# 8 Statistical analysis

## Introduction

Two sets of analyses have been undertaken to illustrate the extent of association between areas with low socioeconomic status and poor health. Correlation coefficients have been produced to indicate interdependence between the measures of socioeconomic status, health status and use of health services. Cluster analysis has been undertaken to indicate the extent to which areas display significantly similar characteristics from among the chosen measures of socioeconomic status, health status and use of health services.

Inequalities in health have traditionally been indicated by an approximation to social class, frequently based on a categorisation of occupations. The other major indicators traditionally used have included income, education, ethnicity and employment status (which allows for the inclusion of unemployed people and those not in the labour force). Measures of socioeconomic status included in this analysis include income, education, occupation, labour force status and Aboriginality.

## Correlation analysis

### Description

Correlation is the degree to which one variable is statistically associated with another. The correlation coefficient is a measure of the strength of this association. When high values for one variable are matched by high values for the other (or when low values are matched by low values), then they are positively correlated. Where the interdependence is inverse (ie. high values for one are matched by low values for the other), the two variables are negatively correlated.

### Methods

The Pearson product-moment correlation (r) has been used in this analysis to indicate the degree of correlation between pairs of variables. Pearson correlation coefficients range from +1 (complete positive correlation) through 0 (complete lack of correlation) to –1 (complete negative correlation). As a general rule, correlations of plus or minus 0.5 or above are considered to be of meaningful statistical significance. Correlations of plus or minus 0.71 or above are of substantial statistical significance, because this higher value represents at least 50 per cent shared variation ($r^2$ greater than or equal to 0.5).

Correlation coefficients were calculated by comparing the value (expressed as a percentage, or as a standardised ratio) for each variable in each SLA with the value of each of the other variables. Correlation coefficients are generally referred to as being, for example, 'a correlation of low income families with the *paired* variable of hospital admissions of females'. However, to promote ease of reading where many correlation coefficients are quoted in the text, the word 'paired' has been omitted. For similar reasons the symbol used to indicate a correlation coefficient (r) has been omitted.

Two measures of socioeconomic status included in the analysis in this section have not been mapped. They are families receiving an income of $52,000 or more per annum and people in occupations classified as 'managers and administrators' and 'professionals'. These two measures were included as they indicate high socioeconomic status, in contrast to most other measures, which were chosen because they indicate low socioeconomic status.

The results of the correlation analysis, which was undertaken separately for **Sydney** and the rest of the State, are shown in the following tables: coefficients of from 0.5 to 0.7 and from 0.71 to 1 (both positive and negative) are highlighted in the tables, and are referred to in the individual map commentaries, as appropriate. The analysis was not undertaken for **Newcastle** or **Wollongong**, as both of these major urban centres had too few SLAs for the analysis to be valid.

When discussing the results of the correlation analysis in the text, mention is often made of 'the indicators of socioeconomic disadvantage'. This reference is to variables such as those for single parent families, the unemployed, the Indigenous population and housing authority rented dwellings. References to 'high socioeconomic status' reflect the variables for high income families, female labour force participation and managers and administrators, and professionals.

The associations discussed in the text are, in general, limited to associations between the variable under discussion and the indicators of socioeconomic status from Chapter 3. This approach is largely a response to the limited space available for comment. The extent of any association with the other variables analysed can be ascertained from an examination of the correlation matrices (**Tables 8.1** and **8.2**).

## Results

### Sydney

There were correlations of significance at the SLA level between the measures of socioeconomic disadvantage (see Chapter 3) and a number of the health status variables. In **Sydney**, the strongest of these were generally with the variables for people reporting their health as fair or poor (as opposed to those reporting their health as being excellent, very good, or good); the Physical Component Summary (PCS, a measure of physical health); the handicap status of the population; and premature death from, in particular, circulatory and respiratory system diseases (**Table 8.1**). Similarly, strong associations were also evident in the correlation analysis with the health service use variables of GP services to males and females; and of admissions for circulatory and respiratory system diseases, and admissions to a public acute hospital.

### Non-metropolitan areas

SLAs in the non-metropolitan areas range in size from an estimated 35 square kilometres in Armidale to 93,316 in Unincorporated Far West. They also range from sparsely populated rural and remote areas to large country towns. Despite these wide variations, the correlation analysis has been produced and the results presented in **Table 8.2**.

It is clear from the matrix of correlation coefficients that there are fewer correlations of significance at the SLA level in the non-

metropolitan areas of New South Wales than was the case in **Sydney**. This is, in part, a result of the number of areas with relatively small numbers of cases (population, deaths, hospital admissions, etc.) which reduces the strength of the analysis.

However a number of variables are highly correlated with each other: these are the variables for low income families, unemployed people, Indigenous Australians, people born in non-English speaking countries, people with poor proficiency in English and dwellings without a vehicle.

Various sub-sets of these are correlated with measures of health status and use of health services. The strongest correlations with the measures of socioeconomic disadvantage were with the variables for people reporting their health as fair or poor, and the PCS. Although generally weaker, there was a consistent association between socioeconomic disadvantage and the variables for deaths of males; hospital admissions of males and females; and hospital admissions from circulatory and respiratory system diseases.

For the Indigenous population, there was a correlation of substantial significance at the SLA level with the variable for years of potential life lost (the summary measure of premature death). There were also correlations of substantial significance with high rates of admission to hospital (total of public and private hospitals); admissions to a public acute hospital; admissions from the combined causes of accidents, poisonings and violence; and admissions for neuroses.

**Table 8.1: Correlation matrix for SLAs in Sydney**

Refer to file: ch8 correlation matrices

**Table 8.1: Correlation matrix for SLAs in Sydney...** ***cont***

Refer to file: ch8 correlation matrices

**Table 8.2: Correlation matrix for SLAs in the non-metropolitan areas of New South Wales**

Refer to file: ch8 correlation matrices

**Table 8.2: Correlation matrix for SLAs in the non-metropolitan areas of New South Wales *...cont***

Refer to file: ch8 correlation matrices

# Cluster analysis

## Description

The intention of the cluster analysis is to produce summary measures of socioeconomic status, health status and health service use at the SLA level. It is useful to have this information, as the SLA is an important administrative and planning unit. However, the production of clusters at this level is problematic, as SLAs are often large, heterogeneous areas, and their average values sometimes disguise a wide range of sub-area variation in the values of the population characteristics under analysis.

It should also be noted that cluster analysis is an exploratory technique and, as with all such techniques, the real test of a solution is whether it makes any sense. Decisions as to the variables to be used, or the number of clusters in a solution, all impact on the final result.

The results of the cluster analysis, therefore, represent indicative groupings of areas with broadly similar characteristics among the variables analysed in each set. They will be a useful tool for some purposes: on other occasions, however, the individual variables on which they are based may also be relevant.

## Methods

Cluster analysis (using the squared Euclidean measure) was undertaken by the Ward's method. This (hierarchic) clustering method seeks to partition a set of objects (eg. postcodes or, in this case, SLAs) into a set of non-overlapping groups so as to maximise some external criterion of 'goodness of clustering', typically the extent to which the within-cluster inter-object similarities are maximised and the between-cluster similarities minimised.

In cluster analysis, 10 records (ie. SLAs) per variable is considered desirable, with an absolute minimum of five. Had all the datasets been used in the analysis there would have been many fewer than this. A variety of techniques was used to attempt to overcome this problem, including applying a factor analysis or undertaking an experimental fit of the full data set, and using the results to reduce the number of variables included in the final analysis.

**Table 8.3** lists the variables used in the analysis. The analysis was undertaken separately for the major urban centres and the rest of the State. The datasets used in the cluster analysis (based on boundaries in existence from 1991 to 1997) were aggregated to a common set of boundaries (1996). Where the areas differ from the 1996 boundaries, the variations are noted in the text.

**Table 8.3: Variables used in cluster analysis**

**Socioeconomic status**
- % single parent families
- % low income families
- % unskilled or semi-skilled workers
- % unemployed
- % female labour force participation
- People who left school at age 15 or earlier, or who did not attend school (Standardised Ratio)
- % Aboriginal & Torres Strait Islander people
- % Housing authority rented dwellings
- % Dwellings without a motor vehicle

**Health status**
- ***Self-reported health status***
- ***Physical Component Summary score [SF-36]***
- ***Disability and handicap status*** (Standardised Ratio)
  - with a disability
  - with a handicap
- ***Deaths*** (Standardised Death Ratio)
- Infant deaths
- Deaths
  - of males aged 15-64 years, from all causes
  - of females aged 15-64 years, from all causes
  - of persons aged 15-64 years
    - from cancer
    - from circulatory system diseases
    - from respiratory system diseases
    - from accidents, poisonings & violence
  - of persons aged 15-24 years
    - from accidents, poisonings & violence
- Years of potential life lost as a result of deaths at ages 15-64 years
- ***Total Fertility Rate***

**Utilisation of health services**
- ***Hospital admissions*** (Standardised Admission Ratio)
  - to public acute hospitals
  - to private acute & private psychiatric hospitals
  - to public acute & private hospitals, admissions
    - total
    - of males
    - of females
    - for infectious diseases
    - for all cancers
    - for lung cancer
    - for breast cancer for women aged 40 years or more
    - for psychoses
    - for neuroses
    - for circulatory system diseases
    - for ischaemic heart disease
    - for respiratory system diseases
    - for respiratory system diseases in 0 to 4 year old children
    - for bronchitis, emphysema & asthma
    - from accidents, poisonings and violence
    - for all surgical procedures
    - for all surgical procedures as same day admission
    - for tonsillectomy and/or adenoidectomy
    - for myringotomy in children aged 0-9 years
    - for Caesarean sections in women aged 15-44 years
    - for hysterectomy in women aged 30 years and over
    - for hip replacements
    - for lens insertion in people aged 50 years or more
    - for endoscopy
- ***General medical practitioner services*** (Standardised Ratio)
  - for males
  - for females
- ***Children fully immunised at 12 months***

# Results

## Socioeconomic status clusters in the major urban centres

Variables considered for inclusion were those listed in **Table 8.3** under the heading *Socioeconomic status*. The ABS Index of Relative Socio-Economic Disadvantage (IRSD) was also used in the analysis, as an independent check on the solution.

Although a number of other variables were available for analysis, previous experience (Glover 1996) has shown that the inclusion of variables regarding non-English speaking background is not beneficial to the analysis. The congregation of persons of the same ethnic group does not necessarily indicate a pocket of disadvantage. Although on average we may expect these variables to also show higher levels in disadvantaged areas, their

**Table 8.4: Composition of SLA clusters in Sydney**

| SLA | Socioeconomic status | Health status | Health service utilisation | Social health status[1] |
|---|---|---|---|---|
| Ashfield (A) | Medium | Medium | High | High |
| Auburn (A) | Low | Medium | High | Medium |
| Bankstown (C) | Low | Medium | High | Medium |
| Baulkham Hills (A) | High | Good | Low | High |
| Blacktown (C) | Low | Medium | High | Medium |
| Blue Mountains (C) | Medium | Medium | Low | Medium |
| Botany (A) | Low | Medium | High | Medium |
| Burwood (A) | Medium | Medium | Low | Medium |
| Camden (A) | Medium | Medium | High | Medium |
| Campbelltown (C) | Low | Medium | High | Medium |
| Canterbury (C) | Low | Medium | High | Medium |
| Concord (A) | High | Good | Low | High |
| Drummoyne (A) | High | Good | Low | High |
| Fairfield (C) | Low | Medium | High | Medium |
| Gosford (C) | Medium | Medium | Low | Medium |
| Hawkesbury (C) | Medium | Medium | Low | Medium |
| Holroyd (C) | Low | Medium | High | Medium |
| Hornsby (A) | High | Good | Low | High |
| Hunter's Hill (A) | High | Good | High | High |
| Hurstville (C) | Medium | Good | Low | High |
| Kogarah (A) | High | Good | Low | High |
| Ku-ring-gai (A) | High | Good | Low | High |
| Lane Cove (A) | High | Good | Low | High |
| Leichhardt (A) | Medium | Medium | High | Medium |
| Liverpool (C) | Low | Medium | High | Medium |
| Manly (A) | High | Good | Low | High |
| Marrickville (A) | Medium | Medium | High | Medium |
| Mosman (A) | High | Good | Low | High |
| North Sydney (A) | High | Good | Low | High |
| Parramatta (C) | Low | Medium | Low | Medium |
| Penrith (C) | Medium | Medium | Low | Medium |
| Pittwater (A) | High | Good[2] | Low | High[2] |
| Randwick (C) | Medium | Good | High | High |
| Rockdale (C) | Medium | Medium | High | Medium |
| Ryde (C) | High | Good | Low | High |
| South Sydney (C) | Low | Poor | High | Low |
| Strathfield (A) | Medium | Good | Low | High |
| Sutherland Shire (A) | High | Good | Low | High |
| Sydney (C) | Low | Poor | Not grouped | Low |
| Warringah (A) | High | Good[2] | Low | High[2] |
| Waverley (A) | Medium | Good | Low | High |
| Willoughby (C) | High | Good | Low | High |
| Wollondilly (A) | Medium | Medium | High | Medium |
| Woollahra (A) | High | Good | Low | High |
| Wyong (A) | Low | Medium | High | Medium |

**[1] Social health status 'clusters were produced by a joint analysis of the socioeconomic status and health status variables.**
**[2]Health status and Social health status cluster allocations for Pittwater are based on the combined area of Pittwater/Warringah.**

inclusion in the cluster analyses does not assist in the search for viable and sensible solutions.

The variables relating to people born in predominantly non-English speaking countries (and their proficiency in English) were accordingly dropped from the analysis, leaving nine variables for inclusion. There are 45 SLAs in **Sydney** (the SLAs of Sydney-Inner and -Remainder were analysed as one). These 45 records are just theoretically sufficient to carry out a cluster analysis with nine input variables. However, the acid test of a cluster analysis is whether the solution is interpretable, and it is still possible for an analysis to provide an interpretable solution even when there is a shortage of input records. Accordingly, a cluster analysis was performed on the available data, and the solution examined before attempting more complicated techniques to find a solution

Problems of scale can affect the analysis as more common data items will dominate the solution. To avoid these problems, the variables were standardised and the resultant z scores were entered into the cluster analysis.

In this case the analysis provided a very clear three cluster solution (see **Table 8.4** and **Map 8.1**). The three clusters have been labelled as High (17 SLAs), Medium (15 SLAs), Low (13 SLAs) socioeconomic status clusters.

The three cluster solution is supported by a comparison with the ABS Index of Relative Socio-Economic Disadvantage (IRSD) which was also available for the specified SLAs, but was withheld from the analysis and used as an independent check on the solution. This comparison showed that, of the 13 SLAs with the lowest IRSD scores in **Sydney**, 11 were classified to the Low socioeconomic status group in this analysis; and that 15 of the 17 SLAs with the highest scores for the IRSD were classified to the High socioeconomic status group.

After completion of the analysis for **Sydney** the SLAs in the major urban centres of **Newcastle** and **Wollongong** were allocated to the clusters generated in **Sydney** using the quick cluster command in SPSS. This procedure allocates the SLAs based on the minimum euclidean distance from each cluster centre. It therefore does not interfere with the formation of clusters in **Sydney**, but can be said to be on the same basis.

This analysis produced two groupings, with the **Wollongong** SLA of Kiama classified as High socioeconomic status (Kiama also had the highest IRSD of these SLAs) and all of the remaining SLAs in **Wollongong** and **Newcastle** being classified to the Medium socioeconomic status group (**Table 8.5** and **Map 8.1**).

### Health status clusters in Sydney

The data variables available for this analysis were the variables of premature death, disability and handicap status, the Total Fertility Rate and the two synthetically predicted estimates from the 1995 National Health Survey (the Physical Component Summary and the measure of fair/poor health).

With the exception of the Infant Death Rate (shown as the number of deaths per 1,000 live births), all of the variables were represented by age-sex standardised ratios. Missing data values (where there were fewer than five cases for any SLA and a standardised ratio was not calculated) were substituted by zero. Legitimate zero coded values remained as zero.

There were 44 SLAs for this dataset, one less than in the datasets for socioeconomic status and health service use (Pittwater was part of Warringah in the period on which this dataset is based). Thus there were 15 variables to analyse 44 records. Clearly this was not enough data. However, a cluster analysis of all the above variables was conducted to see if it gave a sensible solution despite the lack of data. This produced a clear three cluster solution of good quality, which was accepted without further investigation (**Table 8.4** and **Map 8.2**).

Note that the Poor Status group did have higher status than the Good Status group for two variables (Total Fertility Rate and disability). These results are understandable, in that females in socioeconomically disadvantaged areas have higher Total Fertility Rates; and that disability rates are higher in both socioeconomically disadvantaged areas and areas with high proportions of boarding houses and sheltered and other forms of specialist accommodation.

A check with the IRSD found that, of the bottom two SLAs for **Sydney** (as classified by the IRSD), neither were classified to the Poor health status group in this analysis. Further, of the top 20 SLAs under the IRSD, 18 (90.0 per cent) were classified to the Good health status group.

After completion of the analysis for **Sydney** the SLAs in the major urban centres of **Newcastle** and **Wollongong** were allocated to the clusters generated in **Sydney** as discussed above under *Socioeconomic clusters in Sydney*.

This resulted in all of the SLAs in **Newcastle** (with the exception of Lake Macquarie which was grouped into the Good health status cluster) being grouped into the Medium health status cluster, as was the **Wollongong** SLA of Shellharbour. The remaining SLAs in **Wollongong** (Kiama and the City of Wollongong) formed a Good health status group (**Table 8.5** and **Map 8.2**).

The IRSD was again used as an independent check on the solution. It was found that, of the bottom five SLAs for **Newcastle** and **Wollongong** as classified by the IRSD, four (80.0 per cent) were classified to the Medium health status group in this analysis. Further, of the top three SLAs under the IRSD, two was classified to the Good health status group.

### Health service utilisation clusters in Sydney

All but one of the variables in this data set were represented by age-sex standardised ratios: the immunisation variable is of the proportion of children fully immunised at one year of age. Missing data values (SLAs where fewer than 5 hospital admissions were predicted from the Australian rates) were substituted by zero. Legitimate zero coded values remained as zero.

Problems of scale can affect the analysis as more common data items will dominate the solution. To avoid these problems, the variables were standardised and the resultant z scores were entered into the analysis.

Thus there were 29 variables to analyse 45 records. Clearly this was not enough data. Alternative strategies were tried in an attempt to produce a useful solution:

A cluster analysis of all the above variables was tried to see if it gave a sensible solution despite the lack of data. This produced a solution of doubtful merit.

An exploratory factor analysis was run on the data using Principal Component extraction and orthogonal rotation. The analysis produced a six factor solution. It should be noted that there was not enough data to sustain a factor analysis either.

Factor scales saved in the above analysis were used as input to a cluster analysis. This approach assumes the factor structure is accurate for the SLA data. This analysis resulted in a 2 cluster solution with Sydney (C) not grouped. The solution was promising, but not ideal. In an effort to produce a better solution, hopefully with three factors, the drivers of the factor solution were selected for entry into a cluster analysis. The first three drivers of the first factor (admissions: total, males and respiratory system diseases), the first two drivers of the second factor (admissions: neuroses, hysterectomy), and the first drivers of the remaining factors (general medical practitioner services: admissions; lens, myringotomy, lung cancer) were chosen.

This analysis again produced a two cluster solution, with Sydney (C) not grouped. The solution was very similar to that produced above by the factor scores, and this consistency is reassuring. Since this solution is based on nine variables analysing 45 records, it does not have the same validity concerns attached to the previously tried methods. Also the solution is of slightly better quality. It was therefore accepted, to produce a two cluster solution. These are described as Low[1] and High health service use and are shown in **Table 8.4** and **Map 8.3**.

A check with the IRSD showed that, of the bottom 25 SLAs for **Sydney** as classified by the IRSD, 21 (84.0 per cent) were classified to the High health service use group in this analysis. Further, of the top 19 SLAs under the IRSD, 15 (78.9 per cent) were classified to the Low health service use group.

After completion of the analysis for **Sydney**, the SLAs in **Newcastle** and **Wollongong** were allocated to the clusters generated in **Sydney** as discussed above under *Socioeconomic clusters in Sydney*.

This resulted in the **Newcastle** SLAs of Cessnock, Newcastle and Port Stephens being grouped into the High health service use cluster; with Lake Macquarie and Maitland being grouped into the Low health service use cluster. For **Wollongong,** the groupings were of the SLAs of Shellharbour and Wollongong (High health service use) and Kiama (Low service use) (**Table 8.5** and **Map 8.3**).

[1] Note that the Low health service use group did have higher use of some services (admissions for breast cancer, endoscopy, hip replacement, myringotomy, neuroses and psychoses; and admissions to private hospitals). Many of these exceptions may possibly be explained by a more affluent population and an older age profile.

This solution was checked with the IRSD which showed that, of the bottom five SLAs for **Newcastle** and **Wollongong** as classified by the IRSD, four (80.0 per cent) were classified to the High health service use group in this analysis. Further, of the top three SLAs under the IRSD, two (66.7 per cent) were classified to the Low health service use group.

## Social health status clusters in Sydney

The cluster analysis technique has also been applied to a combination of the socioeconomic status and health status data sets. The results of the cluster analysis for the combination of these data sets may be useful as a summary indicator of the 'social health' status of the population of each grouping of SLAs.

Data considered for inclusion were the demographic variables in the final model for SLAs in **Sydney**, used to examine socioeconomic status, and the health status variables used in the final health status model. The variables excluded from the health status model because of missing data were excluded from this model also.

There were 44 SLAs in **Sydney** for this analysis (the same number as was available for the health status analysis). A cluster analysis of all the above variables was tried to see if it gave a sensible solution despite the lack of data. This produced a clean three cluster solution of good quality, which was accepted without further investigation. The SLAs in each cluster are listed in **Table 8.4** and shown in **Map 8.4**. Note that the Low social health status group did not have a higher ranking than the High social health status group for any variables.

It was found that, of the bottom two SLAs for **Sydney** as classified by the IRSD, neither were classified to the Low social health status group in this analysis. Further, of the top 21 SLAs under the IRSD, 18 (85.7 per cent) were classified to the High social health status group.

After completion of the analysis for **Sydney**, the SLAs in **Newcastle** and **Wollongong** were allocated to the clusters generated in **Sydney** as discussed above under *Socioeconomic clusters in Sydney*.

This analysis produced two groupings, with the **Newcastle** SLA of Lake Macquarie classified to the High social health status cluster and all of the remaining SLAs in **Newcastle** being classified to the Medium social health status cluster. The **Wollongong** SLAs of Kiama and the City of Wollongong were grouped in the High social health status cluster and Shellharbour was in the Medium social health status cluster (**Table 8.5** and **Map 8.4**).

The IRSD was also available for the specified SLAs, and was used as an independent check on the solution. It was found that, of the bottom five SLAs for **Newcastle** and **Wollongong** as classified by the IRSD, four (80.0 per cent) were classified to the High social health status group in this analysis. Further, of the top three SLAs under the IRSD, two (66.7 per cent) were classified to the Low social health status group.

**Table 8.5: Composition of SLA clusters in Newcastle and Wollongong**

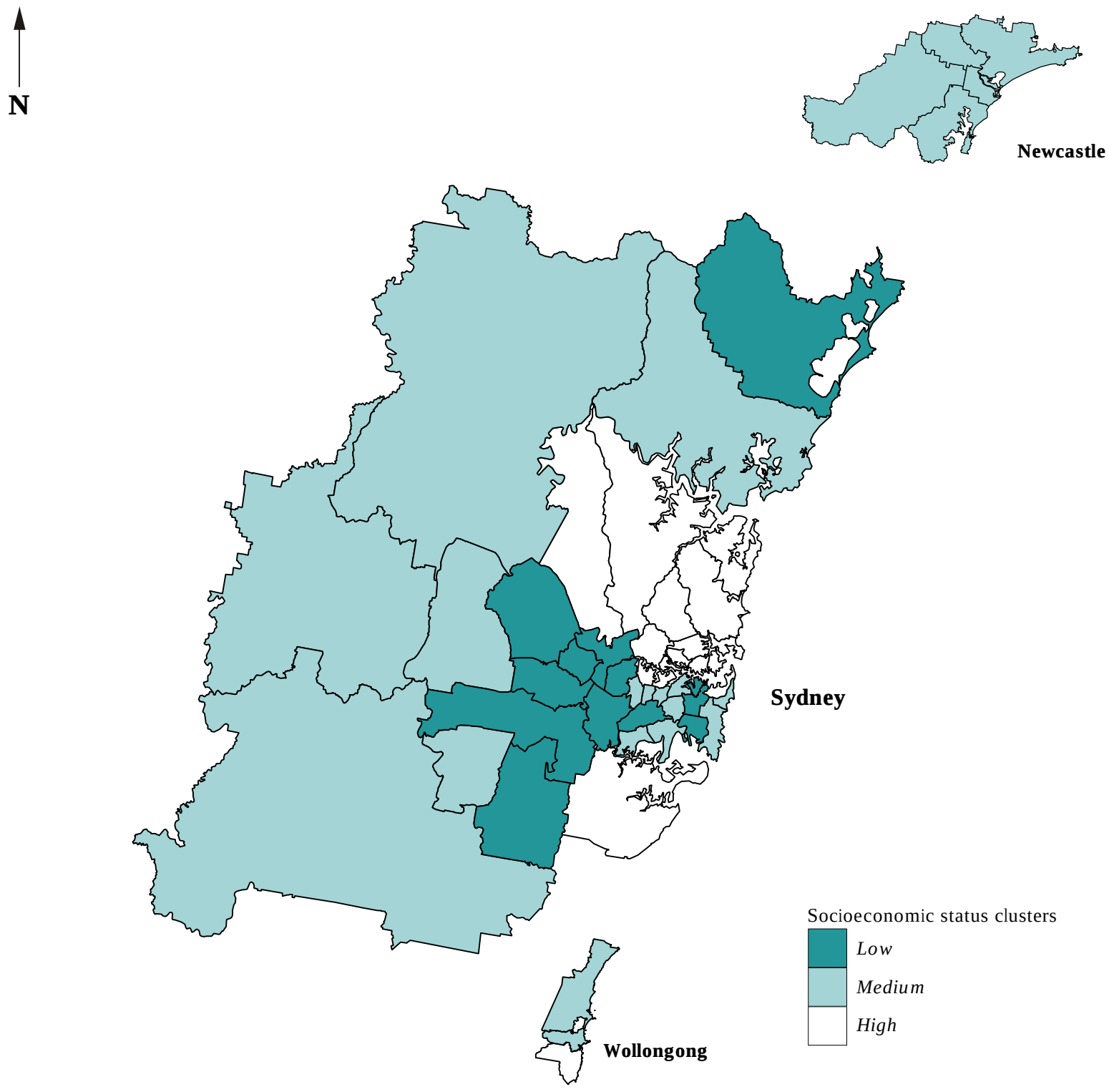
| SLA | Socioeconomic status | Health status | Health service utilisation | Social health status[1] |
|---|---|---|---|---|
| **Newcastle** | | | | |
| Cessnock (C) | Medium | Medium | High | Medium |
| Lake Macquarie (C) | Medium | Good | Low | High |
| Maitland (C) | Medium | Medium | Low | Medium |
| Newcastle (C) | Medium | Medium | High | Medium |
| Port Stephens (A) | Medium | Medium | High | Medium |
| **Wollongong** | | | | |
| Kiama (A) | High | Good | Low | High |
| Shellharbour (A) | Medium | Medium | High | Medium |
| Wollongong (C) | Medium | Good | High | High |

**[1] Social health 'status clusters were produced by a joint analysis of the socioeconomic status and health status variables.**

## Map 8.1

## Socioeconomic status clusters based on Statistical Local Areas, Sydney

clusters of SLAs with generally similar socioeconomic status characteristics

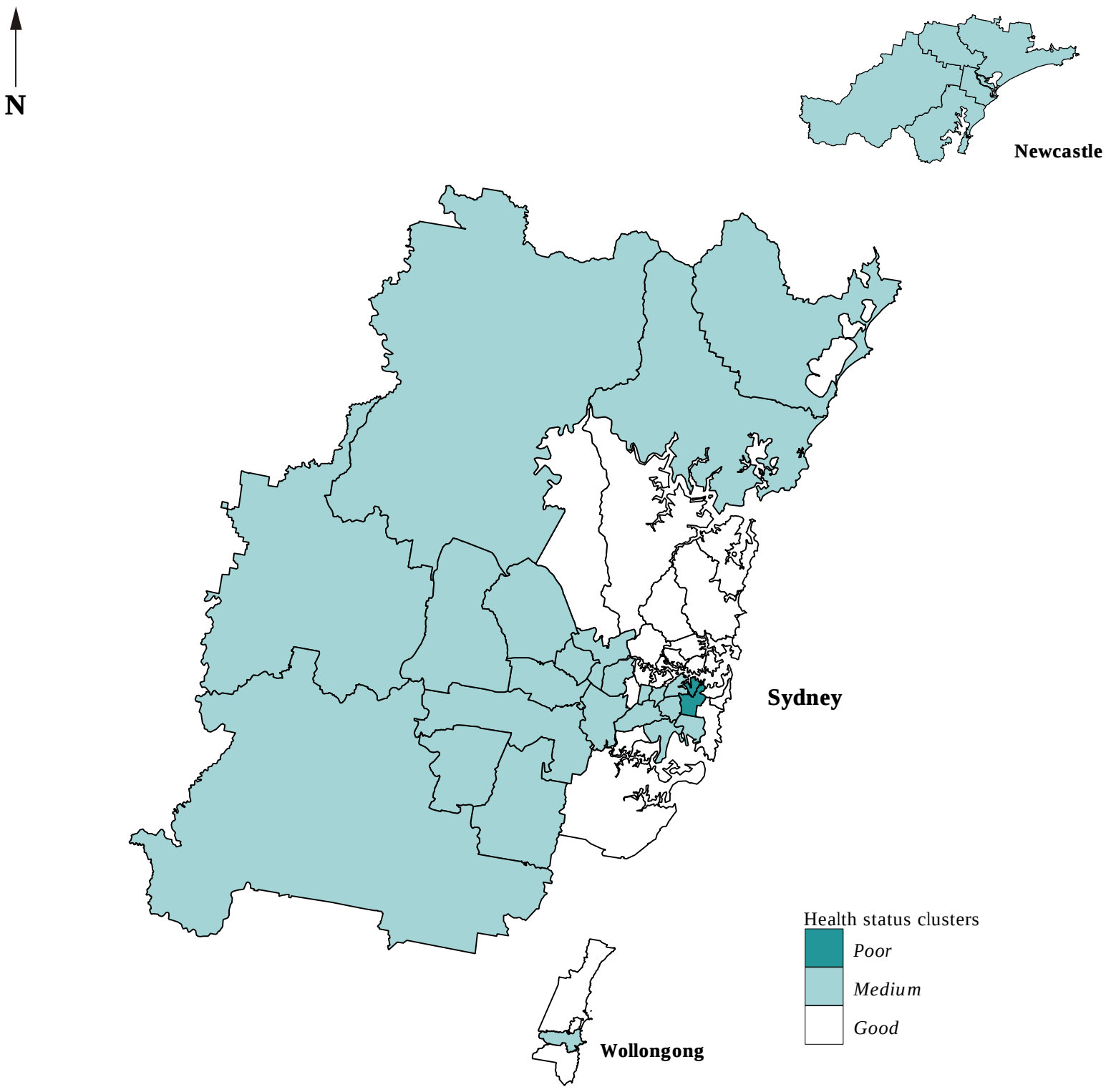



*Source: Compiled from project sources*

*Details of map boundaries are in Appendix 1.2*

## Map 8.2
## Health status clusters based on Statistical Local Areas, Sydney

clusters of SLAs with generally similar health status characteristics



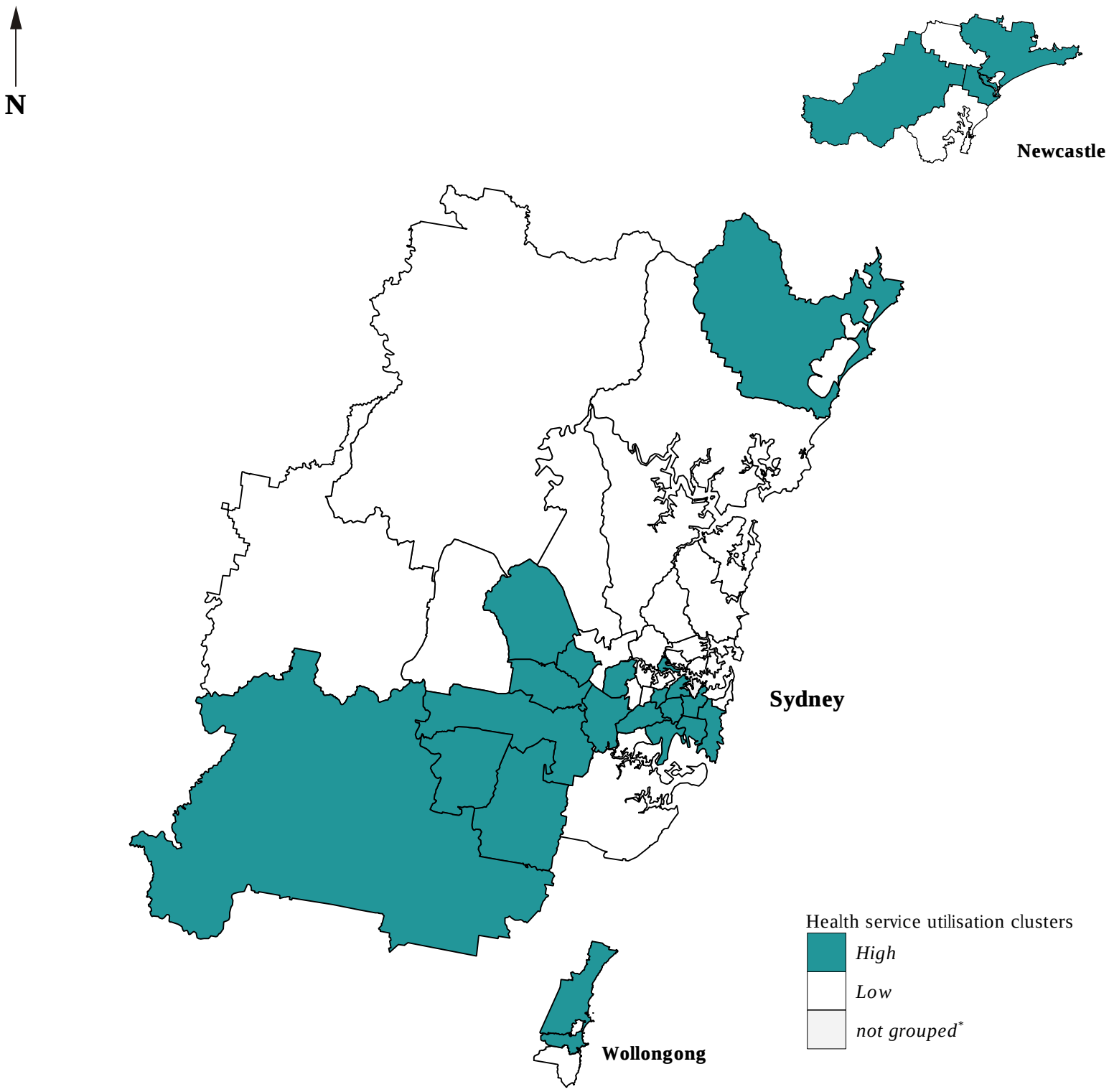

*Source: Compiled from project sources*

*Details of map boundaries are in Appendix 1.2*

**National Social Health Atlas Project, 1999**

## Map 8.3
## Health service utilisation clusters based on Statistical Local Areas, Sydney

clusters of SLAs with generally similar health service utilisation characteristics




*The SLA of Sydney was not grouped in the cluster analysis and has been mapped with this pattern

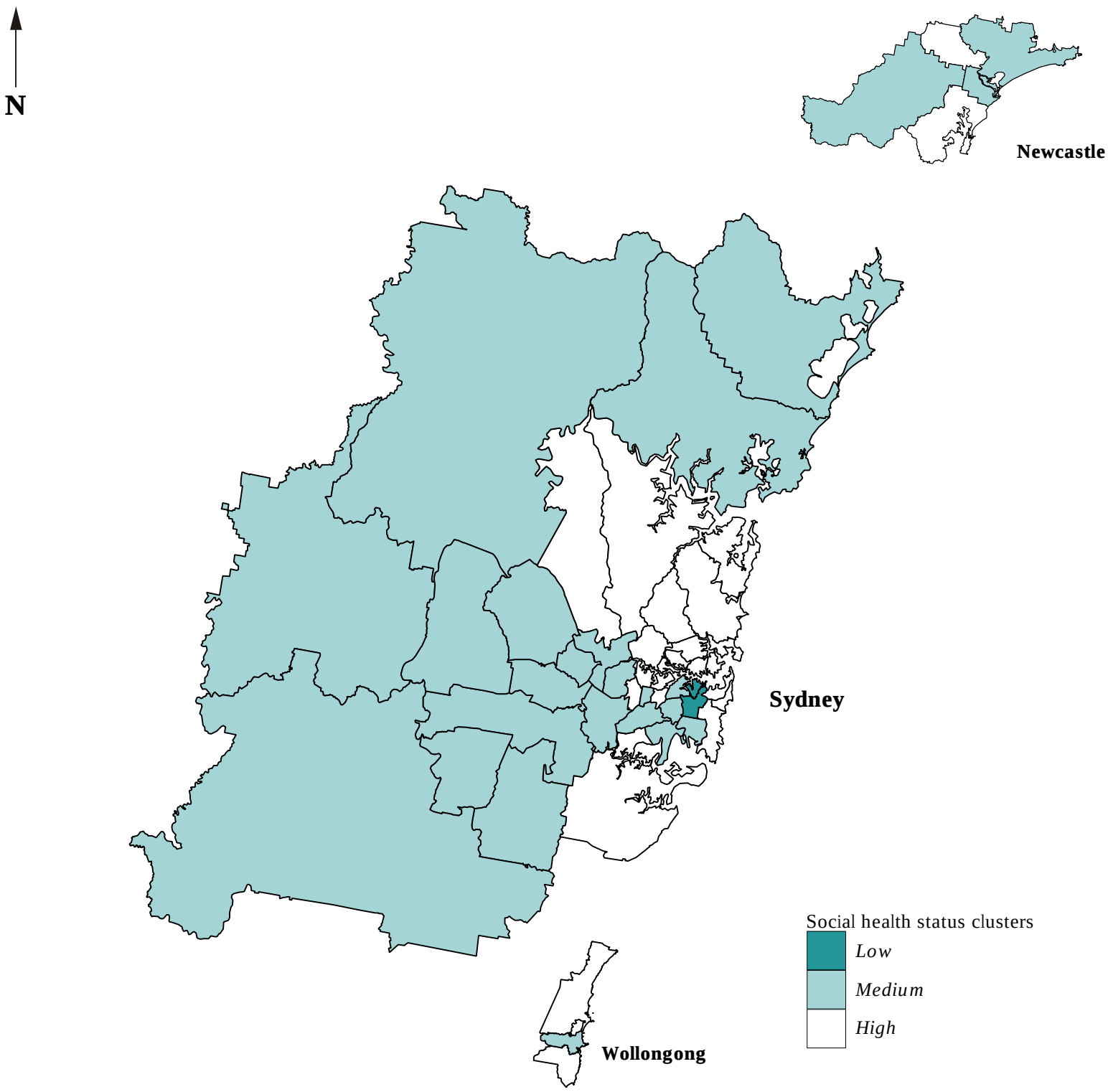
***Source: Compiled from project sources*** ***Details of map boundaries are in Appendix 1.2***

**National Social Health Atlas Project, 1999**

## Map 8.4

## Social health status clusters based on Statistical Local Areas, Sydney

clusters of SLAs with generally similar social health status characteristics




***Source: Compiled from project sources***

***Details of map boundaries are in Appendix 1.2***

**National Social Health Atlas Project, 1999**

## Socioeconomic status clusters of SLAs in the non-metropolitan areas

The production of clusters at the SLA level in the non-metropolitan areas is even more problematic (than for **Sydney**), with SLAs varying enormously in size and composition. For example, large urban centre SLAs such as Wagga Wagga and Albury (population 58,012 and 41,795 respectively) stand in contrast to rural SLAs such as Yarrowlumla [Part B] (population 247) and Windouran (421). Unincorporated Far West, the SLA with the largest land area, occupies 11.8 per cent of New South Wales's land mass yet has a population of only 1,094 (0.02 per cent of the State population). Aboriginal people, generally the most disadvantaged population group, are unevenly distributed throughout these SLAs, from as high as 53.4 per cent of the total population in Brewarrina, 25.3 per cent in Central Darling and 24.7 per cent in Bourke to less than one per cent Aboriginal population in some 17 non-metropolitan SLAs (11.8 per cent of all non-metropolitan SLAs). Despite these variations, the results of the cluster analysis are understandable.

There were data for 133 SLAs across New South Wales. These 133 records are ample to carry out a cluster analysis with the nine input variables. A cluster analysis was performed on the available data, and the solution examined. The dendogram and agglomeration schedule suggested a four or five cluster solution. Both solutions were examined, and neither appeared to have produced a clear discrimination between the SLAs. Also the five cluster solution was felt to be too complicated to interpret. The three cluster solution combined the troublesome clusters in the four cluster solution and was therefore examined in the hope that the solution would provide a better result. It was found to be a clear solution of acceptable quality, and is reproduced in **Table 8.6** and **Map 8.5**. These clusters have been described as Low (74 SLAs), Medium (50 SLAs) or High (7 SLAs) socioeconomic status.

The Low socioeconomic status cluster is comprised of a mix of rural areas and towns, including the State's largest regional centres of Casino, Broken Hill, Grafton and Inverell. SLAs in the High socioeconomic status cluster are grouped in a number of locations, and include Yarrowlumla [Part A and B] and Snowy River, situated in the south-east; Dumaresq, located in the north; and Cabonne [Part A] and Evans [Part A], situated in the central west.

Of the 75 lowest SLAs for the IRSD, 58 (77.3 per cent) were classified to the Low socioeconomic status cluster; and of the top seven SLAs for the IRSD, all were classified to the High socioeconomic status cluster.

## Health status clusters of SLAs in the non-metropolitan areas

The variables for infant deaths; deaths of 15 to 64 year olds from lung cancer and diseases of the respiratory system; and deaths of 15 to 24 year olds from the external causes of accidents, poisonings and violence were excluded from the analysis because five per cent or more of SLAs had no cases. Lord Howe Island and Jervis Bay Territory were excluded from the analysis due to the small number of cases and Yarrowlumla was analysed as one area in this dataset (two areas, Part A and Part B, for the socioeconomic analysis). Thus there were 11 variables to analyse 130 records.

A cluster analysis of all the above variables was undertaken and produced an very clear four cluster solution of good quality, which was accepted without further investigation. The SLAs in each cluster are listed in **Table 8.6** and shown in **Map 8.6**. Note that the Poor health status group did not have higher status than the Good health status group for any variables.

The ABS Index of Relative Socio-Economic Disadvantage (IRSD) was again used as an independent check on the solution. It was found that, of the bottom four SLAs for the non-metropolitan SLAs in New South Wales as classified by the IRSD, three (75.0 per cent) were classified to the Very Poor health status group in this analysis. Further, of the top 32 SLAs under the IRSD, 21 (65.6 per cent) were classified to the Good health status group.

## Health service utilisation clusters of SLAs in the non-metropolitan areas

A number of approaches failed to produce a clear solution from this analysis, mainly because of the large number of missing values. Once all variables with more than 5 per cent missing values were removed from the analysis, three clusters were defined. These clusters have been described as a Low, a Medium and a High health service use cluster. The SLAs in each cluster are listed in **Table 8.6** and shown in **Map 8.7**.

Note that the Low health service use group did have higher use of some services than the high service group: these were immunisation; GP services; admissions to private hospitals, and admissions for breast cancer and hip replacement. Some of these exceptions may possibly be explained by a more affluent population or possibly an older age profile.

There was moderate agreement with the IRSD: of the lowest three SLAs for the IRSD, two (66.7 per cent) were classified to the High health service use cluster; and of the highest 37, 22 (59.5 per cent) were classified to the Low health service use cluster.

## Social health status clusters of SLAs in the non-metropolitan areas

Data considered for inclusion were the demographic variables in the final model for SLAs in the non-metropolitan areas of New South Wales used to examine socioeconomic status, and the health status variables used in the final health status model. The variables excluded from the health status model because of missing data were also excluded from this model. The areas of Unincorporated Far West, Jervis Bay Territory and Lord Howe Island were excluded from the analysis due to a lack of data and Yarrowlumla was analysed as one area in this dataset. Thus there were 18 variables to analyse 130 records (SLAs). This is ample data on which to undertake a cluster analysis and produced an extremely clear three cluster solution of high quality. The SLAs in each cluster are listed in **Table 8.6** and shown in **Map 8.8**. Note that the Low social health status group did not have a higher ranking than the High social health status group for any variables.

Of the four lowest SLAs for the IRSD, three (75.0 per cent) were classified to the Low social health status cluster; and of the top 66 SLAs for the SEIFA index, 55 (83.3 per cent) were classified to the High social health status cluster.

**Table 8.6: Composition of SLA clusters in the non-metropolitan areas of New South Wales**

| SLA | Socioeconomic status | Health status | Health service utilisation | Social health status[1] |
|---|---|---|---|---|
| Albury (C) | Low | Medium | Medium | High |
| Armidale (C) | Low | Medium | Low | High |
| Ballina (A) | Low | Medium | Low | High |
| Balranald (A) | Medium | Medium | Medium | Medium |
| Barraba (A) | Low | Medium | Medium | Medium |
| Bathurst (C) | Low | Medium | Medium | High |
| Bega Valley (A) | Low | Medium | Medium | Medium |
| Bellingen (A) | Low | Medium | Medium | Medium |
| Berrigan (A) | Medium | Good | Medium | High |
| Bingara (A) | Low | Medium | Medium | Medium |
| Bland (A) | Medium | Medium | Medium | High |
| Blayney (A) [Part A] | Medium | Poor | Medium | High |
| Blayney (A) [Part B] | Medium | Good | Low | High |
| Bogan (A) | Low | Medium | Medium | Medium |
| Bombala (A) | Medium | Good | Medium | High |
| Boorowa (A) | Medium | Medium | Low | Medium |
| Bourke (A) | Low | Very Poor | High | Low |
| Brewarrina (A) | Low | Very Poor | High | Low |
| Broken Hill (C) | Low | Medium | Medium | Medium |
| Byron (A) | Low | Medium | Low | Medium |
| Cabonne (A) [Part A] | High | Good | Low | High |
| Cabonne (A) [Part B] | Medium | Good | Low | High |
| Cabonne (A) [Part C] | Medium | Medium | Medium | Medium |
| Carrathool (A) | Medium | Good | Medium | High |
| Casino (A) | Low | Medium | Medium | Medium |
| Central Darling (A) | Low | Very Poor | High | Low |
| Cobar (A) | Low | Poor | Medium | High |
| Coffs Harbour (C) | Low | Medium | Low | Medium |
| Conargo (A) | High | Good | Low | High |
| Coolah (A) | Medium | Medium | Medium | Medium |
| Coolamon (A) | Medium | Good | Medium | High |
| Cooma-Monaro (A) | Low | Good | Medium | High |
| Coonabarabran (A) | Low | Medium | Medium | Medium |
| Coonamble (A) | Low | Medium | Medium | Medium |
| Cootamundra (A) | Low | Medium | Medium | Medium |
| Copmanhurst (A) | Low | Medium | Low | Medium |
| Corowa (A) | Medium | Good | Medium | High |
| Cowra (A) | Low | Medium | Medium | Medium |
| Crookwell (A) | Medium | Good | Medium | High |
| Culcairn (A) | Medium | Medium | Medium | Medium |
| Deniliquin (A) | Low | Medium | Medium | Medium |
| Dubbo (C) | Low | Medium | Medium | High |
| Dumaresq (A) | High | Good | Low | High |
| Dungog (A) | Medium | Medium | Low | High |
| Eurobodalla (A) | Low | Medium | Medium | Medium |
| Evans (A) [Part A] | High | Good | Medium | High |
| Evans (A) [Part B] | Medium | Good | Low | High |
| Forbes (A) | Low | Medium | Medium | Medium |
| Gilgandra (A) | Low | Medium | Medium | Medium |
| Glen Innes (A) | Low | Medium | Medium | Medium |
| Gloucester (A) | Medium | Medium | Medium | High |
| Goulburn (C) | Low | Poor | Medium | High |
| Grafton (C) | Low | Medium | Medium | Medium |
| Great Lakes (A) | Low | Medium | Low | Medium |
| Greater Lithgow (C) | Low | Medium | Medium | Medium |
| Greater Taree (C) | Low | Medium | Medium | Medium |
| Griffith (C) | Medium | Medium | Medium | High |
| Gundagai (A) | Medium | Good | Medium | High |

**Table 8.6: Composition of SLA clusters in the non-metropolitan areas of New South Wales ... *cont***

| SLA | Socioeconomic status | Health status | Health service utilisation | Social health status[1] |
|---|---|---|---|---|
| Gunnedah (A) | Low | Medium | Medium | Medium |
| Gunning (A) | Medium | Poor | Low | High |
| Guyra (A) | Low | Medium | Medium | Medium |
| Harden (A) | Medium | Medium | Medium | Medium |
| Hastings (A) | Low | Medium | Low | Medium |
| Hay (A) | Low | Poor | Medium | High |
| Holbrook (A) | Medium | Good | Medium | High |
| Hume (A) | Medium | Good | Low | High |
| Inverell (A) [Part A] | Medium | Medium | Low | Medium |
| Inverell (A) [Part B] | Low | Medium | Medium | Medium |
| Jerilderie (A) | Medium | Good | Medium | High |
| Junee (A) | Low | Medium | Medium | Medium |
| Kempsey (A) | Low | Medium | Medium | Medium |
| Kyogle (A) | Low | Medium | Medium | Medium |
| Lachlan (A) | Low | Poor | Medium | High |
| Leeton (A) | Medium | Medium | Medium | High |
| Lismore (C) | Low | Medium | Low | High |
| Lockhart (A) | Medium | Good | Medium | High |
| Lord Howe Island | Medium | Not grouped | Low | Not grouped |
| Maclean (A) | Low | Medium | Medium | Medium |
| Manilla (A) | Low | Medium | Medium | Medium |
| Merriwa (A) | Medium | Medium | Medium | Medium |
| Moree Plains (A) | Low | Poor | Medium | High |
| Mudgee (A) | Low | Medium | Medium | Medium |
| Mulwaree (A) | Medium | Good | Low | High |
| Murray (A) | Medium | Medium | Low | High |
| Murrumbidgee (A) | Medium | Poor | Medium | High |
| Murrurundi (A) | Medium | Medium | Medium | Medium |
| Muswellbrook (A) | Low | Good | Medium | High |
| Nambucca (A) | Low | Medium | Low | Medium |
| Narrabri (A) | Low | Poor | Medium | High |
| Narrandera (A) | Low | Poor | Medium | High |
| Narromine (A) | Low | Medium | Medium | Medium |
| Nundle (A) | Medium | Poor | Medium | High |
| Nymboida (A) | Low | Medium | Low | Medium |
| Oberon (A) | Medium | Good | Medium | High |
| Orange (C) | Low | Medium | Medium | High |
| Parkes (A) | Low | Medium | Medium | Medium |
| Parry (A) | Medium | Medium | Low | High |
| Queanbeyan (C) | Low | Medium | Low | High |
| Quirindi (A) | Medium | Medium | Medium | Medium |
| Richmond River (A) | Low | Medium | Medium | Medium |
| Rylstone (A) | Medium | Medium | Medium | Medium |
| Scone (A) | Medium | Good | Medium | High |
| Severn (A) | Low | Medium | Low | Medium |
| Shoalhaven (C) | Low | Medium | Medium | Medium |
| Singleton (A) | Medium | Good | Medium | High |
| Snowy River (A) | High | Good | Low | High |
| Tallaganda (A) | Low | Good | Low | High |
| Tamworth (C) | Low | Medium | Medium | High |
| Temora (A) | Medium | Medium | Medium | Medium |
| Tenterfield (A) | Low | Medium | Medium | Medium |
| Tumbarumba (A) | Medium | Good | Medium | High |
| Tumut (A) | Low | Medium | Medium | Medium |
| Tweed Heads [Tweed (A) - Part A] | Low | Medium | Medium | Medium |
| Tweed (A) [Part B] | Low | Medium | Medium | Medium |
| Ulmarra (A) | Low | Medium | Medium | High |
| Unincorporated Far West | Low | Not grouped | Low | Not grouped |

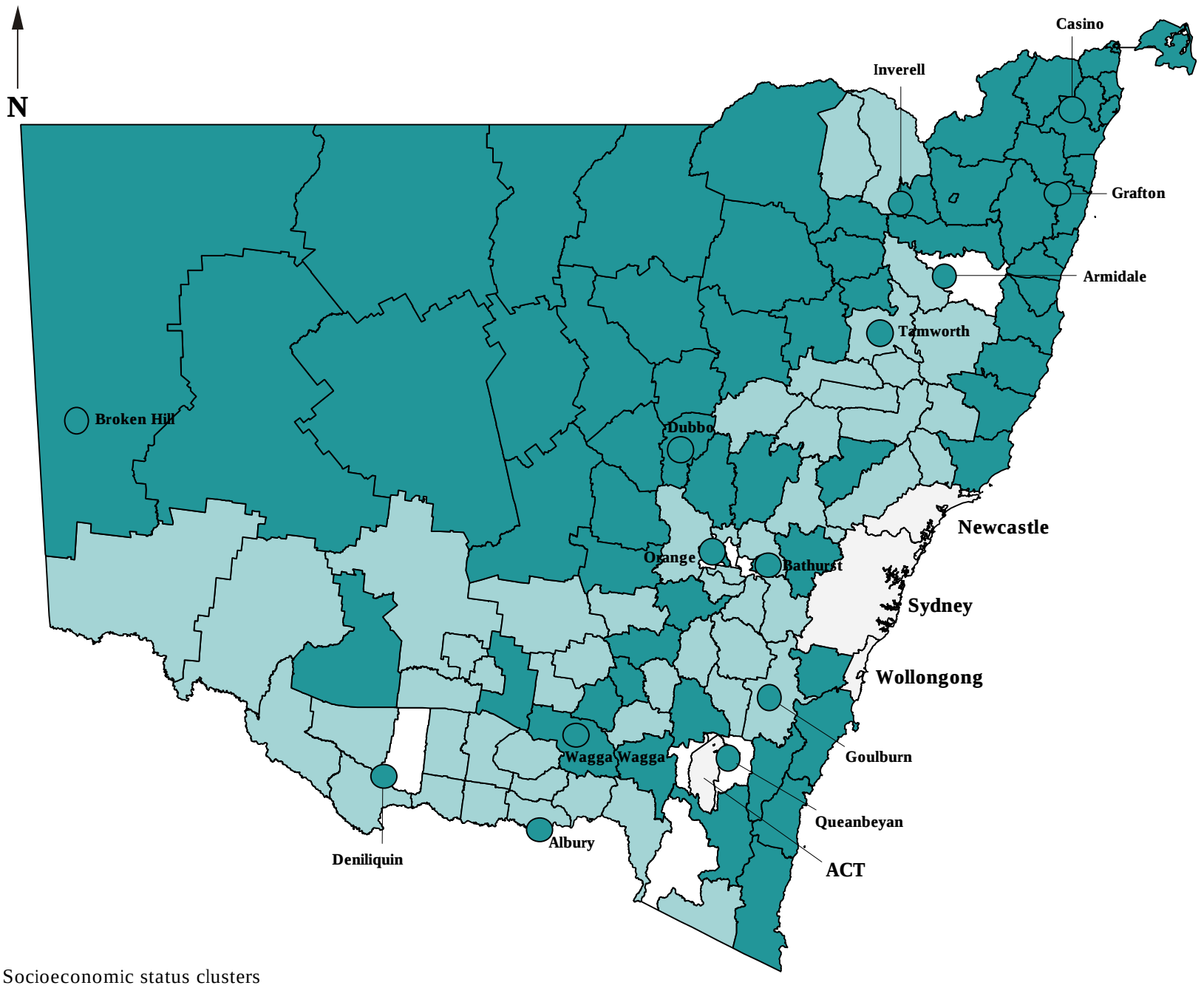
**Table 8.6: Composition of SLA clusters in the non-metropolitan areas of New South Wales ... *cont***

| SLA | Socioeconomic status | Health status | Health service utilisation | Social health status[1] |
|---|---|---|---|---|
| Uralla (A) | Medium | Good | Low | High |
| Urana (A) | Medium | Poor | Medium | Medium |
| Wagga Wagga (C) | Low | Medium | Low | High |
| Wakool (A) | Medium | Good | Low | High |
| Walcha (A) | Medium | Good | Medium | High |
| Walgett (A) | Low | Very Poor | Medium | Low |
| Warren (A) | Low | Poor | Medium | High |
| Weddin (A) | Medium | Medium | Medium | Medium |
| Wellington (A) | Low | Medium | Medium | Medium |
| Wentworth (A) | Medium | Poor | Medium | High |
| Windouran (A) | Medium | Poor | Low | High |
| Wingecarribee (A) | Low | Medium | Medium | High |
| Yallaroi (A) | Medium | Medium | Medium | Medium |
| Yarrowlumla (A) [Part A] | High | Good | Low | High |
| Yarrowlumla (A) [Part B] | High | ..[2] | ..[2] | ..[2] |
| Yass (A) | Low | Good | Low | High |
| Young (A) | Low | Poor | Medium | High |

**[1] Social health 'status clusters were produced by a joint analysis of the socioeconomic status and health status variable.**
**[2] Yarrowlumla was one SLA in this dataset: cluster shown against Part A.**

## Map 8.5
## Socioeconomic status clusters based on Statistical Local Areas, New South Wales

clusters of SLAs with generally similar socioeconomic status characteristics




Socioeconomic status clusters

- *Low*
- *Medium*
- *High*
- *not mapped*[*]

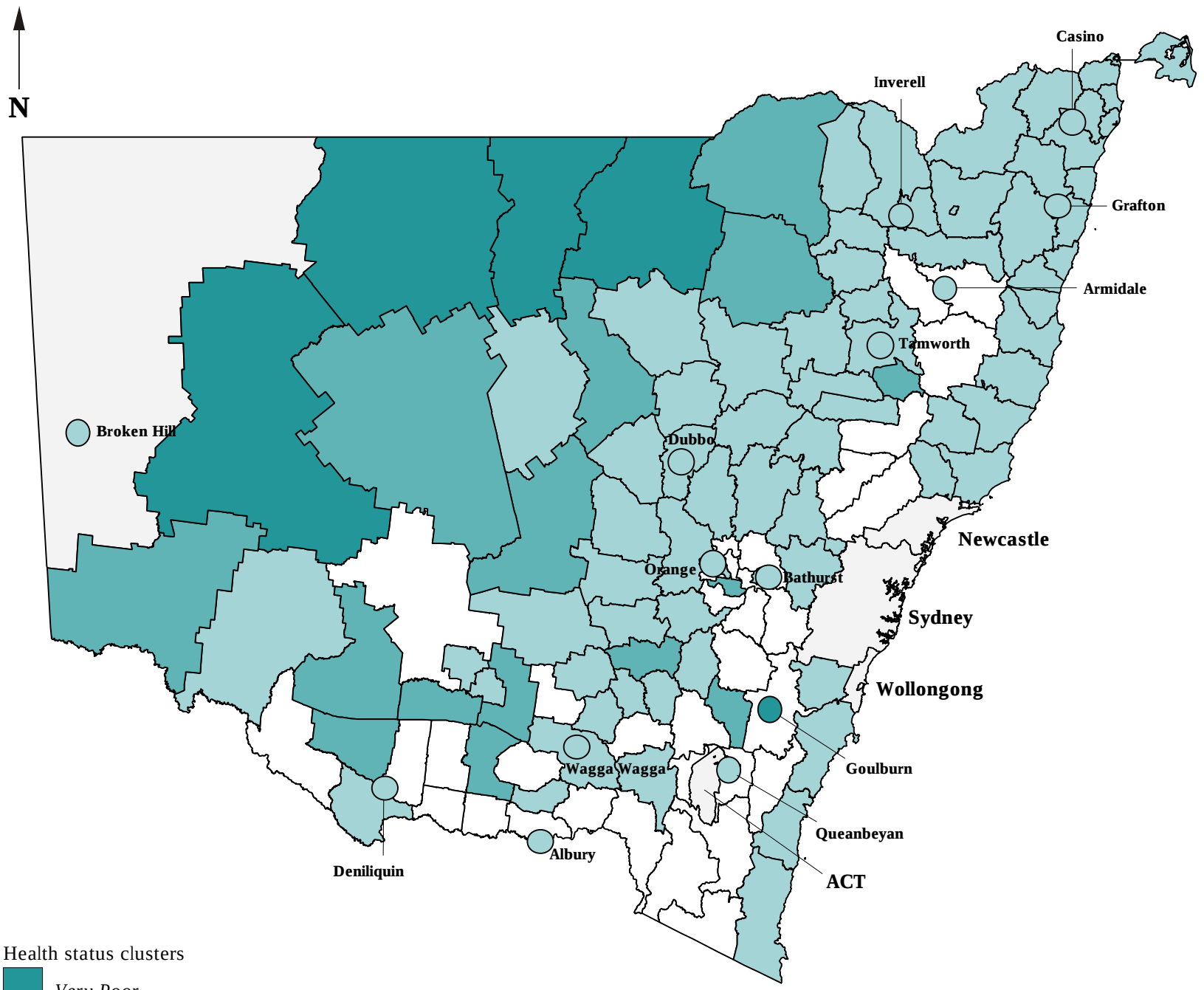
[*]*Areas not mapped include Sydney, Newcastle, Wollongong and the ACT, which were analysed separately*

***Source: Compiled from project sources***

***Details of map boundaries are in Appendix 1.2***

## Map 8.6
## Health status clusters based on Statistical Local Areas, New South Wales

clusters of SLAs with generally similar health status characteristics

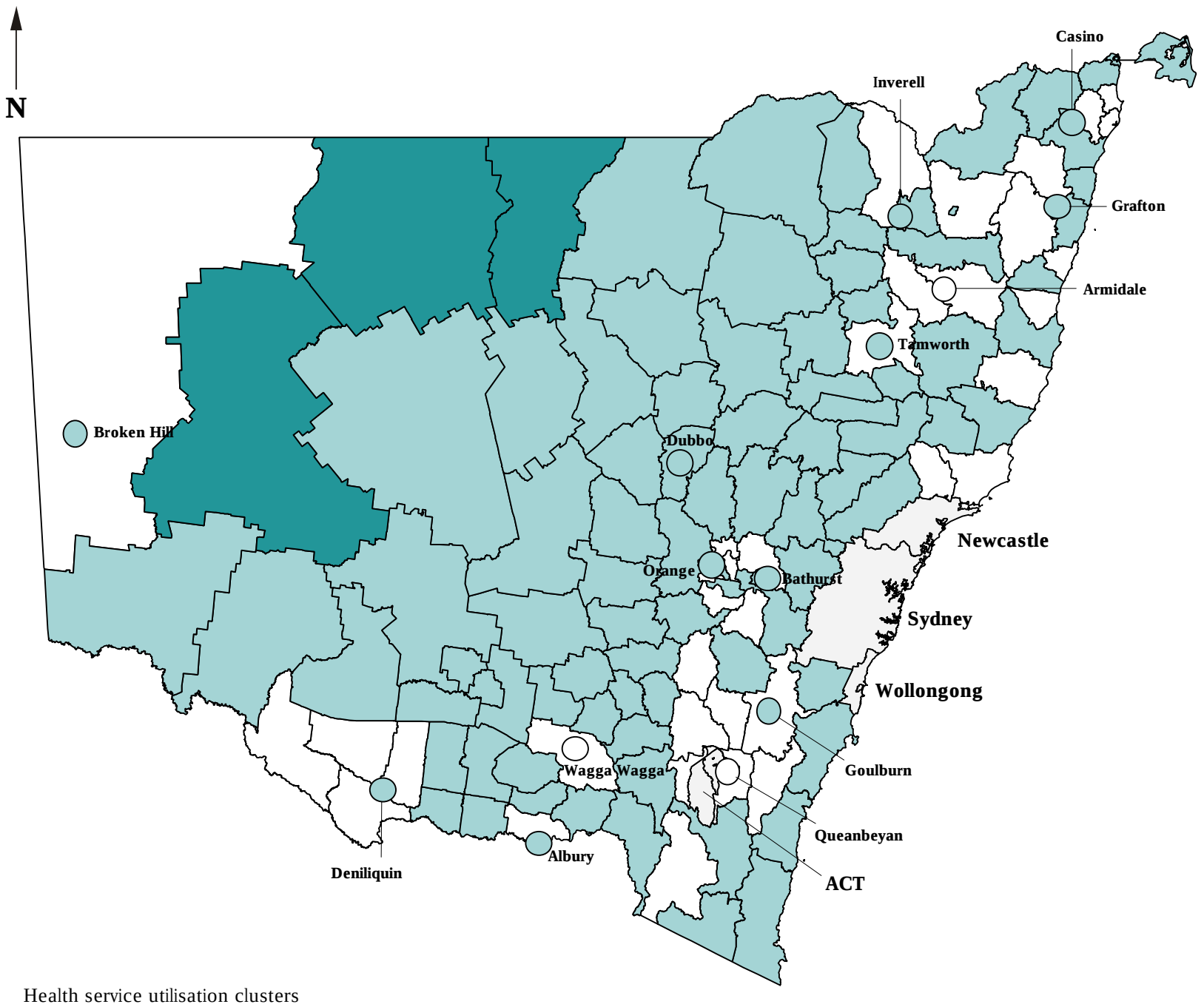



*Areas not mapped include Sydney, Newcastle, Wollongong and the ACT, which were analysed separately, and Unincorporated Far West which was excluded from the analysis

***Source: Compiled from project sources*** ***Details of map boundaries are in Appendix 1.2***

## Map 8.7
## Health service utilisation clusters based on Statistical Local Areas, New South Wales

clusters of SLAs with generally similar health service utilisation characteristics




Health service utilisation clusters

- *High*
- *Medium*
- *Low*
- *not mapped**

**Areas not mapped include Sydney, Newcastle, Wollongong and the ACT, which were analysed separately*

***Source: Compiled from project sources***

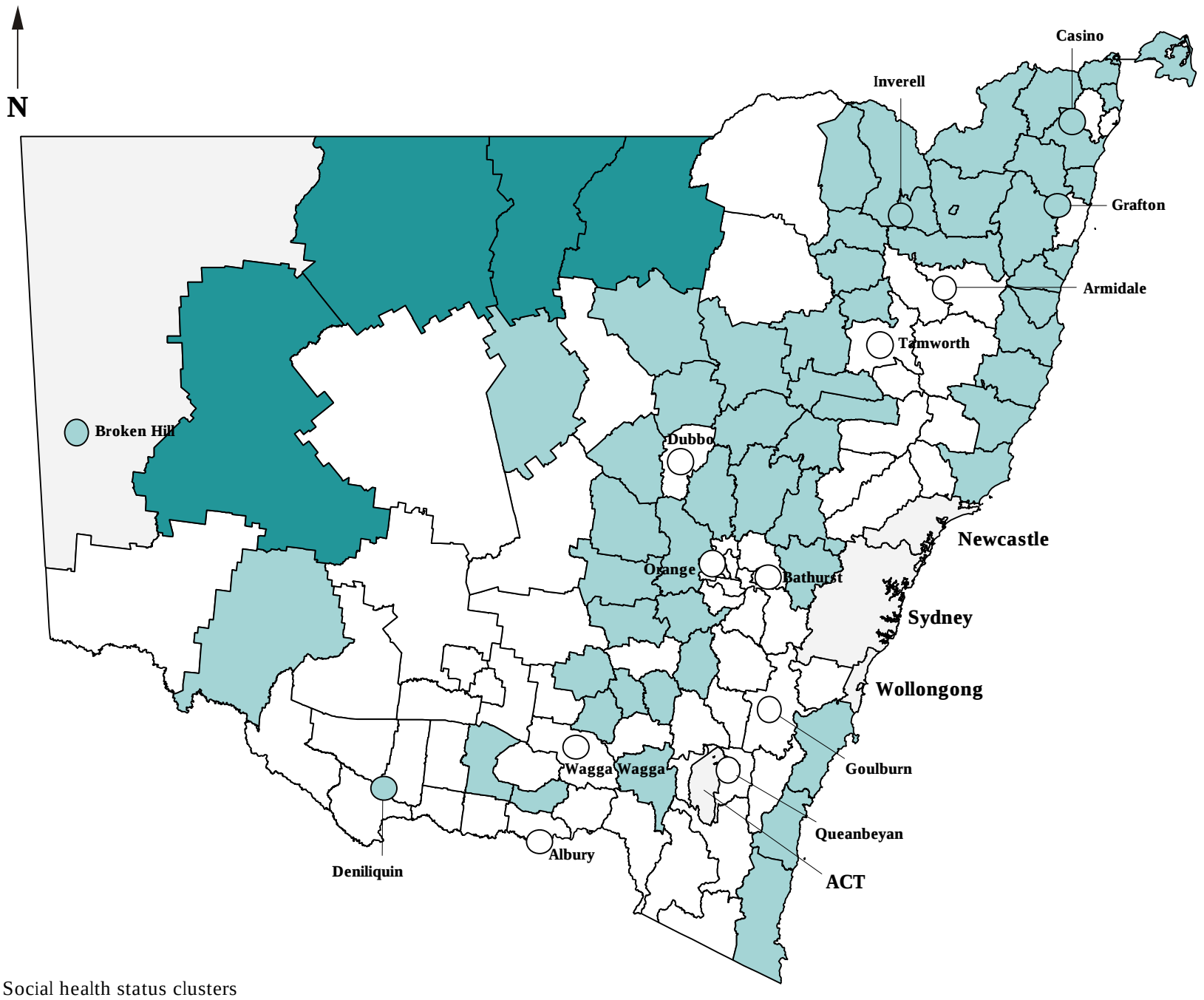
***Details of map boundaries are in Appendix 1.2***

**National Social Health Atlas Project, 1999**

## Map 8.8

## Social health status clusters based on Statistical Local Areas, New South Wales

clusters of SLAs with generally similar social health status characteristics




*Areas not mapped include Sydney, Newcastle, Wollongong and the ACT, which were analysed separately, and Unincorporated Far West which was excluded from the analysis

***Source: Compiled from project sources***

***Details of map boundaries are in Appendix 1.2***

## Socioeconomic clusters of towns

A cluster analysis was undertaken for the 55 towns (urban centres) across Australia that had populations of 7,500 or more at the 1996 Census and were identifiable in the non-Census datasets (see Appendix 1.2 for further details of the selection of these towns). These 55 records are sufficient to carry out a cluster analysis with the nine input variables.

As the analysis was somewhat complicated, only the main results are discussed below. The full description is in Appendix 1.6.

A cluster analysis was performed on the available data, and the solution examined before attempting more complicated techniques to find a solution. This analysis provided a three cluster solution of fair to average quality. It did not discriminate particularly well between clusters, and the High socioeconomic cluster did not perform particularly well against the IRSD.

The 55 records also provided enough information for an exploratory factor analysis, since this analysis has the same data requirements as the previous model.

Although several analyses were tried, the best solution was a four cluster solution (based on low income families, unemployed people, early school leavers, unskilled and semi-skilled workers, Indigenous people and single parent families). This solution is reproduced in **Table 8.7**.

The ABS Index of Relative Socio-Economic Disadvantage (IRSD) was available for the specified towns, but was withheld from the analysis and used as an independent check on the solution. It was found that, of the bottom 17 towns as classified by the IRSD, 16 (94.1 per cent) were classified to the Low socioeconomic group in this analysis. Further, of the top 20 towns under the IRSD, 15 (75.0 per cent) were classified to the High socioeconomic group.

## Health status clusters of towns

There were 15 variables to analyse 55 records. This was not quite enough data. A number of alternative strategies were tried in an attempt to produce a satisfactory solution, with the outcome being a three cluster solution of good quality. The clusters were better spread than in other solutions, and it performed better against the IRSD than other solutions (**Table 8.7**).

The IRSD was again used as an independent check on the solution. It was found that, of the bottom 12 towns as classified by the IRSD, five (41.7 per cent) were classified to the Poor health status group in this analysis. Further, of the top 22 towns under the IRSD, 14 (63.6 per cent) were classified to the Good health status group.

## Health service utilisation clusters of towns

There were 30 variables to analyse 55 records. This was not enough data. A number of alternative strategies were tried in an attempt to produce a satisfactory solution, with the outcome being a three cluster solution of good quality. The clusters were better spread than in other solutions, and it performed better against the IRSD than other solutions (**Table 8.7**).

A check with the IRSD showed that, of the bottom ten towns as classified by the IRSD, three (30.0 per cent) were classified to the High health service use group in this analysis. Further, of the top 26 towns under the IRSD, 13 (50.0 per cent) were classified to the Low health service use group.

## Social health clusters of towns

The cluster analysis technique has also been applied to a combination of the socioeconomic status and health status data sets. Data considered for inclusion were the variables in the final models for towns used to examine socioeconomic status and health status.

There were 24 variables to analyse 55 records. This was clearly not enough data. A cluster analysis of all the above variables was tried to see if it gave a reasonable solution despite the lack of data. This produced a three cluster solution of fair to average quality. The solution did not perform at all well against the IRSD for the Low status group, and lacked definition between the Medium and Low status groups.

Alternative strategies were tried in an attempt to produce a better solution, with the outcome a three cluster solution of reasonable quality, with Charters Towers (C) not grouped. The clusters were better spread than in other solutions, and the solution performed better against the IRSD than other solutions (**Table 8.7**).

Of the 17 lowest towns for the IRSD, nine (52.9 per cent) were classified to the Low social health status cluster; and of the top 14 towns for the IRSD, seven (50.0 per cent) were classified to the High social health status cluster.

**Table 8.7: Composition of town clusters in Australia**

| SLA | Socioeconomic status | Health status | Health service utilisation | Social health status[1] |
|---|---|---|---|---|
| Albany (T) | Very low | Medium | Low | Medium |
| Albury (C) | High | Medium | Low | Low |
| Alice Springs (T) | Low | Medium | Medium | Low |
| Armidale (C) | High | Good | High | High |
| Ballarat (C) | High | Good | Low | Medium |
| Bathurst (C) | High | Good | Low | High |
| Benalla | High | Medium | High | Medium |
| Bendigo (C) | High | Good | Low | Medium |
| Broken Hill (C) | Very low | Poor | Low | Medium |
| Broome (S) | Low | Medium | Medium | Medium |
| Bunbury (C) | Medium | Good | Medium | High |
| Burnie (C) | Very low | Poor | Low | Low |
| Cairns (C) | High | Good | Low | High |
| Casino (A) | Very low | Medium | Medium | Low |
| Charters Towers (C) | Medium | Poor | Medium | Not grouped |
| Colac | Medium | Poor | Low | Low |
| Dalby (T) | Medium | Medium | Low | High |
| Deniliquin (A) | High | Poor | Medium | Medium |
| Devonport (C) | Very low | Medium | Low | Low |
| Dubbo (C) | High | Good | Medium | Medium |
| Echuca | High | Medium | Low | Medium |
| Geraldton (C) | Very low | Medium | Low | Medium |
| Gladstone (C) | Medium | Good | Low | High |
| Goulburn (C) | Medium | Medium | Medium | Low |
| Grafton (C) | Very low | Medium | Medium | Medium |
| Hamilton | High | Good | Low | Medium |
| Hervey Bay (C) | Very low | Medium | Low | Low |
| Horsham (RC) | High | Good | Low | Medium |
| Inverell (A) | Very low | Medium | High | Medium |
| Kalgoorlie/Boulder (C) | Medium | Poor | Medium | High |
| Katherine (T) | Low | Poor | Medium | Low |
| Launceston (C) | High | Good | Low | Medium |
| Mandurah (C) | Very low | Medium | Low | Low |
| Maryborough (C) | Very low | Medium | Low | Medium |
| Mount Gambier (C) | Medium | Good | High | High |
| Mount Isa (C) | Medium | Medium | Medium | High |
| Murray Bridge (RC) | Very low | Medium | Low | Low |
| Noosa | High | Good | Low | Medium |
| Orange (C) | High | Good | Medium | Low |
| Port Augusta (C) | Very low | Poor | Medium | Low |
| Port Hedland (T) | Medium | Medium | Medium | High |
| Port Lincoln (C) | Very low | Poor | High | Low |
| Port Pirie (C) | Very low | Poor | High | Medium |
| Portland | Very low | Poor | High | Medium |
| Queanbeyan (C) | High | Good | High | High |
| Rockhampton (C) | Medium | Good | Low | High |
| Sale | High | Good | Low | Medium |
| Shepparton (C) | Medium | Good | Medium | Low |
| Swan Hill (RC) | High | Good | Low | Medium |
| Tamworth (C) | High | Medium | Medium | Medium |
| Toowoomba (C) | Medium | Good | Low | High |
| Wagga Wagga (C) | High | Good | Medium | High |
| Wangaratta (RC) | Medium | Good | Medium | Low |
| Warwick (S) | Medium | Poor | High | Medium |
| Whyalla (C) | Very low | Medium | High | Low |

[1] **Social health 'status clusters were produced by a joint analysis of the socioeconomic status and health status variables**

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