2 Methods

Measurement of socioeconomic status

Although the socioeconomic status of individuals and of population groups is accepted as a risk factor for ill health, the major Australian data collections of health status and use of health and welfare services do not include use of any direct measure of socioeconomic status. Measures used include education levels, occupation and occupational status, or income.

In the absence of a direct measure of socioeconomic status in the health datasets, the socioeconomic characteristics of the area of residence of the population can be used as a proxy measure. In this atlas, the health status and health service utilisation data are compared *at the small area level* with the measures of socioeconomic status (either through a comparison of the maps, or by reference to the correlation analysis). The socioeconomic status of the area becomes the proxy measure of socioeconomic status for the population of the area.

There are a number of deficiencies associated with this approach. These include that:

- the data for an area represent the average of the characteristics or events (deaths, hospital admissions) for the population of the area: as the population of many of the areas for which data are available is quite large, this can conceal the existence of areas with higher or lower rates;
- there is considerable movement of the population between areas over time, potentially weakening the value of the data for small area analysis: see comments under Major limitations, Usual residence, page 19;
- the use of the socioeconomic status of an area (as measured by the characteristics of the population of the area) can hide the existence of any 'area' or 'locality' effect in the data: that is, where aspects of the location itself are impacting on health, whether through structural factors (such as lack of transport) or environmental factors (such as poor air quality), such that the area itself can be considered a risk factor.

Selection of indicators

The variables used as indicators within broader topics have been chosen because they can be used to illustrate patterns of socioeconomic status, health status and utilisation of health services at a small area level. The indicators of socioeconomic status represent a broad cross-section of data variables that are generally used to illustrate socioeconomic disadvantage. Indicators of health status that can be reproduced at a small area level are to some extent limited by the lack of available measures. Deaths, perinatal risk factors (including low birthweight babies) and child abuse and neglect are the indicators that are available and have been used in the atlas. The choice of indicators to describe patterns of use of health and welfare services at the small area level is limited to hospital episodes, FAYS clients, immunisation status of one year old children, use of community health/ community mental health services and services provided by general medical practitioners.

Data presentation

In maps

Two maps are shown for most variables in the atlas. The first is a map at the postcode or Statistical Local Area (SLA) level for Adelaide, represented by the Adelaide Statistical Division. The SLA is described under the heading of Area mapped/Boundary issues.

The second map is of the whole of the State, by SLA or Country Health Region, but with Adelaide mapped as one area. This enables comparisons to be made of the percentages, ratios, etc. in Adelaide with those in the non-metropolitan areas. Populations living in urban centres can have different characteristics to those living in less settled areas, and frequently have different health status and exhibit different patterns of use of health services. Where it has been possible to identify urban centres with populations of 1,500 or more, they are shown on the whole of State map as circles. Unfortunately the town is not a distinct and identifiable unit within the structure of ASGC. Thus, only urban centres that are incorporated local government areas (and are therefore represented in the ABS classification as SLAs) can be identified in the datasets and separate details published for them. More details of the urban centres mapped and the process of their identification are on page 18, under the heading Urban centres identifiable in the South Australian data.

The majority of maps in this atlas reflect the distribution of the population for whom the particular event is recorded (eg. hospital episode,

death) by location of their 'usual residence', as coded from their address, in the various statistical data collections. The validity of this approach is discussed in more detail under the heading Major limitations, Usual residence, page 19. The maps in Chapter 3 reflect the distribution of the population by a mixture of address locations. The variables for single parent families, low income families, dwellings rented from the South Australian Housing Trust and dwellings without a motor vehicle are mapped to the address of usual residence of the population who were 'at home' on Census night. This is because the data for these variables are only available for people recorded in the Census at their usual address. The remaining variables in Chapter 3 reflect the population counted on Census night and include visitors, people in hospitals and gaols, etc; and exclude usual residents who were absent from the dwelling on that night.

By remoteness

There have been increasing concerns over a number of years about the difficulties faced by Australians living in rural and remote areas of Australia in accessing services that most Australians take for granted. A parallel concern has been the extent to which the health of people living in these areas is poorer than that of those living in areas with greater accessibility to health, welfare and other services. Government in particular has been interested in finding out more about the circumstances and needs of these populations, and in targeting assistance accordingly (DHAC 1999).

This led the (then) Department of Health and Aged Care (DHAC) to sponsor a project to obtain a standard classification and index of remoteness which would allow the comparison of information about populations based on their access, by road, to service centres (towns) of various sizes. Note that although by specifying towns of various sizes the index implicitly takes account of the education, health, welfare, etc. services likely to be located in towns of those sizes, there is no explicit use in the development of the index of what services should exist. That is, distance is the sole measure of access. The outcome of that project was the Accessibility/ Remoteness Index of Australia (ARIA) (DHAC 1999), based on a methodology developed by the National Centre for Social Applications in GIS (GISCA).

More recently, the Australian Bureau of Statistics (ABS) addressed the concept of remoteness, with a view to including it in its classification of areas. The ABS work, also undertaken with GISCA, used ARIA as the underlying methodology for the determination of remoteness.

The new classification, described by the ABS as a 'Remoteness Structure', is referred to as ARIA+ (ie. ARIA plus, ABS 2001), and is an update and refinement of the original ARIA.

ARIA+ measures access in terms of remoteness along a road network from 11,914 populated localities to five categories of service centres (service centres with more than 250,000 persons; with 48,000 to 249,999 persons; with 18,000 to 47,999 persons; with 5,000 to 17,999 persons; and with 1,000 to 4,999 persons). An adjustment is made for localities situated on islands (including Tasmania).

For each locality, the distance to each of the five categories of service centre is converted to a ratio to the mean. To remove the effect of extreme values, a threshold of three is applied to each component and then the five component index values are summed. This produces a continuous variable with values between 0 (high accessibility) and 15 (high remoteness). Index values for an expanded locality and point database of 42,648 localities are then interpolated to produce an index value for 1km grids and averages calculated for larger areas such as postcodes or SLAs.

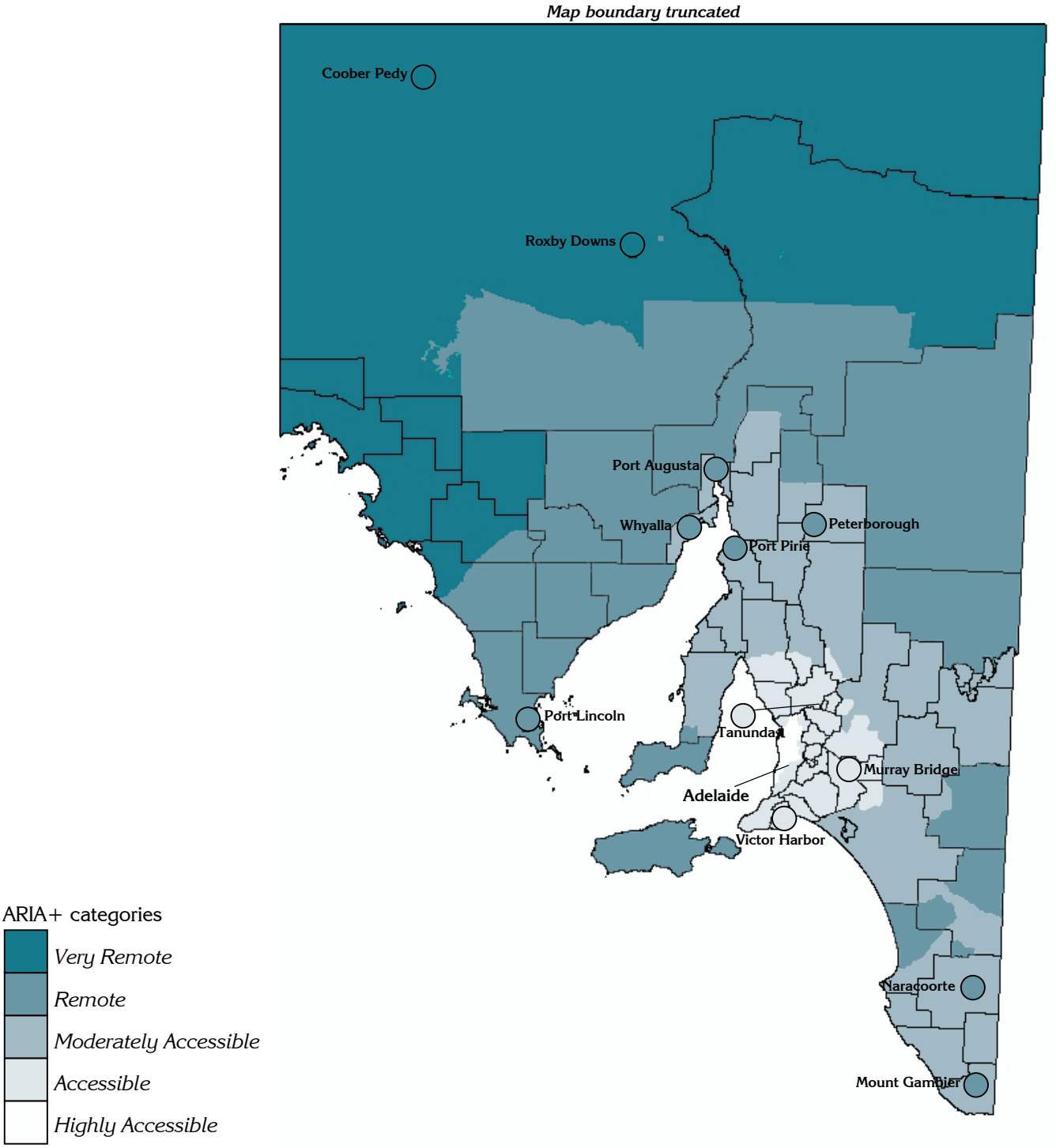
A continuous index is ideally suited to some forms of research; however many other uses require discrete categories. To meet these other uses, the ARIA index values have been grouped into five categories: Very Accessible, Accessible, Moderately Accessible, Remote, Very Remote. The categories were chosen on the basis of natural breaks in the data, balance across categories and broad comparability with the earlier RRMA classification.

Map 2.1 shows the ARIA+ Index for each SLA in South Australia.

The ARIA+ index for each SLA in non-metropolitan South Australia is shown in Appendix 1.2 (SLAs in Adelaide all have an ARIA Index of 1). For each variable in the atlas, details were calculated of the average percentage, ratio etc. for each of the five ARIA categories described above. For example, for children living in single parent families, the average percentage of all such families in SLAs in category 1 (Very Accessible) was calculated and shown in a graph beneath the whole of State map, together with the average percentage in each of the other four categories. The ARIA index thereby provides a summary measure of the characteristics of the population, for each of the variables mapped, categorised by accessibility to the largest populated centres.

Map 2.1
Accessibility/Remoteness Index of Australia (ARIA+), for SLAs in South Australia, 1996

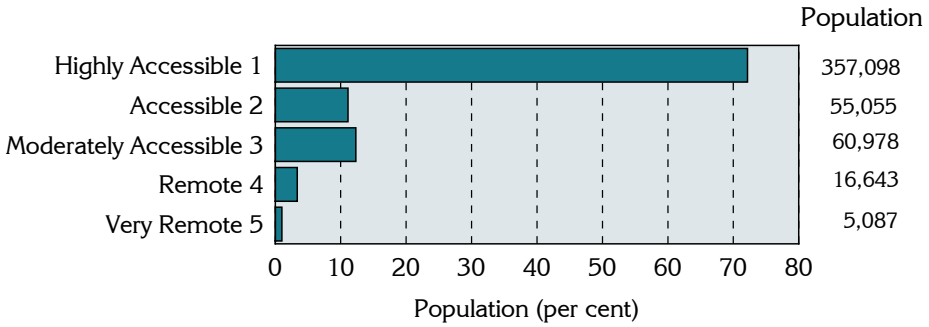
ARIA Index in each Statistical Local Area



Source: Map provided by The National Centre for Social Applications of GIS, University of Adelaide, using the Accessibility/Remoteness Index of Australia as described in *Department of Health and Aged Care*, Occasional Paper Series No. 6, Revised Edition.

Figure 2.1 shows the distribution of the population across Australia by ARIA+. The population used here is the Estimated Resident Population by Statistical Local Area (SLA) at 30 June 1999. Almost three quarters (72.2%) of South Australia's children and young people live in areas classed as Highly Accessible, 11.1% live in areas in the Accessible class, 12.3% in Moderately Accessible, 3.4% in Remote and 1.0% in Very Remote.

Figure 2.1: Population aged 0 to 24 years by ARIA+, Australia, 1999



Source: Calculated on Estimated Resident Population, June 1999, ABS Cat. No. 3235.0 (ABS 2000), using a concordance supplied by ABS

By socioeconomic disadvantage of area

As well as presenting the data in maps and by the ARIA+ remoteness classification, the data have also been grouped into quintiles of approximately equal population, based on the Index of Relative Socio-Economic Disadvantage (IRSD) score for the SLA as calculated from data collected at the 1996 Population Census[1]. Quintile 1 comprises the SLAs with the highest IRSD scores (highest socioeconomic status, or most advantaged, areas) and Quintile 5 comprises the SLAs with the lowest IRSD scores (lowest socioeconomic status, or most disadvantaged, areas). Each quintile comprises approximately 20% of the total population in the areas under analysis (eg. Adelaide or non-metropolitan South Australia). Once grouped in this way, the analysis has been repeated to calculate the various rates, ratios, percentages to show variations between the populations in each of the quintiles. Data grouped in this way are presented in Chapter 7.

The data

General issues

Data describing the characteristics of the population mapped in Chapter 3, *Demography and socioeconomic status* are largely from the 1996 Census of Population and Housing and 1998 Estimated Resident Population (ERP) data.

The data mapped in other chapters are recorded for a range of periods: for deaths and child abuse and neglect, it is for the four years from 1996 to 1999; for perinatal risk factors and low birthweight babies it is for the three years from 1995 to 1997; for hospital admissions, it is for the three years from 1996/7 to 1998/9; for general medical practitioner services, it is 1998; for Family and Youth Services it is for 1999; for use of community health and community mental health services, it is for the three years from 1997 to 1999; and 2001, for immunisation status. In a number of instances, data for a number of years have been combined to increase the number of cases available for the analysis. This gives the rates and ratios produced from the analysis greater statistical power at the small area level.

However, the lack of data for a common period introduces a problem with the choice of boundaries to use in mapping the various topics, as boundaries also change over time, and comparability is lost. For example, if three new SLAs are formed out of two existing SLAs, then the earlier data (for the two SLAs) are only comparable with the aggregate of the three new areas. Obviously, the availability of a common set of boundaries over time would assist in making the datasets comparable, but this is not always possible. The deaths' data, covering the four years from 1996 to 1999, have been coded using a number of versions of the ASGC and have be aggregated in such a way as to be comparable with data coded to 1996 boundaries (Census data). Similarly, the 1996/97 to 1998/99 hospital admissions' data are coded to the 1996 classification and can also be generally compared with the deaths' data and the 1996 Census data.

[1] The IRSD is one of five Socio-Economic Indexes for Areas (SEIFA) produced by the Australian Bureau of Statistics from data collected in the 1996 Census. Further details of the construction of this index are in the Glossary.

The way in which boundary changes in South Australia have been addressed in this atlas is discussed in more detail below, under the heading of *Area mapped/Boundary issues*.

Data quality

Postcode areas

The main issues with regard to data quality arise from the lack of a generally accepted Australian standard for the classification of spatial data, in particular, spatial data for small areas.

A majority of data collections conducted by agencies other than the ABS use the postcode area as the spatial unit for their data. The postcode is, in most instances, a cost-effective indicator of the geographical location of a person's usual residence, as it is universally included as part of the address of usual residence in administrative and statistical data collections. It is, in effect, self-coded, unlike the SLA code which is determined either manually or electronically by examining the address. Another advantage of the postcode include that, in Adelaide, it is a generally smaller unit than the SLA and can therefore be used to describe smaller and more homogeneous population groupings. Its disadvantages include that it is the postcode of a person's postal address, not necessarily the postcode of their usual residence. This is only a problem to the extent to which the population of an area has a postal address which is different from their usual residence address. This is likely to be of greater concern in urban fringe and country areas, and appears to affect some data for postcode areas to the east of the city in the Adelaide Hills, around *Summertown*, *Carey Gully* and *Basket Range*. In addition, some CDs in this area are very large (relative to the postcodes) resulting in a higher level of misallocation of population under the method used by the ABS (described below).

The postcode used in this atlas is that available from the particular statistical collection. For the Census data it is not the actual postcode, but a postal area, derived by allocating whole Census Collection Districts to approximate postcodes. For all other data, it is the postcode reported in the records of the particular statistical collection. The use of the postal area as the denominator (ie. population data) when calculating percentages or rates, and the postcode area for the numerator (eg. dependent children, immunisation) can results in there being more people with the characteristic than there are people in the denominator population. It is likely that a mismatch in definition of the areas is the cause for this difference.

The postcodes in metropolitan Adelaide for which data have not been mapped are:

- *Parafield Airport* (5106), *Adelaide Airport* and *GPO Private Boxes* (5001) and *Export Park Private Boxes* (5950), which do not have residents;
- postcode areas with a population of less than 100 persons;
- postcode areas which lie across the Adelaide boundary, but which are predominantly (based on population counts) outside Adelaide; and,
- for data variables describing personal characteristics, *Adelaide* and *North Adelaide* (postcode 5000 and 5006), as there are generally more people recorded in these postcodes on Census night than are usual residents (in part because of the predominance of hotels and the inclusion of patients in a number of public and private hospitals and inmates of the remand centre). For data variables describing family and dwelling characteristics, the postcode data have been mapped, as these characteristics are only provided from the Census for usual residents. The family and dwelling data is, in effect, usual resident data.

A list of postcodes excluded under these various categories is included in **Appendix 1.2**.

In the non-metropolitan areas of the State, SLAs rather than postcodes were mapped, as the postcode boundaries reflect the postal areas, which are not necessarily the areas where people who use those postcodes live. When mapped, the geographic areas they delineate are not always useful, as some pick up separate small communities along a main road – a mail run.

Analysis and presentation

Measures mapped

Most measures were produced using age-sex standardisation. The major exceptions are the measures mapped in Chapter 3, which are generally percentages. Where this is not so, the text describes the basis of calculation of the measure.

Where it was considered that variations in the age and/or sex distribution of the population for any variable could affect the analysis, the data have been standardised. Standardisation, which largely removes variations in rates between areas where such variations arise solely as a result of age and/or sex structure (see Appendix 1.3 for more details),

was applied to the majority of the variables describing the health status and the utilisation of health services.

By mapping the data as percentages, rates or ratios, the distribution of the population or event, and variations in that distribution, can be easily seen across the areas mapped. These variations are important in highlighting areas of, for example, high service use, high death rates or low provision of services. However, in using the data, it is important to recognise that while the same percentage or standardised ratio value may apply in two areas, the areas may differ greatly in population size, which may have implications for health service delivery or program planning. For example, an area with a highly elevated rate of hospitalisation and a relatively small population may be of lesser concern than an area with a moderately high rate of hospitalisation and a very large population, because of the larger number of people affected. As it has not been possible at the scale of these atlases to show on the map both relative values (percentages, rates and ratios) and absolute values (number of people, events etc.), users should bear this caution in mind and refer to the absolute values listed in the associated tables. This aspect is discussed in more detail under the heading *Reading the maps*, below.

Area mapped/Boundary issues

The majority of data are mapped at the postcode level for Adelaide and the SLA[2] level for non-metropolitan areas. However, because of the relatively small number of deaths, the spatial unit used for Adelaide in mapping deaths data is the SLA and for non-metropolitan areas is the Health Region.

The SLA is, in a majority of cases, based on (and equal to) local government areas. This gives rise to a number of concerns, including the wide variability in size (both of area and population) and the lack of control that the ABS has over changes in these boundaries.

Area name changes

The boundaries of some SLAs have changed extensively over the periods for which the data have been collected and coded. In some cases this can be handled by the amalgamation of two or more areas, thus enabling comparisons to be made. For example, boundary changes to the SLAs of Central Yorke Peninsula and Minlaton in 1998 meant that, to be comparable, the population data need to be analysed for the combined area.

In other cases, boundary changes were such that combining areas was not a satisfactory option, because the combinations necessary were so extensive as to reduce the value of the correlation analysis, or of other comparisons of the data. Where this occurred, the 1998 population data were re-coded to the SLA boundaries in existence in 1996. In this way, the correlation analysis could be undertaken on a set of boundaries common to all the datasets.

Urban centres identifiable in the South Australian data

Just as the demographic characteristics and health profiles of Australians vary between residents of the major cities and non-metropolitan areas, they also vary within the non-metropolitan areas between residents of the urban centres and those living in more rural and remote locations. SLAs have deficiencies as a spatial unit to describe urban centres outside of the capital cities and other major urban centres. For example, of the 35 urban centres in South Australia with a population of 1,500 or more, only four can be identified in the SLA classification. That is, only four of these urban centres were also SLAs in their own right; the others formed only part of an SLA, with the SLA comprised of the urban centre (and possibly more than one urban centre) and other people living in smaller localities, as well as rural populations.

To increase the number and range of urban centres for which data could be published, a set of rules was established. These rules are discussed in detail in Appendix 1.2. Briefly, they allow for an urban centre with a population of 1,500 or more to be mapped where it comprised 80.0% or more of the SLA in which it was located. This resulted in 12 of the 35 urban centres in South Australia being mapped. Details of the urban centres mapped, as well as those not mapped, are in Appendix 1.2 (**Table A3**).

These urban centres (referred to as towns in the discussion of the maps and data in the atlas) are shown as circles on the maps. In cases where the area of the SLA is larger than the area of the circle, the underlying SLA can be seen on the map and both are mapped in the same shade. Where the location of the circle in its correct geographic position would have hidden details of another SLA, the circle has been located off the map, with a line

[2] In 1996, the SLA was generally equivalent to a local government area, with additional codes allocated to areas outside local government areas (eg. unincorporated areas in non-metropolitan South Australia) and to local government areas which have been split for statistical purposes (the only instance is Enfield, split into Part A (eastern) and Part B (western).

adjoining the circle and the correct geographic location.

Other supporting information

Wherever possible, the introductory notes to each topic provide background information to the topic (eg. hospital admissions) as well as the individual variables mapped (eg. hospital admissions for respiratory system diseases). This background information may include definitions, details of collection methods, references to other analyses relevant to the variable being mapped and details of the age distribution of the population represented in the data.

Major limitations

Data availability

Despite the generally high quality of health data in Australia, there are identifiable gaps and deficiencies, as documented by AIHW (1998): these include: *The quality of Indigenous health statistics*; *Data requirement for national health priority areas*; *Health Surveys*; *Public health information*; and *Health service outcomes and quality of health care*. Data for small area analysis are also deficient.

Details of data limitations, with an emphasis on small area data, are included in the introductions to Chapters 4 and 5. In addition to these collection specific limitations, three important overall limitations of the data for undertaking small area analysis are discussed below. These are the geographic areas to which small area data are classified, the measurement of socioeconomic status and data linkage.

Usual residence

The maps in this atlas reflect the distribution of the population (with various characteristics) by location of their 'usual residence'. For some people their current usual residence will have been the same for many years while, for many, it will be only a recent address: it is not possible to distinguish in the statistics between long and short term residents. *The analysis assumes, therefore, that the populations mapped in each area usually reside in those areas, or in other areas sharing similar characteristics.* This is a common assumption in analyses of this nature, and a reasonable assumption for the majority of the data analysed.

An analysis (Glover et al 2002) of data in the Western Australian Data Linkage System – where data are available of the number of admissions per individual, over time – showed that, four out of five people admitted to hospital more than once in a five year period had not moved (out of the Collection District of their address at the first admission) by the time of their second admission. For those who did move, while there was movement between areas right across the socioeconomic profile, most movement was to areas in adjacent quintiles of socioeconomic disadvantage of area.

Reading the maps

The atlas employs a choropleth mapping technique for all maps. Under this technique, areas (such as postcode areas or SLAs) are shaded according to the total value, percentage or rate for that area. As a consequence of this generalisation, variation within the area is concealed. The larger the areal unit, the greater the degree of generalisation, and for this reason the values shown on the maps for large postcodes or SLAs, in particular those which are sparsely and irregularly populated, must be treated with caution.

An alternative technique commonly used by geographers to combat this problem is to present data in proportional circles, with the size of the circle representing the absolute value of the variable and the fill representing the relative value.

This method was not used because it would have been difficult to achieve a satisfactory result given the map scales used in this atlas, and therefore the small size of many of the mapped areas.

The choropleth maps are based on data expressed as percentages of an appropriate denominator, or as indirectly standardised rates. For example, children living in single parent families are mapped as a percentage of all children and the unemployed as a percentage of the total labour force. It is, therefore, important to recognise that in a postcode or SLA with a small total population, a high percentage of a particular sub group will only represent a small absolute number, and that in a postcode or SLA with a large population it will represent a large absolute number. Similarly, a highly elevated standardised rate may relate to a large or small absolute number of cases. These comments are of particular relevance to the larger SLAs in the north of the State. The map commentaries draw attention to contrasts in relative values revealed in the maps, with occasional reference to the absolute values.

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