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). The 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 **Perth** 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 different years for which the data is available, and changes in boundaries between those periods, have meant that the correlation matrices for **Perth** and the rest of Western Australia are on an adjusted common set of boundaries (boundaries in the 1991 to 1994 editions of the ASGC). Thus, due to boundary changes in **Perth**, the SLAs of Perth, Cambridge and Vincent were combined, as were the SLAs of Wanneroo – Central Coast, - North-East, - North-West, - South-East and – South-West. In the non-metropolitan areas the SLAs of Wiluna and Ngaanyatjarraku were combined.

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 (**Table 8.1** and **8.2**).

Results

Perth

There were correlations of significance at the SLA level between the measures of socioeconomic disadvantage and a number of the health status variables. The strongest of these were 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 PCS (the Physical Component Summary, a measure of physical health); and premature death from, in particular, lung cancer and circulatory 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, admissions to a public hospital admissions for Caesarean section and admissions for hysterectomy.

Non-metropolitan areas

SLAs in the non-metropolitan areas range in size from an estimated 13 square kilometres in Narrogin to 378,445 in East Pilbara. 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 Western Australia than was the case in **Perth**. 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, single parent families, unemployed people, the Indigenous population and dwellings without a motor 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 pattern between socioeconomic disadvantage and the variables for deaths of males and females; hospital admissions of males and females; and hospital admissions from accidents, poisonings and violence.

For the Indigenous population, there were correlations of meaningful significance at the SLA level with the variables for years of potential life lost (the summary measure of premature death), people reporting fair or poor health, people with a handicap, deaths of 15 to 64 year old males and females, admissions to a public hospital and admissions from the combined causes of accidents, poisonings and violence; and admissions for neuroses.

Table 8.1: Correlation matrix for SLAs in Perth

Refer to file: ch8 correlation matrices

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

Refer to file: ch8 correlation matrices

Table 8.2: Correlation matrix for SLAs in the non-metropolitan areas of Western Australia

Refer to file: ch8 correlation matrices

Table 8.2: Correlation matrix for SLAs in the non-metropolitan areas of Western Australia ...*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 **Perth** 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 clusters in Perth

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

Table 8.4: Composition of SLA clusters in Perth

SLA	Socioeconomic status	Health status	Health service utilisation	Social health[1]
Armadale (C)	Low	Medium	Very high	Low
Bassendean (T)	Low	Poor	High	Low
Bayswater (C)	Medium	Medium	High	High
Belmont (C)	Low	Poor	Very high	Low
Canning (C)	Medium	Good	Low	High
Claremont (T)	High	Good	Medium	High
Cockburn (C)	Low	Medium	Very high	Low
Cottesloe (T)	High	Good	Medium	High
East Fremantle (T)	High	Medium	High	High
Fremantle	Low	Medium	Very high	Low
Gosnells (C)	Low	Medium	Very high	Low
Kalamunda (S)	Medium	Good	High	High
Kwinana (T)	Low	Poor	Very high	Low
Melville (C)	High	Good	Low	High
Mosman Park (T)	Low	Poor	Medium	Low
Mundaring (S)	Medium	Good	High	High
Nedlands (C)	High	Good	Medium	High
Peppermint Grove (S)	High	Very good	Medium	Very high
Perth (C: South)	Low	Poor	High	Low
Perth Central	High	Medium	High	High
Rockingham (C)	Low	Medium	Very high	Low
Serpentine-Jarrahdale (S)	Medium	Good	High	High
South Perth (C)	High	Good	High	High
Stirling (C): Central	Low	Medium	Very high	Low
Stirling (C): Coastal	High	Poor	High	Low
Stirling (C): South-eastern	Low	Medium	Low	High
Subiaco (C)	High	Good	Medium	High
Swan (S)	Low	Medium	High	Low
Wanneroo	Medium	Good	High	High

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

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.

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 29 SLAs in **Perth** (the SLAs of Perth-Inner and -Remainder were analysed as one). These 29 records are not 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.

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

Several analyses were undertaken and a three cluster solution was accepted as it performed as well as or better than any other solution against the ABS Index of Relative Socio-Economic Disadvantage (IRSD) (**Table 8.4** and **Map 8.1**).

Although, as noted above, theoretically there is insufficient data to justify the model, the solution is so good it should be accepted (ie. the end justifies the means). This is supported by a comparison with the IRSD. This comparison showed that, of the 13 SLAs with the lowest IRSD scores in **Perth**, 11 were classified to the Low socioeconomic status group in this analysis; and that all of the SLAs with the highest scores for the IRSD were classified to the High socioeconomic status group.

Health status clusters in Perth

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.

The variables deaths of 15 to 64 year olds from respiratory system diseases and lung cancer and deaths of people aged 15 to 24 years from the combined causes of accidents, poisonings and violence were excluded from the analysis because five per cent or more of the SLAs had no cases.

Thus there were 12 variables to analyse 29 records. Clearly this was not enough data.

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 very clean four cluster solution of high quality, which was accepted without further investigation (**Table 8.4** and **Map 8.2**).

The ABS Index of Relative Socio-Economic Disadvantage (IRSD) was also available for the specified SLAs, but was withheld from the analysis and used as an independent check on the solution. It was found that, of the bottom six SLAs for **Perth** (as classified by the IRSD), three (50.0 per cent) were classified to the Poor health status group in this analysis. Further, the top SLA under the IRSD was classified to the Very Good health status group, and of the next highest 11 SLAs under the IRSD, 7 (63.6 per cent) were classified to the Good health status group. .

Health service utilisation clusters in Perth

All but one of the variables in this data set was 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 five hospital admissions were predicted from the Australian rates) were substituted by zero. Legitimate zero coded values remained as zero.

Thus there were 29 variables to analyse 29 records. Clearly this was not enough data.

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 very clean four cluster solution (see **Table 8.4** and **Map 8.3**).

A check with the IRSD showed that, of the bottom eight SLAs for **Perth** as classified by the IRSD, seven (87.5 per cent) were classified to the High health service use group in this analysis. Although none of the top three SLAs under the IRSD was classified to the Low health service use group, six of the top nine SLAs (66.7 per cent) were classified to the Medium or Low service use groups.

Social health clusters in Perth

The cluster analysis technique has also been applied to a combination of the final socioeconomic status and health status data sets used in the analyses above. 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.

Thus there were 21 variables to analyse 29 records. Clearly this was not enough data.

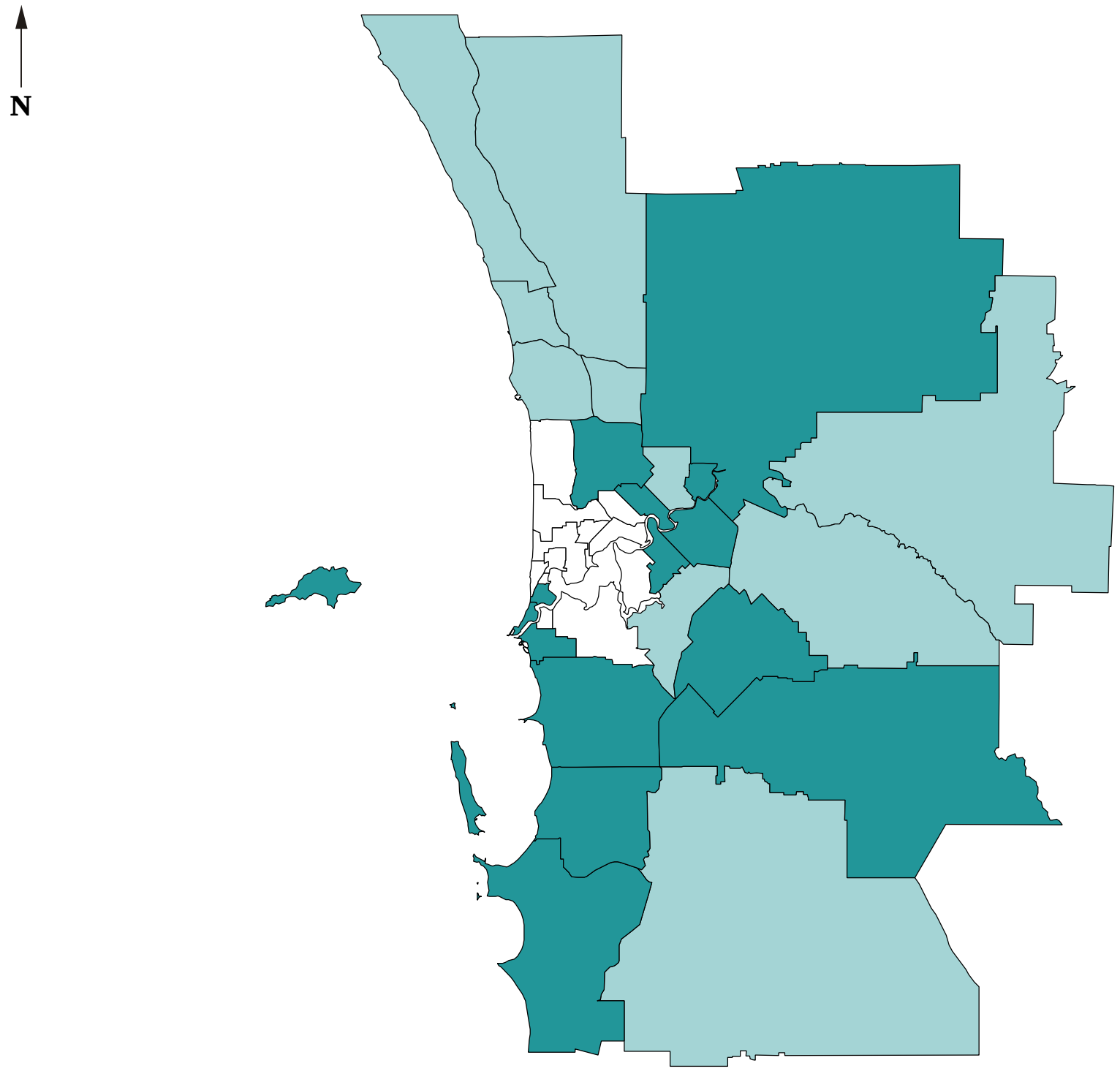
A cluster analysis of all the above variables was tried to see if it gave a sensible solution despite the lack of data. This produced a very clean two cluster solution of good quality. However, there was also a possibility of accepting a three cluster solution based on the agglomeration schedule of the cluster analysis. The SLAs in the three cluster solution are listed in **Table 8.4** and **Map 8.4**. Note that the Low social health status group had a higher ranking than the High social health status group for disability and female labour force participation.

It was found that, of the bottom 13 SLAs for **Perth** as classified by the IRSD, 11 (84.6 per cent) were classified to the Low social health status group in this analysis. The top SLA under the IRSD was classified to the Very high social health status group, and of the next top 15 SLAs under the IRSD, 13 (86.7 per cent) were classified to the High social health status group.

Map 8.1

Socioeconomic status clusters based on Statistical Local Areas, Perth, 1996

clusters of SLAs with generally similar socioeconomic status characteristics



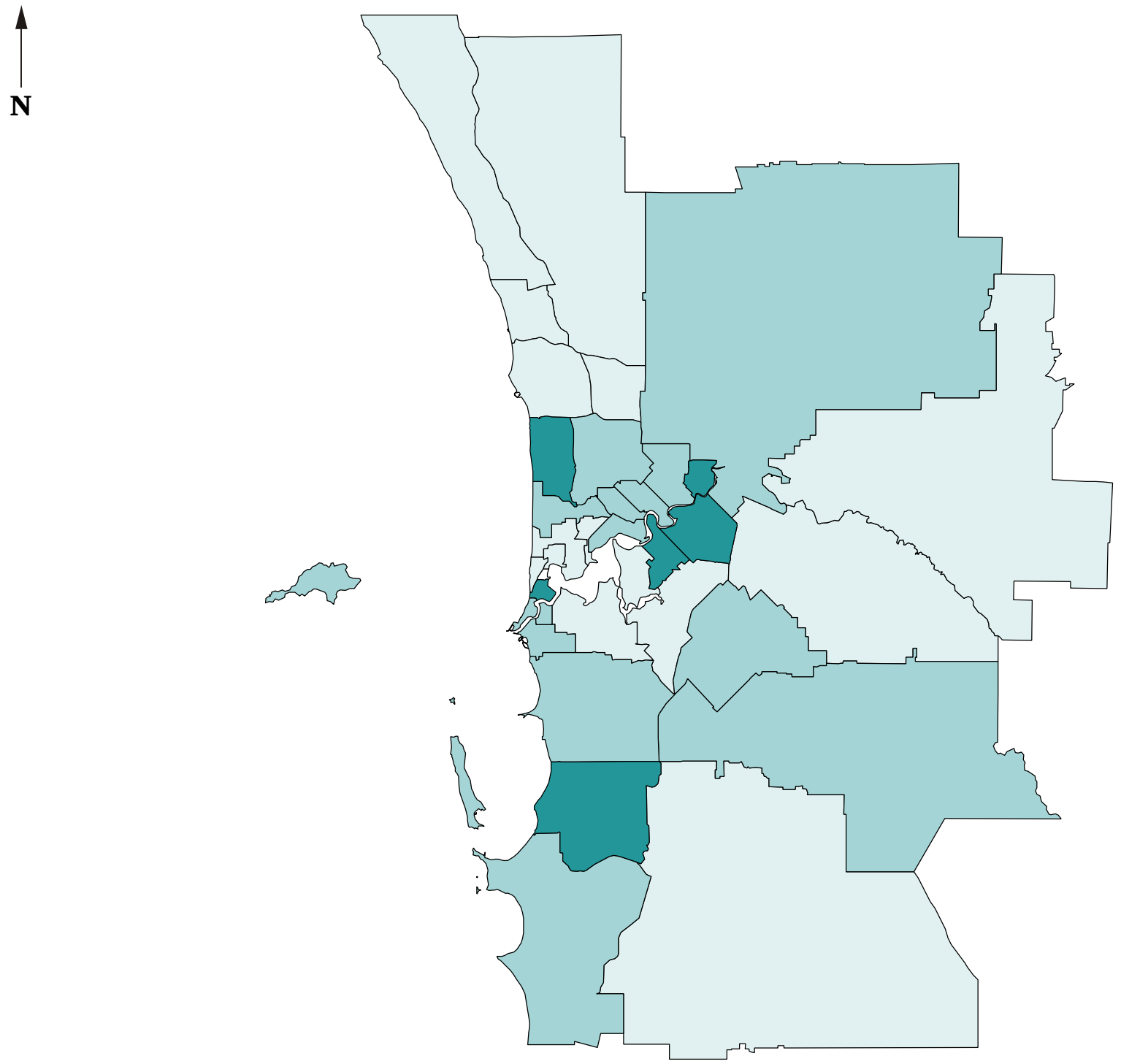
Source: Compiled from project sources

Details of map boundaries are in Appendix 1.2

National Social Health Atlas Project, 1999

Map 8.2
Health status clusters based on Statistical Local Areas, Perth, 1996

clusters of SLAs with generally similar health status characteristics



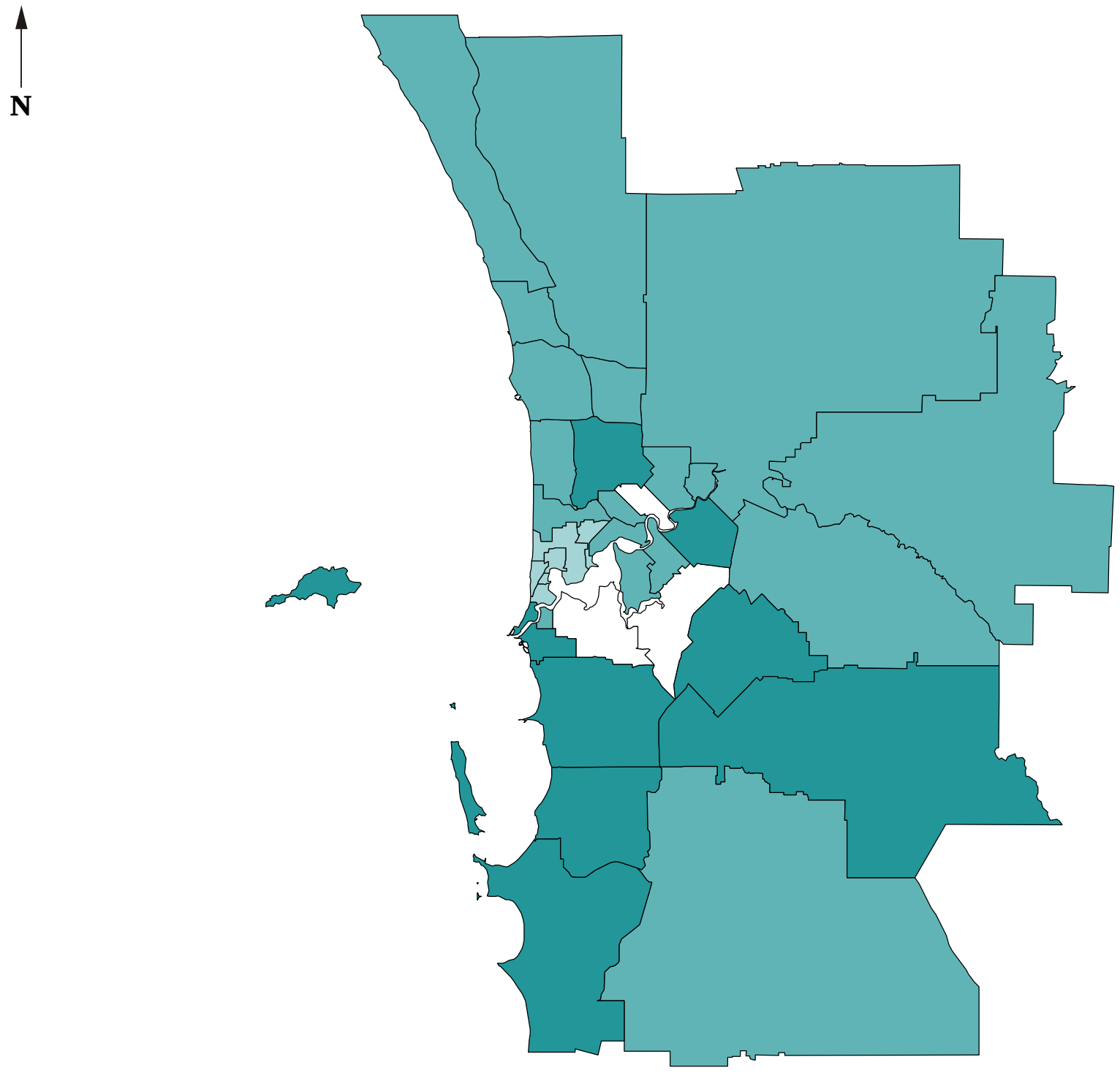
Source: Compiled from project sources

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, Perth, 1996

clusters of SLAs with generally similar health service utilisation characteristics



Source: Compiled from project sources

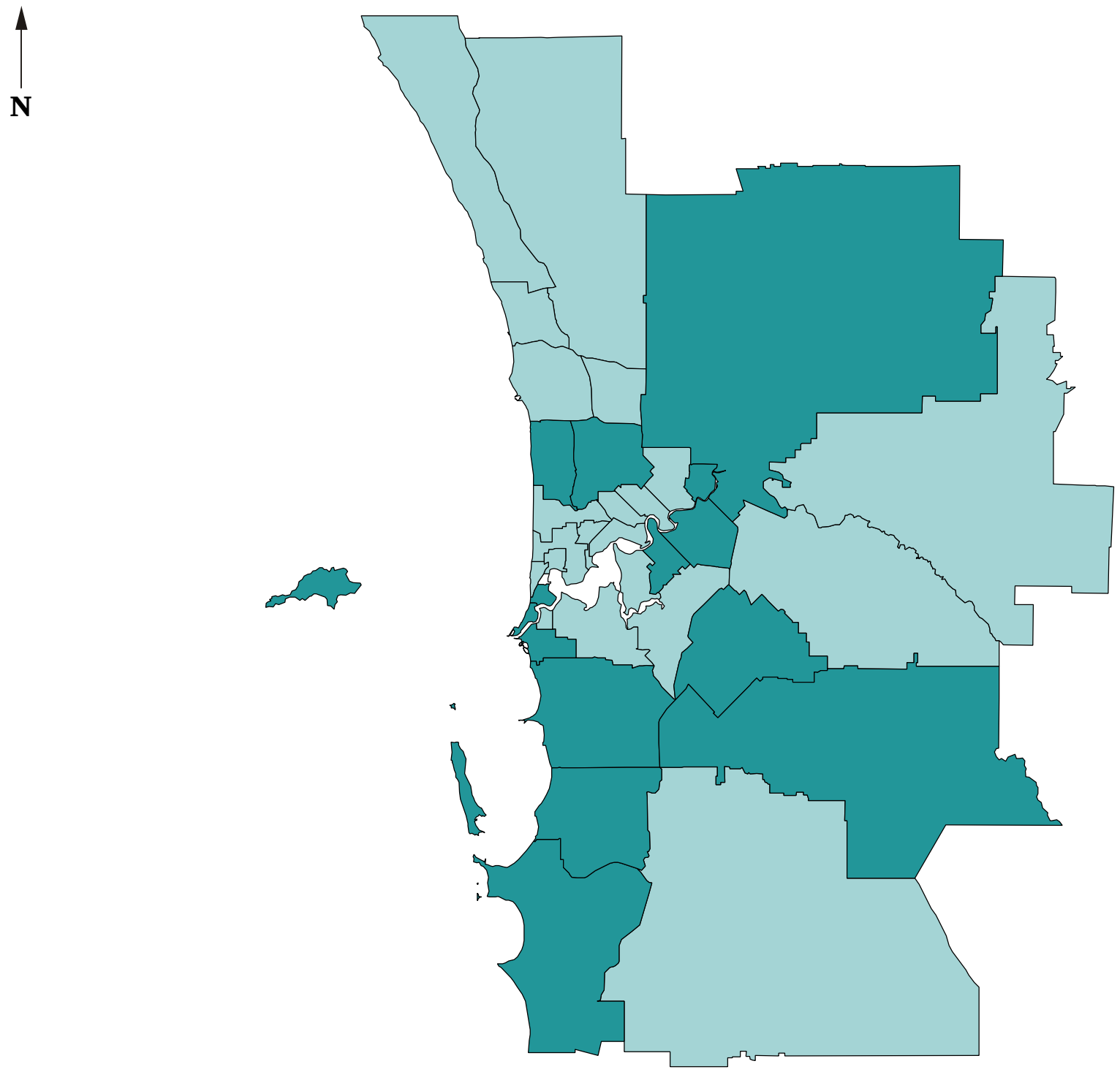
Details of map boundaries are in Appendix 1.2

National Social Health Atlas Project, 1999

Map 8.4

Social health status clusters based on Statistical Local Areas, Perth, 1996

clusters of SLAs with generally similar social health status characteristics



Source: Compiled from project sources

Details of map boundaries are in Appendix 1.2

Socioeconomic clusters of non-metropolitan SLAs

The production of clusters at the SLA level in non-metropolitan areas is even more problematic (than for **Perth**), with SLAs varying enormously in size and composition. For example, SLAs such as Mandurah, Kalgoorlie/Boulder and Bunbury (population 37,922, 29,685 and 26,558 respectively) stand in contrast to rural SLAs such as Murchison (174) and Nungarin (282). Indigenous people, generally the most disadvantaged population group, are unevenly distributed throughout these SLAs, from as high as 85.6 per cent of the total population in Ngaanyatjarraku, 59.1 per cent in Halls Creek and 54.6 per cent in Derby-West Kimberley to less than one per cent Indigenous population in some 19 non-metropolitan SLAs (16.8 per cent of all non-metropolitan SLAs). Despite these variations, the results of the cluster analysis are understandable.

There was data for 112 SLAs across Western Australia. These 112 records are ample to carry out a cluster analysis with eight input variables. A cluster analysis was performed on the available data, and the solution examined. This produced a three cluster solution which was a very clean solution of high quality, and it is reproduced in **Table 8.5** and **Map 8.5**. Three clusters have been described as Low (7 SLAs), Medium (54 SLAs) or High (51 SLAs) socioeconomic status.

The Low socioeconomic status cluster is mainly comprised of areas located in the western regions of the State, including Derby-west Kimberley, Halls Creek, Wiluna/Ngaanyatjarraku and Laverton. SLAs in the High socioeconomic status cluster are grouped in a number of locations, including the towns of Broome, and Port Headland.

The ABS Index of Relative Socio-Economic Disadvantage (IRSD) was again used as an independent check on the solution. Of the seven lowest SLAs for the IRSD, six (85.7 per cent) were classified to the Low socioeconomic status cluster; and of the top 51 SLAs for IRSD, 37 (72.5 per cent) were classified to the High socioeconomic status group.

Health status clusters of non-metropolitan SLAs

The variables infant deaths; deaths of males and females aged between 15 to 64 years; deaths of 15 to 64 year olds from cancer, lung cancer, respiratory system diseases, circulatory system diseases and accidents, poisonings and violence; and deaths of 15 to 24 year olds from accidents, poisonings and violence were excluded from the analysis because five per cent or more of SLAs had no cases. Thus there were six variables to analyse 112 records. Clearly this is ample data.

A cluster analysis of all the above variables was tried to see if it gave a sensible solution. The solution was a fairly clean three cluster solution which did not discriminate well between Medium and Good health status clusters. However, it did line up fairly well against the IRSD and was accepted without further investigation. The SLAs in each cluster are listed in **Table 8.5** and shown in **Map 8.6**.

It was found that, of the bottom eight SLAs for the non-metropolitan SLAs in Western Australia as classified by the IRSD, four (50.0 per cent) were classified to the Poor health status group in this analysis. Further, of the top 47 SLAs under the IRSD, 35 (74.5 per cent) were classified to the Good health status group.

Health service utilisation clusters of non-metropolitan SLAs

The variables for admissions of lung cancer, breast cancer, myringotomy, hysterectomy and hip replacement were excluded from the analysis because over 5 per cent of areas had no cases. Thus there were 24 variables to analyse 112 records. This was not quite enough data.

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

A number of alternative strategies were tried in an attempt to produce a useful solution. The only solution which consistently grouped SLAs into High and Low service use clusters was a reasonably clean three factor solution. The SLAs in each cluster are listed in **Table 8.5** and shown in **Map 8.7**.

There was moderate agreement with the IRSD: of the lowest 41 SLAs for SEIFA, 14 (34.1 per cent) were in the High health service use cluster and, of the highest 10, none were in the Low health service use cluster.

Social health clusters of non-metropolitan SLAs

Data considered for inclusion were the demographic variables in the final model for SLAs in the non-metropolitan areas of Western Australia 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. Thus there were 13 variables to analyse 122 records (SLAs). Clearly this was enough data. A cluster analysis of all the above variables was tried to see if it gave a sensible solution. It resulted in a clean three cluster solution of good quality which was accepted without further investigation. The SLAs in each cluster are listed in **Table 8.5** and shown in **Map 8.8**. Note that the Low social health status group did have a higher ranking than the High social health status group for disability.

Of the 10 lowest SLAs for the IRSD, seven (70.0 per cent) were classified to the Low social health status cluster; and of the top 72 SLAs for the IRSD, 59 (81.9 per cent) were classified to the High social health status cluster.

Table 8.5: Composition of SLA clusters in non-metropolitan areas of Western Australia

SLA	Socioeconomic status	Health status	Health service utilisation	Social health[1]
Albany (S)	Medium	Medium	High	Medium
Albany (T)	Medium	Medium	High	Medium
Ashburton (S)	High	Good	Medium	High
Augusta-Margaret River (S)	Medium	Medium	High	Medium
Beverley (S)	Medium	Medium	High	Medium
Boddington (S)	Medium	Good	Medium	High
Boyup Brook (S)	Medium	Medium	High	Medium
Bridgetown-Greenbushes (S)	Medium	Medium	Medium	Medium
Brookton (S)	Medium	Medium	Medium	Medium
Broome (S)	High	Poor	Medium	Low
Broomehill (S)	High	Good	Medium	High
Bruce Rock (S)	High	Medium	Medium	High
Bunbury (C)	Medium	Medium	High	Medium
Busselton (S)	Medium	Medium	Medium	Medium
Capel (S)	High	Good	High	High
Carnamah (S)	High	Good	Low	High
Carnarvon (S)	Medium	Poor	Medium	Medium
Chapman Valley (S)	High	Good	Medium	High
Chittering (S)	Medium	Medium	Medium	High
Collie (S)	Medium	Medium	High	Medium
Coolgardie (S)	High	Good	High	High
Coorow (S)	Medium	Medium	Medium	High
Corrigin (S)	High	Good	Medium	High
Cranbrook (S)	Medium	Good	Medium	High
Cuballing (S)	Medium	Good	Medium	High
Cue (S)	High	Medium	Medium	High
Cunderdin (S)	Medium	Good	High	High
Dalwallinu (S)	High	Good	Medium	High
Dandaragan (S)	Medium	Medium	High	Medium
Dardanup (S)	Medium	Medium	Medium	High
Denmark (S)	Medium	Medium	High	Medium
Derby-west Kimberley (S)	Low	Poor	Medium	Low
Donnybrook-Balingup (S)	Medium	Medium	Medium	Medium
Dowerin (S)	Medium	Good	High	High
Dumbleyung (S)	High	Good	High	High
Dundas (S)	Medium	Poor	High	High
East Pilbara (S)	High	Good	Low	High
Esperance (S)	Medium	Medium	High	Medium
Exmouth (S)	Medium	Good	Low	High
Geraldton (C)	Medium	Medium	High	Medium
Gingin (S)	Medium	Medium	Medium	Medium
Gnowangerup (S)	High	Medium	High	High
Goomalling (S)	Medium	Good	Low	High
Greenough (S)	Medium	Medium	Medium	Medium
Halls Creek (S)	Low	Poor	Medium	Low
Harvey (S)	Medium	Medium	Medium	Medium
Irwin (S)	Medium	Medium	High	Medium
Jerramungup (S)	High	Good	Medium	High
Kalgoorlie/boulder (C)	Medium	Good	High	High
Katanning (S)	Medium	Medium	High	High
Kellerberrin (S)	Medium	Medium	High	Medium
Kent (S)	High	Good	Medium	High
Kojonup (S)	High	Medium	High	High
Kondinin (S)	High	Good	Medium	High
Koorda (S)	High	Medium	High	High
Kulin (S)	High	Good	Medium	High

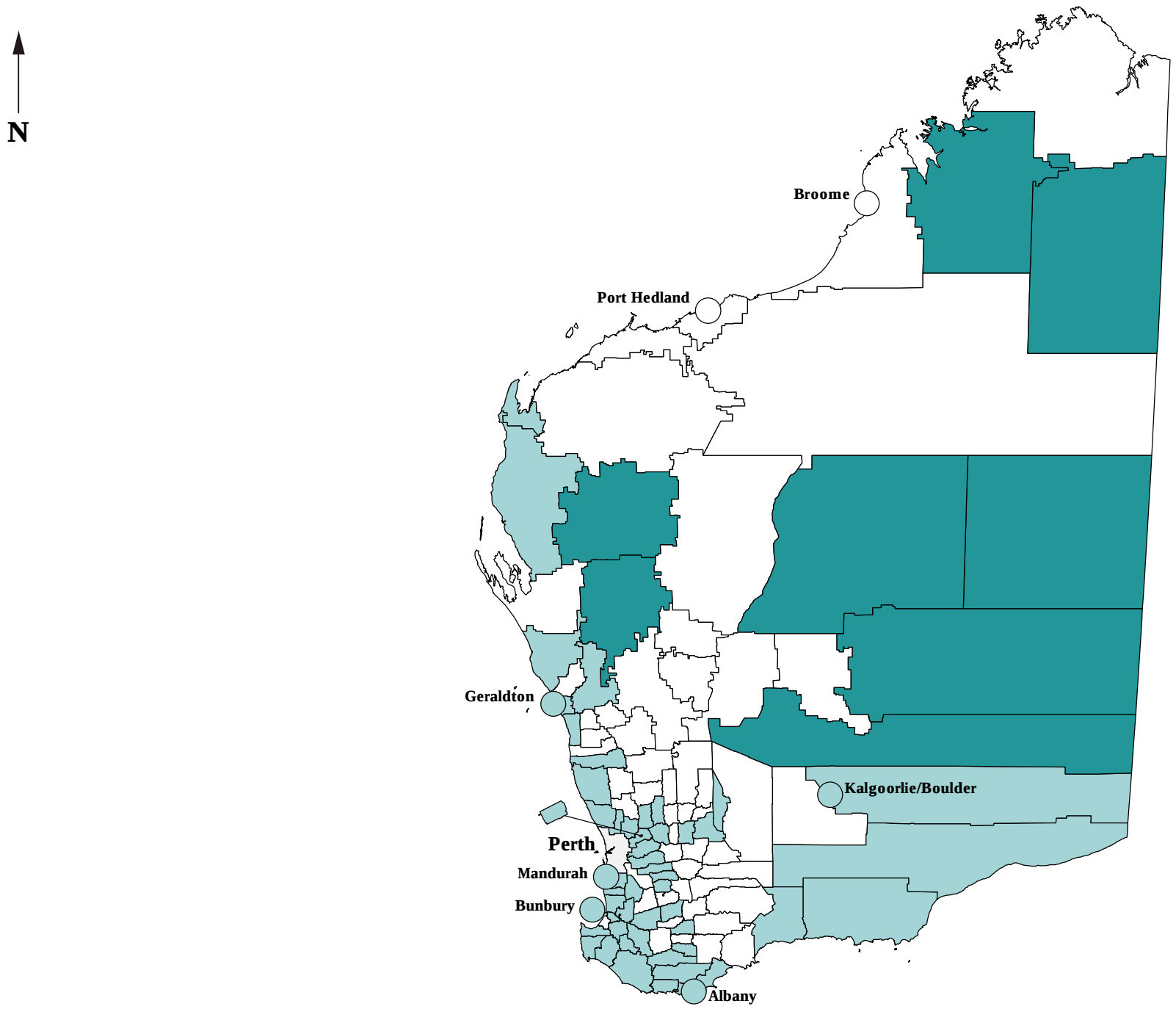
Table 8.5: Composition of SLA clusters in non-metropolitan areas of Western Australia ... *cont*

SLA	Socioeconomic status	Health status	Health service utilisation	Social health[1]
Lake Grace (S)	High	Good	High	High
Laverton (S)	Low	Good	Medium	Low
Leonora (S)	High	Good	Medium	High
Mandurah (C)	Medium	Medium	Medium	Medium
Manjimup (S)	Medium	Medium	Medium	High
Meekatharra (S)	High	Good	Medium	High
Menzies (S)	Low	Poor	High	Low
Merredin (S)	Medium	Medium	Medium	High
Mingenew (S)	High	Medium	High	High
Moora (S)	High	Medium	Medium	High
Morawa (S)	High	Medium	Medium	High
Mount Magnet (S)	High	Medium	Low	High
Mount Marshall (S)	High	Good	Medium	High
Mukinbudin (S)	High	Good	Medium	High
Mullewa (S)	Medium	Medium	Low	Low
Murchison (S)	Low	Medium	Medium	Low
Murray (S)	Medium	Medium	Medium	Medium
Nannup (S)	Medium	Medium	Medium	Medium
Narembeen (S)	High	Good	Medium	High
Narrogin (S)	High	Good	High	High
Narrogin (T)	Medium	Medium	Medium	High
Northam (S)	Medium	Medium	Medium	Medium
Northam (T)	Medium	Medium	Medium	Medium
Northampton (S)	Medium	Medium	Medium	Medium
Nungarin (S)	High	Good	High	High
Perenjori (S)	High	Good	Medium	High
Pingelly (S)	Medium	Medium	High	High
Plantagenet (S)	Medium	Medium	High	High
Port Hedland (T)	High	Good	High	High
Quairading (S)	High	Medium	Medium	High
Ravensthorpe (S)	Medium	Medium	High	High
Roebourne (S)	High	Good	Medium	High
Sandstone (S)	High	Good	Low	High
Shark Bay (S)	High	Good	Medium	High
Tambellup (S)	Medium	Medium	High	High
Tammin (S)	High	Medium	High	High
Three Springs (S)	High	Good	Low	High
Toodyay (S)	Medium	Medium	Medium	Medium
Trayning (S)	High	Medium	Medium	High
Upper Gascoyne (S)	Low	Good	Medium	Low
Victoria Plains (S)	High	Good	Medium	High
Wagin (S)	Medium	Medium	High	High
Wandering (S)	High	Medium	High	High
Waroona (S)	Medium	Medium	Medium	Medium
West Arthur (S)	Medium	Good	Medium	High
Westonia (S)	Medium	Good	High	High
Wickepin (S)	High	Good	Medium	High
Williams (S)	High	Good	Medium	High
Wiluna (S) Ngaanyatjarraku (S)	Low	Poor	Low	Low
Wongan-Ballidu (S)	High	Good	High	High
Woodanilling (S)	High	Good	Medium	High
Wyalkatchem (S)	High	Medium	High	High
Wyndham-east Kimberley (S)	High	Poor	Medium	Low
Yalgoo (S)	High	Good	Medium	High
Yilgarn (S)	High	Good	High	High
York (S)	Medium	Medium	Low	Medium

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

Map 8.5
Socioeconomic status clusters based on Statistical Local Areas, Western Australia, 1996

clusters of SLAs with generally similar socioeconomic status characteristics



Socioeconomic status clusters

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

*Perth has not been mapped as it has been analysed separately

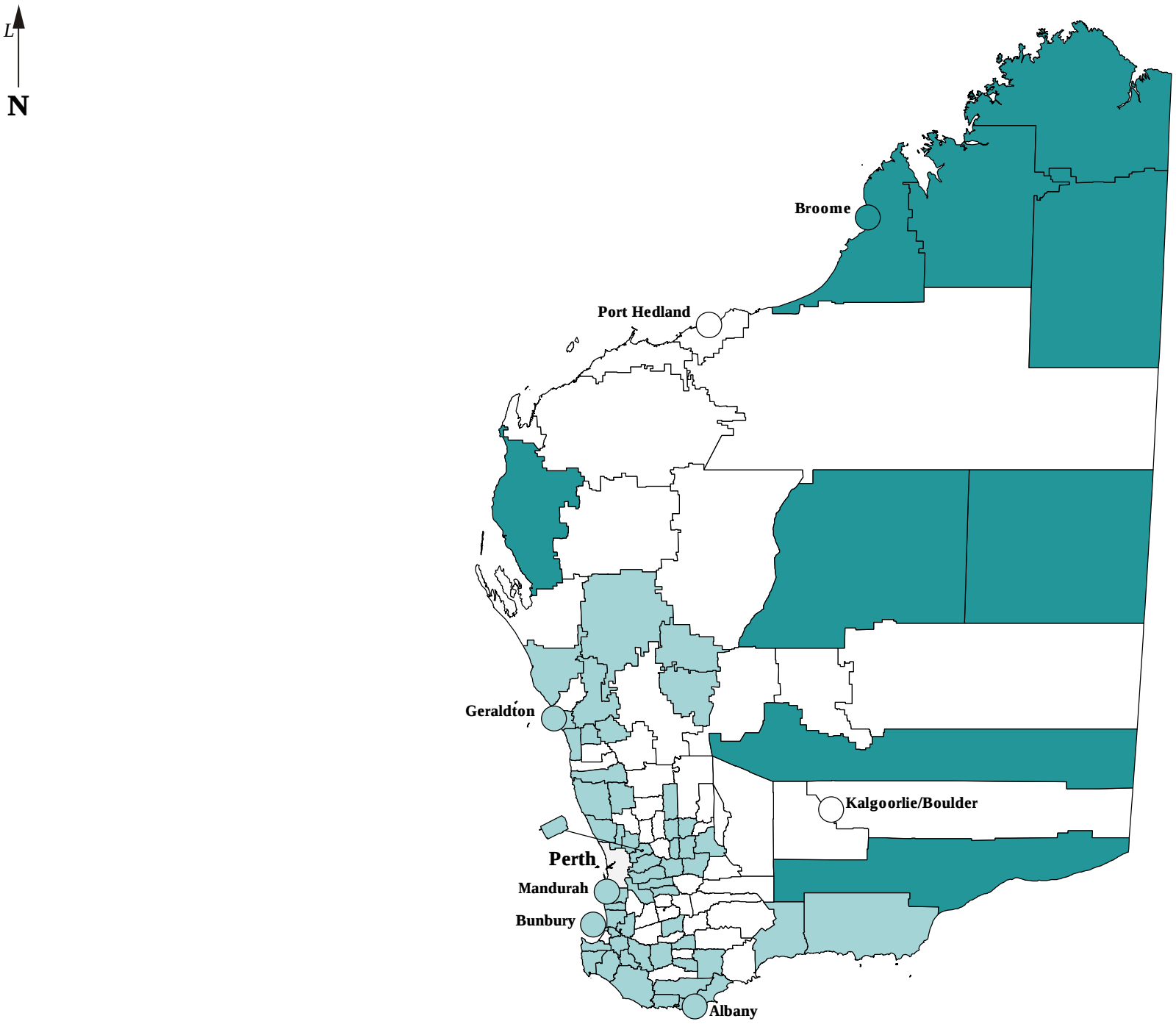
Source: Compiled from project sources

Details of map boundaries are in Appendix 1.2

National Social Health Atlas Project, 1999

Map 8.6
Health status clusters based on Statistical Local Areas, Western Australia, 1996

clusters of SLAs with generally similar health status characteristics



Health status clusters

- *Poor*
- *Medium*
- *Good*
- *not mapped*[*]

[*]Perth has not been mapped as it has been analysed separately

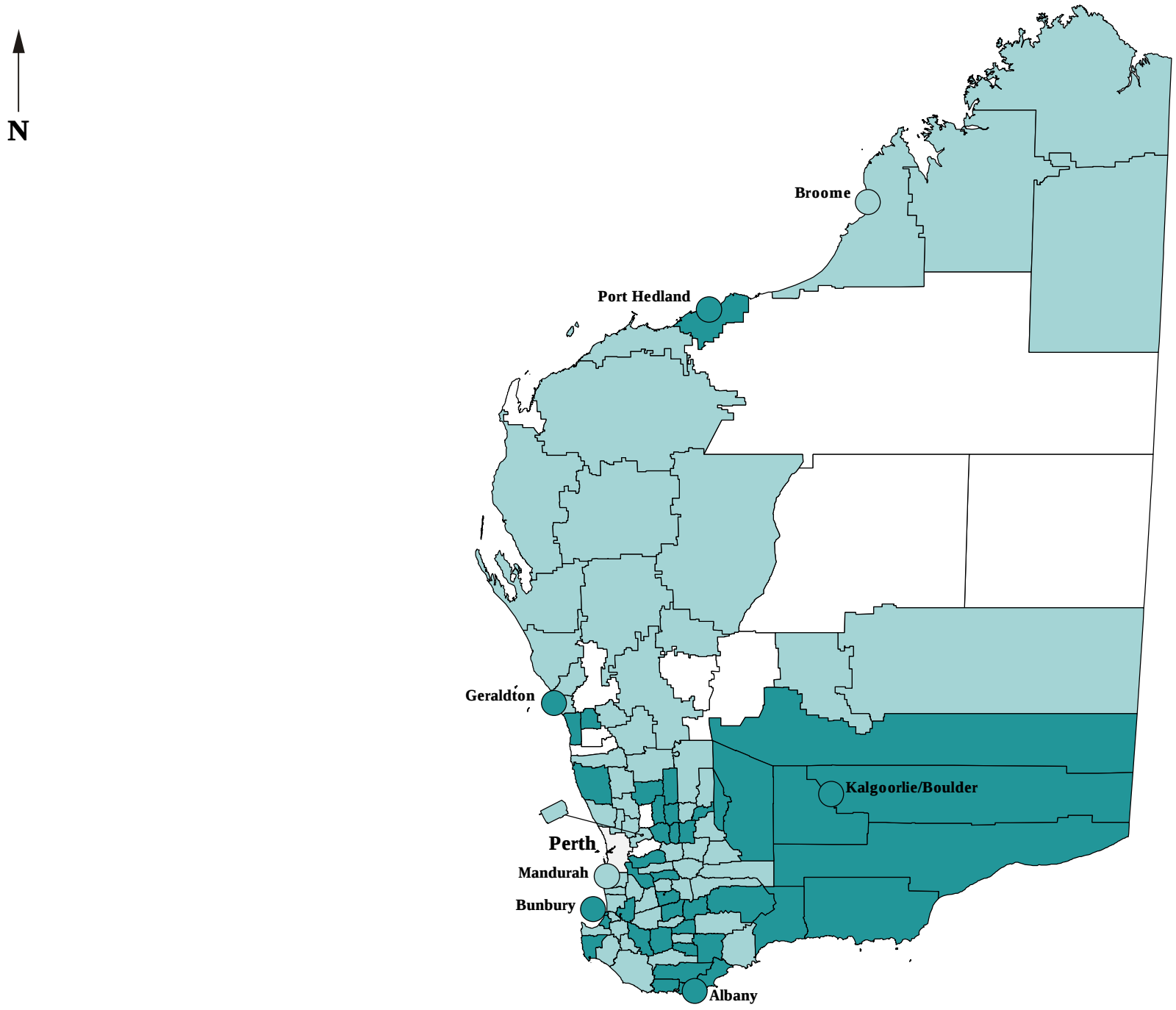
Source: Compiled from project sources

Details of map boundaries are in Appendix 1.2

National Social Health Atlas Project, 1999

Map 8.7
Health service utilisation clusters based on Statistical Local Areas, Western Australia, 1996

clusters of SLAs with generally similar health service utilisation characteristics



Health service utilisation clusters

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

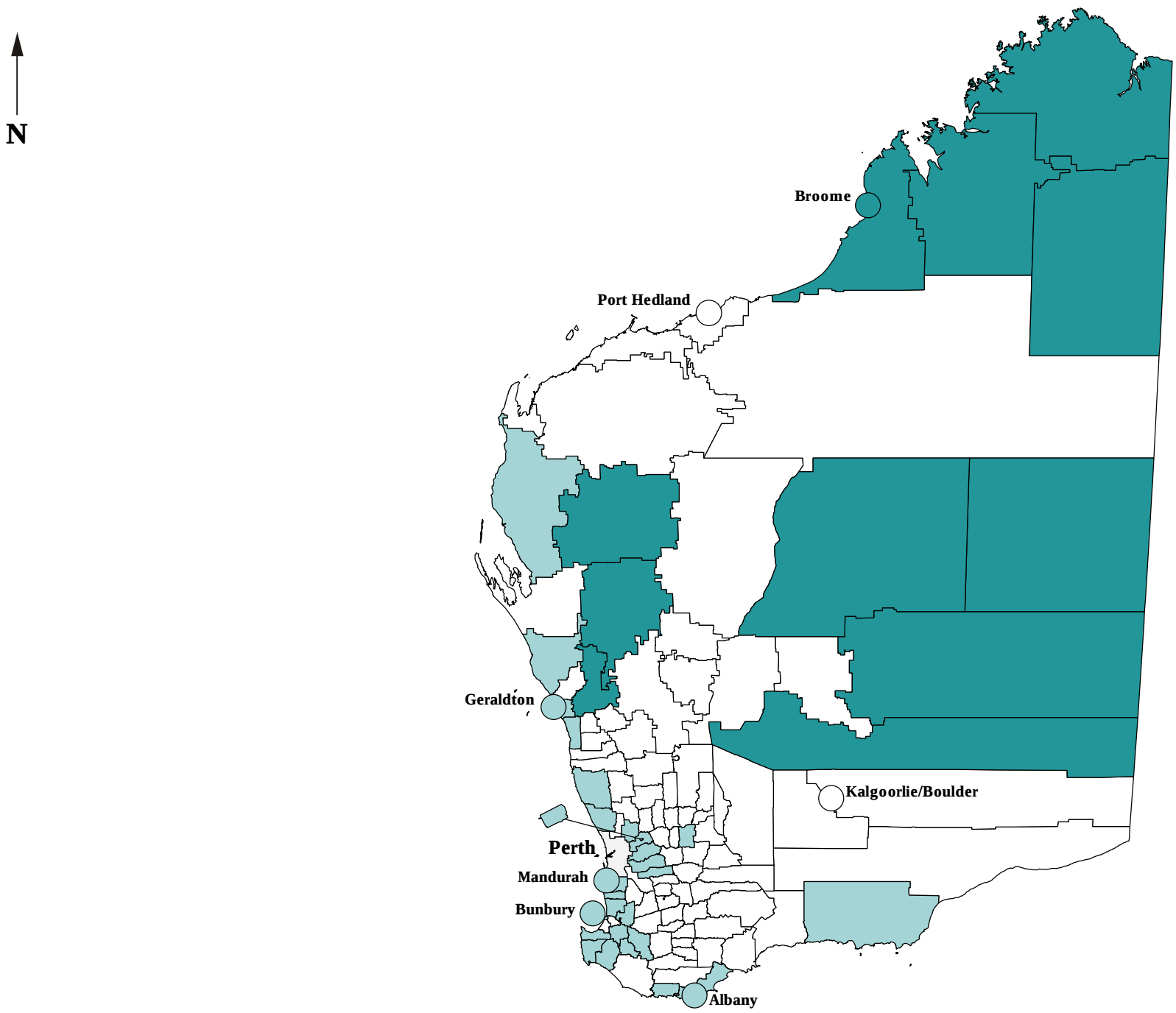
[*]Perth has not been mapped as it has been analysed separately

Source: Compiled from project sources

Details of map boundaries are in Appendix 1.2

Map 8.8
Social health status clusters based on Statistical Local Areas, Western Australia, 1996

clusters of SLAs with generally similar social health status characteristics



Social health status clusters

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

*Perth has not been mapped as it has been analysed separately

Source: Compiled from project sources

Details of map boundaries are in Appendix 1.2

National Social Health Atlas Project, 1999

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 8.6**.

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 8.6**).

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 8.6**).

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 8.6**).

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 8.6: 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**