

Service distribution and models of rural outreach by specialist doctors in Australia: a national cross-sectional study

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Abstract

Objective. This paper describes the service distribution and models of rural outreach by specialist doctors living in metropolitan or rural locations.

Methods. The present study was a national cross-sectional study of 902 specialist doctors providing 1401 rural outreach services in the Medicine in Australia: Balancing Employment and Life study, 2008. Five mutually exclusive models of rural outreach were studied.

Results. Nearly half of the outreach services (585/1401; 42%) were provided to outer regional or remote locations, most (58%) by metropolitan specialists. The most common model of outreach was drive-in, drive-out (379/902; 42%). In comparison, metropolitan-based specialists were less likely to provide hub-and-spoke models of service (odd ratio (OR) 0.31; 95% confidence interval (CI) 0.21–0.46) and more likely to provide fly-in, fly-out models of service (OR 4.15; 95% CI 2.32–7.42). The distance travelled by metropolitan specialists was not affected by working in the public or private sector. However, rural-based specialists were more likely to provide services to nearby towns if they worked privately.

Conclusions. Service distribution and models of outreach vary according to where specialists live as well as the practice sector of rural specialists. Multilevel policy and planning is needed to manage the risks and benefits of different service patterns by metropolitan and rural specialists so as to promote integrated and accessible services.

What is known about this topic? There are numerous case studies describing outreach by specialist doctors. However, there is no systematic evidence describing the distribution of rural outreach services and models of outreach by specialists living in different locations and the broad-level factors that affect this.

What does this paper add? The present study provides the first description of outreach service distribution and models of rural outreach by specialist doctors living in rural versus metropolitan areas. It shows that metropolitan and rural-based specialists have different levels of service reach and provide outreach through different models. Further, the paper highlights that practice sector has no effect on metropolitan specialists, but private rural specialists limit their travel distance.

What are the implications for practitioners? The complexity of these patterns highlights the need for multilevel policy and planning approaches to promote integrated and accessible outreach in rural and remote Australia.

Additional keywords: fly-in fly-out, hub-and-spoke, medical specialist.

Received 15 December 2014, accepted 17 July 2015, published online 21 September 2015

Introduction

Rural outreach service delivery is a key strategy to help rural and remote populations overcome geographic, cost and cultural

barriers to accessing specialist services. Outreach clinics support resident primary health workers to manage complex illness, reducing hospitalisation rates.¹ Moreover, they can achieve

equivalent health outcomes to metropolitan-based clinics.^{2,3} Around one in five Australian specialists participates in rural outreach work, with research indicating that service distribution differs according to where specialists live.⁴ However, we lack national-scale evidence to more explicitly describe the spatial distribution of services and service models underpinning rural outreach by specialists from different locations. Identifying these patterns and the drivers at play will inform the development of strategies to promote integrated and accessible outreach services.

Only 15% of specialists, but 30% of the population, live in rural and remote areas, which span 99.8% of Australia's land mass.^{5,6} Metropolitan areas have a greater range of specialists⁷ and account for approximately three-quarters (68%) of outreach providers.⁴ However, there is no information about where their services, compared with those of rural-based specialists, are provided.

Apart from where services are provided, models by which metropolitan- and rural-based specialists deliver these outreach services raise different planning implications. Several outreach models have been loosely described, including hub-and-spoke, fly-in, fly-out (FIFO) and drive-in, drive-out (DIDO),^{8,9} but they remain to be defined and quantified, including whether their prevalence varies by location. Conceptually, they relate to different structural configurations of services delivered within or beyond regional boundaries, via different modes of transport.

The hub-and-spoke model is typically organisationally driven and intends to promote integrated care because workers in the hub know the context at spoke sites, acting as a referral site for higher-level services, to manage care within a geographic boundary. It is a formal policy of the Queensland government,¹⁰ but the capacity for such models in the public sector could be limited because 33% of all medical specialists work solely in the public sector and 48% in mixed public and private practice, in both metropolitan or rural areas.¹¹ Restricted case studies exemplify specialists within hub-and-spoke models visiting towns within a 300-km boundary.^{2,3,9}

The FIFO model commonly refers to the flexible deployment of individual staff over long distances, usually to a key site, on a rostered basis.¹² Limited case studies exemplify specialists flying to provide outreach services to a key town more than 300 km away,^{13,14} but its viability depends on the specialist's access to long-distance transport and capacity to absorb transport costs. A variant on this model involves flying to more than one distant location.⁹ Both variants risk poor regional integration.

The DIDO model is poorly defined in the literature. A parliamentary inquiry into FIFO practices in regional Australia suggested DIDO involves shorter distance commuting by car.¹² Delivering services nearby could be an organisational initiative and occur within a regional boundary similar to the hub-and-spoke model, but targeting only one nearby town, as somewhat a model of convenience.

Whether the specialist normally works in public or private practice also has the potential to affect the distribution of outreach services because of responsibility for the costs incurred. Those working in mixed or private practice can incur direct costs for outreach travel and opportunity costs for travel time. They may require adequate clinical throughput to enable sufficient financial reimbursement via a fee-for-service

payment system. Conversely, salaried public-employed specialists have their time covered and are reimbursed for travel expenses.

Patterns of outreach service distribution by metropolitan and rural-based specialists are also likely to vary at a local level with regard to different regional contexts, such as the size and location of regional towns, how remote the catchment is and whether major regional towns have any formal plan for specialist outreach services.

The aims of the present paper are to describe service distribution and models of rural outreach by specialist doctors living in metropolitan or rural locations, how service distribution varies by working in public or private practice and to use case studies to explore the role of regional context.

Methods

Data come from the Medicine in Australia: Balancing Employment and Life (MABEL) longitudinal survey of doctors (<https://mabel.org.au/>, accessed 5 August 2015). Between June and November 2008, all doctors undertaking clinical work in Australia were invited to participate in the study.¹⁵ Overall, 4596 or 22% of all Australian specialist doctors who had completed advanced training to gain accreditation with a specialist medical college participated by completing either a paper or online survey. Selection bias was tested by the MABEL research team, showing respondents were broadly representative based on key covariates, age, sex, hours worked and location.¹⁵ As indicated in Table 1, the characteristics of specialists in the cohort were similar to those of the national specialist workforce.

Specialists were asked whether they 'travel to provide services/clinics in other geographic locations' and could report up to three locations they visited. The present cohort included specialists who travelled to provide clinics or services to at least one identifiable rural location. Thirty-five specialists who reported visiting 'various locations' were not considered rural outreach providers, but rather locum workers or retrieval services. Locations were geo-coded and categorised according to the five-level Australian Standard Geographical Classification Remoteness Area scale.¹⁶ Rural locations included inner regional, outer regional, remote and very remote.

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).

Predictors

The specialist's residential location was used to define the base location as either metropolitan (major city) or rural (four categories, as defined above). Seven specialists not indicating a residential location were excluded because the distance they travelled could not be measured.

Practice sector was defined using information about weekly hours worked in public hospitals, private hospitals, private consulting rooms or 'other' (e.g. aged care facilities, tertiary education; Table 2).

Table 1. Characteristics of specialist doctors in the 2008 Medicine in Australia: Balancing Employment and Life (MABEL) sample ($n = 4596$)^A

Unless indicated otherwise, data are given as the number of subjects in each group with percentages in parentheses

	Males		Females	
	MABEL	Population ^B	MABEL	Population
Mean age (years)	52.4	50.6	46.5	45.2
Age group (years)				
<45	938 (20%)	6284 (26%)	637 (14%)	3334 (14%)
45–64	1937 (42%)	9596 (40%)	580 (13%)	2569 (11%)
65+	422 (9%)	2252 (9%)	43 (1%)	255 (1%)
Mean total clinical hours worked	47.2	47.0	38.2	37.8
Location of main place of work				
Metropolitan	2457 (53%)	13 340 (68%)	1042 (23%)	3646 (19%)
Rural	625 (14%)	2203 (11%)	158 (3%)	389 (2%)
Specialist type				
Other specialists	1575 (34%)	8159 (34%)	691 (15%)	3484 (14%)
Internal	862 (19%)	4968 (21%)	374 (8%)	1743 (7%)
Pathology	117 (3%)	707 (3%)	58 (1%)	430 (2%)
Surgery	498 (11%)	4298 (18%)	60 (1%)	500 (21%)
Total	3318 (72%)	18 132 (75%)	1278 (28%)	6158 (25%)

^AOverall, 21 male and 18 female respondents to the MABEL survey were missing observations about age, 207 male and 55 female respondents were missing observations about total hours worked, 236 male and 78 female respondents were missing observations about the location of the main place of work and 266 male and 85 female respondents were missing observations about specialist type.

^BData on the Australian specialist workforce population were obtained from the Australian Medical Labour Force Survey data 2009 ($n = 24\ 290$) (Australian Institute of Health and Welfare (AIHW). Medical Labour Force Survey. Canberra: AIHW, 2009. Available at: <http://www.aihw.gov.au/publication-detail/?id=10737419680&tab=3> [verified 5 August 2015]), except for data on location of main place of work, which were obtained from the 2008 Australian medical directory dataset ($n = 19\ 578$) (Australasian Medical Publishing Company Direct (AMPCo). Australian Medical Directory Dataset Sydney: AMPCo Direct; 2008).

Table 2. Normal sector of practice, used in the analysis

Sector	Usual weekly hours worked
Public	All hours worked in public hospital only
Private	Hours worked in private consultation rooms and/or private hospital, not public hospital
Mixed, mainly public	Hours worked in public and private sectors but spends more than median total hours in public hospital ($\geq 33\%$)
Mixed, mainly private	Hours worked in public and private sectors but spends less than median total hours in public hospital ($< 33\%$)

Outcome measures

Spatial distribution of services

Four mutually exclusive patterns of outreach service distribution were defined based on specialist residential and outreach locations: (1) metropolitan to inner regional; (2) metropolitan to outer regional or remote; (3) rural to inner regional; and (4) rural to outer regional or remote.¹⁶

Models of outreach

Five mutually exclusive models of outreach service delivery were defined to enable standardised comparison between metropolitan and rural-based specialists and to draw out different planning implications. Four models were based on the typical configurations of distance travelled, number of communities visited and transport mode, as described in published case studies^{2,3,9,12–14} (see Table 3). A mixed model was also defined to account for the small proportion of remaining specialists.

Travel distance was calculated by the straight-line distance in kilometres between each residential location and corresponding

outreach location(s) as a conservative estimate. Straight-line distance approximates the flight path to distant locations and accommodates the fact that most major highways are relatively direct to regional areas. A cut-off of < 300 km or ≥ 300 km was applied because this was consistent with the distance travelled in published case studies of different models in practice (Table 3). Personal Communication by the main author (BOS) with rural service delivery stakeholders confirmed that 300 km reasonably approximated regional boundaries.

To analyse practice sector, specialist residential location was stratified as metropolitan or rural. To account for cell sizes, specialists were categorised as providing outreach to local (< 300 km) or distant towns (≥ 300 km) according to the most distant service provided.

Statistical analyses

Fisher's Chi-squared test was used to examine the association between metropolitan or rural-based specialists and the remoteness of outreach service distribution. The mean distance specialists travelled was also calculated.

Table 3. Five mutually exclusive models of outreach used in the analysis
DIDO, drive-in, drive-out; FIFO, fly-in, fly-out

Model	References	No. locations ^A	Distance from base location ^A (km)	Description and implications
DIDO	12	1	<300	Outreach services to towns within a regional boundary, convenient for the specialist to provide, normally by car; potentially fragmented
Hub-and-spoke	2, 3, 9	2–3	<300	Outreach services to multiple towns within a regional boundary ^B and integrated at an organisational level with a hub
FIFO	13, 14	1	≥300	Outreach services to a key location normally by flight, which bypasses regional boundaries; potentially fragmented and costly to provide
Multiple distant	9	2–3	≥300	A variant of FIFO, but services are to multiple key locations, normally by flight, bypassing regional boundaries; potentially fragmented and more costly to provide than FIFO services to one location
Mixed		2–3	<300 and ≥300	A mixture of services to towns in the region or bypassing regional boundaries

^AThe cut-off point of 300 km was based on published case studies exemplifying the number of locations and distance travelled by medical specialists working under different models.

^BThe regional boundary could be the major regional centres of the state they live in for metropolitan specialists, or towns within the health region they work in for rural specialists.

The association between metropolitan or rural-based specialists and the model of outreach was measured using univariate logistic regression as odds ratios (OR) and 95% confidence intervals (CI).

Separate univariate logistic regression tested the association between practice sector and local or distant distribution of outreach. Specialists who reported most of their work hours in the 'other' setting and who worked <10 h in public or private settings or both public and private (for the mixed sector group) were excluded from this analysis.

Cross-sectional sampling weights were applied to all calculations of proportions and statistical analyses of models of outreach and doctor's practice sector.

Regional context: case studies

Eight regional towns were purposefully selected as key rural hubs to study the effect of regional context. They reflected different populations (20 000–250 000), hospital sizes (<100 or ≥100 beds), locations (with remote vs regional catchments, proximity to metropolitan areas, inland or coastal) and six states and territories, one of which had a formal plan for specialist outreach. Between one and three nearby towns within the vicinity of the regional town (hub) were chosen based on having a viable population to support an outreach service (>5000 people)¹⁷ and being less than 3-h drive away or easily reached in <2 h by flight according to Google Maps (<http://maps.google.com>, accessed 5 August 2015). The range of service patterns by metropolitan and rural-based specialists were examined by the authors to determine typical patterns specific to Australia's rural and remote population dispersion and geography.

Results

Of 4596 specialists who responded, weighted analysis showed 909 (19%) provided rural outreach services; seven were excluded because they had no residential address. The final cohort of 902 specialists provided 1401 rural outreach services. Most (79%) were male, their mean age was 50.8 years, they worked an average of 46.6 clinical hours per week and 33% were internal

physicians, 47% were other specialists, 16% were surgeons and 4% were pathologists. Specialist types in the cohort have been described previously.⁴

Spatial distribution of services

Forty-two per cent (585/1401) of outreach services were provided to outer regional or remote rather than to inner regional locations, and most of these ($n = 338$; 58%) were provided by metropolitan-based specialists. Outer regional or remote outreach services were significantly associated with rural specialists ($n = 247$; 48% of all rural services vs 38% of all metropolitan services; $P < 0.0001$).

Metropolitan-based specialists travelled a mean distance of 262 km to inner regional and 954 km to outer regional or remote locations. Rural-based specialists travelled an average of 106 km to inner regional and 318 km to outer regional or remote locations.

Models of rural outreach

The most common outreach model based on weighted analysis was DIDO ($n = 379/902$; 42%), with 74% provided by metropolitan-based specialists. Other common models were the hub-and-spoke ($n = 183$; 19%) and FIFO ($n = 168$; 20%). Metropolitan specialists were significantly less likely to provide outreach services via a hub-and-spoke model compared with DIDO (OR 0.31; 95% CI 0.21–0.46), but significantly more likely to provide outreach via FIFO (OR 4.15; 95% CI 2.32–7.42) or multiple distant models (OR 3.60; 95% CI 1.79–7.24; Table 4).

Practice sector

There were no significant associations between practice sector and providing local or distant outreach services by metropolitan-based specialists (Table 5). Public sector specialists in rural and metropolitan areas provided similar rates of local outreach services (60% and 55%, respectively). However, within the rural specialist group, compared with public sector specialists, local outreach service models were significantly associated with private only (OR 3.16; 95% CI 1.01–9.94) and mixed practice,

whether mainly private (OR 7.13; 95% CI 2.74–18.60) or mainly public (OR 2.83; 95% CI 1.35–5.93).

Regional context

There were three typical patterns by which regional context tended to affect outreach service distribution, two which applied to isolated regional towns with remote catchments and one to regional towns in areas of higher population concentration (Table 6). Outreach services were more likely to be provided from isolated regional towns serving remote catchments, which also had larger regional hospitals and a formal outreach service plan. If the regional hospital was smaller and direct commercial air transport was available to the nearby remote sites,

metropolitan-based specialists provided most services. In regional towns in areas of higher population concentration, a disorganised mix of rural and metropolitan-based specialists provided outreach services.

Discussion

This paper demonstrates that nearly half of all rural outreach services are provided to outer regional or remote, rather than inner regional, locations. Many intersecting factors affected service distribution and models of rural outreach, including where specialists live, the practice sector of rural specialists and the regional context.

Where specialists live

Rural-based specialists provided a higher rate of outreach services to outer regional or remote locations compared with metropolitan specialists. However, metropolitan-based specialists boosted the overall number of outer regional or remote services. Metropolitan-based specialists more commonly provided FIFO or multiple distant models of outreach service. Furthermore, although they were less prone to provide outreach services through hub-and-spoke models, they provided the majority of all DIDO services.

The policy implications with regard to using metropolitan-based outreach services are twofold. First, they involve managing a high rate of service delivery that bypasses regional boundaries and, second, being aware of the large number of services targeting one nearby town through the DIDO model. The FIFO model allows some flexibility to reach more distant communities and adapt services to changing needs.⁹ To mitigate the risk of disconnected care, these services need to communicate a regular, predictable visiting schedule,¹⁸ spend sufficient time

Table 4. Association between metropolitan-based^A specialist doctors and model of outreach^B

Unless indicated otherwise, data are given as the number of subjects in each group with percentages in parentheses. DIDO, drive-in, drive-out; FIFO, fly-in, fly-out; OR, odds ratio; CI, confidence interval

Model of outreach	Metropolitan based	Rural based	Univariate OR (95% CI)	P-value
DIDO	264 (74%)	115 (26%)	Reference 1.0	
Hub-and-spoke	77 (47%)	106 (53%)	0.31 (0.21–0.46)	<0.0001
FIFO	151 (92%)	17 (8%)	4.15 (2.32–7.42)	<0.0001
Multiple distant	66 (91%)	12 (9%)	3.60 (1.79–7.24)	<0.0001
Mixed	58 (69%)	36 (31%)	0.78 (0.48–1.27)	0.31
Total	616	286	–	–

^ABase location coded according to the specialist's residential location, using Australian Standard Geographical Classification Remoteness Area (ASGC-RA) scale.¹⁶

^BAnalysis includes 902 specialist doctors who provided outreach services and cross-sectional sampling weight. Models are defined in Table 3.

Table 5. Association between practice sector at main practice and outreach to local towns^A stratified by base location^B of the specialist doctor^C

Unless indicated otherwise, data are given as the number of subjects in each group with percentages in parentheses. OR, odds ratio; CI, confidence interval

	Local towns	Distant towns	Univariate OR (95% CI)	P-value
Outreach by metropolitan-based specialist	<i>n</i> = 323	<i>n</i> = 255		
Practice arrangement				
Public only	94 (55%)	76 (45%)	Reference 1.0	
Private only	46 (46%)	48 (54%)	0.72 (0.43–1.21)	0.22
Mixed-mainly private	95 (59%)	65 (41%)	1.20 (0.76–1.87)	0.44
Mixed-mainly public	88 (57%)	66 (43%)	1.10 (0.70–1.74)	0.68
Outreach by rural-based specialist	<i>n</i> = 213	<i>n</i> = 61		
Practice arrangement				
Public only	38 (60%)	30 (40%)	Reference 1.0	
Private only	26 (83%)	5 (17%)	3.16 (1.01–9.94)	0.049
Mixed-mainly private	76 (92%)	7 (8%)	7.13 (2.74–18.60)	<0.0001
Mixed-mainly public	73 (81%)	19 (19%)	2.83 (1.35–5.93)	0.006

^ALocal towns included specialist doctors travelling to one or more towns <300 km from their residential location. Distant towns included travelling to at least one town ≥300 km away.

^BBase location coded according to the specialist's residential location, using Australian Standard Geographical Classification Remoteness Area (ASGC-RA) scale.¹⁶

^CAnalysis includes 852 specialist doctors who provided outreach services. Nine specialists (eight metropolitan, one rural) were missing observations about hours worked in different settings, so their practice sector could not be coded, and 41 specialists (30 metropolitan, 11 rural) predominantly worked in 'other' settings. Analysis includes cross-sectional sampling weight.

Table 6. Regional-level characteristics affecting outreach service distribution by metropolitan and rural doctors

Pattern	Characteristics of the hub and nearby towns	Mix of outreach services ^A
1	Isolated regional town with nearby remote communities with large hospital (≥ 100 beds) and formal plan for outreach from the regional town to remote towns nearby	Specialists living in the regional town provide most of the outreach to remote sites
2	Isolated regional town with small hospital (<100 beds); direct flights available to remote towns in catchment from metropolitan area	Remote towns supplied by metropolitan specialists also visiting the regional town
3	Regional town of various size in area of higher population concentration	Few specialists deployed from regional town; metropolitan specialists provide services to the regional or rural towns in the region, not both

^AOutreach to the regional town was provided primarily by metropolitan-based specialists in all cases.

on the ground to engage with local staff,¹⁹ work in a culturally sensitive way, use local referral networks, provide high-quality team-based handovers to conclude each visit²⁰ and allow for local staff to contact them between visits.² Given that 20% of Australia's rural population resides in 1500 communities of fewer than 5000 people,⁸ deciding about where to provide FIFO services also needs to be sensitive to sustainability, efficiency and equity principles.

The large number of DIDO services provided by metropolitan specialists is likely to be related to delivering services to larger regional centres near major cities. This is potentially related to the specific equipment or staff needs of subspecialists and proceduralist specialists. Nearby regional towns may also offer higher financial return than more remote locations because of the size of regional communities and their potential willingness to pay to offset the costs of regularly seeking care in metropolitan areas. However, it is also possible that outreach is overused in regional areas when permanent services are viable.¹² A key policy challenge is to ensure that outreach services to regional areas focus on specialties that best complement, and do not detract from, existing rural-based services, and that they are not concentrated in one regional town without considering the needs of other rural communities.

Rural specialists provided a smaller proportion of DIDO services and a higher proportion of hub-and-spoke services compared with metropolitan specialists, but rural services overall are not as far-reaching.

Practice sector

The sector of practice made no difference to how far specialists travelled from metropolitan locations, probably because of the better access to expedient transport by flight, which limits the loss of income related to travel time. Conversely, rural specialists working in mixed or private practice are likely to travel nearby, perhaps to ensure the practice is financially sustainable. Outreach services by private rural specialists could enhance in-referral and limit the pressure on the public sector, where fewer specialists work overall. However, it is important that they are coordinated and targeted to reach communities most in need of care, not just those able to pay. Informal as well as formal links between rural specialists in the same region are likely to increase the chance that specialists in different sectors know who is going where and when. Implementing more deliberate strategies, such as clinical networks,

could also be important to promote coordinated regional service delivery between the public and private sector.²¹

Regional context

The characteristics of regions including how isolated they are, the population concentration, the size of regional hospital, whether outreach is formally planned and the availability of air transport has the potential to affect the distribution of regionally-based outreach services. This means that the supply of specialists will vary by regional context. In the Northern Territory, specialist outreach services are formally planned and other proposed outreach services are expected to communicate with planned services.²² This is likely to reinforce regionally-based outreach, but is not pragmatic for regional areas with smaller hospitals and fewer local specialists.

The disorganised mix of rural and metropolitan-based specialists apparent across more densely populated regions, suggests they are likely to benefit from developing: (1) a clear position about the role of outreach to and from the regional centre and the services the public sector will deploy; (2) systems to remain abreast of local outreach activity; and (3) methods to develop partnerships that promote integrated service delivery and services that match regional need.

Limitations

The present study was limited to the spatial dimension of accessibility (locations visited), not the frequency of visits or the nature or quality of the outreach work. We were restricted to using MABEL covariates to describe the models, so we could not measure more than three locations per specialist, the transport mode or exact regional boundaries. The 300 km cut-off for the local travel model is reasonable for more populated states, but may not sensitively reflect the size of regional boundaries in areas of low population density. However, straight-line distance calculations underestimate the distance travelled by road, potentially overestimating the proportion of specialists providing services <300 km away.

Despite weighting the analysis, there is some potential for bias from other unweighted covariates, namely childhood years of rural background, practice management and overall work satisfaction.

Data from 2008 were used to show the complexity of outreach systems. These findings are relevant to current policy and planning challenges.

Conclusion

The spatial distribution of services and models of rural outreach by specialist doctors are inherently complex and vary according to where specialists live, the practice sector of rural specialists and the regional context. The variation in service patterns highlights the capacity to better use outreach services by specialists living in different locations, as well as the risks that need to be mitigated to promote integrated and accessible services. Given specialists commonly visit a single location, considerable effort is needed to ensure services are appropriately targeted and that services from metropolitan and rural areas are coordinated. Rather than one simple policy solution, the complexity of service patterns highlights the need for multilevel policy and planning to promote integrated and accessible outreach in rural and remote Australia.

Competing interests

None declared.

Acknowledgements

This publication used data from the MABEL longitudinal survey of doctors conducted by the University of Melbourne and Monash University. Funding for MABEL comes from the National Health and Medical Research Council (Health Services Research Grant 2008–11 and Centre for Research Excellence in Medical Workforce Dynamics 2012–16), with additional support from the Commonwealth Department of Health (in 2008) and Health Workforce Australia (in 2013). BOS was supported by an Australian Postgraduate Award.

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