emerge. These are: (1) 0-5K – 'Small Rural'; (2) 5-15K – 'Medium Rural'; (3) 15-50K – 'Large Rural'; (4) >50K – 'Regional Centre' & 'Metropolitan' - groupings which are not dissimilar from the service centre levels used in the calculation of ASGC-RA ¹⁷.

[Figure 1 here]

Further exploration of the heterogeneity of the existing ASGC-RA groups is summarised in Table 3, which tests the statistical association between population size and the six indicators within each ASGC-RA group individually. If the ASGC-RA categories are homogeneous, then most associations within Table 3 should not be statistically significant. However, within each of ASGC-2, ASGC-3 and ASGC-4, the associations between population size and public hospital work, on-call work, good partner employment and adequate schooling are all highly statistically significant. Total hours is only significantly associated with population size within ASGC-3, whilst difficulty getting time off is not associated with population size.

[Table 3 here]

In contrast, Table 4 tests the association between ASGC-RA and the six indicators within each population size group individually. The addition of ASGC-RA captures no additional variation of the 6 indicators within both the >50K and 15-50K categories and very little association within the 5-15K category. It is only when population size decreases to the

smallest group (0-5K) that the addition of ASGC-RA captures a significant association for total hours, public hospital, on-call and schooling.

[Table 4 here]

Assuming all ASGC-1 locations are 'metropolitan', combining the four population size groups identified in Figure 1 (ordered first) with the four non-metropolitan ASGC-RA levels (ordered within each of four population size groups) defines 13 different ordered levels, with examples of locations within each level shown in Table 5. However, our results to this point, in particular those in Tables 3 and 4, strongly suggest that only a 6-level classification is necessary, with combined levels also shown in Table 5. Non-metropolitan populations are separated into three population groups >50K, 15-50K and 5-15K, where further separation by ASGC-RA has been shown to add nothing to its discriminatory power (see Table 4). Finally, the smallest communities of 0-5K are separated into those in 'regional' areas (ASGC-2&3) and 'remote' areas (ASGC-4&5), where further separation did significantly add to its discriminatory power (see Table 4).

[Table 5 here]

Table 6 confirms that adoption of a new 6-level rurality classification measures a significantly stronger association with four out of six sentinel indicators, compared to the association with ASGC-RA alone, and is statistically equivalent to the full 13-level classification. For example, the measured association (chi-square statistic) between GPs undertaking work in a public hospital and rurality increases dramatically from 18.2 for ASGC-RA to 156.8 for the new 6-level classification. Associations for three other indicators have also increased significantly for the 6-level classification: on-call work, good partner employment and adequate schooling. Associations for total hours increased slightly, whilst associations with difficulty getting time-off (not statistically significant) decreased slightly.

[Table 6 here]

Discussion

Which doctors receive incentives (and their amount) is currently determined by geographical criteria, as defined by ASGC-RA. Continuing to use ASGC-RA in its current form will not only maintain the existing distributional inequities (with GPs receiving the same incentives regardless of the fact that their practice activities and workplace locations vary significantly), but also exacerbate existing difficulties in attracting GPs to small, 'difficult-to-recruit-to' communities where they receive the same incentives as doctors practising in larger communities.

Our choice of medical workforce indicators relates to their importance to recruitment and retention in rural areas where the shortage of doctors is most acute and persistent. Our research shows that key professional and non-professional aspects of rural practice correlate with locality-based characteristics including town size and remoteness. This is useful in grouping doctors according to those warranting incentives and those who don't, and delimiting geographically-defined groups which maximise 'within-group' and minimise 'between-group' similarity. In this way, GPs sharing similar characteristics and needs for support are grouped together and differentiated from other groups of GPs who arguably need more or less support through incentives. Using the indicators it is shown that a classification predominantly defined by population size effectively defines homogeneous groupings of doctors eligible for incentive funding.

An important motivation for this research has been the anomalies in the distribution of incentives for rural GPs resulting from using the existing ASGC-RA classification. Based on our research, an improved geographical classification is proposed as the basis for allocating resources designed to support recruitment and retention of doctors in non-metropolitan Australia. Although the new 6-level classification exceeds the current five categories, it has the important benefit of reducing existing anomalies that result from the enormous heterogeneity characterising the current scheme – particularly in ASGC-2 and ASGC-3 regions.

What our study does not do, however, is to indicate what the nature of the differential between the 6 groups should be. That is, it does not determine the amount of resources that

should be allocated in the form of incentives for GPs in different groups. This is clearly the next aspect to be considered, and results from the MABEL study discrete choice experiment data will assist here.

Some limitations should be acknowledged. The study was restricted by the range of variables available at the national level. Wave 1 data from MABEL provided the best available sentinel professional and non-professional indicators, consistent with their proven importance to rural workforce recruitment and retention. Access to alternative unit record data (such as Medicare) is, however, almost impossible to obtain and even then Medicare data do not include information on the six sentinel indicators. The six sentinel indicators are based on extant literature, but could in the future be based on more robust evidence of the factors that influence recruitment and retention in underserved areas. It should be emphasised that the lower than desirable proportion of doctors participating in the baseline cohort of MABEL represents a sub-set of the full population rather than a sub-set of a sample and has been shown to be representative of the national medical workforce.

Conclusion

In order to overcome existing problems associated with the recruitment and retention of doctors to underserved rural and remote areas, Governments and health authorities require a resource allocation framework that distributes taxpayers' money to its best effect and targets those most in need ensuring that it is graduated equitably according to the magnitude of the problems faced by practitioners working in different areas. What we propose here is a validated geographical classification scheme that provides a better basis for equitable resource allocation for doctors based on (1) the nature of activity and service provided by doctors in their communities, and (2) their attractiveness both professionally and non-professionally as settings to work and live in.

Acknowledgements

This work, part of the MABEL study, was supported by a National Health and Medical Research Council Health Services Research Grant (454799) and by the Australian Government Department of Health and Ageing. The views in this paper are ours alone.

Thanks to the other members of the MABEL team for their support and input, and a special thank-you to the doctors who gave their valuable time to participate in MABEL.

References

1. Humphreys JS, Solarsh G. At-risk populations: rural. In: Heggenhougen HK, Quah S, editors. *The International Encyclopedia of Public Health*. London: Academic Press; 2008.
2. Australian Government Department of Health and Ageing. Report on the audit of health workforce in rural and regional Australia, April 2008. Canberra: Commonwealth of Australia, 2008.
3. Productivity Commission. *Australia's health workforce*. Research Report, Canberra, 2005.
4. Barnighausen T, Bloom D. Financial incentives for return of service in underserved areas: a systematic review. *BMC Health Services Research*. 2009;9:86.
5. Grobler L, Marais B, Mabunda S, Marindi P, Reuter H, Volmink J. Interventions for increasing the proportion of health professionals practising in rural and other underserved areas. *Cochrane Database of Systematic Reviews*. 2009(1):CD005314.
6. Sempowski IP. Effectiveness of financial incentives in exchange for rural and underserved area return-of-service commitments: systematic review of the literature. *Canadian Journal of Rural Medicine*. 2004;9(2):82-88.
7. World Health Organization. *Increasing access to health workers in remote and rural locations through improved retention: Background paper*. Geneva: WHO, 2009.
8. Buykx P, Humphreys JS, Wakerman J, Pashen D. A systematic review of effective retention incentives for health workers in rural and remote areas: Towards evidence-based policy. *Australian Journal of Rural Health*. 2010;18(3):102-109.
9. Dussault G, Franceschini M. Not enough there, too many here: understanding geographical imbalances in the distribution of the health workforce. *Human Resources for Health*. 2006;4:12.
10. Hancock C, Steinbach A, Nesbitt T, Adler S, Auerswald C. Why doctors choose small towns: A developmental model of physician recruitment and retention. *Social Science and Medicine*. 2009;69(9):1368-1376.

11. Humphreys JS, Jones JA, Jones MP, Hugo G, Bamford E, Taylor D. A critical review of rural medical workforce retention in Australia. *Australian Health Review*. 2001;24(4):91-102.
12. Kamien M. Staying in or leaving rural practice: 1996 outcomes of rural doctors 1986 intentions. *Medical Journal of Australia*. 1998;169(6):318-321.
13. Thistlethwaite J, Shaw T, Kidd M, Leeder S, Burke C, Corcoran K. Attracting health professionals into primary care: Strategies for recruitment. Canberra: Australian Primary Health Care Research Institute, 2007.
14. Humphreys JS, Wakerman J, Pashen D, Buykx P. Retention strategies and incentives for health workers in rural and remote areas: What works? Canberra: Australian Primary Health Care Research Institute, 2010.
15. Wilson N, Couper I, De Vries E, Reid S, Fish T, Marais B. A critical review of interventions to redress the inequitable distribution of healthcare professionals to rural and remote areas. *Rural and Remote Health*. 2009;9:1060.
16. Van der Plaats F. Lines in the sand. *Australian Rural Doctor*. 2011;pg. 22-24.
17. Australian Institute of Health and Welfare. Rural, regional and remote health: a guide to remoteness classifications. Canberra: AIHW, 2004 March. Report No.: AIHW Cat. No. PHE 53.
18. McGrail MR, Humphreys JS. Geographical classifications to guide rural health policy in Australia. *Australia and New Zealand Health Policy*. 2009;6:28.
19. Australian Government Department of Health and Ageing. Rural Health Workforce Strategy. 2011 [accessed 12th August 2011]; Available from: <http://www.health.gov.au/internet/otd/Publishing.nsf/Content/program-RuralHealthWorkforceStrategy-lp>.
20. Joyce C, Scott A, Jeon S, Humphreys JS, Kalb G, Witt J, et al. 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*. 2010;10:50.

21. Humphreys J, Jones J, Jones M, Mildenhall D, Mara P, Chater B, et al. The influence of geographical location on the complexity of rural general practice activities. *Medical Journal of Australia*. 2003;179:416-420.
22. Alexander C. Why doctors would stay in rural practice in the New England Health area of New South Wales. *Australian Journal of Rural Health*. 1998;6:136-139.
23. Goertzen J. The four-legged kitchen stool: recruitment and retention of rural family physicians. *Canadian Family Physician*. 2005;51:1181-1183.
24. Hays R, Wynd S, Veitch C, Crossland L. Getting the balance right? GPs who chose to stay in rural practice. *Australian Journal of Rural Health*. 2003;11(4):193-198.
25. Humphreys JS, Jones MP, Jones JA, Mara PR. Workforce retention in rural and remote Australia: determining the factors that influence length of practice. *Medical Journal of Australia*. 2002;176:472-476.

Figure 1: Association between population size and 6 sentinel indicators

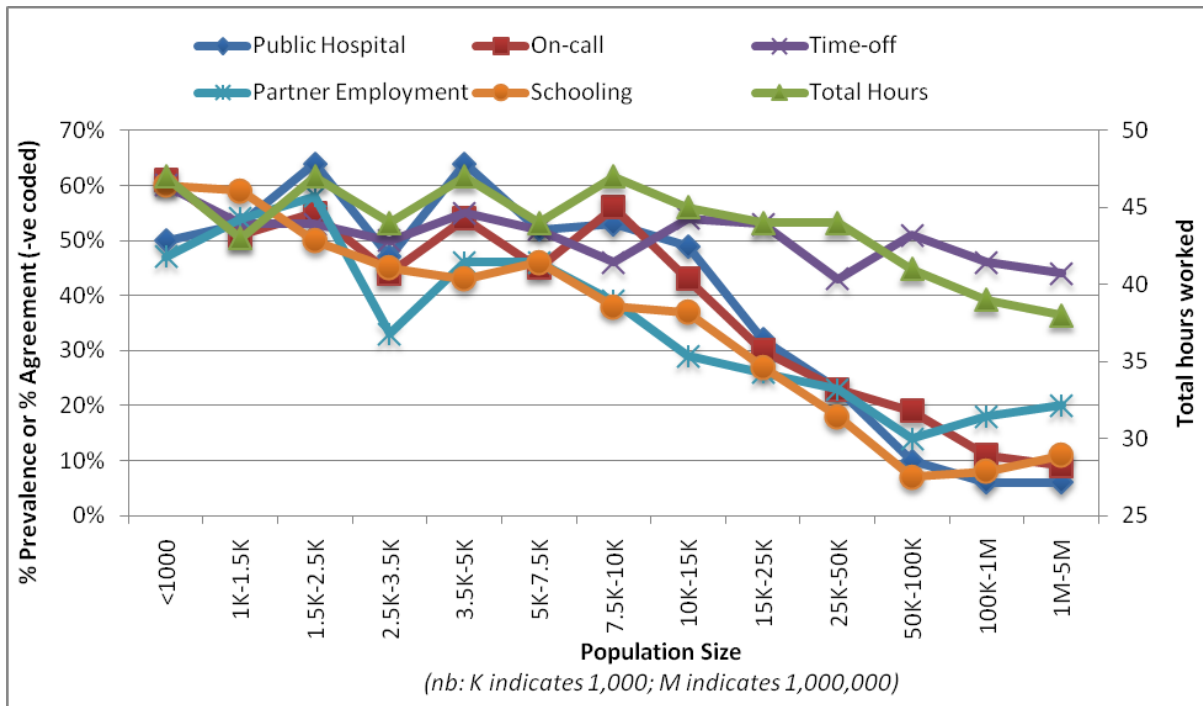


Table 1: Association between ASGC-RA and the 6 sentinel indicators

	ASGC-1	ASGC-2	ASGC-3	ASGC-4	ASGC-5
Sample (n)	2399 (66%)	718 (20%)	344 (10%)	130 (4%)	45 (1%)
Total Hours	38.8	43.2	45.9	47.8	48.2
Public Hospital	7%	35%	45%	54%	48%
On-call	10%	33%	43%	52%	73%
Time-off	45%	47%	54%	65%	60%
Partner	20%	28%	39%	35%	37%
Employment					
Schooling	10%	24%	41%	58%	77%

Table 2: Association between population size and the 6 sentinel indicators, for GPs located in ASGC-2 and ASGC-3

ASGC-2	<1K	1-2.5K	2.5-5K	5-10K	10-25K	25-100K	>100K
Sample (n)	29 (4%)	69 (9%)	86 (12%)	102 (14%)	158 (22%)	221 (31%)	53 (8%)
Total Hours	40.3	45.1	41.3	45.7	44.9	42.7	36.3
Public Hospital	26%	53%	47%	54%	48%	15%	2%
On-call	31%	45%	42%	49%	38%	21%	11%
Time-off	48%	47%	45%	49%	49%	46%	43%
Partner	37%	49%	32%	47%	26%	16%	14%
Employment							
Schooling	22%	40%	29%	46%	29%	10%	5%
ASGC-3	<1K	1-2.5K	2.5-5K	5-10K	10-25K	25-100K	>100K
Sample (n)	37 (11%)	50 (14%)	63 (18%)	49 (14%)	36 (11%)	82 (24%)	27 (8%)
Total Hours	51.2	43.5	50.9	45.4	46.3	41.7	40.8
Public Hospital	51%	67%	65%	46%	43%	25%	8%
On-call	54%	58%	59%	47%	36%	27%	15%
Time-off	67%	52%	53%	52%	59%	46%	38%
Partner	50%	76%	50%	43%	41%	14%	4%
Employment							
Schooling	70%	63%	58%	44%	35%	15%	5%

nb: K indicates 1,000 people

Table 3: Statistical significance of association between the 6 sentinel indicators and 4 population size levels (0-5K; 5-15K; 15-50K; >50K) within each ASGC-RA (2-4) individually

	Statistical Test	ASGC-2 only	ASGC-3 only	ASGC-4 only
Total Hours	Rho	0.04 (p=0.26)	0.177	0.146 (p=0.10)
Public Hospital	$\chi^2(1)$	62.0	54.3	34.0
On-call	$\chi^2(1)$	31.2	37.4	17.2
Time-off	$\chi^2(1)$	0.16 (p=0.69)	2.20 (p=0.14)	1.88 (p=0.17)
Partner	$\chi^2(1)$	27.6	43.5	5.2 (p=0.02)
Employment				
Schooling	$\chi^2(1)$	30.6	49.2	11.8

nb: All p-values are <0.001 unless specified

Table 4: Statistical significance of association between the 6 sentinel indicators and 4 remoteness levels (ASGC-RA 2-4) within each population size group (0-5K; 5-15K; 15-50K) individually

	Statistical Test	>50K only	15-50K only	5-15K only	0-5K only
Total Hours	Rho	-0.005 (p=0.94)	0.013 (p=0.83)	0.069 (p=0.25)	0.190
Public Hospital	$\chi^2(1)$	1.4 (p=0.23)	3.3 (p=0.07)	0.0 (p=0.93)	4.9 (p=0.03)
On-call	$\chi^2(1)$	2.2 (p=0.13)	1.4 (p=0.23)	0.1 (p=0.75)	23.3
Time-off	$\chi^2(1)$	0.1 (p=0.79)	0.1 (p=0.74)	4.8 (p=0.03)	7.0 (p=0.01)
Partner	$\chi^2(1)$	2.1 (p=0.15)	0.9 (p=0.35)	1.6 (p=0.21)	0.6 (p=0.46)
Employment					
Schooling	$\chi^2(1)$	0.6 (p=0.44)	1.9 (p=0.17)	2.5 (p=0.12)	32.7

nb: All p-values are <0.001 unless specified; K indicates 1,000 people

Table 5: Proposed new 6-level rurality classification

New 6 level classification	Full 13-level classification	Population Size	ASGC-RA	Example locations
1	1	All	ASGC-1	Capital cities, Wollongong, Newcastle, Geelong, Sunshine Coast, Gold Coast
2	2	>50K	ASGC-2	Bendigo, Ballarat, Hobart, Mackay, Launceston, Rockhampton
2	3	>50K	ASGC-3	Townsville, Cairns, Darwin
3	4	15-50K	ASGC-2	Coffs Harbour, Shepparton, Mt Gambier, Bundaberg, Busselton
3	5	15-50K	ASGC-3	Mildura, Albany, Broken Hill, Whyalla, Burnie, Kalgoorlie
3	6	15-50K	ASGC-4	Alice Springs, Mt Isa
4	7	5-15K	ASGC-2	Ulladulla, Sale, Warwick, Ararat, Gympie, Lithgow, Victor Harbor
4	8	5-15K	ASGC-3	Port Augusta, Emerald, Bairnsdale, Horsham, Moree, Ayr, Parkes
4	9	5-15K	ASGC-4	Broome, Port Lincoln, Esperance, Katherine, Karratha
5	10	0-5K	ASGC-2	Gundagai, Leongatha, Strathalbyn, Pinjarra, Cooroy, Latrobe

5	11	0-5K	ASGC- 3	Port Sorell, Naracoorte, Bega, Kerang, Chinchilla, Margaret River
6	12	0-5K	ASGC- 4	Bourke, Kununurra, Roxby Downs, Charleville, Queenstown
6	13	0-5K	ASGC- 5	Derby, Tennant Creek, Halls Creek, Ceduna, Nhulunbuy, Weipa

nb: K indicates 1,000 people

Table 6: Statistical significance of association between the 6 sentinel indicators and the new 13 and 6-level classifications compared to the currently used ASGC-RA classification

	Statistical Test	ASGC-RA	Full 13-level classification	New 6-level classification
Total Hours	Rho	0.114	0.137	0.125
Public Hospital	$\chi^2(1)$	18.2	149.7	156.8
On-call	$\chi^2(1)$	42.9	121.3	120.2
Time-off	$\chi^2(1)$	11.8	6.0 (p=0.014)	5.0 (p=0.025)
Partner Employment	$\chi^2(1)$	5.2	72.2	72.3
Schooling	$\chi^2(1)$	68.6	141.2	134.5

nb: Responses from ASGC-RA = 1 were excluded for all statistical tests; All p-values are <0.001 unless specified



Minerva Access is the Institutional Repository of The University of Melbourne

Author/s:

Humphreys, JS; McGrail, MR; Joyce, CM; Scott, A; Kalb, G

Title:

Who should receive recruitment and retention incentives? Improved targeting of rural doctors using medical workforce data

Date:

2012-02-01

Citation:

Humphreys, J. S., 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 (1), pp.3-10.
<https://doi.org/10.1111/j.1440-1584.2011.01252.x>.

Persistent Link:

<http://hdl.handle.net/11343/115259>

File Description:

Accepted version