Australian Government
Australian Institute of Health and Welfare

Spatial distribution of the supply of the clinical health workforce 2014

Relationship to the distribution of the Indigenous population

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Authoritative information and statistics to promote better health and wellbeing

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Australian Institute of Health and Welfare
Canberra
Cat. no. IHW 170

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Abbreviations

ABS	Australian Bureau of Statistics
AHPRA	Australian Health Practitioner Regulation Agency
AIHW	Australian Institute of Health and Welfare
ASGS	Australian Statistical Geography Standard
EN	enrolled nurse
FTE	full-time equivalent
GIRS	Geographically-adjusted Index of Relative Supply
GIS	Geographic Information System
GP	general practitioner
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification
ISPHCS	Indigenous-specific primary health care service
NHMD	National Hospital Morbidity Database
NHWDS	National Health Workforce Data Set
PPH	potentially preventable hospitalisation
RN	registered nurse
SA1	Statistical Area level 1
SA2	Statistical Area level 2

Summary

This report uses a new measure developed by the Australian Institute of Health and Welfare—the Geographically-adjusted Index of Relative Supply (GIRS). This index is used to look at the geographic supply of the clinical health workforce in seven key professions with particular relevance to Indigenous Australians, and to identify areas in Australia that face particular supply challenges. The professions considered were general practitioners, nurses, midwives, pharmacists, dentists, psychologists and optometrists. The GIRS scores were compared with the distribution of the Indigenous population to assess the extent to which Indigenous people live in areas with lower relative levels of supply.

The GIRS was developed to overcome limitations in using relatively simple provider-to-population ratios to compare areas with vastly different geographic characteristics. The GIRS takes data on hours worked in clinical roles and on main practice location from the 2014 National Health Workforce Data Set; it then adjusts it for three other factors—land size, population dispersion, and drive time to services—to create a score ranging from 0 to 8 for each of the seven professions in each Statistical Area level 2 (SA2) in Australia. Areas with lower GIRS scores are more likely to face workforce supply challenges than those with higher GIRS scores.

The report's findings are as follows:

- GIRS scores of 0 or 1 (most likely to face supply challenges) occur most often for midwives, optometrists and psychologists, and least often for nurses.
  - Over 19,000 Aboriginal and Torres Strait Islander women of child-bearing age (15–44 years) live in 120 SA2s with a low relative supply of midwives.
  - Over 85,000 Aboriginal and Torres Strait Islander people live in 56 SA2s with a low relative supply of optometrists.
  - Over 76,000 Aboriginal and Torres Strait Islander people live in 49 SA2s with a low relative supply of psychologists.
- For each profession, a higher proportion of Aboriginal and Torres Strait Islander people than non-Indigenous people live in areas with lower GIRS scores.
- While relative supply challenges are more common in remoter parts of Australia, the findings show that there is considerable variation in regional and remote areas.
- There were 155 SA2s out of 2,091 (8%) with a GIRS score of 0–1 in at least one profession. Nearly 20% of Aboriginal and Torres Strait Islander people live in these areas, compared with 3% of the non-Indigenous population.
- Over 72,000 Aboriginal and Torres Strait Islander people live in the 39 SA2s where at least four of the seven professions (that is, over half the professions) have GIRS scores of 0 or 1. Over 30,000 of these people live in the 13 SA2s where at least six of the seven professions have GIRS scores of 0 or 1.

The GIRS is an important resource for policy discussions on improving the supply of health services. It has limitations, however. In particular, it does not take into account outreach services and the distribution of the workforce supply within SA2s is unknown. As well, it cannot take into account the adequacy of services, whether the services are financially or culturally accessible, or the extent to which they meet the needs of the populations within each area. Future work could build on the GIRS by including these other factors.

1 Introduction

The poorer health status of Aboriginal and Torres Strait Islander Australians, compared with that of non-Indigenous Australians, is evident throughout the life course. Aboriginal and Torres Strait Islander babies are more likely to be exposed to smoking while *in utero*, are more likely to be born pre-term and with low birthweight, and are more likely to die before their first birthday than are non-Indigenous babies. These inequalities continue throughout childhood and adulthood and are evident in indicators such as poor health, lower life expectancy and higher levels of chronic disease (AIHW 2015b).

The factors underpinning these differences are complex and interrelated, and include:

- higher levels of social disadvantage
- greater exposure to environmental risk factors (such as inadequate and overcrowded housing)
- sociocultural and historical factors
- poorer nutrition, higher rates of smoking and risky alcohol consumption
- poorer access to health services.

Access to health services is compounded by the fact that Aboriginal and Torres Strait Islander people are more likely than non-Indigenous Australians to live outside cities. This population distribution is important because distance often poses substantial challenges for workforce recruitment and health service delivery, particularly in areas where populations are widely dispersed or isolated.

Access to health services and health professionals will not on its own eliminate the differences in health status between Indigenous and non-Indigenous Australians. However, having access to appropriate, high-quality and timely health care can help to improve health and wellbeing. For a start, it improves health literacy and self-management of chronic disease; it also provides links to services within and outside the health system, and improves screening and treatment of acute and chronic illnesses. Thus, the extent to which there are gaps in the geographic distribution of the health workforce in professions with particular relevance for Aboriginal and Torres Strait Islander people is a critical policy issue.

This report looks at the geographic supply of the clinical health workforce in seven key professions with particular relevance to Indigenous Australians—general practitioners (GPs), nurses, midwives, pharmacists, dentists, psychologists and optometrists—to identify areas in Australia that face particular supply challenges.

Traditional measures of workforce supply (such as provider-to-population ratios) have shortcomings in that they do not take into account differences between areas in terms of their geographic size, location of service providers, and the location of populations across areas. These factors directly affect the capacity of providers to supply services, and the ability of the population to access those services.

To overcome these issues, a new Geographically-adjusted Index of Relative Supply (GIRS) was developed to indicate the supply of professionals in one area compared with another. The GIRS takes data on hours worked in clinical roles and on main practice location from the 2014 National Health Workforce Data Set (NHWDS)—combined with data on population size, geographic size and drive time to services—to create a score ranging from 0 to 8 for each of the seven professions in each Statistical Area level 2 (SA2) in Australia.

The area-level GIRS scores are combined with information on the spatial distribution of the Indigenous population. This is done for two reasons: firstly, to calculate the number of Indigenous Australians who live in areas with each of the GIRS scores and, secondly, to identify those areas with relative supply challenges for each profession individually and with challenges across multiple professions.

This work builds on previous Australian Institute of Health and Welfare (AIHW) reports focusing on access to GPs relative to need (AIHW 2014a), spatial variation in Aboriginal and Torres Strait Islander people's access to primary health care (AIHW 2015a) and to maternal and child health services (AIHW 2016a).

Structure of this report

The rest of the report is structured as follows:

- Chapter 2 provides an overview of the conceptual development of the GIRS, then presents the data sources and steps used to calculate the GIRS scores for each profession.
- Chapters 3 to 9 present detailed descriptions of the findings for each of the seven included professions. Each chapter begins with an overview of the role of the profession and how it relates to the health of Aboriginal and Torres Strait Islander people. The chapters then present a summary of the GIRS scores by remoteness. Maps follow that illustrate the spatial distribution of the GIRS scores, the 1 hour drive times of the service included in the proximity measure, and the mesh block population distribution of those who live outside the 1 hour drive time boundary. The population distribution by GIRS is discussed next, followed by tables highlighting the areas that have the lowest GIRS scores (0 or 1).
- Chapter 10 presents a high-level overview of the findings, and reviews the consistency of GIRS scores across the seven included professions.

The appendices provide more detail on the selection of geographic scale, information on data sources and methods, details of the steps used in constructing the GIRS, as well as extra tables.

2 Methods

Conceptually, the GIRS takes the known workforce supply in an area and adjusts it for three other factors—land size, population dispersion, and the proximity of the population to the relevant service locations (Figure 2.1).

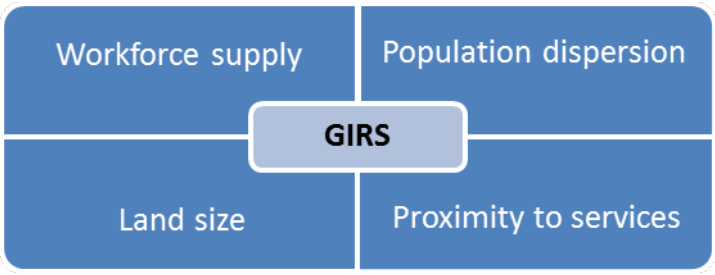
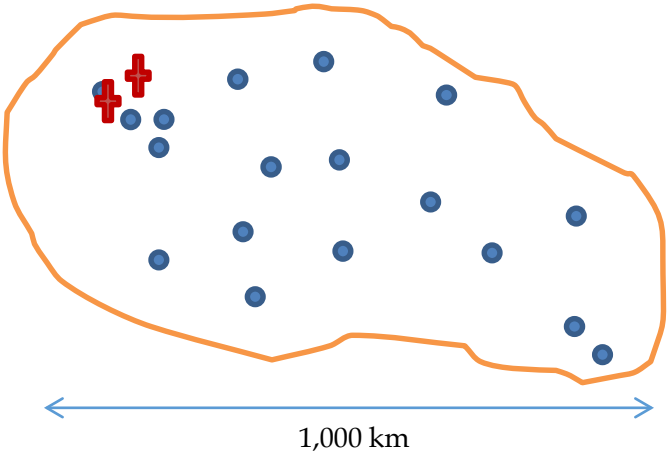


Figure 2.1: Components of the GIRS

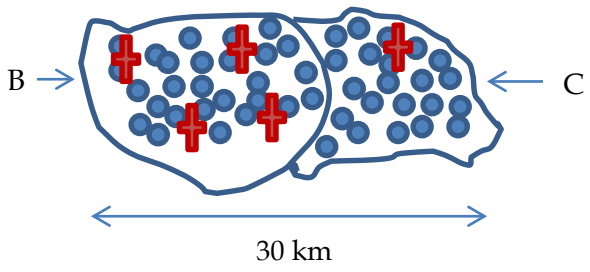
If these factors were not taken into account, comparisons of workforce supply across areas could be misleading. Consider the following three areas shown in Box 2.1.

Box 2.1: Comparison of workforce supply across three areas—A, B and C

Area A: geographically large, sparsely populated, 2 full-time providers, 2,000 people, no neighbouring areas with service providers.



Area B: geographically small, densely populated, 4 providers working the equivalent of 3 full-time providers, 3,000 people, close to another densely populated area (C).



Area C: geographically small, densely populated, 1 full-time provider, 4,000 people, close to another densely populated area (B) with more providers.

The most common way to measure workforce supply is to calculate a full-time equivalent (FTE) rate (also known as a provider-to-population ratio) for a particular area (for example, city, state, national). FTE rates are calculated as follows:

FTE rate = (number of FTE positions/number of people) × 1,000.

The FTE rates for each of the above areas are:

A = 1 full-time provider/1,000 population

B = 1 full-time provider/1,000 population

C = 0.25 full-time providers/1,000 population.

Looking only at the FTE rates, it would appear that the workforce supply is the same in areas A and B, and that area C has more supply challenges.

However, FTE rates do not take the following into consideration:

- *Population dispersion and land size* – the FTE rates in areas A and B are both 1/1,000; however, area A is the larger of the two, with its population dispersed across its large area and its two providers co-located in a small section of its area. Therefore, the probability is higher that area A is more challenged in terms of workforce supply than is area B.
- *Proximity to services within the area and across boundaries* – people in area A have poor access to services due to the distance they have to travel within the area and the fact that there are no services available in neighbouring areas. Furthermore, in this situation, it is likely that the health professionals in area A also serve populations in other nearby areas, so the FTE rate overstates the actual supply of services. The people in area C, on the other hand, are within a reasonable driving distance of the providers in area B, and can access services in that area. Thus, the FTE rate for area C understates the supply available to the population.

The GIRS is a better indicator of the relative supply of services in an area than FTE rates on their own. This is because the GIRS takes into account how hard it might be for people to access the services based on the dispersion of the population, the size of the area and the location of the population relative to the services (even when these services are located in neighbouring areas).

Calculation of the GIRS

The GIRS provides a supply score for each area and for each of the seven professions included in this report. Figure 2.2 presents the indicators used to measure each of the four concepts.

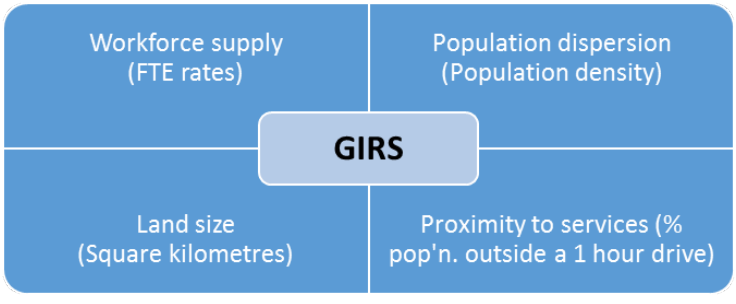


Figure 2.2: GIRS components and indicators

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 2.1). 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 2.1: Method for assigning scores to the four GIRS components

	Range of values to which score assigned, by GIRS component			
Score	**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%

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

(b) Rounded to the nearest percentile. Population refers to the total population in the SA2.

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

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

For land size, areas in the top quartile (that is, the largest) are assigned a score of 0, those in the middle 50% a score of 1, and the smallest 25% 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 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 population who are outside a 1 hour drive time are coded against a set standard. Areas where less than 1% of the population is outside a 1 hour drive to a service are assigned a score of 2, areas where between 1% 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 in which no-one (as measured by a rounded score of less than 1% of the population) is outside a 1 hour drive are 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 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 (see Figure 2.2) 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.

Relationship between population density and land size

It is important to note that there is a relationship between population density and land size—that is, larger geographic areas are more likely to have lower population densities. Including both in the GIRS could increase the likelihood that these areas will have lower GIRS scores. However, there is not an exact correlation between the two variables: 23.7% of areas do not have corresponding population density and region size rankings.

To test the effect of including one, rather than both variables, GIRS scores were recalculated using three rather than four components (leaving out the population density component). Comparing the approaches showed that there was little difference in the extreme values (that is, the lowest and the highest). For example, when population density was excluded, there was no change in the areas that scored 0 and 1 (the lowest scores) for GPs, pharmacists, dentists, psychologists and optometrists. Using only the three variables, there was 1 additional SA2 for nurses and 13 additional SA2s for midwives, which were re-categorised from GIRS scores of 2 to GIRS scores of 1 (all had high population densities).

Including both population density and land size resulted in greater resolution in distinguishing between different levels of relative supply in the mid-range SA2s (that is, not the highest or lowest, but those with scores in the middle). Even if all other components of the GIRS scores were equal, a lower population density adds an independent effect, reflecting greater difficulties in servicing populations that are more dispersed. For those reasons, this project has included all four components.

Relationship between land size and drive time to services

There is also a relationship between land size and drive time to services. Areas that are larger (and given lower scores for the land size component) also tend to have a greater proportion of the population living outside a 1 hour drive time (which will result in lower scores for the proximity component). However, as with the relationship between population density and land size, there is not an exact correlation between land size and drive time. A key point to recognise is that the proximity to services (drive time) measure takes into account the potential for people to access services *outside* the SA2 for which the GIRS score is being

calculated, as well as services within that SA2. This recognises the potential for populations near the perimeter of larger SA2s to access services in adjacent SA2s.

The next section describes the choice of geographic scale at which the GIRS is calculated, followed by an overview of the data sources.

Geographic scale

Theoretically, the GIRS could be calculated at any geographic scale for which there are data. However, choices are constrained by pre-existing spatial boundaries, the lowest available level of geographic detail available in the data, and the availability of other required information at a similar spatial scale (such as population data).

Within Australia, spatial data can be presented at various scales reflecting political boundaries (local government areas), service or funding boundaries (health districts) or administrative boundaries drawn for consistent reporting of statistics (Australian Bureau of Statistics (ABS) boundaries).

For the purposes of this paper, the main (SA) structure of the 2011 Australian Statistical Geography Standard (ASGS), developed by the ABS for the collection and dissemination of geographic statistics, was selected as the most relevant framework (ABS 2011). Within the ASGS structure, SA2 was selected as the most appropriate:

- SA2s are generally based on officially gazetted suburbs and localities. In urban areas, SA2s largely conform to whole suburbs and combinations of whole suburbs, while in rural areas they define functional zones of social and economic links.
- SA2s are contiguous, with most having populations between 3,000 and 25,000.
- SA2s are the lowest level for which the ABS reports on Estimated Resident Population by Indigenous Status.

Appendix A describes in more detail the factors considered in selecting the geographic scale at which the GIRS was calculated.

Data sources

A brief overview of the data sources used in this project, and their limitations, is presented below, with more detail provided at Appendix B.

Workforce supply data

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

The NHWDS contains information on 14 health professions. It is a product of a national yearly registration process administered by the Australian Health Practitioner Regulation Agency (AHPRA) and includes the medical, dental, nursing and midwifery workforces along with 11 types of allied health professionals.

Seven professions with key relevance for the health needs of the Aboriginal and Torres Strait Islander population were included in this study, and were selected in consultation with the Department of Health. They are:

- GPs

- nurses
- midwives
- pharmacists
- dentists
- psychologists
- optometrists.

The NHWDS does contain information on 332 registered Aboriginal and Torres Strait Islander health practitioners; however, this group is only a small subset of the larger number of Aboriginal health workers who play an important role in improving the health of Aboriginal and Torres Strait Islander Australians. As the numbers are too low for reliable area comparisons, this group was not included in this project.

Other professionals who play key roles in Indigenous health and wellbeing, such as dieticians and counsellors, could not be included as their registrations are not overseen by the AHPRA and they are not part of the NHWDS.

The data for the GIRS were restricted to currently employed health practitioners working in clinical roles in their area of registration, as the focus for this project 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 ABS (Appendix B).

The numbers of providers and their FTEs are summarised in Table 2.2. The FTE numbers were used as the numerators in the calculation of the FTE rates.

Table 2.2: Number of health professionals working in clinical roles with valid SA2 codes

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

The NHWDS has three main limitations:

- Where a provider works at more than one location, all of his/her hours are included, but they are attributed to the primary location only. Thus, if a dentist does outreach clinics 1 day a week that are outside the SA2 of the main practice, they will not be included in the supply of the second SA2. Thus, the FTEs at the main practice SA2 location may be overstated and the FTEs at outreach services may be understated. The extent to which

this affects particular areas is unknown as there is no detailed information on the second (or further) location (whether it is inside or outside the SA2 of the primary location) and on how the FTEs are distributed across location.

- Data on hours worked are based on self-reports and not everyone participated in the optional survey component of the registration process. This means that FTEs are understated; however, non-response rates in the NHWDS are low. We consider it inappropriate to make an adjustment because we do not know the FTEs of non-respondents and how they are distributed across SA2s.
- The addresses of practice locations are not available in the NHWDS, so postcodes/suburbs were used to allocate data to the SA2 level. Where single postcode/suburb combinations were split into multiple SA2s, the distribution of those providers and hours was assumed to be proportional to the distribution of the estimated resident population. That is, it was assumed that the distribution of the health workforce mirrors the distribution of the population. As a result of this assumption, FTE rates for some areas may be overstated and some understated. Note that this assumption affects only the workforce supply component of the GIRS, not the other three components.

Despite these potential effects, the NHWDS remains the best source of data for this work as it includes national level data, a number of professions, and information on hours worked.

The ranges of FTE rates used to assign the workforce supply scores for each profession are presented in Table 2.3.

Table 2.3: Ranges of SA2 level FTE rates[(a)] used to assign scores to GIRS workforce supply component

Score	GPs	Nurses	Midwives	Pharmacists	Dentists	Psychologists	Optometrists
0	<0.83	<3.79	<0.10	<0.47	<0.18	<0.16	<0.02
1	0.83–<1.41	3.79–<11.78	0.10–<0.79	0.47–<0.85	0.18–<0.64	0.16–<0.78	0.02–<0.24
2	1.41+	11.78+	0.79+	0.85+	0.64+	0.78+	0.24+

(a) Number of FTEs per 1,000 total estimated residential population.

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 ABS 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 ASGS geography in 2011. It is available from the ABS 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.

The values of population dispersion (population density) and land size used to assign component scores are presented in Table 2.4.

Table 2.4: Values of population density and land size used to assign scores to GIRS population dispersion and land size components

Score	Population dispersion (population density) (people/km^2)	Land size (km^2)
0	<40	>135
1	40–1,826	6–134
2	>1,826	<6

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 the 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 2.5 summarises the service location indicators used for each of the seven professions and the source of the data, with more details provided at Appendix B. Table 2.6 provides information on how many service locations were included.

Table 2.5: 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, double-checked against other sources.
Nurses	Public hospitals and Indigenous-specific primary health care services (ISPHCSs)	Data on public hospitals, including multipurpose health centres, are held by the AIHW. ISPHCS locations include those that report to the Online Services Report and/or national Key Performance Indicator 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 another project (AIHW 2016a).
Pharmacists	Pharmacy locations	The Pharmacy Guild provided the AIHW with geocoded locations of community pharmacies for this project.
Dentists	GP practices (proxy)	Existing GP practice locations from the 2013 Medical Directory of Australia, double-checked against other sources.
Psychologists	GP practices (proxy)	As above
Optometrists	GP practices (proxy)	Existing GP practice locations from the 2013 Medical Directory of Australia, double-checked against other sources.

Table 2.6: Number of service locations included

Service location	Number included
GP practice locations	7,601
Public hospitals (including multipurpose health centres)	677
ISPHCSs	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. For the nursing workforce, key service locations include public hospitals and ISPHCSs. In remote and very remote areas, an 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. For pregnant women, the geographic supply and accessibility of hospitals offering birthing services is a critical issue. In rural and remote areas where no birthing facilities are available, women assessed at risk of poor outcomes often have to relocate to an urban or regional hospital location at 36–38 weeks of pregnancy. Research in rural British Columbia has shown that the incidence of poor birth outcomes is higher for women living outside a 1 hour drive to a birthing service, even after controlling for maternal characteristics (Grzybowski et al. 2011).

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 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.

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 (more detail is available at Appendix B):

- The addresses were geocoded to point locations.
- For each location, a 1 hour drive time radius was calculated using geospatial software, which uses the existing road structures.
- The 1 hour drive time radius was then combined with mesh block population level data from the Census to calculate the number of people inside/outside the 1 hour radius and then aggregated to the SA2 level.

For the midwifery workforce, the population of interest included women of child-bearing age (15–44 years) rather than the total population, and required using Statistical Area level 1 (SA1) midpoints, as age breakdowns are not available at mesh block level (AIHW 2015a).

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.

Table 2.7 summarises how the SA2s are distributed across the three scoring categories for the proximity to services measure, by type of practice location.

Table 2.7: Distribution of SA2s within each of the proximity categories, by type of practice location

	Number of SA2s, by type of practice location			
% of SA2 pop'n outside a 1 hour drive time	GP practice locations	Public hospitals or ISPHCSs	Public birthing units	Community pharmacies
50+	26	8	157	29
1–<50	64	95	124	57
<1	2,002	1,989	1,810	2,006
Total	**2,092**	**2,092**	**2,091**	**2,092**

Note: The proximity measure for midwives was calculated relative to women of child-bearing age (not the total population). Because this was not feasible for one SA2, the total number of SA2s with valid data for the midwife GIRS is 2,091 instead of 2,092.

Putting it all together

Once the data were finalised for each component of the GIRS score, the final step was to add the four component scores. This yielded a GIRS score between 0 and 8 for each SA2 included in the analyses. The GIRS is calculated for the total population and reflects the supply for all those living in the SA2—Indigenous and non-Indigenous.

Appendix C provides an overview of the process using GPs as an example, illustrated by maps for each step.

The final output is an SA2 level data set with GIRS scores for each of the seven professions, data on each of the individual components, and the numbers of Aboriginal and Torres Strait Islander and non-Indigenous Australians who live in each SA2.

Interpretation

A GIRS score of 0 indicates that an area has low FTE rates, poor access to services, and is large and sparsely populated. A score of 8 indicates that an area has FTE rates among the highest 25% of all rates, that 100% of the population is able to access services within a 1 hour drive, and that the area is small and densely populated (that is, it is easier to service). Areas with lower GIRS scores face relatively more challenges with workforce supply than areas with higher GIRS scores. However, this does not imply that areas with higher GIRS do not face any challenges with workforce supply.

Because the GIRS is constructed from four components, there may be more than one way in which a given GIRS score can be derived. For example, a score of 4 could reflect a score of 2 for two components, or a score of 1 across four components. However, the focus of this report is on identifying areas in which there are relatively low levels of supply, as measured by GIRS scores of 0 or 1. In such cases, the issue of how the score is made up from the four constituent components is less relevant. A GIRS score of 0 by definition reflects scores of 0 across all four components.

Validation of GIRS approach

The GIRS aims to capture relative workforce supply across areas. A low GIRS score should indicate an area where the risk of poor health outcomes is relatively high because of these supply challenges. One indicator that has been shown to relate to poor access to primary health services is potentially preventable hospitalisations (PPHs) (AIHW 2014a).

Admissions for potentially preventable conditions reflect hospitalisations that might have been prevented through the timely and appropriate provision and use of primary care or other non-hospital services (Li et al. 2009). Hospitalisations for potentially preventable conditions include those for vaccine-preventable diseases (such as influenza and pneumonia), those for chronic conditions (such as asthma, congestive heart failure and diabetes), and those for acute conditions (such as dehydration and gastroenteritis).

If the GIRS index is reliably capturing relative differences in workforce supply, we would expect there to be a statistical association between the GIRS and PPHs. That is, it would be reasonable to expect that in areas with greater workforce supply challenges (lower GIRS scores), a larger proportion of hospitalisations may be potentially preventable.

To test this hypothesis, the association between the GIRS and the percentage of hospitalisations that were potentially preventable was looked at, using 2012–2013 data from the AIHW's National Hospital Morbidity Database (NHMD) (more detail is included at Appendix B). Correlation analyses were used to test the relationship between the percentage of hospitalisations that were potentially preventable and GIRS scores for GPs, pharmacists and dentists. These three professions were selected as they would be expected to have the strongest relationship with the types of admissions categorised as potentially preventable.

The results showed that there is a statistically significant negative correlation between the individual GIRS scores for each of the three professions and the percentage of hospitalisations that were potentially preventable (Table 2.8). That is, areas with lower GIRS scores were more likely to have a higher percentage of hospitalisations that were potentially preventable than areas with higher GIRS scores.

Table 2.8: Correlation coefficients for SA2 level GIRS score and percentage of hospitalisations that were potentially preventable (N=2,091)

	PPH
GP GIRS	–0.247***
Pharmacist GIRS	–0.288***
Dentist GIRS	–0.309***

*** p<0.001 (2-tailed).

The relationship between the GIRS and PPHs is potentially confounded by remoteness however; that is, average GIRS scores are lower in more remote areas than in less remote areas because, in general, remote areas are harder to service (they tend to be larger, with more dispersed populations and fewer overall services). Previous research has also shown that PPHs vary by remoteness and by access to services (AIHW 2014a, 2015a).

One way to test if the GIRS score is simply masking remoteness is to repeat the analysis within remoteness categories. Because of the small numbers, three broad remoteness categories were used (*Major cities, Inner regional* and *Outer regional* areas, and *Remote* and *Very remote* areas). An additional set of correlation analyses were run between the GIRS scores for GPs, pharmacists and dentists and PPHs within each of these three areas (Appendix Table D1).

These stratified analyses showed that all the correlations were statistically significant at the $p<0.05$ level. What this indicates is that the relationship between PPH and the GIRS holds even after controlling for remoteness, illustrating that there may be a unique contribution of workforce supply to health service outcomes beyond the broader effects of remoteness.

However, it is possible that there are other unobserved factors that relate both to GIRS scores and PPH within remoteness areas.

It could also be useful to test if there is a relationship between PPH and GIRS scores for the other professions (nurses, midwives, psychologists, optometrists), and/or combinations of professions. It might be expected, for example, that areas with relatively greater access to doctors *and* nurses would have a lower proportion of PPHs than areas with relatively greater access to either doctors *or* nurses. Such analysis was beyond the scope of this project but could be undertaken as part of a future work program.

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 in this paper:

- 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 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, or cultural appropriateness. 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 (15–44 years), 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 Aboriginal and Torres Strait Islander Australians, and see the GIRS as an important first step, which can be developed further in the future.

3 General practitioners

GPs play a key role in Australia's primary health care system. Their duties include providing preventive care and screening, managing acute and chronic illnesses and providing a link to specialist and multidisciplinary care. They also perform important legal functions, such as certifying documents and assessing eligibility for programs such as the Disability Support Pension. GPs work in a variety of settings, including in private solo or group practices, in Aboriginal medical services and/or community health services and in hospital-based clinics. GPs may also provide additional services outside their practice locations, including outreach clinics, home visits and visiting services at locations such as aged care facilities (AIHW 2014c).

Given the higher rates of social disadvantage, chronic illness and psychological distress within the Indigenous population, the supply of the GP workforce is a critical issue for Aboriginal and Torres Strait Islander people. Identifying areas in which Indigenous people live that have relatively low supplies of GPs provides a starting point for further examination and potential policy follow-up.

GP GIRS scores

GP GIRS scores by remoteness are presented in Table 3.1.

Table 3.1: GIRS scores for GPs by remoteness

	Number of areas (SA2s) by remoteness					
GIRS score	**Major cities**	**Inner regional**	**Outer regional**	**Remote**	**Very remote**	**Total areas**
0–1	0	3	6	7	23	39
2–3	7	194	150	25	21	397
4–5	547	197	81	5	4	834
6–8	656	81	73	10	2	822
Total	**1,210**	**475**	**310**	**47**	**50**	**2,092**

Notes

1. Lower GIRS scores indicate areas with higher probabilities of workforce supply challenges compared with areas with higher GIRS scores.
2. Only SA2s with a total population of greater than 100 were included.

The distribution of the GP GIRS scores shows that:

- 39 SA2s had GIRS scores of 0–1 (higher probability of workforce supply challenges). Of these, the majority were in *Very remote* areas, along with 7 in *Remote* areas, 6 in *Outer regional* areas and 3 in *Inner regional* areas
- at the other end of the scale, the majority of SA2s with the highest GP GIRS scores (6–8) were in *Major cities*, with the number declining with increasing remoteness
- although SA2s within *Remote* and *Very remote* areas are more likely to have GP GIRS scores at the lower end of the spectrum, it is important to note that there is variation within remoteness categories. Ten (10) of the 47 *Remote* SA2s and 2 of the 50 *Very remote* SA2s had GIRS scores of 6–8.

Figure 3.1 illustrates the spatial distribution of the GIRS scores. Figure 3.2 adds the 1 hour drive time catchments of the known GP locations (proximity to services), which highlights

how service catchments cross area boundaries; it shows that there are vast areas of SA2s that are not within a 1 hour drive of a GP. Figure 3.3 adds the mesh block populations of those outside a 1 hour drive to show the size and locations of those with poor proximity to a GP service location. Box 3.1 explains the mesh block population sizes and locations.

The purpose of the maps is to illustrate areas with a higher probability of workforce supply challenges, as reflected in a GIRS score of 0 or 1. A table listing the 39 areas with GP GIRS scores of 0–1 is included at the end of this chapter (Table 3.3).

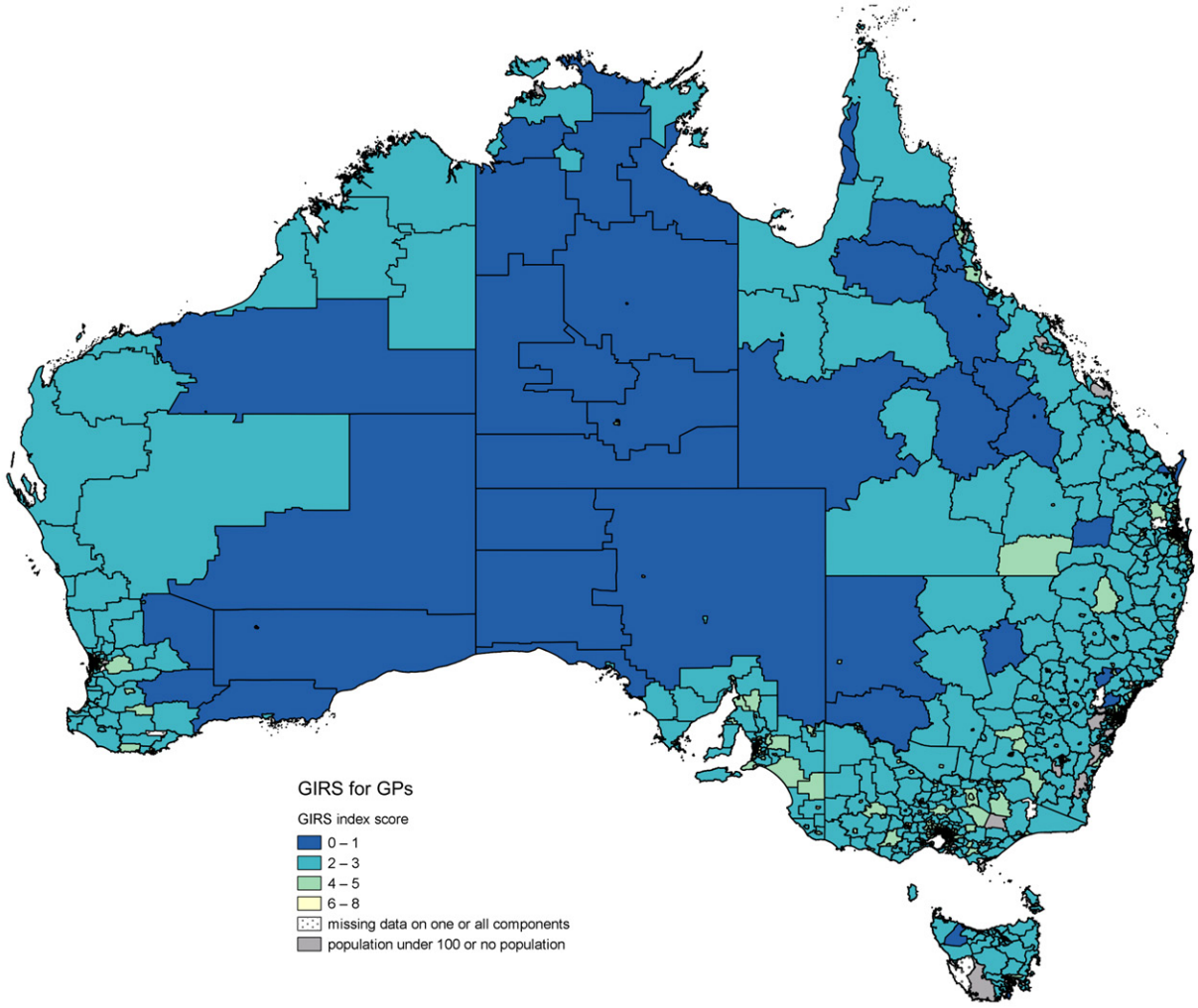


Figure 3.1: Map of GP GIRS scores, by SA2

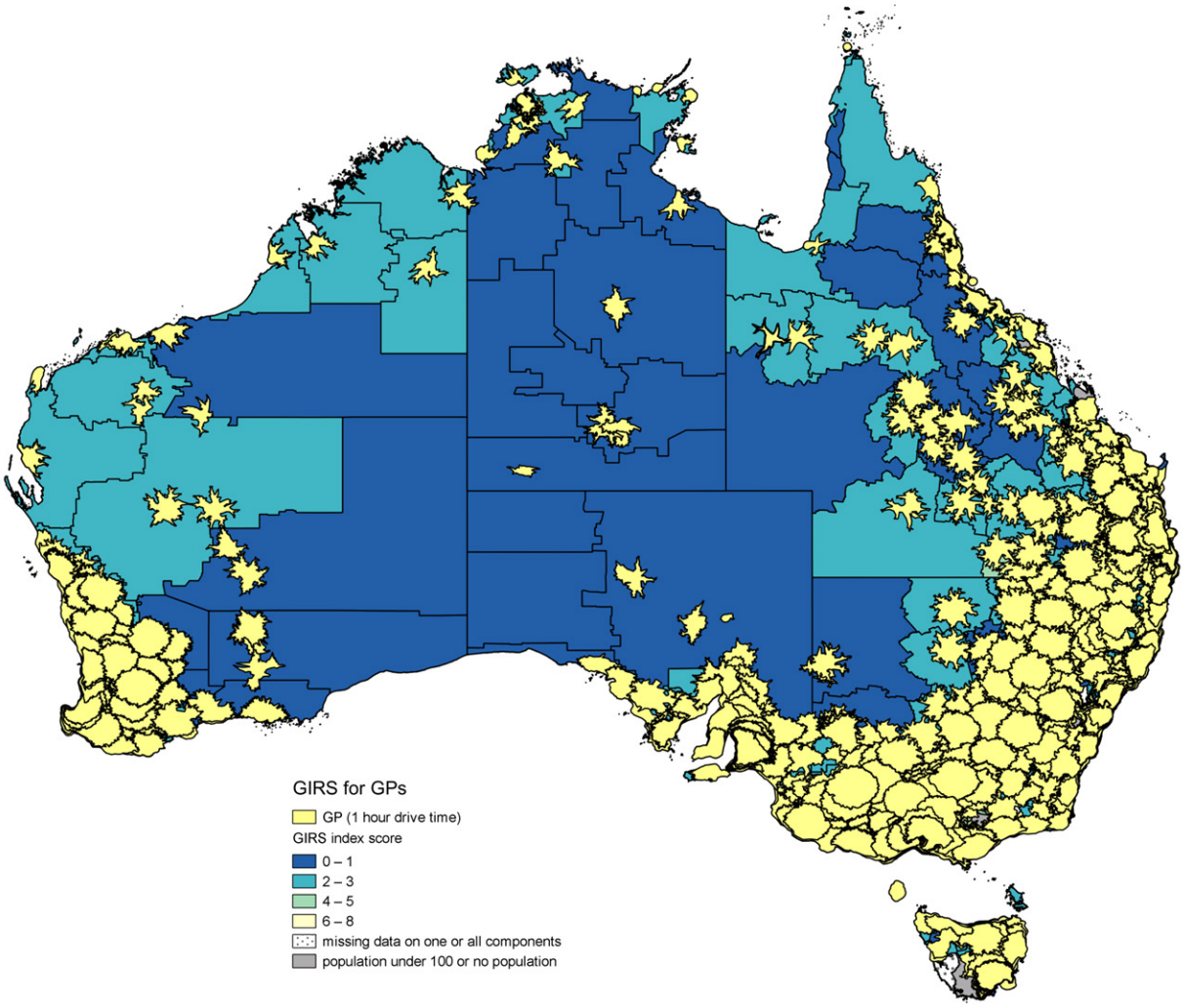


Figure 3.2: Map of GP GIRS scores, by SA2, with drive time boundaries added

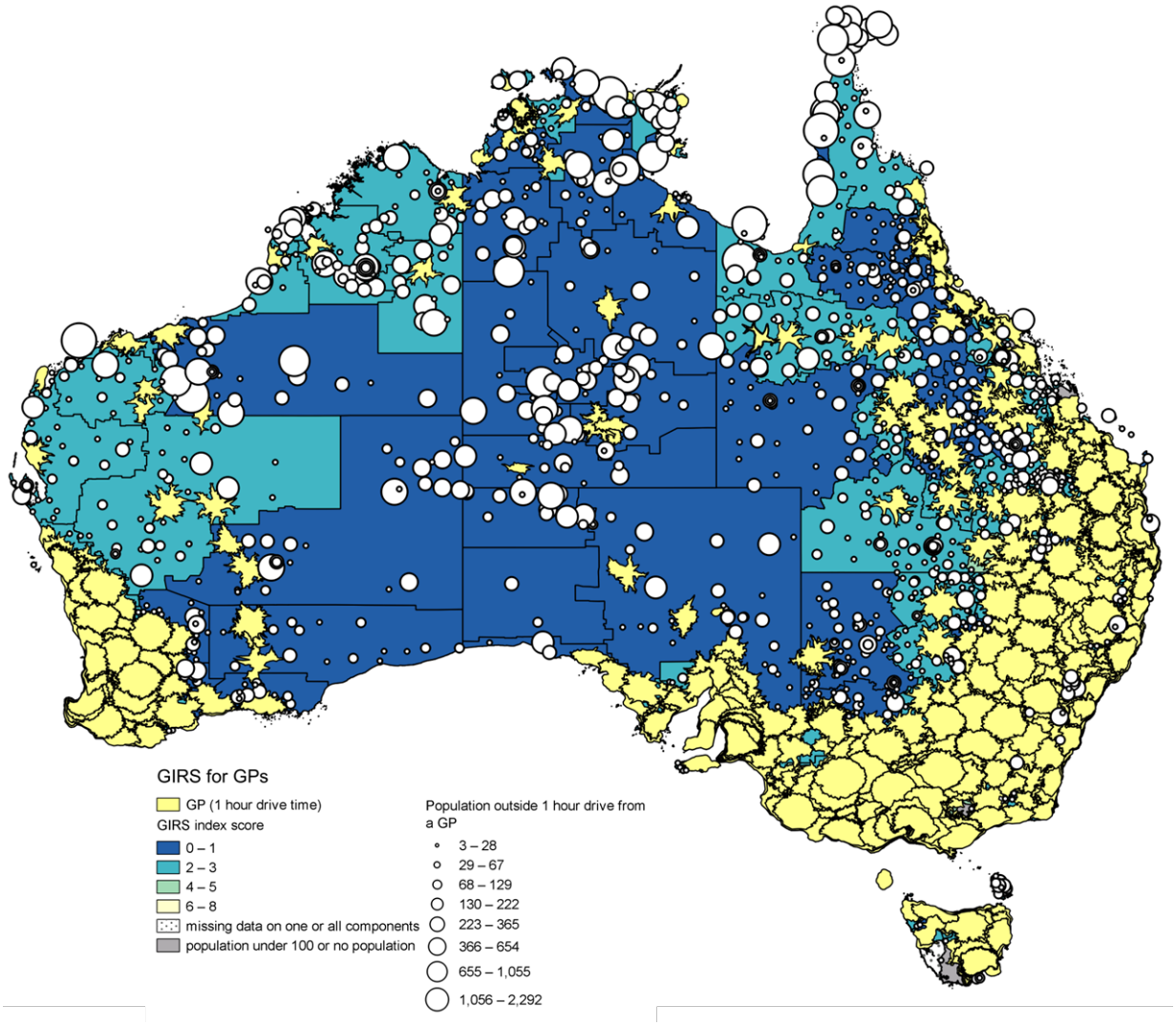


Figure 3.3: Map of GP GIRS scores, by SA2, with drive time boundaries and mesh block populations added

Box 3.1: Mesh block populations

The map shown as Figure 3.3 (and equivalent maps in subsequent chapters of this report) represents every mesh block location that is excluded from accessing a GP within a 1 hour drive time (that is, they fall outside a 1 hour catchment from the physical location of the GP practice).

This includes every mesh block outside a 1 hour drive time as well as those with very low populations.

To ensure anonymity, the ABS randomises population counts under 4 and reports those populations as 3. Therefore, any mesh block with a reported population of 3 will be in the range 1–3 (and, potentially, even 0 people).

The locations of every mesh block point are the centroids of each mesh block area, as defined by the ABS. In rural and regional areas, the mesh blocks become less dense (and consequently larger) than those in the cities.

The size of the proportional symbols (the bubbles) is taken from ABS population data for that particular mesh block.

Population distribution

The GIRS score reflects the relative workforce supply in each SA2. Table 3.2 presents the distribution of the estimated residential population by GP GIRS score by Indigenous status. That is, it presents the numbers of Indigenous and non-Indigenous people who live in SA2s with particular GIRS scores.

Because there were SA2s without data on Indigenous status, Table 3.2 underestimates the number of Aboriginal and Torres Strait Islander and non-Indigenous people who live in areas within each of the GIRS ranges.

Table 3.2 shows that:

- Aboriginal and Torres Strait Islander people are much more likely than non-Indigenous Australians to live in areas with low GP GIRS scores (areas with higher probabilities of GP workforce supply challenges)
- over 46,000 Aboriginal and Torres Strait Islander people live in areas with the lowest GIRS scores (0–1).

Table 3.2: Distribution of the population by GP GIRS and Indigenous status

	Number			%		
GIRS score	**Indigenous**	**Non-Indigenous**	**Total**	**Indigenous**	**Non-Indigenous**	**Total**
0–1	46,199	108,321	154,520	6.91	0.50	0.69
2–3	169,980	2,438,260	2,620,529	25.44	11.29	11.74
4–5	279,754	9,372,408	9,691,475	41.86	43.39	43.42
6–8	172,308	9,680,037	9,853,282	25.79	44.82	44.15
Total	**668,241**	**21,599,026**	**22,319,806**	**100.00**	**100.00**	**100.00**

Notes

1. Lower GIRS scores indicate areas with higher probabilities of workforce supply challenges compared with areas with higher GIRS scores.
2. The Indigenous and non-Indigenous populations do not add up to the total population because the ABS did not provide a breakdown by Indigenous status for 23 SA2s.

Discussion

The GIRS should be considered indicative of GP workforce supply challenges. The proximity to services measure did capture the known locations of GP services (including Royal Flying Doctor service clinic locations and ISPHCSs). There may, however, be outreach services in the SA2s with low GIRS scores that were not captured in either the supply component (FTE rate) or the proximity to services component, and GPs may have moved into or out of areas since the 2014 NHWDS data were collected.

Table 3.3: SA2s with GP GIRS scores of 0–1, by descending size of Indigenous population

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous	Non-Indigenous	Total
NT	Daly - Tiwi - West Arnhem	West Arnhem	Very remote	1	4,913	487	5,400
NT	Katherine	Gulf	Very remote	1	4,029	633	4,662
NT	Alice Springs	Sandover - Plenty	Remote	0	3,878	441	4,319
NT	Alice Springs	Tanami	Very remote	0	2,814	552	3,366
WA	Goldfields	Leinster - Leonora	Very remote	1	2,491	3,335	5,826
NT	Barkly	Barkly	Very remote	0	2,444	606	3,050
SA	Outback - North and East	APY Lands	Very remote	1	2,375	285	2,660
NT	Katherine	Victoria River	Very remote	1	2,251	619	2,870
NT	Alice Springs	Yuendumu - Anmatjere	Very remote	0	2,094	280	2,374
WA	Pilbara	East Pilbara	Very remote	0	2,023	5,823	7,846
NT	Katherine	Elsey	Very remote	1	1,831	521	2,352
Qld	Far North	Kowanyama - Pormpuraaw	Very remote	0	1,691	136	1,827
NT	Daly - Tiwi - West Arnhem	Daly	Very remote	1	1,494	743	2,237
Qld	Far North	Aurukun	Very remote	0	1,306	92	1,398
NT	Alice Springs	Petermann - Simpson	Very remote	1	1,108	1,367	2,475
Qld	Tablelands (East) - Kuranda	Herberton	Outer regional	1	956	4,691	5,647
NSW	Bourke - Cobar - Coonamble	Nyngan - Warren	Remote	1	938	4,468	5,406
NSW	Broken Hill and Far West	Far West	Very remote	1	936	1,850	2,786
Qld	Far North	Tablelands	Outer regional	1	895	4,802	5,697
WA	Goldfields	Kambalda - Coolgardie - Norseman	Very remote	1	755	4,842	5,597
SA	Eyre Peninsula and South West	West Coast (SA)	Very remote	1	689	2,997	3,686
SA	Outback - North and East	Outback	Very remote	0	589	2,947	3,536
Qld	Outback - South	Far Central West	Very remote	1	507	2,021	2,528
Qld	Maryborough	Burrum - Fraser	Inner regional	1	426	8,472	8,898
Qld	Outback - South	Barcaldine - Blackall	Very remote	1	352	5,197	5,549
Qld	Darling Downs (West) - Maranoa	Tara	Outer regional	1	293	3,944	4,237
Qld	Central Highlands (Qld)	Central Highlands - West	Remote	1	280	8,793	9,073
Tas	West Coast	Waratah	Outer regional	1	264	3,654	3,918

(continued)

Table 3.3 (continued): SA2s with GP GIRS scores of 0–1, by descending size of Indigenous population

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous	Non-Indigenous	Total
NSW	Lower Murray	Wentworth - Balranald Region	Outer regional	1	240	3,526	3,766
WA	Wheat Belt - South	Kulin	Remote	1	206	4,515	4,721
WA	Esperance	Esperance Region	Very remote	1	165	4,127	4,292
NSW	Upper Hunter	Muswellbrook Region	Inner regional	1	163	3,943	4,106
Qld	Charters Towers - Ayr - Ingham	Dalrymple	Remote	1	161	3,819	3,980
Tas	Huon - Bruny Island	Bruny Island - Kettering	Outer regional	1	129	2,823	2,952
Qld	Far North	Croydon - Etheridge	Very remote	0	128	1,128	1,256
WA	Wheat Belt - North	Mukinbudin	Remote	1	121	3,422	3,543
Qld	Bowen Basin - North	Clermont	Remote	1	111	3,745	3,856
NSW	Hawkesbury	Bilpin - Colo - St Albans	Inner regional	1	81	2,635	2,716
SA	Eyre Peninsula and South West	Western	Very remote	1	72	40	112
				Total	**46,199**	**108,321**	**154,520**

* SA3 = Statistical Area level 3.

4 Nurses

Nurses play a critical role in Australia's health-care system, providing care and support to all ages and groups within the population. They work across numerous settings, including hospitals, GP practices, clinics, community health services, Aboriginal medical services, aged care facilities/nursing homes, and schools. There are two levels of nursing qualification in Australia: registered nurse (RN) and enrolled nurse (EN). RNs are required to have a tertiary-level Bachelor of nursing, while ENs complete a 2-year (or equivalent) Diploma of nursing within the vocational education training sector.

Nurses perform diverse duties, including clinical care (such as wound care, administering medications, personal care, physical examinations and health histories) as well as specialised care for patients with particular needs (such as for those with diabetes or mental illness) (AIHW 2013b).

Nursing also encompasses other key functions, including health promotion/prevention, counselling, patient education, chronic disease management, coordinating and collaborating with other health professionals, and supervising other health professionals (for example, RNs supervise ENs and nurses' aides). In rural and remote areas, nurses may lead and staff primary health clinics/services on a daily basis, with medical backup from visiting GPs and specialists, and nurses make up the highest proportion of the health workforce in these areas (AIHW 2016b).

Access to nursing care is particularly important for Aboriginal and Torres Strait Islander people because of their higher rates of social disadvantage, morbidity, risk factors (medical and behavioural), compared with non-Indigenous people; their ongoing chronic health conditions that require regular management in the community; and their higher likelihoods of living in rural and remote communities.

Nurse GIRS scores

Nurse GIRS scores by remoteness are presented in Table 4.1.

Table 4.1: GIRS scores for nurses, by remoteness

	Number of areas (SA2s) by remoteness					
GIRS score	**Major cities**	**Inner regional**	**Outer regional**	**Remote**	**Very remote**	**Total areas**
0–1	1	1	8	1	6	17
2–3	16	206	152	28	34	436
4–5	533	170	85	11	9	808
6–8	660	98	65	7	1	831
Total	**1,210**	**475**	**310**	**47**	**50**	**2,092**

Notes

1. Lower GIRS scores indicate areas with higher probabilities of workforce supply challenges compared with areas with higher GIRS scores.
2. Only SA2s with a total population of greater than 100 were included.

The distribution of the nursing GIRS scores shows that:

- 17 SA2s had GIRS scores of 0–1 (higher probability of workforce supply challenges). Of these, the majority were in *Outer regional* and *Very remote* areas

- the pattern for SA2s within *Major cities* differs from that for all other remoteness categories: while there are only 17 SA2s in *Major cities* that have GIRS scores below 4, a substantial number of SA2s in all other remoteness categories (a majority in the *Outer regional*, *Remote* and *Very remote* categories) have GIRS scores below 4.

Figure 4.1 illustrates the spatial distribution of the GIRS scores. Figure 4.2 adds the 1 hour drive time catchments of the ISPHCSs and public hospitals (proximity to services). Figure 4.3 adds the mesh block populations of those outside a 1 hour drive to show the size and locations of those with poor proximity to either a public hospital or an ISPHCS.

The purpose of the maps is to illustrate areas with a higher probability of workforce supply challenges, as reflected in a GIRS score of 0 or 1. A table listing the 17 areas with GIRS scores of 0–1 is presented at the end of the chapter (Table 4.3).

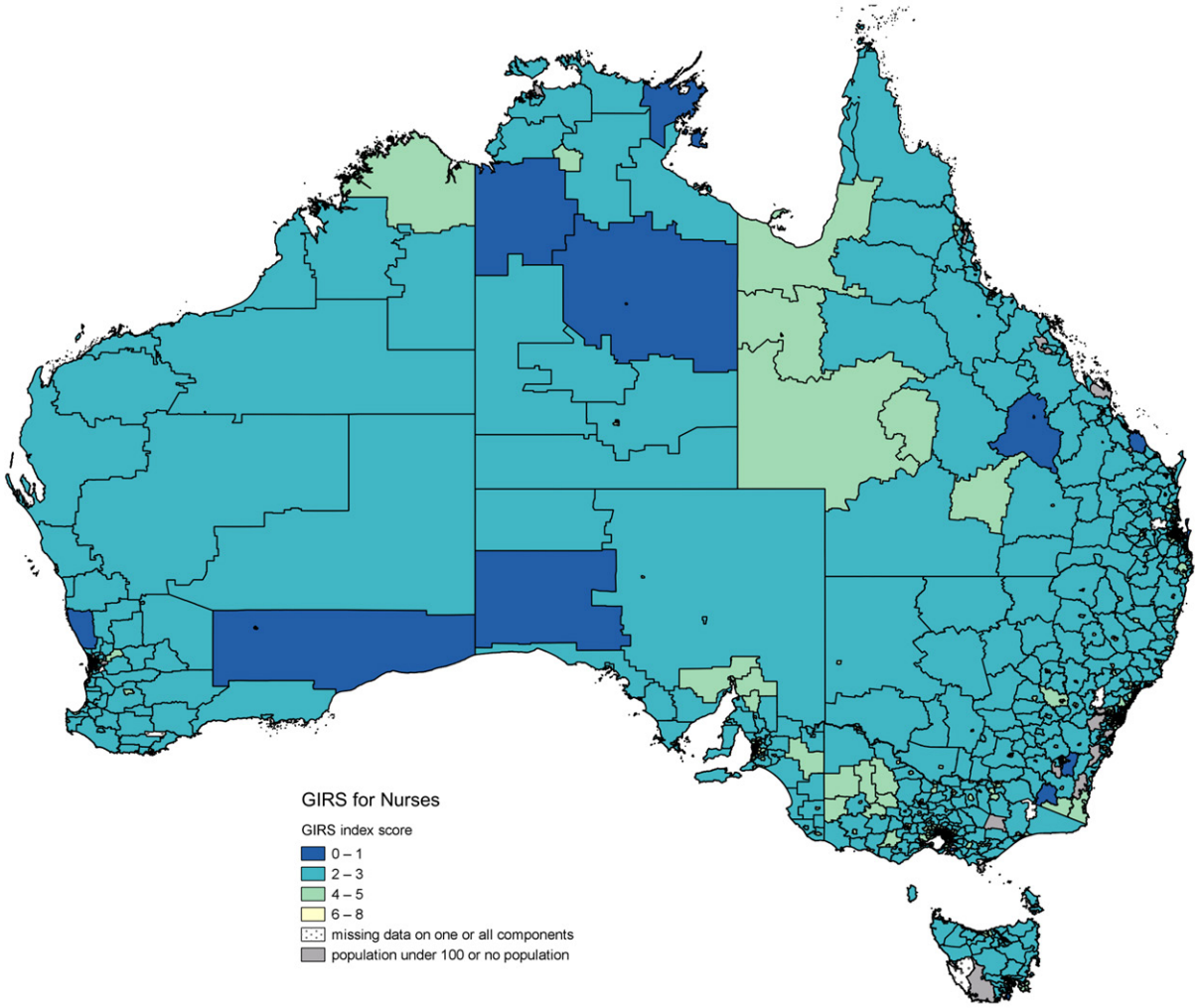


Figure 4.1: Map of nurse GIRS scores, by SA2

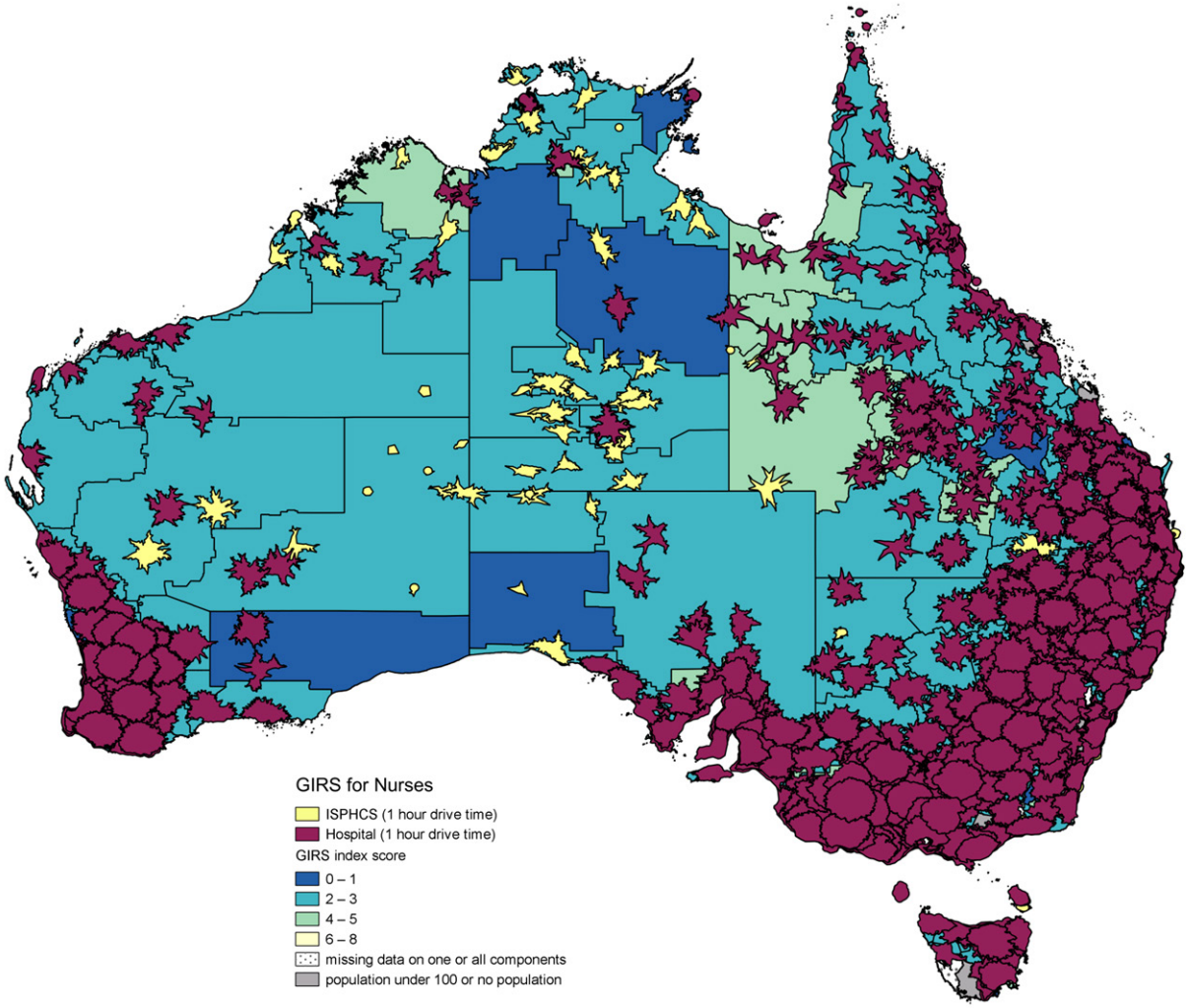


Figure 4.2: Map of nurse GIRS scores, by SA2, with drive time boundaries added

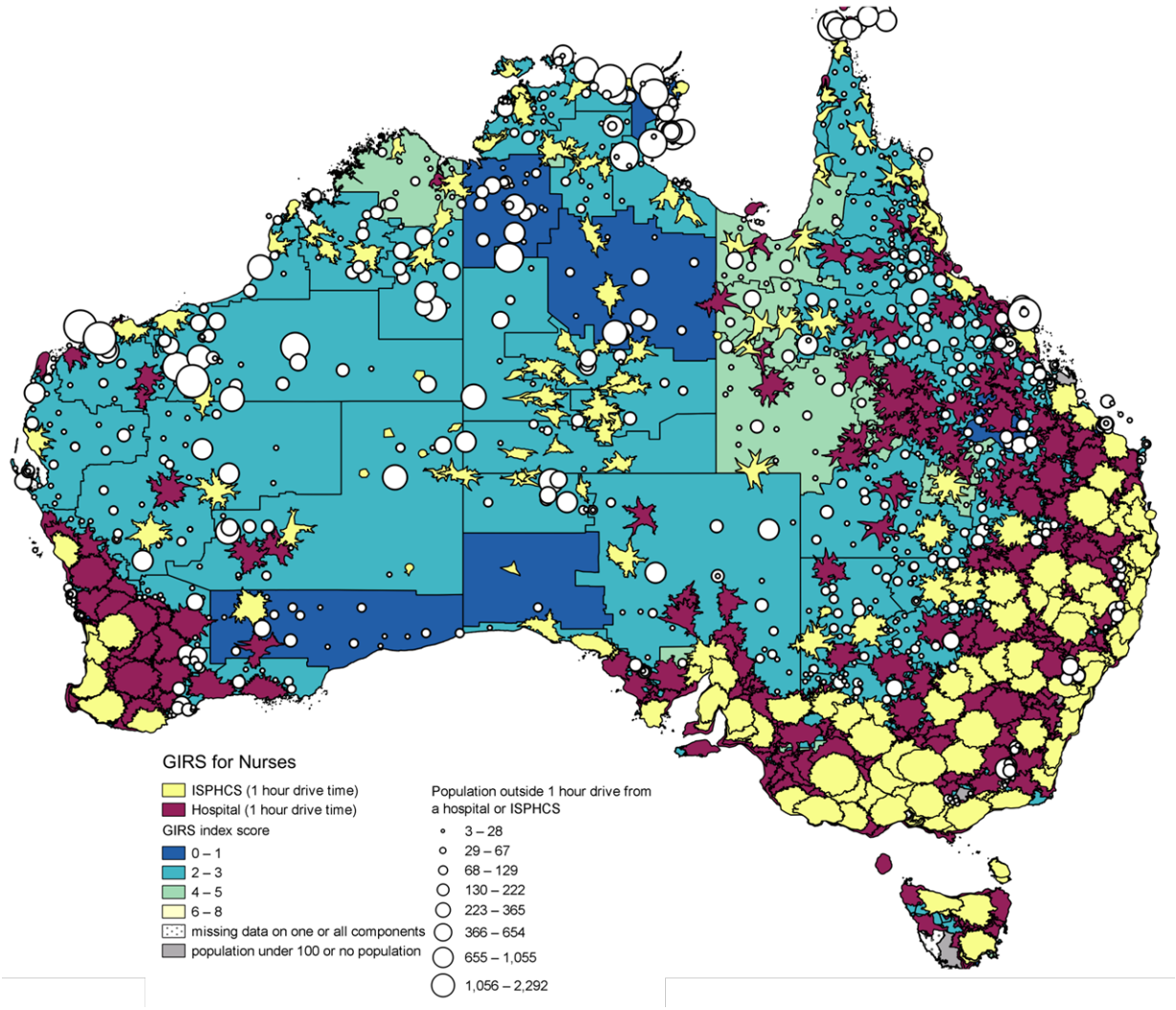


Figure 4.3: Map of nurse GIRS scores, by SA2, with drive time boundaries and mesh block populations added

Population distribution

Table 4.2 presents the distribution of the estimated residential population by nurse GIRS score. Because there were SA2s without data on Indigenous status, Table 4.2 underestimates the number of Aboriginal and Torres Strait Islander people who live in areas within each of the GIRS ranges.

Table 4.2 shows that:

- Aboriginal and Torres Strait Islander people are more likely than non-Indigenous Australians to live in areas with low nursing GIRS scores (areas with higher probabilities of nursing workforce supply challenges); however, the majority of Aboriginal and Torres Strait Islander people (69.47%) live in SA2s with nursing GIRS scores above 4
- over 17,000 Aboriginal and Torres Strait Islander people live in areas with the lowest GIRS scores (0–1).

Table 4.2: Distribution of the population by nurse GIRS and Indigenous status

	Number			%		
GIRS score	Indigenous	Non-Indigenous	Total	Indigenous	Non-Indigenous	Total
0–1	17,350	73,349	96,372	2.60	0.34	0.43
2–3	186,690	2,637,394	2,830,700	27.94	12.21	12.68
4–5	263,526	8,673,236	8,977,012	39.44	40.16	40.22
6–8	200,675	10,215,047	10,415,722	30.03	47.29	46.67
Total	**668,241**	**21,599,026**	**22,319,806**	**100.00**	**100.00**	**100.00**

Notes

1. Lower GIRS scores indicate areas with higher probabilities of workforce supply challenges compared with areas with higher GIRS scores.
2. The Indigenous and non-Indigenous populations do not add up to the total population because the ABS did not provide a breakdown by Indigenous status for 23 SA2s.

Discussion

The GIRS should be considered indicative of nursing workforce supply challenges. It does not recognise nurses who work at more than one location, as FTEs are attributed to the primary location only and do not take into account outreach services.

The proximity to services measure included public hospitals and ISPHCSs—it was not able to include other types of facilities at which nurses work (such as aged care facilities).

The GIRS also provides an aggregated measure of the nursing workforce; it does not disaggregate the workforce by work site (all nursing hours are treated as equivalent, whether they are delivered in hospital, clinic, or community settings).

Table 4.3: SA2s with nurse GIRS scores of 0–1, by descending size of Indigenous population

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous	Non-Indigenous	Total
NT	East Arnhem	East Arnhem	Very remote	1	7,967	670	8,637
NT	Barkly	Barkly	Very remote	1	2,444	606	3,050
NT	Katherine	Victoria River	Very remote	1	2,251	619	2,870
NT	East Arnhem	Anindilyakwa	Very remote	1	1,855	1,100	2,955
Qld	Cleveland - Stradbroke	Redland Islands	Outer regional	1	793	8,162	8,955
WA	Goldfields	Kambalda - Coolgardie - Norseman	Very remote	1	755	4,842	5,597
Qld	Central Highlands (Qld)	Central Highlands - West	Remote	1	280	8,793	9,073
NSW	Queanbeyan	Queanbeyan Region	Inner regional	1	273	14,339	14,612
WA	Wheat Belt - North	Gingin - Dandaragan	Outer regional	1	206	7,908	8,114
Qld	Whitsunday	Airlie - Whitsundays	Outer regional	1	205	10,777	10,982
Tas	Huon - Bruny Island	Bruny Island - Kettering	Outer regional	1	129	2,823	2,952
NSW	Snowy Mountains	Jindabyne - Berridale	Outer regional	1	94	6,811	6,905
SA	Eyre Peninsula and South West	Western	Very remote	1	72	40	112
NSW	Dural - Wisemans Ferry	Galston - Laughtondale	Major city	1	23	5,280	5,303
NT	Darwin City	Darwin Airport	Outer regional	1	3	466	469
Vic	Gippsland - South West	French Island	Outer regional	0	0	113	113
Qld	Gladstone - Biloela	Agnes Water - Miriam Vale	Outer regional	1	n.a.	n.a.	5,673
				Total**	**17,350**	**73,349**	**96,372**

* SA3 = Statistical Area level 3.

** The totals in the columns for Indigenous and non-Indigenous do not add up to the total population because data on Indigenous status were not available (as indicated by 'n.a.') for the Agnes Water - Miriam Vale SA2.

5 Midwives

Midwives provide care and advice to women during pregnancy, labour and delivery; they also provide postnatal care for women and babies in diverse settings, including the home, community, hospitals, clinics, Aboriginal medical services, and health units (AIHW 2013c). Midwives can be registered as nurses, as midwives, or as both. Only data on midwifery-specific FTEs were included in the midwifery GIRS.

Access to midwives is particularly critical for the health of Aboriginal and Torres Strait Islander mothers and babies. Indigenous mothers are less likely to attend antenatal care in the first trimester of pregnancy, have higher levels of social disadvantage, and are more likely to smoke during pregnancy. These factors contribute to the higher likelihoods that babies born to Aboriginal and Torres Strait Islander mothers are born prematurely, are of low birthweight and will die before their first birthday.

There are a large number of government and non-government initiatives whose purpose is to improve access to high-quality, culturally appropriate care for mothers and babies in order to reduce these disparities (AIHW 2014d).

Midwife GIRS scores

Midwife GIRS scores by remoteness are presented in Table 5.1.

Table 5.1: GIRS scores for midwives by remoteness

	Number of areas (SA2s) by remoteness					
GIRS score	**Major cities**	**Inner regional**	**Outer regional**	**Remote**	**Very remote**	**Total areas**
0–1	0	13	51	22	34	120
2–3	16	193	130	11	14	364
4–5	467	181	69	5	1	723
6–8	726	88	60	9	1	884
Total	**1,209**	**475**	**310**	**47**	**50**	**2,091**

Notes

1. Lower GIRS scores indicate areas with higher probabilities of workforce supply challenges compared with areas with higher GIRS scores.
2. Only SA2s with a total population of greater than 100 were included.
3. Only 2,091 SA2s have valid midwife GIRS scores. The proximity measure was calculated relative to women of child-bearing age (not the total population), and there was an additional SA2 with missing data.

The distribution of the midwife GIRS scores shows that:

- 120 SA2s had GIRS scores of 0–1 (lowest relative supply). Of these, the majority were in *Outer regional* areas, followed by *Very remote* and *Remote* areas
- over half of *Very remote* SA2s had GIRS scores of 0–1, while only 1 had a score of 6–8.

Figure 5.1 illustrates the spatial distribution of the GIRS scores. Figure 5.2 adds the 1 hour drive time catchments of hospitals with public birthing units (proximity to services). Figure 5.3 adds the mesh block populations of those outside a 1 hour drive to show the size and locations of those with poor proximity to a hospital with a public birthing unit. The purpose of the maps is to illustrate areas with a higher probability of workforce supply challenges, as reflected in a GIRS score of 0 or 1. A table listing the 111 areas with midwife GIRS scores of 0–1 is included at the end of this chapter (Table 5.3).

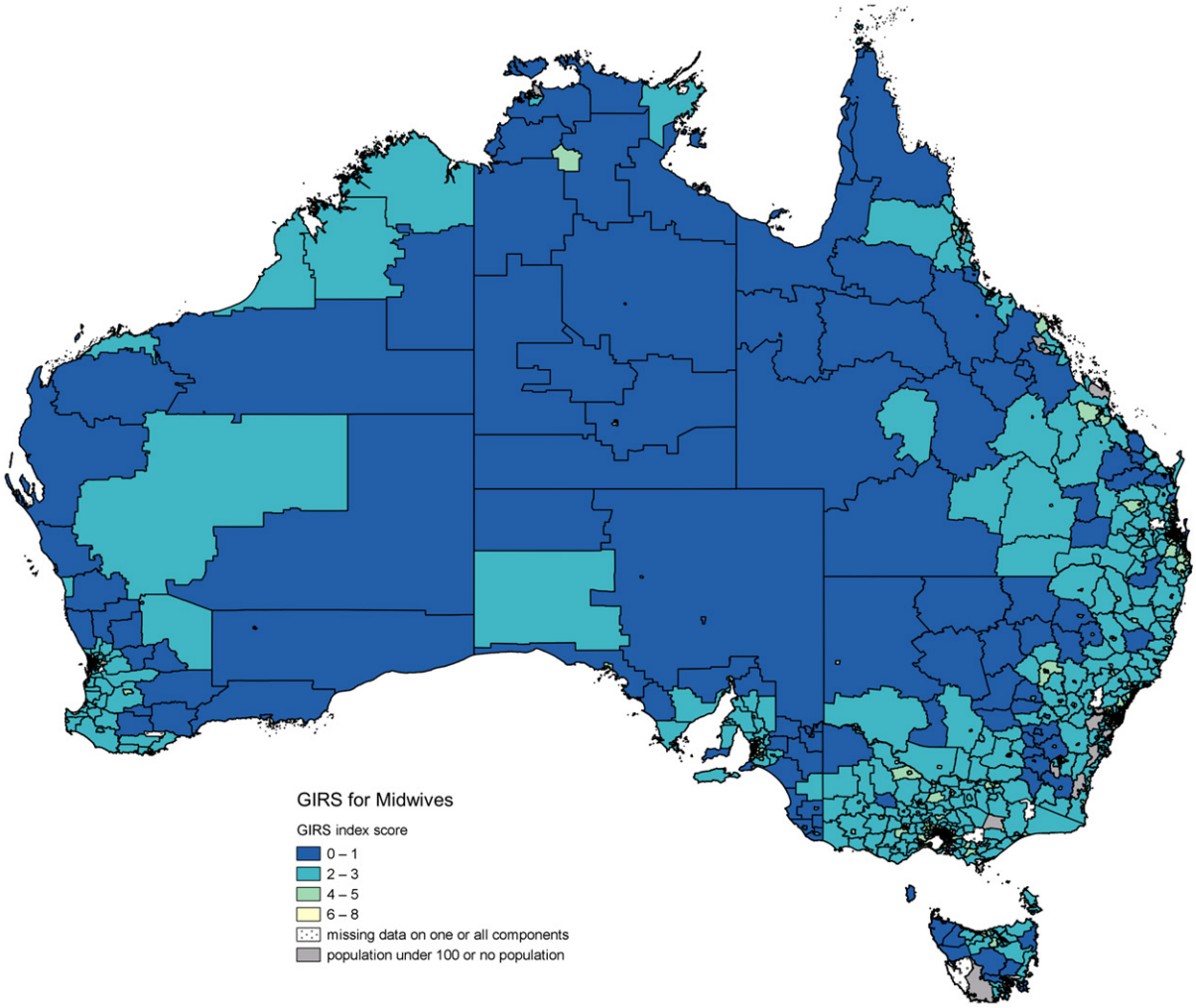


Figure 5.1: Map of midwife GIRS scores, by SA2

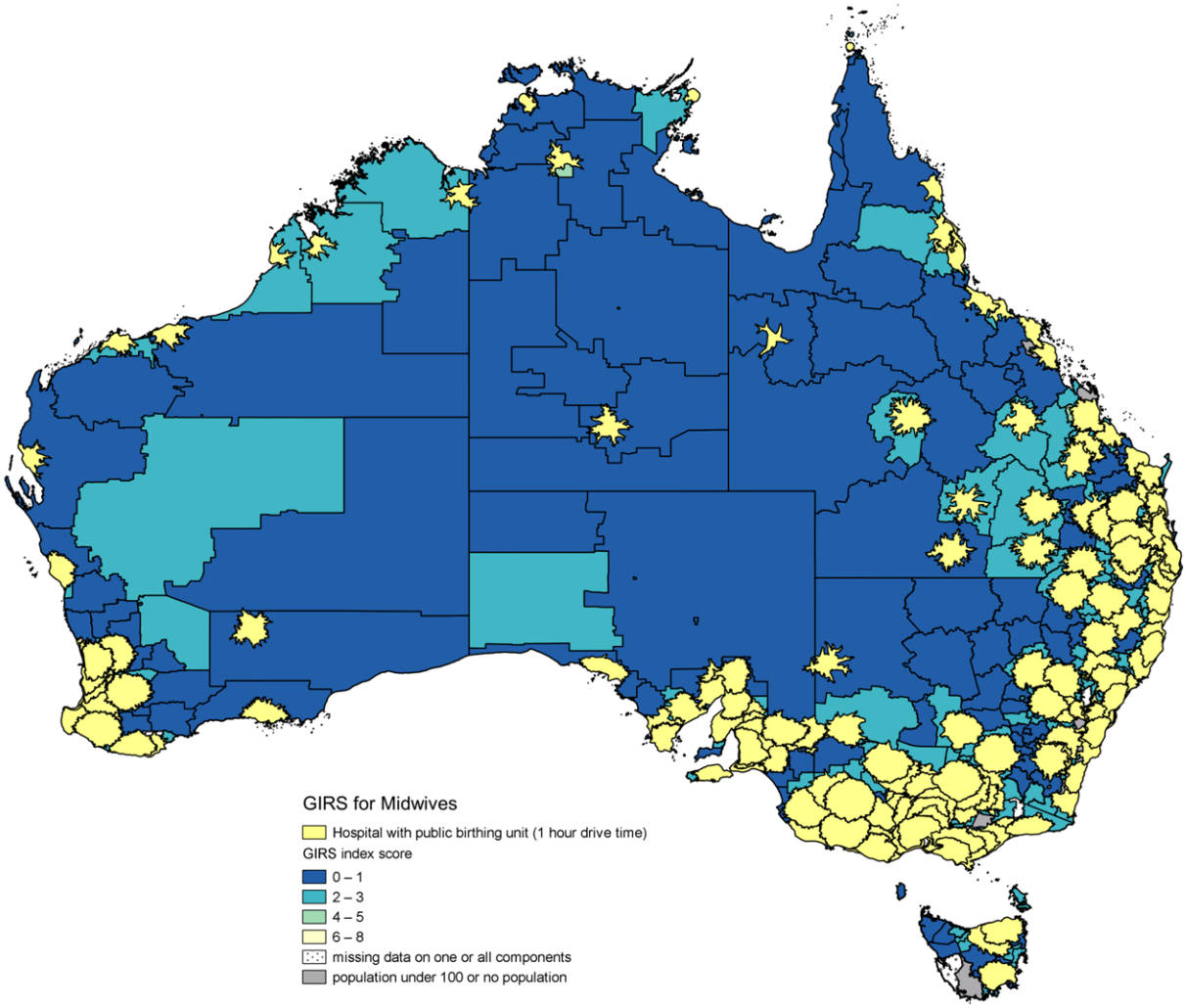


Figure 5.2: Map of midwife GIRS scores, by SA2, with drive time boundaries added

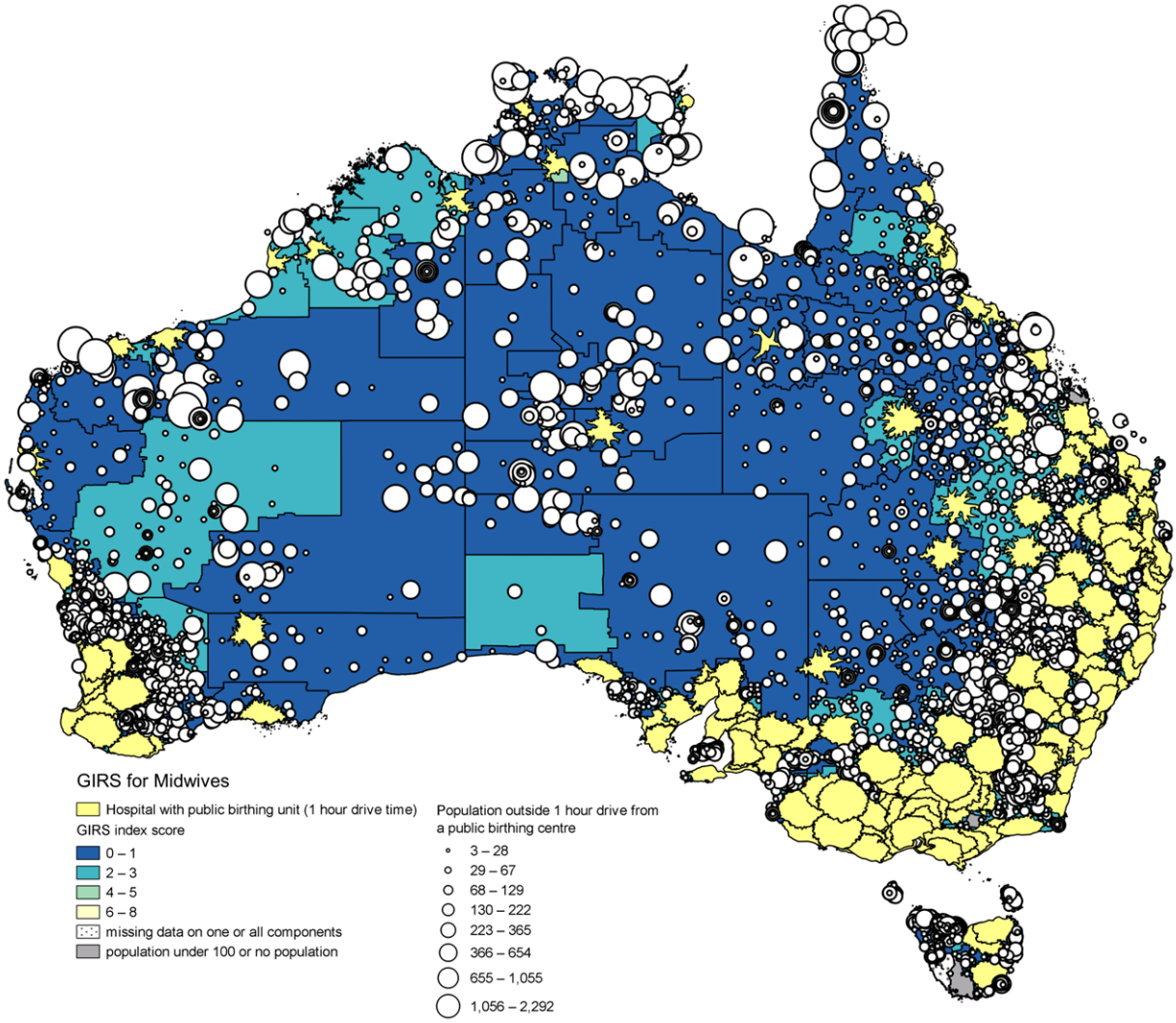


Figure 5.3: Map of midwife GIRS scores, by SA2, with drive time boundaries and mesh block populations added

Population distribution

Table 5.2 presents the distribution of the estimated residential population by midwife GIRS score. Because there were SA2s without data on Indigenous status, Table 5.2 underestimates the number of Aboriginal and Torres Strait Islander people who live in areas within each of the GIRS ranges.

Table 5.2 shows that:

- Aboriginal and Torres Strait Islander women of child-bearing age are much more likely than non-Indigenous women to live in SA2s with lower GIRS scores
- over 19,000 Aboriginal and Torres Strait Islander women of child-bearing age live in SA2s with GIRS scores of 0–1
- over half of non-Indigenous women of child-bearing age (52.1%) live in SA2s with GIRS scores of 6–8, compared with 30.9% of Aboriginal and Torres Strait Islander women of child-bearing age.

Table 5.2: Distribution of the population of women of child-bearing age (15–44 years) by midwife GIRS and Indigenous status

	Number of women aged 15–44			%		
GIRS score	Indigenous	Non-Indigenous	Total	Indigenous	Non-Indigenous	Total
0–1	19,017	74,966	98,083	15.34	1.82	2.21
2–3	23,267	376,302	415,632	18.77	9.13	9.35
4–5	43,390	1,521,669	1,626,721	35.00	36.91	36.61
6–8	38,309	2,149,469	2,302,754	30.90	52.14	51.83
Total	**123,983**	**4,122,406**	**4,443,190**	**100.00**	**100.00**	**100.00**

Notes:

1. Lower GIRS scores indicate areas with higher probabilities of workforce supply challenges compared with areas with higher GIRS scores.
2. The Indigenous and non-Indigenous populations do not add up to the total population because the ABS did not provide a breakdown by Indigenous status for 23 SA2s.

Discussion

The GIRS should be considered indicative of midwife workforce supply challenges. The GIRS is unable to capture midwife FTEs that are delivered outside the SA2 of midwives' primary work location through outreach services. These services might include those delivered through Royal Flying Doctor Service clinics, ISPHCSs, maternity units at hospitals and those funded by the Rural Health Outreach Fund.

The proximity to service component was measured by access to hospitals with public birthing units (which include private hospitals funded to deliver services to public patients). While these data were accurate when collected, the list of hospitals changes over time as new units open or begin providing services to public patients, or close their birthing units.

Table 5.3: SA2s with midwife GIRS scores of 0–1, by descending size of population of Indigenous women aged 15–44

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous women aged 15–44	Non-Indigenous women aged 15–44	Total women aged 15–44
NT	Daly - Tiwi - West Arnhem	West Arnhem	Very remote	1	1,121	103	1,227
NT	Katherine	Gulf	Very remote	1	863	99	971
Qld	Far North	Cape York	Remote	1	822	455	1,323
NT	Alice Springs	Sandover - Plenty	Remote	1	733	54	799
Qld	Outback - North	Carpentaria	Very remote	1	689	285	1,032
WA	Kimberley	Halls Creek	Very remote	1	678	137	821
NT	Alice Springs	Tanami	Very remote	1	664	80	749
SA	Outback - North and East	APY Lands	Very remote	1	593	59	655
NT	Daly - Tiwi - West Arnhem	Tiwi Islands	Remote	1	554	41	598
NT	Barkly	Barkly	Very remote	1	533	100	653
WA	Goldfields	Leinster - Leonora	Very remote	1	526	457	1,056
NT	Daly - Tiwi - West Arnhem	Thamarrurr	Very remote	1	515	39	558
NT	Alice Springs	Yuendumu - Anmatjere	Very remote	1	465	48	513
Qld	Far North	Northern Peninsula	Very remote	1	463	71	541
NT	Katherine	Victoria River	Very remote	1	458	123	588
NSW	Bourke - Cobar - Coonamble	Walgett - Lightning Ridge	Remote	0	453	629	1,133
NT	East Arnhem	Anindilyakwa	Very remote	1	438	205	646
WA	Pilbara	East Pilbara	Very remote	1	405	581	1,134
NT	Katherine	Elsey	Very remote	1	400	85	488
Qld	Far North	Kowanyama - Pormpuraaw	Very remote	1	392	34	426
NSW	Bourke - Cobar - Coonamble	Bourke - Brewarrina	Very remote	1	383	403	871
NSW	Broken Hill and Far West	Far West	Very remote	1	176	291	472
Qld	Outback - North	Mount Isa Region	Remote	1	174	489	733
Qld	Outback - South	Far South West	Very remote	1	169	382	557
SA	Eyre Peninsula and South West	West Coast (SA)	Very remote	1	167	432	621
NSW	Lachlan Valley	Cowra	Inner regional	1	164	1,192	1,434
NSW	Dubbo	Coonabarabran	Outer regional	0	157	1,006	1,223
Qld	Cleveland - Stradbroke	Redland Islands	Outer regional	1	136	961	1,206

(continued)

Table 5.3 (continued): SA2s with midwife GIRS scores of 0–1, by descending size of population of Indigenous women aged 15–44

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous women aged 15–44	Non-Indigenous women aged 15–44	Total women aged 15–44
NSW	Bourke - Cobar - Coonamble	Cobar	Remote	0	134	689	877
NSW	Moree - Narrabri	Narrabri Region	Outer regional	1	129	647	812
WA	Esperance	Esperance	Remote	1	126	1,936	2,154
WA	Goldfields	Kambalda - Coolgardie - Norseman	Very remote	1	117	854	1,089
NSW	Inverell - Tenterfield	Tenterfield	Outer regional	1	109	818	964
SA	Outback - North and East	Outback	Very remote	0	108	407	564
NSW	Lachlan Valley	Parkes Region	Outer regional	1	85	399	504
Qld	Outback - South	Far Central West	Very remote	1	83	339	432
WA	Wheat Belt - North	Cunderdin	Outer regional	1	82	505	603
WA	Wheat Belt - North	Moora	Outer regional	1	81	712	815
WA	Albany	Katanning	Outer regional	1	80	746	845
Tas	West Coast	North West	Outer regional	1	77	628	733
Tas	West Coast	West Coast (Tas)	Remote	1	72	754	862
WA	Mid West	Northampton - Mullewa - Greenough	Remote	1	71	769	871
NSW	Goulburn - Yass	Young	Inner regional	1	70	1,662	1,810
SA	Murray and Mallee	The Coorong	Outer regional	1	66	720	827
NSW	Wagga Wagga	Cootamundra	Inner regional	1	66	1,025	1,133
Qld	Bowen Basin - North	Moranbah	Outer regional	1	66	1,929	2,105
TAS	Central Highlands (Tas)	Southern Midlands	Outer regional	1	62	909	999
Qld	Burnett	Gayndah - Mundubbera	Outer regional	1	62	899	1,009
NSW	Goulburn - Yass	Young Region	Inner regional	1	62	1,009	1,119
Qld	Outback - South	Barcaldine - Blackall	Very remote	1	61	889	988
NSW	Tamworth - Gunnedah	Gunnedah Region	Outer regional	1	60	647	744
WA	Gascoyne	Exmouth	Very remote	1	59	656	779
WA	Albany	Kojonup	Outer regional	1	57	618	694
WA	Wheat Belt - North	Merredin	Outer regional	1	56	775	864
Qld	Bowen Basin - North	Broadsound - Nebo	Outer regional	1	56	1,768	1,991

(continued)

Table 5.3 (continued): SA2s with midwife GIRS scores of 0–1, by descending size of population of Indigenous women aged 15–44

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous women aged 15–44	Non-Indigenous women aged 15–44	Total women aged 15–44
WA	Esperance	Esperance Region	Very remote	1	55	654	735
NSW	Armidale	Walcha	Outer regional	1	53	440	500
WA	Mid West	Morawa	Remote	0	52	635	713
Qld	Burnett	Monto - Eidsvold	Outer regional	1	51	499	566
Tas	West Coast	Waratah	Outer regional	0	50	568	633
WA	Wheat Belt - North	Dowerin	Outer regional	1	47	576	636
Qld	Outback - North	Northern Highlands	Very remote	1	45	546	627
Qld	Darling Downs (West) - Maranoa	Tara	Outer regional	1	45	580	660
NSW	Lachlan Valley	West Wyalong	Outer regional	1	42	868	923
Tas	North East	St Helens - Scamander	Outer regional	1	42	773	830
SA	Murray and Mallee	Barmera	Outer regional	1	41	939	1,028
Qld	Bowen Basin - North	Collinsville	Remote	0	38	584	695
Qld	Maryborough	Maryborough Region - South	Inner regional	1	37	1,003	1,089
WA	Wheat Belt - North	Gingin - Dandaragan	Outer regional	0	35	1,064	1,181
SA	Outback - North and East	Flinders Ranges	Outer regional	1	34	280	327
SA	Mid North	Peterborough - Mount Remarkable	Outer regional	1	33	672	726
Qld	Charters Towers - Ayr - Ingham	Ingham Region	Remote	1	32	864	922
WA	Wheat Belt - South	Kulin	Remote	0	31	666	710
Tas	Central Highlands (Tas)	Derwent Valley	Inner regional	1	29	501	533
NSW	Tumut - Tumbarumba	Tumut Region	Inner regional	1	29	627	672
Qld	Burnett	Gin Gin	Outer regional	1	28	678	738
Qld	Gladstone - Biloela	Agnes Water - Miriam Vale	Outer regional	0	28	727	802
Tas	Central Highlands (Tas)	Central Highlands	Outer regional	1	27	277	322
SA	Limestone Coast	Millicent	Outer regional	1	27	830	884
Qld	Nambour - Pomona	Noosa Hinterland	Inner regional	1	27	2,978	3,156

(continued)

Table 5.3 (continued): SA2s with midwife GIRS scores of 0–1, by descending size of population of Indigenous women aged 15–44

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous women aged 15–44	Non-Indigenous women aged 15–44	Total women aged 15–44
Qld	Charters Towers - Ayr - Ingham	Dalrymple	Remote	1	26	637	682
SA	Murray and Mallee	Mannum	Inner regional	1	26	743	796
SA	Murray and Mallee	Loxton	Outer regional	1	25	833	877
Qld	Far North	Croydon - Etheridge	Very remote	1	24	171	202
Qld	Bowen Basin - North	Clermont	Remote	1	24	708	766
WA	Albany	Gnowangerup	Remote	0	22	441	478
Qld	Darling Downs (West) - Maranoa	Miles - Wandoan	Outer regional	1	20	599	655
Tas	South East Coast	Forestier - Tasman	Outer regional	1	19	261	293
NSW	Lower Murray	Hay	Outer regional	1	19	410	445
NSW	Wagga Wagga	Gundagai	Inner regional	1	18	517	547
SA	Outback - North and East	Roxby Downs	Remote	1	17	1,010	1,086
SA	Limestone Coast	Grant	Outer regional	1	15	866	899
NSW	Snowy Mountains	Cooma Region	Outer regional	1	13	441	466
SA	Murray and Mallee	Waikerie	Outer regional	1	13	877	913
Vic	Grampians	St Arnaud	Outer regional	1	12	493	508
SA	Murray and Mallee	Karoonda - Lameroo	Remote	1	11	432	449
NSW	Goulburn - Yass	Yass Region	Inner regional	1	11	1,779	1,872
SA	Limestone Coast	Penola	Outer regional	0	10	538	559
Vic	Mildura	Mildura Region	Outer regional	0	8	493	523
Tas	West Coast	King Island	Very remote	1	7	230	242
SA	Limestone Coast	Kingston - Robe	Outer regional	0	7	554	569
SA	Limestone Coast	Naracoorte Region	Outer regional	1	<5	377	385
NSW	Tumut - Tumbarumba	Tumbarumba	Outer regional	1	<5	441	474
SA	Yorke Peninsula	Yorke Peninsula - South	Remote	1	<5	437	450
SA	Eyre Peninsula and South West	Le Hunte - Elliston	Very remote	0	<5	363	366
SA	Murray and Mallee	Renmark Region	Outer regional	1	<5	827	864
SA	Fleurieu - Kangaroo Island	Yankalilla	Inner regional	1	<5	636	652
Vic	Baw Baw	Mount Baw Baw Region	Inner regional	1	<5	936	975

(continued)

Table 5.3 (continued): SA2s with midwife GIRS scores of 0–1, by descending size of population of Indigenous women aged 15–44

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous women aged 15–44	Non-Indigenous women aged 15–44	Total women aged 15–44
Vic	Gippsland - South West	French Island	Outer regional	0	<5	7	7
SA	Murray and Mallee	Loxton Region	Outer regional	1	<5	270	279
SA	Limestone Coast	Wattle Range	Outer regional	1	<5	494	494
				Total	**19,017**	**74,966**	**98,083**

* SA3 = Statistical Area level 3.

6 Pharmacists

Pharmacists play a crucial role in ensuring the safe supply and use of medicine. Those working in clinical roles serve several key functions, including:

- receiving and checking prescriptions, checking medication history and potential compatibility/incompatibility of multiple medications before dispensing them
- filling prescriptions, which includes proper preparation, labelling and dosage instructions
- undertaking medication reviews for individual patients, particularly in complex cases (AIHW 2013a).

As well, pharmacists provide information and counselling on medication management and can help to increase patient adherence.

The majority of pharmacists in clinical roles work in commercial/business services (for example, in chemists), followed by hospital settings and community health-care services. A small number work in Aboriginal medical services.

Because Aboriginal and Torres Strait Islander people have higher rates of chronic and ongoing illnesses than non-Indigenous people, they often have complex medication needs. Despite this, they often face substantial costs for pharmacy services, compounded by the restricted availability of these services and cultural barriers to appropriate levels of service.

Pharmacist GIRS scores

Pharmacist GIRS scores by remoteness are presented in Table 6.1.

Table 6.1: GIRS scores for pharmacists, by remoteness

	Number of areas (SA2s) by remoteness					
GIRS score	**Major cities**	**Inner regional**	**Outer regional**	**Remote**	**Very remote**	**Total areas**
0–1	0	0	5	13	27	45
2–3	6	196	155	18	16	391
4–5	447	200	83	13	7	750
6–8	757	79	67	3	0	906
Total	**1,210**	**475**	**310**	**47**	**50**	**2,092**

Notes:

1. Lower GIRS scores indicate areas with higher probabilities of workforce supply challenges compared with areas with higher GIRS scores.
2. Only SA2s with a total population of greater than 100 were included.

The distribution of the pharmacist GIRS scores shows that:

- 45 SA2s had GIRS scores of 0–1 (lowest relative supply). Of these, the majority were in *Very remote* areas, followed by *Remote* areas, with another 5 SA2s in *Outer regional* areas
- no SA2s in *Major cities* or *Inner regional* areas had GIRS scores of 0–1
- overall, GIRS scores are inversely related to remoteness—the modal GIRS scores for *Major cities* are 6–8, followed by 4–5 for *Inner regional* areas, 2–3 for *Outer regional* and *Remote* areas and 0–1 for *Very remote* areas
- there is variation within the remoteness categories.

Figure 6.1 illustrates the spatial distribution of the GIRS scores. Figure 6.2 adds the 1 hour drive time catchments of community pharmacies (proximity to services). Figure 6.3 adds the mesh block populations of those outside a 1 hour drive to show the size and locations of those with poor proximity to a community pharmacy. The purpose of the maps is to illustrate areas with a higher probability of workforce supply challenges, as reflected in a GIRS score of 0 or 1. A table listing the 45 areas with pharmacist GIRS scores of 0–1 is included at the end of this chapter (Table 6.3).

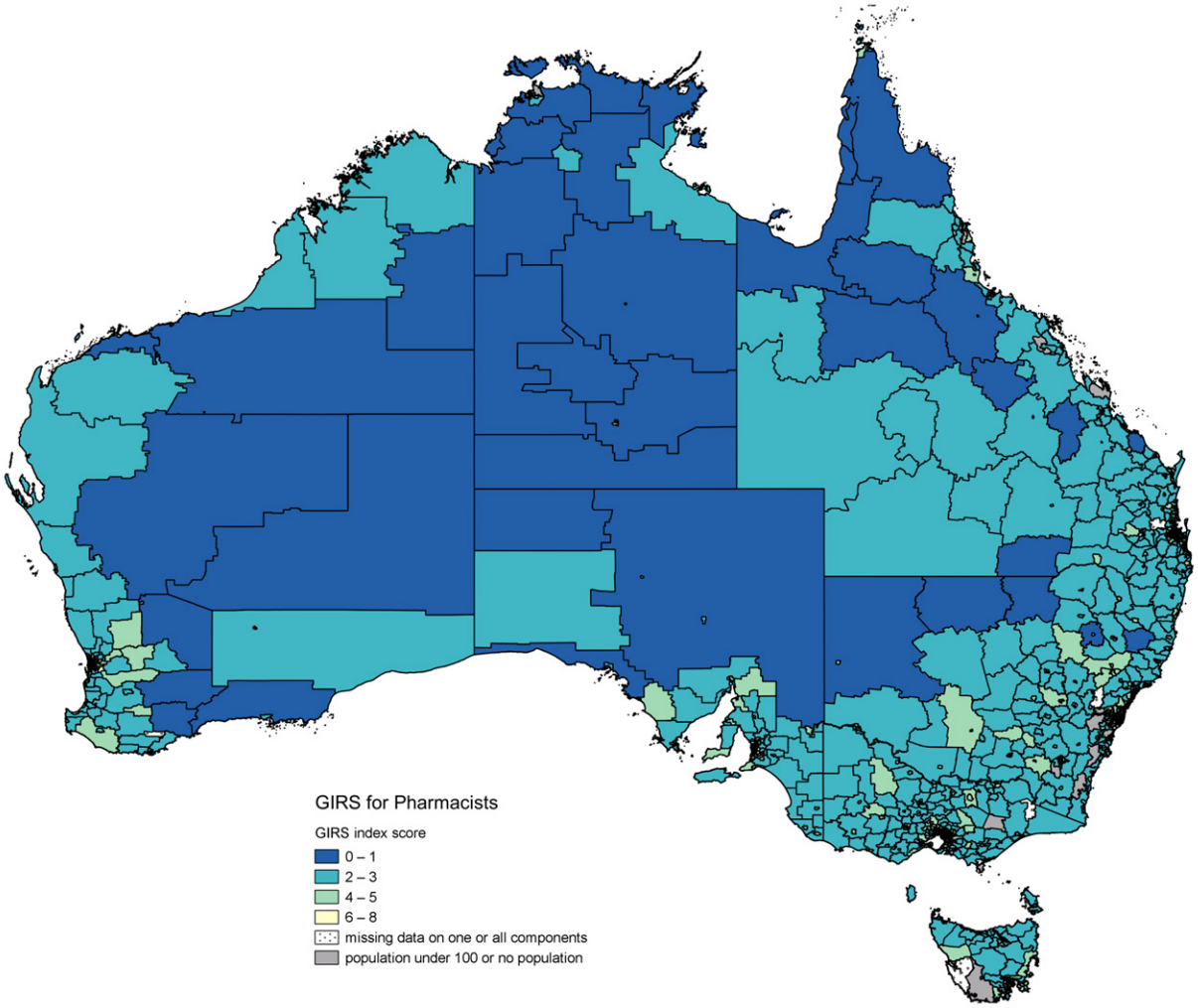


Figure 6.1: Map of pharmacist GIRS scores, by SA2

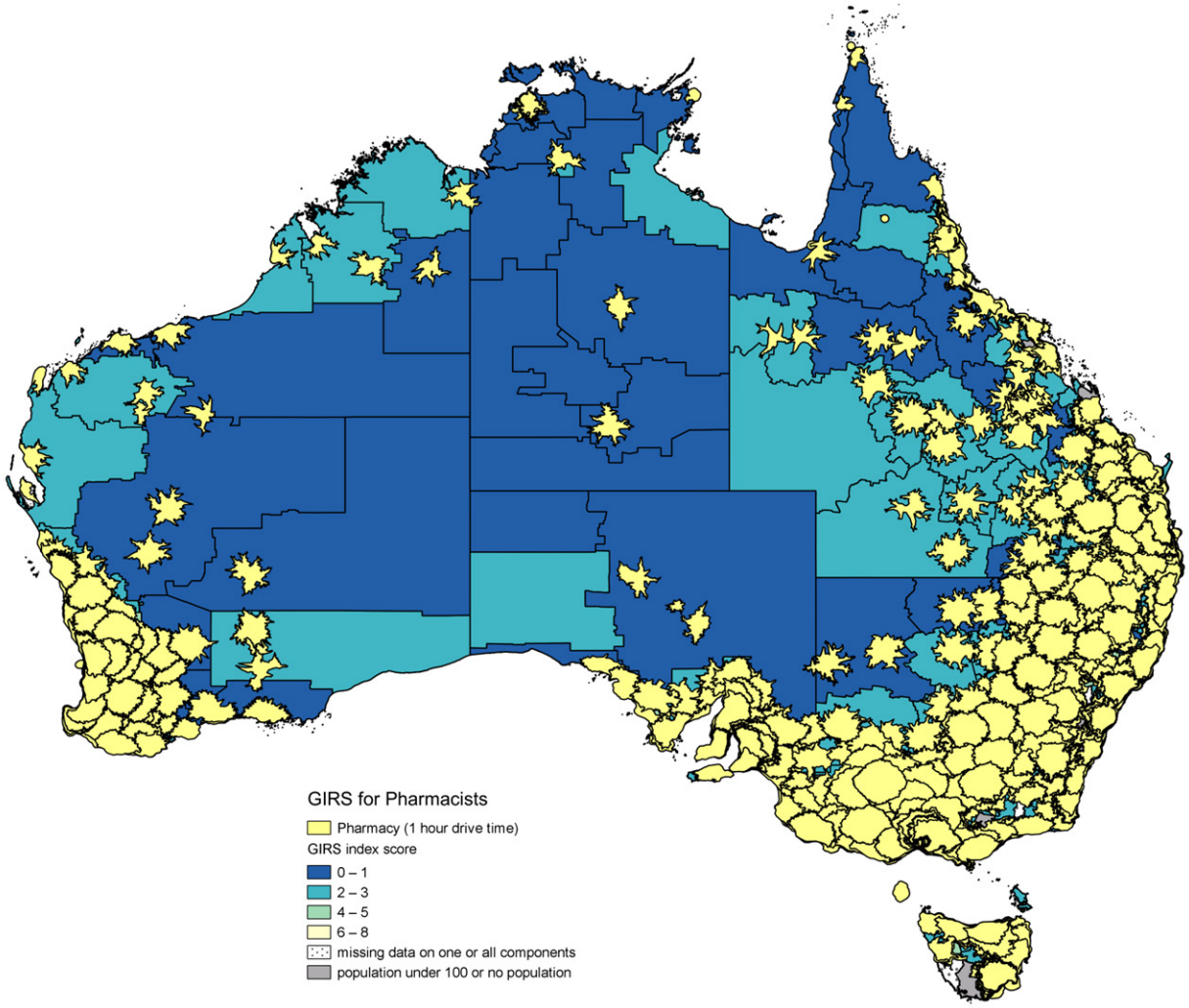


Figure 6.2: Map of pharmacist GIRS scores, by SA2, with drive time boundaries added

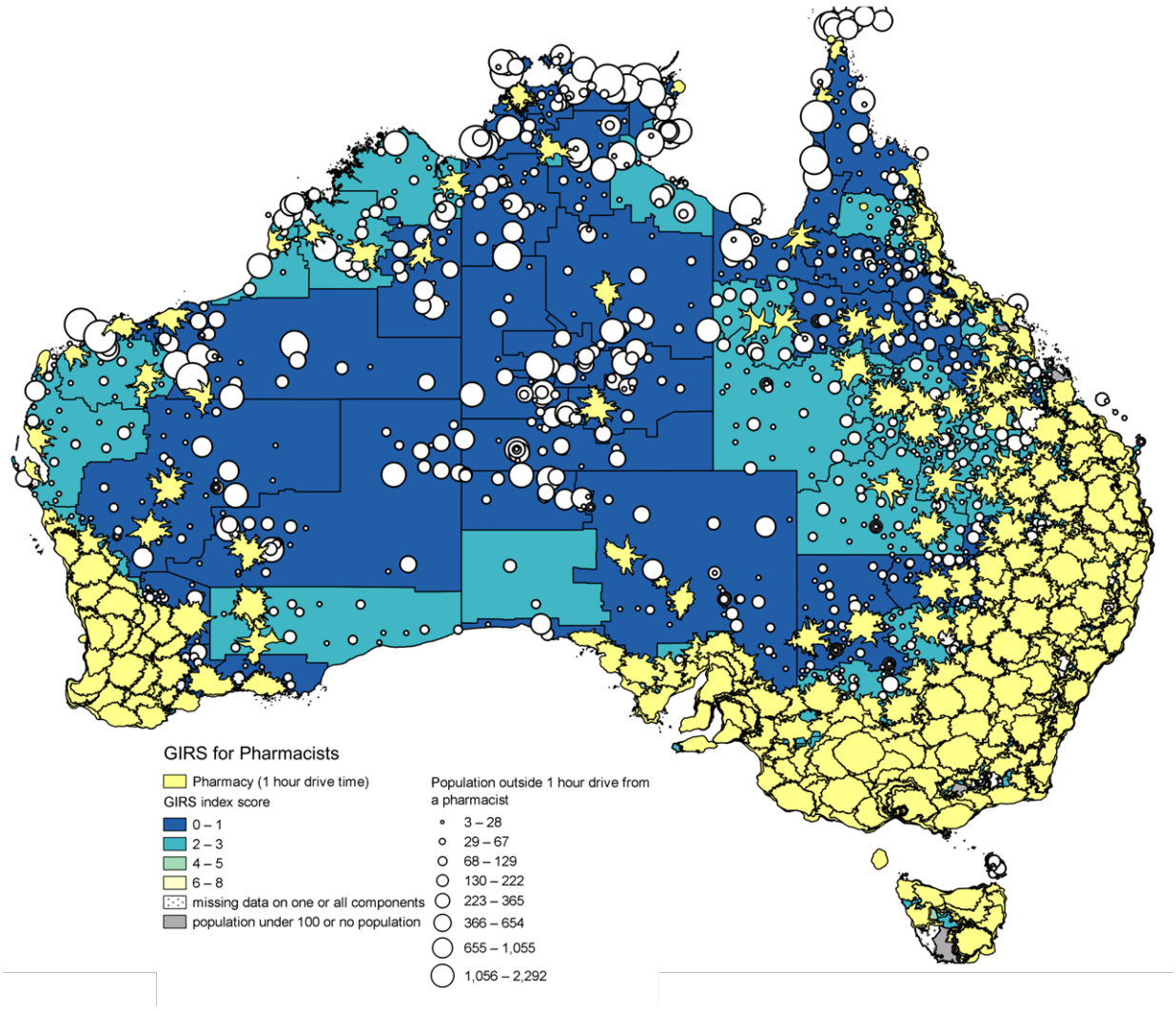


Figure 6.3: Map of pharmacist GIRS scores, by SA2, with drive time boundaries and mesh block populations added

Population distribution

Table 6.2 presents the distribution of the estimated residential population by pharmacist GIRS score. Because there were SA2s without data on Indigenous status, Table 6.2 underestimates the number of Aboriginal and Torres Strait Islander people who live in areas within each of the GIRS ranges.

Table 6.2 shows that:

- Aboriginal and Torres Strait Islander people are much more likely than non-Indigenous Australians to live in areas with low pharmacist GIRS scores (areas with higher probabilities of pharmacist workforce supply challenges)
- nearly 79,000 Aboriginal and Torres Strait Islander people live in areas with the lowest GIRS scores (0–1).

Table 6.2 Distribution of the population, by pharmacist GIRS and Indigenous status

	Number			%		
GIRS score	Indigenous	Non-Indigenous	Total	Indigenous	Non-Indigenous	Total
0–1	78,970	92,468	177,111	11.82	0.43	0.79
2–3	133,443	2,447,269	2,587,328	19.97	11.33	11.59
4–5	271,085	8,127,620	8,430,608	40.57	37.63	37.77
6–8	184,743	10,931,669	11,124,759	27.65	50.61	49.84
Total	**668,241**	**21,599,026**	**22,319,806**	**100.00**	**100.00**	**100.00**

Notes

1. Lower GIRS scores indicate areas with higher probabilities of workforce supply challenges compared with areas with higher GIRS scores.
2. The Indigenous and non-Indigenous populations do not add up to the total population because the ABS did not provide a breakdown by Indigenous status for 23 SA2s.

Discussion

The GIRS should be considered indicative of pharmacist workforce supply challenges. The proximity to service measure is based on the locations of community pharmacies only. People may also potentially access pharmacists and pharmacy services through some ISPHCSs or through hospitals, although we do not have information on the extent to which these services are available and for whom (for example, if community members are able to access hospital pharmacy services). Locations of outreach pharmacist visits and details about pharmacist telehealth services were not available for inclusion in this report.

It is important to note that the pharmacist GIRS does not reflect accessibility to medications *per se*, which may be dealt with through the s100 Remote Aboriginal Health Services Program, through the Royal Flying Doctor Service medical chest program, or via online ordering and delivery systems. The s100 Remote Aboriginal Health Services Program provides Pharmaceutical Benefits Scheme (PBS) medicines at no cost to clients of approximately 162 eligible remote area Aboriginal Health Services. The medications are provided in bulk to each Aboriginal Health Service by approved community pharmacies or hospital authorities. Medications are then dispensed to patients by health service staff under the supervision of a medical practitioner, without the need for a PBS prescription.

Table 6.3: SA2s with pharmacist GIRS scores of 0–1, by descending size of Indigenous population

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous	Non-Indigenous	Total
NT	East Arnhem	East Arnhem	Very remote	0	7,967	670	8,637
NT	Daly - Tiwi - West Arnhem	West Arnhem	Very remote	0	4,913	487	5,400
Qld	Far North	Torres Strait Islands	Very remote	1	4,304	274	4,578
Qld	Far North	Cape York	Remote	1	4,089	3,416	7,505
NT	Alice Springs	Sandover - Plenty	Remote	1	3,878	441	4,319
Qld	Outback - North	Carpentaria	Very remote	1	3,642	1,706	5,348
WA	Kimberley	Halls Creek	Very remote	0	3,205	688	3,893
NT	Alice Springs	Tanami	Very remote	0	2,814	552	3,366
NT	Daly - Tiwi - West Arnhem	Tiwi Islands	Remote	0	2,637	333	2,970
NSW	Bourke - Cobar - Coonamble	Walgett - Lightning Ridge	Remote	1	2,502	4,688	7,190
WA	Goldfields	Leinster - Leonora	Very remote	0	2,491	3,335	5,826
NT	Daly - Tiwi - West Arnhem	Thamarrurr	Very remote	0	2,464	198	2,662
Qld	Charters Towers - Ayr - Ingham	Palm Island	Remote	1	2,447	91	2,538
NT	Barkly	Barkly	Very remote	0	2,444	606	3,050
SA	Outback - North and East	APY Lands	Very remote	0	2,375	285	2,660
NT	Katherine	Victoria River	Very remote	0	2,251	619	2,870
NT	Alice Springs	Yuendumu - Anmatjere	Very remote	0	2,094	280	2,374
WA	Pilbara	East Pilbara	Very remote	1	2,023	5,823	7,846
NT	East Arnhem	Anindilyakwa	Very remote	0	1,855	1,100	2,955
NT	Katherine	Elsey	Very remote	0	1,831	521	2,352
Qld	Far North	Kowanyama - Pormpuraaw	Very remote	0	1,691	136	1,827
WA	Pilbara	Roebourne	Remote	1	1,674	4,953	6,627
WA	Mid West	Meekatharra	Very remote	1	1,521	2,691	4,212
NT	Daly - Tiwi - West Arnhem	Daly	Very remote	0	1,494	743	2,237
Qld	Central Highlands (Qld)	Central Highlands - East	Outer regional	1	1,476	6,336	7,812
NT	Daly - Tiwi - West Arnhem	Alligator	Remote	1	1,342	3,488	4,830
Qld	Far North	Aurukun	Very remote	0	1,306	92	1,398
NT	Alice Springs	Petermann - Simpson	Very remote	0	1,108	1,367	2,475

(continued)

Table 6.3 (continued): SA2s with pharmacist GIRS scores of 0–1, by descending size of Indigenous population

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous	Non-Indigenous	Total
Qld	Darling Downs (West) - Maranoa	Balonne	Remote	1	977	3,885	4,862
NSW	Broken Hill and Far West	Far West	Very remote	0	936	1,850	2,786
SA	Eyre Peninsula and South West	West Coast (SA)	Very remote	1	689	2,997	3,686
SA	Outback - North and East	Outback	Very remote	0	589	2,947	3,536
NSW	Tamworth - Gunnedah	Gunnedah Region	Outer regional	1	351	4,317	4,668
NSW	Armidale	Walcha	Outer regional	1	268	3,026	3,294
Qld	Outback - North	Northern Highlands	Very remote	1	249	3,523	3,772
WA	Wheat Belt - South	Kulin	Remote	1	206	4,515	4,721
WA	Albany	Gnowangerup	Remote	1	178	2,746	2,924
WA	Esperance	Esperance Region	Very remote	1	165	4,127	4,292
Qld	Charters Towers - Ayr - Ingham	Dalrymple	Remote	1	161	3,819	3,980
Qld	Far North	Croydon - Etheridge	Very remote	0	128	1,128	1,256
WA	Wheat Belt - North	Mukinbudin	Remote	1	121	3,422	3,543
Qld	Bowen Basin - North	Clermont	Remote	1	111	3,745	3,856
NSW	Lord Howe Island	Lord Howe Island	Very remote	1	3	389	392
Vic	Gippsland - South West	French Island	Outer regional	0	0	113	113
Qld	Gladstone - Biloela	Agnes Water - Miriam Vale	Outer regional	1	n.a.	n.a.	5,673
				Total**	**78,970**	**92,468**	**177,111**

* SA3 = Statistical Area level 3.

** The totals in the columns for Indigenous and non-Indigenous do not add up to the total population because data on Indigenous status were not available (as indicated by 'n.a.') for the Agnes Water - Miriam Vale SA2.

Note: the pharmacist GIRS does reflect accessibility to medicines *per se*, which may be dealt with through other programs including the s100 Remote Aboriginal Health Services Program and the Royal Flying Doctor Service medical chest program.

7 Dentists

Dentists are independent practitioners who provide assessment, diagnosis, treatment, management and preventive services related to oral health. The education requirement for a graduate dentist to be registered is a minimum 4-year full-time education program approved by the National Board (Dental Board of Australia 2015).

Physical, financial and cultural access to dentists is a critical issue for Aboriginal and Torres Strait Islander health. Indigenous Australians have overall poorer oral health than non-Indigenous Australians, which includes having more caries, more tooth loss and higher rates of periodontal disease. Poor dental health has important social as well as physical consequences, and can affect all aspects of daily life.

Dentist services may be delivered at private practice locations, in clinic/hospital settings, through Aboriginal Medical Services or through mobile dental services.

Dentist GIRS scores

Dentist GIRS scores by remoteness are presented in Table 7.1. As discussed in the method section (Chapter 2), the proximity measure for the dentist GIRS scores uses GPs as a proxy as no service location information was available.

Table 7.1: GIRS scores for dentists, by remoteness

	Number of areas (SA2s) by remoteness					
GIRS score	Major cities	Inner regional	Outer regional	Remote	Very remote	Total areas
0–1	0	1	10	7	25	43
2–3	8	187	153	27	21	396
4–5	463	190	80	12	3	748
6–8	739	97	67	1	1	905
Total	1,210	475	310	47	50	2,092

Notes

1. Lower GIRS scores indicate areas with higher probabilities of workforce supply challenges compared with areas with higher GIRS scores.
2. Only SA2s with a total population of greater than 100 were included.

The distribution of the dentist GIRS scores shows that:

- 43 SA2s had GIRS scores of 0–1. Of these, the majority (25) were in *Very remote* areas, along with 10 in *Outer regional* areas, 7 in *Remote* areas, and 1 in an *Inner regional* area
- the majority of SA2s with the highest dentist GIRS scores (6–8) were in *Major cities*; the scores decline as remoteness increases
- over half the SA2s in *Outer regional* areas had GIRS scores of 3 or under.

Figure 7.1 illustrates the spatial distribution of the GIRS scores. Figure 7.2 adds the 1 hour drive time catchments of the known GP locations (used as a proxy for proximity to services). Figure 7.3 adds the mesh block populations of those outside a 1 hour drive time. The purpose of the maps is to illustrate areas with a higher probability of workforce supply challenges, as reflected in a GIRS score of 0 or 1. A table of the 43 areas with dentist GIRS scores of 0–1 is included at the end of this chapter (Table 7.3).

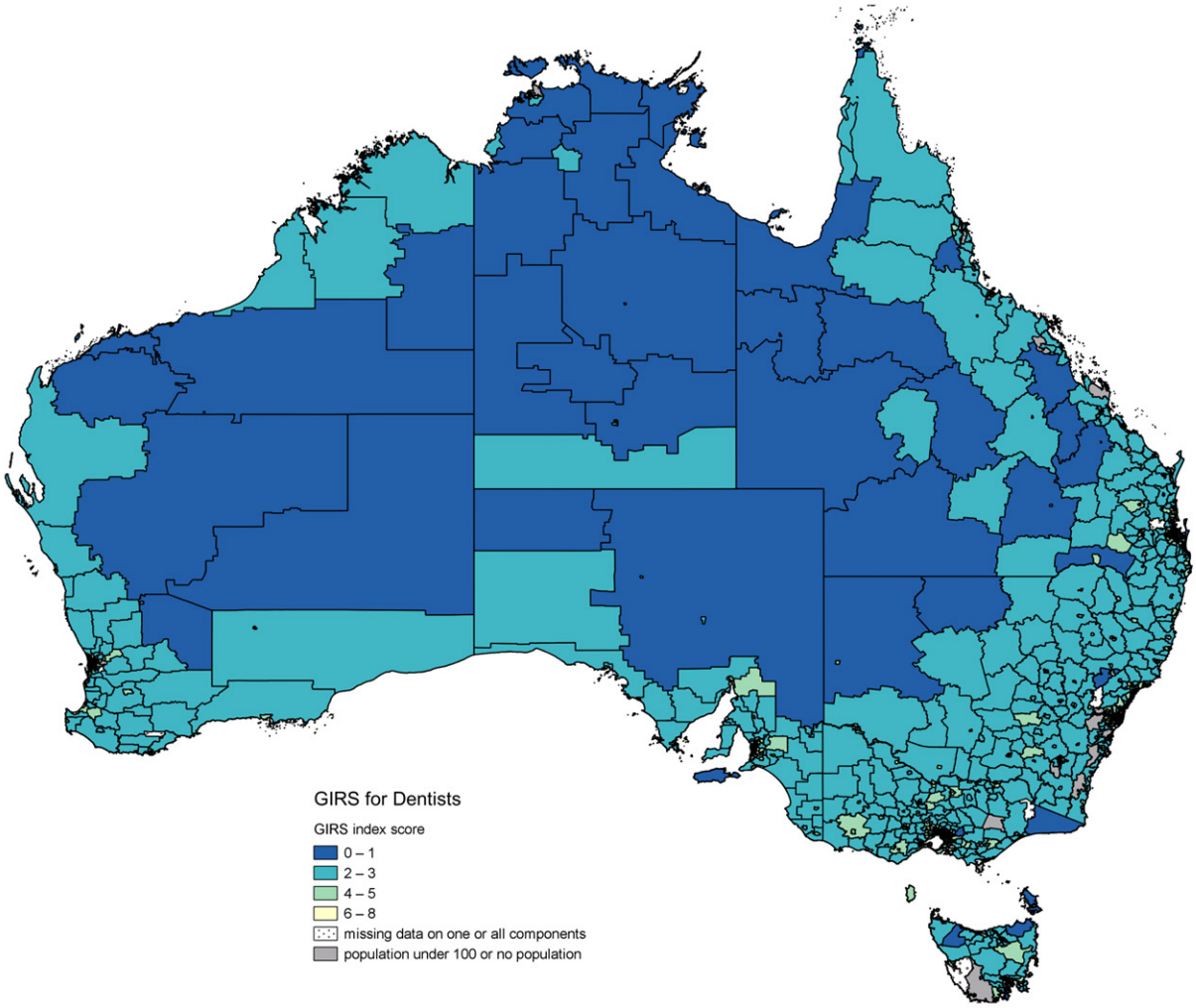


Figure 7.1: Map of dentist GIRS scores, by SA2

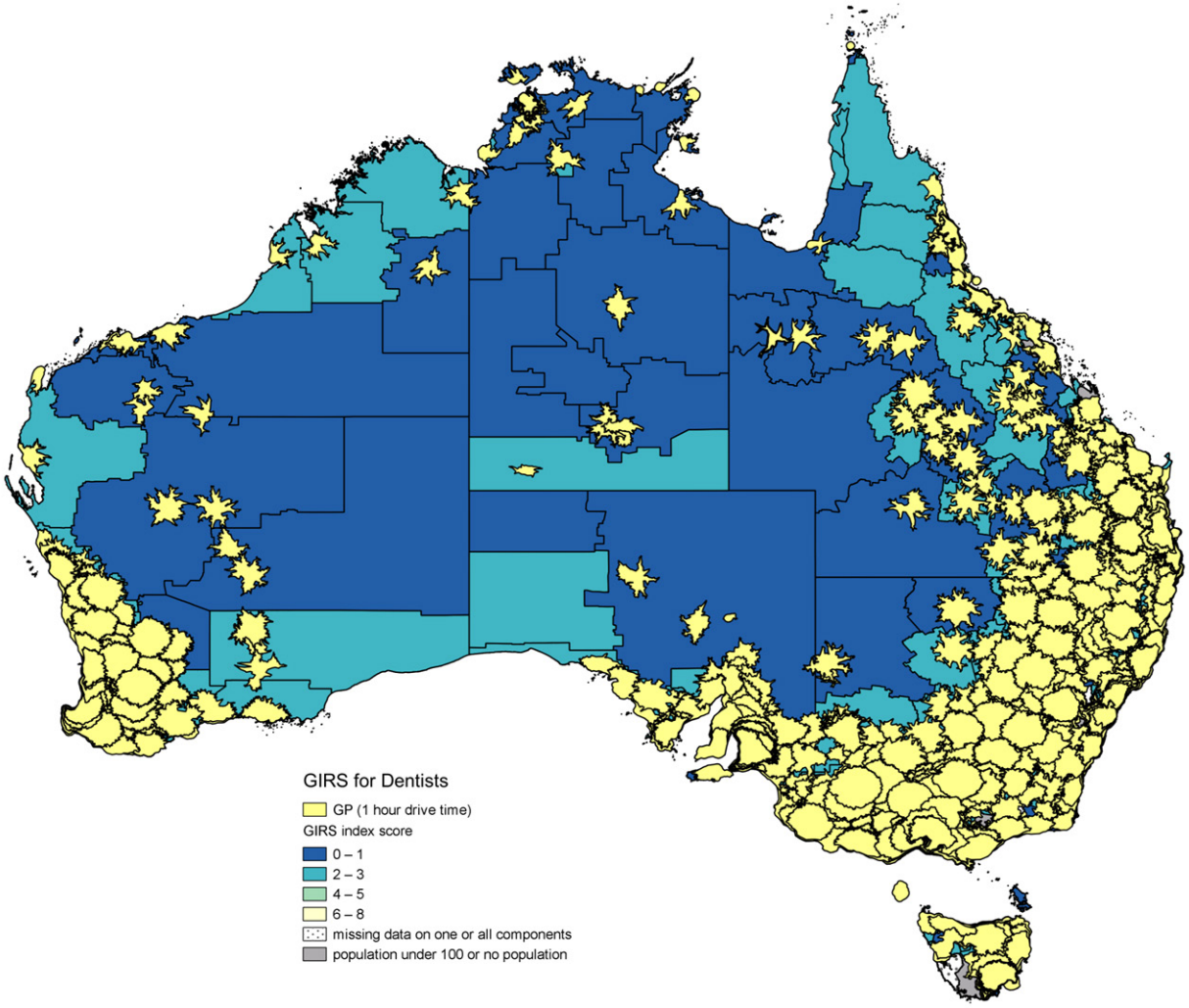


Figure 7.2: Map of dentist GIRS scores, by SA2, with drive time boundaries of GP practice locations added

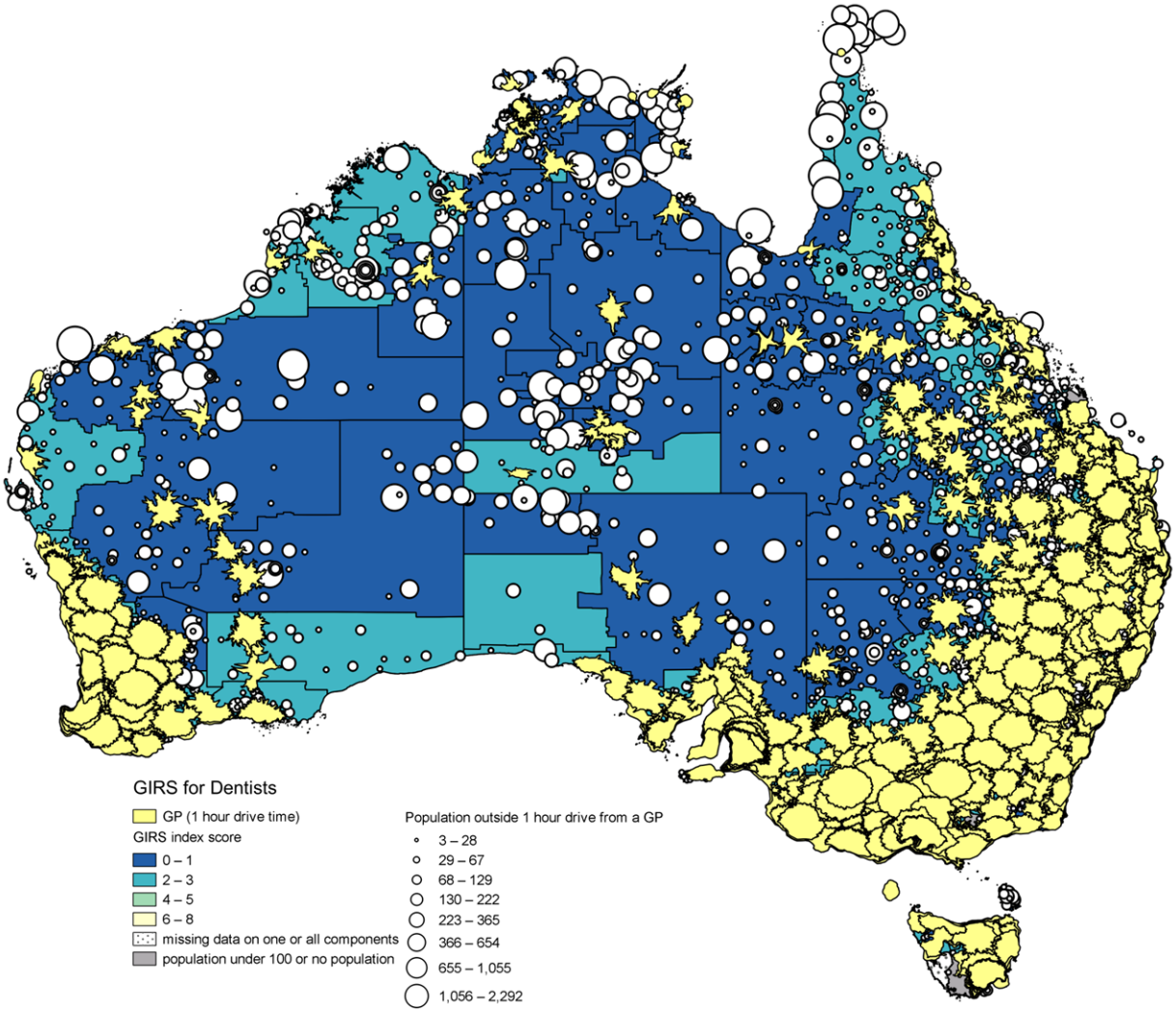


Figure 7.3: Map of dentist GIRS scores, by SA2, with drive time boundaries of GP practices and mesh block populations added

Population distribution

Table 7.2 presents the distribution of the estimated residential population by dentist GIRS score. Because there were SA2s without data on Indigenous status, Table 7.2 underestimates the number of Aboriginal and Torres Strait Islander people who live in areas within each of the GIRS ranges.

Table 7.2 shows that:

- Aboriginal and Torres Strait Islander people are much more likely than non-Indigenous Australians to live in areas with low dentist GIRS scores (areas with higher probabilities of dentist workforce supply challenges)
- over 76,000 Aboriginal and Torres Strait Islander people live in areas with the lowest dentist GIRS scores (0–1).

Table 7.2: Distribution of the population by dentist GIRS and Indigenous status

	Number			%		
GIRS score	Indigenous	Non-Indigenous	Total	Indigenous	Non-Indigenous	Total
0–1	76,803	132,602	209,405	11.49	0.61	0.94
2–3	137,746	2,388,973	2,539,008	20.61	11.06	11.38
4–5	272,780	8,272,467	8,584,560	40.82	38.30	38.46
6–8	180,912	10,804,984	10,986,833	27.07	50.03	49.23
Total	**668,241**	**21,599,026**	**22,319,806**	**100.00**	**100.00**	**100.00**

Notes

1. Lower GIRS scores indicate areas with higher probabilities of workforce supply challenges compared with areas with higher GIRS scores.
2. The Indigenous and non-Indigenous populations do not add up to the total population because the ABS did not provide a breakdown by Indigenous status for 23 SA2s.

Discussion

The GIRS should be considered indicative of dentist workforce supply challenges. As the geographic locations of dental practices were not available, the locations of GP services are used as a proxy measure. The GIRS is also unable to capture the locations of Indigenous-specific and mainstream dental outreach programs that deliver services in remote areas. Were these to be included, the values for the GIRS index in these areas might change.

Table 7.3: SA2s with dentist GIRS scores of 0–1, by descending size of Indigenous population

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous	Non-Indigenous	Total
NT	East Arnhem	East Arnhem	Very remote	1	7,967	670	8,637
NT	Daly - Tiwi - West Arnhem	West Arnhem	Very remote	0	4,913	487	5,400
Qld	Far North	Torres Strait Islands	Very remote	1	4,304	274	4,578
NT	Katherine	Gulf	Very remote	1	4,029	633	4,662
NT	Alice Springs	Sandover - Plenty	Remote	1	3,878	441	4,319
Qld	Outback - North	Carpentaria	Very remote	0	3,642	1,706	5,348
WA	Kimberley	Halls Creek	Very remote	0	3,205	688	3,893
NT	Alice Springs	Tanami	Very remote	1	2,814	552	3,366
NT	Daly - Tiwi - West Arnhem	Tiwi Islands	Remote	1	2,637	333	2,970
WA	Goldfields	Leinster - Leonora	Very remote	0	2,491	3,335	5,826
NT	Barkly	Barkly	Very remote	1	2,444	606	3,050
SA	Outback - North and East	APY Lands	Very remote	0	2,375	285	2,660
NT	Katherine	Victoria River	Very remote	0	2,251	619	2,870
Qld	Far North	Northern Peninsula	Very remote	0	2,198	265	2,463
NSW	Bourke - Cobar - Coonamble	Bourke - Brewarrina	Very remote	1	2,158	2,393	4,551
NT	Alice Springs	Yuendumu - Anmatjere	Very remote	1	2,094	280	2,374
WA	Pilbara	East Pilbara	Very remote	0	2,023	5,823	7,846
NT	East Arnhem	Anindilyakwa	Very remote	1	1,855	1,100	2,955
NT	Katherine	Elsey	Very remote	0	1,831	521	2,352
WA	Pilbara	Roebourne	Remote	1	1,674	4,953	6,627
WA	Mid West	Meekatharra	Very remote	1	1,521	2,691	4,212
NT	Daly - Tiwi - West Arnhem	Daly	Very remote	1	1,494	743	2,237
Qld	Central Highlands (Qld)	Central Highlands - East	Outer regional	1	1,476	6,336	7,812
NT	Daly - Tiwi - West Arnhem	Alligator	Remote	1	1,342	3,488	4,830
WA	Pilbara	Ashburton (WA)	Very remote	1	1,214	9,013	10,227
Qld	Outback - North	Mount Isa Region	Remote	1	1,067	2,937	4,004
Qld	Tablelands (East) - Kuranda	Herberton	Outer regional	1	956	4,691	5,647
NSW	Broken Hill and Far West	Far West	Very remote	0	936	1,850	2,786
Qld	Outback - South	Far South West	Very remote	0	888	2,474	3,362
Qld	Cleveland - Stradbroke	Redland Islands	Outer regional	1	793	8,162	8,955

(continued)

Table 7.3 (continued): SA2s with dentist GIRS scores of 0–1, by descending size of Indigenous population

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous	Non-Indigenous	Total
SA	Outback - North and East	Outback	Very remote	0	589	2,947	3,536
Qld	Outback - South	Far Central West	Very remote	0	507	2,021	2,528
Vic	Gippsland - East	Orbost	Outer regional	1	461	6,339	6,800
Tas	North East	Scottsdale - Bridport	Outer regional	1	436	7,535	7,971
Qld	Darling Downs (West) - Maranoa	Roma Region	Remote	1	431	5,845	6,276
Qld	Gladstone - Biloela	Banana	Outer regional	1	407	8,372	8,779
Qld	Bowen Basin - North	Broadsound - Nebo	Outer regional	1	370	9,760	10,130
Tas	West Coast	Waratah	Outer regional	1	264	3,654	3,918
Qld	Outback - North	Northern Highlands	Very remote	1	249	3,523	3,772
Qld	Darling Downs (West) - Maranoa	Inglewood - Waggamba	Outer regional	1	206	4,069	4,275
NSW	Upper Hunter	Muswellbrook Region	Inner regional	1	163	3,943	4,106
Tas	Huon - Bruny Island	Bruny Island - Kettering	Outer regional	1	129	2,823	2,952
WA	Wheat Belt - North	Mukinbudin	Remote	1	121	3,422	3,543
				Total	**76,803**	**132,602**	**209,405**

* SA3 = Statistical Area level 3.

8 Psychologists

The definition of a clinician in the NHWDS is a practitioner who spends the majority of his or her time working in the area of clinical practice—that is, the diagnosis, care and treatment (including recommended preventive action) of patients or clients (AIHW 2013a). The roles of psychologists in clinical roles include the assessment, diagnosis and treatment of mental illness or psychological problems. Clinical hours include time spent working one-on-one with clients as well as designing and running group programs. Only psychologists working in clinical roles were included (which covers a number of subspecialties, such as clinical neuropsychology, clinical psychology, community psychology, counselling psychology and health psychology).

On average, Aboriginal and Torres Strait Islander people are exposed to higher rates of personal stressors than non-Indigenous Australians and their levels of high/very high psychological distress are twice as high (AIHW 2015b). The reasons for these differences are complex and multifaceted. Numerous programs have been put in place to try to ensure that Indigenous people can access culturally sensitive and appropriate psychological and counselling services. Psychologists are an important component of those services.

Psychologist GIRS scores

Psychologist GIRS scores by remoteness are presented in Table 8.1. The psychologist GIRS includes the proximity to GPs as a proxy measure since no location data were available.

Table 8.1: GIRS scores for psychologists, by remoteness

	Number of areas (SA2s) by remoteness					
GIRS score	Major cities	Inner regional	Outer regional	Remote	Very remote	Total areas
0–1	0	2	10	8	29	49
2–3	7	192	158	26	17	400
4–5	411	190	75	7	4	687
6–8	792	91	67	6	0	956
Total	**1,210**	**475**	**310**	**47**	**50**	**2,092**

Notes

1. Lower GIRS scores indicate areas with higher probabilities of workforce supply challenges compared with areas with higher GIRS scores.
2. Only SA2s with a total population of greater than 100 were included.

The distribution of the psychologist GIRS scores shows that:

- 49 SA2s had GIRS scores of 0–1, the majority of which were in *Very remote* areas, followed by *Outer regional* and *Remote* areas
- no SA2s in *Very remote* areas had GIRS scores of 6–8
- considerable variation occurs in GIRS scores within regional and remote areas.

Figure 8.1 illustrates the spatial distribution of the GIRS scores. Figure 8.2 adds the 1 hour drive time catchments of the known GP locations (which is used as a proxy measure for proximity to services). Figure 8.3 adds the mesh block populations of those outside a 1 hour drive to a GP location. The purpose of the maps is to illustrate areas with a higher probability of workforce supply challenges, as reflected in a GIRS score of 0 or 1. A table

listing the 49 areas with psychologist GIRS scores of 0–1 is included at the end of the chapter (Table 8.3).

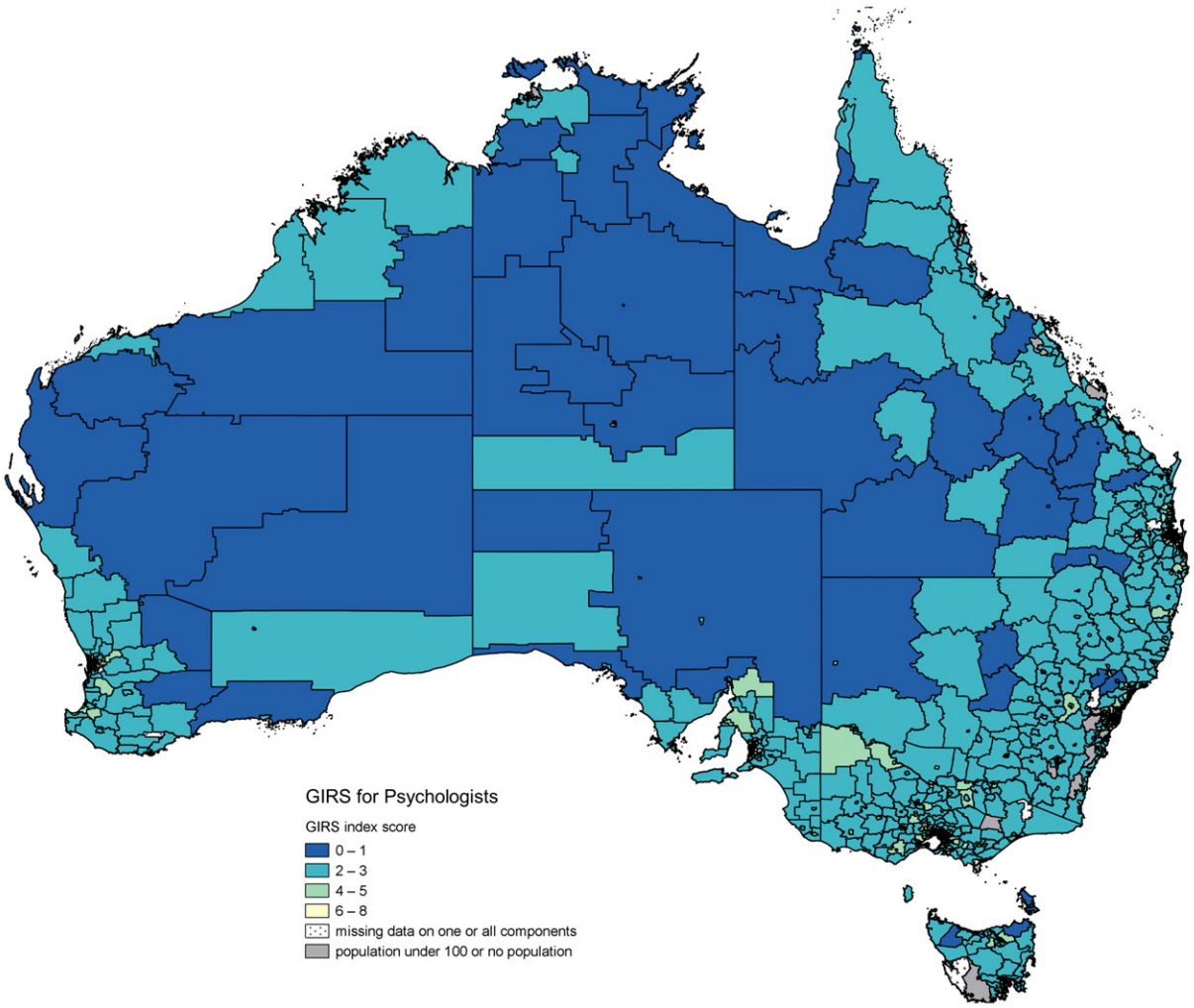


Figure 8.1: Map of psychologist GIRS scores, by SA2

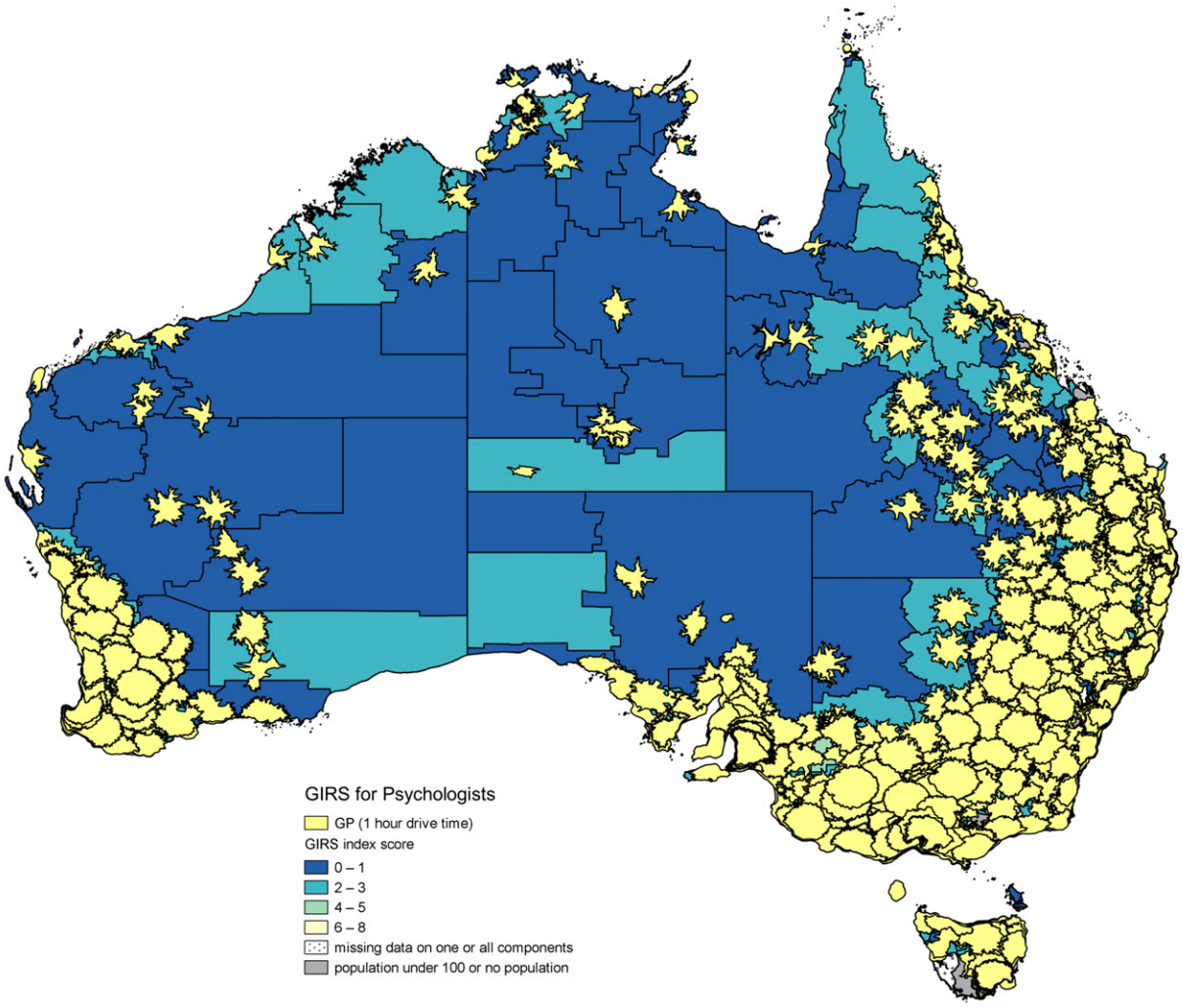


Figure 8.2: Map of psychologist GIRS, by SA2, with drive time boundaries of GPs added

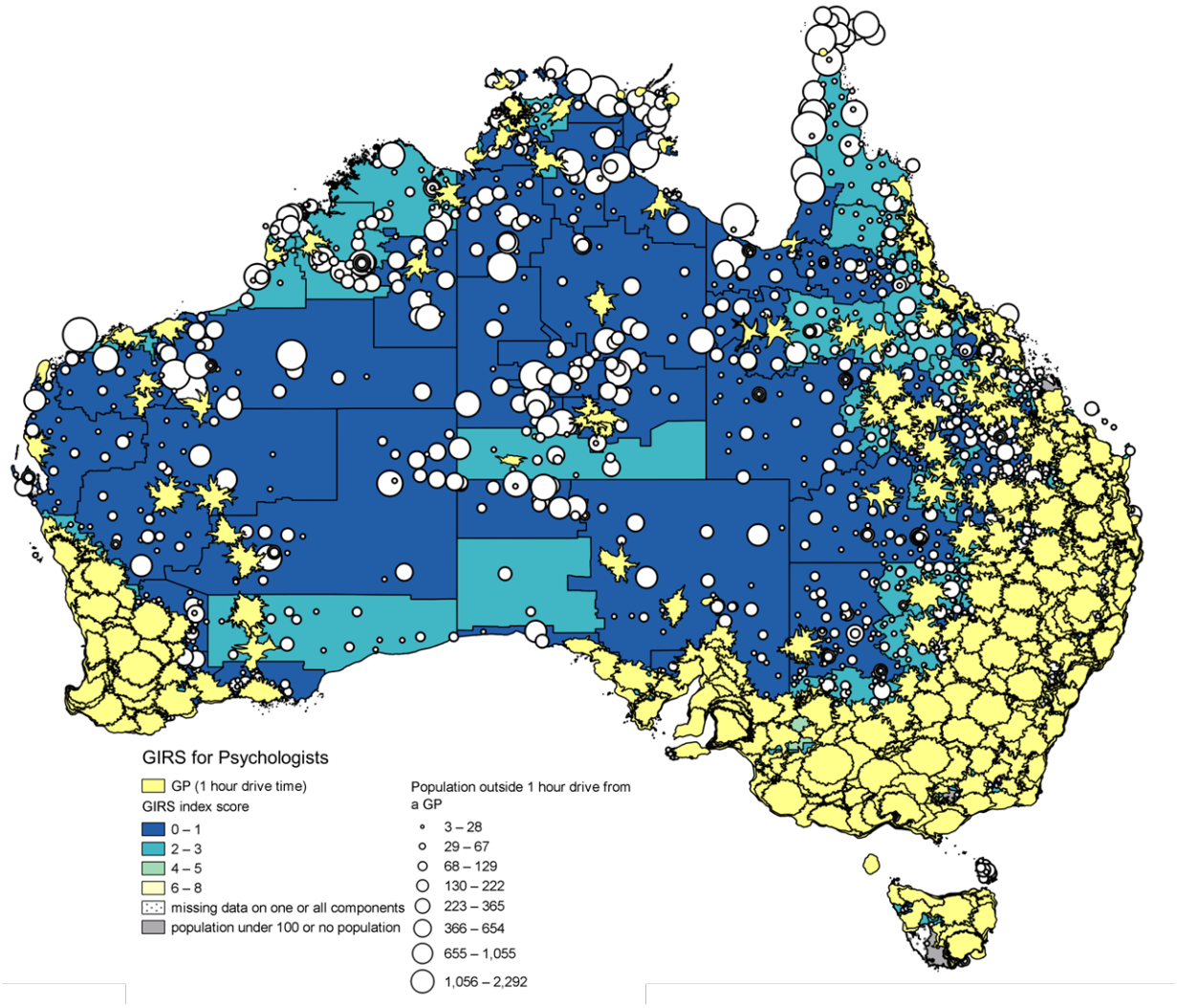


Figure 8.3: Map of psychologist GIRS scores, by SA2, with drive time boundaries of GPs and mesh block populations added

Population distribution

Table 8.2 presents the distribution of the estimated residential population by psychologist GIRS score. Because there were SA2s without data on Indigenous status, Table 8.2 underestimates the number of Aboriginal and Torres Strait Islander people who live in SA2s within each of the GIRS ranges.

Table 8.2 shows that:

- Aboriginal and Torres Strait Islander people are much more likely than non-Indigenous Australians to live in areas with low psychologist GIRS scores (areas with higher probabilities of psychologist workforce supply challenges)
- over 76,000 Aboriginal and Torres Strait Islander people live in areas with the lowest GIRS scores (0–1).

Table 8.2: Distribution of the population by psychologist GIRS and Indigenous status

	Number			%		
GIRS score	Indigenous	Non-Indigenous	Total	Indigenous	Non-Indigenous	Total
0–1	76,258	148,327	224,585	11.41	0.69	1.01
2–3	144,896	2,432,485	2,589,670	21.68	11.26	11.60
4–5	235,449	7,444,725	7,695,411	35.23	34.47	34.48
6–8	211,638	11,573,489	11,810,140	31.67	53.58	52.91
Total	**668,241**	**21,599,026**	**22,319,806**	**100**	**100.00**	**100.00**

Notes

1. Lower GIRS scores indicate areas with higher probabilities of workforce supply challenges compared with areas with higher GIRS scores.
2. The Indigenous and non-Indigenous populations do not add up to the total population because the ABS did not provide a breakdown by Indigenous status for 23 SA2s.

Discussion

The GIRS should be considered indicative of psychologist workforce supply challenges. As no address data were available for the psychologist workforce, proximity to GPs was used as a proxy for the proximity to services measure. As with the other professions, data on outreach services could not be included. It is also important to note that psychologists may provide one-on-one or group counselling, interventions and support through telephone or internet-based platforms, and thus their reach extends beyond a specific service location.

The psychologist GIRS reflects only a segment of the workforce that is involved in providing social, emotional and wellbeing support to Aboriginal and Torres Strait Islander people. For example, Aboriginal health workers and counsellors working in Link-up programs provide important services to Aboriginal and Torres Strait Islander people.

We acknowledge that while these Aboriginal health workers and counsellors are not included in a GIRS measure of their own (because they do not fall under the AHPRA's registration process), they do provide important services to Indigenous people.

Table 8.3: SA2s with psychologist GIRS scores of 0–1, by descending size of Indigenous population

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous	Non-Indigenous	Total
NT	East Arnhem	East Arnhem	Very remote	1	7,967	670	8,637
NT	Daly - Tiwi - West Arnhem	West Arnhem	Very remote	0	4,913	487	5,400
Qld	Far North	Torres Strait Islands	Very remote	1	4,304	274	4,578
NT	Katherine	Gulf	Very remote	1	4,029	633	4,662
NT	Alice Springs	Sandover - Plenty	Remote	1	3,878	441	4,319
Qld	Outback - North	Carpentaria	Very remote	1	3,642	1,706	5,348
WA	Kimberley	Halls Creek	Very remote	0	3,205	688	3,893
NT	Alice Springs	Tanami	Very remote	1	2,814	552	3,366
NT	Daly - Tiwi - West Arnhem	Tiwi Islands	Remote	1	2,637	333	2,970
WA	Goldfields	Leinster - Leonora	Very remote	1	2,491	3,335	5,826
NT	Barkly	Barkly	Very remote	1	2,444	606	3,050
SA	Outback - North and East	APY Lands	Very remote	0	2,375	285	2,660
NT	Katherine	Victoria River	Very remote	0	2,251	619	2,870
Qld	Far North	Northern Peninsula	Very remote	1	2,198	265	2,463
NT	Alice Springs	Yuendumu - Anmatjere	Very remote	1	2,094	280	2,374
WA	Pilbara	East Pilbara	Very remote	0	2,023	5,823	7,846
NT	East Arnhem	Anindilyakwa	Very remote	1	1,855	1,100	2,955
NT	Katherine	Elsey	Very remote	0	1,831	521	2,352
Qld	Far North	Kowanyama - Pormpuraaw	Very remote	0	1,691	136	1,827
WA	Mid West	Meekatharra	Very remote	1	1,521	2,691	4,212
NT	Daly - Tiwi - West Arnhem	Daly	Very remote	1	1,494	743	2,237
Qld	Central Highlands (Qld)	Central Highlands - East	Outer regional	1	1,476	6,336	7,812
NSW	Lachlan Valley	Condobolin	Outer regional	1	1,286	5,852	7,138
WA	Pilbara	Ashburton (WA)	Very remote	1	1,214	9,013	10,227
Qld	Outback - North	Mount Isa Region	Remote	1	1,067	2,937	4,004
NSW	Bourke - Cobar - Coonamble	Nyngan - Warren	Remote	1	938	4,468	5,406
NSW	Broken Hill and Far West	Far West	Very remote	0	936	1,850	2,786
Qld	Outback - South	Far South West	Very remote	0	888	2,474	3,362
Qld	Cleveland - Stradbroke	Redland Islands	Outer regional	1	793	8,162	8,955

(continued)

Table 8.3 (continued): SA2s with psychologist GIRS scores of 0–1, by descending size of Indigenous population

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous	Non-Indigenous	Total
SA	Eyre Peninsula and South West	West Coast (SA)	Very remote	1	689	2,997	3,686
SA	Outback - North and East	Outback	Very remote	0	589	2,947	3,536
Qld	Outback - South	Far Central West	Very remote	0	507	2,021	2,528
Tas	North East	Scottsdale - Bridport	Outer regional	1	436	7,535	7,971
Qld	Darling Downs (West) - Maranoa	Roma Region	Remote	1	431	5,845	6,276
Qld	Gladstone - Biloela	Banana	Outer regional	1	407	8,372	8,779
Qld	Outback - South	Barcaldine - Blackall	Very remote	1	352	5,197	5,549
WA	Gascoyne	Exmouth	Very remote	1	332	3,716	4,048
Qld	Central Highlands (Qld)	Central Highlands - West	Remote	1	280	8,793	9,073
Qld	Bowen Basin - North	Collinsville	Remote	1	275	3,867	4,142
Tas	West Coast	Waratah	Outer regional	1	264	3,654	3,918
SA	Outback - North and East	Flinders Ranges	Outer regional	1	232	2,071	2,303
Qld	Darling Downs (West) - Maranoa	Inglewood - Waggamba	Outer regional	1	206	4,069	4,275
WA	Esperance	Esperance Region	Very remote	1	165	4,127	4,292
NSW	Upper Hunter	Muswellbrook Region	Inner regional	1	163	3,943	4,106
NSW	Lower Hunter	Singleton Region	Inner regional	1	150	4,777	4,927
Qld	Darling Downs (West) - Maranoa	Miles - Wandoan	Outer regional	1	147	3,743	3,890
Tas	Huon - Bruny Island	Bruny Island - Kettering	Outer regional	1	129	2,823	2,952
Qld	Far North	Croydon - Etheridge	Very remote	0	128	1,128	1,256
WA	Wheat Belt - North	Mukinbudin	Remote	1	121	3,422	3,543
				Total	**76,258**	**148,327**	**224,585**

* SA3 = Statistical Area level 3.

9 Optometrists

Optometrists are allied health professionals focused on eye health. They have a critical role as a link between general practice and eye health medical specialists (ophthalmologists). Optometrists perform eye examinations, conduct vision tests, prescribe lenses and other optical aids and therapies, and diagnose and manage eye movement disorders and associated sensory problems. Optometrists detect, diagnose and manage eye disease, including referring patients to, and receiving referrals from, other health providers; they can also prescribe medications to treat eye disease (AIHW 2013a).

Poor eye health is a major issue in the Aboriginal and Torres Strait Islander community. Although Aboriginal and Torres Strait Islander children have fewer eye problems in early childhood than do non-Indigenous children, adults have rates of eye disease that are 6 times as high as those of non-Indigenous adults (AIHW 2011). Eye health problems include trachoma, refractive errors, cataracts, glaucoma, and complications from the higher rates of diabetes Indigenous people experience. Vision problems and poor eyesight affect all aspects of life, including learning, employment, the ability to drive and overall quality of life.

Governments at all levels have programs and policies in place both to deal with the risk factors for poor eye health and to treat those already diagnosed with vision problems or eye health disease.

Optometrist GIRS scores

Optometrist GIRS scores by remoteness are presented in Table 9.1. The optometrist GIRS scores include drive time boundaries of GPs as a proxy measure for proximity.

Table 9.1: GIRS scores for optometrists by remoteness

	Number of areas (SA2s) by remoteness					
GIRS score	Major cities	Inner regional	Outer regional	Remote	Very remote	Total areas
0–1	0	0	13	14	29	56
2–3	6	178	145	18	18	365
4–5	473	199	87	15	2	776
6–8	731	98	65	0	1	895
Total	**1,210**	**475**	**310**	**47**	**50**	**2,092**

Notes

1. Lower GIRS scores indicate areas with higher probabilities of workforce supply challenges compared with areas with higher GIRS scores.
2. Only SA2s with a total population of greater than 100 were included.

The distribution of the optometrist GIRS scores shows that:

- 56 SA2s had GIRS scores of 0–1. Of these, the majority (29) were in *Very remote* areas, along with 14 in *Remote* areas and 13 in *Outer regional* areas
- at the other end of the scale, the majority of areas with the highest GIRS scores (6–8) were in *Major cities*. Only 1 SA2 in a *Very remote* area, and none in *Remote* areas, had GIRS scores of 6–8.

Figure 9.1 illustrates the spatial distribution of the GIRS scores. Figure 9.2 adds the 1 hour drive time catchments of the known GP locations (the proxy measure for proximity to

services). Figure 9.3 adds the mesh block populations of those outside a 1 hour drive time to a GP location. The purpose of the maps is to illustrate areas with a higher probability of workforce supply challenges, as reflected in a GIRS score of 0 or 1. A table listing the 56 areas with optometrist GIRS scores of 0–1 is included at the end of the chapter (Table 9.3).

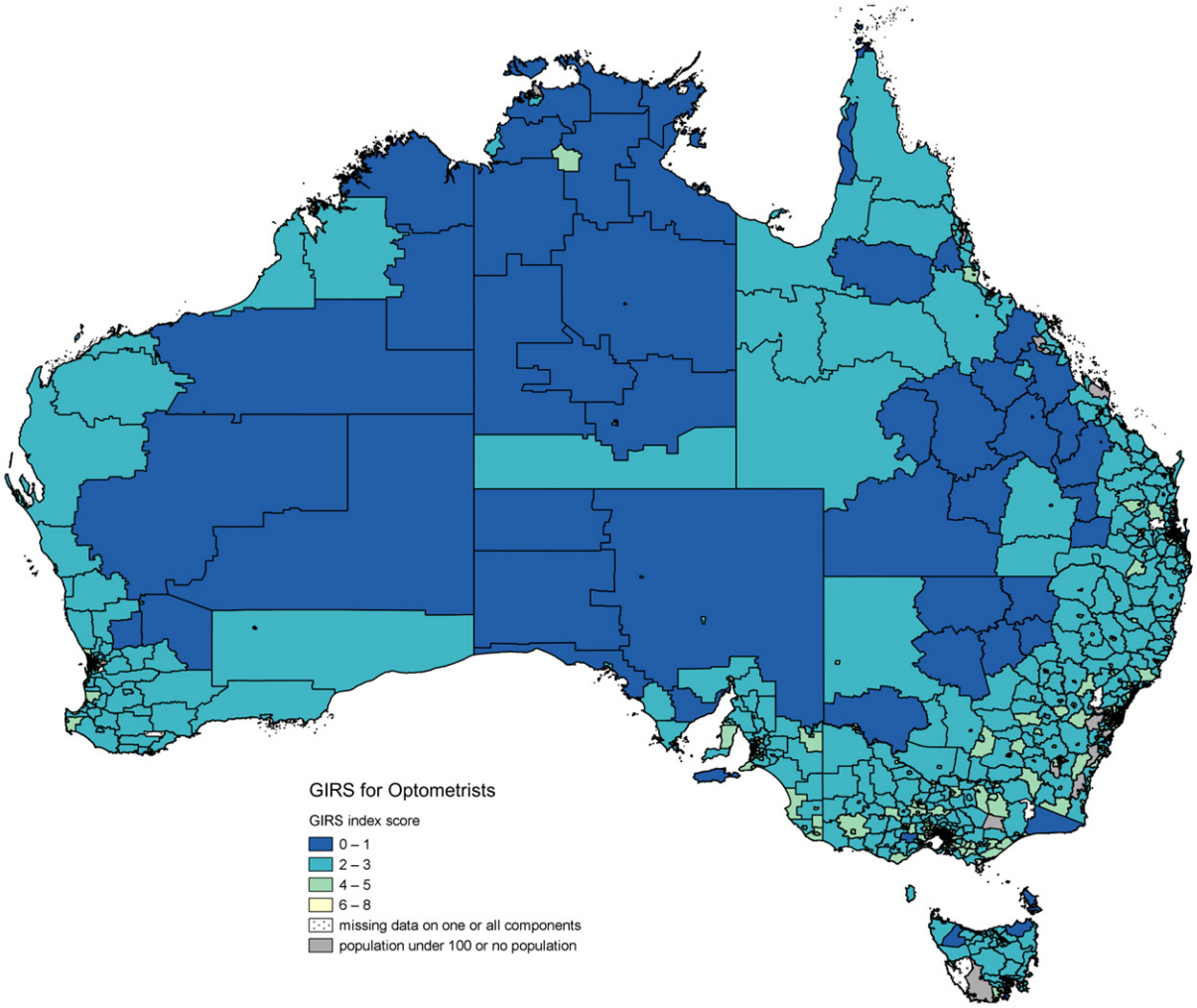


Figure 9.1: Map of optometrist GIRS scores, by SA2

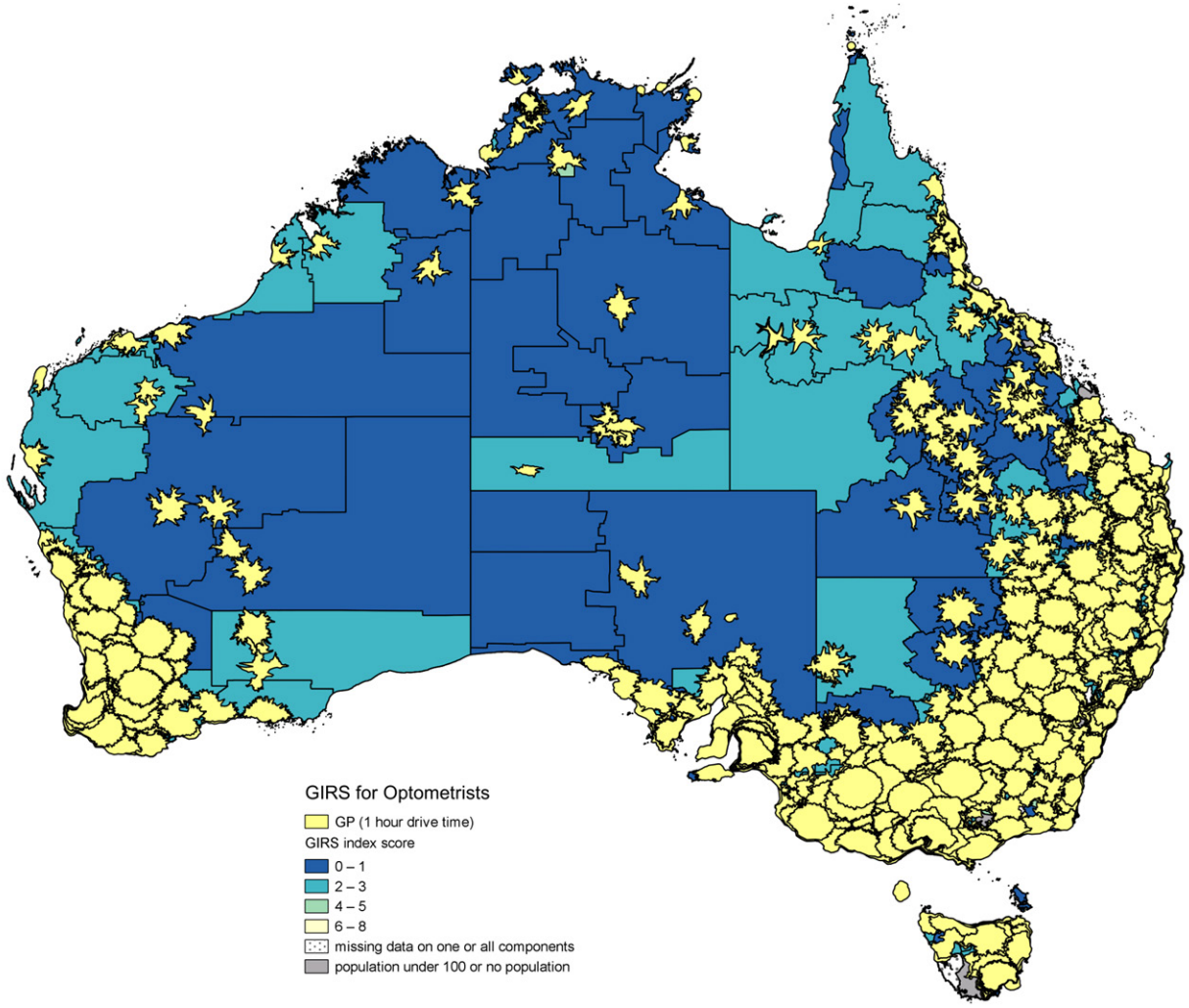


Figure 9.2: Map of optometrist GIRS scores, by SA2, with drive time boundaries added

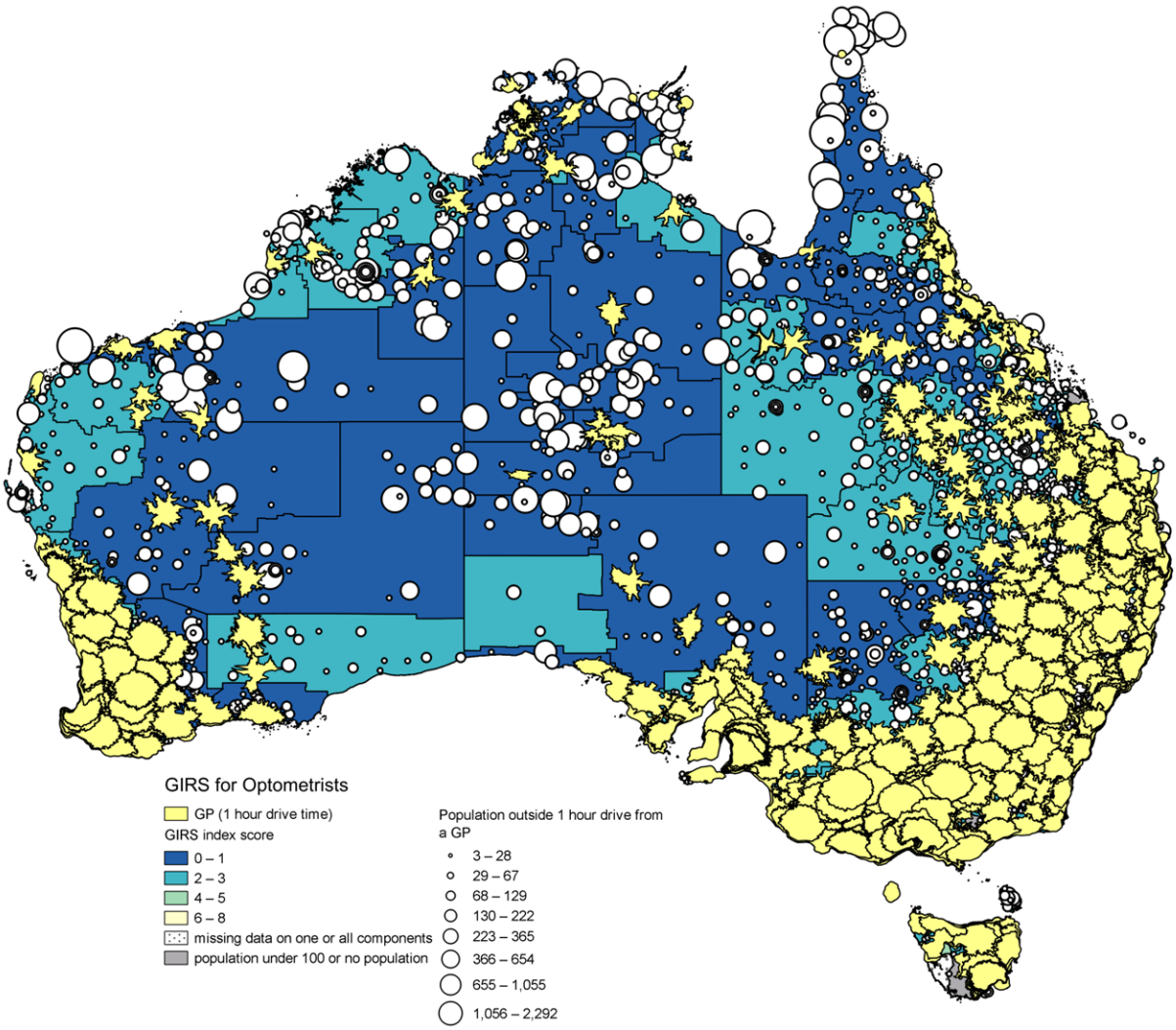


Figure 9.3: Map of optometrist GIRS scores, by SA2, with drive time boundaries and mesh block populations added

Population distribution

Table 9.2 presents the distribution of the estimated residential population by optometrist GIRS score. Because there were SA2s without data on Indigenous status, Table 9.2 underestimates the number of Aboriginal and Torres Strait Islander people who live in areas within each of the GIRS ranges.

Table 9.2 shows that:

- Aboriginal and Torres Strait Islander people are much more likely than non-Indigenous Australians to live in areas with low optometrist GIRS scores (areas with higher probabilities of optometrist workforce supply challenges)
- over 85,000 Aboriginal and Torres Strait Islander people live in areas with the lowest GIRS scores (0–1).

Table 9.2: Distribution of the population by optometrist GIRS and Indigenous status

	Number			%		
GIRS score	Indigenous	Non-Indigenous	Total	Indigenous	Non-Indigenous	Total
0–1	85,301	172,626	257,927	12.77	0.80	1.16
2–3	123,920	2,236,045	2,368,352	18.54	10.35	10.61
4–5	275,578	8,609,963	8,928,217	41.24	39.86	40.00
6–8	183,442	10,580,392	10,765,310	27.45	48.99	48.23
Total	**668,241**	**21,599,026**	**22,319,806**	**100.00**	**100.00**	**100.00**

Notes

1. Lower GIRS scores indicate areas with higher probabilities of workforce supply challenges compared with areas with higher GIRS scores.
2. The Indigenous and non-Indigenous populations do not add up to the total population because the ABS did not provide a breakdown by Indigenous status for 23 SA2s.

Discussion

The GIRS should be considered indicative of optometrist workforce supply challenges. Data on the locations of optometrists are not available, so the GIRS used access to GP locations as the proximity to services measure. The GIRS was also unable to capture the locations of outreach services delivered in regional and remote areas, and may thus underestimate access to optometrists for Aboriginal and Torres Strait Islander people.

Table 9.3: SA2s with optometrist GIRS scores of 0–1, by descending size of Indigenous population

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous	Non-Indigenous	Total
NT	East Arnhem	East Arnhem	Very remote	1	7,967	670	8,637
NT	Daly - Tiwi - West Arnhem	West Arnhem	Very remote	0	4,913	487	5,400
Qld	Far North	Torres Strait Islands	Very remote	0	4,304	274	4,578
NT	Katherine	Gulf	Very remote	0	4,029	633	4,662
NT	Alice Springs	Sandover - Plenty	Remote	1	3,878	441	4,319
WA	Kimberley	Kununurra	Remote	1	3,406	4,800	8,206
WA	Kimberley	Halls Creek	Very remote	1	3,205	688	3,893
NT	Alice Springs	Tanami	Very remote	1	2,814	552	3,366
NT	Daly - Tiwi - West Arnhem	Tiwi Islands	Remote	1	2,637	333	2,970
Qld	Far North	Torres	Very remote	1	2,587	890	3,477
NSW	Bourke - Cobar - Coonamble	Walgett - Lightning Ridge	Remote	1	2,502	4,688	7,190
WA	Goldfields	Leinster - Leonora	Very remote	0	2,491	3,335	5,826
NT	Barkly	Barkly	Very remote	1	2,444	606	3,050
SA	Outback - North and East	APY Lands	Very remote	1	2,375	285	2,660
NT	Katherine	Victoria River	Very remote	0	2,251	619	2,870
Qld	Far North	Northern Peninsula	Very remote	0	2,198	265	2,463
NSW	Bourke - Cobar - Coonamble	Bourke - Brewarrina	Very remote	1	2,158	2,393	4,551
NT	Alice Springs	Yuendumu - Anmatjere	Very remote	1	2,094	280	2,374
WA	Pilbara	East Pilbara	Very remote	0	2,023	5,823	7,846
NT	East Arnhem	Anindilyakwa	Very remote	1	1,855	1,100	2,955
NT	Katherine	Elsey	Very remote	0	1,831	521	2,352
Qld	Far North	Kowanyama - Pormpuraaw	Very remote	0	1,691	136	1,827
WA	Mid West	Meekatharra	Very remote	0	1,521	2,691	4,212
NT	Daly - Tiwi - West Arnhem	Daly	Very remote	1	1,494	743	2,237
Qld	Central Highlands (Qld)	Central Highlands - East	Outer regional	1	1,476	6,336	7,812
NSW	Bourke - Cobar - Coonamble	Coonamble	Remote	1	1,462	2,999	4,461
NT	Daly - Tiwi - West Arnhem	Alligator	Remote	1	1,342	3,488	4,830
Qld	Far North	Aurukun	Very remote	0	1,306	92	1,398
Qld	Tablelands (East) - Kuranda	Herberton	Outer regional	1	956	4,691	5,647
NSW	Bourke - Cobar - Coonamble	Nyngan - Warren	Remote	1	938	4,468	5,406

(continued)

Table 9.3 (continued): SA2s with optometrist GIRS scores of 0–1, by descending size of Indigenous population

State/ territory	SA3*	SA2	Remoteness	GIRS score	Indigenous	Non-Indigenous	Total
Qld	Outback - South	Far South West	Very remote	0	888	2,474	3,362
Qld	Cleveland - Stradbroke	Redland Islands	Outer regional	1	793	8,162	8,955
NSW	Bourke - Cobar - Coonamble	Cobar	Remote	1	743	4,147	4,890
SA	Eyre Peninsula and South West	West Coast (SA)	Very remote	1	689	2,997	3,686
Qld	Outback - South	Charleville	Very remote	1	648	4,083	4,731
SA	Outback - North and East	Outback	Very remote	0	589	2,947	3,536
Vic	Gippsland - East	Orbost	Outer regional	1	461	6,339	6,800
Tas	North East	Scottsdale - Bridport	Outer regional	1	436	7,535	7,971
Qld	Gladstone - Biloela	Banana	Outer regional	1	407	8,372	8,779
Qld	Bowen Basin - North	Broadsound - Nebo	Outer regional	1	370	9,760	10,130
Qld	Outback - South	Barcaldine - Blackall	Very remote	1	352	5,197	5,549
Qld	Outback - South	Longreach	Very remote	1	346	3,950	4,296
Qld	Darling Downs (West) - Maranoa	Tara	Outer regional	1	293	3,944	4,237
Qld	Central Highlands (Qld)	Central Highlands - West	Remote	1	280	8,793	9,073
Qld	Bowen Basin - North	Collinsville	Remote	1	275	3,867	4,142
WA	Wheat Belt - North	Dowerin	Outer regional	1	265	3,920	4,185
Tas	West Coast	Waratah	Outer regional	1	264	3,654	3,918
NSW	Lower Murray	Wentworth-Balranald Region	Outer regional	1	240	3,526	3,766
Qld	Darling Downs (West) - Maranoa	Miles - Wandoan	Outer regional	1	147	3,743	3,890
Tas	Huon - Bruny Island	Bruny Island - Kettering	Outer regional	1	129	2,823	2,952
Qld	Far North	Croydon - Etheridge	Very remote	0	128	1,128	1,256
WA	Wheat Belt - North	Mukinbudin	Remote	1	121	3,422	3,543
Qld	Bowen Basin - North	Clermont	Remote	1	111	3,745	3,856
SA	Eyre Peninsula and South West	Western	Very remote	0	72	40	112
SA	Fleurieu - Kangaroo Island	Kangaroo Island	Remote	1	59	4,463	4,522
SA	Eyre Peninsula and South West	Kimba - Cleve - Franklin Harbour	Remote	1	47	4,268	4,315
				Total	**85,301**	**172,626**	**257,927**

* SA3 = Statistical Area level 3.

10 Conclusion

This chapter provides an overview of the GIRS findings for the individual professions. It also then looks at whether there is within-area consistency in GIRS scores across professions to identify those areas facing workforce supply challenges in multiple professions.

A summary of GIRS scores for all seven professions is presented in Table 10.1. The table shows that GIRS scores of 0 or 1 (most likely to face supply challenges) occur most often for midwives and optometrists, and least often for nurses.

Table 10.1: Number of SA2s, by GIRS score and profession

GIRS score	GPs	Nurses	Midwives	Pharmacists	Dentists	Psychologists	Optometrists
0–1	39	17	120	45	43	49	56
2–3	397	436	364	391	396	400	365
4–5	834	808	723	750	748	687	776
6–8	822	831	884	906	905	956	895
Total	**2,092**	**2,092**	**2,091**	**2,092**	**2,092**	**2,092**	**2,092**

Notes

1. Includes only SA2s with resident populations of at least 100 people and valid data on all 4 GIRS components.
2. Scores of 0 and 1 indicate a higher probability that an area faces supply challenges compared with areas with higher GIRS scores.
3. As noted in Chapter 5, there are only 2,091 SA2s with valid midwife GIRS scores.

Individual GIRS scores are important for identifying areas of workforce supply challenge within professions. There is, however, another critical issue: the extent to which there is consistency in GIRS scores across professions. The question is, in other words: if an area has a low GIRS score for one profession, is it also likely to have low GIRS scores for other professions? It might be expected, for example, that regions with lower relative supply of GPs or nurses also have lower relative supply of dentists or psychologists.

To measure the consistency of GIRS scores across the seven professions, the number of times that each SA2 had a GIRS score of 0 or 1 (that is, it was measured as having a low level of relative supply for that profession) was counted across the seven professions (refer to Table 10.2). Values for this summary variable can range between 0 (no GIRS scores of 0 or 1) to 7 (GIRS scores of 0 or 1 for every profession). Higher values indicate a higher number of workforce supply challenges.

Table 10.2: Number of times SA2s scored 0 or 1 on each GIRS, across all seven professions

Number of professions with GIRS scores of 0 or 1	Areas		Population				
	SA2s	%	Indigenous	%	Non-Indigenous	%	Total
0	1,936	92.5	534,066	80.52	20,786,865	96.99	21,367,797
1	79	3.8	29,100	4.39	402,938	1.88	432,038
2	17	0.8	14,888	2.24	69,048	0.32	83,936
3	20	1.0	12,539	1.89	83,105	0.39	101,317
4	14	0.7	19,030	2.87	45,677	0.21	64,707

(continued)

Table 10.2 (continued): Number of times SA2s scored 0 or 1 on each GIRS, across all seven professions

Number of professions with GIRS scores of 0 or 1	Areas		Population				
	SA2s	%	Indigenous	%	Non-Indigenous	%	Total
5	12	0.6	22,589	3.41	26,496	0.12	49,085
6	11	0.5	26,357	3.97	16,514	0.08	42,871
7	2	0.1	4,695	0.71	1,225	0.01	5,920
Total	**2,091**	**100.0**	**663,264**	**100.00**	**21,431,868**	**100.00**	**22,147,671**

Notes

1. Higher numbers of GIRS scores of 0 or 1 indicate a greater level of relative workforce supply challenges.
2. Includes only SA2s with resident populations greater than 100 and valid data for all seven GIRS scores.
3. The columns of Indigenous and non-Indigenous populations do not add up to the total population due to the 23 SA2s where total population was available, but not Indigenous status.

Table 10.2 illustrates several patterns:

- The majority of SA2s in Australia (92.5%) have GIRS scores of 2 or above across all professions.
- The majority of Aboriginal and Torres Strait Islander people (80.5%) and non-Indigenous Australians (97.0%) live in areas with GIRS scores of 2 or above across all professions.
- A higher percentage of the Indigenous population, compared with the non-Indigenous population, lives in areas with relatively more workforce supply challenges.
- Over 72,600 Aboriginal and Torres Strait Islander people live in SA2s where at least four of the seven professions (that is, over half of them) have GIRS scores of 0 or 1.
- Over 30,000 Aboriginal and Torres Strait Islander people live in SA2s where at least six of the seven professions have GIRS scores of 0 or 1.

Appendix D comprises a set of tables that present details about the 39 areas with GIRS scores of 0 or 1 for at least four professions.

The challenges of workforce supply in regional and remote areas are well documented. The distribution of the composite GIRS measure by remoteness is shown in Table 10.3.

Table 10.3: Number of times SA2s scored 0 or 1 on each GIRS, across seven professions, by remoteness

Number of professions with GIRS scores of 0 or 1	Number of SA2s by remoteness classification					
	Major cities	Inner regional	Outer Regional	Remote	Very Remote	Total SA2s
0	1208	457	247	16	8	1936
1	1	17	42	13	6	79
2	0	0	9	6	2	17
3	0	1	8	5	6	20
4	0	0	1	4	9	14
5	0	0	3	2	7	12
6	0	0	0	1	10	11
7	0	0	0	0	2	2
Total	**1,209**	**475**	**310**	**47**	**50**	**2,091**

Table 10.3 shows that:

- overall, supply challenges across professions increase with remoteness. Twenty-eight (28) of the SA2s with low GIRS scores across four or more professions are located in *Very remote* areas, with another 7 located in *Remote* areas
- there is variation within *Remote* and *Very remote* areas: 16 SA2s in *Remote* areas and 8 SA2s in *Very remote* areas did not have GIRS scores of 0 or 1.

The spatial distribution of the composite measure is presented in Figure 10.1.

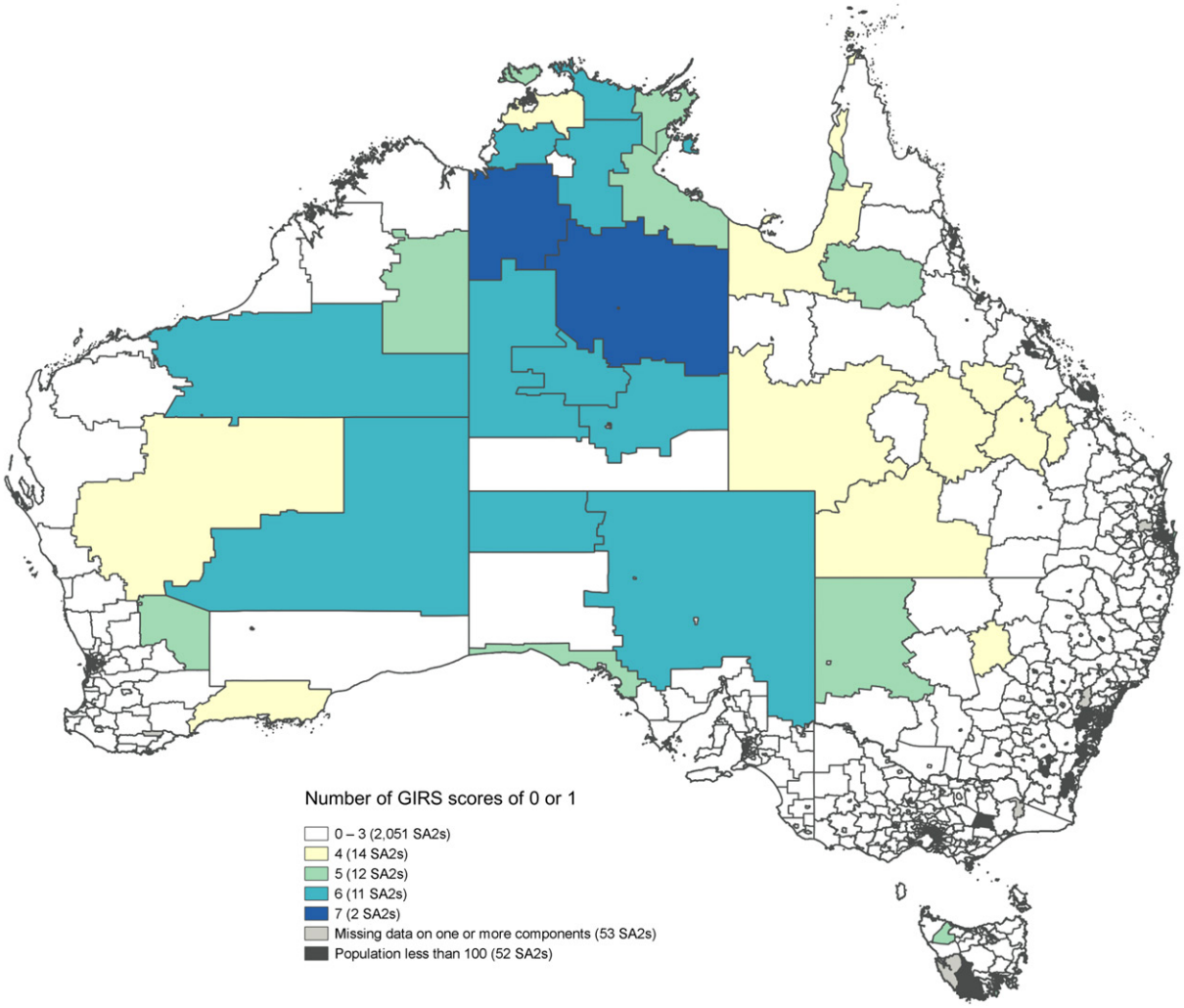


Figure 10.1: Map showing the number of times an area has GIRS scores of 0 or 1

Discussion

Identifying areas of relative workforce supply challenge for Aboriginal and Torres Strait Islander people is an important first step for policy discussions on:

- how to improve supply in these areas, *or*

- how to ensure that residents' needs for primary care services are met in other ways (such as outreach services for GPs, dentists and optometrists; medical chests and the S100 Remote Aboriginal Health Services Program for accessing medicines; and online/telephone-based counselling by psychologists).

The GIRS was developed as a way to examine the relative probability that areas face workforce challenges by specifically incorporating measures of population dispersion, land size and proximity with other services, along with workforce supply. As such, it overcomes the shortcomings associated with using FTE rates on their own. It thus differs from the formula used by the Department of Health to characterise districts of workforce shortage, which is based on SA2 level FTE rates.

The GIRS shares some similarities with the modified Monash Model, in that it recognises the importance of spatial accessibility of service centres. The modified Monash Model was developed in response to the fact that remoteness categories outside *Major cities* mask considerable in-category variation. For example, the model stratifies SA1s in the remoteness categories of *Inner regional* and *Outer regional* according to their road distance to towns of particular sizes, with greater resources targeted at those areas with greater distances/smaller town sizes. While the modified Monash Model has the advantage of being calculated at a lower level of geographic specificity (SA1), it does not assess workforce supply in these areas.

It is important that the GIRS is seen as indicative of potential workforce supply challenges—it is not a measure of the adequacy of services. Neither is it a measure of whether the services are financially or culturally accessible nor of the extent to which they meet the needs of the populations within each area. The GIRS is thus a first step, examining workforce supply from a spatial perspective; future work could build on the GIRS by explicitly including these other factors.

Better data on exactly where individual practitioners provide their services and the number of FTEs at each location would permit more accurate calculations of both workforce supply and proximity to services. Future work could also examine different coding structures for the individual components of the GIRS. In addition, as noted in Chapter 2, there could also be value in further analyses of the relationship between GIRS scores for different combinations of professions and health outcomes.

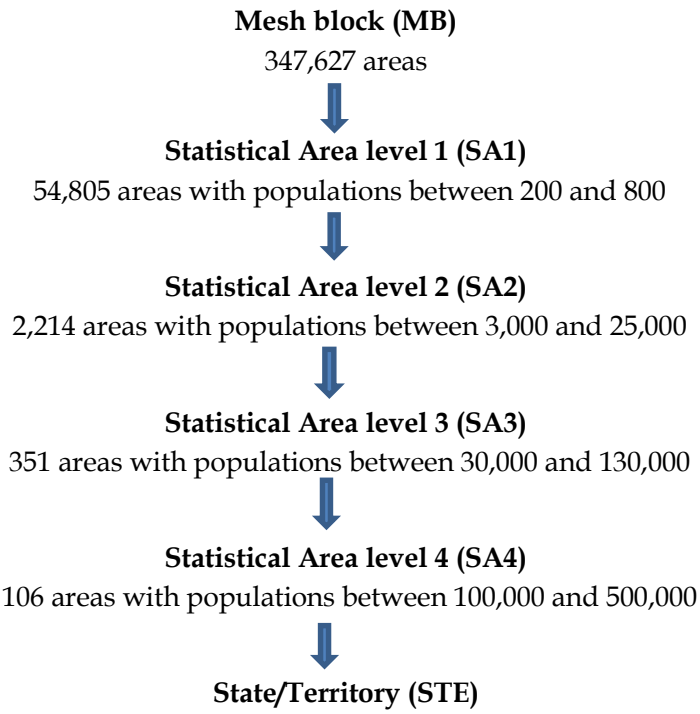
Appendix A: Selection of geographic scale

A major challenge for any spatial analysis is the choice of geographic framework and the unit of analysis. Choices are constrained by pre-existing spatial boundaries, the lowest available level of geographic detail available in the data, and the availability of other required information at a similar scale (such as population data).

Within Australia, spatial data can be presented at various scales, reflecting political boundaries (local government areas), service or funding boundaries (health districts) or administrative boundaries drawn for consistent reporting of statistics (ABS boundaries).

The main (SA) structure of the ASGS, developed by the ABS for the collection and dissemination of geographic statistics, was selected as the most relevant framework for this work (Box A1).

Box A1: Hierarchical construction of SA levels from the ASGS



The SA structure is hierarchical—lower level units fit wholly into higher level units—and is based on the functional areas of major cities and towns and gazetted suburbs and localities (Figure A1).

Figure A1: Boundaries of Statistical Areas levels 2, 3 and 4 (SA2, SA3 and SA4)

Several factors governed the selection of the unit of analysis from within the ASGS. Ideally, a geographic unit of analysis should:

- be large enough to provide reliable estimates, while small enough not to mask within-unit variations
- be based on boundaries that reflect existing political, social, cultural, economic or administrative aspects of an area
- be relatively comparable with other areas in either physical size or population
- be comparable with data and statistics from other sources
- have non-overlapping boundaries.

SA2 is the lowest level for which the ABS reports Estimated Resident Population by Indigenous Status.

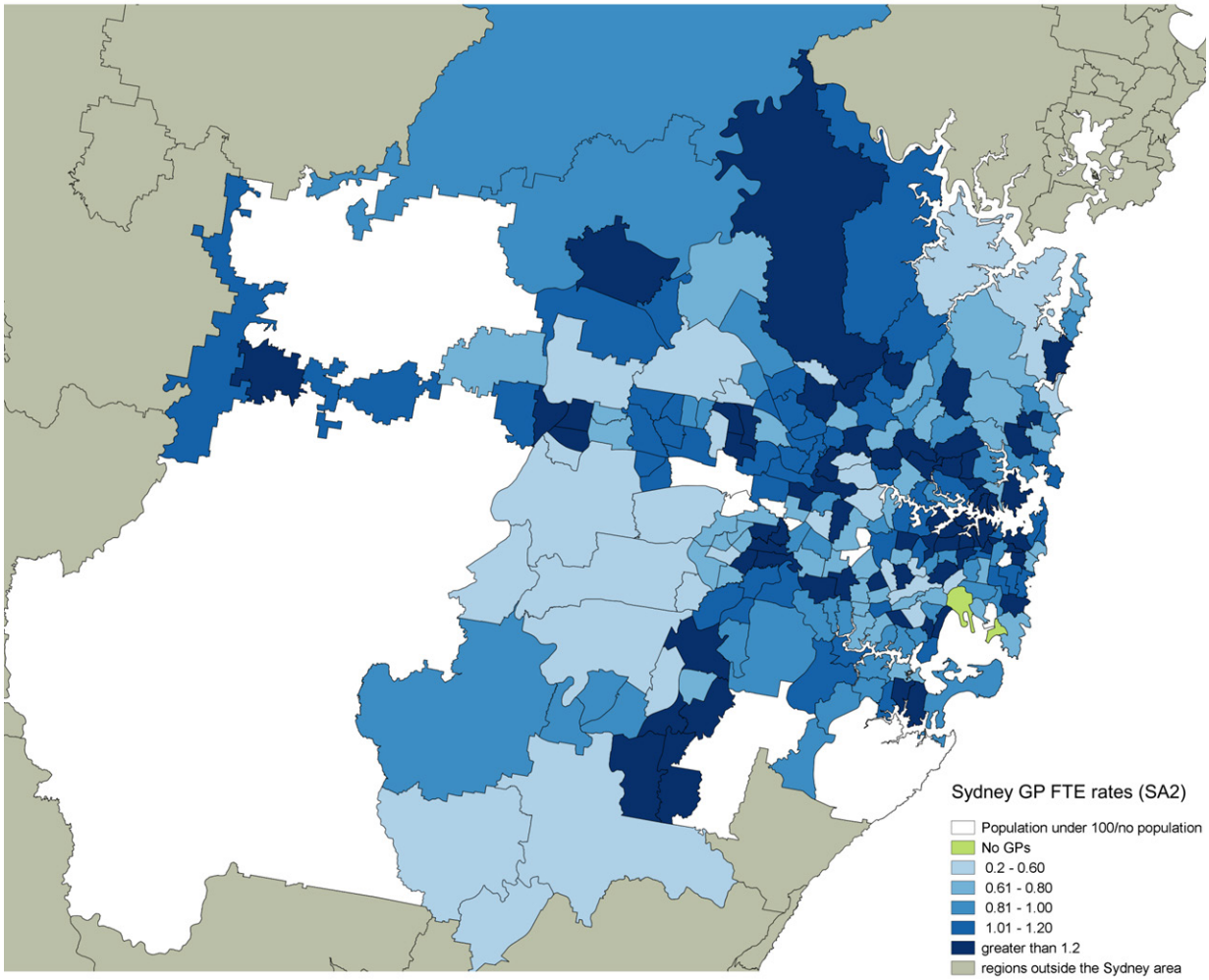
Wherever possible, SA2s are based on officially gazetted suburbs and localities. In urban areas, SA2s largely conform to whole suburbs and combinations of whole suburbs, while in rural areas they define functional zones with social and economic links.

SA2 meets most of the criteria listed above, except for comparability of physical size. *Remote* and *Very remote* SA2s tend to be geographically large with low population densities (which must be kept in mind when comparing areas) and this is taken into account in the GIRS.

Preliminary analyses were undertaken with SA2s as the unit of analysis. SA2 level FTE rates were calculated for key professions, then mapped. For the purposes of this project—which is to look at workforce supply in local areas—it became apparent that SA2 FTE rates were not appropriate in *Major cities*. This is because, as the SA2s are geographically small, it can be reasonably assumed that health professionals serve populations outside these boundaries. For example, in Sydney, 5 SA2s make up the Eastern Suburbs - South SA3 (Coogee, Kensington - Kingsford, Malabar - La Perouse - Chifley, Maroubra, and Randwick). Individually, their GP FTE rates ranged from 0.69–1.28, while the GP FTE rate for the SA3 was 1.10.

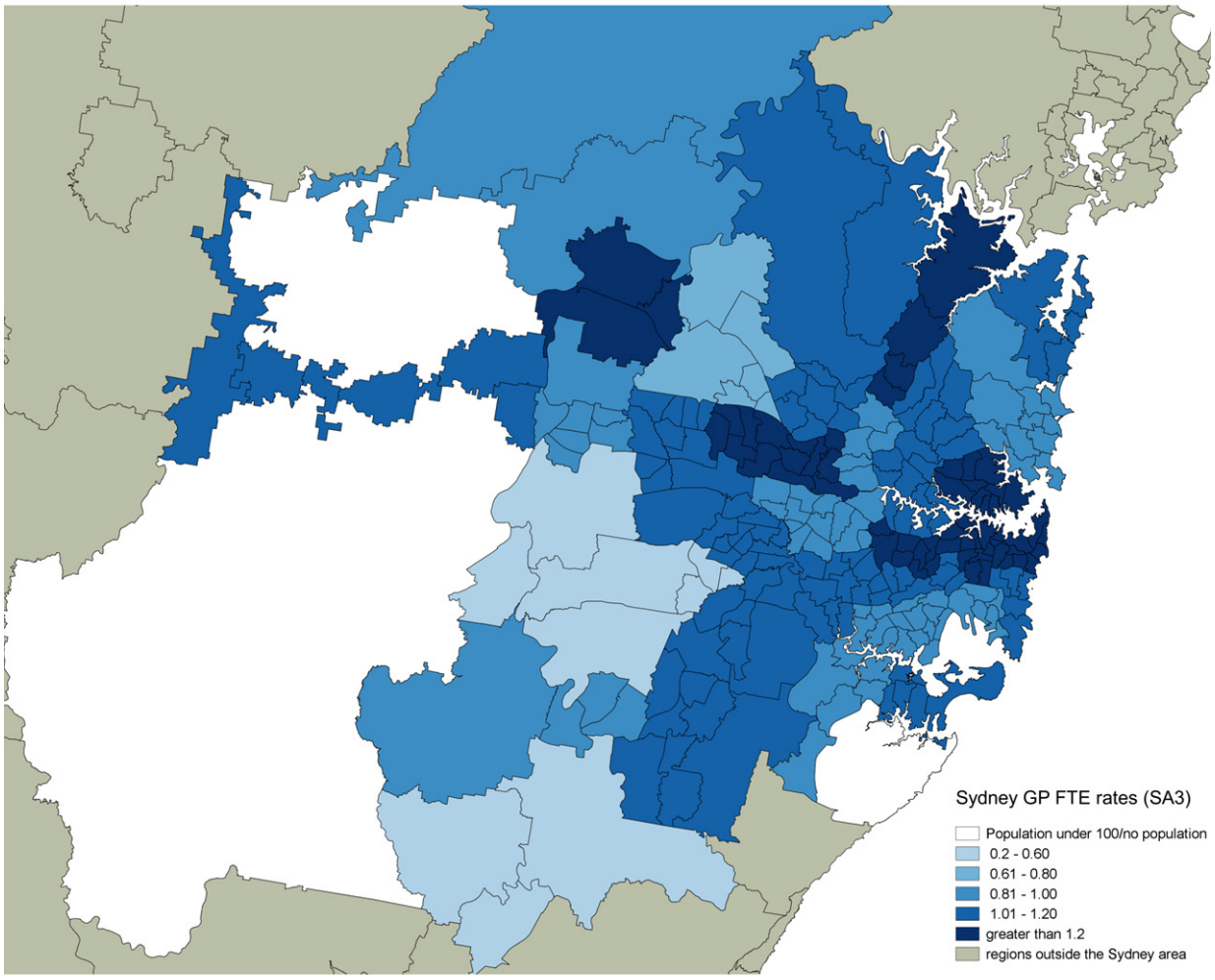
In consultation with the Department of Health, the decision was made to calculate FTE rates at the SA3 level for SA2s within *Major cities*. The SA3 level FTE rate is then applied to all the SA2s within that SA3. For example, the GP FTE rate of 1.10 was applied to all 5 SA2s within the Eastern Suburbs - South SA3 (Coogee, Kensington - Kingsford, Malabar - La Perouse - Chifley, Maroubra, and Randwick). This same method was used for all SA2s within *Major cities.*

The difference between FTE rates at the SA2 and SA3 level in Sydney is shown in figures A2 and A3.



Source: NHWDS 2013.

Figure A2: GP FTE rates for Sydney, calculated at the SA2 level



Source: NHWDS 2013.

Figure A3: GP FTE rates for Sydney, calculated at the SA3 level

Appendix B: Detailed data sources and methods

Workforce data

Data on the numbers, locations and FTE positions of medical practitioners, nurses and midwives, allied health professionals and dental professionals were sourced from the 2014 NHWDS, supplied by the AIHW's Expenditure and Workforce Unit.

The NHWDS was selected as the best source of data on workforce supply for this report as it:

- is a nationally consistent, high-quality data set
- includes data on all 14 health professions, with a national yearly registration process administered by the AHPRA (Box B1)
- allows the identification of currently employed clinicians working in the areas of their registration
- includes hours worked, allowing the calculation of FTE rates, not just the number of providers
- permits the calculation of small area rates.

The broad categories of medical practitioners, nurses and midwives, and dental practitioners can be disaggregated by more detailed specialties (see Table B1 for a description). For example, medical practitioners include GPs, specialists and specialists-in-training, while dental practitioners include dentists and dental hygienists. There are also 11 professions under the allied health umbrella.

NHWDS data are presented at a number of geographies (including SA3 level and by Primary Health Networks) in an online data portal at <http://analytics.aihw.gov.au/Viewer/VisualAnalyticsViewer_guest.jsp?reportPath=%2FAIHW%2FReleasedPublic%2FExpenditure%2FReports&reportName=Health%20Workforce&appSwitcherDisabled=true>.

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

The NHWDS includes data on location of professionals by suburb/postcode. The FTEs have been apportioned to SA2s, based on a concordance file provided by the ABS. Where a single postcode/suburb combination was mapped to multiple SA2s, the FTEs for the health professionals have been distributed between the SA2s proportionally, based on the population. This means that there may be some inaccuracy in the FTE data; however, this is not expected to greatly affect the ratings of relative workforce supply, given the multiple components used in the GIRS. Where a provider works at more than one location, all his or her hours are included, but they are attributed to the primary location only.

Table B1: Available detailed categories of health practitioners in the NHWDS

Broad category	Detailed categories	Other detail available	
Medical workforce	GP	*Specialists and Specialists-in-training*	*Detailed Specialists and Specialists- in-training*
	Hospital non-specialist	Physicians total	Cardiology
	Specialist	Surgery total	Endocrinology
	Specialist-in-training	Radiology total	Gastroenterology and hepatology
	Other clinician	Obstetrics and gynaecology total	General medicine
	Non-clinician	Paediatrics total	Medical oncology
		Pathology total	Nephrology
		Ungrouped total	Neurology
		No current specialty	Respiratory and sleep medicine
			Rheumatology
			Psychiatry
			Ophthalmology
			Dermatology
Nursing and midwifery workforce	RNs (clinicians)	*Supply of employed midwives*	
	RNs (non-clinicians)	Clinical midwives	
	ENs (clinicians)	Non-clinical midwives	
	ENs (non-clinicians)	(Note that FTE hours worked by midwives may also include hours in non-midwifery roles.)	
Allied health workforce	Psychologist		
	Pharmacist		
	Physiotherapist		
	Occupational therapist		
	Medical radiation practitioner		
	Optometrist		
	Chiropractor		
	Chinese medicine practitioner		
	Podiatrist		
	Osteopath		
	Aboriginal and Torres Strait Islander health practitioner		
Dental workforce	Dentists	*Employed dentists*	
	Oral health therapists	General dental practice	
	Dental hygienists	Specialist dental practice	
	Dental therapists		
	Dental prosthetists		

Other data sources

Data included in this report on the locations and service characteristics of ISPHCSs funded by the Australian Government were sourced from the AIHW's Online Services Report for 2012–13 and from the AIHW's National Key Performance Indicators for the Aboriginal and Torres Strait Islander primary health-care services data collection for 2012–13.

Data on the geographic distribution of the Aboriginal and Torres Strait Islander population were sourced from the ABS's 2011 Census of Population and Housing. This population,

rather than a more recent estimated resident population, was used because it is available at the SA1 level. Having population data at this level is necessary to calculate drive times to nearest service location.

Health-care service addresses for the GPs were sourced from the Australasian Medical Publishing Company, which provides year-to-date information on registered GPs, including GP service addresses, the number of GPs working at each service, and an FTE value for each GP. Additional GP service locations were sourced from Australia's Royal Flying Doctor Service. Services deemed not to provide 'traditional' GP medical care—such as homeopaths, naturopaths, cosmetic services, tanning clinics and plastic surgeons—were disregarded. All GP data were for 2013. It should be noted that any changes made to these service addresses after 2013, including the opening of new GP services, will not be captured in the analyses presented in this report. The AIHW is currently in the process of obtaining the most up-to-date list of GP service addresses for future analyses.

Locations of public hospitals (and multipurpose service locations) were sourced from data held by the AIHW. These data have been made available on the MyHospitals website <http://www.myhospitals.gov.au/>. It should be noted that this website also presents hospital information provided by data custodians other than the AIHW and may therefore show some hospital locations (in particular private hospitals) that are not included in this report.

PPHs are hospitalisations that could potentially be avoided through effective preventive measures or early diagnosis and treatment in primary health care. A wide range of conditions can lead to a PPH, including vaccine preventable diseases, chronic conditions that can be managed without hospitalisation, and acute conditions that can be prevented without vaccination. The data on PPHs used in this study came from the AIHW's NHMD; this database is compiled by the AIHW from data on hospital separations supplied by the state and territory health authorities. Hospitalisations were classified as PPHs using the ICD-10-AM codes reported in the NHMD and the definition of PPH used in the 2015 National Healthcare Agreement (see <http://meteor.aihw.gov.au/content/index.phtml/itemId/559032>). NHMD data from the financial year 2012–13 were used in the analysis. Hospitalisations for dialysis were excluded from the analyses.

To examine the spatial accessibility of hospitals with birthing units, the AIHW compiled and geocoded a list of public and private hospitals in Australia with birthing units, based on publicly available information on health websites, on information included in state/territory 'Mothers and babies' reports and on communications with state and territory officials. Hospitals were included only if they offered a dedicated birthing facility; that is, a service into which women book for their labour and delivery of their baby. Hospitals were not included if they provided only emergency delivery services. The birthing units themselves range from small birthing services for women at low risk of complications, through to tertiary centres with full services for women at high risk, including neonatal services for the babies. Birthing units located within private hospitals were counted as public birthing units if they were funded to provide services to public patients.

Data on the longitude and latitude of community pharmacy locations were supplied by the Pharmacy Guild.

Geocoding of service locations

Latitude and longitude coordinates for each of the services were derived from address information using GPS Visualizer (Schneider 2013), an online geocoder that converts physical address information into latitude and longitude coordinates. The resulting coordinates were loaded into MapInfo Professional (a Geographic Information System—GIS—application) and plotted onto ASGS digital boundary maps of Australia (obtained from the ABS website).

Address data were validated using Bing satellite maps (a web-based mapping service provided by Microsoft) to find the service locations of GPs. A potential disadvantage of using satellite imagery to validate the locations of services is the age of the satellite maps available in the public domain. Often satellite imagery is composed of several years of data, meaning it is possible for a service to exist in a particular area even though it does not appear in the satellite map. When this issue arose, other satellite mapping applications such as Google Earth (maps and street view) were used to confirm the existence of a service. However, there were instances when these, too, failed and a call to the health service in question was necessary to validate its street address.

A second issue associated with validating locations using satellite maps was the loss of map resolution with increased remoteness, making it hard to verify the location of services in *Remote* and *Very Remote* locations. When this occurred, validation of service locations was undertaken in the same way as described above for dealing with older satellite maps.

Population centroids

MapInfo Professional's Drivetime application was used to calculate travel distances between population centroids and service locations. A population centroid denotes the geographic centre point of an ASGS-derived boundary. Populations tend to be distributed throughout a geographic boundary. Hence, the centre point is used to represent the location of the boundary's population in much the same way as a mean represents the average point within a data set. SA1 centroids were selected to represent the locations of populations primarily because they are the smallest geographic level at which ABS population data are available and because of their relatively small size compared with that of other geographic areas. How well the geographic midpoint represents the location of the population of an SA1 depends on the size of the SA1 and the distribution of people within its borders. The ABS determined the size of SA1s so that most had a population ranging from 200–800 people (ABS 2011).

In most instances, the dense populations in metropolitan areas ensure that SA1s are small enough to be adequately represented by a given area's geographic midpoint (centroid). However, the size of areas is population-dependent; therefore, areas increase in size as their populations are more widely distributed with increasing remoteness. Hence, centroids—the geographic midpoints of SA1s—are less precise approximations of the actual locations of people in remote areas than in more densely populated urban and regional areas. The size of some SA1s in *Very remote* areas of Australia exceeds 100,000 square kilometres (an SA1 in Western Australia covers 329,000 square kilometres). However, there are also many small SA1s around towns, villages and settlements in *Remote* and *Very remote* areas. In *Very remote* areas, 85% of Aboriginal and Torres Strait Islander people live in SA1s that are less than 100 square kilometres in area. In combination with the manual adjustment of centroids described in the next section, this tendency for the majority of the population to live in smaller SA1s

ensures that the centroids provide a relatively accurate representation of the location of SA1 populations.

A common method used to ensure that centroids are placed where they best represent the location of people within an area is the construction of population-weighted centroids. Population data, at a smaller geographic level than that used in the analysis for this report, are used to create a centroid that represents the average location of people within the larger area. However, it was not possible to use population-weighted centroids in this study as population data from the 2011 Census have not been released at a level lower than SA1 for reasons related to confidentiality and privacy. Instead, the centroids of larger SA1s in *Remote* and *Very remote* areas were adjusted manually, based on the actual locations of communities in these areas.

Manual adjustment of area centroids

The locations of area centroids in larger SA1s in *Remote* and *Very remote* areas were derived manually, using the Australian Government Indigenous Programs & Policy Locations dataset, in conjunction with GIS 'Bing' web-based satellite maps. Once the locations of population centres were determined, area centroids were placed in such a way that the total distance to all known communities within each area was minimised. In total, 105 SA1 area centroids in *Remote* and *Very remote* areas were adjusted manually, representing less than 1% (0.19%) of all SA1s. All distances were measured using MapInfo Professional.

It should be noted that using a single population centroid to represent populations spread over large areas is a limitation of any geospatial analysis. One possible solution to this problem—and one that future studies of access to primary health care in *Remote* and *Very remote* areas of Australia may be able to use—would be to develop multiple centroids for the largest areas.

Calculating drive times from population centroid to service locations

Coordinates for geographic centroids and service locations were entered into a rectangular matrix within Drivetime, and the travel times (by road in a motor vehicle) from each centroid to all primary health services located within 1 hour were calculated. Drivetime determines travel times based on the quickest route between the origin (centroid) and destination (such as ISPHCSs, GPs, public hospitals). Travel times are generated according to the ambient travel speed available on a given road network. The time represents the minimum off-peak travel time for the road type (highway, suburban street and so forth), assuming the highest driving speeds available to a driver of a car on a given road network between 8.30 am and 3.30 pm and after 7 pm on weekdays.

A potential limitation of using geographic-based centroids when calculating population travel times to health providers is that the location of the centroid representing the population may not be on a road. MapInfo Professional's Drivetime attempts to control for this by allowing for the adjustment of off-network travel speed at the point of origin and point of destination. Off-network travel speeds for the origin and destination were both set at 200 km/h. When an area centroid (origin point) is located some distance from a road network, Drivetime travels the distance between the origin/destination point and the nearest road at 200 km/h. This ambient travel speed of 200 km/h was selected arbitrarily and is

based on the assumption that the majority of Australian cities, towns and communities, including Indigenous communities, are accessible by road. Therefore, travel times between area centroids and the nearest road network should be set at a high speed in order to model travel times as realistically as possible. Off-network travel time is a concern only in very large SA1s where the area centroid is more likely to be located far from a road network. In this study, as well as setting the off-network travel times to 200 km/h, the locations of area centroids were adjusted manually in the larger SA1s to make travel time estimates more realistic. This method is consistent with what has been done to calculate drive times in previous AIHW reports.

One (1) hour is often considered the maximum time people should have to travel to access primary or emergency health care (Bagheri et al. 2008). Of course, the time people are prepared to travel to access health care is likely to vary between different areas and populations.

Proportion of SA2 population within a 1 hour drive of nearest service location

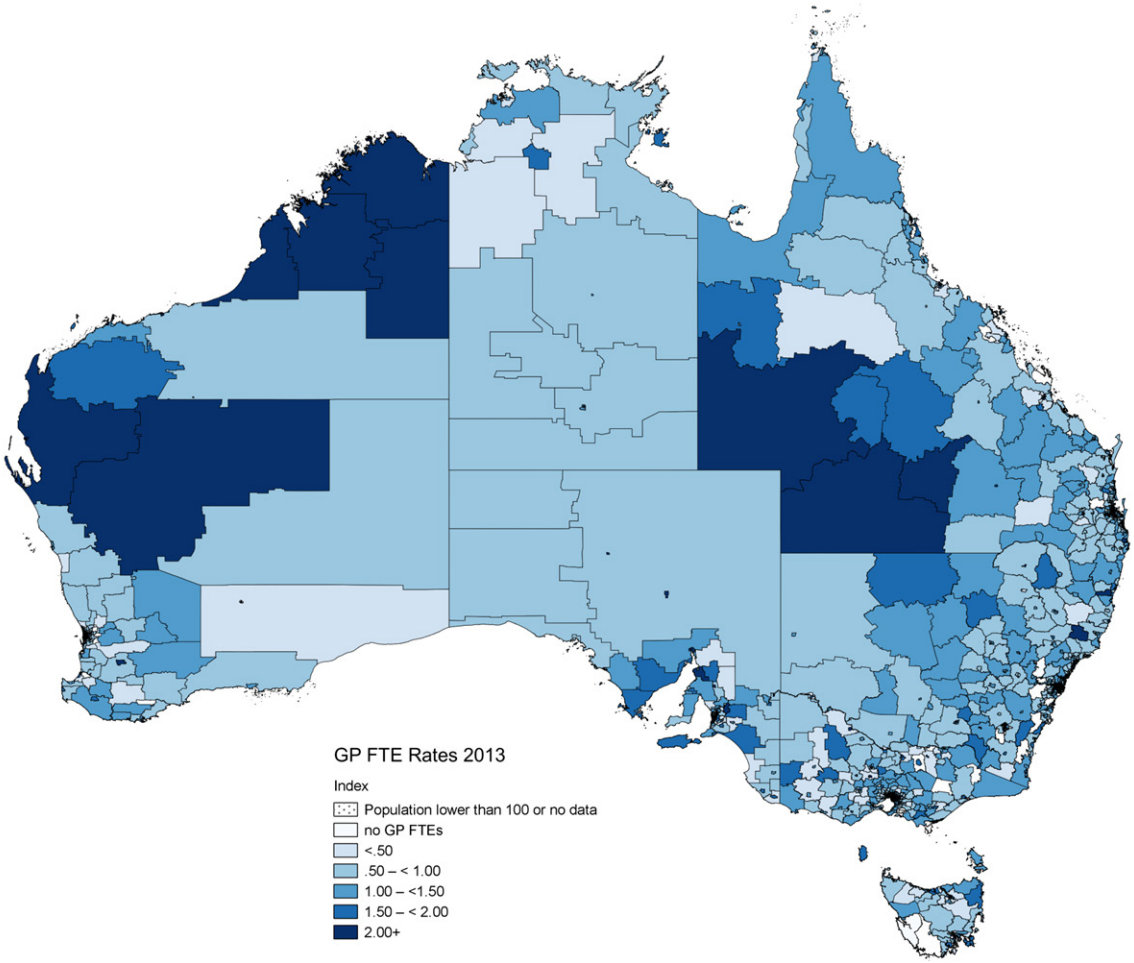
The whole population of each SA1 was assumed to have the same drive time to their nearest service location (SA1 centroid-to-service as described above). The proportion of the total population—the non-Indigenous population and the Aboriginal and Torres Strait Islander population of an SA2 who live within a 1 hour drive of their nearest service location—was then taken to be the proportion who live in an SA1 with a centroid within 1 hour of the nearest service.

Appendix C: Constructing the GIRS for GPs

This appendix presents an overview of the steps involved in constructing the GIRS for GPs, illustrated by maps for each step. A similar process was used to construct the GIRS for the other professions. These maps are based on data from the 2013 NHWDS.

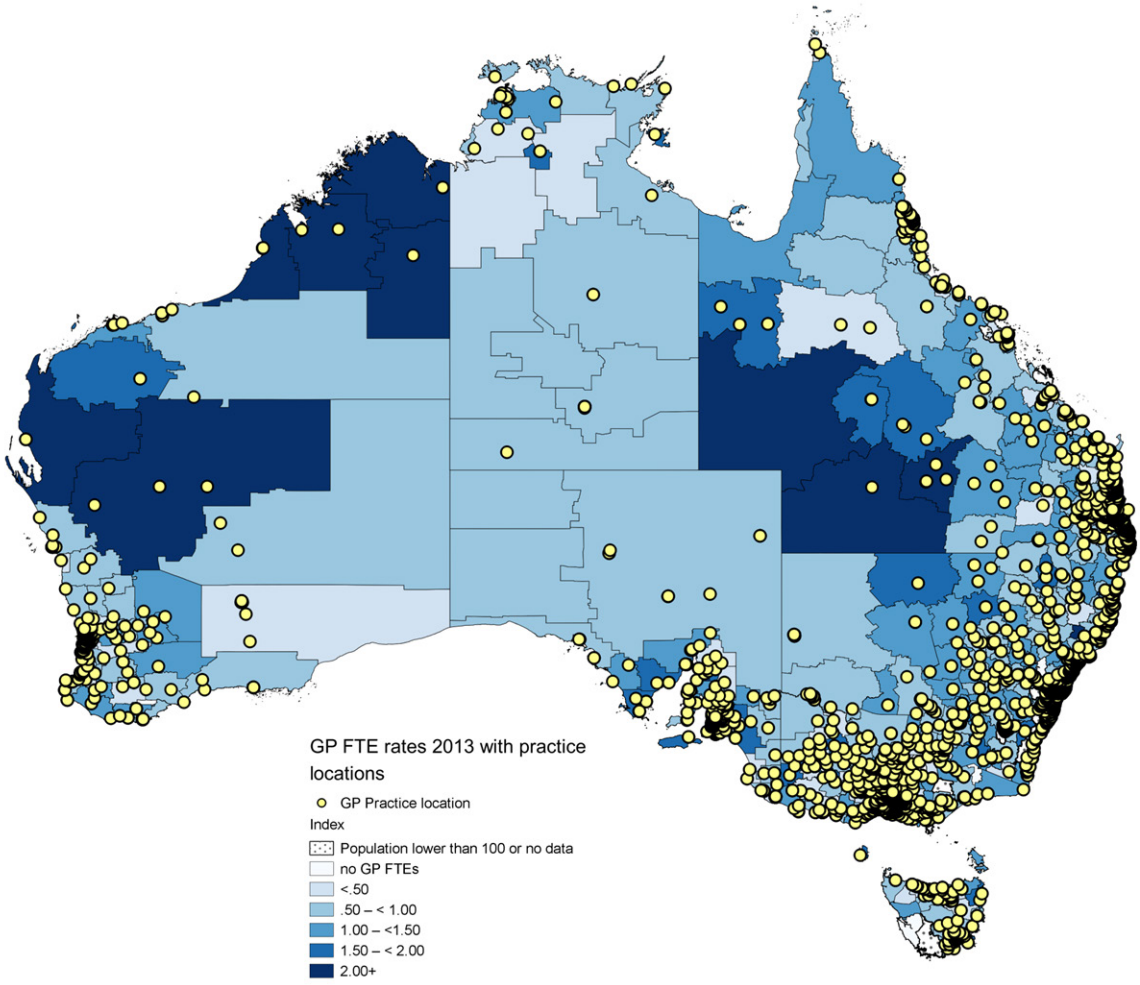
Step 1: FTE rates

Calculate FTE rates for SA2s outside major cities and SA3s within major cities. The map illustrates the spatial distribution of the rates.



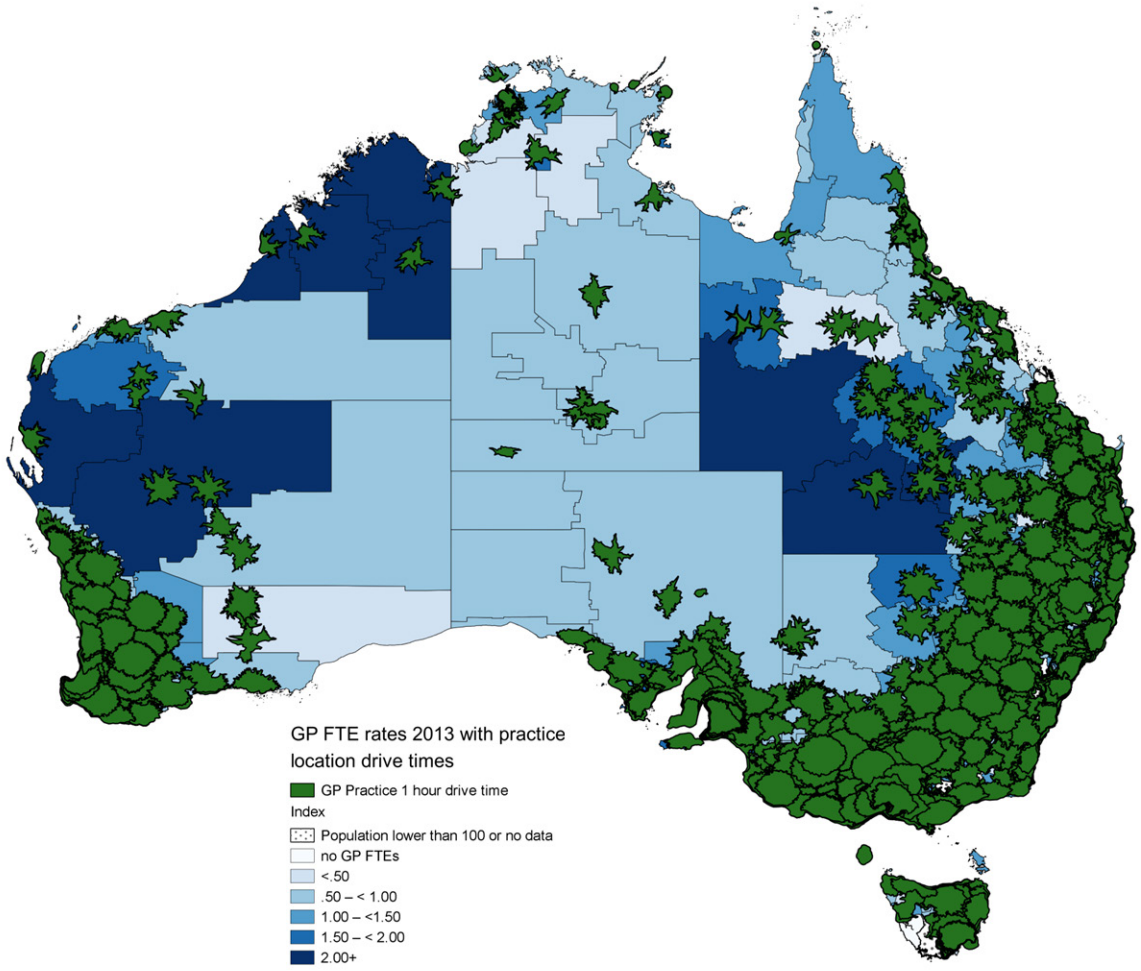
Step 2: Geocode GP practice locations

Each GP address is geocoded to a point location. The map illustrates these locations.



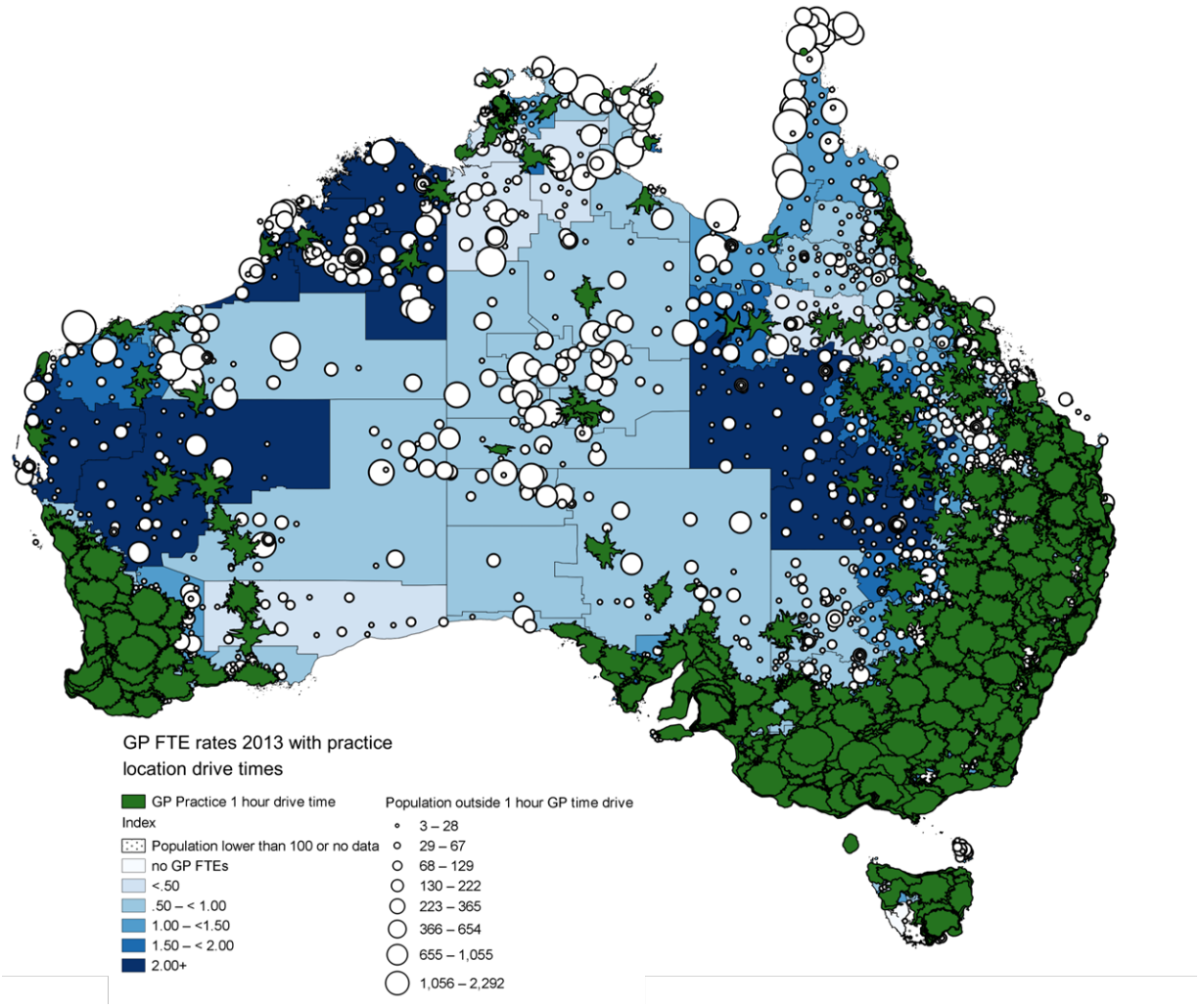
Step 3: Drive time catchments

Calculate 1 hour drive times from each GP practice point location. The map illustrates what these catchments look like.



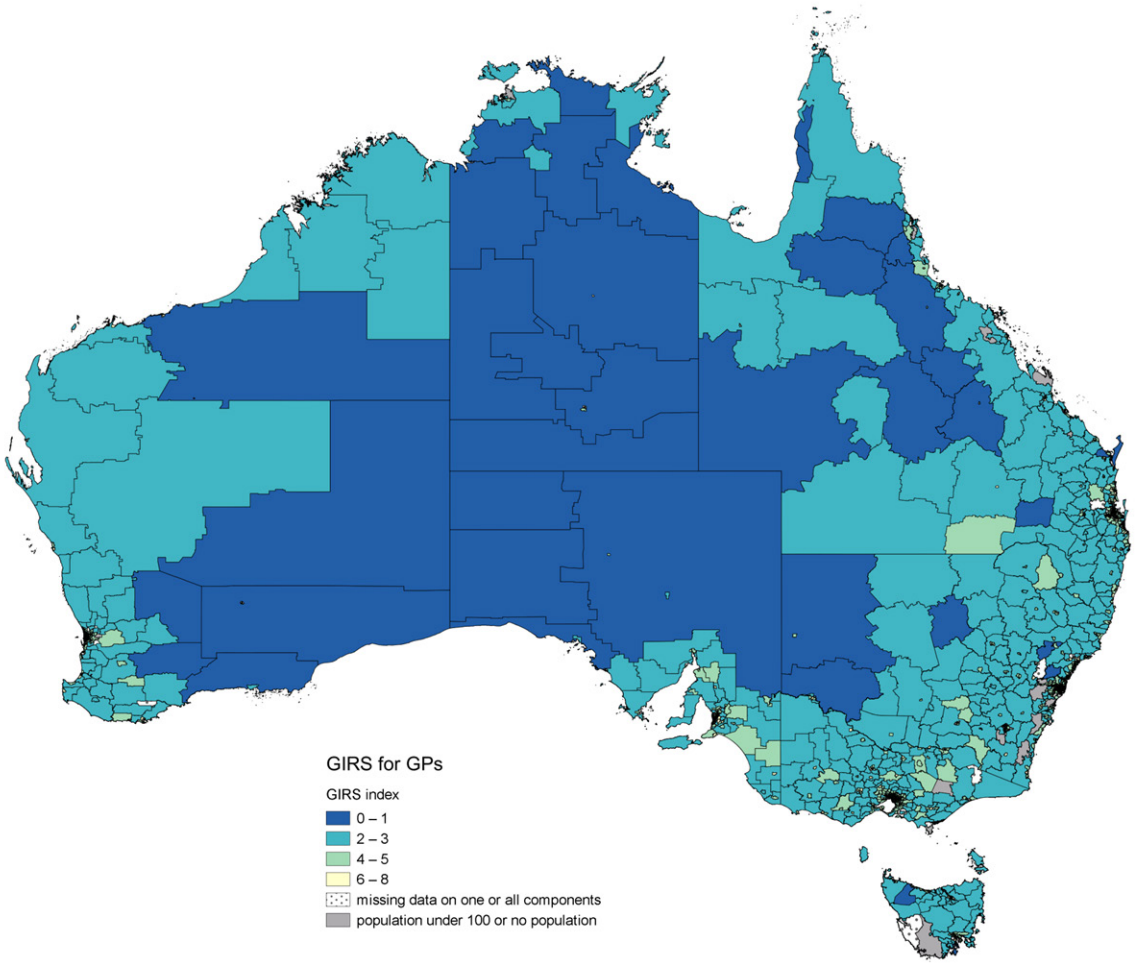
Step 4: Estimate populations inside/outside 1 hour drive time catchments

The percentage of the SA2 population within a 1 hour drive of a particular type of service was calculated using the steps described at Appendix B. Mesh block population data are used to calculate the number of people in each SA2 who live inside/outside the 1 hour drive catchment area. The map shows the size of the populations in the mesh blocks that are outside the catchment through the use of white circles. The size of the circle relates to the size of the population.



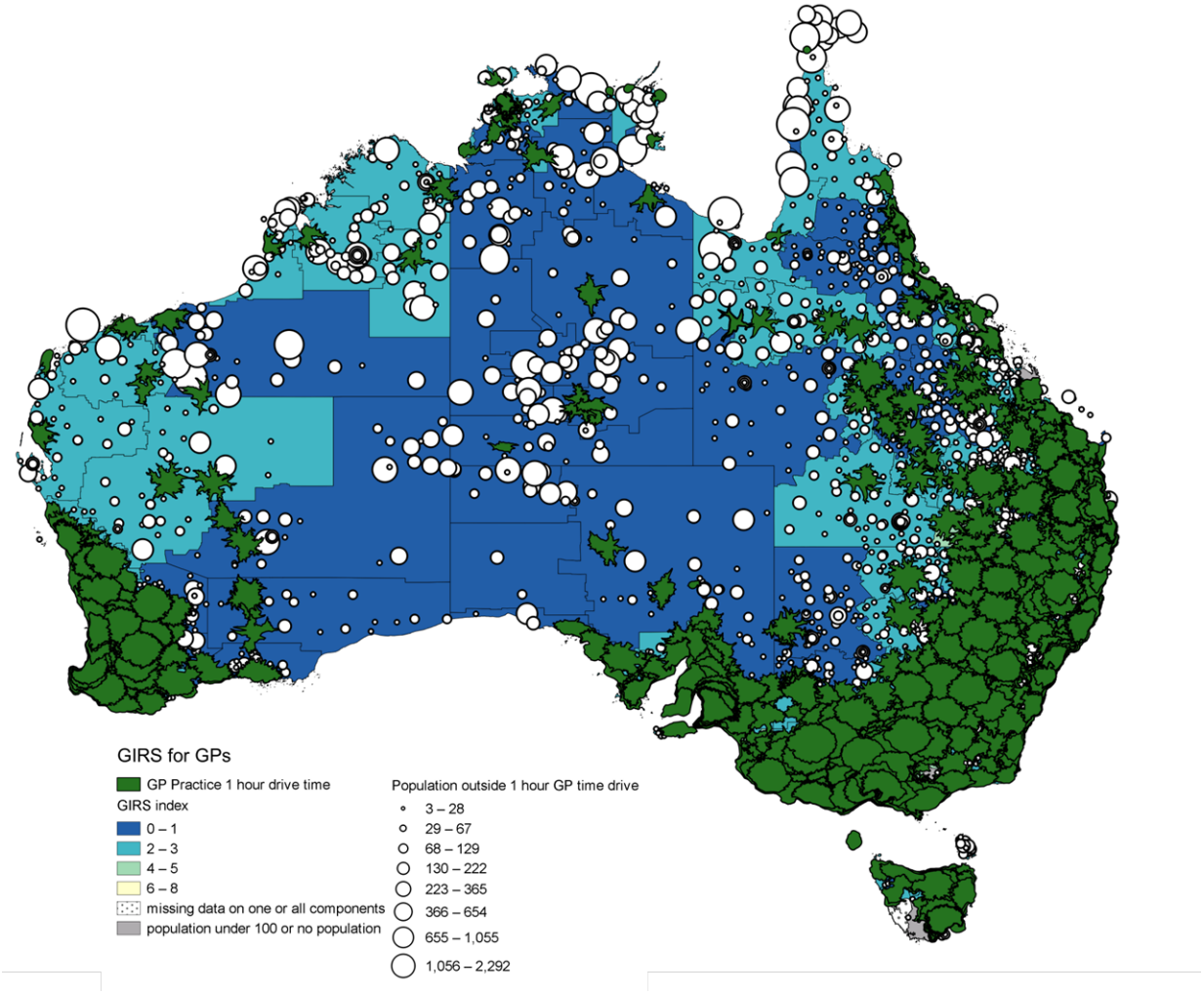
Step 5: Calculate the GIRS for GPs

The GIRS for GPs is calculated for each SA2 and includes assigned values for workforce supply, population dispersion, area size and proximity to services. The map below illustrates the GIRS scores.



Step 6: Illustrating the GIRS and its components

The map below adds the drive time catchment areas of the GP practices and the mesh block populations outside the catchment to provide some context to the index.



Appendix D: Additional tables

Table D1: Correlation coefficients for SA2 level GIRS score and percentage of hospitalisations that were potentially preventable by remoteness (N=2,091)

	Major city SA2s	Inner and Outer regional SA2s	Remote and Very remote SA2s
GP GIRS	–0.247***	–0.111**	–0.126*
Pharmacist GIRS	–0.288***	–0.101**	–0.230*
Dentist GIRS	–0.309***	–0.707*	–0.254*
Number of SA2s	1,210	785	97

*** p<0.001; ** p<0.01; * p<0.05 (2-tailed).

Table D2: Areas that scored 0–1 in the GIRS for four or more professions (14 areas)

State/ Territory	SA3*	SA2	Remoteness	GP	Nurse	Mid-wife	Pharm	Dentist	Psych	Optom	Indigenous	Non-Indigenous	Total
NSW	Bourke - Cobar - Coonamble	Nyngan - Warren	Remote	Low	. .	Low	. .	. .	Low	Low	938	4,468	5,406
Qld	Central Highlands (Qld)	Central Highlands - East	Outer Regional	. .	. .	. .	Low	Low	Low	Low	1,476	6,336	7,812
Qld	Central Highlands (Qld)	Central Highlands - West	Remote	Low	Low	. .	. .	. .	Low	Low	280	8,793	9,073
Qld	Bowen Basin - North	Clermont	Remote	Low	. .	Low	Low	. .	. .	Low	111	3,745	3,856
Qld	Far North	Aurukun	Very Remote	Low	. .	Low	Low	. .	. .	Low	1,306	92	1,398
Qld	Far North	Northern Peninsula	Very Remote	. .	. .	Low		Low	Low	Low	2,198	265	2,463
Qld	Far North	Torres Strait Islands	Very Remote	. .	. .	. .	Low	Low	Low	Low	4,304	274	4,578
Qld	Outback - South	Barcaldine - Blackall	Very remote	Low	. .	Low	. .	. .	Low	Low	352	5,197	5,549
Qld	Outback - North	Carpentaria	Very Remote	. .	. .	Low	Low	Low	Low	. .	3,642	1,706	5,348
Qld	Outback - South	Far Central West	Very Remote	Low	. .	Low	. .	Low	Low	. .	507	2,021	2,528
Qld	Outback - South	Far South West	Very Remote	. .	. .	Low	. .	Low	Low	Low	888	2,474	3,362
WA	Esperance	Esperance Region	Very Remote	Low	. .	Low	Low	. .	Low	. .	165	4,127	4,292
WA	Mid West	Meekatharra	Very Remote	. .	. .	. .	Low	Low	Low	Low	1,521	2,691	4,212
NT	Daly - Tiwi - West Arnhem	Alligator	Remote	. .	. .	Low	Low	Low	. .	Low	1,342	3,488	4,830
										Total	**19,030**	**45,677**	**64,707**

* Statistical Area level 3.

. . = indicates that the GIRS score for that profession was greater than 1.

Table D3: Areas that scored 0–1 in the GIRS for five or more professions (12 areas)

State/ Territory	SA3*	SA2	Remoteness	GP	Nurse	Mid-wife	Pharm	Dentist	Psych	Optom	Indigenous	Non-Indigenous	Total
NSW	Broken Hill and Far West	Far West	Very remote	Low	. .	Low	Low	Low	Low	. .	936	1,850	2,786
Qld	Cleveland - Stradbroke	Redland Islands	Outer regional	. .	Low	Low	. .	Low	Low	Low	793	8,162	8,955
Qld	Far North	Croydon - Etheridge	Very remote	Low	. .	Low	Low	. .	Low	Low	128	1128	1,256
Qld	Far North	Kowanyama - Pormpuraaw	Very remote	Low	. .	Low	Low	. .	Low	Low	1,691	136	1,827
SA	Eyre Peninsula and South West	West Coast (SA)	Very remote	Low	. .	Low	Low	. .	Low	Low	689	2,997	3,686
WA	Kimberley	Halls Creek	Very remote	. .	. .	Low	Low	Low	Low	Low	3,205	688	3,893
WA	Wheat Belt - North	Mukinbudin	Remote	Low	. .	. .	Low	Low	Low	Low	121	3,422	3,543
Tas	Huon - Bruny Island	Bruny Island - Kettering	Outer regional	Low	Low	. .	. .	Low	Low	Low	129	2,823	2,952
Tas	West Coast	Waratah	Outer regional	Low	. .	Low	. .	Low	Low	Low	264	3,654	3,918
NT	Daly - Tiwi - West Arnhem	Tiwi Islands	Remote	. .	. .	Low	Low	Low	Low	Low	2,637	333	2,970
NT	East Arnhem	East Arnhem	Very remote	. .	Low	. .	Low	Low	Low	Low	7,967	670	8,637
NT	Katherine	Gulf	Very remote	Low	. .	Low	. .	Low	Low	Low	4,029	633	4,662
										Total	**22,589**	**26,496**	**49,085**

* Statistical Area level 3.

. . = indicates that the GIRS score for that profession was greater than 1.

Table D4: Areas that scored 0–1 in the GIRS for six or more professions (11 areas)

State/ Territory	SA3*	SA2	Remoteness	GP	Nurse	Mid-wife	Pharm	Dentist	Psych	Optom	Indigenous	Non-Indigenous	Total
SA	Outback - North and East	APY Lands	Very remote	Low	. .	Low	Low	Low	Low	Low	2,375	285	2,660
SA	Outback - North and East	Outback	Very remote	Low	. .	Low	Low	Low	Low	Low	589	2,947	3,536
WA	Goldfields	Leinster - Leonora	Very remote	Low	. .	Low	Low	Low	Low	Low	2,491	3,335	5,826
WA	Pilbara	East Pilbara	Very remote	Low	. .	Low	Low	Low	Low	Low	2,023	5,823	7,846
NT	Alice Springs	Sandover - Plenty	Remote	Low	. .	Low	Low	Low	Low	Low	3,878	441	4,319
NT	Alice Springs	Tanami	Very remote	Low	. .	Low	Low	Low	Low	Low	2,814	552	3,366
NT	Alice Springs	Yuendumu - Anmatjere	Very remote	Low	. .	Low	Low	Low	Low	Low	2,094	280	2,374
NT	Daly - Tiwi - West Arnhem	Daly	Very remote	Low	. .	Low	Low	Low	Low	Low	1,494	743	2,237
NT	Daly - Tiwi - West Arnhem	West Arnhem	Very remote	Low	. .	Low	Low	Low	Low	Low	4,913	487	5,400
NT	East Arnhem	Anindilyakwa	Very remote	. .	Low	Low	Low	Low	Low	Low	1,855	1,100	2,955
NT	Katherine	Elsey	Very remote	Low	. .	Low	Low	Low	Low	Low	1,831	521	2,352
										Total	**26,357**	**16,514**	**42,871**

* Statistical Area level 3.

. . = indicates that the GIRS score for that profession was greater than 1.

Table D5: Areas that scored 0–1 in the GIRS for seven or more professions (2 areas)

State/ Territory	SA3*	SA2	Remoteness	GP	Nurse	Mid-wife	Pharm	Dentist	Psych	Optom	Indigenous	Non-Indigenous	Total
NT	Barkly	Barkly	Very remote	Low	Low	Low	Low	Low	Low	Low	2,444	606	3,050
NT	Katherine	Victoria River	Very remote	Low	Low	Low	Low	Low	Low	Low	2,251	619	2,870
										Total	**4,695**	**1,225**	**5,920**

* Statistical Area level 3.

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This report uses a new measure developed by the Australian Institute of Health and Welfare—the Geographically-adjusted Index of Relative Supply (GIRS)—to examine the geographic supply of the clinical health workforce in seven key professions with particular relevance to Indigenous Australians. These professions were general practitioners, nurses, midwives, pharmacists, dentists, psychologists and optometrists. Areas with lower GIRS scores are more likely to face workforce supply challenges than those with higher GIRS scores. The GIRS scores were compared with the distribution of the Indigenous population to assess the extent to which Indigenous people live in areas with lower relative levels of workforce supply.