1 Introduction

Background

This atlas for Tasmania is one of a series. Separate atlases are available for each State and Territory, with a national overview atlas covering Australia as a whole.

Over the last few decades it has been increasingly recognised that health inequalities exist between socioeconomic groups in Australia, despite general improvements in the overall health of the population (AIHW 1998). People of low socioeconomic status (those who are relatively socially or economically disadvantaged) experience worse health than those of higher socioeconomic status for almost every major cause of mortality and morbidity. This trend has been reported in many countries around the world and has prompted the World Health Organisation (WHO) to initiate a campaign to encourage awareness, debate and action amongst policy makers on the social and economic determinants of health. As part of this campaign, the WHO has prepared a document entitled *The Solid Facts* which shows how research evidence on the broad determinants of health can inform new health policy interventions (Wilkinson & Marmot 1998). In particular, it demonstrates how this research information can be used to resolve health problems "upstream" and reduce the inequalities in health found within countries. The purpose of this atlas, now in its second edition, is to provide policy makers and communities in Australia with this type of resource. It provides detailed information on the distribution of socioeconomically disadvantaged groups in Australia and the links between socioeconomic disadvantage and health status.

Socioeconomic health inequalities have been repeatedly shown to exist in Australia. In 1988 the *Health for All Australians* report drew attention to these, among other, major inequalities in health status between population groups. Mathers (1994) found "overwhelming" inequalities in the health of Australians by all measures of socioeconomic status. Between 1994 and 1996 Mathers released a series of detailed analyses which comprised the first comprehensive examination of the relationship between socioeconomic status and health in Australia. These analyses showed that the most disadvantaged groups had the poorest health, made the most use of primary and secondary health services (with the exception of dentists) and made the least use of preventive services. He also noted that, despite their higher use of primary and secondary services, disadvantaged groups had fewer hospital episodes than their poorer reported health status would suggest appropriate.

A recent review of all published journal articles on health inequalities in Australia also found the evidence on the relationship between socioeconomic factors and health "unequivocal" (Turrell 1999). It found that people lower down the socioeconomic hierarchy experienced higher mortality rates for most major causes of disease, experienced more ill health and were less likely to use preventative health services or detect disease at the asymptomatic stage. These inequalities existed for both men and women, at all ages and irrespective of the measurement used to describe socioeconomic status.

The group in Australia with the poorest health is the Aboriginal and Torres Strait Islander population. In 1997 the Australian Institute of Health and Welfare reported that "the health of Aboriginal and Torres Strait Islander peoples is poor by any standard". Indigenous Australians, when compared to non-Indigenous Australians, have a decreased life expectancy, higher death rates for almost every specific cause of death, higher infant mortality rates and higher rates of hospitalisation (AIHW/ABS 1997).

Of concern in Australia is evidence that the gap between the rich and poor has been increasing over the last few decades (Hugo & Ambagtsheer 1998). This has been characterised by a growth in high income groups, and a larger growth in low income groups which is thought to be partly due to reduced access to services such as health and education (Hugo & Ambagtsheer 1998). Of similar concern is evidence that suggests that health inequalities in Australia may also be widening over time. Mathers (in press) compared death rates between 1985-87 and 1995-97 and showed that the most disadvantaged areas in Australia continue to have higher premature death rates than the most advantaged areas (**Table 5.2**). For some causes of death, the differences between these areas had increased over the decade.

Mathers calculated age standardised mortality rates for males and females in high, middle and low socioeconomic areas as indicated by the Index of Relative Socioeconomic Disadvantage (IRSD) (see page 17 for a discussion of this measure). Despite overall declines in mortality rates between 1985-87 and 1995-97 for the majority of conditions, the differentials observed in the earlier period were still evident a decade later (**Table 5.2**). For example, during 1995-97 infants and children living in the most disadvantaged areas still experienced the highest mortality rates for perinatal conditions, sudden infant death syndrome and for injury and poisoning. Similarly, adults aged 25 to 64 years residing in the most disadvantaged areas continued to experience the highest death rates for all causes of mortality and for specific causes such as respiratory disease, digestive system diseases, cardiovascular disease, stroke, motor vehicle traffic accidents and pneumonia/bronchitis.

For some conditions the difference in the rates of death between low and high socioeconomic groups increased over the decade (**Table 5.2**). For example, there was an increase in the rate of suicide in males aged from 15 to 64 years who lived in middle and low socioeconomic areas. There were also increased differences between low and high socioeconomic areas in the mortality rates of adults aged from 25 to 64 years for diabetes mellitus, lung cancer and asthma/emphysema. Further details of this major Australian study are contained in Chapter 5.

Glover and Woollacott (1992) documented evidence of health inequalities in Australia in the first edition of this atlas and this second edition has confirmed these. For example, correlation analysis undertaken at the small area level (Statistical Local Area, SLA) within the capital cities revealed a strong association between socioeconomic disadvantage and poor health status as measured by premature death. An example of the results of the correlation analysis for Hobart as reported in the first edition of the atlas can be seen in **Table 1.1**. The results show a clear gradient in the association between high rates of premature

deaths of males (deaths before 65 years of age), labour force status (employed, unemployed) and occupational prestige in the data from the first atlas (from mid to late 1980s). High rates of premature death for males are inversely correlated (-0.68) at the SLA level in Hobart with high proportions of males in high status occupations (managers and administrators, and professionals): that is, males from these occupations are less likely to die prematurely. In contrast, there is a positive correlation (0.88) between high rates of premature death and high proportions of low status workers (those in unskilled and semi-skilled occupations): that is, they are significantly more likely to die prematurely. The association is even stronger with high rates of unemployment, showing a correlation coefficient of 0.89. Although not shown in the table, the extent of association with youth unemployment was stronger again, with a correlation coefficient of 0.91.

Table 1.1: Correlation coefficients for small areas in Hobart

Population characteristics	**Deaths**		
1986 Census	**1985 to 1989**		
	Infants	**15 to 64 years**	
		Females	**Males**
Managers & administrators, & professionals	0.51	-0.63	-0.68
Unskilled and semi-skilled workers	-0.17	0.79	0.88
Unemployment	0.23	0.76	0.89
Female labour force participation	-0.03	-0.73	-0.84
Single parent families	0.13	0.32	0.68
1996 Census	**1992 to 1995**		
	Infants	**15 to 64 years**	
		Females	**Males**
Managers & administrators, & professionals	0.18	-0.63	-0.65
Unskilled and semi-skilled workers	-0.17	0.71	0.69
Unemployment	0.42	0.45	0.43
Female labour force participation	-0.12	-0.49	-0.49
Single parent families	0.60	0.27	0.31

Source: Calculated from project sources

For females, there are similar gradients with the population characteristics discussed above. High rates of premature death for females were inversely correlated (-0.73) at the small area level in Hobart with high rates of labour force participation by females. In contrast, high rates of premature deaths for females were correlated with unemployment (0.76) and high proportions of single parent families (0.32).

Although generally less marked, the differentials are still present in the data analysed for this second edition in which the analysis is repeated using data from the early to mid 1990s.

While evidence such as this demonstrates the importance of social and economic factors in determining the population's health, it does not establish the causal pathways. It is now generally thought that two groups of factors are responsible for the gradients in health seen around the world: structural/material factors and psychosocial factors.

Structural or material factors relate to a person's income and assets and therefore standard of living. People with a low standard of living have limited access to social and environmental resources while those with a high standard of living have much greater (and in some cases, unlimited) access. This leads to an uneven distribution of resources such as education, employment, housing, water supply, food, transport and health care services and facilities and this deprivation of material goods and services is thought to lead to ill health gradients (Benzeval et al. 1995). There is now evidence to suggest that a lack of these resources in early life (including poor nutrition *in utero*) may contribute to morbidity and premature mortality in adulthood (Barker 1994).

Other material factors relating to the quality of the physical environment also play a part in determining a population's health. For example, overseas researchers have demonstrated a relationship between the levels of several pollutants in the air and death rates or signs of sickness of resident populations (such as hospital admissions or use of medications for respiratory disease). Other studies have related an increase in signs of poor health with elevated levels of sulphur dioxide and total suspended particulates in the air (Dept. of the Environment, Sport and Territories 1996). Australian researchers have also confirmed the deleterious effects of lead as a pollutant on the neuropsychological development of young children through early long-term environmental exposure (Tong et al. 1996, 1998).

Psychosocial factors are also thought to be important in the relationship between socioeconomic status and health. These relate to low status in a social hierarchy and to stress, lack of self-esteem, lack of social support and social exclusion. Such factors are thought to cause changes to the nervous and immune systems and thus contribute to physical conditions such as cardiovascular and digestive disease and to behaviours that may harm health, such as cigarette smoking and alcohol consumption (Wilkinson 1996).

The importance of psychosocial factors is demonstrated by the work of Marmot who studied the mortality rates of 10,000 British civil servants for more than twenty years. Marmot ranked the civil servants into an occupational hierarchy and found four fold differences in the mortality rates of 40 to 64 year olds between the lowest and highest professional groups (for a good review of Marmot's studies, see Evans et al. 1994). Marmot also demonstrated that mortality levels increased at every stage down the socioeconomic scale and that, consequently, a health gradient existed from the top to the bottom of society. These differentials, and the gradients, remain after adjustments for risk factors such as smoking and alcohol use. The existence of these gradients led Marmot to argue that there was something about being within a hierarchy *per se* which led to ill health, even without material deprivation. These findings have now been replicated in numerous studies around the world (Evans et al. 1994).

Some authors have argued that the gradients observed in Marmot's studies can be explained by the movement of people down the socioeconomic scale as the result of poor health. For example, poor health status leads to people being unemployed and therefore, socially and economically disadvantaged. While some movement undoubtedly occurs downwards, these arguments have largely been refuted by a series of studies, which have been reviewed elsewhere (Lupton & Najman, 1995; Wilkinson 1996).

Spatial analysis is increasingly being used as a way of measuring health inequalities. Geography can be utilised to examine socioeconomic status, locality factors (factors directly related to place), and ethnic/cultural factors that are independent of socioeconomic status. Similarly, health service access and utilisation patterns can also be examined using spatial analysis (N.Z. Ministry of Health 1996). The earlier edition of *A Social Health Atlas of Australia* provided, for the first time, an opportunity to examine the patterns of distribution of the population by socioeconomic status, health status and health service utilisation at a small area level across Australia (Glover & Woollacott 1992). By using maps, variations in these patterns were highlighted and attention drawn to possible associations between the various datasets. These associations were also shown through a correlation analysis. Both maps and correlations are continued in this edition.

National Health Priority Areas

In 1994, the Australian Health Ministers agreed four initial priority areas: Cardiovascular health; Cancer Control; Injury prevention and control; and Mental health (Commonwealth Department of Human Services and Health 1994). This initiative focused attention on areas that continued to contribute most to the burden of illness in the community and where it was considered that a concerted effort could achieve significant gains in the health status of the nation. At their July 1996 meeting, Health Ministers agreed that diabetes become the fifth National Health Priority Area (AIHW 1997) (NHPA). A sixth area, asthma, was added in August 1999.

Data is currently not available to describe fully and to report on changes over time in all of the NHPA indicators and identified targets. This is even more the case at the small area level. **Table 1.2** lists the NHPAs and the data in the atlas that may be of assistance in describing geographic variations in the rates of morbidity and mortality from these conditions, as well as associations with socioeconomic status.

For example, the Primary goal for the NHPA in cardiovascular health is to *Improve cardiovascular health by reducing coronary heart disease and its impact on the population*. Targets established for this NHPA include the reduction of the death rate for coronary heart disease for specific population groups; as well as broader targets to reduce the prevalence of regular smokers among adults and secondary school students; and to reduce the average contribution of fat as a proportion of total energy intake in the food supply. An examination of the information in the maps, text and tables in Chapters 5 (premature deaths from cardiovascular disease) may assist in gaining an understanding of the way in which the diseases which are the focus of the NHPAs vary across Australia geographically, and between groups in the population. Reference to the results of the correlation analysis, showing the extent of association between these indicators of cardiovascular mortality and morbidity and indicators of socioeconomic disadvantage, adds another dimension to the information that needs to be considered in developing strategies to reduce the impact of these diseases on the health of the Australian population.

Purpose

The primary aims of the first edition of the atlas were to illustrate the spatial distribution of the socioeconomically disadvantaged population and to compare this with patterns of distribution of major causes of illness and death, use of health services and health risk factors (such as smoking, alcohol misuse and weight problems). Consequently, the first edition provided information on the distribution of many of the population groups, illnesses, causes of death and risk factors of relevance to the current National Health Priority Areas initiative. It presented them in a way that highlighted the role of social and economic factors in relation to health and illness.

At a broader level it integrated information on health, education, welfare and housing, for example, in a way that could enable more informed debates on resource allocation and policy and program directions, both within and beyond the health system. As such, it made an important contribution to the process of changing the social structures and processes that impact on the health of certain population groups.

The South Australian Department of Human Services (previously the South Australian Health Commission) was funded by the (then) Commonwealth Department of Health, Housing and Community Services to produce the first edition of the atlas and has been funded to produce this second edition by the Population Health Division of the Commonwealth Department of Health and Aged Care.

The atlas has proved to be a major resource, not only for government agencies in health and other fields, but also for many organisations and individuals in the health, welfare and education fields. The presentation of data as maps has been particularly well received and has provided, together with the growing range of data in the National Social Health Database (HealthWIZ), a major source of information for the conduct of needs-based planning activities.

The majority of data in the first edition of the atlas related to 1986 and the years immediately following the 1986 Australian Bureau of Statistics (ABS) Census of Population and Housing. With the release of the 1996 Census it was considered appropriate to produce a second edition, to update as much of the original material as possible. In doing so, the opportunity has been taken to examine the contents of the first edition in the light of developments in the availability of data, and, to look at opportunities to include data that were not available at the time.

Table 1.2: Small area data of relevance to the National Health Priority Areas

NHPA	Small area data
Cardiovascular health	
Primary goal: Improve cardiovascular health by reducing coronary heart disease and its impact on the population	Chapter 5: Premature deaths from circulatory system diseases Chapter 6: Admissions for circulatory system diseases Admissions for ischaemic heart disease Chapter 8: Correlation analysis, showing associations between indicators of cardiovascular mortality and morbidity (Chapters 5 & 6) and socioeconomic status (Chapters 3 & 4)
Cancer control	
Primary goal: Reduce the incidence of, mortality from, and impact of cancer on the Australian population	Chapter 5: Premature deaths from all cancers Chapter 5: Premature deaths from lung cancer Chapter 6: Admissions for all cancers Admissions for lung cancers Admissions for breast cancer (females) Chapter 8: Correlation analysis, showing associations between indicators of cancer mortality and morbidity (Chapters 5 & 6) and socioeconomic status (Chapters 3 & 4)
Injury prevention and control	
Primary goal: Reduce the incidence, and impact on health, of injury in the Australian population	Chapter 5: Premature deaths from the external causes of accidents, poisonings and violence Chapter 5: Estimates of years of potential life lost from premature deaths Chapter 6: Admissions from the external causes of accidents, poisonings and violence Chapter 8: Correlation analysis, showing associations between indicators of injury (Chapters 5 & 6) and socioeconomic status (Chapters 3 & 4)
Mental health	
Primary goal: Reduce the loss of health, well-being and social functioning associated with mental health problems and mental disorders in the Australian population	Chapter 6: Admissions for psychosis Chapter 6: Admissions for neurotic, personality and other mental disorders Chapter 8: Correlation analysis, showing associations between indicators of mental health (Chapter 6) and socioeconomic status (Chapters 3 & 4)
Diabetes mellitus	
Primary goal: A set of goals has been identified (see Chapter 2 *National Health Priority Areas Diabetes Mellitus Report, 1998*, AIHW cat. number PHE 10*)*	Small area data not available
Asthma	
Primary goal: Not yet determined	Chapter 5: Premature deaths from diseases of the respiratory system Chapter 6: Admissions for bronchitis, emphysema or asthma Chapter 6: Admissions for diseases of the respiratory system Chapter 8: Correlation analysis, showing associations between indicators of respiratory system diseases (incl. asthma) (Chapters 5 & 6) and socioeconomic status (Chapters 3 & 4)

Source: Compiled from information in Australian Institute of Health and Welfare and Commonwealth Department of Health and Family Services, *First report on National Health Priority Areas 1996*, AIHW & DHFS: Canberra, 1997 and project resources

The atlas is accompanied by the release of a larger range of up-to-date data series on HealthWIZ than have been previously available. HealthWIZ also incorporates a mapping function to allow users to map the tables they have made. Together these products represent a major initiative in strengthening Australia's public health information infrastructure.

In addition to meeting the needs stated above, the aims of this second edition are:

- to be a source of information for health providers (eg. specialist clinicians, community health service workers, general medical practitioners), managers of health and welfare agencies, community groups, researchers, educators and students;
- to assist in a better understanding of
  - the patterns of distribution of health status and utilisation of health services in the population at a small area level;
  - the linkages which exist between socioeconomic disadvantage and health status;
  - the implications of these patterns and linkages for the provision of appropriate health services, in particular health services which address inequalities in health outcomes; and
- to broaden the use and understanding of data on health status and health outcomes beyond the health system into areas where decisions are made which impact on the health of the population.

In this second edition, it has also been possible to draw attention to variations in the patterns of distribution of the data mapped over the period between the two editions. This varies from 10 years for the demographic and socioeconomic status data to six years for the mortality and hospital admissions data.

Overview of contents

The following is a brief overview of the contents of the atlas. More detailed comments are contained in Chapter 2.

The information in the atlas is categorised under the broad chapter headings of *Demography and socioeconomic status*, *Income support payments, Health status, Utilisation of health services*, *Provision of health services* and *Statistical analysis*. The variables mapped are generally presented as percentages, or as age or age-sex standardised ratios. The process of age/age-sex standardisation enables comparisons to be made between areas regardless of differences in the age or sex profiles of the populations of the areas being compared (this process is described in more detail in Chapter 2, *Methods*, under the heading *Analysis and presentation*).

The major change from the first edition is the production of a set of atlases, with a separate atlas for each State and Territory and a national overview, rather than a single national atlas. In addition, the incorporation of the data from the atlas project in the HealthWIZ software allows greater flexibility in mapping not only the variables in the atlas, but many more variables from the same and other topics.

These changes are in line with the recommendations made in the report of the evaluation of the first edition, in particular that:

> It would seem advisable rather than producing a (single) national hard copy atlas to produce separate atlases for each state and territory, although the production should be coordinated to achieve economies and comparability. This is because most users are state-based and desire intra-state comparability. It would also facilitate greater 'ownership' of the atlas by the States, encourage the development of social health information systems at State/Territory level, achieve greater sales of the atlas and facilitate a greater amount of publicity and spread of information about the atlases. A national overview atlas might also be considered. The model of the successful *Atlas of Australian People* might be considered in this context. (Hugo 1995)

Changes to the contents from the first edition are:

i) the inclusion of data on health status that were previously not available at the small area level (examples are synthetic estimates of two health status measures (the self-assessed health status of the population and the Physical Component Summary) and the population with a handicap);

ii) the presentation of data by the Accessibility/Remoteness Index for Australia (ARIA), which classifies each SLA in Australia into one of five classes, as determined by access to major population centres (this index enhances comparisons of data for regional Australia, from the largest urban centres to the most remote areas of Australia);

iii) the inclusion of a cluster analysis to highlight areas with similar characteristics; and

iv) the addition of a Summary to highlight the main findings from the data and likely policy implications.

In this second edition it has also been possible in many cases to draw attention to changes, since the mid to late 1980's, in the patterns of socioeconomic status, health status and utilisation of health services of the population at a small area level across Australia.

The State and Territory atlases contain maps at the Statistical Local Area (SLA) level, a commonly used area in Australia (see Chapter 2 for a description of these areas). This is the same level of spatial detail as mapped in the first edition of the atlas for the capital cities and the other five major urban centres with populations in excess of 100,000. For the non-metropolitan areas, the SLA maps provide more detail than was available in the first edition, where the area mapped was the larger Statistical Subdivision.

To show all SLAs in Australia on the one map would require a much larger page size than users asked for in the evaluation of the first edition. Therefore, to meet the requirement for a 'whole of Australia' map, data in the separate national atlas are mapped at the next level up in the ABS spatial hierarchy, the Statistical Subdivision.

Volume 2 from the first edition comprised information from the National Health Survey and the Survey of Disability and Ageing. These data were mapped by areas generally equivalent to Statistical Subdivisions for the capital cities, and amalgamations of Statistical Subdivisions for the remainder of Australia. Rather than produce this data only at such a broad regional level in this second edition, estimates at the SLA level have been made and included for a selected set of variables from these surveys.

Future developments

As noted above, numerous studies have been undertaken in recent years using small area data to highlight the existence and strength of the associations between poor health and socioeconomic disadvantage. Small area data analyses will continue to extend our knowledge in this area, although they will be limited in their capacity to do so unless there are changes in the way data are collected and compiled. There are three major issues to be addressed if small area analysis is to do more than describe the nature and extent of associations between socioeconomic status and health status. These issues are in addition to the need to extend the coverage of data collections to incorporate a wider range of health services (see Chapter 6) and health status measures (see Chapter 5).

Generally there is a need for

i. a different approach to the identification of the spatial characteristics of data;

ii. an agreed standard set (or sets) of questions to be included in data collections to measure socioeconomic status; and

iii. a unique identifier to allow for data to be linked (within and) across datasets.

These issues are discussed in Chapter 2, under the heading *Major limitations*.

It is vital that information about the health of the population be made available in a range of accessible formats in order to reach as wide an audience as possible. Availability involves issues of presentation, cost and ease of access (of particular importance to community groups, and even more so to those outside the major urban centres, in regional, rural and remote areas of Australia). It is hoped that this atlas and the associated products (HealthWIZ and the other electronic products available) will go some way to meeting these criteria.

2 Methods

Measurement of socioeconomic status

In the absence of a 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 is 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 represents 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 is 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, weakening the value of the data for small area analysis: see comments under *Usual residence*, page 14;
- 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

Selected indicators of socioeconomic status, health status and utilisation of health services are presented in this atlas. In addition, details have been included on the level of provision of selected services.

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. In this atlas premature death, disability, and hospitalisation are among the indicators that have been used. The choice of indicators to describe patterns of use of health services at a small or local area level for all States and Territories is limited to hospital episodes, services provided by general medical practitioners and immunisation.

Maps

The Statistical Local Area (SLA) is generally equivalent to a local government area, with additional codes allocated to areas outside local government areas (eg. unincorporated areas) and to local government areas which have been split for statistical purposes.

There are a number of problems with the SLA as a major spatial unit for coding and analysis. Issues specific to Tasmania, and the way in which they have been addressed in this atlas, are discussed in more detail on page 13, under the heading of *Area mapped/Boundary issues*. Broader issues regarding the Australian Standard Geographical Classification (ASGC) are discussed on page 13, under the heading of *Area classifications*.

Two maps are shown for each variable in this atlas (with the exception of the variable for unskilled and semi-skilled workers). The first comprises a map at the SLA level for **Hobart**, represented by the Hobart Statistical Division. The names of the capital city Statistical Divisions are typed in bold, to distinguish them from the SLAs of the same name.

The second map is of the whole of the State, by SLA, but with **Hobart** area. This enables comparisons to be made of the percentages, ratios, etc. in the major urban centres with those in SLAs 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 separately identify urban centres with populations of 7,500 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 13, under the heading of *Area mapped/Boundary issues*.

The majority of maps in this atlas reflect the distribution of the population for whom the particular events are 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 *Important points to note*, below. 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, housing authority rented dwellings and dwellings without a motor vehicle are mapped to the address of usual residence of the population who were in Australia on Census night. This is because the data for these variables is only available for people recorded in the Census at their usual address. The remaining variables reflect the population counted in the SLA 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.

Accessibility and Remoteness

The following is an extract from Accessibility/Remoteness Index of Australia (ARIA), *Department of Health and Aged Care, Occasional Papers Series No. 6.*

There has been an increasing concern 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. Government in particular has been interested in finding out more about their circumstances and needs, and targeting assistance accordingly. However the concept of remoteness itself has lacked precision. It is clear that distance is central to most people's understanding of the concept. For example,

"Remote: ... Far away, far off, distant from some place, thing or person, removed, set apart... "[1]

There are, however, a number of aspects to the concept of remoteness - not all of which are negative. For the purposes of the project *(to develop ARIA)* the concept of "remoteness" had to be refined to the extent that it could be quantified, as a necessary step to identifying the needs of people living outside metropolitan areas. With access to an objective measure of "remoteness", services could more easily be designed and targeted to address priority areas of need. Effort has focused on disadvantage in terms of accessible services, especially those routinely available to people in metropolitan areas. Remoteness has largely come to be identified with lack of accessibility to services[2].

ARIA supersedes an earlier index of remoteness called the Rural, Remote and Metropolitan Areas classification (RRMA). It is the culmination of effort over a number of years directed toward quantifying remoteness, to serve as both an analytical and a policy tool. ARIA was designed to be an unambiguously geographical approach to defining remoteness. Socioeconomic, urban/rural and population size factors are excluded. ARIA measures access in terms of remoteness along a road network from 11,340 populated localities to four categories of service centres. An adjustment is made for localities situated on islands (including Tasmania). The four categories of service centres are:

Level A: service centres with more than 250,000 persons
Level B: service centres with 48,000 to 249,999 persons
Level C: service centres with 18,000 to 47,999 persons
Level D: service centres with 5,000 to 17,999 persons

For each locality, the distance to each of the four categories of service centre is converted to a ratio to the mean. To remove the effect of extreme values, a threshold of 3 is applied to each component and then the four component index values are summed. This produces a continuous variable with values between 0 (high accessibility) and 12 (high remoteness). Index values for each of the 11,340 populated localities are then interpolated to produce an index value for 1km grids and averages calculated for larger areas such as postcodes or SLAs.

An 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.

The ARIA Index became available toward the end of the atlas project and has been incorporated into each atlas for each variable. **Map 2.1** shows the ARIA Index for the whole of Australia, both at the one square kilometre level for the five categories and for each SLA. A comparison of the two maps illustrates the extent to which the ARIA category at the SLA level (in particular for the largest SLAs) represents the average of two or more categories. **Map 2.2** shows the index for each SLA in Tasmania. There are no SLAs in Tasmania in ARIA category 4, Remote.

The ARIA index for each SLA in non-metropolitan Tasmania is shown in Appendix 1.2 (SLAs in Hobart 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 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.

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.

The data mapped in other chapters are recorded for a range of periods: for income support payments and general medical practitioner services it is for 1996; for hospital admissions it is for 1995/96; for deaths and the Total Fertility Rate it is for the four years from 1992 to 1995; for the synthetic predictions from the National Health Survey it is 1994 and for those from the Disability and Ageing it is 1993; and 1997 for health services and facilities. In a number of instances, data for four 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, one of the main purposes of the atlas, but this is not always possible.

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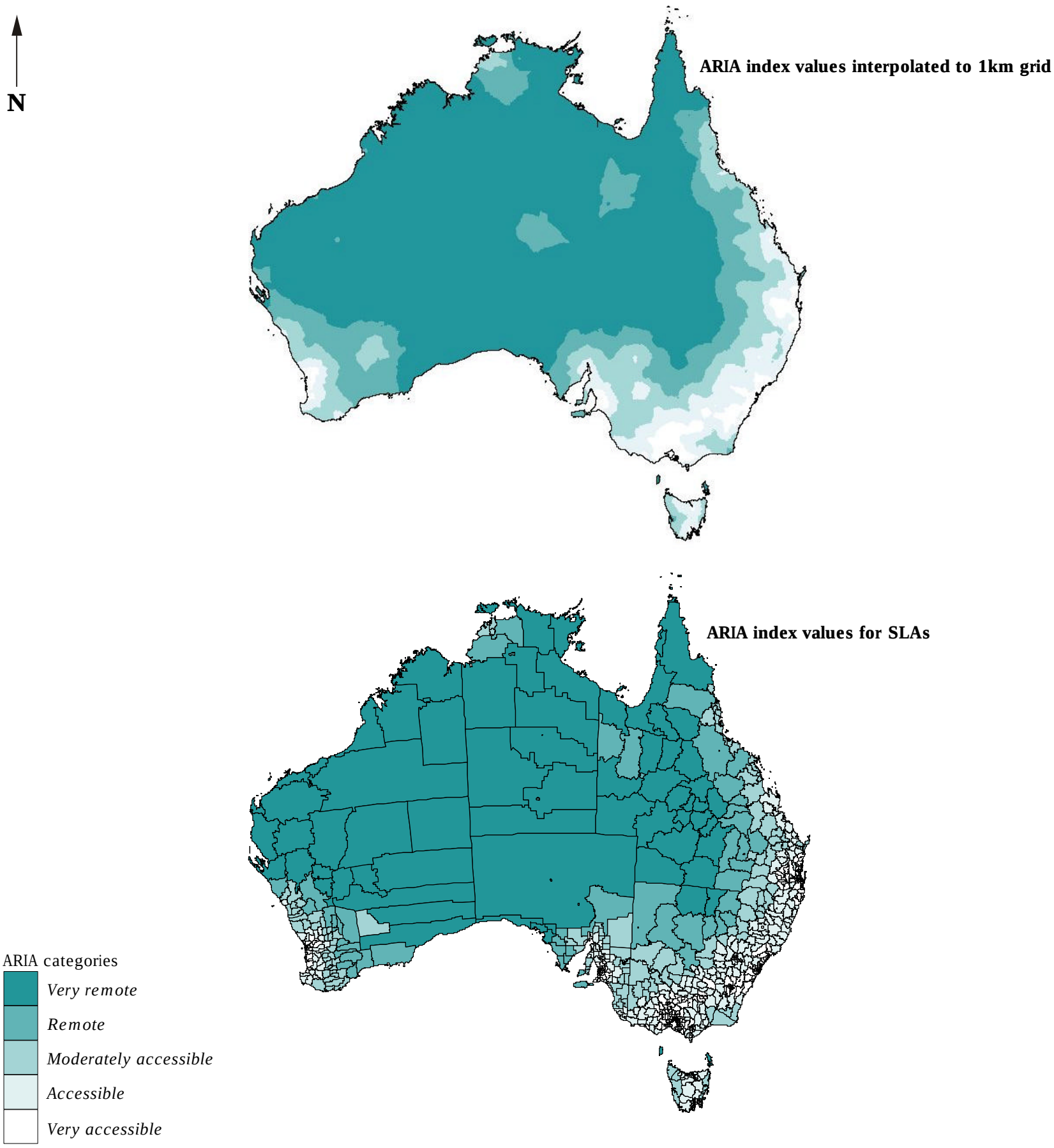
[1] Shorter Oxford Dictionary.

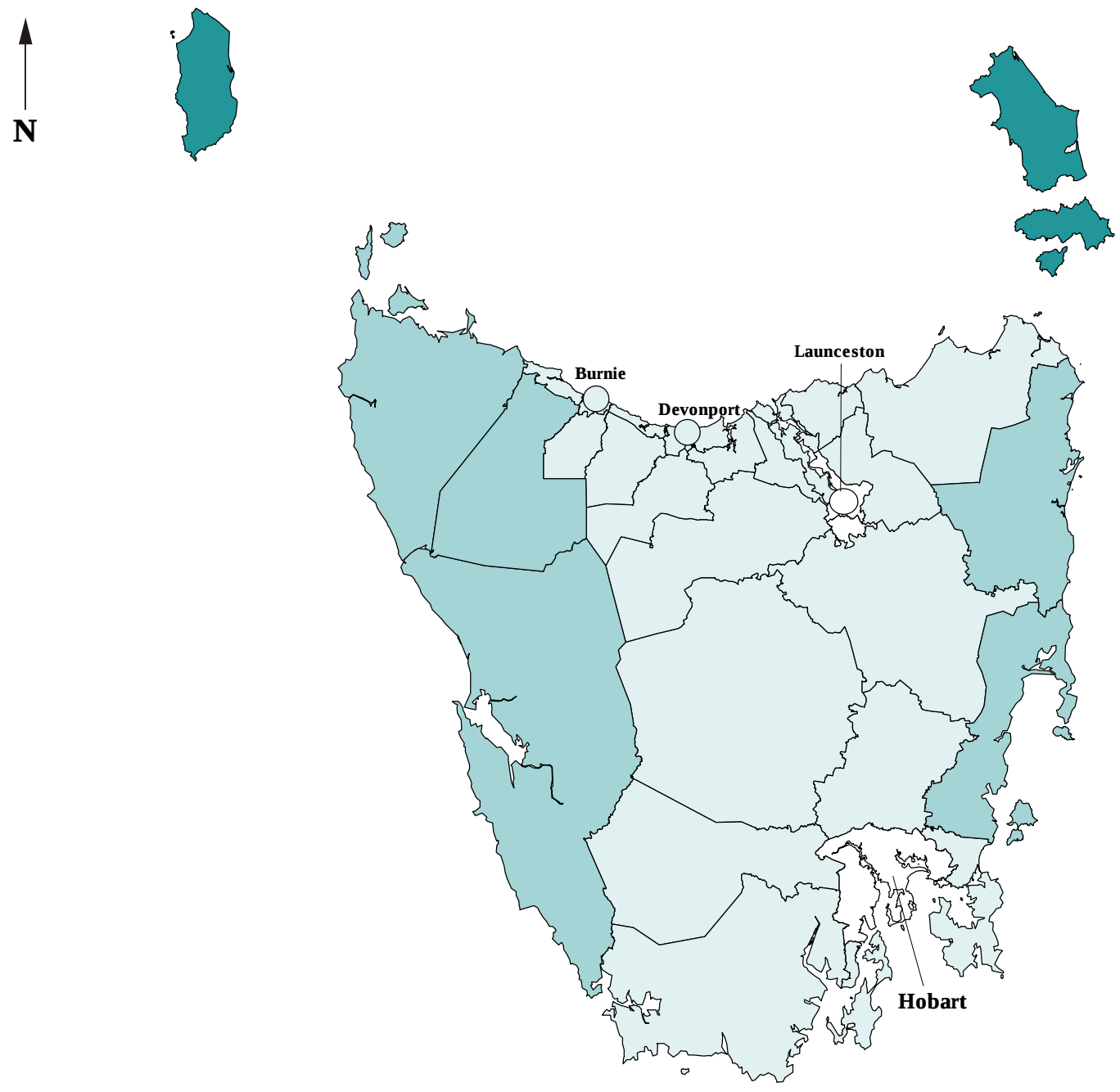
[2] The term "accessibility" is generally used rather than "access", as the approach has been to consider the extent to which services are *able* to be accessed, rather than the extent to which people are *actually* accessing them.

Map 2.1
Accessibility/Remoteness Index of Australia (ARIA), 1996



Source: Maps provided by The National Key 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 Papers Series No. 6*

Map 2.2
Accessibility/Remoteness Index of Australia (ARIA), for SLAs in Tasmania, 1996



Source: Maps based on the Accessibility/Remoteness Index of Australia as described in *Department of Health and Aged Care, Occasional Papers Series No. 6*

The deaths data, covering the four years from 1992 to 1995, have been coded using a number of versions of the ASGC (from 1991 to 1994) and can be aggregated in such a way as to be, in most instances, comparable with data coded to 1996 boundaries (Census data, income support payments etc.). Similarly, the 1995/96 hospital admissions data are coded to the 1994 classification and can also be generally compared with the deaths data and the data on 1996 boundaries. The way in which boundary changes in Tasmania have been addressed in this atlas is discussed in more detail below, under the heading of *Area mapped/Boundary issues*.

Conversion of postcode data

Another important issue is that, for many datasets produced by the States and Territories, the only spatial detail available is the postcode of the address. This necessitates that the postcode data be converted to SLA if it is to be mapped on a common basis with data coded to SLA.

SLAs are generally larger than postcode areas, and the conversion frequently allocates a whole postcode (or more than one postcode) area to an SLA, together with a part of another postcode (or parts of more than one postcode). The conversion is undertaken using approximate allocations of postcode populations (based on the best fit of Census Collection Districts (CDs) to postcode areas) to SLAs, derived from data at the previous Census. In many instances this conversion represents a crude allocation of the population of any SLA. For example, in many cases the boundaries of CDs do not match the boundaries of postcodes, and whole CDs are allocated to the postcode into which the population largely falls. Postcodes are similarly allocated to an SLA on a 'whole postcode' basis, leading to further approximations. However, in the absence of accurate population counts from the Census for postcode areas, this method has been used in this atlas. Because the allocation is done on the basis of total populations, it does not take account of differences in the location within a postcode (or CD) of different age groups in the population and may mask the differential use of services, death rates and population characteristics between age groups.

An example of the inaccuracies resulting from this conversion process can be seen from the data in **Table 2.1**. Although the analysis in the table is limited to South Australia, a similar situation applies elsewhere in Australia.

The first section of the table shows details for the 15 to 64 year age group and the second includes deaths at the remaining ages (0 to 14 years and 65 years and over). The first two columns show the number of deaths (by sex) in 1996 for a selection of SLAs, as coded by the ABS. The second two show the number of deaths per SLA estimated using the postcode to SLA converter from the 1996 Census. The last four columns show the difference, firstly numerical, then the percentage, difference.

For the 15 to 64 year age group, the total number of deaths at the State level varies by just 1.2 per cent for males and 3.8 per cent for females: in both cases the estimating process produces higher numbers. The extent of the difference between the ABS coding and the results using the converter varies widely, however, for individual SLAs. For example, some SLAs with relatively small numbers of deaths (eg. Adelaide) have relatively small differences, as do some of the SLAs with larger numbers of deaths (eg. Marion). On the other hand, Hindmarsh and Woodville, with a relatively large number of deaths also had a relatively large difference, with the estimating technique showing 6.4 per cent more deaths of males and 11.7 per cent fewer deaths of females. For East Torrens, with a relatively small number of deaths, the estimating technique also produced large differences, with 20.2 per cent more deaths of males and 66.8 per cent more deaths of females. Some of the differences evident for SLAs in the non-metropolitan areas of the State are also very large. This is particularly the case when the numbers are small, such as in Unincorporated Far North. Similar discrepancies are evident in the estimates produced for the other age groups shown in the second part of the table.

Differences of this order can have a major impact on the results of analyses using data estimated in this manner. This is an unsatisfactory way in which to estimate data and should be addressed along with the broader issue of the need for a new area base for Australia's statistics discussed below, under the heading *Major limitations: Area classification*.

However, in the absence of an alternative, data based on postcodes were converted in this way for a number of the datasets mapped. These were the income support data, data for general medical practitioner (GP) services and population per GP, and the beds/places in selected facilities (nursing homes and hostels) per population. As noted in Chapter 5, a decision was taken not to use this method to convert data for cancer incidence or screening rates (see page 107).

Analysis and presentation

Measures mapped

Most measures were produced using age-sex standardisation. The major exceptions are the measures mapped in Chapters 3 and 4, 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 health status and the utilisation of health services. Standardisation was also used to derive the measure from the 1996 Census for persons who left school aged less than 15 years, to adjust for differences in educational participation rates over the years.

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.

Table 2.1: Conversion of 1996 deaths data to SLA using the ABS Census-based postcode converter: deaths by age group for selected SLAs, South Australia, 1996

Deaths of people aged from 15 to 64 years

SLA	Coded to SLA by ABS		Estimated from postcode		Difference			
					Number		Per cent	
	Males	Females	Males	Females	Males	Females	Males	Females
Metropolitan								
Adelaide	19	5	18.0	5.0	-1.0	0.0	-5.3	0.0
Brighton	22	18	21.6	17.3	-0.4	-0.7	-1.7	-4.0
East Torrens	4	1	4.8	1.7	0.8	0.7	20.2	66.8
Elizabeth	36	19	31.1	16.4	-4.9	-2.6	-13.7	-13.7
Enfield - Pt A	59	33	58.7	32.7	-0.3	-0.3	-0.5	-0.8
Enfield - Pt B	22	13	17.9	16.5	-4.1	3.5	-18.5	27.2
Glenelg	20	6	18.6	5.6	-1.4	-0.4	-6.9	-6.9
Henley & Grange	15	3	14.0	5.3	-1.0	2.3	-6.7	76.0
Hindmarsh & Woodville	77	55	81.9	48.6	4.9	-6.4	6.4	-11.7
Marion	60	43	59.0	44.6	1.0	-1.6	1.7	-3.8
Munno Para	41	14	40.3	16.7	-0.7	2.7	-1.7	19.2
Tea Tree Gully	62	44	63.4	41.6	1.4	-2.4	2.3	-5.4
Thebarton	8	1	10.2	2.5	2.2	1.5	27.1	154.1
Unley	34	20	36.3	20.8	2.3	0.8	6.7	3.8
Non-metropolitan								
Elliston	4	0	4.3	0.0	0.3	0.0	7.7	..
Streaky Bay	2	1	1.5	1.5	-0.5	0.5	-25.8	48.4
Victor Harbor	8	8	5.8	7.8	-2.2	-0.2	-27.0	-2.6
Whyalla	22	10	22.9	9.0	0.9	-1.0	4.2	-10.3
Unincorporated Far North	8	2	4.1	0.3	-3.9	-1.7	-48.5	-86.6
Total State[1]	**1,353**	**706**	**1,368.9**	**733.0**	**15.9**	**27.0**	**1.2**	**3.8**

Deaths of people aged from 0 to 14 and 65 years and over

SLA	Coded to SLA by ABS		Estimated from postcode		Difference			
					Number		Per cent	
	Males	Females	Males	Females	Males	Females	Males	Females
Metropolitan								
Adelaide	55	74	53.0	75.0	-2.0	1.0	-3.6	1.4
Brighton	120	141	103.5	129.9	-16.5	-11.1	-13.8	-7.9
East Torrens	9	13	13.3	16.4	4.3	3.4	47.9	26.0
Elizabeth	89	70	67.8	55.8	-21.2	-14.2	-23.8	-20.3
Enfield - Pt A	198	174	185.2	182.2	-12.8	8.2	-6.5	4.7
Enfield - Pt B	66	56	61.4	63.3	-4.6	7.3	-6.9	13.0
Glenelg	99	120	93.1	119.2	-5.9	-0.8	-6.0	-0.7
Henley & Grange	77	93	75.1	95.2	-1.9	2.2	-2.4	2.3
Hindmarsh & Woodville	369	376	369.0	352.7	0.0	-23.3	0.0	-6.2
Marion	280	267	297.0	285.9	-17.0	-18.9	-6.1	-7.1
Munno Para	40	48	59.2	60.1	19.2	12.1	48.0	25.3
Tea Tree Gully	146	132	154.2	143.7	8.2	11.7	5.6	8.9
Thebarton	34	33	35.6	35.6	1.6	2.6	4.6	7.8
Unley	198	263	162.7	238.8	-35.3	-24.2	-17.8	-9.2
Non-metropolitan								
Elliston	1	1	1.5	1.3	0.5	0.3	53.9	30.8
Streaky Bay	7	3	6.2	2.2	-0.8	-0.8	-11.5	-25.8
Victor Harbor	68	48	66.2	47.7	-1.8	-0.3	-2.6	-0.6
Whyalla	61	65	59.6	64.4	-1.4	-0.6	-2.4	-0.9
Unincorporated Far North	8	3	2.8	1.3	-5.2	-1.7	-65.0	-57.4
Total State[1]	**4,708**	**4,839**	**4,605.1**	**4,762.0**	**-102.9**	**-77.0**	**-2.2**	**-1.6**

[1]Includes all SLAs in the State

Source: Calculated from data supplied by ABS

Tables

The data on which the maps are based are published in Volume 7.1 as absolute numbers (number of deaths, population with a particular characteristic, etc.) and as the percentages, ratios, etc. which have been mapped (see Appendix 1.1 for details). Some of the data are also available in the HealthWIZ database.

Area mapped/Boundary issues

As noted above, the spatial unit used in the State and Territory atlases is the Statistical Local Area (SLA). The SLA is a spatial unit within the Australian Standard Geographical Classification (ASGC 1996), the geographical classification developed by the Australian Bureau of Statistics (ABS) for coding data to areas within Australia and is a standard geographic area for many statistical purposes. It was chosen as the area to be mapped in this atlas because it is the smallest area to which a wide range of statistics is coded across all States and Territories.

The Statistical Local Area (SLA) is generally equivalent to a local government area, with additional codes allocated to areas outside local government areas (eg. unincorporated areas) and to local government areas which have been split for statistical purposes.

Boundary changes

As noted above, the boundaries of a number of SLAs in Tasmania have changed over the periods for which the data has been collected and coded (periods varying from one year to four years). In some cases this requires that two or more areas be combined to enable the data to be mapped and compared, or for the correlation analysis to be undertaken. For example, boundary changes to the Tasmanian SLAs of Brighton (M), Clarence (C) and Southern Midlands (M) in 1993 meant that, to maintain comparability with Census data, data for deaths and hospital admissions has been analysed for the combined area of Brighton/Clarence/Southern Midlands. This amalgamated area was also used in the correlation analysis. A list of the areas grouped and the name assigned to each is included in the beginning of the relevant chapter.

The local government areas of Hobart and Launceston both have two SLAs: Hobart-Inner and Hobart-Remainder and Launceston-Inner and Launceston-Remainder. The Inner component represents the Central Business District. As these Inner/Remainder SLAs are not used to code most of the data mapped in this atlas, they have been combined with data presented for Hobart (C) and Launceston (C).

Urban centres identifiable in the ASGC

Just as the demographic characteristics and health profiles of Australians vary between the major cities and non-metropolitan areas, they also vary within the non-metropolitan areas, between residents in towns and those living in more rural and remote locations. SLAs have deficiencies as a spatial unit to describe urban centres (other than the capital cities and other major urban centres - urban centres with a population of 100,000 or more). For example, of the four urban centres in Tasmania with a population of 7,500 or more, none can be identified in the SLA classification. That is, none of these urban centres were also SLAs in their own right: they formed only part of an SLA comprising one or more urban centres of 7,500 or more people, and/or smaller urban centres and/or 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 7,500 or more to be mapped where it comprised 75.0 per cent or more of the SLA in which it was located. This resulted in three of the four urban centres in Tasmania being mapped. Details of the urban centres mapped, as well as those not mapped, are shown in Appendix 1.2 (**Table A2**).

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 adjoining the circle and the correct geographic location. Similarly, areas on the map that are too small for variations in the shading to be seen have been enlarged and located off the map.

Other supporting information

Wherever possible the introductory notes to each topic provide background information to the topic (e.g. hospital admissions) as well as the individual variables mapped (e.g. hospital admissions for circulatory 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 general high quality of health data in Australia there are a number of identifiable gaps and deficiencies in the data available. The AIHW (1998a) has documented these. They highlight 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*. These comments are also relevant to data for small area analysis.

Details of data limitations, with an emphasis on small area data, are included in the introductions to Chapters 5, 6 and 7. In addition to these collection specific limitations, three important overall limitations of the data for undertaking small area analysis are also discussed. These are the classification of small area data, the measurement of socioeconomic status and data linkage.

Area classification

As noted above, the spatial unit used in the State and Territory atlases is the Statistical Local Area (SLA). The SLA is a spatial unit within the Australian Standard Geographical Classification (ASGC 1996), the geographical classification developed by the Australian Bureau of Statistics (ABS) for coding data to areas within Australia and is a standard geographic area for many statistical purposes. It was chosen as the area to be mapped in this atlas because it is the smallest area to which a wide range of statistics is coded across all States and Territories.

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. For example, several SLAs in **Hobart** have populations of fewer than 15,000 people, and the largest is 47,460. By way of contrast, **Sydney** has SLAs ranging in size from a population of 11,969 to 232,219. Similarly, the area covered by SLAs varies widely, from 77.3 square kilometres to 377.7 square kilometres in **Hobart** and 28.7 to 9,574.6 in non-metropolitan Tasmania. These differences lead to major difficulties in making comparisons of the type in this atlas, whether directly from the maps, or through the correlation analysis.

During the 1980s and 1990s, State and local government authorities in a number of States have been involved in numerous reviews that have resulted in the re-drawing of local government boundaries. The outcome of many of these changes has been the amalgamation of several areas into a single, larger unit. This may be accompanied by parts of a single area having spilt off and included in two or more new areas. Such changes in boundaries often make it impractical to compare areas over time, and sometimes make it impossible. For example, the Australian Bureau of Statistics cannot provide a concordance from the 1994 boundaries to the 1996 Census boundaries for Victoria, because of the extent and nature of changes to local government authority boundaries in that State. The only comparisons available are for amalgamations of (often substantial) groups of areas, and even these do not allow for exact comparisons.

The difficulties involved in converting data from postcode areas to SLA, and in obtaining statistics for towns, separate from their hinterland, have been discussed above.

It is clear that Australia lacks an appropriate, consistent hierarchy of spatial units to which data can be coded to describe the patterns of distribution of its populations and their characteristics. This is a major concern for many involved in the planning and management of services and in research. Although this concern has been raised on numerous occasions, it remains unaddressed. It is to be hoped that the current interest in developing a better understanding of spatial variations in health, welfare, education and other characteristics of the population - in particular those in regional and remote areas of Australia - will act as a catalyst for the agencies concerned to address there concerns.

Measurement of socioeconomic status

The lack of a measure of socioeconomic status in health data collections reduces the value of analyses that seek to highlight associations between socioeconomic status and health. Although the use of the area of residence of the population as a proxy indicator of socioeconomic status provides a valuable alternative, it has a number of limitations (page 7).

There is a need for a standard approach to the measurement of socioeconomic status. This may be through the development of a set of questions around agreed indicators to be used in a consistent way across the major national datasets, as well as by others involved in collecting data for research or policy purposes.

Record linkage

There are many datasets in Australia that include information which, when linked, can potentially increase their value for research and policy analysis. This is equally so for small area analyses. Record linkage can also lead to changes in the way services are delivered. Linking records allows for direct comparison of information about the health status, use of health and welfare services and socioeconomic status of individuals and the population as a group. It overcomes the necessity to use the area of the patient's address of usual residence as a proxy for socioeconomic status, thus enhancing the possibility of identifying area effects in the data.

A requirement for record linkage is the existence of a unique identifier. The introduction of such an identifier can also lead to more effective, and cost-effective, treatment and service delivery arrangements. For example, a number of studies have shown that a relatively small proportion of the population consumes a relatively large proportion of health service resources. The Commonwealth Government's Coordinated Care Trials (CCT) are an example of a program designed to provide better targeted and more coordinated health care and welfare services to high level users of (often high cost) services, and who are among those with the poorest health status. Record linkage raises issues of confidentiality and privacy concerns. The CCT, which rely on access to linked data about the use of health and welfare services by individuals participating in the trials, have shown that data confidentiality and privacy issues can be satisfactorily addressed.

Record linkage is attracting increasing attention in Australia. It is to be hoped that ways can be found to enable record linkage to proceed in Australia in a much broader way than at present.

Important points to note

The following points should be noted when reading the maps and text.

Usual residence

The maps in this atlas generally 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. In those instances where this assumption is not warranted the analysis has been constructed to take this into account, or attention is drawn to this deficiency.

Reading the maps

The choropleth mapping technique adopted for the atlas inevitably involves a degree of generalisation because it conceals variations within the spatial units used. The larger the spatial unit, the greater the degree of generalisation, and for this reason the values shown on the maps for large SLAs, in particular those which are sparsely and irregularly populated, or have very small populations, must be treated with caution.