

What is a reasonable length of employment for health workers in Australian rural and remote primary healthcare services?

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Abstract

Background. Optimising retention of rural and remote primary healthcare (PHC) workers requires workforce planners to understand what constitutes a reasonable length of employment and how this varies. Currently, knowledge of retention patterns is limited and there is an absence of PHC workforce benchmarks that take account of differences in geographic context and profession.

Methods. Three broad strategies were employed for proposing benchmarks for reasonable length of stay. They comprised: a comprehensive literature review of PHC workforce-retention indicators and benchmarks; secondary analysis of existing Australian PHC workforce datasets; and a postal survey of 108 rural and remote PHC services, identifying perceived and actual workforce-retention patterns of selected professional groups.

Results. The literature review and secondary data analysis revealed little that was useful for establishing retention benchmarks. Analysis of primary data revealed differences in retention by geographic location and profession that took time to emerge and were not sustained indefinitely. Provisional benchmarks for reasonable length of employment were developed for health professional groups in both rural and remote settings.

Conclusions. Workforce-retention benchmarks that differ according to geographic location and profession can be empirically derived, facilitating opportunities for managers to improve retention performance and reduce the high costs of staff replacement.

What is known about the topic? Health services located in small rural and remote locations are likely to continue to experience workforce shortages and high costs of recruitment. Health workforce retention is therefore crucial. However, effective rural health workforce planning and use of strategies to maximise retention of existing health workers is hindered by inadequate knowledge about baseline employment-retention patterns.

What does this paper add? Differences in health worker retention patterns by geographic location and profession are most evident after the first 6 months through until the end of the second year of employment. Health worker-retention benchmarks that differ according to geographic location and profession are proposed.

What are the implications for practitioners? Benchmarking workforce retention in comparable health services can enable identification of best practice and the underpinning retention strategies. Workforce planners can use this, together with knowledge of baseline retention patterns and the high cost of staff replacement, to guide the design, timing and implementation of cost-neutral retention strategies.

Additional keywords: Aboriginal health workers, allied health, benchmark, costs, costs analysis, doctors, managers, nurses, retention, workforce.

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Introduction

A key factor in ensuring sustainability of primary healthcare (PHC) services in rural and remote Australia is the maintenance of

an adequate, appropriately qualified health workforce.¹ Persistent workforce undersupply translates into recruitment difficulties to these areas, which combines with high staff turnover to result in

restricted access to appropriate PHC for many rural and remote residents.

Despite a raft of government measures to improve workforce supply in rural and remote areas, recruitment of health workers to rural areas remains problematic.^{2,3} Health services in these areas must therefore focus on retaining health workers for as long as feasible through minimising avoidable turnover of staff and the associated high costs of their replacement.

Optimal workforce retention is vital to efficient functioning of health services and delivery of improved health outcomes.⁴ Employee longevity is important because it takes time for the worker and client to build trust and interact successfully. Good employee retention also results in improved patient care as managers have a more experienced group of healthcare workers who require less direct supervision. This in turn can enhance workforce stability and job satisfaction, and result in higher productivity, the delivery of continuous, high-quality healthcare, greater patient satisfaction and lower costs.⁵ In contrast, high turnover is linked to reduced productivity and burnout of staff covering the vacant position, thereby affecting the organisation's ability to fulfil its program goals.⁶

Optimising retention does not imply an indefinite length of service in one location. Career progression invariably necessitates movement between positions, services and organisations, and most health services seek some staff change. Nevertheless health services aim to minimise avoidable premature departure of their staff through workforce strategies designed to retain staff for some critical minimum length of service.⁷⁻⁹ Exactly what constitutes a sufficient length of service is likely to vary according to profession and position, as well as by geographic location and characteristics of the community and health service. Unfortunately, little is known about existing retention patterns, and what retention benchmarks are appropriate to guide health workforce planning. This hinders our understanding of the effectiveness of retention strategies.

This article identifies what might be a reasonable length of employment for selected PHC workers in Australian rural and remote services, based on the performance indicator health worker median survival.¹⁰ The objective is to develop workforce-retention benchmarks for this indicator (and for the complementary indicators survival probability after 12 and 24 months of employment) that take account of differences in geographic context and profession, and to discuss the implications for workforce-retention strategies.

Health workforce benchmarking

Benchmarking can be simply defined as 'finding and implementing best practice.'¹¹ The simplicity of this definition belies the considerable power that benchmarking has to promote and manage change, most notably within a quality-improvement framework. Although benchmarks are numerical values that are tied to corresponding performance indicators (and sometimes to financial rewards or penalties),¹² it has been noted that to maximise the scope for improvement it is important to emphasise the processes involved rather than the numerical values.¹³ These processes include:

- identifying what aspect of healthcare delivery to benchmark and who to benchmark against,
- identifying suitable performance indicators and deriving benchmarks with which to make comparisons with peers,
- identifying outperformers and investigating the underlying practices that drive their superior achievements, and
- implementing best practices and monitoring to ensure sustained improvement.¹⁴

The benchmarking process consumes scarce resources, and therefore must focus on a small number of the most important and challenging goals that are central to a healthcare organisation's purpose. Retaining an adequate health workforce is recognised as being fundamental to the performance of rural and remote health services, especially to their sustainability.¹⁴⁻¹⁶ It remains crucial, therefore, to identify performance indicators and their benchmarks relevant to the retention of health workers in rural and remote health settings.

The identification of understandable, feasible and responsive retention indicators and setting corresponding workforce benchmarks for use within rural and remote Australian health services is still in its infancy. The process has been dogged by a lack of accessible, specific and high-quality data and inconsistencies in how different health professional groups are defined and workforce data is collected.^{17,18} This limits comparative analysis even when data are accessible. Nevertheless, health services can gain financially from benchmarking health worker retention if employee retention can be optimised and high costs of recruitment subsequently reduced.

Methods

Three broad strategies were employed to examine workforce-retention patterns, identify relevant indicators and develop benchmarks. First, a comprehensive literature review (both 'black' and 'grey') of relevant rural and remote PHC workforce performance indicators and benchmarks was undertaken.^{19,20}

Second, existing health workforce datasets from Australian, state and territory health authorities and rural workforce agencies were sought in order to undertake analysis of retention patterns that could inform the setting of benchmarks. In particular, de-identified individual-level data were sought that could be used for the calculation of Kaplan–Meier survival probabilities and median survival.

Third, a survey was posted to a stratified random sample of 108 health services located in Rural, Remote and Metropolitan Areas 5, 6 or 7.²¹ Services were stratified by jurisdiction and service type.¹⁹

The survey questionnaire collected data including:

1. de-identified commencement and exit dates for all doctors, nurses, allied health professionals (AHP), Aboriginal health workers and health service managers employed at each service at any time between 1 January 2003 and 31 August 2009;
2. total direct costs associated with replacing each type of health professional; and
3. managers' perceptions of workforce retention.

Descriptive statistical analysis and estimation of Kaplan–Meier survival probabilities and Cox proportional hazards modelling²² was undertaken using StataIC, release 10. Analysis took account of right-censoring (ongoing employment at end of observation period), left-truncation (commencement of

employment before start of observation period) and clustering of sampling of employees (by health service).

A Reference Group comprising senior policy advisors and workforce data experts assisted with scoping the study, maximising access to available relevant literature and data, and dissemination and take up of the study outcomes.

Empirically based retention benchmarks for:

1. reasonable length of employment (median survival);
2. survival probability after 12 months of employment; and
3. survival probability after 24 months of employment

were derived by evaluating health worker-retention data obtained using all three strategies. Benchmarks were validated through site visits to five PHC services across different rural and remote settings.¹⁹ Ethics approval for the study was obtained from the Flinders University Ethics Committee.

Results

Patterns of workforce retention and costs of turnover in rural and remote PHC services

A comprehensive literature search revealed that most of the measures of Australian health workforce turnover and retention reported in the literature (including annual turnover rates, stability rates after 1 and 2 years, length of service in current location, and average length of service in current location) are largely unsuitable for establishing retention benchmarks for what might be a reasonable length of employment. Reports of employment-survival probabilities, the most useful measure reflecting average length of employment of all employees (i.e. both former and current), were largely absent in the literature. One notable exception showed the unadjusted median survival of around 16 months for Northern Territory hospital nurses and around 21 months for remote area nurses during the period 1995–2007.²³ Another indicated that the unadjusted median survival for AHP was similar in rural compared with remote Victorian health services (1.7 and 2.1 years respectively).²⁴

The second strategy, securing access to longitudinal, de-identified individual-level secondary data from the Australian Government Department of Health and Ageing (Medicare data), state and territory health authorities and workforce agencies was largely unsuccessful, despite the existence of significant amounts of health workforce data that are routinely collected by these agencies. National datasets maintained by rural workforce agencies and the Australian Institute of Health and Welfare are cross-sectional. Those collected by the Australian Bureau of Statistics are not accessible at de-identified unit record level. Those data provided by four state health authorities were limited in usefulness for estimating health service survival probabilities because length of service related to tenure with the entire health authority rather than a specific health service. Additional data limitations included: access to de-identified individual-level commencement and exit data being refused; fields of interest, such as geographic location of health service, not being accurately maintained in centralised health authority databases; and definitions of specific health disciplines not being consistent across jurisdictions.

Empirical evidence of existing patterns of workforce retention therefore largely depended on the collection and analysis of primary data. Of the 108 health services approached to

participate, 44 surveys were returned; 33 of these provided employee commencement and exit data. Of the non-responders, 11 declined to participate, 17 indicated that they did not have the capacity to provide data within the timeframe required, and others were unable to provide data on all employees but instead provided only partial data, such as for current or recent employees but not others. Twenty services provided data on 1285 employees of sufficient quality and completeness for calculation of survival probabilities. Of these, 12 health services were located in small rural towns providing data on 776 employees, and eight health services were in remote locations providing data on 509 employees. Most employees were either nurses (69%) or AHP (21%). Unfortunately because of the small numbers of services participating, our survey obtained data on relatively small numbers of doctors (67), Aboriginal health workers (39) and health service managers (22).

Although not attaining statistical significance, differences in employee retention according to geographic location began to emerge 6 months after commencement and were sustained for the next 18 months. Retention patterns according to profession showed a similar but statistically significant pattern, with further examination of these differences (Fig. 1) revealing that retention of nurses was 53% longer in health services in small rural towns compared with those in remote locations (hazard ratio 1.53; 95% CI 1.01, 2.30, modelling not shown). Retention patterns for AHP exhibited little difference according to geographic location.

Cox proportional hazards modelling confirmed that AHP were statistically significantly more likely than nurses to leave employment (Table 1, Model 1). After adjustments for remoteness AHP were 78% more likely to leave employment (hazard ratio 1.78; 95% CI 1.28, 2.48) compared with nurses (Table 1, Model 2).

The estimated median direct costs of replacement of health workers were highest for doctors (\$74 000) and lowest for Aboriginal health workers (\$13 700) (Table 2). The range of cost estimates of replacing staff was very large, within and between professional groups.

In general, surveyed health service managers considered 2 years to be a reasonable length of employment for doctors,

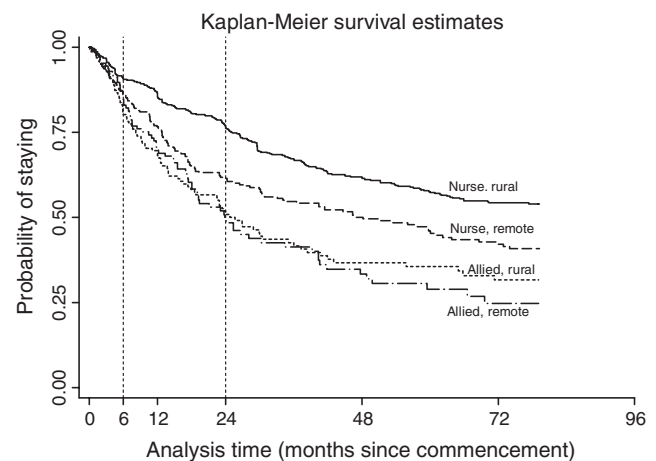


Fig. 1. Workforce survival curve by rurality and remoteness (rural, remote and metropolitan areas classification), and health discipline.

Table 1. Cox proportional hazards regression models showing relative hazard of leaving employment
CI, confidence interval; RRMA, rural, remote and metropolitan areas classification

Reference	Variable	Model 1		Model 2	
		Hazard ratio	95% CI	Hazard ratio	95% CI
Nurse	Doctor	1.81	0.61, 5.38	1.68	0.52, 5.44
	Allied health professional	1.84	1.36, 2.50	1.78	1.28, 2.48
	Aboriginal health worker	0.97	0.36, 2.66	0.87	0.31, 2.47
	Manager	0.76	0.44, 1.33	0.76	0.44, 1.32
Rural (RRMA 5)	Remote (RRMA 6 and 7)			1.23	0.78, 1.91

Table 2. Health worker total direct replacement costs in small rural and remote health services

Due to skewed data the median is a better measure of central tendency than the mean

Discipline	Total replacement cost ^A		n
	Median (\$)	Interquartile range (\$)	
Nurse	19 300	7028–36 000	23
Doctor	74 000	66 000–111 312	8
Allied health professional	21 925	8500–34 238	12
Aboriginal health worker	13 700	3534–43 600	5
Manager	29 600	16 500–36 000	13

^ATotal replacement cost = cost of vacancy + cost of recruitment + cost of orientation and training.

nurses, physiotherapists, mental health workers, psychologists, social workers, podiatrists and Aboriginal health workers, and 3 years for health service managers. There was, however, considerable variability in health manager perceptions, even after taking geographic location and profession into account. Perceptions of a reasonable length of employment for rural nurses, for example, ranged between 12 months and 20 years.

Deriving workforce-retention benchmarks that take account of differences in profession

Smoothing of the (unadjusted) survival curves derived from our primary data (and inspection of the Cox proportional hazards Model 1 in Table 1) revealed that, overall, retention of health service managers was highest (Fig. 2). This observation accorded

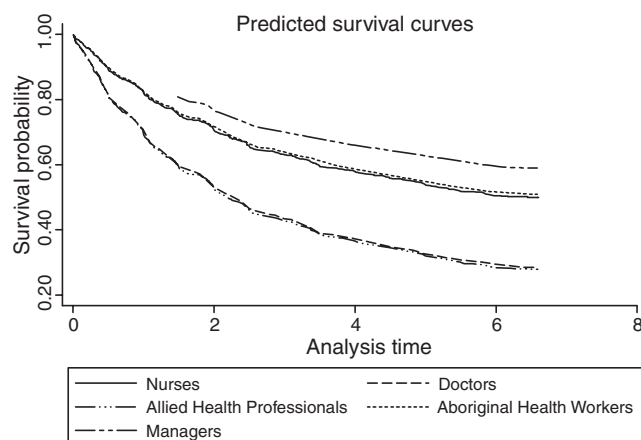


Fig. 2. Predicted workforce survival curve by health discipline.

with managerial perceptions of longer periods of retention being reasonable for managers compared with other types of health workers. Health service managers were less able to differentiate between reasonable retention of nurses, doctors, AHP and Aboriginal health workers, despite differences being apparent in our primary data survival analysis.

Deriving workforce-retention benchmarks that take account of differences in geographic locations

Health service managers of both remote and small rurally located health services similarly perceived 2 years to be a reasonable employment length for most health workers. Primary data analysis, however, indicated differences in retention emerging between 6 and 24 months after commencement of employment, associated with an estimated 22% increased hazard of leaving employment for remote health workers compared with health workers in rural locations. Whilst not statistically significant when analysis extends to cover longer periods of employment, empirical research by Chisholm *et al.*²⁴ revealed a similar pattern evident in early phases of employment. Taking into account (1) the importance of retaining health workers for some critical minimum amount of time, so that problems associated with initial reduced productivity and high turnover can be curtailed, and (2) that significant differences according to geographic location emerge within the first 2 years of employment, at least for some professional groups, benchmarks were proposed that also differed according to geographic location.

Suggested empirically based benchmarks that differ according to profession and geographic location are presented in Table 3. Further adjustment to these benchmarks could be made for additional factors known or subsequently shown to be significant influences on the risk of employees leaving, for example, employee age, size of the service and provision of incentives.

Visits to five health service managers in five different sites provided an opportunity to present data about the retention performance of their health service in conjunction with the proposed reasonable length of employment benchmarks. The managers were able to authenticate that the proposed benchmarks were both appropriate and useful.

Discussion

There is great potential for the Australian rural and remote health workforce to be strengthened by establishing agreed indicators of workforce retention with corresponding performance benchmarks. Specifically, this research proposes preliminary benchmarks for reasonable length of employment according to

Table 3. Proposed retention benchmarks according to discipline and geographic location

Discipline	Rural ($\leq 10\,000$ population)			Remote		
	Median survival	12-month survival probability	24-month survival probability	Median survival	12-month survival probability	24-month survival probability
Nurse	5	0.80	0.67	3.5	0.78	0.64
Doctor	3	0.75	0.60	2	0.68	0.50
Allied health professional	3	0.75	0.60	2	0.68	0.50
Aboriginal health worker	3	0.75	0.60	3	0.75	0.60
Manager	5	0.80	0.67	3.5	0.78	0.64

geographic context and health worker profession. Two complementary indicators, survival probabilities after 12 and 24 months' employment, and their corresponding benchmarks are also proposed.

Our study illustrates how empirically derived workforce-retention benchmarks can be developed using analysis of existing health service human resources datasets, and triangulation with other sources of evidence, including health manager perceptions of workforce retention, existing published black and grey retention literature, and analysis of other existing secondary data sources. Of course, these are not the only methodologies. External benchmarking with non-health sector Australian rural and remote workforces, or even with international comparators, are alternative approaches.

For several reasons, the specific numerical benchmark values proposed should be used with some caution. First, and most importantly, it is better to emphasise the underlying quality-improvement process that these benchmarks can drive, rather than the actual values. Second, the primary data may be biased toward reflecting better-managed PHC services capable of generating reliable workforce data. Third, the small number of health services providing primary data limits the confidence that we can have in the results. A similar study collecting data through face-to-face visits to health service managers (rather than through mailed surveys) yielded a far higher response rate and better-quality data.²⁴

Notwithstanding these caveats, our findings are consistent with other Australian health workforce-retention studies^{23–25} and provide important new insights. First, they highlight important differences in the patterns of workforce retention by professional discipline and geographic location. It is important, therefore, to differentiate workforce retention benchmarks accordingly. Of note, the scope of this research did not extend to analysis and comparison of retention patterns experienced in health services located in rural centres with a population $>10\,000$. Further research is indicated to determine whether differences in retention patterns observed in the present study extend to these larger rural centres.

Second, by simultaneously extending our understanding of rural and remote health worker-retention patterns and costs of recruitment, an opportunity is provided for health service managers to make more efficient use of existing funding to enhance retention through careful structure and timing of incentives. For example, knowing that the median survival of AHP is 2 years (Fig. 1) and the total direct cost of replacing an AHP is \$22 000 (Table 2), a \$10 000 retention bonus offered to each AHP after completing an additional third year of service could improve retention and continuity of care and reduce recruitment costs.

Here it is worth noting that direct replacement costs underestimate the total costs of health worker replacement. A recent study that factored in both direct and indirect costs estimated median replacement costs for rural AHP to be approximately \$27 000 and \$46 000 for remote AHP.²⁴

Whichever indicators are used to develop appropriate workforce-retention benchmarks, the capacity to record commencement and separation dates and manage these data remains essential for all rural and remote health services, so that appropriate comparisons can be made. This requires standardisation of data collection, extraction, cleaning, analysis, compilation and reporting, rather than the current patchy and *ad hoc* approach. Accordingly, funders need to strengthen the capacity of services (infrastructure, training and human resource requirements) to collect and analyse appropriate workforce data if consistent national data aggregation and monitoring is to be a reality.

Conclusions

Despite the numerous health workforce recruitment and retention initiatives, it is probable that health services located in small rural and remote locations will continue to experience workforce shortages and high costs of recruitment.³ It therefore remains important that health services in these locations optimise the retention of their health workforce, and minimise avoidable staff turnover. Importantly, our research has demonstrated how evidence from a range of different sources can be triangulated to establish retention benchmarks appropriate to discipline and context. Although the benchmarks are tentative, they provide a much better comparator of average rural or remote health worker retention than has previously been available.

Further, through identifying workforce performance indicators and their corresponding benchmarks according to geographic location and profession, this research has the potential to assist managers to better understand their baseline retention patterns, and how they compare with other similar services. This, in turn, provides improved possibilities for identifying best practice in health worker retention, and subsequent adoption of more effective retention strategies through quality-improvement processes, ultimately benefitting the health worker (through better support), the health service (through greater staff stability and retaining staff with high-level skills and experience) and the community (through improved continuity and quality of care). Most importantly, such evidence-based improvements can be implemented without additional costs to either the health service or the regional health authority.

Competing interests

The authors declare that they have no competing interests.

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References

- Productivity Commission. Australia's Health Workforce. Productivity Commission Research Report. Canberra: Commonwealth of Australia; 2005. Available at <http://www.pc.gov.au/projects/study/health-workforce/docs/finalreport> [verified 7 May 2012].
- Buykx P, Humphreys J, Wakerman J, Pashen D. Systematic review of effective retention incentives for health workers in rural and remote areas: towards evidence-based policy. *Aust J Rural Health* 2010; 18: 102–9. doi:10.1111/j.1440-1584.2010.01139.x
- Health Workforce Australia. Health Workforce 2025 – Doctors, Nurses and Midwives – Volume 1. Adelaide: 2012. Available at <https://www.hwa.gov.au/health-workforce-2025> [verified 7 May 2012].
- World Health Organization. Improving Health Worker Performance: In Search of Promising Practices. Geneva: WHO; 2006. Available at http://www.who.int/hrh/resources/improving_hw_performance.pdf [verified 7 May 2012].
- Arnold E. Managing human resources to improve employee retention. *Health Care Manag (Frederick)* 2005; 24: 132–40.
- Fang YQ. Turnover propensity and its causes among Singapore nurses: an empirical study. *Int J Hum Resour Manage* 2001; 12: 859–71.
- Humphreys JS, Wakerman J, Wells R, Kuipers P, Jones J, Entwistle P, et al. Improving primary health care workforce retention in small rural and remote communities – How important is ongoing education and training. Canberra: Australian Primary Health Care Research Institute; 2007. Available at <http://aphcri.anu.edu.au/content/stream-six-workforce/improving-primary-health-care-workforce-retention-small-rural-and-remote> [verified 7 May 2012].
- Waldman JD. Change your metrics: if you get what you measure, then measure what you want – retention. *J Med Pract Manage* 2006; 22: 13–9.
- Waldman JD, Arora S. Measuring retention rather than turnover: a different and complementary HR calculus. *Human Resour Plan* 2004; 27: 6–9.
- Russell DJ, Humphreys JS, Wakerman J. How best to measure health workforce turnover and retention: five key metrics. *Aust Health Rev* 2012; 36: 290–295.
- Camp RC, Tweet AG. Benchmarking applied to health care. *Jt Comm J Qual Improv* 1994; 20: 229–38.
- National Health and Hospital Reform Commission. Beyond the blame game: accountability and performance for the next Australian Health Care Agreements. Canberra: NHHRC; 2008. Available at [http://www.health.gov.au/internet/nhhrc/publishing.nsf/Content/504AD1E61C23F15ECA2574430000E2B4/\\$File/BeyondTheBlameGame.pdf](http://www.health.gov.au/internet/nhhrc/publishing.nsf/Content/504AD1E61C23F15ECA2574430000E2B4/$File/BeyondTheBlameGame.pdf) [verified 7 May 2012].
- National Rural Health Alliance. Rural health information papers. Best practice for rural and remote health services. Canberra: NRHA; 1997. Available at <http://nrha.ruralhealth.org.au/cms/uploads/publications/rhip1.pdf> [verified 7 May 2012].
- National Health Ministers' Benchmarking Working Group. First national report on health sector performance indicators. Canberra: 1996. Available at <http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=6442454193> [verified 7 May 2012].
- Australian Institute of Health and Welfare. Rural, regional and remote health. Information framework and indicators. Version 1. AIHW cat. no. PHE 44. Canberra: 2003. Available at <http://www.aihw.gov.au/publication-detail/?id=6442467477> [verified 7 May 2012].
- Australian Institute of Health and Welfare. Rural, regional and remote health. Information framework and indicators. Version 1b. Rural Health Series Number 6. AIHW cat. no. PHE 69. Canberra: 2005. Available at <http://www.aihw.gov.au/publication-detail/?id=6442467780> [verified 7 May 2012].
- Health Workforce Australia. Aboriginal and Torres Strait Islander health worker project: Interim Report. Adelaide: 2011. Available at <https://www.hwa.gov.au/sites/uploads/atshw-project-interim-report-20111017.pdf> [verified 7 May 2012].
- Keane S, Smith T, Lincoln M, Fisher K. Survey of the rural allied health workforce in New South Wales to inform recruitment and retention. *Aust J Rural Health* 2011; 19: 38–44. doi:10.1111/j.1440-1584.2010.01175.x
- Humphreys JS, Wakerman J, Kuipers P, Wells B, Russell D, Siegloff S, et al. Improving workforce retention: developing an integrated logic model to maximise sustainability of small rural & remote health care services Canberra: Australian Primary Health Care Research Institute; 2009. Available at <http://aphcri.anu.edu.au/research-program/aphcri-network-research-completed/stream-twelve-extension-funding-workforce/improving-workforce> [verified 7 May 2012].
- 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; 2009. Available at <http://aphcri.anu.edu.au/research-program/aphcri-network-research-completed/stream-sixteen-rapid-response-projects/retention-strategies-and> [verified 7 May 2012].
- Department of Primary Industries and Energy. Rural, Remote and Metropolitan Areas Classification 1991 Census Edition. Canberra: Australian Government Publishing Service; 1994. Available at http://www.pc.gov.au/_data/assets/pdf_file/0004/45724/subdr096.pdf [verified 7 May 2012].
- Collett D. Modelling survival data in medical research. London: Chapman & Hall/CRC; 2003.
- Garnett S, Coe K, Golebiowska K, Walsh H, Zander K, Guthridge S, et al. Attracting and Keeping Nursing Professionals in an Environment of Chronic Labour Shortage: A Study of Mobility Among Nurses and Midwives in the Northern Territory of Australia. Darwin: Charles Darwin University Press; 2008. Available at <http://cdupress.cdu.edu.au/books/documents/NTNurseandmidwifeturnover.pdf> [verified 7 May 2012].
- Chisholm M, Russell D, Humphreys J. Measuring rural allied health workforce turnover and retention: what are the patterns, determinants and costs? *Aust J Rural Health* 2011; 19: 81–8. doi:10.1111/j.1440-1584.2011.01188.x
- Doiron D, Jones G. Nurses' retention and hospital characteristics in New South Wales. *Econ Rec* 2006; 82: 11–29. doi:10.1111/j.1475-4932.2006.00290.x