AGEING IN VICTORIA

An Electronic Social Atlas

Anna L. Howe, Peter Newton and Penny Sharwood
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ABBREVIATIONS

ABS     Australian Bureau of Statistics
AIMA    Australian Institute of Multicultural Affairs
CDCS    Commonwealth Department of Community Services
CSIRO   Commonwealth Scientific and Industrial Research Organisation
LAMM    Local Area Microcomputer Mapping
LGA     Local Government Area
MSD     Melbourne Statistical Division
NATMAP  Division of National Mapping
This Social Atlas was prepared as part of a project evaluating the development of regional geriatric assessment services in Victoria, supported by the Commonwealth Department of Community Services. The aim of the project was not merely to provide information on the aged population by way of background to the operation of assessment services, but to do so in a way that made the data accessible for those wishing to carry out analyses for their own planning purposes.

The means to this end was the adoption of an electronic mapping package developed by the Commonwealth Scientific and Industrial Research Organisation, with Dr. Peter Newton of the CSIRO acting as consultant to the project. His contribution went far beyond the provison of technical advice and his wider interest added much to the compilation and interpretation of the maps.

Data for the project were drawn from several sources, with assistance provided by the Australian Bureau of Statistics, the Commonwealth Department of Community Services, Community Services Victoria, the Health Department of Victoria and the Royal District Nursing Service.

Within the National Research Institute, Bill Edgar, visiting from the Department of Town and Regional Planning, University of Dundee, provided critical comment on draft material. Jacqui Gillam and Gail Buysen assisted with word processing.

With the release of data from the 1986 Census and the development of more extensive data bases by government agencies involved in the administration of aged care programs, the present Atlas may be seen as the precursor of many future applications of electronic mapping in service planning and research. It is hoped that this Atlas will demonstrate the value of this methodology and stimulate interest in its further development and application.
PART 1

INTRODUCTION TO THE SOCIAL ATLAS OF AGEING AND COMPUTERISED MAPPING
1. VARIABILITY OF THE AGED POPULATION -

THE SPATIAL DIMENSION

INTRODUCING AN ELECTRONIC SOCIAL ATLAS

Perhaps the only generalisation that can be made about the aged is that they are not all the same; variability is arguably the prime characteristic of the aged population. Many approaches might be taken in describing, analysing and explaining this variability, but insofar as all ageing people are located in a particular place, there is a spatial dimension to all other aspects of demographic and social variation which provides a useful and meaningful basis for presenting an account of the variability of the aged population.

This presentation is made in the form of a Social Atlas of Ageing in Victoria. The aims of the Atlas are, firstly, to depict the spatial variability of demographic and social characteristics of the aged population, and, secondly, to relate this variability to patterns of need for and provision of services for the aged. These rationales are developed in this introductory section.

A third aim of the Atlas is to demonstrate the application of microcomputer mapping techniques. Methodological and technical aspects of the compilation of the maps using the LAMM microcomputer package and the distinctive features of computer mapping techniques and their application in this Atlas are reviewed in the next section. The Electronic Atlas, comprising the data disk and the LAMM package, can be seen as an extension to this hard copy Atlas.

The maps and commentaries, Part 2 of the Atlas, are grouped in three sections covering the distribution and growth of the aged population, social characteristics, and service provision and use. Separate maps are presented for the Melbourne metropolitan area and non-metropolitan Victoria, and the commentaries detail the data used in each map as well as discussing the main patterns and particular features of each map.

Part 3 of the Atlas presents reference and source material in three sections. A key map and list is provided, giving Local Government Areas by State Health Districts, to assist in locating particular areas. Source material cited in all sections of the Atlas is detailed in the list of references and a bibliography of Australian social atlases is also included.

A final point that warrants mention in introducing this Atlas is that it can be seen as an outcome of a close association between geography and gerontology that has characterised the development of interest in ageing in Australia. Urban and social geographers with interests in demography and migration have made a significant contribution to understanding the patterns and processes of population ageing in Australia, and have often brought their research to bear on applied issues of planning and policy development. Among work that provides this background to the Atlas are Hugo's reports of demographic change and migration of the elderly population (Hugo, 1984, 1986), Howe's studies of service provision and use in relation to population variation (Howe, 1981a, 1981b, 1986), Rowland's investigations of aspects of ageing and the family (Rowland, 1983, 1986), and Lee's recent work on need-based planning (Lee, 1987).
The same applied interests in planning and policy development underlie the preparation of this Atlas. As well as presenting an account of the spatial variation of the aged population and of the provision of services for the aged, the Atlas is intended to go some way in assisting in the evaluation of these service programs. The main part of the following discussion makes a review of the range of variables available for mapping, and of considerations in selecting from among the possible variables, then turns to issues of interpretation and application.

**SELECTION OF VARIABLES TO DEPICT SPATIAL VARIABILITY**

A key consideration in the development of this Atlas has been the selection of variables to be mapped. This selection has been guided by three factors. Firstly, attention has focused on variables that are meaningful in describing the aged population, that is, they represent major characteristics of variation both between the aged population and younger age groups, and also within the aged population.

Single measure variables have been used rather than more complex multi-dimensional measures or scales, although the presentation of bi-variate maps does enable the associations between pairs of single variables to be depicted. The meaningfulness of the variables is also enhanced through defining them in ways which relate as closely as possible to the characteristics being described. For example, while the general level of retirement could be represented by the proportion of the total population aged 65 years and over retired, a definition in terms of the proportion of the male population aged 60 to 69 retired highlights the trend to early retirement. When this variable is mapped in conjunction with income levels, some insight can be gained into associations between voluntary early retirement facilitated by adequate income and involuntary retirement associated with unemployment and redundancy among older workers, leading to low retirement incomes.

Secondly, characteristics which display a marked degree of spatial variation have been selected over those which vary less. This issue of variability is particularly relevant to the definition of class limits for mapping; these limits need to be set so that the mapping of areas belonging to different classes represents a pattern of real variation rather than marginal differences. Where a selected variable characterises only a small proportion of the aged population, a high degree of spatial differentiation is required for meaningful mapping and interpretation. A case in point is ethnicity. While just on 10 per cent of the total aged population were born in non-English speaking countries, their spatial concentration is marked. The map of ethnicity for the Melbourne metropolitan area (Map 2.7) shows that in a small number of LGAs, more than a quarter of the aged population is of ethnic background, but in most other areas the proportion is below 2 per cent.

The third consideration in the selection of variables has been the availability of data at the Local Government Area or other appropriate geographic level. Demographic data from the 1981 Census was the most readily available, followed by social characteristics also taken from the Census. Standardised collections of data on service provision and use are only now being established, and hence the number and range of variables available is limited. It has also been more appropriate to map some of these variables at the regional or sub-regional scale at which the service is planned and delivered. Data sources are detailed below and data metrics and classification for each variable are set out as part of the commentary for the relevant maps.
DEMOGRAPHIC PATTERNS AND PROCESSES OF AGEING

General accounts of the demography of ageing have usually mentioned the uneven spatial outcome of the processes involved. For example, Pollard and Pollard (1986) comment on the uneven distribution of the aged population, noting in particular the impact of retirement settlements on local age structure. This variability between local areas and regions reflects not only national demographic trends but also the dynamics of settlement and population movements. Thus within an overall ageing population, age structure varies from one area to another; the aged population is unevenly spread across the state and comprises a varying proportion of the population of any local area, and is also changing at varying rates.

Distribution of the aged population

The distribution of aged population in Melbourne as at the 1976 Census has been described by Howe (1978), who identified four groups of LGAs on the basis of the relative concentration of the aged, that is, the proportion of total population aged 65 years and over. A map of this distribution showed the highest concentrations, with more than 13 per cent aged, were in the band of LGAs comprising the inner eastern and southern suburbs settled between the wars; this concentration arises from ageing in situ. In contrast, it is retirement migration that accounts for the second area of high concentration on the Mornington Peninsula. The inner suburbs have only average proportions of aged population, due to the loss of the older generation and replacement by younger groups, and the outer suburbs all have below average proportions, being areas of more recent urban expansion and and youthful population growth associated with family formation. Attention was also drawn to the absolute concentration of the aged population, with the nine LGAs in the established suburbs containing over 25 per cent of the total metropolitan aged population.

A further set of maps of the distribution of aged populations at the 1981 Census for all states and capital cities has been prepared by Hugo (1984), using only three class intervals to show below average, average and above average concentrations. Explanations for both the state-wide and metropolitan patterns were given in terms of the same processes of ageing in situ and retirement migration accounting for high concentrations of aged population, with areas of recent suburban growth or rural settlement being characterised by younger populations.

Hugo also draws attention to the need to consider absolute numbers of aged people as well as relative concentration, as it is absolute numbers that are of most relevance to those concerned with assessing demand for services and other planning functions. He observes that the areas of highest concentration are often not the areas of largest numbers, with the analysis of Adelaide and non-metropolitan South Australia showing a poor match between LGAs with large numbers and high proportions aged. In non-metropolitan areas, the largest numbers of old people were in provincial cities but the highest proportions in coastal retirement areas; in the metropolitan areas, the inner city and near-city coastal LGAs have high proportions aged, while the middle distance suburbs have large numbers.

A final aspect of variability of the aged population is its age structure. While the age structure of the older population has commonly been divided into the "young-old", those aged 65 to 75 years, and the "old-old", aged 75 years and over, a further division is now being made in the later group to distinguish the "very old", aged 85 years and over. The extent of
spatial variation in age structure has been demonstrated by McCracken (1985) in his analysis of the old age structure of Sydney. Data presented for selected pairs of LGAs show that similar proportions aged 65 and over mask considerable variation in age structure; of the two LGAs which are "oldest" on the basis of total aged population with around 16 per cent aged 65 years and over, the proportions of the aged population aged 85 years and over varied from 5 to 11 per cent, these differing proportions also being found for the "youngest" pair of LGAs with only 10 per cent of total population aged 65 years and over.

The relevance of this disaggregation is most apparent for the planning of health and other support services, the use of which is heavily concentrated among the very old, but is also pertinent for the examination of other demographic and socio-economic characteristics that are likely to show pronounced ageing or generation effects. For example, the strong age effect in morbidity and mortality requires the use of standardised ratios by at least these three age groups rather than for the 65 years and over population as a whole. Similarly, differences between the "young-old" and the "old-old" can be expected in the condition of housing occupied; differences associated with period of settlement in different localities are likely to be compounded by differences in residential mobility behaviour, with the "old-old" becoming entrenched in older housing while the "young-old" avail themselves of new options for retirement housing.

Residential mobility and migration

Patterns of mobility and migration of Australia's aged population have also been analysed extensively by Hugo (1986). Although the elderly are less mobile than younger age groups, their residential mobility has increased in recent years, particularly for the "young-old", suggesting that the bulk of movement is related to retirement adjustment. The types of migration examined covered not only interstate, inter-regional (within-state) and intra-metropolitan migration, but extended to return migration and international migration of the aged. Interstate movement was dominated by migration to Queensland, with all other states losing population. Intra-regional and intra-metropolitan migration accounted for the major part of all elderly population movement. In these patterns, net out-migration occurred from older settled rural regions, while coastal regions generally gained from in-migration.

From Hugo's analysis it is apparent that the complexity of residential mobility of the aged is such that mapping a single variable, such as proportion of aged population changing residence in an intercensal period, without added information on the origins and destinations of the moves made, can give only a very limited account of this aspect of the demography of ageing. Even this basic statistic was not readily available at the LGA level for Victoria for the 65 years and over population from the full Census data, hence no maps of residential mobility and migration could be prepared for this Atlas, and reference must instead be made to the aggregate analyses carried out by Hugo using the 1 per cent sample from the Census.

Past and projected change

The final aspect of demographic patterns to be considered is past and future change, with a number of possible methods available to show different aspects of change. For example, past change can be mapped simply as the percentage change in aged population from over an intercensal period, positive changes indicating areas of aged population gain and negative changes indicating areas of aged population loss.
The present distribution of cohorts approaching retirement age is another indicator of potential change that has been used for the Melbourne metropolitan area (Howe, 1978). Comparison of the distribution of the population aged 55-65 years in 1976 to the 65 years and over population indicated relative little change, the main shift being the extension of LGAs with the highest proportions of aged population from the established eastern and southern suburbs to the band of northern and western suburbs adjacent to the inner areas. Comparison with the map of the proportion aged 65 years and over in 1981 (Map 1.2) confirms this outcome.

The maps presented in the Atlas show changes between the 1971 and 1981 Census in the metropolitan Melbourne and rural Victoria. Some of the processes underlying losses and gains can be inferred, such as out-migration from rural areas and relocation to provincial centres. The pattern of ageing in situ in the metropolitan areas has produced varying outcomes, depending on the size of the emergent aged cohorts compared to the very oldest and the rate of attrition due to death.

Mapping of future changes is more complex. Again, Hugo and others have prepared detailed projections for total populations in South Australia that provide a methodology for similar analyses in other states (Hugo, Rudd and Cooper, 1981). The preferred cohort-component method requires data on fertility, mortality and migration. Estimation of changes in aged population depends on having mortality rates to apply to younger cohorts, and the lack of such data at the LGA level, together with the lack of suitable measures of migration, precluded the preparation of a map of projected changes in aged population. Earlier age-sex specific mortality data examined by Howe (1981) and the analyses of aged migration noted above demonstrate considerable local and regional variation which would be negated in the application of generalised mortality and migration rates, obscuring the very differences of interest.

From these accounts of the demography of ageing and given the constraints of data availability, four aspects have been selected for mapping:

1. the relative concentration of aged population within local areas: the proportion of each LGA population aged 65 years and over.
2. share of total aged population: the absolute concentration of aged population, shown by grouping LGAs by size of aged population, into four categories each accounting for 25 per cent of the total aged population.
3. relative and absolute concentrations of the aged: this bi-variate maps shows four categories of areas with high or low absolute numbers and concentrations of aged population, based on cross-classification of the preceding two variables.
4. change in aged population: increase or decrease in aged population between 1971 and 1981.

Ageing in metropolitan and non-metropolitan Victoria

Summary demographic statistics for the metropolitan and non-metropolitan areas are set out in Table 1. The metropolitan area is taken as the Melbourne Statistical Division, with non-metropolitan Victoria comprising the rest of the state. At the 1981 Census, the population aged 65 years and over was 374,256, and accounted for 9.8 per cent of the total state population. This proportion increased from 9 per cent in 1971, with ageing of the population being due to the rate of increase in the number of aged people, 26.9 per cent over the decade, being well ahead of the growth of 9 per cent in the total population.
Although over two-thirds of the aged reside in the metropolitan area, non-metropolitan Victoria is older, with 10.4 per cent of the population aged 65 years and over, compared to 9.4 per cent in the metropolitan area. This relativity remained stable over the decade however. It should also be noted that insofar as out-migration to northern states has reduced the size of the aged population of Victoria, the ageing of the state's population has been suppressed, and the effect of continuing long-distance retirement migration will be a factor affecting future trends.

Separate maps are presented for the metropolitan and non-metropolitan areas. Where appropriate, the same class bounds have been used for mapping, and where distributions have a similar mean and range, classes based on the mean, standard deviation and minimum and maximum values are similar. In some cases however, distributions vary markedly, hence class bounds are different.

### Table 1: Aged and Total Population of Victoria, 1981

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<tr>
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<tbody>
<tr>
<td>Number 65+, 1981</td>
<td>257875</td>
<td>116381</td>
<td>374256</td>
</tr>
<tr>
<td>Total, 1981</td>
<td>272281</td>
<td>1109626</td>
<td>3832443</td>
</tr>
<tr>
<td>Per cent aged, 1981</td>
<td>9.4</td>
<td>10.4</td>
<td>9.8</td>
</tr>
<tr>
<td>Share of State aged</td>
<td>68.9</td>
<td>31.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Share of State total</td>
<td>71.0</td>
<td>29.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Inc. 65+, 1971-81</td>
<td>25.0</td>
<td>31.0</td>
<td>26.9</td>
</tr>
<tr>
<td>Inc. total, 1971-81</td>
<td>8.8</td>
<td>11.0</td>
<td>9.0</td>
</tr>
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</table>

**Socio-economic attributes of the aged population**

The socio-economic differentiation of the aged population has been made increasingly apparent through studies of the family status, housing and workforce participation of the elderly. Unlike the demographic analyses of ageing, these studies have given little attention to the spatial dimension of social variation in these studies. They nonetheless provide a sound basis for the selection of variables for mapping to illustrate key social characteristics. Variables that have been widely used in other social atlases and in the development of social indicators for the total population usually include measures of family structure or living arrangements, housing status, income level, workforce status, ethnicity and health status. The Census provides a wide range of data on relevant variables, and items can be readily extracted for the population aged 65 years and over at the LGA level.

**Living arrangements**

Living arrangements of the aged are a key indicator of likely levels of need for and sources of support and assistance in the event of the onset of disability. A comprehensive account of these associations is provided in the report of the ANU Ageing and the Family Project, Health, Welfare and Family in Later Life (Kendig et al, 1983: 120-124). The survey carried out in the project focused on the aged living in the community in private households, and the analysis of living arrangements found that some 25 per cent of respondents lived alone, 45 per cent lived with spouse only, and the remainder lived with spouse and/or others, most often daughters.

Each of the principle correlates of advanced age (75+), being female, being never married or widowed, and being disabled could be considered for mapping.
social characteristics of the aged as all were found to be associated with consistent variations in need for and receipt of assistance in household tasks and personal care. While around two-thirds of the aged received assistance with household tasks, about 12 per cent were helped with personal care. Co-residence was identified as the crucial factor in the provision of daily assistance in personal care, with family carers being responsible for a much greater share of such assistance than were formal community services. It was concluded that few highly dependent elderly were able to remain in the community living alone. Living arrangements provide a summary indicator of these associations, and given equivalent need for support, the variable that most clearly differentiates the likelihood of receiving assistance sufficient for continued living in the community is living with others. Living alone thus not only is an indicator of the family status of the aged, but also serves as a surrogate measure of need for community services.

Housing status

A further important aspect of the capacity to remain in the community even with the onset of dependency in old age is housing tenure. A pre-requisite for home care, whether provided by family or formal services, is the availability of secure and suitable accommodation. Around 75 per cent of aged Australians are owner-occupiers or purchasers, the exact figure varying somewhat depending on whether the unit of measurement is the individual or households headed by an aged person.

It should be noted here that home-ownership encompasses a very broad range of housing type, condition and value. Two extreme examples illustrate. "Home" for a retired company director may be a recently and luxuriously refurbished mansion in Toorak worth a million dollars or more. For a working class widow it may be a weatherboard cottage in what is euphemistically described in real estate parlance as "original condition"; if in a declining industrialised suburb, the value of the property might be only $50,000. This diversity within the owner-occupier category is probably much greater than within the rental category; public rental housing for the aged is relatively standardised, and private rental housing affordable by the aged is likely to be concentrated at the lower end of the market. Insofar as housing condition shapes the immediate living environment of the elderly, it is an important characteristic in relation to need for home modification and maintenance services, but it is a difficult attribute to assess, with the elderly themselves usually rating their housing as being in better condition than observers using objective criteria.

Housing tenure also indicates various elements of economic well-being, as an indicator of housing cost and asset wealth. Kendig (1984) has demonstrated very clearly that home-ownership is a fundamental factor underlying economic inequity among the elderly, being the culmination of life-long opportunities that result in financial security or insecurity in old age. He further shows that these inequities have been compounded rather than alleviated by public housing and pension policies. Thus, it can be suggested that notwithstanding the diversity of property owned as noted above, the relationship of the aged home-owner to that property is fundamentally different to that of the renter and his or her housing.

The socio-economic differences between owner-occupiers and renters take on a spatial dimension through the operation of the property market. As long term owners of housing in well established suburbs, many elderly owners are located in areas of high property values.
Within the rental market, the elderly are restricted to lower cost housing because of their limited incomes, resulting in further spatial differentiation. Low income also determines eligibility for public housing, and to the extent that the location of public housing is similarly shaped by property values, the distribution of aged tenants in public sector accommodation is likely to be similar to that of private tenants, with both varying from the distribution of owner-occupiers. Nature of occupancy, as home owner or renter, rather than public sector housing is thus the key variable that provides the most informative indicator of housing status. This variable is accordingly mapped as the proportion of aged population whose nature of occupancy is owner or purchaser, the inverse showing the distribution of renters and those with other occupancy arrangements.

**Income level**

A general correspondence between the distribution of poverty in Australian metropolitan areas and concentration of aged population has been demonstrated by Manning (1976). Pensioner status in terms of receipt of the Age Pension is not however a useful measure of economic well-being for two reasons. First, eligibility for the Age Pension extends over a wide range of incomes; as of late 1987, full pension entitlement for a single aged person extends to incomes of $40 a week, with part pension cutting out at $272 a week. Second, other pension eligibility criteria mean that some low income aged are among those excluded as well as those excluded on income and assets grounds. In particular, the residence qualification excludes some low income recently arrived migrant elderly. The more useful measure is a specific dollar income, set here as $77 per week, this figure being marginally above the Age Pension as at mid-1981. The proportion of aged population with weekly income below this figure thus defines those with incomes just above and below Age Pension level. Insofar as home-ownership provides a measure of asset wealth, the relationship between income and assets can be shown on a bi-variate map of nature of occupancy and income level.

**Workforce status**

Workforce status of the elderly population has been an area of marked dynamism in recent years. Whereas some 78 per cent of men aged 65 and over were retired in 1972, by 1982 the figure had risen to 91 per cent; for men aged 60 to 64, the figures at the same dates were 23 and 52 per cent respectively (Bureau of Labour Market Research, 1983).

A number of different forces affect different groups of older workers. Whereas the spread of early retirement in the 1970s was seen as voluntary retirement largely associated with increasing access to occupational superannuation and the ageing of the cohort of veterans who were eligible for pensions at age 60, more recent economic recession has affected older workers in manufacturing industry and forced many into early retirement as an alternative to unemployment (Howe and Manning, 1983).

That the effects of these different forces have been felt unevenly in different parts of the country is evidenced in a recent study of the situation of older workers in the Illawarra region, an area of major industrial activity in NSW. Recession in mining and in the steel industry and associated manufacturing had a greater impact on older workers than other age groups and lead to levels of unemployment among this group above the national average (Johnstone, 1986).

As the changes in workforce status are most evident in the pre-retirement age group, and more so for men than
women, the key variable selected for mapping is the proportion of men aged 60-69 who are retired from the workforce, following the Census definition of retired on the basis of self reporting of working hours. Interpretation of the association of the observed levels of retirement with the various forces outlined above is assisted by relating this variable to income level, and a bi-variate map is presented for this purpose.

Ethnicity

Another major change in the composition of the aged population is the increasing representation of migrants from non-English speaking backgrounds, here referred to as the ethnic aged. In 1981, 11 per cent of the population aged 60 years and over were born in non-English speaking countries, and this is projected to increase to 22 per cent by 2001 (AIMA, 1986:5).

The distribution of the total ethnic population has been found to differ from the Australian born population, with varying degrees of concentration and dispersal found between one ethnic group and another (Burnley, 1985). While reflecting these general patterns, it can be expected that some particular factors will affect the distribution of the ethnic aged compared to younger populations of the same ethnic background. On the one hand, to the extent that the same generational differences in residential mobility found for the Australian population apply to ethnic groups, some separation may be expected between concentrations of the ethnic aged and dispersal of subsequent generations. On the other hand, this may be countered by higher co-residence of the ethnic aged with younger family members; data on living arrangements of the ethnic aged show that just on half live with their spouse and/or others compared to one-third of the Australian born (AIMA, 1986:19).

Health status and disability

Many aspects of health status of the elderly could usefully be mapped to show the epidemiology of acute illness, chronic health problems and disability among the aged, using both mortality and morbidity data. Geographic variations in age, sex and cause specific mortality rates have been well documented and such data can be seen as providing a summary indicator of variation in the health status of the aged population. In a study of cancer deaths in New Zealand, for example, the mapping of age-specific death rates for various cancers showed significant variations, and correlations with a number of physical and social variables were then examined to establish relationships with possible geogens (Kendrick, 1980).

Morbidity data are however more useful than mortality data for demonstrating the health status of the aged because the major part of morbidity and disability is due to non-fatal illnesses. A further distinction can be drawn between measuring morbidity by the presence or absence of clinical pathologies such as in data showing the prevalence of certain conditions, and measures of functional capacity that show the consequences of illness in terms of disability and handicap in activities of daily living.

Despite the concentration of chronic illnesses among the aged, and the increasing significance of these illnesses on the demand for health care, there has been remarkably little epidemiological research into this area. While data on age-specific prevalence rates for the major illnesses of old age could be extracted from the 1987 Australian Health Survey (ABS, 1981), this information is available only for highly aggregated geographic units.
There has been considerable improvement in the amount and quality of data available on disability in the last few years, notably through the 1981 Handicapped Persons' Survey (ABS, 1981). While analysis of these data has demonstrated that there appears to be no real variation between the states in age-specific rates of handicap among the aged population (Howe and Preston, 1985), this aggregate scale may disguise variations between local populations. Far more detailed data would be required for analysis at the LGA level.

That there is marked spatial variation in the health status of the aged population is shown by McCracken's analysis of age specific mortality rates by LGA for the Sydney metropolitan area. When these rates were compared to state average rates, significant variations were found for numerous LGAs both for the aggregate 65 years and over rate and for separate age groups; in some cases, the latter variations were masked in the aggregate data, reinforcing the need to use disaggregated data for a variable that is highly age related and hence affected by the local age structure.

Unfortunately, current detailed mortality data could not be obtained for Victoria. Had such data been available, comparison with earlier data would make it possible to determine whether the recent marked declines in overall mortality at older ages in Australia have occurred evenly across the population, or whether some groups have gained more than others. Areas that were found to have experienced less improvement in mortality than others might be identified as target areas for health care services, with analysis of possible geogens pointing to the need for preventative as well as treatment services.

**SERVICE PROVISION AND USE**

The two groups of services for the aged to be described in the Atlas, residential care services and community care services, present different sets of problems in regard to the selection of data and methods of mapping. These issues arise as much from aspects of program structure and administration as from the nature of the services themselves. A key element in program operation that affects variability of outcomes between geographic areas is whether resources are distributed between areas according to any guidelines for provision in relation to population or in response to submissions that depend on local initiative. Spatial variations also reflect the influence of mediating factors such as economies of scale, management practices and delivery strategies, the use of volunteers and other supplementation, on the service outcomes resulting from given resource inputs. These factors are of particular relevance in selecting measures of program operation, as input and outcome measures may give different accounts. The variables selected for mapping are also constrained by the kinds of data collected for program development and monitoring.

**Residential care**

Nursing homes and hostels are the two forms of residential care subsidised by the Commonwealth Government, and the allocation of resources to both has increasingly been directed by standards expressed as a number of places per 1000 target population in a defined region. Refinement of these ratios from fairly arbitrary figures based on averages of existing provision to normative standards based on estimates of dependency rates in the aged population has been a feature of the development of residential care programs. This progress is covered in the recent
In 1972 a ratio of 50 beds per 1000 population aged 65 years and over was introduced as a means of controlling the growth of nursing home provision, with no additional approvals being granted in areas with provision in excess of this level, other than in exceptional circumstances, such as provision for a particular ethnic group. In recognition that most nursing home patients were of more advanced age, the relevant base population was subsequently raised to age 70 years and over; recalculation on this population base yielded a ratio of existing provision of 80 beds per 1000/70+, which was then adopted for planning purposes.

Further consideration of levels of dependency in the aged population, rates of admission of various dependency groups and the level of nursing care to be provided has lead to major restructuring of the nursing home program. The ratio is now set at 40 beds per 1000 population aged 70 and over, this provision being deemed adequate for the number of highly dependent persons requiring extensive nursing care in an institutional setting (CDCS, 1986a).

At the national level, the total ratio of nursing home beds and hostel places was 100 per 1000/70+, as at 1986, and having determined the level of nursing home provision at 40 beds per 1000, the balance of 60 beds per 1000 has been assigned to hostel places. This ratio is based less on estimates of need for such care than being a means of changing the balance of nursing home and hostel places. It is planned that hostels will increasingly care for mildly to moderately dependent elderly some of who previously would have received ordinary level care in nursing homes. In most areas any additional residential care provision will be in the form of hostel places, and where nursing home provision is in excess of the new ratio, restructuring will be brought about by funding some beds as hostel places.

The Nursing Homes and Hostels Review makes a number of observations on geographic variations in residential care provision. Overall, major discrepancies are seen to be due to very high provision in a number of regions, notably in metropolitan areas, rather than gross underprovision. With particular reference to Victoria, regional variation in nursing home provision is less than in other states, in part because of the lower provision, the ratio being 55.3 beds per 1000/70+ in 1985. The range in Victoria is mostly between 45 to 55 beds per 1000/70+, compared to anything from 50 to 120 beds in the other states. Hostel provision is less variable overall, and somewhat more favourable in rural areas. Victoria again has lower provision than other states, there being only 27.8 hostel places per 1000/70+ in 1985.

Provision of nursing home and hostel places is mapped as ratios per 1000/70+. Detailed data are available from the close Commonwealth involvement and centralised administration of the programs. The spatial units by which approvals are granted are sub-regions of Health Districts, that is, groupings of LGAs to achieve a more standard minimum population, as defined by the Health Department of Victoria, and provision is mapped accordingly.

Despite the differences in their substantive basis, both the planning ratios provide useful normative standards for examining the provision of residential care. In using the set ratios as class bounds, it should be noted that in the case of hostels, so few regions reach the set level that the maps depict the
relative degree of underprovision rather than a wider range of provision. A bi-variate map of nursing home beds and hostel places indicates both the level of additional provision and changes in balance between types of provision that can be expected as restructuring proceeds.

It needs to be emphasised that the mapping of provision of residential care does not equate fully with utilisation at the same scale given that there will be a degree of inter-regional movement. Whether a very high degree of regional self-containment is either practically feasible or theoretically justifiable is doubtful; recognition of residents preferences for facilities close to their own neighbourhoods and relatives must allow proximity rather than administrative boundaries to guide location choices, and inter-regional moves may well represent shorter moves than some intra-regional moves, given the size of the regions. Whether such movement to gain access to facilities overcomes or compounds inequities in provision can only be determined by analysing utilisation data on resident origins, but such data are not currently available on a routine and comprehensive basis.

Community care services

Until the emergence of the Home and Community Care Program, Commonwealth involvement in community care services was primarily through contributing matching funding to the states, with little direction of the distribution of resources on a regional basis or through specification of target groups. Marked variation in the level of provision from one local area to another has been found to be a feature of community services provision in Victoria, deriving in part from the organisation of service delivery. Earlier analyses have found considerable variation for services delivered by Local Government Authorities, which vary in their propensity to participate in state and Commonwealth programs, with less variation evident for services delivered through agencies that operate at a wider scale and so have wider scope for redistribution between local areas. Meals on wheels and home help, provided through Local Government, show this contrast compared to domiciliary nursing which is delivered through a metropolitan wide agency (Howe, 1981b).

There have recently been moves towards establishing needs based planning as the basis for resource allocation and for program evaluation. However, no ratios for provision have yet been set for community care services, such as the number of domiciliary nurses or home help staff per 1000 aged population. In the absence of standard ratios, the use of average levels of provision can serve as a comparative standard for determining the extent of variability of provision and of relative under and over provision and so identify priority areas for potential redistribution of resources when need levels are taken into account. Ratios of provision of meals on wheels and domiciliary nursing have been calculated as the numbers of recipients per 1000/70+ by LGA, with home help provision mapped in terms of expenditure per capita 70+.

The services for which data are presented here represent the basic components of community care, and could usefully be expanded to take into account the growing array of services. A hypothesis that might well be tested is that there will be a direct relationship between the adequacy of basic services and further service development; that is, areas with more adequate provision of basic services might be expected to have developed further services, such as day care, home maintenance and modification, transport and
recreation services, whereas areas lacking in even basic services might not have the capacity to instigate alternative services.

INTERPRETATION AND APPLICATION

The remaining issue to be addressed in introducing the Electronic Social Atlas is how it can be applied in areas of program development and evaluation. Four prerequisites for the evaluation of health and welfare programs have been noted, and the Atlas is seen as making a contribution to each of these areas. The four requirements are: a statement of need, the formulation of goals, the setting of criteria or standards of evaluating progress towards these goals and the development of a database to provide measures of need and program outcomes (Baume, 1979: 5-6).

Statement of need

The statement of need for aged care services can be taken most simply as the distribution of aged population; changes in population distribution point to areas where likely future increases or decreases in provision could occur. More complex need indicators are provided by the mapping of socio-economic characteristics. The statement of need required for evaluation thus has to take into account relevant socio-economic variables which, in addition to being descriptors of the aged population, lend themselves to interpretation as social indicators. Lee has canvassed the use of such indicators as a statistical basis for needs based planning, to be complemented by consultative approaches. Applied in this way, following the definition of a social indicator set out by the US Department of Health, Education and Welfare, social indicators are statistics "of direct normative interest which facilitates concise, comprehensive and balanced judgements about the conditions of major aspects of a society. It is in all cases a direct measure of welfare and is subject to the interpretation that, if it changes in the 'right' direction while other things remain equal, things have got better, or people are 'better off'." (Lee, 1986). An example relevant to the aged population would be a decrease in the proportion of aged persons in private rental accommodation, which could indicate not only a change in occupancy status but also point to possible reductions in the cost of housing and greater security of tenure; it might also be relevant to ask whether the change had come about from increased home-ownership with successive cohorts of aged population, or from improved access of elderly people to general public housing programs, or the impact of housing programs targetted specifically on the aged.

The mapping of social characteristics relevant to determining need for assistance is able to demonstrate both normative and comparative need, as distinguished by Bradshaw (1972). Normative need can be defined by setting a standard below which need is recognised to exist. For example, a normative standard for income can be set as an amount adequate to meet the cost of living, taking into account household composition, as in the definition of poverty lines. All those falling below this standard are then recognised as being in need of income support. The income represented by the Age Pension can be taken as a normative standard in that it is set at a level that is seen to provide an adequate income. Normative standards of this kind provide a meaningful basis for setting class bounds for mapping variables which can serve as needs indicators in this way.

When normative standards cannot be readily set, relative well-being can be ranked on a comparative basis. For example, to the extent that living alone predisposes aged people to need assistance from formal
services in the event of dependency, the distribution of aged population living alone presents a map of potential need, with areas of high proportions of aged population living alone having greater need for services than those with lower proportions living alone. The maps of socio-economic characteristics in the Atlas thus provide at least a first approximation of patterns of spatial variation in need among the aged.

In addition to depicting need on the basis of single variables, it is possible to develop multi-variate indices of need and categorise areas on the basis of similarity of index values. This approach is demonstrated in an analysis of 12 variables taken as indicators of social, economic and physical risk in the aged population of Melbourne, which yielded a major explanatory factor that could be labelled social risk. Scores on this factor clearly differentiated the inner city LGAs as having populations characterised by highest risk and markedly lower risk levels for almost all other areas, only a small number of LGAs having intermediate levels (Howe, 1981a).

Formulation of goals

Goals for aged care programs have usually been set only in very general terms, but the more explicit statement of goals, against which outcomes or performance can be measured, is a corollary of moves towards needs based planning. Equity goals can be readily expressed in relation to population distribution, and recognising that the distribution of characteristics that predispose the aged to have need of support services may vary from place to place, service provision goals are better specified in relation to some needs based formula rather than by equity in per capita terms alone. Efficiency goals can be prescribed in relation to resource inputs, and take into account aspects of service provision, such as scale of delivery and inter-service substitution, in comparing outcomes. Effectiveness goals are more concerned with the ways in which services are provided and their success in meeting the needs which they are intended to address. While spatial variation in population characteristics and service provision is most clearly relevant to the evaluation of equity goals, it can also be brought to bear on assessment of efficiency and effectiveness of outcomes.

The specification of equity goals separately from effectiveness goals has particular relevance for the distribution of current resources when the total available resources are less than required to meet all needs. Thus equity goals can assist in ensuring the distribution of scarce resources is in accord with some equity principle; whether that principle is to provide most assistance to those judged to be in greatest need, or to ensure that the shortfall in resources does not disadvantage some areas more than others, is a matter for policy decision. Effectiveness goals are rather concerned with specifying the level of resources required to meet need to a predetermined level; again, whether this level is a minimum standard or something more is a policy decision.

The overall aim of the Home and Community Care Program has been stated as the provision of co-ordinated community care services to people of all ages with disabilities, and to their carers, helping them to continue living as independently as possible in the community. Among the priorities to be addressed in the first few years of the program is greater access for the whole target population, requiring in turn an improved geographic spread of services (CDCS, 1986b). It follows that it should be possible to set goals in terms of the level of service provision regarded as an
adequate minimum provision achievable within given resource constraints, the degree of variability of provision that is acceptable in relation to equity considerations and the need for redistribution of resources to achieve this outcome.

The goals of residential care programs also give attention to more equitable geographic distribution of both hostel and nursing home provision and the achievement of a balance between the different forms of residential care (CDCS, 1986a). In the past, it is apparent that the ratio set of 50 beds per 1000 was so high that it brought about shifts only at the margin rather than forcing new facilities to the areas of lowest provision. More significant shifts can be expected in future, with new development restricted to regions with very low provision, and with changes between types of provision occurring in other regions.

Standards and outcome criteria

The evaluation of programs is taken a step further by the definition of standards and outcome criteria, with the specification of program goals in precise terms providing yardsticks against which service provision can be assessed. For example, a program may aim to achieve a goal of providing services to a given number of clients per 1000 population, with this standard being expressed as a ratio; actual provision can then readily be compared to the standard.

In the first instance, population distribution provides a baseline for comparing service provision outcomes on a per capita basis; other things being equal, an equitable outcome could be seen to have been achieved if service provision varies in accordance with population distribution. Where variations from an approximation of per capita distribution is found, questions can be asked as to whether the differences reflect variations in need to which service provision is responding, or whether the difference is due to some other factors affecting the allocation of resources and the organisation and delivery of services.

Following Hughes (1972), these variables represent the structural attributes of need among the aged population, with provision outcomes being attributes of performance of the programs concerned. Where both sets of attributes are spatially variable, observations for areal units can be compared to assess how services are performing in relation to need. With program goals increasingly to be set in terms of responsiveness to need and with reference to specified target groups (CDCS, 1986b), this comparative method provides a useful methodology for evaluation.

The first step in examining service data is to establish the extent of variation that exists in the level of provision for each service and from one service to another. Attempts can then be made to explain the variations found and to evaluate the performance of service programs according to goals that may be concerned with equity, effectiveness or efficiency. Accepting that the full capacity of provision is used, service provision rates can be taken as synonymous with utilisation rates; use is constrained by supply of services on one hand, while on the other there may be an element of supply induced demand.

In areas where the service outcome, measured either as provision or use, appears low relative to need as indicated by socio-economic characteristics, a degree of unmet need may be indicated. In this case, comparative analysis suggests that equity goals may not be achieved. Normative standards can also be applied in this context, taking account of an important proviso noted by Pinch (1980). He argues that where
considerable variation occurs but even the minimum
 provision is at a high absolute level, say well in
 excess of a standard set as adequate, there may be
 less cause for concern on equity grounds than where
 resources are scarce. In the situation of plentiful
 resources, where even the worst-off areas are judged
 to be adequately served, there may be a case for
 redistribution to other kinds of services as much as
 between areas.

Further, allowing that supply can vary independently
of need if resources are not allocated accordingly,
areas of high provision and utilisation may not be
areas of high need. In such a case where variations
in service provision cannot be related to need,
ineffectiveness in reaching target populations may be
indicated. The use of expenditure data in similar
comparative analyses enables examination of the
efficiency of programs in achieving certain levels of
service outcomes in relation to inputs.

Both normative and comparative standards can be used
in this task where program goals are set as ratios of
service provision to aged population or in terms of
needs based formulae, possibly including the speci-
fication of particular target groups. Progress
towards setting such outcome goals has advanced
further in residential care programs in Australia than
for community care services, but with the emphasis now
being given to needs-based planning, some formulae to
guide future resource allocation can be expected. The
maps presented here can give a first indication of the
scale of redistribution that may be likely, and of
priority areas for additional resources. Where ratios
have been used as guidelines for the distribution of
services, they are still quite simple and far from
complex needs based formulae. Their impact on
resource allocation can however be judged in the
variability of provision of these services compared to
those provided through programs with no such guide-
lines.

The distinction between resource allocation and needs
based formulae can be related to the earlier dis-
cussion of equity and effectiveness goals. Most
simply, a resource allocation formula can be used to
determine an equitable distribution of existing
resources, or a level of resources known to be
available, whereas a needs based formula will in-
corporate some consideration of the resources required
to meet needs to a specified level or in a particular
way. The application of resource allocation formulae
can thus be seen as a more immediate practical adjunct
to program budgeting, with the development of needs
based formulae being part of longer term program
evaluation and planning.

The derivation of these formulae is not merely a
technical exercise, but as Eyles (1985) points out in
his analysis of approaches to resource allocation for
hospital services in NSW, a political and bureaucratic
process. It follows that having a formula does not of
itself mean that the desired result will be realised,
with many other factors influencing the distribution
of resources and the outcome achieved through their
use. In the absence of any formula, resource alloc-
at ion will be determined entirely by the interplay of
these other factors, and in the case of community
service programs which have no such guidelines, it has
been suggested above that many of the anomalies
evident in levels of service provision can be attri-
buted to this lack.

Databases

The fourth prerequisite for program evaluation is a
database that will yield the necessary information
about program performance and enable it to be related
to population characteristics. Decisions about the population that is to comprise the denominator in calculating service provision or utilisation ratios require careful consideration of two issues. First, the spatial unit for population data needs to be congruent with the scale of service provision. Thus different spatial units would be used for compiling data on services that serve a neighbourhood or small locality, such as day care centres, than specialist services that may serve a wide region or even a state. In the former case, too large units may obscure significant local variations, while in the latter case, it may be difficult to apportion centralised service provision to small areas.

Secondly, it may be desirable to specify target populations rather than using total populations, particularly where there are grounds for expecting that the characteristics that identify the target population are not evenly spread over the total population. Target populations may also be defined in different ways for different purposes, for example eligibility criteria based on means or disability, or social characteristics such as ethnicity.

In the area of residential care, the changes made in the age base for calculation of nursing home bed provision ratios were based on an improved understanding of the user population, and lead to a refinement of the target population. Bed provision ratios however measure only one aspect of access to residential care, namely the stock of beds. Other measures of the flow of patients take aspects of bed utilisation, such as length of stay, into account, and an index of accessibility has been derived combining the rate of turnover and the level of bed provision (Howe, Phillips and Preston, 1986). The data needed to compile this measure is more complex, and is not readily available at a regional level for Victoria, although partial analysis has shown considerable variation in accessibility calculated in this way, and that a relatively high provision of beds is not accompanied by greater access unless turnover is also high. This measure is of importance for program development, as changes in turnover may be as significant a means of improving access as the provision of more beds.

Databases for community services are only now being established, and three different sources have been drawn on in compiling the Atlas maps. The largest database is that being compiled by the Commonwealth Department of Community Services, which draws on returns provided by Local Government Authorities and other service agencies and central administrative data on home help and meals on wheels, together with data on residential care places. Aged population estimates for 1986 are included in this database and have been used in calculating ratios of service provision to population. Data on combined Commonwealth and state government expenditure on home help was provided by Community Services Victoria, which administers the program, but this data is incomplete insofar as contributions from Local Government are not included. Service data on domiciliary nursing were provided by the Royal District Nursing Service for the Melbourne metropolitan area, but no comparable data could be obtained for non-metropolitan areas.

Several measures of inputs and outcomes of community care have been collected in these various data sets. Input measures include expenditure and staffing, while output measures include the number of users and the amount of service provided. No one single measure is adequate for making comparisons between different services, and an attempt has been made to derive some standardised ratios for mapping. For example, the data available for meals on wheels, the number of
meals delivered per week in each LGA, was converted to a ratio of recipients per 1000 population aged 70 years and over by assuming five meals per week were received on average.

Domiciliary nursing is similarly indicated as a ratio of the number of enrolled clients per 1000 aged population by LGA. Both expenditure data and hours of service provided per quarter were available for home help, but anomalies in the latter figures precluded the calculation of ratios of recipients to population at an assumed level of average provision, hence expenditure per capita population aged 70 years and over has been used instead. Considerable further work is required to develop a database that will provide standardised outcome information.

The experience of selection and manipulation of existing data into forms suitable for mapping has a bearing on the future development of databases. While the expansion of data that may become available through the introduction of computerised record systems in service agencies has the potential to yield a very large database, a balance needs to be struck between the need for more data per se and fuller analysis of selected items. Electronic mapping provides an economical and effective means of analysing and displaying information to demonstrate patterns of need as part of planning exercises, or to show service outcomes which can be evaluated by more complex mapping procedures to show relationships between need and outcomes. Further information gains are likely to come from the development of analyses of more complex relationships within the original data sets than from expansion of those sets alone. Evaluation of the patterns presented in these maps in turn rests on interpretation of the findings in the context of program and policy goals.

Interpreting the maps

The contribution of electronic mapping to the description of spatial variability in the aged population and its applications in program evaluation can be seen to be considerable, but it is beyond the scope of this Atlas to develop these analyses fully, which rather requires use of the LAMM package and the data disc to address particular problems. The brief commentaries that accompanying the maps in the Atlas aim only to describe the main features of the spatial distribution of each variable and to propose some explanations for the patterns found.

Three provisos should be born in mind in interpreting the patterns shown. First, the scale of mapping disguises a degree of internal variation at the LGA level, and even more so for the sub-regions of Health Districts. Second, the use of only four classes presents a very generalised account of variability and tends to highlight contrasts at class bounds in what are mostly continuous distributions. Third, much of the demographic data used in compiling the maps has been taken from the 1981 census and is hence dated; to the extent that subsequent change has reinforced the patterns seen in the 1981 data, the maps provide a first approximation of the current scene and will serve as baselines for comparison with mapping of the 1986 Census data.

The commentaries to the maps attempt to give a systematic account of four aspects of the distributions:

1. the range of values of the variable being mapped and its degree of variability;
2. spatial continuity and discontinuity between areas, noting characteristics of areas of markedly high or low values;
3. any relationships of the pattern of variation to that for other relevant variables, followed up by the presentation of bi-variate maps and references to subsequent maps; and
4. possible explanations for patterns observed, noting questions prompted by associations found or unexplained variations.
2. THE DEVELOPMENT AND APPLICATION OF ELECTRONIC MAPPING

FROM HARDCOPY TO THE ELECTRONIC ATLAS

Since the 1971 Census, over 30 social atlases have been produced within Australia. What most of these social atlases hold in common is their avowed strong applied orientation: viz. to assist planners in service and facility provision; to assist market researchers in targeting areas for particular products; to provide social scientists with sampling frames for field surveys; to devise new political-administrative boundaries etc. The question which now demands an answer is how well does the hardcopy social atlas serve the needs of the contemporary practitioner? Is there any alternative?

The rapid growth in use of microcomputers with colour graphics in the planning and policy departments of the public sector as well as in private sector firms provides the means by which geographic information/spatially-referenced information can be communicated by practitioners to their clients in a radically different form than that available during the 1970s.

That form is the electronic atlas. As embodied and outlined in the present report, there are two necessary components:

1. A hardcopy product - which typically defines the sets of variables and areal units employed in the electronic atlas, performs a first-pass analysis and commentary (including bibliography) on selected segments of the data set, possibly suggests paths for subsequent analysis by prospective end-users and provides reference material for the associated software and data, and

2. an electronic product - comprising files of statistical and boundary data on microcomputer disk and microcomputer package for colour mapping (including user's manual).

Indeed, the concern is as much with process as it is with product. The electronic atlas facilitates interaction between the database and the practitioner in the technical mapping process (e.g. application of different classificatory schemes to the one variable). It facilitates (but does not necessarily enforce) discourse between different parties in the planning process e.g. private sector planner, commercial-industrial firm, public sector planner, local residents etc. (see Newton, 1986). It facilitates examination of the dynamics of a particular spatial system - i.e. the pattern (and to a lesser extent process) of change associated with a particular variable, by virtue of being able to access a database comprising a temporal as well as spatial dimension (e.g. area population over time). The electronic atlas also facilitates the teaching process. In their recent review of Australian social atlases, Faulkner and Woolmington (1985: 135) remark that "It is essential that we go beyond simply illustrating what this new (computer graphics) technology can produce, and demonstrate to the students how they can apply it themselves. This may be achieved by designing user-friendly packages which would enable students to produce similar maps themselves". The technology was and is in place (Newton and Crawford, 1985, 1986).
Electronical atlases comprise two principal components: a database (containing boundary and attribute files) and computer software. A full technical discussion of both, in the context of the CSIRO microcomputer colour mapping package LAMM, can be found in Crawford and Newton (1985). A brief outline is detailed below:

1. Database

The LAMM package requires two files as input - one containing the digital area outlines, and the second containing the data relating to those areas.

Digitised boundaries are introduced into LAMM as an ASCII file containing pairs of X, Y coordinates in sufficient number to describe each polygonal area uniquely. More points implies more detail on the map but may be unnecessary because of the rather low resolution of many microcomputer systems. The program does not impose a rigid format for boundary data but merely requires the provision for each area, of: (i) a unique numeric (or alpha-numeric) identifier; (ii) a point within the closed polygonal area; (iii) the number of X, Y pairs making up the boundary, and (iv) values of those X, Y pairs in succession around the boundary. The number of map areas is not limited as such, but the number of vertices in the boundaries file is limited to 2000 pairs currently. Hence depending on the complexity of the areas, display of up to 500 areas is possible.

The statistical data values, both census and non-census based, are associated with the boundary data through the unique identifier appearing in each boundary file and each related spatial variables file. Some of the hardcopy social atlases include a listing of the data represented in the maps. With electronic atlases this is not a requirement as microcomputer mapping packages such as LAMM provide facility for a screen listing, and subsequent hardcopy if necessary, of any variable within the data file.

The data files being in ASCII form can be handled by most database management software (DBMS) such as dBASE III and LOTUS 1-2-3. Use of DBMS also permits updating, aggregating data and generating indices, percentages, etc. as input files for LAMM. The number of variables in any one LAMM file is limited to 20, but multiple files can be read in (replacing the previous one) for the same map base.

2. The LAMM package

LAMM has been developed at CSIRO by J.R. Crawford and P.W. Newton as a menu-driven microcomputer program for the manipulation and display of spatially referenced data. It is capable of performing in a stand-alone fashion, given "packaged" statistical and boundary files on diskette, or as part of a microcomputer-based geographic information and mapping system as outlined in Newton and Crawford (1986).

LAMM comprises three sub-programs, one relating to univariate display (colour or black and white), another to bi-variate mapping and a third to image restoration.

Univariate sub-program

Upon entering LAMM and requesting access to the univariate option, the user is prompted for various brief responses relating to data filenames, colour palette to be used and for descriptive title information to be displayed. Following user selection of a variable to be displayed, an initial (default) image is obtained with a minimum of user intervention and comprises a histogram and several summary statistics (minimum and maximum values, median, mean
and standard deviation) for use in subsequent cartographic manipulation. An equivalent map and key are also produced and displayed.

The user subsequently has the option of specifying the number of classes to be displayed, of choosing the limits between classes and the colour to be associated with each class, and then the reworked map and its corresponding histogram are displayed, typically within 60 seconds.

Bi-variate sub-program

Bi-variate maps can be produced in a related fashion. Selection of pairs of variables to be mapped generates an initial map with several default classes (depending on the hardware configuration) for each variable, together with related summary statistics. A scatter diagram, correlation coefficient and regression line affords further insight into the pattern of inter-relationship between the variables and the identification of "outliers". In a similar manner to the univariate sub-program, the bi-variate sub-program prompts the user for any desired change in the number of data classes, their corresponding limits, and the colour for each class, then redisplay the modified map and its associated scatter diagram, statistics, etc. Both the univariate and bi-variate sub-programs possess a windowing facility for enlargement of map segments on the screen.

Image restore sub-program

Screen images produced with LAMM may quickly be saved on disk at various stages throughout the program, and later rapidly restored to the screen. This allows the immediate presentation of results, rapid comparison across several map images, or the subsequent printing of the maps.

Screen images can be readily printed or plotted on a variety of output devices through the use of the print (graphics) screen option on most microcomputers. Many printer/plotter manufacturers provide a driver to allow the graphics screen image to be printed, such as IBM PC/AT to IBM graphics or inkjet printers, Tektronix inkjet printers, Itoh or NEC colour printers and Epson black and white dot matrix printers.

ADVANTAGES OF ELECTRONIC ATLASES

Evaluation of existing social atlases by the authors and others (see Adrian, 1985; Forrest and Poulsen, 1986; Faulkner and Woolmington, 1985; Thrift, 1983; and Wadley, 1982 for detailed reviews) indicates several areas where electronic atlases exert a measure of superiority over their hardcopy (only) counterparts:

1. Currency of data

Most hardcopy atlases are somewhat dated by their time of publication. Commonly one finds lags of three years or more for those atlases based on a particular census year. Databases devised to support electronic atlases and under "management" of commercial database management packages such as dBASE III are typically designed to accommodate the entry of new data at any time and the manipulation of the full array of variables to generate "new" or composite measures (see Newton and Crawford, 1986). Research and policy applications demand such flexibility.

2. Relevance of data

With hardcopy atlases, the selection of mapped variables is limited and not under the control of the end user. The 1981 Census generates over 1500 variables from which all hardcopy social atlases
select a small sub-set - typically between 20 to 50; within such small sub-sets there is also imbalance in variables selected (see Adrian, 1985: 18). Rarely, if ever, would such a limited collection of attributes satisfy the requirements of a particular research project.

Furthermore, the manner in which particular variables have been defined can limit their utility. Using "the aged" as an example, it is apparent that the two Melbourne-based social atlases which utilise 1981 Census data have chosen different definitions. Matwijiw (1986: 2) selected 60+ as the criteria of the aged "because of its increasing importance for retirement and because it is the age at which women become eligible for the pension". For the NATMAP-ABS Atlases the criterion was 65+ (Australia Division of National Mapping et. al., 1984). The problem generated here appears not so much with the existence of different definitions in the hardcopy publications (one can assemble a rationale for each), but rather the problem they present to practitioners in determining the spatial implications, across a metropolitan area for instance, of adopting different threshold measures for "the aged". Direct visual comparison is prevented by the different spatial units and different denominators employed in both atlases.

The maps presented in Figure 1 illustrate differences in spatial configuration for MSD when "the aged" is variously defined as 60+, 65+ and 70+ years.

The electronic atlas, with its potential for accessing a wide array of variables, both census and non-census, and manipulating data, such as by selection of different denominators, choice of number of classes to map, class intervals, etc., prior to display, facilitates direct comparison with published output where necessary and provides the basis for original research and analysis.
FIGURE 1.2: SPATIAL CONFIGURATION WHEN THE AGED IS DEFINED AS 65+ YEARS

FIGURE 1.3: SPATIAL CONFIGURATION WHEN THE AGED IS DEFINED AS 70+ YEARS

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5169
245
Many more maps than are contained in contemporary social atlases can be retained on microfiche (now technologically obsolescent) or on compact disk. The emerging compact disk-ROM facility currently has the capacity to store 550 megabytes of data which translates into some 33,000 maps of the type represented in this report. Clearly an advance over the hardcopy counterpart, and not without some application perhaps in educational institutions, but still lacking in the flexibility sought by planning practitioners as selection of variables and their mode of display remains outside the control of the end user.

The purported move by ABS and the Division of National Mapping towards provision of statistical and boundary data, respectively, in a medium suitable for microcomputers will strengthen the diffusion of the electronic atlas to a wider and less computer literate audience.

3. Relevance of spatial units

The hardcopy social atlases produced to date are almost universally restricted to one particular type of areal unit: either census subdivisions, suburbs, local government areas or most commonly census districts. An exception is the Parkes and Young (1984) Atlas which presents data at three different spatial scales, although there is a trade-off in terms of the relatively restricted selection of variables mapped.

During the stage at which boundary digitisation is undertaken, as well as identifying the different spatial scales which are to be accommodated, consideration should also be given to treatment of vacant urban and farming areas. In some atlases, such as the present, the administrative boundaries are employed; in others (e.g. Australia, Division of National Mapping et. al., 1984) non-residential and farmland is omitted.

Research problems will always dictate the spatial resolution at which data is required to be assembled, analysed and displayed. Practitioners require the flexibility to assemble and display data at the appropriate scale and the electronic atlas provides such flexibility. Typically, purpose-specific databases are established for manipulation and mapping with the principal constraints relating to the resolution afforded by microcomputer graphics (the current study employs enhanced graphics with a resolution of 640 x 400 pixels) and the ease with which data can be assembled for a particular level of spatial unit.

LGA-level data was assembled for the present report since it provided access to a significant body of health and community services information assembled at that scale. Given availability of data, however, mapping can be undertaken at intramunicipal level; Figure 2 reveals the distribution of population aged 65+ years within the LGA of Coburg.

4. Data metrics

A variety of measurement scales have been employed to represent the data presented in the hardcopy social atlases published to date. In the 1981 NATMAP Atlases, density measures are employed for a significant number of the demographic variables; for example, number of German born persons per square kilometre; elsewhere in the Atlas there are relative measures, that is, percentages based on sub-area totals. Houghton's (1979) Atlas employs a variant of the relative measure; an index of concentration depicting a sub-area's share of the total metropolitan "population" on a given attribute. Yet others (e.g. Poulsen and Spearrit, 1981) are based on absolutes.
A range of indicants can be derived for any one variable - as absolutes, percentages, rates per thousand, averages and so on, and in practical planning projects this is frequently necessary. In the present report, for example, it was considered essential for absolute as well as relative measures to be employed in order to take into account the size of the aged population as well as the proportion aged.

5. System of classification

The choice of classification (i.e. number of categories and class intervals) in hardcopy atlases is made external to the end user and in the group of over 30 social atlases published to date a variety of procedures have been employed. These range from "natural breaks" (a subjective procedure employed in the NATMAP series which highlights the fact that, in part, mapping retains a component of art as well as science), to statistically-based equal interval procedures, mean (and s.d.), quartiles, or use of some imposed criteria, relating perhaps to government-based thresholds associated with different levels of budgeting provision. Clearly there is no universal standard which can be recommended or imposed.

Practitioners need to be aware, however, as Wadley (1982: 184) notes that "use of a certain number of categories or system of classifications can force data into particular classes and determine the visual impression". This is clearly evident in the example of the spatial patterning of the population aged over 60 across the Melbourne urban area when mapped according to equal interval, mean and standard deviation, and quartiles, as shown in Figure 3. In particular, and as Adrian (1985: 19) points out, adoption of classes with an equal number of observations, tends to obscure the variation contained in the original data and can be inherently misleading.
FIGURE 3.1: POPULATION AGED 60+ YEARS MAPPED BY EQUAL INTERVALS

FIGURE 3.2: POPULATION AGED 60+ YEARS MAPPED BY MEAN AND STANDARD DEVIATION
In discussing selection of the appropriate number of classes and associated class intervals, Hart (1984: 242) indicates that they must be "... based on extensive experimentation and prolonged immersion in the data." Clearly there needs to be scope for a range of classificatory procedures to be employed. With manual methods of mapping such experimentation is rarely if ever possible. However, microcomputer mapping positively encourages such experimentation and since it takes approximately 1 minute to remap a variable via the electronic atlas route, potential for such manipulation should be an integral part of any spatial analysis exercise.

6. Statistical accompaniments

The amount of manipulation required of a data set in the context of mapping can be reduced with provision of summary graphs and statistics which represent the distribution of data for specific variables (or sets of variables). The LAMM Mapping Package provides such measures as: mean, standard deviation, median, minimum value, maximum value, histogram, and scattergram and correlation coefficient for any selected variable(s) within the database. Such an array of measures is uncommon in hardcopy social atlases.

7. Bi-variate Mapping

Most social atlases are avowedly applied in orientation. The series of NATMAP Atlases based on the 1981 Census are no exception and in relation to discussions on "the aged" (65+) pattern for Melbourne (Australia, Division of National Mapping et. al., 1984: 5) reference is made to the fact that:

"With age the ability to maintain an independent life is also sometimes impaired, necessitating the provision of facilities to care for those unable to look after themselves. With ageing there is
also an increased need for specialised medical and other health care. Each of these factors makes an appreciation of the size and spatial distribution of the aged population very important.

Clearly so, but how useful are such univariate maps (of the distribution of aged) in their hardcopy form (or CD-ROM form for that matter) to the health delivery process? Social services delivery decision-making is better served by a facility which allows cross classification of some target variable (e.g. "the aged" - defined either as 60+, 65+, or 70+) with facility and service measures in order to determine current levels and patterns of provision on an area basis. The microcomputer mapping package, LAMM, possesses a bi-variate mapping option which is illustrated in the body of the report.

8. Colour mapping

Colour graphics is now a standard component in the configuration of microcomputers employed in research, planning and policy settings. Furthermore, enhanced graphics (640 x 400 pixels), now the de facto standard, provides for a level of resolution comparable to that depicted in the top bracket of hardcopy social atlases, and provides an extensive palette of colours (typically of the order of 16, a considerable advance on the two sets of four colours in a 320 x 200 pixel array typical of the IBM PC when released in the early 1980s). This permits, if required, use of different intensities of the one colour to provide a gradation or density pattern; examples are also appearing of procedures capable of representing densities in bi-variate colour mapping (see Eyton, 1984). In the present study we employ the black and white shading option within the LAMM package.

Enquiries

Regarding the LAMM Package, contact:
Dr. Peter Newton
CSIRO
PO, Box 56
Highett, VIC 3190
Telephone 556 2211

The LAMM program currently can execute on IBM PC/XT/AT and PS/2, Olivetti M24, AWA Corona, NEC APC III, Toshiba T1500, Canon A-200; in other words most 16 bit machines supporting a normal colour graphics (CG) card, MSDOS 2.0 or higher, and President Turbo IV advanced BASIC.
PART 2

THE MAPS AND COMMENTARIES
1. AGED POPULATION DISTRIBUTION AND CHANGE:

MELBOURNE METROPOLITAN AREA

MAP 1.1: PROPORTION OF POPULATION AGED 65+ YEARS, 1981

SPATIAL UNITS: Local Government Areas
DATA SOURCE: Census of Population and Housing
DATE: 1981
DATA METRICS: Percentage of total population aged 65+ years
CLASSIFICATION: Four equal class intervals in range from minimum, 2.2%, to maximum, 23.1%; class 2 contains the mean value, 10.3%

The concentration of aged population leads to marked variation in the proportion of population aged 65 years and over between LGAs. This range is from under 5% to almost 25%; that is, in some areas only one person in 20 is elderly, compared to one in four in other areas.

The highest proportions of population aged 65 years and over are found in two parts of the metropolitan area: established eastern and south-eastern suburbs, notably the LGAs of Kew, Caulfield and Brighton, and in the Peninsula shire of Flinders and nearby Phillip Island. Other areas with above average proportions aged are spread around these two core areas. A band of "older" LGAs extends around the north western fringe of the inner suburbs, through the eastern suburbs and taking in the inner suburbs to the south of the City of Melbourne and extending along the bayside. Westernport can be seen as an extension of the Peninsula concentration.

The inner city LGAs have only average proportions of aged population, around 10%. These areas fill in the centre of the ring of older areas and another group of LGAs with average proportions of aged population lie just beyond this ring, and along the bayside, linking the south-eastern suburbs to the Peninsula. The outer rural-urban fringe comprises a third group of LGAs with average levels of aged population.

Very low concentrations of aged population are found in the outer suburbs, with this suburban expanse spreading from the western suburbs across the north of the metropolitan area to the outer eastern and south-eastern areas.

The levels of aged population concentration can be explained by the processes of urban settlement, with the four groups of LGAs identified representing different phases of growth. The highest concentrations occur in areas settled between the wars and arise through ageing in situ, with this processes now becoming evident in suburbs settled in the early post-war years. The other areas of conspicuous ageing are areas of high amenity which have attracted retirees, and some of the rural-urban fringe areas may also have a residual older farming population. The lower proportion of aged population in the inner LGAs is due to the loss of aged population of earlier generations with out-movement of subsequent generations leaving middle-aged groups insufficient for replacement of older cohorts; at the same time, in-movement of younger age groups, including recently arrived overseas migrants, have made the balance of the population structure younger. The outer suburban areas most recently settled by younger age groups maintain their youthful age structure for many years as family formation proceeds, and this rapid growth means that the aged comprise a very small proportion of the total population in these areas.
MAP 1.1: PROPORTION OF POPULATION AGED 65+ YEARS, 1981

Mean 10.3
Std. Dev. 4.9
Minimum 2.1
Maximum 23.1
Median 10.1

No. of areas

50

2.1 7.4 12.6 17.8 23.1

%
This map shows another aspect of the concentration of the aged population of Victoria by mapping four groups of LGAs which each contain one quarter of the state's aged population. The number of metropolitan and rural LGAs in each quartile is detailed below.

The degree of concentration is demonstrated by 25% of the aged population being contained in just 10 LGAs with the largest absolute numbers of aged people. In rank order these are: Camberwell, Caulfield, Moorabbin, Preston, Essendon, Nunawading, St. Kilda, Coburg, Heidelberg and the City of Melbourne. All these have aged populations of more than 7000, up to 15,000 in Camberwell. Another 25% of the aged population is accounted for in a further 15 LGAs, mostly in the established suburbs of Melbourne and on the Peninsula.

All but three of the 25 LGAs which together contain half the state's aged population are in the metropolitan area, the exceptions being the cities of Ballarat and Bendigo, and Geelong. With these 22 metropolitan LGAs containing almost half the state's aged population, the concentration even within the metropolitan area is evident as the total 62 metropolitan LGAs account for just on 70% of the aged population overall.

The third quartile of aged population is contained in 31 LGAs, spread between the metropolitan and rural area, the former being outer suburbs and the latter some of the larger rural LGAs. The remaining 154 LGAs with very small aged populations that make up the final quartile comprise a few outer metropolitan LGAs and all rural LGAs. Given this distribution, no equivalent map is presented for non-metropolitan Victoria.

The dispersion of half of the aged population over a total of 185 out of 210 LGAs in the state stands in marked contrast to the concentration already noted. This uneven spread in the absolute numbers of aged population has a number of implications for service provision. On one hand, coverage of the aged population will be most efficiently achieved by the development of services in the 25 LGAs that contain half the aged population; advantages of scale are likely to be realised and access is also enhanced by spatial proximity. On the other hand, quite different strategies will be needed to cover the remaining half of the aged population, where small local populations limit the scale of provision and dispersion poses problems of access.
This bi-variate map shows the relationship between the proportionate concentration and absolute numbers of aged people in each LGA. The four categories mapped show four types of areas as follow:

Areas with large numbers and above average proportions of aged population: The consolidation of relative concentration and absolute numbers of aged population is evident in two groups of LGAs in the inner south-eastern suburbs, namely Camberwell, St. Kilda, Caulfield, and Moorabbin, and a band extending from the City of Melbourne, through the north-western suburbs of Essendon, Coburg, Preston and Heidelberg. These nine LGAs account for all but one of the 10 LGAs which between them contain 25% of the state's aged population, as shown in Map 1.3.

Areas with large numbers but below average proportions of aged population: Only one LGA comes within this category. This is Nunawading, where rapid urban growth has increased the total population substantially so that notwithstanding the absolute size of the aged population, the proportion aged is below the metropolitan average; the 7894 aged 65+ account for 8.1% of the total.

Areas with small numbers but above average proportions of aged population: Two separate areas are characterised by this relationship, namely, the inner city municipalities and the Peninsula. The latter LGAs have the highest proportions aged of all metropolitan LGAs, but these are derived from relatively small numbers of aged people; for example, the Shire of Flinders had some 5500 aged 65+ years. In the inner city, the proportions aged are somewhat closer to the metropolitan average, and numbers are again small; for example, numbers and proportions of aged population for Collingwood and Richmond are 1421 and 9.4%, and 2518 and 10.3% respectively.

Areas with small numbers and below average proportions of aged population: These are outer metropolitan areas of most recent and youthful settlement where the few aged people make up only small proportions of the total population.

This map presents a useful summary of the distribution of aged population, with the four categories of LGAs describing both absolute and proportionate concentration. The first group are readily identified as prime target areas for services to reach the aged, while the fourth category raises questions about the level of need for and feasibility of providing age-specific services.
### Map 1.3: Absolute and Relative Concentration of Population Aged 65+ Years, 1981

<table>
<thead>
<tr>
<th>Number aged 65+ years</th>
<th>% aged 65+ years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>4246</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>3156</td>
</tr>
<tr>
<td>Minimum</td>
<td>438</td>
</tr>
<tr>
<td>Maximum</td>
<td>15012</td>
</tr>
<tr>
<td>Median</td>
<td>3472</td>
</tr>
</tbody>
</table>

**Legend:**
- 15012
- Number 7120
- 438

- 2.1 10.3 23.1
This map presents a retrospective picture of changes in the distribution of aged population. Overall, the metropolitan aged population increased by 25% over the decade 1971-81, compared to the total population increase of 9%. The pattern of change at the LGA level was very uneven, ranging from declines of up to 30% to increases of 149%.

Two types of LGAs experienced very high growth. Firstly, aged population increased in areas of high overall population growth, and secondly in areas of in-migration of the aged; in the latter areas of retirement settlement, the increase resulted in changes in age structure but this was far less so in the former areas.

Above average growth of aged population occurred in the middle distance suburbs and the rural urban fringe, due largely to ageing in situ of earlier cohorts of settlers, but in some areas of high amenity there was an element of retirement migration. Below average growth of aged population characterised the outer metropolitan areas.

The areas of loss of aged population were inner city and older established areas, including the City of Melbourne, Port Melbourne, Collingwood and Fitzroy, and extending into Hawthorn and Malvern. The scale of loss of population varied, involving small numbers in some cases, for example less than 200 people in the outer area of Bulla, but almost 2000 in others, for example, some 1807 in Hawthorn.

To the extent that the same processes of demographic change have continued to operate, the future pattern of aged population distribution can be interpolated from the past changes. Accordingly, the core of aged population will consolidate in the middle distance suburbs to the north and south east of the city, the inner areas will decline and the outer suburbs will experience only slow proportionate ageing although in some cases having substantial numbers of aged people. The aged populations in areas of retirement migration are likely to grow in size as well as maintaining their high proportionate representation.
MAP 1.4: CHANGE IN POPULATION AGED 65+ YEARS 1971-81

Mean 38.3
Std. Dev. 40.2
Minimum -26.2
Maximum 149.0
Median 35.8

No. of areas

-26.2 0.0 38.3 78.5 149.0
2. SOCIAL CHARACTERISTICS: MELBOURNE METROPOLITAN AREA

MAP 2.1: INCOME LEVEL

SPATIAL UNITS: Local Government Areas
DATA SOURCE: Census of Population and Housing
DATE: 1981
DATA METRICS: Percentage of population aged 65+ years with income less than $77 per week in 1981
CLASSIFICATION: Based on mean, 67.7%, and standard deviation, 8.7%, then minimum and maximum values

Income level of the aged population is mapped in terms of the proportion of the population aged 65 years and over in each LGA with an income of less than $77 per week. The monetary figure of $77 per week defines a category marginally over the pension level, which was just on $66 in 1981.

While the range is from 44% with low incomes in some areas to almost 80% in other areas, most areas fall within the narrower range from 59% to 76%. The areas in the extreme classes reflect concentrations of high and low income aged. The highest proportions of low income aged, the less well off are found in the western suburbs as well as some inner city areas. In these areas over three quarters of the aged have low incomes as defined here. At the other extreme are the LGAs with low proportions of low income aged; around half the aged in these areas have low incomes. These higher income areas include the band of established eastern and south-eastern suburbs, extending around Port Phillip Bay and including the LGA of Mornington.

The remaining LGAs have slightly above or below average proportions of low income aged. Areas which are slightly better off, with less than two thirds of the aged on low incomes, include LGAs in the outer west, north-east and south-eastern regions of Melbourne. Areas which are less well off are located in the north and west of the city as well as the outer eastern suburbs.
MAP 2.1: INCOME LEVEL

<table>
<thead>
<tr>
<th>No. of areas</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>67.7</td>
<td>8.7</td>
<td>44.1</td>
<td>79.9</td>
<td>69.9</td>
</tr>
</tbody>
</table>
MAP 2.2: WORKFORCE STATUS

SPATIAL UNITS: Local Government Areas
DATA SOURCE: Census of Population and Housing
DATE: 1981
DATA METRICS: Percentage of males aged 60-69 years retired in 1981
CLASSIFICATION: Based on mean, 61.1%, and standard deviation, 6.9%, then minimum and maximum values

Workforce status is mapped as the percentage of males aged 60 to 69 years in each LGA who were retired in 1981. By focusing on the age range encompassing early retirement, and excluding those over the age at which almost all are retired, the extent of variation in retirement patterns among different groups of the aged population is enhanced. As can be seen from the histogram, these proportions are normally distributed; two thirds of the LGAs are close to the mean and one third located at the two extremes. It is these areas with very high and very low proportions of retirees that are of interest.

The areas of Melbourne with a low proportion of retired men are mostly located in the eastern and south-eastern areas, in particular Kew and Brighton. Surrounding these areas are those suburbs with slightly below average retirement rates among males aged 60 to 69 years of age.

Very high proportions of retired males can be found in the outer fringe areas of Melbourne; in most of these areas 7 of 10 males aged between 60-69 years are retired. These areas include the traditional retirement communities of Phillip Island, Flinders and Bass. The rural-urban fringe area of Upper Yarra is contiguous with areas of moderately above average levels of retirement, including the outer eastern LGAs of Lillydale, Sherbrooke and Healesville. A band of northern suburbs ranging from Brunswick, Preston and extending out to Diamond Valley also has slightly above average levels of retired males.

It is also important to consider the impact post retirement migration may have on the distribution of retirement in Melbourne. It is possible that people are moving out the middle suburbs on retirement and this attrition may be one explanation for the lower levels of retirement in those areas.
MAP 2.2: WORKFORCE STATUS

Mean 61.1
Std. Dev. 6.7
Minimum 48.5
Maximum 83.6
Median 61.0

%
This bi-variate map shows the relationship between workforce status and income level among the elderly. Four categories of areas are mapped which show the proportion retired among men aged 60 to 69 and the proportion of the aged population with low incomes, defined as less than $77 per week. The four categories are defined on the basis of above and below average levels of retirement for this age group, that is 61%, and above and below average proportions of low income aged, that is 68%. A direct relationship is observed between these characteristics; on one hand, areas with high proportions retired are found to have high proportions on low incomes, while areas with low proportions retired have low proportions with low incomes, that is, continued workforce participation is associated with higher income levels. Further, there are only a small number of LGAs with high proportions retired but low proportions with high incomes, although a larger number show low proportions retired but higher proportions with low incomes. There are clear spatial patterns for each category.

Areas with a high proportion retired and a high proportion with low incomes: The large number of LGAs in this category are widely distributed over the metropolitan area, but some groupings emerge. Most of the inner city LGAs with the exception of the City of Melbourne are in this category, with extensions to the outer western suburbs and the inner northern LGAs.

Areas with below average proportions retired but low proportions on low incomes: These areas show the converse relationship to the previous areas, with higher levels of continuing workforce participation being associated with higher income levels. The majority of LGAs characterised by this pattern are found in a solid band covering the established southern and eastern suburbs, extending from Brighton and Sandringham through Malvern and Kew to the outer north-eastern areas of Doncaster-Templestowe and Eltham. The low levels of retirement may also reflect out-migration of retirees to the higher amenity areas noted above, or even to more distant destinations interstate.

Areas with a high proportion retired but a low proportion with low incomes: These LGAs are mainly in the outer eastern areas of Melbourne, such as Lillydale and Sherbrooke, and the Peninsula LGAs of Mornington and Frankston. It is likely that the above average proportions of retired in these areas are due to in-movement of retirees, but in these cases, they appear to be higher income elderly than in the more distant areas of retirement settlement as noted above.

Areas with a low proportion retired but a high proportion with low incomes: The association of continued workforce participation but low income levels is apparent in the western and northern suburbs and some outer south-eastern areas. These are typically areas of manufacturing workforce and there may be some disguised "retirement" in the form of unemployment among older workers. It appears that although remaining in the workforce, these older workers are receiving lower incomes.
MAP 2.3: WORKFORCE STATUS BY INCOME LEVEL

<table>
<thead>
<tr>
<th>Workforce Status</th>
<th>Income Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>61.1</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>6.7</td>
</tr>
<tr>
<td>Minimum</td>
<td>48.5</td>
</tr>
<tr>
<td>Maximum</td>
<td>83.6</td>
</tr>
<tr>
<td>Median</td>
<td>61.0</td>
</tr>
</tbody>
</table>

83.6
% 61.1

48.5

44.1
% 67.7

79.9
The high rate of home ownership among the elderly is demonstrated by the average proportion of renters by LGA being 28%. In the data presented here, public and private renters are grouped together in a single category. The histogram shows that the distribution of LGAs on this variable is highly skewed; in the majority of LGAs the proportion of renters is below the average and only a few have a very high proportion of renters.

The eight LGAs with more than 40% renters are highly concentrated spatially, clustering in the inner city areas of Melbourne, notably Collingwood, Fitzroy, Prahran, St. Kilda and Richmond. This concentration is a reflection of the large stock of public rental housing in the inner city, much of which is specifically provided for the elderly.

Areas with slightly above average proportions of aged renters include several northern and outer north-eastern areas, while the large number of LGAs with marginally below average proportions encompass most of the metropolitan area.

There are only four areas with less than 17.5% of the aged population living in rented dwellings, and these stand out as areas of exceptionally high home ownership. These are Bulla and Keilor, in the outer north-west, and Doncaster-Templestowe and Waverley to the east.
This map shows the relationship between housing tenure and income level. This is an important relationship to examine in order to identify risk groups within the community. By mapping these two variables four classes are identified:

Areas with high proportions of both renters and those on low incomes: Three clusters of these LGAs can be identified, firstly in the inner city and the inner northern suburbs of Preston and Northcote, secondly the outer southern LGAs of Dandenong, Berwick and Cranbourne, and third the outer north-eastern area of Healesville. The high proportions of low income and renters in the inner city can be closely related to the availability of public housing. In contrast the high proportions of both renters and those on low incomes in the outer areas may be explained by the tendency for retirement villages to locate in these regions.

Areas with a high proportion of renters but a low proportion of persons on low incomes: The small number of LGAs in this category are identifiable as areas of high provision of better quality rental accommodation, with the elderly accounting for a substantial proportion of occupants. These LGAs are located in the inner south-eastern suburbs of Brighton and Caulfield and extend northwards through Kew and Heidelberg to Eltham; the City of Melbourne is also in this group. While having lower proportions of low income aged overall, it is likely that at least some of the renters are in the low income group.

Areas with low proportions of renters but high proportions on low incomes: These LGAs evidence the norm of home-ownership even among the elderly with relatively low incomes. Some of these LGAs are also likely to offer little rental accommodation. These areas encompass all of the western suburbs in an arc from Williamstown, Altona and Werribee to Whittlesea and Broadmeadows. Similar associations are found in the outer eastern LGAs of Croydon, Knox and Upper Yarra.

Areas with a low proportion of renters and a high proportion of persons on above average incomes: This association of home-ownership and higher incomes is typical of the established eastern suburbs such as Camberwell and Doncaster-Templestowe, and is also found in the upper status retirement areas on the Peninsula and the Dandenong hills.

Against the overall background of high levels of home ownership, it is the supply of private and public rental accommodation that affects the spatial pattern of association between renting and income levels. The impact of special retirement housing in retirement villages is less readily discernable; retirement migration occurs across a wide income range and it appears that, if not quite as wide, the retirement village market is pitched at different levels. The scale of provision is as yet not sufficient to be discernable within the overall process of retirement settlement, and as most of this accommodation is occupied on an ownership rather than rental basis, it is again indistinguishable from the general pattern.
### Housing Tenure by Income Level

<table>
<thead>
<tr>
<th>Housing Tenure</th>
<th>Income Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>28.2</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>10.7</td>
</tr>
<tr>
<td>Minimum</td>
<td>13.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>69.9</td>
</tr>
<tr>
<td>Median</td>
<td>25.6</td>
</tr>
</tbody>
</table>

69.9

% 28.2

13.0

44.1 67.7 79.9
The proportion of aged persons who were living alone in 1981 provides a useful summary measure of living arrangements. The average percentage of those aged 65+ years living alone is 24% in Melbourne, and the range here is limited, with only a few areas having fewer than 17% or more than 30% living alone. The areas with a markedly higher than average proportion of the aged living alone tend to be located in the inner city; in these areas approximately one in three persons is living alone. This can be seen to be an effect of the large number of elderly persons residing in public housing, which until recently has been directed towards single persons. Areas with slightly above average proportions of single aged persons are found in the band of established suburbs surrounding Melbourne's inner regions, while areas with marginally below average proportions are found in the outer areas of Melbourne, particularly in the south and east. This pattern stems from the former areas being older than the latter, with more widows whereas other areas are predominantly married couples.

The western and northern suburbs of Melbourne are areas with the lowest proportions of aged living alone. Doncaster/ Templestowe and Waverley stand out as having very low proportions living alone, these areas all have "younger" aged populations and high levels of home ownership.

It is interesting to note that the main retirement LGAs of the Peninsula have below average proportions of elderly living alone. This suggests that there may be a process of return migration to the established or inner areas of the city of the occurrence of widowhood.

High numbers of persons living alone can also be a reflection of the location of public housing. As mentioned earlier this type of housing was originally directed towards, and is still occupied to a large extent, by single aged persons. This would be one explanation of the large percentage of aged persons living alone in the inner areas of Melbourne. However, any tendency for older people to remain in independent households after the death of their spouse could see this pattern change in the future, and lead to increased proportions of single elderly in areas of home ownership.

Living arrangements give a useful approximation of potential need for social support and hence for local community services such as day care.
MAP 2.6: LIVING ARRANGEMENTS

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of areas</td>
<td>Mean</td>
<td>23.7</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td></td>
<td>6.3</td>
</tr>
<tr>
<td>Minimum</td>
<td></td>
<td>9.8</td>
</tr>
<tr>
<td>Maximum</td>
<td></td>
<td>42.0</td>
</tr>
<tr>
<td>Median</td>
<td></td>
<td>23.3</td>
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</tbody>
</table>

The map illustrates the distribution of living arrangements across different areas, with a bar chart showing the number of areas within each range of values.
Recent acceleration in the ageing of Victoria's population is accompanied by growing numbers of aged from non-English speaking countries. While it is estimated that the numbers of Australian-born will rise by a third between 1980 and 1990, the number of the migrant aged will more than double. Certain members of this sub-group may have special needs arising from language difficulties and cultural differences. This map presents the distribution of this group of the aged population.

The distribution of this variable is skewed and shows an uneven geographic spread. Most LGAs have a small proportion born overseas, less than 17% and there is a high degree of spatial concentration of LGAs with high proportion of ethnic aged.

In the areas of high concentration more than one in four aged persons was born in a non-English speaking country. A band of western and northern suburbs can be identified as the areas with the highest concentration of aged migrants, in particular Whittlesea, Broadmeadows, Keilor and Sunshine. Several inner city suburbs also have above average proportions of aged migrants.

Areas with moderately above average aged migrant populations include south-eastern areas such as; Dandenong, Springvale and Waverley, as well as some of the northern suburbs such as Northcote and Preston.

The rest of Melbourne has below average proportions of ethnic aged, with some areas with as little as 5% of their aged population born in a non-English speaking country. The bayside and Peninsula LGAs stand out as having very low proportions of ethnic aged.

The areas of high migrant populations can be explained by the older ethnic population remaining static while the younger populations move out of the area. The high concentration of the ethnic aged in Melbourne is further complicated by the different location patterns of the many ethnic groups. While some, such as the Jewish population from eastern European countries, is highly concentrated, others such as the Dutch elderly are more widely dispersed. The major groups of ethnic aged, the Italian and Greek populations, account for the major concentrations of ethnic aged overall.

Several issues arise as to preferred strategies of providing metropolitan-wide or regional based services for some sub-populations of the ethnic elderly rather than locally based services which may be underutilised in some areas and unable to meet the demand in other areas. However, in areas of the highest ethnic concentrations, where a small number of groups predominate, local services will need to give recognition to their cultural needs.
MAP 2.7: ETHNICITY

Mean: 17.2
Std. Dev.: 9.9
Minimum: 5.0
Maximum: 48.4
Median: 13.5

No. of areas

5.0 7.3 17.2 27.1 48.4
This map shows domiciliary nursing enrolments per 1000 population aged 70+ years of age by Local Government Area. The average is 30 enrolments per 1000, only 3% of the aged population are receiving domiciliary nursing at any one time, but there is a relatively wide level of variation, ranging from no enrolments in some areas to over 80 per 1000 in others.

Domiciliary nursing enrolments are highest in the outer western and northern suburbs, with between 48 and 83 enrolments per 1000. There are several further areas where enrolments are moderately above the average, between 30 and 48 enrolments per 1000; these include the inner northern and western areas, bayside areas and the Peninsula region. All these areas are characterised by lower provision of nursing home beds, as can be seen from map 3.5; it is however likely that the high utilization of domiciliary nursing is associated with other socio-economic characteristics of the population rather than being directly attributable to the lack of nursing homes.

Areas with slightly below average enrolments are located in the inner and outer eastern areas of Melbourne, while the areas with very low enrolments per 1000 population can be identified mainly as the fringe areas of the city. While the latter areas tend to have relatively "young" aged populations and hence possibly a lower need for domiciliary nursing, the situation in the former areas is less readily explained. It can be suggested that higher socio-economic status and more ready access to nursing home beds may combine to reduce need for domiciliary nursing despite them being areas of "old" aged populations.
MAP 3.1: DOMICILIARY NURSING ENROLMENTS

<table>
<thead>
<tr>
<th>No. of areas</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30.0</td>
<td>18.0</td>
<td>0.0</td>
<td>83.0</td>
<td>13.0</td>
</tr>
</tbody>
</table>

Mean 30.0
Std. Dev. 18.0
Minimum 0.0
Maximum 83.0
Median 13.0
MAP 3.2: MEALS ON WHEELS

SPATIAL UNITS: Local Government Areas
DATA SOURCE: Commonwealth Department of Community Services
DATE: 1986
DATA METRICS: Recipients per 1000 aged 70+ years estimated from total number of meals delivered per quarter, assuming five meals per week
CLASSIFICATION: Based on the mean 23/1000, and 0.5 standard deviation, 7, then minimum and maximum values

This map displays the number of regular recipients of meals on wheels. It shows the number of recipients per 1000 population aged 70+ years of age, estimated from the total number of meals delivered in a given quarter, assuming each recipient receives an average of five meals a week. The average number of recipients is low, at 23 per 1000, but again the range is very wide. The distribution over this range is uneven, with a sizable class at the upper range of 30 to 73 per 1000.

Areas with high numbers of regular recipients per 1000 fall into two types of LGAs: the inner areas of Melbourne and several scattered fringe regions. Several other western and northern suburbs also have slightly above average levels of use. Below average levels characterise the eastern and south-eastern regions, notwithstanding them being the main areas of aged population concentration.

Other outer areas have very low numbers using this service. A possible reason for this may be that as these areas are traditional retirement communities, many people still have a spouse capable of preparing meals. There may also be distance constraints on delivery in these fringe areas.

The most striking feature of this map overall is the lack of correspondence of high levels of meals on wheels utilization and the concentration of aged population. Instead the pattern can be related to socio-economic factors and particular Local Government responses in the level of provision made available. This pattern is further broken down by isolated LGAs having levels of utilization markedly different to adjoining areas. For example, Ringwood stands out as a high provision area compared to the surrounding below average areas; Footscray on the other hand has very low provision in a region of otherwise above average provision.
MAP 3.2: MEALS ON WHEELS

- Mean: 23.0
- Std. Dev.: 14.0
- Minimum: 0.0
- Maximum: 73.0
- Median: 20.0

![Map showing the distribution of meals on wheels across different areas.](image-url)
Together with meals on wheels, home help is seen as a basic part of domiciliary support services. Both services enable the more frail or disabled elderly to remain as long as possible in their own homes and communities. This map shows the annual expenditure on home help for the population aged 70 years and over on a per capita basis. The expenditure is from a combination of Commonwealth and State Government subsidies. The average expenditure per capita for Melbourne as a whole is $75, but the distribution is skewed, with a small number of areas having expenditure up to almost $400 per capita.

Areas with above average per capita expenditure are the inner LGAs of Fitzroy and Collingwood on one hand, and on the other the outer western areas and several other outer areas including Eltham, Lillydale, Berwick and Phillip Island. As many of these latter LGAs have small aged populations, it is possible that there is a diseconomy of scale existing in the expenditure on home help services for the aged. In the two inner LGAs, high expenditure is more likely to be due to high levels of service provision.

Areas of lowest per capita expenditure can be identified as the higher socio-economic areas, particularly those in the inner east, notably Camberwell, Hawthorn and Kew, and in the south, Brighton and Sandringham.

The inverse relationship between socio-economic status and level of expenditure is further seen in the areas with expenditure marginally below the average generally being in lower socio-economic status areas in the western suburbs and outer south-east areas.

There is a general relationship between levels of meals on wheels utilization and expenditure on home help and socio-economic status of LGAs that suggests that not only do areas with higher proportions of low income elderly have a greater need for these basic services, but that Local Governments have responded accordingly. The lower levels of service provision in the higher socio-economic status areas of the established eastern and inner southern LGAs reinforce this interpretation. These patterns demonstrate the need to examine the social characteristics of the aged population rather than simply taking demographic concentration as an indicator of service need.
MAP 3.3: HOME HELP EXPENDITURE

<table>
<thead>
<tr>
<th>No. of areas</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>75.0</td>
<td>52.0</td>
<td>21.0</td>
<td>390.0</td>
<td>63.0</td>
</tr>
</tbody>
</table>

No. of areas

21.0 49.0 75.0 101.0 390.0
$ per capita/70+
The provision of hostel places is mapped according to the sub-regions of Victorian Health Districts, which have recently been adopted for approving the development of further hostel provision. The planning ratio set for hostels is a maximum of 60 beds per 1000 population aged 70 years and over, and class limits have been set in relation to this. Hostel and population data are for 1986.

As provision is below the 60 beds per 1000 ratio in all sub-regions of the metropolitan area, the map shows the degree of relative underprovision. With the average provision being 30 beds per 1000, those sub-regions with between 30 and 60 beds per 1000 can be seen as having at least a moderate provision compared to those areas with less than 30 beds.

The areas which have at least 45 beds per 1000, that is within 75% of the ratio, extend in a broken band from the central city to the outer eastern suburbs. Among the LGAs reaching this level are the established areas of Camberwell and Kew, but also some outer areas such as Knox and Sherbrooke. Sub-regions with between 50 and 75% of the ratio level fill in between these areas and also include sub-regions in the south western suburbs and outer north eastern metropolitan area. This contiguity of provision is however broken by the sub-regions with the lowest provision, including the LGAs of Doncaster, Ringwood and Croydon. The remaining areas, which include some inner LGAs such as South Melbourne and St. Kilda as well as the Peninsula LGAs, have less than half the ratio level, that is, between 15 and 30 places per 1000.

The distribution of hostel places bears little relationship to the distribution of aged population, with the absolute size of aged population being the relevant consideration in determining the number of additional places required to bring provision closer to an adequate level, say 45 places per 1000. While some of the LGAs with both large numbers and high proportionate concentrations of aged population have provision of over 30 places per 1000, many other areas of potentially high demand have lower provision. Cross reference to Map 1.3 identifies the inner northern LGAs and middle distance LGAs such as Waverley and Moorabbin as priority areas for future development. The sub-region of lowest provision noted above is also conspicuous in this regard as it contains LGAs with large numbers of aged people. The scale of additional provision required to bring many of the outer areas up to an adequate level is much less due to the smaller aged populations there. For example, on the basis of 1986 population 70+ years, it is estimated that a further 133 places would be needed in Doncaster-Templestowe compared to 45 in Melton to achieve provision of 45 places per 1000.

To the extent that home-ownership and socio-economic level are likely to affect the need for hostel places, comparison with Map 2.5 is of value, and in particular reinforces the interpretation that comparative need is greatest in the inner northern LGAs, notably Brunswick, Northcote and Preston.
MAP 3.4: HOSTEL PLACES

Mean 30.0
Std. Dev. 11.0
Minimum 0.0
Maximum 53.0
Median 28.0

No. of areas

0.0 15.0 30.0 45.0 53.0
per 1000/70+
The provision of nursing home beds is mapped with reference to the planning ratio of 40 beds per 1000 population aged 70+ years and over at 1986, for sub-regions of Victorian Health Districts.

The average provision is 52 beds per 1000; as this figure is well above the set maximum ratio, the map can be taken as showing the pattern of relative over-provision. More than half the sub-regions have provision above the planning ratio, and a number have almost twice this level. The sub-regions in the class with between 36 and 52 beds per 1000 approximate the ratio and so can be seen as having adequate provision. At the other extreme, some sub-regions of low provision are as much as 40% below the ratio.

The spatial pattern of provision is discontinuous and uneven in relation to the concentration of aged population. The band of very high provision to the east and south of the city includes the LGAs of Kew, Camberwell, Hawthorn and Caulfield and extends to the bayside LGAs of Brighton and Sandringham; these are all areas of aged population concentration. The outer eastern extension of high provision however covers LGAs with smaller local aged populations, but the location of these areas means there is likely to be little in-movement of nursing home patients from other areas of lower provision. Other areas of above average provision fill in between the high provision sub-regions for most of the eastern and southern suburbs, and elsewhere include the inner LGAs with the exception of the City of Melbourne, extending across the south-western LGAs. The difference between these areas is that the former involve large absolute numbers of beds, whereas in the latter, high ratios are achieved with fewer beds because of smaller aged populations. Most of the remaining areas approximate the ratio.

Four sub-regions of substantial aged population but very low provision stand out from adjoining areas of very high provision. The question to be addressed here is the extent to which needs of these areas are, or could be, met by excess provision in adjacent areas; this proposition could be tested by remapping different combinations of LGAs with ratios calculated accordingly. The other areas of very low provision are peripheral areas with small aged populations, and small additions to bed numbers would markedly increase provision ratios. For example, another 30 bed nursing home in the outer-western sub-region that includes the LGAs of Melton, Gisborne and Bacchus Marsh would bring the ratio up to 50 beds per 1000 for the population aged 70 years and over as at 1986.
MAP 3.5: NURSING HOME BEDS

Mean: 52.0
Std. Dev.: 15.0
Minimum: 24.0
Maximum: 81.0
Median: 52.0

No. of areas: 24.0 37.0 52.0 67.0 81.0 per 1000/70+
The balance between the different types of residential care within the overall ratio of 100 places per 1000 can be analysed by examining nursing home provision in relation to hostel provision. Comparison of these two distributions can readily be made by compiling a bi-variate map, as in Map 3.6. The four categories show the relative under and over provision of nursing home and hostel places together, with class bounds set at 40 nursing home beds and 30 hostel places per 1000. The areas of higher provision of both hostels and nursing homes have a minimum combined provision of 70 places per 1000; conversely, this is the maximum provision for areas having lower provision of both. The class boundaries used mean that areas of higher nursing home provision but lower hostel provision will generally have higher overall provision than those with higher hostel provision and lower nursing home provision.

It is apparent that the two types of provision tend to reinforce rather than compensate for each other; most of the areas with the highest nursing home ratios also have the highest hostel provision, albeit at a lower level. In other areas with nursing home provision well above the ratio but lower hostel provision, a change in balance will require additional development of hostel places, with some scope for changing the function of excess nursing home provision. Only the City of Melbourne is identified as having above average hostel provision while nursing home provision is below the ratio.

The areas which stand out as having very low provision of both forms of residential care are Doncaster and Templestowe, Waverley and Moorabbin, and given their large aged populations, these LGAs emerge as areas of greatest relative and absolute underprovision. The other areas with low overall provision are outer areas of smaller aged populations, where provision could be brought closer to the ratios by relatively small additions to nursing home beds and hostel places. The impact of different allocations of additional provision between the various areas of low provision could be demonstrated by further mapping applications.
MAP 3.6: BALANCE OF HOSTEL AND NURSING HOME PROVISION

<table>
<thead>
<tr>
<th>Nursing home beds</th>
<th>Hostel places</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>52.0</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>15.0</td>
</tr>
<tr>
<td>Minimum</td>
<td>24.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>81.0</td>
</tr>
<tr>
<td>Median</td>
<td>52.0</td>
</tr>
</tbody>
</table>

Nursing home beds per 1000/70+:
- 81.0
- 40.0
- 24.0

Hostel places per 1000/70+:
- 0.0
- 30.0
- 53.0
4. AGED POPULATION DISTRIBUTION AND CHANGE:

NON-METROPOLITAN VICTORIA

MAP 4.1: PROPORTION OF POPULATION AGED 65+ YEARS, 1981

SPATIAL UNITS: Local Government Areas
DATA SOURCE: Census of Population and Housing
DATE: 1981
DATA METRICS: Percentage of total LGA population aged 65+ years
CLASSIFICATION: Based on mean, 10.9%, and standard deviation, 3.3%, then maximum and minimum values

The proportion of population aged 65 years and over at the 1981 census by LGAs in rural Victoria varies from only 5% to 24%. While this range and the mean of 10.9% are similar to the metropolitan area, the distribution of LGAs is skewed in accordance with the somewhat older population of non-metropolitan Victoria, with a larger number of LGAs in the highest class than in the lowest class.

Three features of the spatial pattern of ageing are notable. First, the regions with the highest proportions of aged population are spread in a band of rural shires from the Wimmera and Mallee in the west of the state, through the Central Highlands and extending through to the Shires of Goulburn and Euroa to the north-east border shires around Wodonga. Ageing in these areas can be attributed mainly to out-movement of younger population, leaving a residual aged population. Second, separate concentrations of aged population in coastal areas of East Gippsland and near Geelong are due to longer-distance retirement migration; localised concentrations such as at Lakes Entrance and Winchelsea are generalised over whole LGAs in the map. Third, a number of rural Cities have older populations than their surrounding Shires, suggesting local retirement migration of the rural population into the towns; the Cities and Shires of Stawell and Maryborough and the City of St. Arnaud in Kara Kara Shire illustrate this effect. The Latrobe Valley and surrounding inland shires, and the northern shires of the North Goulburn sub-region stand out as areas of low aged population, with the remaining LGAs with low proportions of aged population scattered across the state.
MAP 4.1: PROPORTION OF POPULATION AGED 65+ YEARS, 1981

Mean 10.9
Std. Dev. 3.3
Minimum 5.2
Maximum 24.3
Median 10.5
In depicting the areas of absolute and relative concentration of aged population, this map demonstrates first of all very uneven spread of aged population in non-metropolitan Victoria. There are very small numbers of aged people in most rural shires, less than 770, where the proportion aged is also below the state average. In many cases, these areas surround separate cities and towns that have larger, older populations; almost all the concentrations of more than 1000 aged people are in such areas. For example, the 2400 aged in the City of Warrnambool comprise 11% of the population, while in the surrounding Shire some 500 aged people account for just under 8% of the population.

Only four shires have large numbers (more than 770) and above average proportions of aged population. In two of these, Tambo and Woorayl in Gippsland, the aged populations are concentrated in coastal settlements rather than being spread over the whole area. Although the town of Kyneton is not defined as a separate LGA, most of the aged in Kyneton Shire are likely to be in that city. Only the Shire of Hampden can be seen to have a generally aged rural population.

The implications of these distribution patterns for service provision are, on the one hand, that coverage is facilitated by concentration in towns and cities, and on the other, that there are likely to be problems in rural shires regarding the viability of the scale of provision and delivery of services for very small and scattered populations.
MAP 4.2: ABSOLUTE AND RELATIVE CONCENTRATION OF POPULATION AGED 65+ YEARS, 1981

<table>
<thead>
<tr>
<th>Number aged 65+ years</th>
<th>% aged 65+ years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>770</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>987</td>
</tr>
<tr>
<td>Minimum</td>
<td>48</td>
</tr>
<tr>
<td>Maximum</td>
<td>6592</td>
</tr>
<tr>
<td>Median</td>
<td>490</td>
</tr>
</tbody>
</table>

Number 770
48

5.2 10.9 24.3
The average change in aged population for LGAs in non-metropolitan Victoria between 1971 and 1981 was an increase of 28%. Changes ranging from no growth up to the average increase account for the largest class of LGAs, indicating the overall stability of the distribution of aged population. The distribution of percentage change is skewed towards a number of LGAs with very high rates of change, over 50%, while the class of population decline contains very few LGAs.

The map of the change in aged population between 1971 and 1981 is broadly divided between LGAs in the western half of the state, where growth was below the average increase of 28%, and LGAs in the eastern half of the state with increases above this level. The former LGAs include three of the six which experienced declines in aged population, namely Kerang in the north, Wimmera and Arapiles in the west, and Daylesford and Maryborough Shires in the Central Highlands.

Very high levels of increase of aged population, in excess of 50%, occurred in two types of areas. First, the main non-metropolitan cities of Ballarat, Bendigo, Shepparton and Wodonga stand out; not only have their large urban populations aged, but the urban areas have also attracted older population from the surrounding rural areas. Second, retirement migration can be taken as underlying the increases not only in the coastal areas around Geelong, notably on the Bellarine Peninsula and the Shire of Corio, and in East Gippsland, but also in the Cobram-Yarrawonga area along the Murray.
MAP 4.3: CHANGE IN POPULATION AGED 65+ YEARS 1971-81

- Mean: 28.3
- Std. Dev.: 22.3
- Minimum: -5.1
- Maximum: 115.0
- Median: 24.9

Histogram showing the distribution of change in population aged 65+ years.
5. SOCIAL CHARACTERISTICS: NON-METROPOLITAN VICTORIA

MAP 5.1: INCOME LEVEL

SPATIAL UNITS: Local Government Areas
DATA SOURCE: Census of Population and Housing
DATE: 1981
DATA METRICS: Percentage of population aged 65+ years with income less than $77 per week in 1981
CLASSIFICATION: Based on mean, 64.2%, and standard deviation, 6.7%, then minimum and maximum values

This map shows the proportion of the population aged 65 years and over in each LGA with an income of less than $77 per week. The histogram shows that the proportions are normally distributed with two-thirds of the LGAs close to the average of 64%, while the remaining third is located at the two extremes. It is these areas of high and low concentration that are of major interest.

The highest proportions of low income aged are widespread throughout Victoria. Regional centres such as Geelong, Ballarat and Bendigo have high proportions of the aged on low fixed incomes. Local Government Areas along the Murray River and in the Ovens Valley and La Trobe Valley and Gippsland also have above average proportions of low income aged. Urban and industrial/ small farmers-irrigation and dairying.

Rural shires in general and the western district of Victoria in particular can be identified as being the more affluent regions of the state. Most LGAs within this region have below average proportions of the aged with incomes of less than $77 per week, while in many this drops lower than 40% of the total aged population of the LGA.
MAP 5.1: INCOME LEVEL

Mean: 64.2
Std. Dev.: 6.7
Minimum: 37.5
Maximum: 79.2
Median: 64.6
This map presents the workforce status of males aged between 60 and 69 years of age, focusing on the proportion who were retired in 1981. A different pattern emerges in rural Victoria compared to the Melbourne metropolitan area. The average proportion retired was 55% in rural Victoria compared with 61% in Melbourne. The patterns which can be seen in this map reflect those evident in the previous map on income level. Two main areas emerge:

Those with a high proportion of retired men tend to be concentrated in the coastal regions of Victoria, around Geelong and the Central Highlands areas, and on the Murray River and in Gippsland. As can be seen from the previous map these areas are also those with relatively high proportions of low income aged. Therefore, it can be assumed that a high proportion of the elderly in these areas would be retirees on fixed pensions.

At the other extreme, are the regions with low proportions of retired men aged between 60 and 69. The western district of Victoria once again can be identified as the region with substantially below average proportions of retired males, as low as 25% in some areas. As these are farming communities a large proportion of males aged between 60 and 69 years of age would be self employed. A strong relationship between income and retirement can therefore be established.

Another important process which can be identified is the local relocation effect between cities and shires. Where there is a defined City LGA surrounded by its Shire it appears that as people retire they relocate from the surrounding shire into the provincial town. For example; in the Shire of Ararat only 37% of males aged between 60 and 69 years were retired in 1981, compared with 76% in the City of Ararat.
MAP 5.2: WORKFORCE STATUS

<table>
<thead>
<tr>
<th>Measure</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>55.2</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>12.8</td>
</tr>
<tr>
<td>Minimum</td>
<td>25.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>78.4</td>
</tr>
<tr>
<td>Median</td>
<td>56.8</td>
</tr>
</tbody>
</table>
This map shows the proportion of persons aged 65 years and over who were living in rented dwellings in 1981 by LGA. The average proportion is similar for both rural Victoria and metropolitan Melbourne, 27% and 28% respectively. However, the distribution is less dispersed with two thirds of areas falling within 15% of the mean.

The population living in rented accommodation does not follow a clear pattern of distribution. In general cities are higher than the surrounding shires, with areas along the Murray River, within Gippsland and the La Trobe Valley having high proportions of aged renters. Most of the western district LGAs, with only a few exceptions, have below average proportions of renters.

The low level of rental occupancy and conversely high home ownership has implications for the need for residential care, and this is taken up in further commentaries.
MAP 5.3: HOUSING TENURE

**Mean**: 26.7

**Std. Dev.**: 6.6

**Minimum**: 11.1

**Maximum**: 61.0

**Median**: 26.2

![Map of housing tenure with data information](image)
MAP 5.4: LIVING ARRANGEMENTS

SPATIAL UNITS: Local Government Areas
DATA SOURCE: Census of Population and Housing
DATE: 1981
DATA METRICS: Percentage of population 65+ years living alone
CLASSIFICATION: Based on mean, 24.3%, and standard deviation, 3.9%, then minimum and maximum values

This map shows the proportion of aged persons in each LGA who were living alone in 1981 in private dwellings. The figures are therefore not affected by the aged population resident in institutions and aged persons homes. The average proportion of persons living alone is similar to that in the metropolitan area of Melbourne. However, it is less spread than in the Melbourne area.

There are generally a higher proportion of persons alone in the western district of Victoria and also in the La Trobe Valley region. Areas with below average proportions of the elderly who are living alone can be identified as the major retirement areas of Victoria. In particular, regions along the Murray River and the coastal areas of the state.

The city/shire phenomena is also evident in this map, with higher proportions of the elderly living alone in the provincial towns rather than the surrounding rural areas. Therefore, it could be assumed that change in household structure may be one explanation for the relocation process previously identified.
Map 5.4: Living Arrangements

- Mean: 24.3
- Std. Dev.: 3.9
- Minimum: 13.4
- Maximum: 34.2
- Median: 24.5
This map displays a very different pattern to that which emerged in the corresponding map for Melbourne. As can be seen from the histogram, the distribution is heavily skewed in favour of the LGAs with very small ethnic populations. The average is 5%, compared to 17% for metropolitan Melbourne. Some two-thirds of the LGAs in rural Victoria, over 90, have less than 5% of their aged populations made up of persons born in non-English speaking countries.

The areas with higher than average proportions of ethnic aged are few, but several areas of local concentrations can be identified. Industrial areas such as Geelong and the La Trobe Valley have above average proportions of ethnic aged as does the Ovens Valley region of Victoria. The irrigation areas near Shepparton, Mildura and Swan Hill also have above average proportions of this sub-group of the aged population.

Considering the small numbers and diverse backgrounds of those born in non-English speaking countries, the limited scale of need for Ethno-specific services for the elderly in most rural areas poses difficulties in developing effective delivery strategies.
MAP 5.5: ETHNICITY

Mean: 5.1
Std. Dev.: 4.7
Minimum: 0.0
Maximum: 28.0
Median: 3.8
6. SERVICE PROVISION: NON-METROPOLITAN VICTORIA

MAP 6.1: MEALS ON WHEELS

SPATIAL UNITS: Local Government Areas
DATA SOURCE: Commonwealth Department of Community Services
DATE: 1986
DATA METRICS: Recipients per 1000 aged 70+ years, estimated from total number of meals delivered per quarter, assuming five meals per recipient
CLASSIFICATION: Based on mean, 22/1000, and standard deviation, 19, then maximum and minimum values

The rates of provision of meals on wheels are mapped as the number of recipients per 1000 population aged 70 years and over per week. These ratios are estimated from the total number of meals delivered in a selected quarter and assuming each resident receives an average of five meals per week.

Provision varies markedly, both in level of provision and spatial distribution, and while the average is similar to the metropolitan figure, the range is wider. The largest number of LGAs are within the class from the mean of 22 per 1000 up to 40 per 1000, with far fewer LGAs having provision above the latter limit. Of the LGAs with below average provision, a larger number are in the lowest class, some having no provision, than are marginally below average.

LGAs in the far west and north of the state are conspicuous in having the highest levels of provision, and a pattern of towns and cities having higher provision than surrounding shires is evident. The LGAs with the lowest provision are typically in these associations; in 11 of the 13 paired Cities and Shires, only the City Council operates a meals on wheels service.

Reference to Map 4.3, showing relative and absolute concentrations of aged populations, reveals variable relationships between meals on wheels provision and the distribution of aged population. While higher levels of provision accord with aged population concentrations in towns, there is less consistency in levels of provision in shires with small numbers and low proportions of aged population. Many of the western and northern LGAs noted for their high provision have very small aged populations, while other LGAs in the north east of the state with similar demographic profiles have low provision. A different relationship again is seen in the case of the Gippsland LGAs of Tambo and Woorayl which have substantial retirement populations but low service provision.

Distance can be identified as the major factor constraining meals on wheels provision, with frequency of required delivery being a compounding factor. Some of the differences observed may also be attributable, at least in part, to the role taken by Local Government, and suggest that consideration of these organisational factors may be important in developing strategies to improve provision in areas of under-utilisation.
MAP 6.1: MEALS ON WHEELS

<table>
<thead>
<tr>
<th>No. of areas</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Median</th>
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Expenditure on home help in non-metropolitan LGAs averaged $83 per capita population aged 70 years and over, but the largest single class is of LGAs with below average expenditure. About equal numbers of LGAs show very high expenditure, up to over $200 per capita, and very low expenditure, including some with no provision. While the average is comparable to that for metropolitan LGAs, both the non-metropolitan upper and lower limits are lower; no metropolitan LGA had expenditure below $20 per capita while some rural LGAs had no provision, and the metropolitan maximum was almost double the highest rural expenditure.

Nor are consistent relationships with the concentration of aged population readily apparent. Insofar as some of the areas of highest provision cover very small aged populations, the total resource commitments involved are limited and do not indicate scope for any substantial redistribution. Socio-economic status does not appear to be closely related to expenditure levels, as areas in Gippsland, the Mallee shires and the Ovens Valley, relatively depressed agricultural areas, have the same high levels of expenditure as LGAs in the wealthy Western District. Finally, there is little support for the expectation that LGAs making high provision of meals on wheels will also make above average expenditures on home help.

The map of expenditure shows a very irregular distribution. In the south west of the state for example, many LGAs of highest provision are adjacent to LGAs of lowest provision. The association between towns and cities and surrounding shires seen for meals on wheels provision is not evident, and in some case there is a reversal, with higher expenditure in the shires; the Cities and Shires of Swan Hill and Mildura are cases in point. Distance thus appears to be less of a constraint in the provision of home help where service is less frequent than for meals on wheels.


3. BIBLIOGRAPHY OF AUSTRALIAN URBAN SOCIAL ATLASES


Vol. 1, Perth (1979)
Vol. 2, Adelaide (1979)
Vol. 3, Brisbane and Gold Coast (1980)
Vol. 4, Newcastle and Wollongong (1980)
Vol. 5, Canberra and Hobart (1980)
Vol. 6, Sydney, (1980)


PART 3

REFERENCE MATERIAL

1. KEY MAPS
2. REFERENCES
3. BIBLIOGRAPHY OF AUSTRALIAN SOCIAL ATLASES
<table>
<thead>
<tr>
<th>LGA</th>
<th>Pop. 65+ yrs %</th>
<th>Change in pop. 65+ 1971-81</th>
<th>Percent of aged population living alone</th>
<th>Percent of aged population renting</th>
<th>Ethnicity</th>
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profile shows these areas to be of lower status, with above average to high proportions of low income aged, above average to high proportions living alone, high proportions of renters and high ethnicity.

2. Emerging ageing areas of higher socio-economic status:

These 13 LGAs are characterised by average or above average proportions aged 65+ years, above average increases in aged population between 1971-81, average proportions of low income aged, below average proportions living alone, below average proportions of renters and below average ethnicity. This cluster contains the peninsula LGAs that are destinations for intra-urban retirement migration, and overall will be the areas of major ageing in future.

3. Emerging ageing areas of mixed socio-economic status, divided into:

3a. Inner areas: These seven LGAs are characterised by above average proportions aged 65+ years but below average increases in aged population between 1971-81. Future ageing will result from ageing in situ of already large aged populations. Lower socio-economic status is indicated by above average proportions of low income aged, above average proportions living alone and of renters and high ethnicity.

3b. Outer areas: These 16 LGAs are characterised by below average proportions aged 65+ years but above average increases in aged population between 1971-81, identifying them as areas of significant future ageing. Although having above average proportions of low income aged, these areas have higher socio-economic status associated with a young-old population, with below average proportions living alone, below average proportions of renters and below average ethnicity.
MAP 6.4: NURSING HOME BEDS

<p>| | |</p>
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MAP 6.3: HOSTEL PLACES

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No. of areas

per 1000/70+

19.0 31.0 37.0 43.0 46.0
MAP 6.2: HOME HELP EXPENDITURE

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$ per capita/70+