



Using Geographical Information Systems (GIS) To Establish Access To Aged Care Residential Services In Non-Metropolitan Australia

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INTRODUCTION

In the second half of the 1990s there is compelling evidence that Australia like other OECD nations has experienced a 'hollowing out' of the middle classes and growth of high income, and especially low income, groups so that there has been an increase in inequality and a widening of the gap between well-off and not so well-off Australians (Badcock 1997a and b; Gregory 1993 and Gregory and Hunter 1995a and b). This trend is one of the most disturbing in contemporary Australia and there are fears of the gap widening because of inequalities among groups in access to basic services like education and health between parts of Australia. In addition, the late 1990s has seen an increasing concern with locational disadvantage - that people's welfare may be suffering purely because they live in particular parts of the country. In particular, attention is being paid to people living in non-metropolitan Australia and the problems that many residents in these areas face in gaining access to services.

The present paper's focus is upon such inequalities among a particular sub group with respect to access to a specific type of health care and its aim is to demonstrate how contemporary developments in the methodology and technology of Geographical Information Systems (GIS) have enhanced our capacity to identify groups and areas which are disadvantaged in relation to their access to such important and fundamental services. In planning the provision of health care services a common problem is the provision of specific service through a number of geographically fixed outlets to a subgroup in the population whose spatial distribution is in a constant state of change. We consider that GIS offers a highly useful methodology to establish the degree to which current services meet the needs of the groups in need and indicate where new services will need to be established and existing services can be reduced in size or closed down.

The paper shows how GIS can be utilised to identify elderly people and areas that are disadvantaged in their access to residential care in non-metropolitan South Australia. It is argued that GIS can assist in targeting programs designed to ameliorate this disadvantage and to monitor and assess the impact of those programs targeted at the aged.



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PROVISION OF RESIDENTIAL CARE SERVICES FOR THE ELDERLY

The elderly is one of the fastest growing segments in the Australian population. Table 1 demonstrates this indicating that the Australian population aged 65 and over has increased by 50.5 per cent between the 1981 and 1996 censuses compared with 22.7 among the total population. Moreover their share of the population in need from 9.8 per cent to 12.0 per cent. The rapid growth of the older population is of great significance in the health and welfare area since there is an expanding increase in per capita use of such services as the older ages are reached (AIHW, 1995). In the present study we are taking one important service - the provision of institutional residential care through:

- (a) High Care Nursing Home Facilities.
- (b) Lower Level Care Hostels.

TABLE 1: Australia: Actual and Projected Change in the Older Population, 1981-1996, 2001-2031

Age Group	Number (in thousands)							Per Cent Change		
	1981*	1986*	1991*	1996*	2001	2011	2031	1981-1996*	1996-2001	2011-2031
55-64	1326.2	1435.4	1419.8	1483.8	1809.3	2543.1	2934.6	+11.9	+2.19	+15.4
65-74	919.1	1020.9	1153.0	1258.2	1282.8	1619.8	2567.9	+36.9	+2.0	+58.5
75-84	409.0	499.0	602.0	693.4	821.2	906.3	1688.7	+69.5	+18.4	+86.3
85+	101.2	126.7	152.1	199.3	255.3	363.2	587.3	+96.9	+28.1	+61.7
Total 65+	1429.3	1646.7	1907.2	2150.9	2359.3	2889.3	4843.9	+50.5	+9.7	+67.6
Total Persons	14576.3	15602.2	16847.3	17892.4	19169.5	20952.4	23874.0	+22.7	+7.2	+13.9

Source: ABS Censuses, 1981, 1986 and 1996; ABS, 1994, Projections Series A and B

* Census Count Population.

Since the early 1980s the Federal Government has adopted a policy of introducing policies and programs to keep the elderly in their own homes as long as possible through its provision of a range of Home and Community Care (HACC) services and subsidies. This has been very effective in bringing down rates of institutionalisation of the elderly. Despite this 'At Home Rather Than In A Home' strategy, the fact remains that at a certain inevitable stage loss of physical and mental capacity means that older people can not lead independent lives and need some form of institutional help and the cost of provision of such help is very substantial.

Much of the policy attention is focussed on the elderly living in metropolitan Australia. However, Table 2 indicates that 36.9 percent of the nation's 65+ population live outside cities of 100,000 residents or more. It is noticeable that this population increased between 1991 and 1996. This reflects the increasing pattern of younger retirees settling in non-metropolitan, usually coastal resort, areas. However, it will be noted that among the older old, the population living in



large cities is greater reflecting the fact that many non-metropolitan aged persons are forced to move because of lack of adequate local aged care services.

TABLE 2: Australia: Population Aged 65+ and 75+ by Section of State, 1991 and 1996

Section of State	1991				1996			
	65+		75+		65+		75+	
	No	%	No	%	No	%	No	%
Major urban	1 219 477	63.9	493 557	65.4	1 357 519	63.1	580 995	65.1
Other urban	477 471	25.0	190 654	25.3	559 501	26.0	234 077	26.2
Bounded locality	59 454	3.1	21 777	2.9	60 978	2.8	23 389	2.6
Rural Balance	150 114	7.9	48 014	6.4	172 109	8.0	53 970	6.0
Migratory	640	0.0	174	0.0	814	0.0	294	0.0
Total	1 907 156	100.0	754 176	100.0	2 150 921	100.0	892 725	100.0

Source: ABS 1991 and 1996 Censuses

It is not often recognised that the quality of life of elderly people can be enhanced if their inevitable institutionalisation takes place in a nursing home or hostel in the area in which they have lived independently. To many old people the local community is of greater significance than it is for younger counterparts. This is due to the fact that their mobility is often lower than the rest of the population so that their local social networks are paramount in their social well being. The local community not only contains the bulk of their friends and acquaintances with whom they can still interact in the institution but it has a lot of memories and connotations important to them. Hence institutionalising people in their local area can be an important element in maintaining the well being of the older person. We consider that the spatial matching of consumer with demand is an overlooked and important consideration in looking at residential care planning.

Persons living in rural and remote communities were one of the key special needs groups identified under the Aged Care Reform Strategy, a program of changes implemented from the mid 1980s whose major objective was the reformation of home-based and residential care. This mentions that one of the strategies adopted to address provision of services in these areas was the development of 'multi-purpose centres' which were designed to 'provide a range of state and federal government services from the one agency or outlet' (Gibson, 1998, 44). However, in 1997-98, 75.8 per cent of nursing home places and 68.6 per cent of hostel places were provided in capital cities. A further 22.5 and 29.8 per cent respectively were provided in rural areas, with the remainder provided in remote areas. For South Australia, the corresponding figures were 85.7, 14.3 and 0.0 for nursing homes and 75.8, 23.9 and 0.2 per cent for hostels (Productivity Commission, 1999: 732-733). It is clear that there is a significant



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bias in the distribution of nursing home and hostel places toward metropolitan areas, since 60.0 per cent of the 65+ and 61.8 per cent of the 75+ population lived in capital cities.

The present study takes South Australia as a case study and uses GIS to investigate variations in the degree of accessibility which older people living outside the capital city have to aged care institutional facilities. It does not examine access to home-based aged care facilities.

METHODOLOGY: DETERMINATION OF ACCESSIBILITY

Two different measures of accessibility were employed in the analysis. These were the calculation of distance to the nearest facility, and the determination of population catchments within specified distances from each facility. The first is the simpler measure, and is an indicator of remoteness from facilities. It does not take into account distribution or composition of population, and reflects merely the shortest distance one would have to travel along the road network before reaching a particular type of facility. Despite these limitations, when interpolated as a surface the measure acts as a powerful visual representation of spatial accessibility to residential care facilities. The second measure is more complicated, and approaches the issue of accessibility from a different perspective. Rather than asking the question, 'what is the shortest distance from each locality to the nearest facility?', it asks 'how many localities can be reached within x km of each facility?' Having determined the extent of the road network that is within x km of each facility, population-based measures of accessibility can be calculated. The following section outlines the process used to generate each measure of accessibility and briefly discusses some early results.

DISTANCE TO THE NEAREST FACILITY

The first measure of accessibility, calculation of the shortest distance along the road network to the nearest facility, borrowed in part from the construction of the Accessibility/Remoteness Index for Australia (ARIA). In order to construct ARIA, a distance matrix was generated that contained the shortest distance from every populated locality in Australia to every populated centre with a population greater than 5,000 people that was within 4,000 km of the locality. The distance was calculated via a road network coverage obtained from the Australian Surveying and Land Information Group (AUSLIG).

In order to perform the shortest distance to the nearest facility calculation, a list of South Australian residential care facilities was obtained from the Commonwealth Department of Health and Aged Care. While many of the facilities were located in centres of over 5,000 people (and so were included in the initial calculation of the ARIA distance matrix), a significant number were situated in smaller centres. For these smaller centres that were initially omitted from the calculation of the distance matrix, the distance to each populated locality in South Australia was determined and appended to the matrix. Interstate



facilities in populated centres located just outside the South Australian border were also included in the analysis so that allowance could be made for South Australians choosing to cross the border in search of a residential care facility.

The completed distance matrix contained the shortest distance via the road network between each South Australian populated locality and each populated centre with a residential care facility. As the spatial distribution of low (hostel) and high care (nursing home) facilities differs quite significantly in South Australia, the facilities list was separated into two lists relating to low and high care respectively. The shortest distance from each locality to the nearest facility of each type was then determined by extracting from the distance matrix the minimum distance between each populated locality and any populated centre containing a facility of that type.

Each South Australian populated locality was thus assigned a distance to the nearest high care facility (nursing home) and the nearest low care facility (hostel), and the results plotted on separate maps. An accessibility surface was generated in Arcview based on interpolation of the distance values at each point location for each facility type.

Analysis of the interpolated surfaces showed that distance to the nearest facility of both types was generally greatest in those areas classified as most remote by ARIA. There was also a fair deal of variation between the maps relating to high and low care facilities; this variation is entirely attributable to differences in the spatial distribution of the two types of facilities.

DETERMINATION OF POPULATION CATCHMENTS

The second stage of the accessibility analysis, identification of service catchment areas and adequacy of service provision levels, employed a different methodology to that used in the first stage. The location of South Australian residential care facilities (in addition to a small number of interstate facilities situated just outside the South Australian border) were plotted against the AUSLIG road network using *ARCVIEW 3.0B*. Using the *Network Analyst* extension, a network analysis procedure was performed in which the extent of the road network within 100 km and 200 km road distance of each residential care facility (termed a *service network*) was determined. Service catchment areas were then generated on the basis of the outer boundary of each 100km and 200km service network.

In many instances, and particularly on the fringe of the metropolitan area and large urban centres, the service catchment areas for residential care facilities located close to one another overlapped. Where this occurred, the boundaries between overlapping catchments were dissolved. Four maps were thus generated, representing 100 km and 200 km catchment areas for low and high care facilities. The maps revealed that on the whole, a significant segment of South Australia, incorporating an area stretching from Mount Gambier in the state's far south-east to the eastern border of the Eyre Peninsula in the west, is within 200km of a residential care facility, whether it be a high or low care facility.



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However, there was some variation within the general pattern in that the distribution of high care facilities was much more concentrated than for low care facilities, and hence service catchments were more contracted. The majority of the far northern and western areas in the state were, in contrast, generally situated further than 200 km from any type of facility.

The aim of the next step was to determine the number of residential care beds and the number of persons aged seventy years and over (the target population for residential care facilities) contained within each catchment area. Ascertaining the number of beds within each area was a relatively simple task as this information was an already-existing attribute attached to the facility location data. Facilities were selected if they were located within each respective catchment area, and the total number of beds were summed.

In contrast, quantification of the number of the target population within each catchment area proved to be difficult, as small-area population data is only provided by the ABS (Australian Bureau of Statistics) for localities with over 200 persons or by CD (Collector's District) in rural areas. Neither of these measures alone is sufficient to determine the population contained within service catchments, as firstly, there are many localities with less than 200 persons in rural areas and secondly, service catchment boundaries often completely bisect the large CD areas.

The ultimate approach adopted (after overlaying the CD boundaries with the catchment areas) was to sum the populations of each whole CD contained within each catchment area. For each CD that was not contained fully within the catchment but instead intersected its boundary, the following procedure was followed: initially, the population of any centre with over 200 persons that fell both within the CD and the catchment area was subtracted from the population of that CD. Following Rudd and Nicolson (1997), a population density (persons per sq. km) was calculated on the basis of the remaining CD population and the total CD area (thus the remaining CD population was treated as though it were evenly distributed throughout the CD). The percentage of the area of the CD that also contained the service catchment was determined. This percentage was then applied to the population density figure in order to estimate the number of the population not living in centres of over 200 people that was contained within the service catchment. This number was then added back to the population of the centres containing 200+ people within the catchment to obtain the final population estimate.

Having obtained figures for both the population aged seventy and over and bed numbers for each service catchment, a service provision ratio was calculated by dividing the number of beds by the target population and multiplying by 1,000. This ratio was compared with the stated government service provision targets of 40 high care (nursing home) beds and 50 low care (hostel) beds per 1,000 persons aged 70 years and over.

Early results indicated that people aged 70 years and over living within the catchment areas possessed just adequate, if slightly low, levels of service provision in comparison with policy targets. High care service provision was



worse in this regard than low care service provision, showing a significant under-provision in some areas. Further, extensive areas of the State were effectively not within easy reach of a residential care facility. Although numbers of persons aged 70 and over in these areas are low in comparison with metropolitan areas, there remains a significant minority of people affected.

An interesting question, although beyond the scope of the current paper, is the existence and direction of possible causal links between accessibility to residential care facilities in rural and remote areas and elderly migration. It is probable that a significant reason for the low population counts of the elderly living within these areas relates to their inability to access local facilities.

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