



S6.9 Estimating the supply of the health workforce

Supplementary technical information for Chapter 6.9 'Supply of the health workforce for the Indigenous population'.

Methodology

The Geographically-adjusted Index of Relative Supply (GIRS) takes the provider-to-population ratio (or FTE rate—full-time equivalent providers per 1,000 population, also known as 'workforce supply') in an area, and adjusts it for three other factors: population dispersion, land size and proximity to services. This supplementary document briefly highlights the methodology underpinning the calculation of the GIRS across seven professions—general practitioners (GPs), nurses, midwives, pharmacists, dentists, psychologists and optometrists (AIHW 2016a).

Indicators

The following infographic illustrates the indicators used to measure each of the four concepts in the GIRS:



Workforce supply is represented by FTE rates. Land size is measured in square kilometres. Population density (population/square kilometre) is used as an indicator of population dispersion, as a more direct indicator is not available. There may be some geographically large areas with low population densities where the population is not dispersed, but concentrated within particular areas.

The extent to which the population in one area can access services (within and across the boundaries of their own area) is captured by the percentage of the population who are outside a 1-hour drive time to a relevant service location, which may either be in that area or in a nearby area.

To calculate the GIRS score, each of its four components is assigned an integer value between 0 and 2, with 0 suggesting the greatest challenges (Table A6.9.1). The scores for population density and land size are constant across the professions, while the scores for workforce supply and proximity vary by profession.



Table A6.9.1: Method for assigning scores to the four GIRS components

Score	Range of values to which score assigned, by GIRS component			
	FTE rate, by profession ^(a)	Population density	Land size	Population outside a 1-hour drive, by profession ^(b)
0	Lowest 25% of FTE rates	Least densely populated 25%	Largest 25%	Greater than 50%
1	Middle 50% of FTE rates	Middle 50%	Middle 50%	Between 1 and 50%
2	Highest 25% of FTE rates	Most densely populated 25%	Smallest 25%	Less than 1.0%

(a) FTE rates are calculated for the total population.

(b) Rounded to the nearest percentile. Population refers to the total population in the SA2 (Statistical Area Level 2).

The supply rates are based on quartiles—the bottom 25% of areas are assigned a score of 0, the middle 50% are assigned a score of 1, and the 25% with the highest FTE rates are assigned a score of 2.

The least densely populated areas (bottom 25%) are assigned a score of 0, the middle 50% are assigned a score of 1, and the most densely populated (top 25%) are assigned a score of 2.

For land size, areas in the top quartile of size (that is, the largest) are assigned a score of 0, those in the middle 50% are assigned a score of 1, and the smallest 25% are assigned a score of 2.

The proximity to service measure is based on the population outside a 1-hour drive time to a particular service. The 1-hour drive time is often considered to be the maximum time people should have to travel to access primary or emergency health care, including for birthing services (for example, see Bagheri et al. 2008; Lerner & Moscati 2001).

The percentages of each SA2 (Statistical Area Level 2) population who are outside a 1-hour drive time are coded against a set standard. Areas where less than 1.0% of the population is outside a 1-hour drive to a service are assigned a score of 2; areas where between 1.0% and half the population are outside a 1-hour drive are assigned a score of 1; and areas where more than half the population is outside a 1-hour drive are assigned a score of 0. Importantly, the proximity measure takes into account the extent to which the population can access services in adjacent SA2s as well as in the SA2 for which the GIRS score is being calculated.

Workforce supply, land size and population dispersion indicator scores are based on relative comparisons within each of the components. That is, FTE rates in the bottom 25% are relatively low compared with those in the next 50%, which are (in turn) lower than those in the top 25%.

The cut-off scores for the proximity measures are not meant to reflect specific statistical thresholds. Rather, they are based on the premise that a given region will face workforce supply challenges if a proportion of its population is not able to access services within a 1-hour drive time. With this in mind, areas where no-one (as measured by a rounded score of less than 1.0% of the population) is outside a 1-hour drive were assigned a score of 2.



The remaining areas were assigned a score of 1 if only a minority (less than 50%) of the population is outside a 1-hour drive, and a score of 0 if a majority (more than 50%) of the population is outside a 1-hour drive.

These scoring systems were developed so that low scores represent the extreme cases, and so that the scoring system is transparent and easily understood. However, these are, to some extent, arbitrary categorisations and different scoring systems would yield different results. For example, further restriction of the low and high categories would yield fewer areas with high and low overall GIRS scores. Future work will test different specifications.

The scores for the four GIRS components are then added together to derive a GIRS score for that area and profession, between 0 and 8. Areas with scores of 0 are likely to face the most challenges in terms of workforce supply.

Data sources

This section outlines the data sources that underpin the GIRS.

Workforce supply

Data on the numbers, locations and hours worked by health practitioners were sourced from the 2014 National Health Workforce Data Set (NHWDS) (AIHW 2016b). The 2014 data were the most recent available when developing the GIRS.

The data for the GIRS were restricted to those for currently employed health practitioners working in clinical roles in their area of registration, as the focus of this analysis is the 'on-the-ground' workforce providing direct patient care.

The lowest level of geospatial specificity available in the NHWDS was postcode and suburb of the provider's main practice location. Where the location could be directly matched to an SA2 (using concordances), provider numbers and FTEs were assigned to that SA2. Where a single postcode/suburb combination was split into multiple SA2s, the practitioner supply was distributed among the SA2s according to the population distribution of the SA2s, using estimated resident population data from the Australian Bureau of Statistics.

The numbers of providers and their FTEs are summarised in Table A6.9.2. The FTE numbers were used as the numerators in calculating the FTE rates.

Table A6.9.2: Number of health professionals working in clinical roles with valid SA2 codes

Profession	NHWDS 2014 data	
	Number	FTEs
General practitioners	26,757	25,858
Nurses	261,798	222,782
Midwives	20,915	12,866
Dentists	13,474	12,788
Pharmacists	19,733	18,507
Psychologists	20,700	17,700
Optometrists	4,126	3,864



The NHWDS has three main limitations, described here. For a fuller discussion of the implications of these limitations, see AIHW 2016a.

- If a provider works at more than one location, all of his/her hours are included, but they are attributed to the primary location only.
- Data on hours worked are self-reports and not everyone completed the optional survey.
- The addresses of practice locations were not available, so postcodes/suburbs were used to allocate data to the SA2 level.

Despite these potential effects, the NHWDS was the best source of data for this analysis as it included national-level data, a number of professions, and information on hours worked.

Population dispersion (population density) and land size

Population data were sourced from the Estimated Resident Aboriginal and Torres Strait Islander and Non-Indigenous Population, SA2—30 June 2011 data cube (ABS 2013).

These data include numbers of Indigenous, non-Indigenous and total residents at the SA2 level. However, there are some qualifiers to these data:

- The Australian Bureau of Statistics did not report population data for 52 SA2s; those 52 SA2s have been excluded from the analyses. The majority of these areas were industrial areas, airports or parkland.
- There were 52 SA2s with fewer than 100 residents. These SA2s were excluded because rates with denominators less than 100 tend to be unreliable.
- The final number of SA2s eligible for the GIRS analyses was 2,092.

There were an additional 23 SA2s for which total population data were reported, but no breakdown by Indigenous status was provided. These areas have been included in the GIRS calculations, but the numbers of Indigenous and non-Indigenous people living in those areas could not be included in analyses requiring disaggregation by Indigenous status. The total population data for each SA2 were used as the denominator for the FTE rates, and as the numerator for the population density variable.

Land size (measured in square kilometres) is a property of each SA2 and was released as part of the Australian Statistical Geography Standard in 2011 and is available from the Australian Bureau of Statistics in a number of data cubes, including the Regional Population Growth, Australia, 2013–14 data cube (ABS 2015). Land size is used on its own as well as in the denominator of the population density variable.

Proximity to services

Including a measure of spatial proximity to services in the GIRS provides an estimate of how close the population within a region lives to available services. This includes where those services may be in neighbouring areas. The NHWDS does not provide the specific location information required to calculate the proximity measure. For some professions, data are available from other sources on service locations. For other professions, however, proxy variables were required. Table A6.9.3 summarises the service location indicators used for each of the seven professions and the source of the data, with more details provided in AIHW 2016. Table A6.9.4 provides information on how many service locations were included.



Table A6.9.3: Service location included in the GIRS, by profession and data source

Profession	Service location indicator	Source
GPs	GP practices	Existing GP practice locations from the 2013 Medical Directory of Australia; these were double-checked against other sources.
Nurses	Public hospitals and Indigenous-specific primary health care services (ISPHCS)	Data on public hospitals, including multipurpose health centres, are held by the AIHW. ISPHCS locations include those that report to the Online Services Reporting (OSR) and/or nKPI collections held by the AIHW.
Midwives	Hospitals with public birthing units	Data on the locations of hospitals with public birthing facilities were sourced by the AIHW as part of analyses for AIHW 2017.
Pharmacists	Pharmacy locations	Geocoded locations of community pharmacies were supplied to the AIHW by the Pharmacy Guild.
Dentists	GP practices (proxy)	As above
Psychologists	GP practices (proxy)	As above
Optometrists	GP practices (proxy)	As above

Table A6.9.4: Number of service locations included

Service location	Number
GP practice locations	7,601
Public hospitals (including multipurpose health centres)	677
ISPHCS	305
Hospitals with public birthing units	220
Community pharmacies	5,776

The GIRS scores for GPs and pharmacists include spatial access to known GP and pharmacy locations (community pharmacy locations supplied by the Pharmacy Guild). For the nursing workforce, key service locations include public hospitals and ISPHCS. In *Remote* and *Very remote* areas, ISPHCS may be staffed primarily by nurses with visiting medical professionals. The service location used for the midwifery GIRS is hospitals offering public birthing units. Data on all other locations where midwives work (such as hospitals without public birthing units, community health centres and ISPHCS) were not available.



No service location data were available for dentists, psychologists or optometrists. In the absence of these data, proximity to GPs was used as a proxy. For example, if an area has no dentist FTEs within its boundaries, but everyone lives within a 1-hour drive time of a GP location, it is reasonable to assume that dentist services would be available where there are GP services—and that GPs may also be able to organise a referral to dental services. This is not to suggest that GPs provide an effective substitute for these other services.

The AIHW recognises that these proxies are imperfect measures. Ideally, there would be data on service locations for dentists, optometrists and psychologists, which could be incorporated into future calculations of the GIRS.

The percentage of the SA2 population within a 1-hour drive time was calculated using several steps:

- The addresses were geocoded to point locations.
- For each location, a 60-minute drive time radius was calculated using geospatial software that uses the existing road structures.
- The 60-minute drive time radius was then combined with mesh-block population level data from the Census to calculate the number of people inside/outside the 60-minute radius, and then aggregated to the SA2 level.

A key benefit of this approach is that it does not depend on SA2 boundaries—for example, the 1-hour drive time radius of a single GP practice location can cut across a number of SA2s.

Limitations

Although the GIRS is an improvement on relying on FTE rates as a marker of relative workforce supply, it has several limitations. These need to be considered when interpreting the results:

- The GIRS is a point-in-time measure, while, in practice, workforce supplies are fluid. A provider who moves into or out of an area can change both the supply component within an SA2 and the proximity to services component for surrounding areas as well.
- The GIRS has a particular focus on spatial accessibility variables as adjustment factors for moderating workforce supply levels. It is weighted towards characterising larger, more sparsely populated areas (where physical access is harder) as scoring lower than other areas. Smaller, more densely populated areas (where services are available in surrounding areas) are thus less likely to be characterised as potentially challenged. The GIRS is unable to take into account factors such as car ownership or public transport.
- The GIRS does not include any information on the capacity of the service locations to meet the needs of the population in the 1-hour catchment areas, nor can it take into account the extent to which services bulk bill or whether they are culturally competent. It is also not able to capture the location of outreach services.
- It is important to note that the GIRS does not take into account other potential barriers to accessing services, such as the ability to pay, health literacy and attitudes towards seeking care, personal preferences for type of care, cultural appropriateness, or previous experiences of discrimination. This type of information is not available for inclusion in the GIRS.



- The GIRS also does not take into account the relative health needs of different populations, other than the number of women of child-bearing age (ages 15–44), being the population of interest for the midwifery workforce. It assumes that demand for health services tends to be high regardless of the population being served. An assessment of the differing health needs of different populations was beyond the scope of this project.

We acknowledge that these limitations are critical factors, particularly for Indigenous Australians. We see the GIRS as an important first step, which can be developed further in the future.

References

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