Identifying gaps in remote health-service provision: a GIS approach

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ABSTRACT

Health in remote areas is an increasing concern of the Australian government. Building on the approach taken in ARIA, which characterised localities in terms of generalised access to services, this paper develops two approaches to assessing population access to health services. First, distance to broadly-substitutable "Primary Health Care facilities" is assessed for populated localities to identify centres which do not have such facilities within 100k; such localities do not exist in Southeast Australia but are relatively common in the Northern Territory and the North of Western Australia. Second, an approach to generating "natural catchments" is developed; these catchments are analysed by level of GP services. While the areas which are disadvantaged in terms of number of practitioners do not precisely correspond to those which are most disadvantaged in terms of travel distance, a significant number of remote areas do face this "double jeopardy".

***Keywords and phrases*:** remoteness; service accessibility; road distance; rural health, GIS.

1.0 INTRODUCTION

1.1 Rural health issues

Primary Health care in Australia is largely publicly funded via Medicare, but the principal mode of delivery is via private practitioners. Service access thus depends to a large extent on the willingness of medical practitioners to reside in particular areas. A number of recent studies and policy documents (see for example Craik, 1998; AIHW, 1998) have expressed concern about populations in rural areas being less well served than their metropolitan counterparts in terms of access to health facilities. The issue of "doctor shortages in the bush" in particular has been the subject of stories in not only medical and regional but national media.

At the same time, concern about differences in the health status of populations in remote areas, and indigenous populations in particular, has been widespread.

Analysis which examines the issue of ratios of health care practitioners to population, is usually undertaken within pre-defined geographic units (typically Statistical Local Areas - SLAs[1] -,or Postcodes). However these administrative boundaries do not adequately represent service catchment areas. Catchment boundaries cross these boundaries and to use a fixed administrative boundary to determine the area for calculation of service ratios, can give very misleading results.

1.2 Previous analysis

A previous analysis undertaken by the authors (Bamford and Dunne, 1999) looked at distances to General practitioner services from localities in South Australia. (This included services outside but close to the SA border, including Alice Springs and Broken Hill).

The earlier analysis focussed on General practitioner services identified from information obtained from the South Australian Centre for Rural and Remote Health.; it excluded services provided by hospitals and Aboriginal Medical Services (AMSs), which substitute for GP services in some rural areas. This potentially exaggerated the difference in access between remote and accessible areas.

2 ANALYSIS DETAILS

2.1 Minimum Road Distance

Like the South Australian study, this analysis looked at minimum road distances travelled by people to access health services, in this case extended to the whole of Australia. Distance was calculated using data from the AUSLIG 1:250,000 topographic map series using ESRI's Net Engine and network analysis software package.

It is important to note that the minimum-distance calculations represented "accessibility" in the sense of ability to access services—no account was taken of which if any services people actually accessed. The latter data are in any case unavailable in sufficient detail, and the question of choice of services is subject to many variables that are beyond the scope of this investigation.

Most of these distances had in fact already been calculated by for the ARIA project, which is the subject of a separate paper (Quantifying Remoteness - A GIS Approach) at this conference.

2.2 "Primary Health Care" services

An important modification of the previous methodology was to extend the scope of medical services considered in order to take some account of the substitution effect.

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[1] SLAs are the standard geographical unit used by the Australian Bureau of Statistics (ABS); they are based on Local Government Areas, and vary greatly in population size (0 to around 200,000 persons) and area (x to ykm^2). Source: ASGC…

Although Aboriginal Medical Services predominantly provide services to the indigenous population, services are available to the general population, in many cases (notably those in remote areas) with Medicare funding.

It is recognised that not all hospitals offer outpatient services which could substitute for GP services, but those which do not are overwhelmingly in metropolitan areas, which are well provided with hospital and GP services. Accordingly their inclusion is unlikely to affect the results (especially given that the analysis looks at access to nearest service and does not take account of multiple services at a single location.). Accordingly, and because of the difficulty of identifying those hospitals precisely, all hospitals have been included.

Multipurpose services (MPSs), which combine the functions of hospitals and aged care residential facilities, are increasingly important as a source of primary health care. Most of these are presently co-located with hospitals, but others operate independently and therefore have been included separately.

Accordingly the present approach, in addition to extending the analysis to a national basis, considers access to nearest GP, hospital, MPS or Aboriginal Medical Service, collectively termed primary health care services (PHCs).

2.3 Access boundaries - "buffering approach"

For each of the identified PHCs, service areas based on 100 kilometres road travel were established. (the 100km represents approximately one hour's travel). All populated localities within this buffered zone would have access to a PHC within 100 kilometres. All populated localities outside this zone were then identified.

Estimates of population within, and outside, 100 km of the nearest PHC were calculated by allocating Census collection districts to the two categories on the basis of whether their centroid fell within one or more of the 100-km-access polygons described above. This methodology resulted in a simple estimation of the number of people that could access a PHC service, however the accuracy of this approach was limited in areas where collection districts were large. Urban centre/localities (population "clusters" with 200 or more people[2]) outside the 100 km access zone were identified and mapped.

2.4 Redefining catchments - "natural catchment approach"

Most studies undertaken by government agencies examining general practitioner (GP) population ratios to determine areas of undersupply and oversupply, have used administrative boundaries as the basic areal unit. Limitations of this approach include:

- Administrative spatial units do NOT represent actual catchments for health services;
- Administrative units are often heterogeneous in terms of service access;
- Some administrative areas may in fact have no health services;
- Administrative units may be serviced by health services in an adjoining area;
- Administrative units may change substantially over time;

The approach presented in this paper is to determine the catchment boundary according to the distance that the population travel to reach the nearest GP. It is recognized that people do not necessary choose to use the nearest GP, but in attempting to identify areas of over and under supply the fact that some people may travel further than necessary to a service is a personal choice and is not be taken into account in the analysis.

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[2] ABS, *Australian Standard Geographic Classification* 1998 (ASGC), cat no 1218.0, p29

Figure 3 shows a map of population per GP using the Statistical Local Area (SLA) as the base spatial unit. As can be seen there are a substantial number of areas that do not have a GP. These areas tend to obtain services from neighboring SLAs. Figure 4 shows the same GP data but allocates the population according to the location of the nearest GP.

3 FINDINGS

3.1 National Access to Primary Health Care – "buffering" approach

Not surprisingly, most primary health care services are concentrated in the more densely populated areas around the coastline, and South East Australia in particular (**Figure 1**). The picture here is broadly consistent, but fragmented.

When the principal sources of primary health care (private GPs, hospitals and AMSs) are grouped, and analysed, a composite picture of level of access to health facilities according to degree of remoteness emerges.

The South Australia GP study (Bamford & Dunne 1999) had found road distance to nearest location of a GP "clinic" for populated SA localities ranged from 0 to 677 km with a mean of 57.8 km. The present study also found clear differences in the distribution of health care and related facilities throughout Australia (Figure 1).

From Figure 2 it is clear that the great majority of Australians have to travel less than 100km to the nearest Primary Health Care facility, but there are significant areas where this is not the case. There are no centres of more than 200 people in NSW, Victoria or Tasmania which are not within 100km of the nearest Primary Health Care facility, and only one in SA and three in Qld; however there are 10 in WA and 25 in the Northern Territory.

Table 1 shows that a total of 526,000[3] people (about 2.9% of the Australian population) live in areas more than 100km from the nearest Primary Health Care facility, but these are spread throughout 4.7 million square km — almost 60% of the land mass of Australia.

Table One: Population by distance from the nearest Primary Health Care facility

	Distance to nearest PHC	
	<100 km	>100 km
NUMBER OF CDS	32,665	1,835
AREA (KM^2)	3,103,507	4,703,998
% AREA	39.8	60.2
POPULATION ('000)		
- MALES	8,553	296
- FEMALES	8,812	231
- PERSONS	17,366	526
% POPULATION	97.1	2.9

3.2 National GP Access – redefining catchments

Using the natural catchment approach, population to GP ratios varied from over 4,500 per GP in the most remote areas to less than 500 in the close in metropolitan areas. In comparison the population to GP ratio for statistical local areas (apart from some SLAs where it was theoretically infinite, as there was no GP) ranged from over 40,000 per GP to less than 10 per GP. However it is suggested the natural catchment

[3] Source: GISCA. Estimated from population by Census Collection District according to 1996 Census.

approach will better identify gaps in remote area health service provision than using the administrative boundary approach.

It is planned to refine the methodology to amalgamate clusters of locations of GPs that are within a certain distance threshold. This will have the impact of reducing the number of catchment boundaries and smoothing out large discrepancies in small adjacent catchment areas.

4 CONCLUSIONS

The distances generally travelled by people in rural and remote areas adds to the disadvantages faced by people within these regions; even if population:GP ratios were the same, they would be worse off.

While the areas which are disadvantaged in terms of number of practitioners do not precisely correspond to those which are most disadvantaged in terms of travel distance, a significant number of remote areas do face this "double jeopardy" situation.

The next step would be to model demand (based on population distribution, population characteristics and known service-utilisation patterns) on a geographic basis, and overlay this with service-access patterns to enable the identification of areas of unmet need, which could then be further analysed to determine optimal locations for new services.

5 REFERENCES

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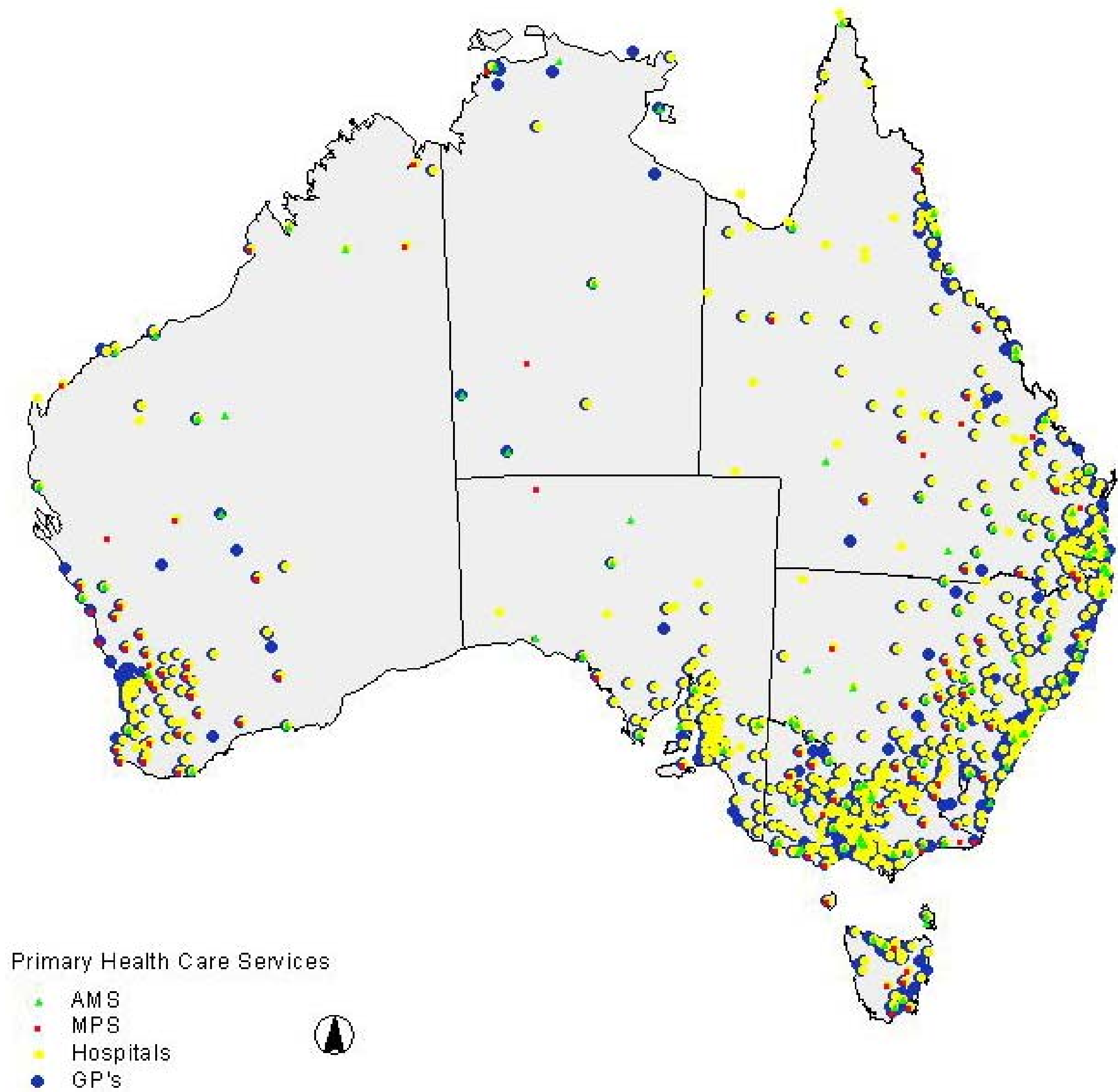
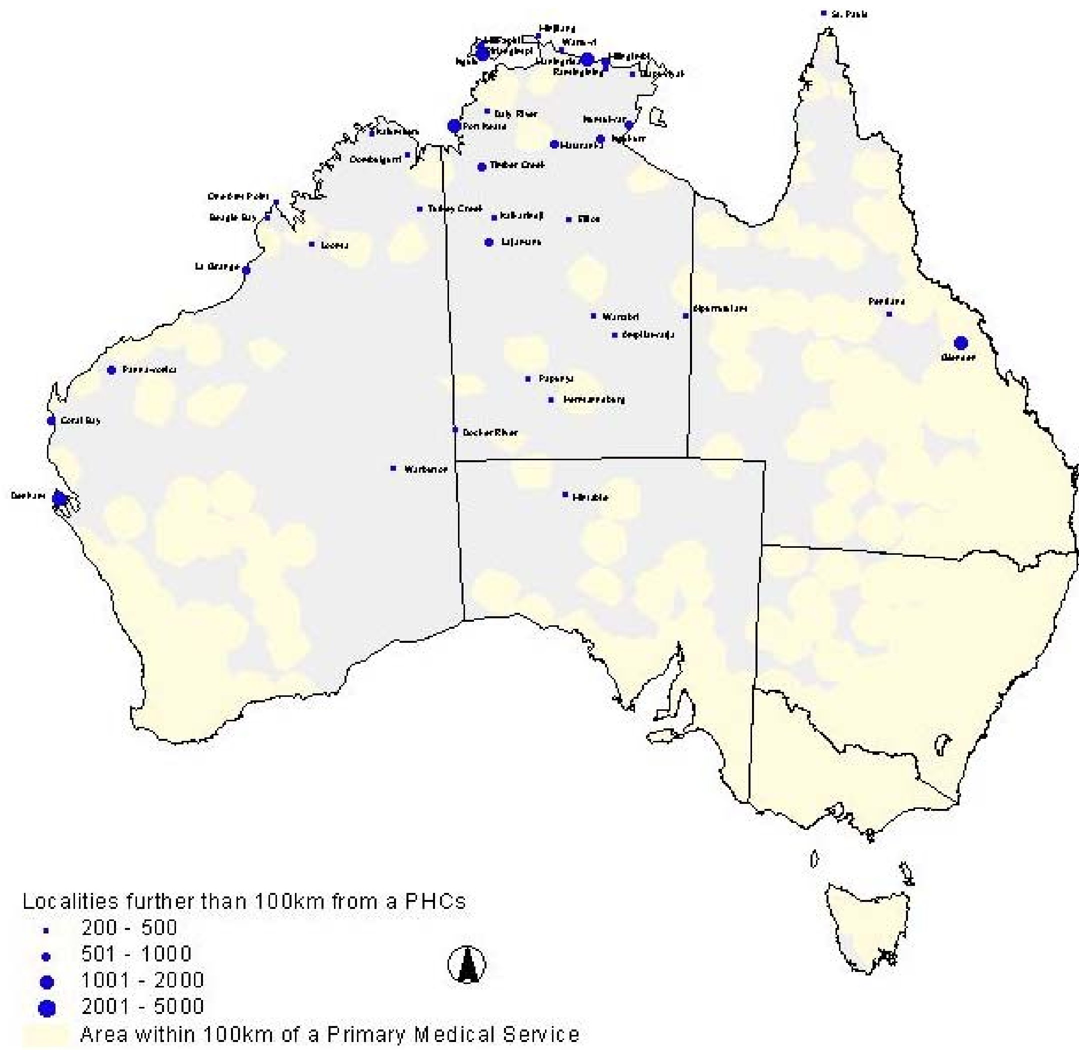
Figure 1: Primary Health Care services in Australia



Data Sources : Health Service Data provided by the Commonwealth Department of Health and Aged Care, August 1999.

0 200 400 600 800 1000 Kilometers

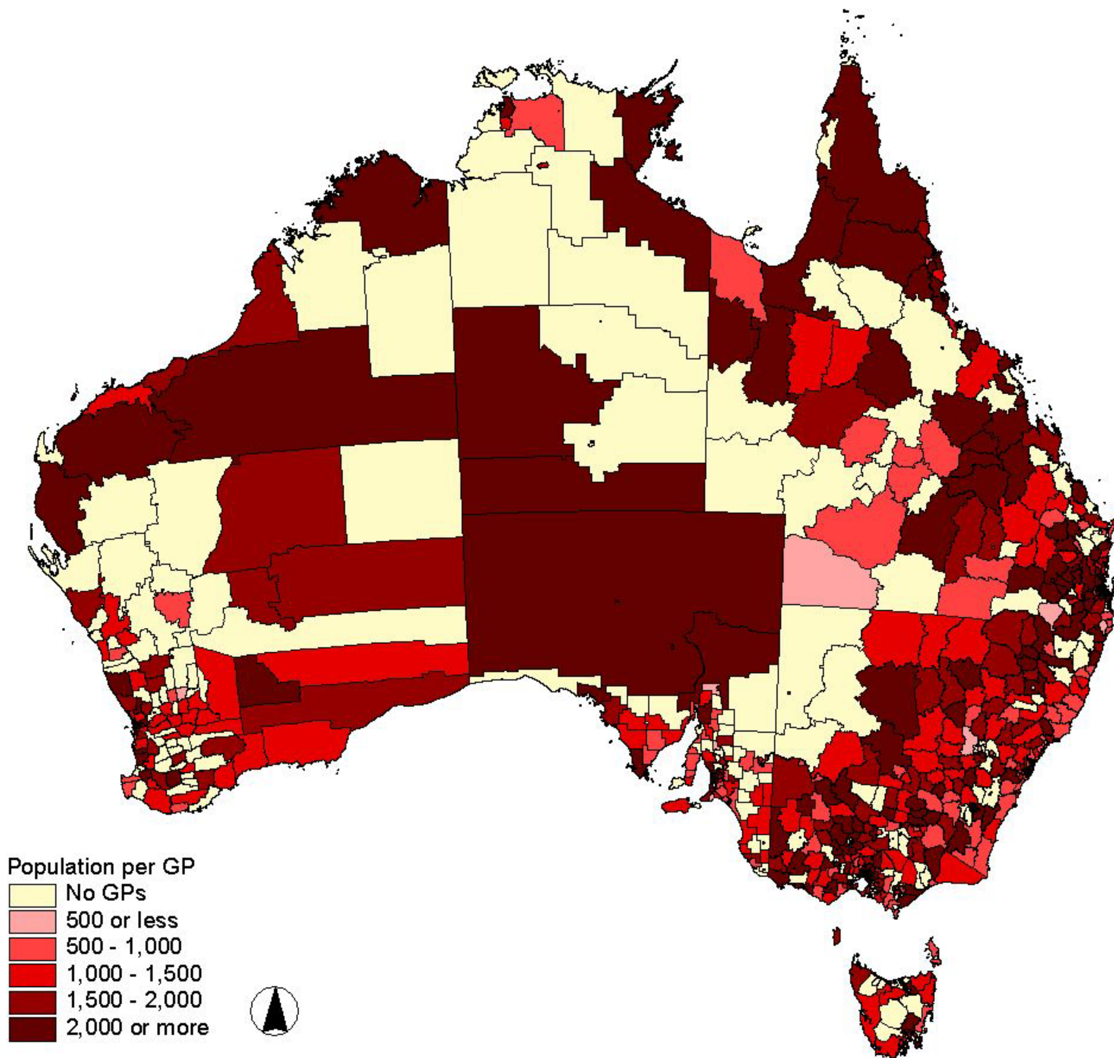
Figure 2: 100km buffer zones around Primary Health Care services, with populated localities of population greater than 200 beyond those zones.



Data Sources : Health Service Data provided by the Commonwealth Department of Health and Aged Care, August 1999.
Population Data from ABS CensusView96

0 200 400 600 800 1000 Kilometers

Figure 3: Population per GP by Statistical Local Area



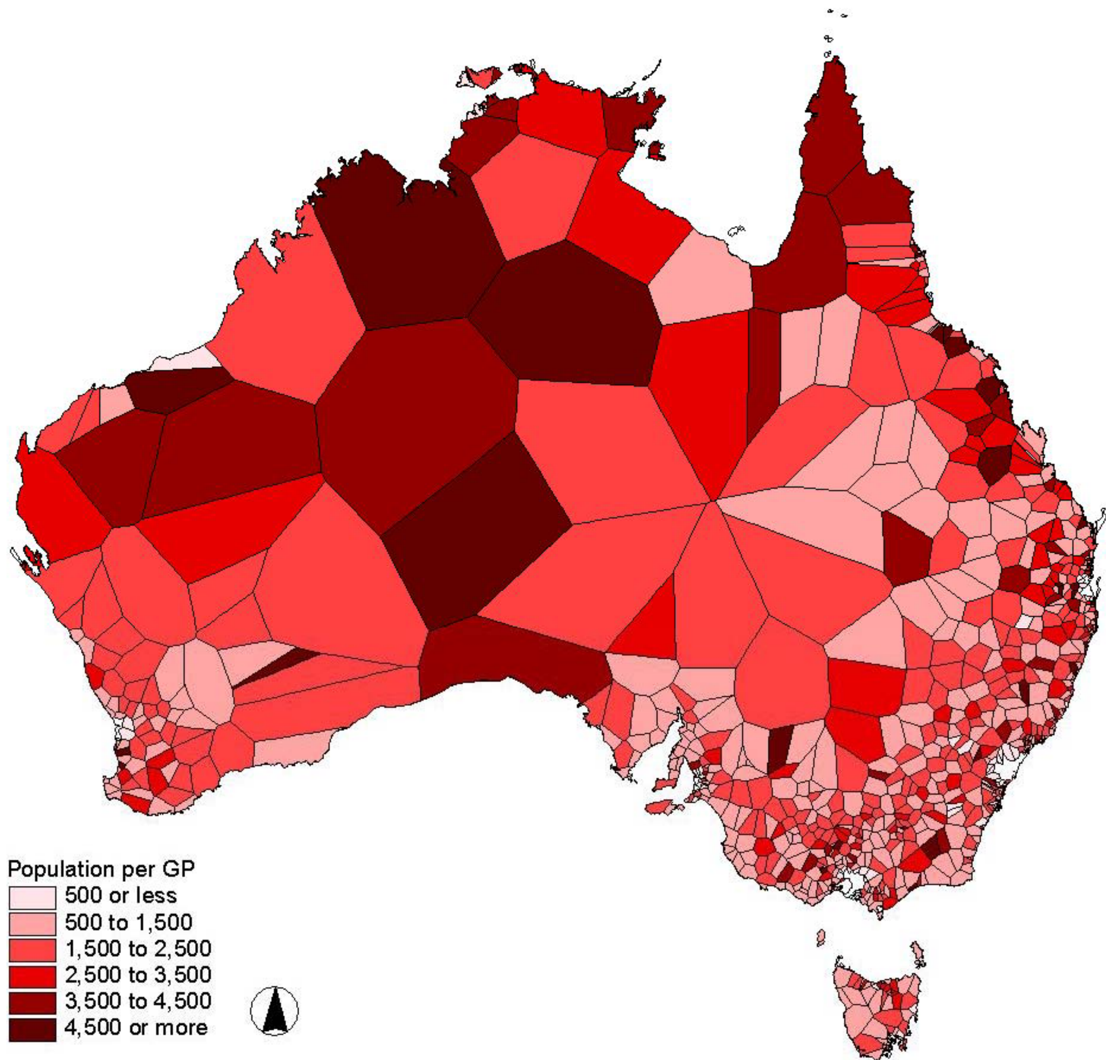
Data Sources :

GP data provided by the Commonwealth Department of Health and Aged Care, August 1999.

Population data from ABS 1996 Census of Population and Housing

0 200 400 600 800 1000 Kilometers

Figure 4: Population per GP by Catchment Area



Data Sources :

GP data provided by the Commonwealth Department of Health and Aged Care, August 1999.

Population data from ABS 1996 Census of Population and Housing

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