An Atlas of Cancer in South Australia

Produced for Cancer Council SA

Public Health Information Development Unit
The University of Adelaide
November 2012

ISBN: 978-0-9873911-3-1

This report was produced by PHIDU (the Public Health Information Development Unit), The University of Adelaide, for Cancer Council South Australia (CCSA), and funded by that organisation. The views expressed in this report are solely those of the authors and should not be attributed to CCSA.

Suggested citation

PHIDU (Public Health Information Development Unit) 2012. An Atlas of Cancer in South Australia. (Produced for Cancer Council SA). Adelaide: PHIDU, The University of Adelaide.

Published by PHIDU, The University of Adelaide.

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Acknowledgements

This report was funded by Cancer Council SA (CCSA), and the authors are grateful to CCSA for the opportunity to undertake this project.

The authors also wish to thank the following people:

- David Roder for his comments, edits and manuscript reviews;
- Jill Rogers, Ada Childs and Lou Williamson from BreastScreen SA for providing breast screening participation data and for reviewing relevant parts of the manuscript;
- Bernadette Hurst from SA Cervix Screening Program for providing cervical screening data and for reviewing relevant parts of the manuscript;
- Greg Sharplin at Cancer Council SA for providing the data relating to sun protection;
- the Epidemiology Branch, SA Health for providing the cancer incidence data, and David Roder, Britt Catcheside and Ron Somers from that Branch for providing the additional information and analyses included in Section 3 and Appendix C; and
- the staff of the Epidemiology Branch, SA Health and BreastScreen SA for providing data over many years, which made possible the analysis over time.

The following staff members at PHIDU were involved in the project:

- Diana Hetzel wrote Section 1, the introductions to and ‘context’ statements in Section 2, and reviewed and edited the final report;
- Kristin Brombal produced the maps and charts in Section 2 and the correlation analysis in Section 4;
- John Glover wrote the commentary in Sections 2 and 4;
- Sarah McDonald provided advice on mapping; and
- Bianca Barbaro edited the draft report.

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Section 1

Context and purpose

In this section …

- Introduction
- Background to the development of the atlas
- Purpose, scope and structure of the atlas

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Introduction

South Australia's cancer survival rates are high by world standards – and the quality of treatment is very good. However, there are inequalities in cancer survival among people living in rural, regional and remote areas of South Australia. Many factors are associated with cancer risk and poorer survival in rural areas, including:

- varied levels of exposures to a wider range of risk factors;
- greater levels of socioeconomic disadvantage;
- limited access to specialist cancer treatment services;
- lack of coordinated care by health practitioners;
- delays in diagnosis, treatment or care processes; and
- greater proportion of Aboriginal peoples who are often diagnosed at more advanced stages and who may receive poorer treatment.[1,2]

Treatment for cancer is usually complex, involving different disciplines and therapies, which can make it more difficult for rural South Australians to access the full range of care they require, within their local community. In rural areas, where hospitals and practitioners do not have ready access to professional cancer networks, the challenges of providing quality, evidence-based cancer care can be significant.

There remain opportunities to produce better outcomes and quality of life for people with cancer living in non-metropolitan areas of the State, by improving the organisation and delivery of cancer control activities – across the spectrum of care, including opportunities to better engage communities and primary care providers.

In partnership with CCSA, the Public Health Information Development Unit (PHIDU), located at The University of Adelaide, has produced this atlas to highlight geographic and other inequalities, which relate to cancer in Metropolitan Adelaide and non-metropolitan areas of South Australia. Staff of the Epidemiology Branch of the South Australian Department of Health, which houses the South Australian Cancer Registry, provided data on cancer survival and staging; their analysis is presented in Section 3.

Purpose, scope and structure of the atlas

A better understanding of the patterns of cancer suffered by people living in rural and remote areas of South Australia can assist health planners, cancer screening services, health practitioners and other care providers, and the community, to assess current needs for a range of services and any relative health differences, or inequalities, which need to be addressed.

This atlas describes inequalities in the prevalence of some risk factors for cancer, participation and outcomes of screening for certain cancers, cancer incidence, and five-year relative survival according to small geographical areas (Statistical Local Areas or SLAs), as well as variations across area-based categories of remoteness and in socioeconomic status (SES) in South Australia (Section 2). Data on cancer survival and staging at a regional level, as well as additional data on cancer incidence for cancers too small for detailed geographic analysis are provided in Section 3. Each of these sections concludes with a summary and discussion of the main findings.

The structure of the atlas follows.

Analysis of data to indicate geographic and other relevant inequalities which relate to selected cancer outcomes

Many datasets are coded by SLA, which allows for mapping, as well as for allocation of cases to the Australian Bureau of Statistics' (ABS) Remoteness classification and groups of areas based on similar levels of socioeconomic disadvantage of their populations (that is, by socioeconomic status (SES)). The maps and graphs are included in this section, as a correlation analysis of all variables for which SLA data are available, separately for Metropolitan Adelaide and non-metropolitan areas.

The atlas covers the following areas of interest to CCSA:

- risk factors (smoking, risky alcohol consumption, high Body Mass Index (BMI), physical inactivity, poor diet);
- prevention activities (sunscreen protective behaviours);
- screening activities (for breast cancers, participation; and for cervical cancers, participation and outcomes);
- incidence (all cancers, lung, breast, colorectal, prostate, melanomas of the skin);
- deaths (all cancers, breast cancer, colorectal cancer, lung cancer); and
- cancer prevention, survival and staging (selected cancers).

Risk factors

PHIDU holds data on a number of risk factors, which are relevant to cancer: smoking, risky alcohol consumption, high Body Mass Index (BMI), physical inactivity and diet (daily fruit consumption). Estimates at the SLA level were produced by modelling national data to produce synthetic predictions of prevalence; these are presented by geographic area, remoteness and SES.

Cancer prevention

Data for sunscreen protection behaviours (hat, shade, sunglasses, clothing and sunscreen) to assess sun protection behaviour, as well as respondents' reports of getting burnt in the previous summer were supplied by CCSA. Data for other such measures, such as Hepatitis B and Human Papillomavirus (HPV) vaccinations, were not available.

Cancer screening

Data are analysed for:

- breast screening participation for the two-year periods 2001-2002 and 2009-2010; and
- cervical cancer screening participation and outcomes for 2001-2002 and 2008-2009.

Cancer incidence and deaths

Cancer incidence data at the Statistical Local Area (SLA) level for South Australia for the periods 1992-1995, 1998-2002 and 2003-2008 cover 'all cancers' and 'selected cancers' (those with sufficiently large numbers for analysis at the SLA level). Data for these years are also held for deaths by cause and SLA.

Additional information, including stage and survival information

Complementary analyses by remoteness and Region using the last ten years of complete data available from the SA Cancer Registry have been undertaken by staff of SA Health for:

- Lip cancer incidence;
- Cervical cancer incidence;
- Breast cancer stage (in situ/invasive) and diameters for invasive breast cancer, by age;
- Melanoma stage (in situ/invasive) and Breslow thickness for invasive melanomas, by age;
- Five and ten year survival for leading cancers, including breast, cervical, colorectal, prostate (note: care needed in interpretation), skin (melanoma), and lung cancer, and for all cancers collectively (relative survival or disease-specific survival); and
- Case fatality, using Cox models, with remoteness as a predictor (inferred from hazard ratios) for invasive breast cancer and invasive melanoma respectively, adjusting for age, sex, and staging variables (i.e., diameter for breast and thickness for melanoma).

The rates of incidence and survival of Aboriginal peoples are likely to impact on the results, but are not able to be well-identified, other than by geographic area, given the relatively poor Indigenous identification in most data sets.

Section 2

Geographic and other inequalities in selected cancer outcomes in SA

In this section …

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About geographic and other inequalities

The social and economic environment is a major determinant of population wellbeing in South Australia. Over the last thirty years, numerous reports and studies have highlighted substantial variations in the wellbeing of the South Australian population, and the gap between those who are 'doing well' and those who are not.[1-3] These differences, or *inequalities*, are readily apparent within Adelaide, and in rural and remote communities across the rest of the state. Inequalities may be evident as a result of age, sex, gender, ethnicity, occupation, wealth, place of residence, access to effective services, and so forth. Inequalities due to age clearly cannot be altered; however, many others are potentially avoidable and amenable to change, and therefore the fact that they exist can be unfair, or inequitable. For example, those people who are the most economically disadvantaged members of our community are more likely to experience poorer health and wellbeing, and fewer chances of having fulfilled and healthy lives. There is mounting evidence of the significant impact of both economic and social inequalities on various groups in society, and government and community concern about the need to address them.

Our health and wellbeing (and in this atlas, whether or not we develop cancer), are the products of many different factors, which interact in complex ways. Some factors include individual characteristics such as the genes that we inherit from our parents, and aspects of our own beliefs and behaviours. Other important influences operate within our families, friends and peers, neighbourhoods, communities, culture and kinship groups, working and living environments, and society as a whole.

Within this atlas, readers should note that it was not possible to undertake a comprehensive analysis for South Australian Aboriginal peoples, as there is a paucity of relevant data for this population group at the small area-level and incomplete recording of Aboriginal status in cancer registry data. However, other research has demonstrated substantial inequalities in cancer outcomes for Aboriginal patients, who have had very low survivals from cancer compared with other South Australians since the late 1970s.[34,42] The elevation in risk of cancer death in the first five years from diagnosis for Aboriginal patients has approximated 40% for all cancer types combined. The elevation for cervical cancer has been similar, but higher elevations in risk of death of 92% have applied for breast cancer and of 48% for large bowel cancer.[42] Aboriginal people are more likely than other South Australians to live in Very Remote areas where distance is often a factor in accessing specialist services. The elevation in risk of death of Aboriginal patients from cancer has been particularly noticeable among those living in the Far North of the State.[42]

Incidence of cancer for Aboriginal peoples in South Australia

Previously published data for 1977-2003 point to a similar or slightly lower incidence in Aboriginal than other South Australians for all cancers and for haematological cancers, melanomas, and cancers of the prostate, female breast, large bowel, and lip.[42] However, these data also indicate higher incidence rates among Aboriginal residents than other South Australians for the following cancer types.

- Hepatobiliary cancers – more than 6 times higher, attributed in part to raised levels of endemic hepatitis infection.
- Mouth, pharynx and oesophagus – more than 4 times higher, due to smoking and possibly differences in patterns of alcohol consumption and diet.
- Cervical cancer – more than 3 times higher, partly due to lower screening coverage.
- Cancer of unknown organ site – more than 3 times higher, reflecting less ready access to diagnostic services in remote areas and more advanced cancers at diagnosis.
- Stomach cancer – more than 2 times higher, consistent with raised levels of Helicobacter pylori infection and poorer living conditions.
- Pancreatic cancer – more than 2 times higher, probably attributable to elevated smoking prevalence, and possibly, raised levels of diabetes, and potentially poor diet.
- Lung cancer – about 80% higher due to elevated smoking rates.[42]

The approach

This atlas describes the extent and significance of inequalities in the risk factors for, and the incidence, prevention and outcomes for various forms of cancer, including drawing particular attention to variations as they relate to communities living in rural and remote areas of the state. Its purpose is to understand better the impact that social, physical, environmental, geographical and economic factors can have on people who are at risk of, or experience cancer, and to describe the distribution of these factors across the South Australian population.

The indicators of inequalities presented in the atlas have been selected because they describe the extent of differences in risk factors for cancer, participation in breast cancer screening and participation and outcomes from the cervical cancer screening program, and cancer incidence, in the context of the demographic and socioeconomic composition of South Australia. They are also those for which reliable data are available and able to be presented in maps and graphs to show variations by area, in Adelaide and in rural and remote regions of the State, and by the socioeconomic status of the population.

The presentation of data for small areas in maps and graphs to show variations in the selected indicators is used to demonstrate:

- the level of significant disadvantage in a small number of geographic areas; and
- the wider distribution of socioeconomic differences in health and wellbeing (as shown by the gradient across groups in the population according to their socioeconomic position); and
- supporting evidence, which highlights the extent to which disadvantage is clustered into particular geographic areas, making the targeting of programs and services in selected geographic locations a useful approach when coupled with broad-based population health strategies.

The distribution of the population with the poorest health and wellbeing has a strong and distinct geographic pattern, both by remoteness (in particular, for Aboriginal and Torres Strait Islander peoples) and in locations with high proportions of people who are significantly socioeconomically disadvantaged. The geographic distribution of the population under these indicators of risk factors for cancer, and cancer screening, incidence and premature mortality is the focus of this Section. The indicators included are shown in Table 1.

Table 1: Indicators presented in this report

Risk factors	Smoking	Risky alcohol use	Overweight & obesity	Physical inactivity	Inadequate fruit consumption
Prevention:					
Sun protection	Sunburn	Participation in sun protective behaviours			
Screening					
Participation	Breast cancer	Cervical cancer			
Outcomes		Cervical cancer			
Incidence	All cancers	Breast cancer	Colorectal cancer	Lung cancer	
	Melanoma of skin	Prostate	Non-melanoma cancer of lip		
Stage at diagnosis	Breast cancer	Melanoma of skin			
Survival	All cancers	Cervical cancer	Breast cancer	Colorectal cancer	
	Prostate cancer	Lung cancer	Melanoma		
Mortality	All cancers	Lung cancer	Breast cancer	Colorectal cancer	

Where available, data are presented to show change over time. For example, data for breast screening participation are presented for the periods 2001-2002 and 2009-2010, with details of the incidence of breast cancer presented for the periods 1986-1993, 1998-2002 and 2003-2008.

The indicators represent areas of interest with respect to cancer, which provide only a partial picture of the existing social and economic inequalities in health and wellbeing in Australia. However, it is hoped that the atlas will raise awareness of the extent of many of these inequalities and their impacts on different sections of the population, and provide a basis for working towards better outcomes for people at risk of or experiencing cancer in South Australia.

A note about use of the term socioeconomic status

In the atlas, the term 'socioeconomic' refers to the social and economic aspects of a population, where 'social' includes information about the community and its level of education, welfare, housing, transport and so forth. It is not used in the context of 'social' as in 'social skills', 'social capital', 'social ability' or 'social behaviour' of community members. Therefore, an area described as having 'a high level of socioeconomic disadvantage' does not imply that the area has low cohesion or lacks strength as a community; rather, it identifies a relative lack of resources or opportunities that are available to a greater extent in more advantaged communities. Thus, this lack of resources leads inevitably to avoidable differences in health and other outcomes for disadvantaged communities.[1]

Identifying the communities whose residents are not faring as well as others may be perceived by some people as stigmatising. However, the purpose of the atlas is to highlight the extent of their disadvantage in order to provide evidence upon which community members and decision-makers can rely, and which can underpin advocacy for change. If we avoid highlighting the most disadvantaged suburbs, we avoid providing the evidence that society is failing those who live there. Moreover, being complacent about their plight, and not publishing the evidence, makes us complicit in their poorer life outcomes.

[1]In discussing the maps reference is also made to 'poor health outcomes for the population of the most disadvantaged areas'. This is not to imply that the same health outcomes (e.g., a high premature death rate) apply to everyone living in the named areas: clearly, the average rate for an area is comprised of a range of rates across the area.

Measures presented

The data are presented as percentages or rates, as appropriate to the indicator. Rates are age-standardised to the appropriate population and presented per 10,000 or 100,000 population. Statistical significance is indicated by * or ** – statistically significantly above the State rate at the 5% confidence level, or 1% confidence level, respectively; and by ^ or ^^ – statistically significantly below the State rate at the 5% confidence level, or 1% confidence level, respectively.

Rate ratios are used to describe the differential (or gap) in rates between the most disadvantaged areas and the least disadvantaged areas; and between the most remote areas and the capital city (least remote) areas. Additional details are provided below of the analyses by socioeconomic status ad by remoteness.

In discussing the extent to which percentages or rates vary from the State figure, the following terms are used:

- "Notable", referring to a difference in a rate or rate ratio of from 10% to <20%;
- "Marked" referring to a difference in a rate or rate ratio of from 20% to <50%;
- "Substantial" referring to a difference in a rate or rate ratio of 50% or more.

Where there are fewer than 20 cases in an area, and that area is mentioned in the text, the actual number of cases is shown.

How to use the information in this section of the atlas

Information is presented in this atlas to describe, at a geographic level, key cancer outcomes for people living in Metropolitan Adelaide and in the non-metropolitan areas of South Australia. In particular, the aim is to identify inequalities that exist in these outcomes between different population groups, within the State, and between regions.

The information, presented as a series of indicators, highlights these inequalities and draws attention to the influence of social, economic and environmental factors on risk factors, cancer prevention and screening participation and outcomes, and the influence of these factors on cancer deaths and survival. The ensuing picture is one of significant differences across the population.

The value of indicators

One way to gauge the impact of social, economic and environmental factors on health and other outcomes and on the wellbeing of the population is through the use of indicators, both at a point in time, and by tracking their movement over time.

Indicators are summary measures of chosen events (for example, the proportion of the population who are physically inactive) derived from data collections that record all cases, or a representative sample, of the events in a population. Describing the geographic variation in indicators of inequality provides information which can be used to support progress towards reducing inequalities.

The indicators are therefore important for:

- informing people about social issues, including access to and outcomes in education;
- monitoring these issues to identify change, both between groups in the population, and over time; and
- assessing progress toward goals or achievement of policy objectives.

These purposes suggest that indicators need to:

- reflect the values and goals of those who will use and apply them;
- be accessible and reliably measured in all of the populations of interest;
- be easily understood, particularly by those who are expected to act in response to the information;
- be measures over which we have some control, individually or collectively, and are able to change; and
- move government, non-government agencies and communities to action.

Using the maps and charts in this atlas

For each indicator, there is an introductory statement as to the relevance of the indicators presented. This is followed by a discussion under the following headings, as the data allow:

- Key points
- Geographic variations
- Regional totals
- Socioeconomic status
- Remoteness
- Correlations

The introductory statement for each indicator is necessarily brief, because of the space limitations.

The following notes give an overview as to how the atlas may be used. Additional details about the indicators, including definitions and data sources, are on the pages describing each indicator, and in Appendix B: these have not been included with the indicator descriptions because of the limited space available.

Two maps, based on SLAs existing in 2006, are shown for most variables in the atlas. The first is a map at the Statistical Local Area (SLA) level for Metropolitan Adelaide, represented by the metropolitan State Regions: in brief, SLAs represent whole or parts of Local Government Areas (LGAs), as well as covering areas of the State not incorporated into LGAs.

The second map is of the whole State, by SLA, but with Metropolitan Adelaide mapped as one area. This enables comparisons to be made of the percentages, ratios etc. in Adelaide with those in the non-metropolitan areas of the State. Urban centres (towns) with a population of 1,500 or more which are separate SLAs and for which data are available are highlighted by circles on the map.

Where possible, these maps are shown for up to three periods, to show the change in the spatial pattern for the indicator mapped. The text description of the maps generally refers to the map for the latest period.

In addition to these maps, where data were available for earlier time periods, a 'Change' map is included, showing where the incidence in an area had either increased, stayed high, stayed moderate, stayed low, or decreased. This map was constructed by examining the extent to which an area moved between one of the five ranges for that indicator. For example, for breast cancer incidence in Metropolitan Adelaide, the ranges mapped for the periods 1986-1993 and 2003-2008 were 225.0 and above (cases per 100,000 female population), 205.0 to 224.9, 185.0 to 204.9, 165.0 to 184.9 and below 165.0. In 1986-1993, Playford Elizabeth had an incidence rate in the lowest range; in 2003–2008 the rate was in the second highest range, and was therefore shown as 'deteriorated' in the 'Change' map. In non-metropolitan South Australia, in 1986-1993 women in The Coorong had an incidence rate in the second highest range, but by 2003-2008 the rate was in the lowest range and the SLA was therefore shown on the map as 'improved'.

Readers should note that the maps reflect the distribution of the population for whom the particular event is recorded (e.g., number of women screened for breast cancer; people admitted to hospital with a cancer diagnosis) showing location (at the SLA level) of their usual residence, as coded from the address information in the various statistical data collections. That is, the maps are not of the location of the service, or of the hospital.

In many cases, the ranges mapped in the metropolitan and country maps will vary, as they do between maps. This should be taken into account when using the maps. In addition, it is important to be aware of the absolute numbers in an area, and to not only use the percentages and rates shown in the maps, as some areas with relatively high percentages or rates may have relatively small populations, or few cases. Where areas mentioned in the text have small numbers, the number is included, along with the rate.

Cautions

Many comparisons are made in the report between SLAs. Readers should note that there are also variations, and sometimes substantial variations, within SLAs, both in Metropolitan Adelaide and country South Australia. As such, the figures for an SLA represent the average of the different groups within the SLA.

How best to read the data and maps

How can I find out about the population in the area where I live or work?

Some readers will want to identify a particular area, where they live or work, to see how it compares with other areas across the indicators. The key maps at the end of the report folds out to allow one to find a geographic area of interest. Although the maps are small, the areas are large enough to follow from page to page, noting the location and size of the variations.

What are the predominant patterns in the data across Adelaide or in country South Australia?

Other readers will want to get an overview of the distribution of the population across all indicators, or across a particular range of indicators.

The distribution of the population in Adelaide is such that it is relatively easy to follow, with many of the maps showing a distinctive pattern. For non-metropolitan areas, it may be helpful to identify the names of the major towns (mapped as circles) to assist in understanding the overall patterns. These towns, which are the only urban centres which are SLAs in their own right and for which data are available at the SLA level, are shown in the key map at the end of the report.

Mapping data for non-metropolitan areas of the State poses a number of challenges, mainly arising from the relatively small population and large numbers of large and sparsely settled SLAs. For example, non-metropolitan SLAs are often mapped in a grey shade, referred to in the legend as 'not mapped'. In the majority of cases, this refers to there being fewer than five events related to people living in the area (e.g., between 1 and four people with cancer), with these areas not mapped as the data are likely to be unreliable. A small number of areas are not mapped because they have population of less than 100: Maralinga Tjarutja is an example.

In addition, the large size of some SLAs in the far north of the State can distort the message the map is presenting. This is particularly so where a large area is mapped in the darkest shade, thereby dominating the map – even though the number of events related to this high rate might be relatively small.

Where the term 'rate' is used it is the age-standardised rate (ASR) per head (e.g., 1,000; 100,000) population, standardised by the indirect method, which allows comparisons between the populations in the SLAs mapped, or the SES or remoteness groups (see below) and the State rate, regardless of differences in the age structure of the populations of the areas. Had the data not been age standardised, comparisons could be affected to the extent that some areas have, for example, older populations, who have had higher smoking rates and a longer period over which to contract lung cancer, in comparison with later generations.

Socioeconomic status

The data for each indicator have also been presented to show the extent of variation within Metropolitan Adelaide by socioeconomic status: the same analysis is provided for the non-metropolitan areas. This is achieved by grouping SLAs into five groups based on socioeconomic status, using the IRSD score for the population in each SLA, as calculated by the Australian Bureau of Statistics (ABS) from data collected at the 2006 Population Census. Group 1 comprises the SLAs with the highest IRSD scores (highest socioeconomic status, or most advantaged areas) and group 5 comprises the SLAs with the lowest IRSD scores (lowest socioeconomic status, or most disadvantaged areas). Each group covers approximately 20% of the total population in the area under analysis (e.g., Metropolitan Adelaide or country South Australia). Rates for each indicator are then calculated for each of the groups.

The graphs also include a 'rate ratio' (RR), which shows the difference between the average percentage, or standardised rate, for that indicator (e.g., people who are current smokers) in the most disadvantaged areas (group 5) and the most advantaged areas (group 1). It is a measure of the extent of inequality, or difference, between the highest and lowest SES groups.

The increment in rates across the SES groups, where each successive group has a higher rate, is referred to as 'the socioeconomic gradient'.

Remoteness

For each variable presented in Section 2, other than the risk factors, details were calculated of the average percentage or rate, for each of five ASGC Remoteness classes of Major Cities (roughly equivalent to Metropolitan Adelaide), Inner Regional, Outer Regional, Remote and Very Remote.[4] This classification provides a summary measure of the characteristics of the population, for each variable, categorised by accessibility to the largest populated centres.

Towns such as Mount Gambier, Murray Bridge and Victor Harbor are in the Inner Regional class; Port Augusta, Peterborough, Port Pirie and Whyalla are in Outer Regional; Port Lincoln and Roxby Downs are Remote; and Coober Pedy is Very Remote.

The risk factor data presented in this section are not available for all five classes, as the survey from which they were derived does not cover the Very Remote areas, and the number of respondents in the Remote class is small. For these data the Outer Regional and Remote classes have been combined, and are referred to as 'Regional and Remote'.

For the remoteness comparisons presented in Section 4, the Outer Regional, Remote and Very Remote classes have been aggregated and are referred to as 'More Remote' areas.

An additional measure, the rate ratio (RR), shows the overall differential in rates between the Very Remote and Major Cities areas; for example, if the rate in the Very Remote areas was 66% higher than in the Major Cities areas, the rate ratio is 1.66.

Correlations

Correlation coefficients have been produced to indicate interdependence between the indicators in the atlas. Separate analyses were undertaken for metropolitan SLAs and non-metropolitan SLAs.

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 (i.e., high values for one are matched by low values for another), the two variables are negatively correlated.

The Pearson product-moment correlation coefficient (r) has been used in the 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 0.30 to 0.49 are considered to be moderate; plus or minus 0.50 to 0.79 are strong; and plus or minus 0.71 or above are very strong.

Caveats

When using data mapped by SLA, readers should be aware that the data may not reflect the true location of the address of the person to whom the record (e.g., of cancer incidence, or screening) relates. This is of particular relevance for Aboriginal people, who may move from the most remote areas of the State to, for example, Port Augusta, or Adelaide, for treatment or for other reasons.

Readers should also be aware that the scales can vary between the map for Metropolitan Adelaide and the non-metropolitan areas for the same indicator. In order to show variation where there are two or three maps for different time periods, the scale has been set to show, as far as is possible, the extent of change. In doing this, in cases where there has been substantial change, the map for the earlier period can show almost no areas with data, and the map for the later period can show almost all areas with data in the higher range.

Further, in some cases, the time periods for which the data are available vary; for example, between five years and eight years for cancer incidence (1986-1993, 1998-2002 and 2003-2008). The number of years between these periods is also not even, as it relates to the periods for when data were obtained in the past.

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Risk factors

Many risk factors for cancer (such as age, genetic makeup, family history, and medical history) are beyond an individual's control. However, there are a number of behavioural risk factors (such as tobacco smoking, body weight, physical inactivity, and alcohol consumption) which are potentially modifiable.

Evidence to support the inclusion in the atlas of a number of behavioural risk factors for the commoner cancers is summarised briefly below.

Tobacco smoking

There is sufficient evidence to establish a causal association between cigarette smoking and cancer of the nasal cavities and paranasal sinuses, nasopharynx, stomach, liver, kidney (renal cell carcinoma) and uterine cervix, and for adenocarcinoma of the oesophagus and myeloid leukaemia.[5] These sites add to the previously established list of cancers causally associated with cigarette smoking, namely cancer of the lung, oral cavity, pharynx, larynx, oesophagus, pancreas, urinary bladder and renal pelvis.[5] Other forms of tobacco smoking, such as cigars and pipes, also increase the risk for cancer, including cancer of the lung and parts of the upper respiratory and digestive tract. A meta-analysis of over 50 studies on involuntary smoking among never smokers showed a consistent and statistically significant association between exposure to environmental tobacco smoke and lung cancer risk.[5] Smoking is currently responsible for a third of all cancer deaths in many Western countries, including Australia.[5]

Physical activity

There is sufficient evidence for the role of physical activity in preventing colon and breast cancers and limited (protective) effect for cancers of the prostate and endometrium, and some of these effects appeared to be independent of body weight.[6,7] Physical inactivity is estimated as being the principal cause for approximately 21-25% of breast and colon cancer burden.[8] Data indicate that moderate- to vigorous-intensity physical activity performed at least 30-60 minutes per day is needed to see significantly lower risks of these two cancers.[9]

Alcohol

Any level of alcohol consumption increases the risk of developing an alcohol-related cancer, and the level of risk increases in line with the level of consumption.[10] There is convincing evidence that alcohol is a cause of cancer of the mouth, pharynx, larynx, oesophagus, bowel (in men) and breast (in women), and probable evidence that alcohol increases the risk of bowel cancer (in women) and liver cancer.[11]

Overweight and obesity

Each increment in a person's body weight above their optimal level is associated with an increase in the risk of ill health.[12] In addition to an increase in the risk of cardiovascular disease and type 2 diabetes, excess body weight is directly associated with risk of cancer at several organ sites, including colon, breast (in postmenopausal women), endometrium, oesophagus, and kidney.[12] In part, these associations with cancer risk may be explained by alterations in the metabolism of endogenous hormones - including sex steroids, insulin, and insulin-like growth factors - which can lead to distortion of the normal balance between cell proliferation, differentiation, and apoptosis.[12] Avoidance of weight gain is therefore an important factor for cancer prevention.

Daily fruit consumption

It is widely believed that cancer can be prevented by high intake of fruits and vegetables. However, inconsistent results from many studies have not been able to conclusively establish an inverse association between fruit intake and overall cancer risk.[13,14] Although there has been a slight weakening of the evidence supporting the role of fruit and vegetables in reducing the risk of some cancers, overall the evidence is suggestive of a protective effect.[14] Fruits may reduce the risk of cancer directly through the provision of specific anti-carcinogenic agents and indirectly through their role in weight management.[14]

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Current smokers aged 18 years and over, by sex, 2007–2008

Tobacco smoking is the greatest single cause of premature death and a leading preventable cause of cancer and other diseases in Australia.[15] Smoking rates among South Australian adults have declined since the early 1970s. In 2007-08, 23.7% of adult males were estimated to be current smokers, compared to 17.3% of adult females, with the highest rates for males in the 35-44 year age group (35.4%) and in the 25-34 year age group for females (22.3%).[15] For the period 2004-05, tobacco smoking was estimated to cost $31.5 billion annually in health care, lost productivity and other costs nationally.[16] The prevalence of smoking is significantly higher among lower socioeconomic groups, particularly those facing multiple personal and social challenges, and among people living in outer regional and remote areas of Australia.[15]

Indicator definition: Estimated number of people aged 18 years and over who were current smokers, expressed as an age-standardised rate per 100 people; further details of these estimates, which were produced using a synthetic prediction process, are in Appendix C.

Geographic distribution

Smoking rates are markedly higher for males than they are for females, and similarly higher in non-metropolitan areas than in Metropolitan Adelaide.

Table 2: Current smokers aged 18 years and over, by sex, 2007–2008

Per cent (age-standardised rate per 100 population)

	Metropolitan Adelaide	Non-metropolitan	South Australia
Males	23.6	26.5	24.4
Females	16.5	20.8	17.6
Persons	19.5	23.1	20.5

The geographic distributions of both male and female smokers clearly delineate the high and the low socioeconomic status areas in Metropolitan Adelaide. This visual impression is supported by the very strong correlations at the SLA level between high smoking rates for males and females and the IRSD, of -0.88 and -0.87, respectively. For males, above-average rates are found in three groupings of SLAs, and include, in:

- the outer north, all of the Playford SLAs, of - Elizabeth (2.6%**), - West Central (31.5%**), - West (28.5%**) and - East Central (27.0%**) and all of the Salisbury SLAs of - Inner North (29.2%**), - Central (28.9%**), - South-East (26.8%**), - North-East (26.6%**) and Balance (26.0%*);
- the outer south, the Onkaparinga SLAs of - North Coast (30.2%**), - Hackham (29.2%**), - South Coast (28.2%**) and - Morphett (27.3%**); and in
- the north and north-west, all of the Port Adelaide Enfield SLAs, of - Port (29.1%**), - Park (29.0%**), - Inner (27.8%**), - East (26.3%**) and - Coast (26.2%**), and Charles Sturt - North-East (26.7%**).

For females, the distribution is much the same, albeit with rates just less than three quarters of those for males, with above-average rates in:

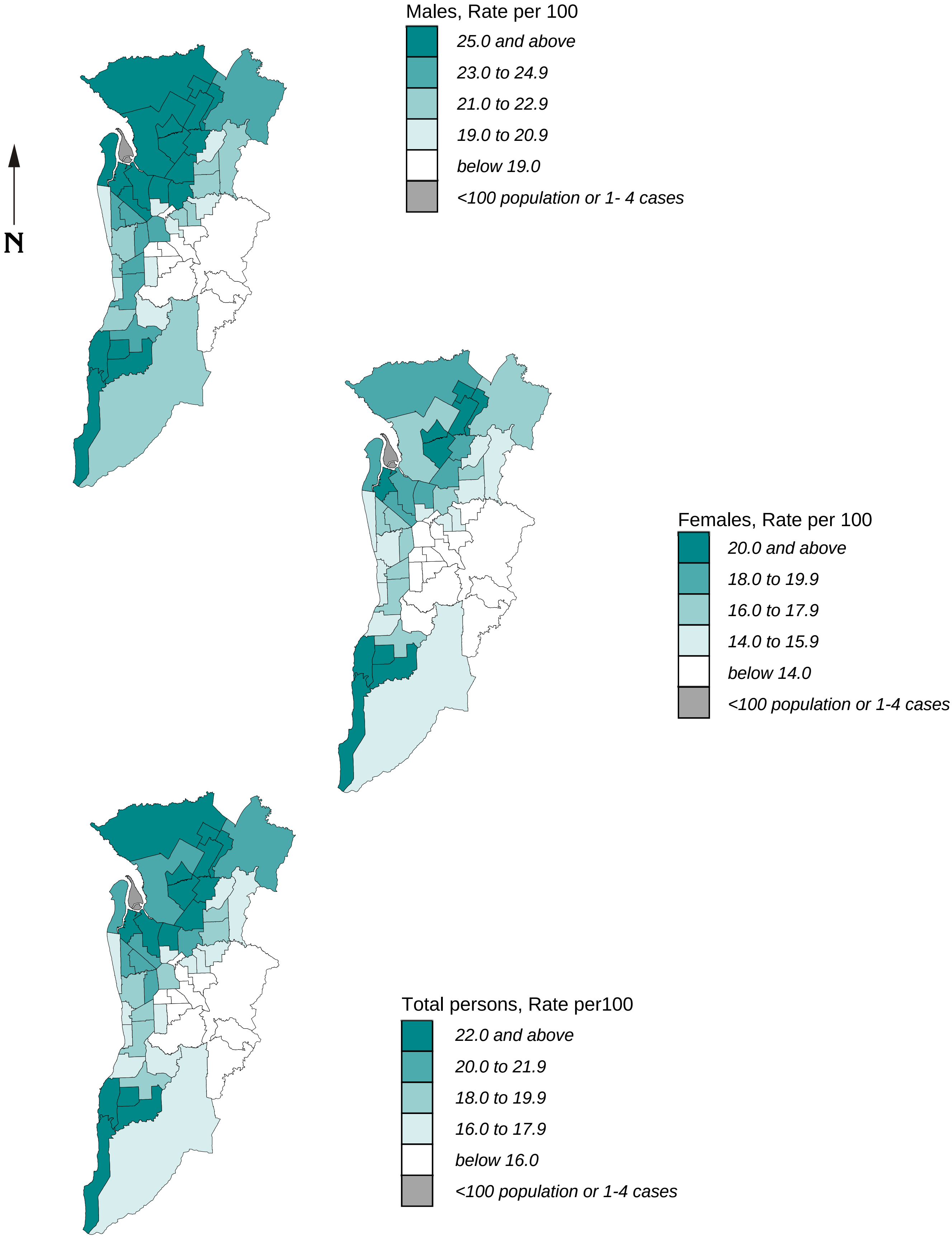
- the outer north, all of the Playford SLAs, of - Elizabeth (24.7%**), - West Central (24.7%**), - East Central (20.0%**), - West (19.7%**) and - Hills (17.2%**), and the Salisbury SLAs of - Inner North (21.2%**), - Central (20.3%**), - North-East (18.9%**), - South-East (18.8%**) and Balance (17.3%**);
- the outer south, the Onkaparinga SLAs of - North Coast (21.3%**), - Hackham (20.7%**) and - South Coast and - Morphett (both 20.2%**); and in
- the north-west, the Port Adelaide Enfield SLAs, of - Port (20.4%**), - Inner (18.8%*), - Park (18.7%*) and - Coast (18.5%*).

Of SLAs with below-average smoking rates, for males the lowest rates were estimated for Burnside - South-West (13.9^^) and - North-East (14.5^^), Mitcham - North-East (4.2^^), Adelaide Hills - Central (15.4%^^) and Walkerville (16.1%^^); and, for females, Burnside - South-West (9.7^^) and - North-East (9.8^^), Walkerville (10.2%^^); Mitcham - North-East (10.5%^^) and Hills (11.2%^^), and Adelaide Hills - Central (11.1%^^) and - Ranges (11.2%^^).

These estimates were not made for the most remote areas of the State, and results for SLAs with populations under 1,000 have not been shown.

Map 1: Estimated current smokers, 18 years and over, by sex, Metropolitan Adelaide, 2007–2008

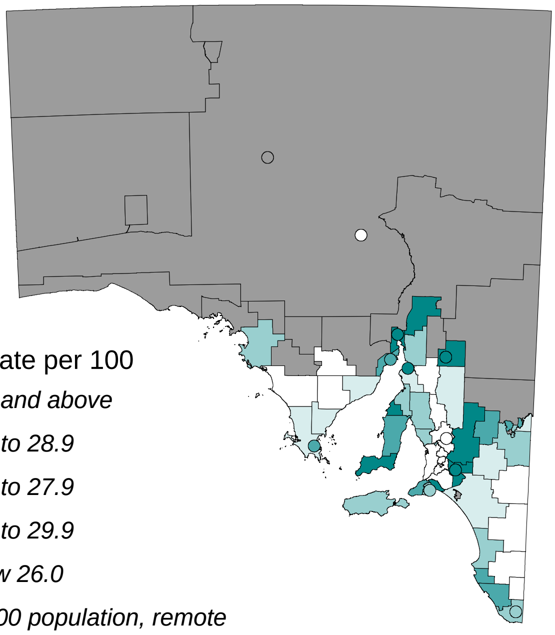
ASR per 100 by Statistical Local Area (synthetic prediction)

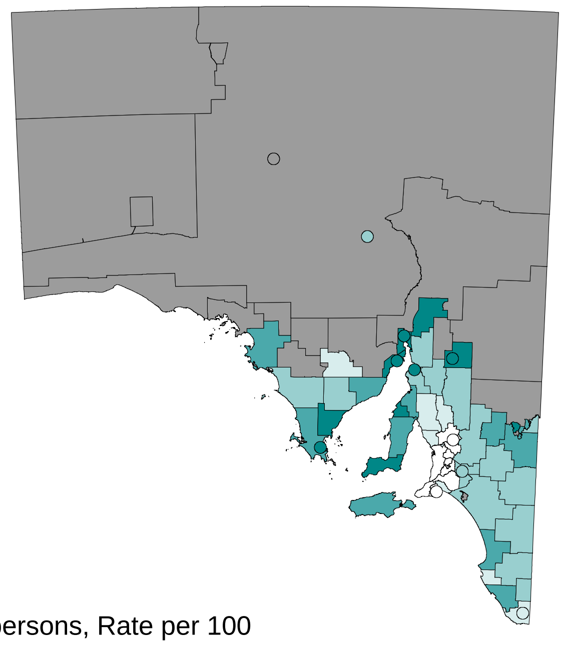


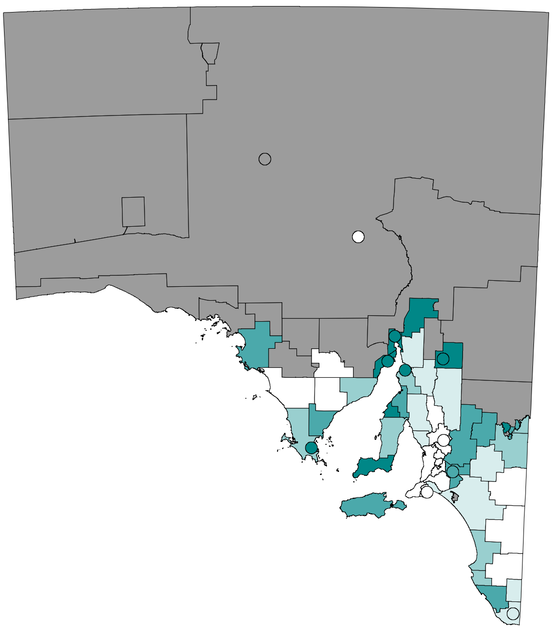
Source: Compiled in PHIDU using unpublished data supplied by ABS (produced as a consultancy)

Map 2: Estimated current smokers, 18 years and over, by sex, non-metropolitan areas, 2007–2008

ASR per 100 by Statistical Local Area (synthetic prediction)







Source: Compiled in PHIDU using unpublished data supplied by ABS (produced as a consultancy)

Rates for males were estimated to be above average in the regional centres of Peterborough (32.8%**), Port Augusta (31.9%**), Port Pirie (30.1%**), Murray Bridge (29.9%**), Whyalla (28.4%**) and Port Lincoln (28.0%**), as well as along the River Murray, in Mid Murray (30.4%**), Barmera (28.8%**), Loxton Waikerie - West (28.6%**) and Renmark (28.2%**); in the far north, in Flinders Ranges (32.7%**); on the Yorke Peninsula, in Copper Coast (30.2%**) and Yorke Peninsula - South (29.7%**) and - North (28.1%**); in the south-east, in Robe (28.9%*) and Wattle Range - West (28.1%**); and, closer to Adelaide, in Alexandrina - Coastal (29.4%**) and Yankalilla (28.4%**).

For females, with rates some four fifths of the male rates, the regional centres are even more predominant, estimated to have five of the eight highest rates. These are in Peterborough (27.5%**), Port Lincoln (27.2%**), Port Augusta (27.0%**), Port Pirie (26.4%**) and Whyalla (25.4%**). The highest proportions in other non-metropolitan areas were, on the Yorke Peninsula, in Yorke Peninsula - South (25.8%**) and - North (23.0%**), Copper Coast (25.4%**) and Barunga West (23.9%**); in the far north, in Flinders Ranges (25.3%**); on the Eyre Peninsula, in Tumby Bay (25.3%**), Franklin Harbour (24.7%**), Streaky Bay (24.7%**) and Lower Eyre Peninsula (24.1%**); in the south-east, in Wattle Range - West (23.8%**) and Kingston (23.2%**); along the River Murray, in Barmera (25.2%**), Renmark (24.6%**), Berri (24.5%**), Loxton Waikerie - West (23.6%**) and - East (23.5%**); and Kangaroo Island (24.8%**).

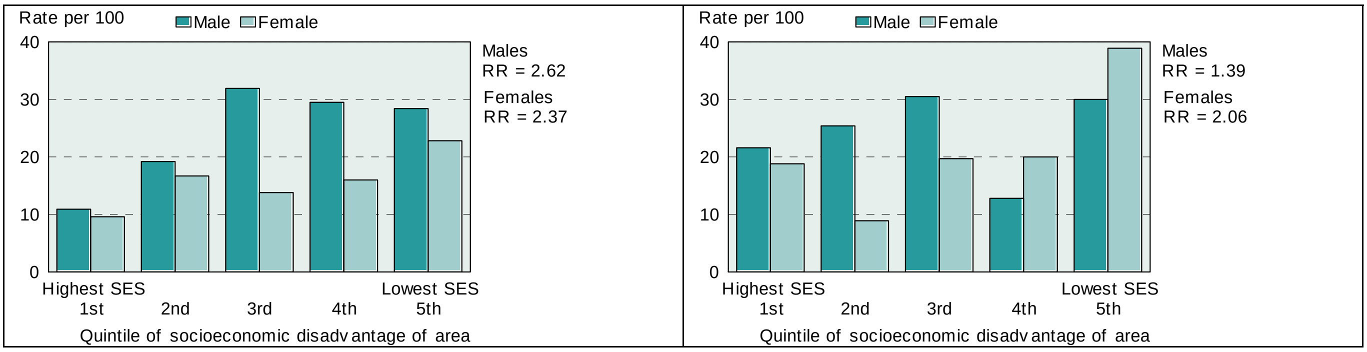
Very few SLAs had very low smoking rates. Those of statistical significance were, for males, Adelaide Hills - North (21.9%^) and Balance (22.3%^^) and Roxby Downs (22.4%^); and, for females, Adelaide Hills - North (14.4%^^) and Balance (15.9%^) and Mount Barker Balance (16.0%^).

Distribution by socioeconomic status and remoteness

Smoking rates for males in Metropolitan Adelaide increase substantially, to the highest rate in the middle quintile, with slightly lower rates in Quintiles 4 and 5 (most disadvantaged, an overall differential in rates of 2.62 with Quintile 1). Although smaller, the gap for females is still substantial, with a rate ratio of 2.37. In the non-metropolitan areas, rates for males again increase strongly over the first three quintiles. For females, rates are more irregular, with the lowest rate in Quintile 2, although the highest is in the most disadvantaged areas, with over twice the rate in Quintile 1.

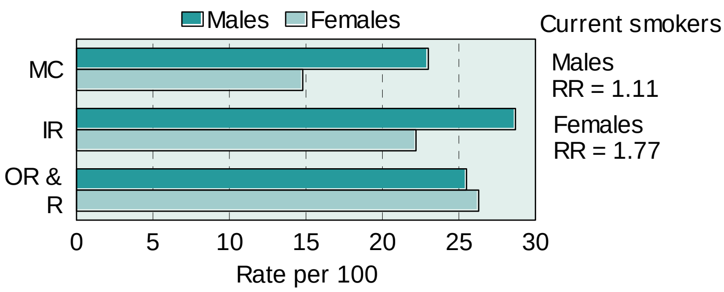
Figure 1: Estimated current smokers, by sex and socioeconomic status, 2007–2008

Metropolitan Adelaide **Non-metropolitan areas**



For both males and females, rates are lowest in the Major Cities areas and highest in the more remote areas, although the rates for females show a more even increase across the remoteness areas.

Figure 2: Estimated current smokers, by sex and remoteness, 2007–2008



High risk alcohol consumption, people aged 18 years and over, 2007–2008

Excessive alcohol consumption is a major risk factor for morbidity and mortality in Australia.[17] Harmful alcohol consumption contributes to cirrhosis of the liver; breast, oral, liver and colorectal cancers; stroke, inflammatory heart disease and hypertension; road traffic accidents; memory lapse; falls, suicide, homicide, and drowning.[18] In South Australia in 2007-08, 6.2% of adult males were estimated to consume alcohol at high risk levels, compared to 3.1% of adult females.[19]

Indicator definition: Estimated number of people aged 18 years and over who reported consuming alcohol at levels that were assessed as being of danger to their health, expressed as an age-standardised rate per 100 people; further details of these estimates, which were produced using a synthetic prediction process, are in Appendix C. These estimates were not made for the most remote areas of the State.

Geographic distribution

Although the rate of people who reported consuming alcohol at levels that were assessed as being of danger to their health is relatively low, in percentage terms, it was 37% higher in the non-metropolitan areas than in Metropolitan Adelaide.

Table 3: High risk alcohol consumption, people aged 18 years and over, 2007–2008

Per cent (age-standardised rate per 100 population)

	Metropolitan Adelaide	Non-metropolitan	South Australia
Persons	4.3	5.9	4.7

The geographic distributions of people reporting alcohol consumption at risky levels includes both areas of socioeconomic disadvantage in the outer north and outer south, as well as some relatively high socioeconomic status areas in the north-east, and along Adelaide's foreshore. The results of the correlation analysis indicate a weak association at the SLA level between high rates for this indicator and the IRSD, of -0.26.

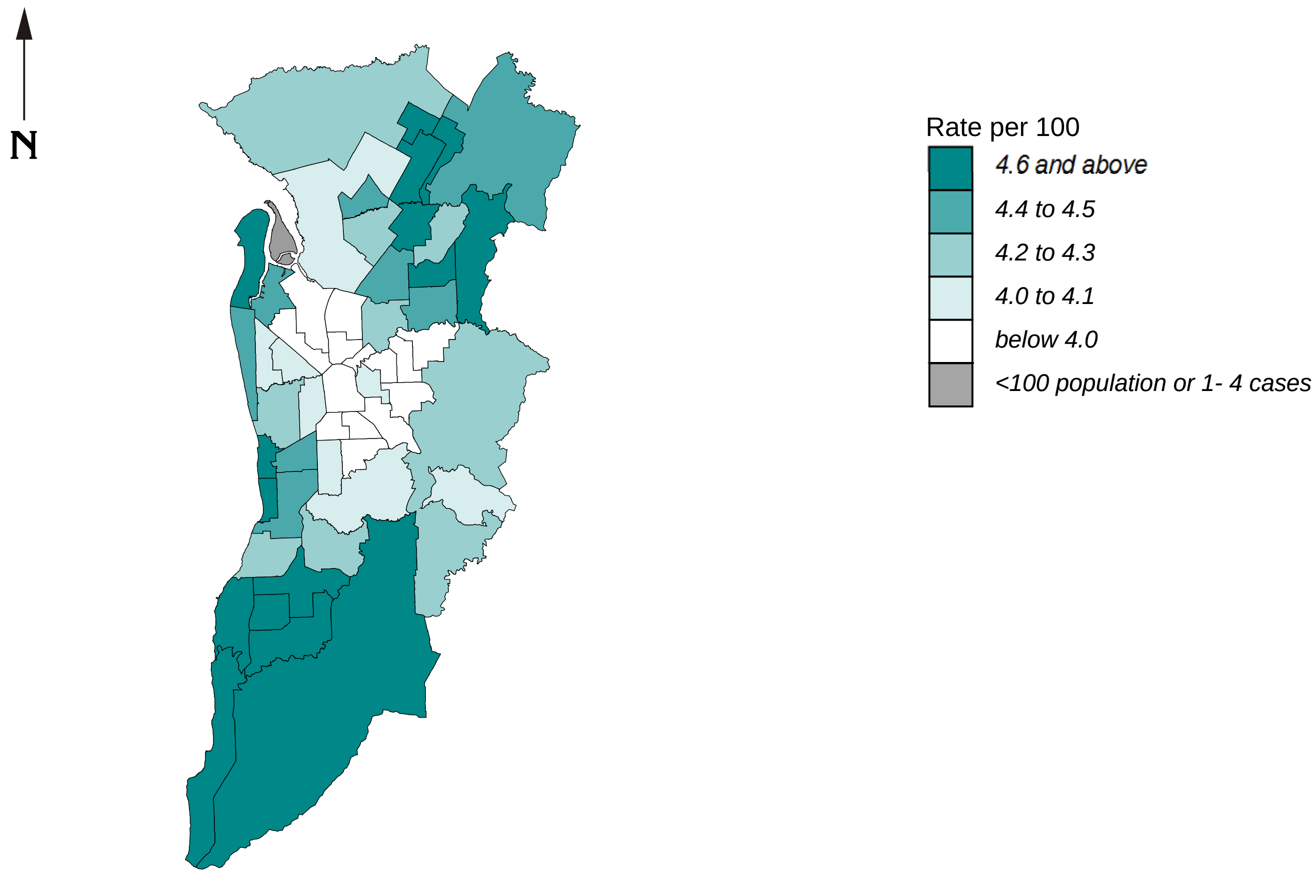
The only rate that was statistically significantly high was in Onkaparinga - South Coast (5.1%**). However, many SLAs had statistically significantly low rates, Port Adelaide Enfield - Park (3.2%^^), Burnside - North-East (3.6%^^) and - South-West (3.7%^^), and Campbelltown - East and - West (both 3.7%^^).

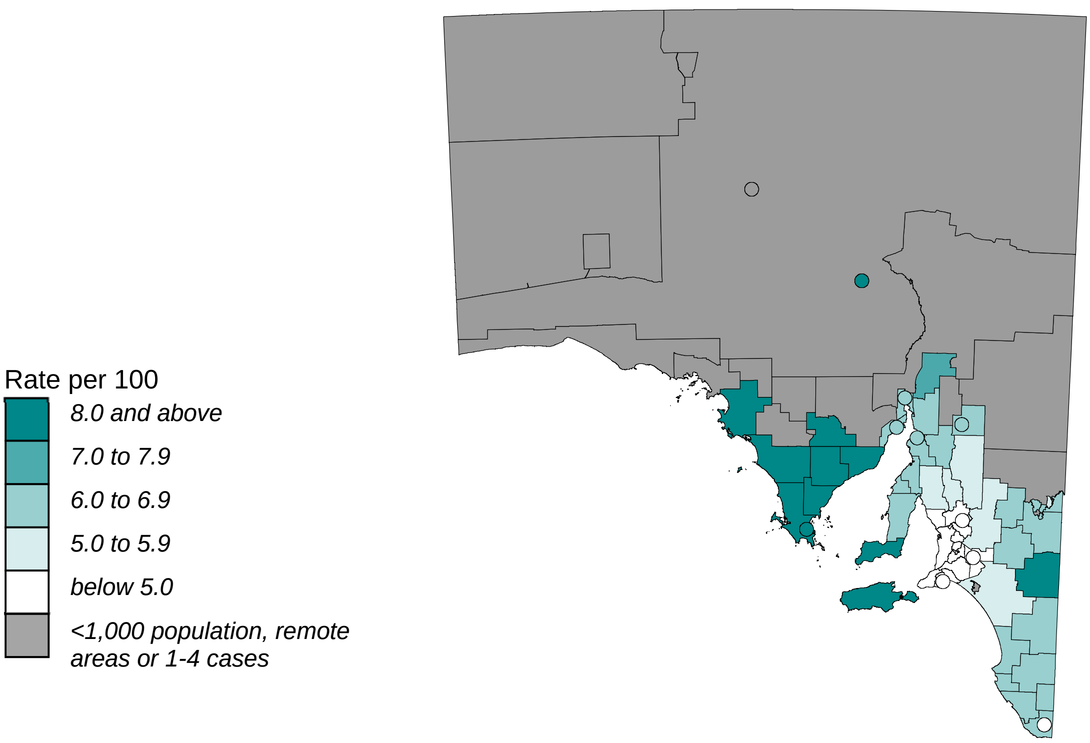
In the non-metropolitan areas, 35 SLAs had proportions (of statistical significance) above the non-metropolitan average, including Franklin Harbour (11.4%**), Streaky Bay (11.4%**), Lower Eyre Peninsula (11.2%**), Port Lincoln (11.1%**), Cleve (11.1%**), Tumby Bay (10.9%**), Elliston and Kimba (both 10.6%**), on the west coast; as well as Yorke Peninsula - South (11.4%**), Kangaroo Island (11.1%**) and Roxby Downs and Southern Mallee (both 10.5%**).

The only below average rate that was of statistical significance was in Mount Barker Central (4.4%^), with a rate that was near to the metropolitan average.

Map 3: High risk alcohol consumption, people aged 18 years and over, Metropolitan Adelaide and non-metropolitan areas, 2007–2008

ASR per 100 by Statistical Local Area (synthetic prediction)





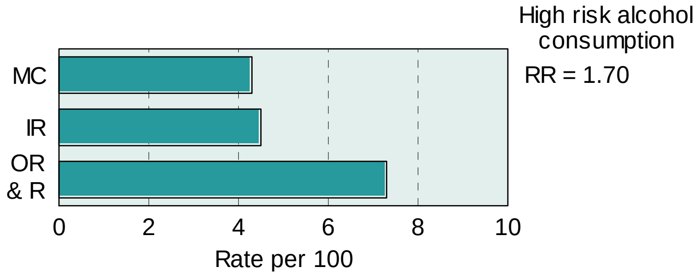
Source: Compiled in PHIDU using unpublished data supplied by ABS (produced as a consultancy)

Distribution by socioeconomic status and remoteness

The data were not available by socioeconomic status.

The self-reported consumption of alcohol, at levels assessed as being of danger to health, are substantially higher in the combined Outer Regional/ Remote areas when compared with the Major Cities and Inner Regional areas.

Figure 3: High risk alcohol consumption by remoteness, 2007–2008



Overweight and obese males aged 18 years and over, 2007–2008

Each increment in a person's body weight above their optimal level is associated with an increase in the risk of ill health. Overweight is associated with higher mortality and morbidity, and those who are already overweight have a higher risk of becoming obese. For adults, the health consequences of obesity include musculoskeletal problems, cardiovascular disease, some cancers, sleep apnoea, type 2 diabetes, and hypertension.[20] In 2007-08, an estimated 42.2% of the South Australian male population were classified as overweight (Body Mass Index (BMI) > 30.0 kg/m²), and an estimated 23.7% were classified as obese (Body Mass Index (BMI) > 30.0 kg/m²).[19]

Indicator definition: Estimated number of males aged 18 years and over who were overweight/ obese based on BMI from self-reported height and weight, expressed as an age-standardised rate per 100 males; further details of these estimates, which were produced using a synthetic prediction process, are in Appendix C.

Geographic distribution

The estimated proportion of the male population who are overweight or obese is similar in Metropolitan Adelaide and in the non-metropolitan areas, with the greatest difference in the obese population.

Table 4: Overweight and obese males aged 18 years and over, by sex, 2007–2008

Per cent (age-standardised rate per 100 population)

	Metropolitan Adelaide	Non-metropolitan	South Australia
Overweight	37.8	37.2	37.6
Obese	16.2	18.3	16.8

The overweight and obesity maps for males in Metropolitan Adelaide have quite distinct patterns, with overweight more concentrated in high socioeconomic status areas to the east and north-east (as supported by the very strong association at the SLA level with the IRSD, a correlation of 0.86) and obesity more concentrated in low socioeconomic status areas to the west and north-west, and the outer north and south (with a strong inverse correlation, of -0.58).

Overweight

SLAs with statistically significantly high proportions of overweight males were Burnside (C) - North-East and - South-West (both 39.8%**), Campbelltown - East (39.6%**), Unley - West (39.5%) and - East (39.3%*), Tea Tree Gully - Hills (39.4%*), Mitcham - North-East and - Hills (both 39.3%**), West Torrens - West (39.3%**) and Charles Sturt - Coastal (39.1%**) and - Inner West (38.9%*) and Onkaparinga - Reservoir (39.1%*). Low proportions were estimated for Playford - West Central (33.2%^^) and - Elizabeth (34.6%^^), Port Adelaide Enfield - Park (33.3%^^), - Port (34.5%^^) and - Inner ((35.0%^^), Adelaide (35.0%^^), Salisbury - Inner North (35.3%^) and - Central (35.0%^), and Onkaparinga - Morphett and Charles Sturt - North-East (both 36.2%^).

Of the relatively few areas in the non-metropolitan areas with elevated proportions, only that in Roxby Downs (44.5%**) was statistically significant. None of the proportions below the State average were very low, with the lowest in Mid Murray (35.3%^), Port Augusta (35.7%^) and Murray Bridge (35.8%^).

Obese

SLAs with statistically significantly high proportions of obese males were Onkaparinga - Hackham (24.7%**), Salisbury - Inner North (24.2%**), - Central (23.6%**), - North-East (18.4%**) and - South-East (18.2%**), Onkaparinga - Morphett (23.1%**) and - South Coast (18.5%**), Charles Sturt - North-East (22.2%**), - Inner West (18.1%**) and - Inner East (17.7%*), Playford - West (18.8%**), Port Adelaide Enfield - Coast (18.5%**) and - East (17.9%**) and Marion - Central (17.7%**).

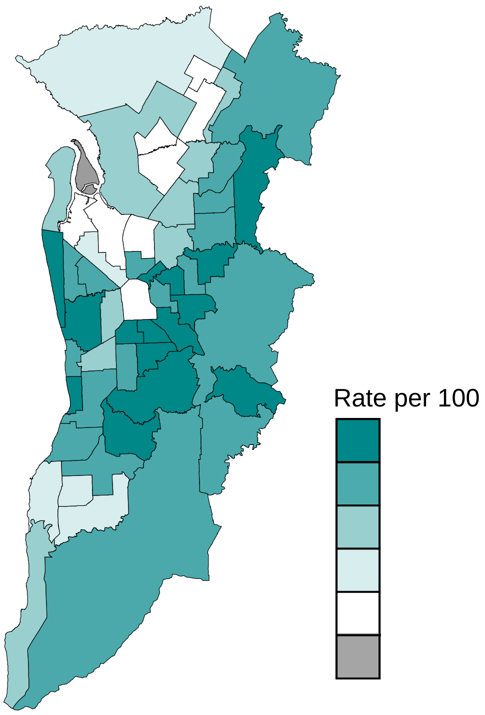
Low proportions were estimated for many areas, the main group of which includes the city and SLAs to the north, east and south, as well as further to the east, south and south-east.

Map 4: Overweight (not obese) and obese males, South Australia, 2007/08

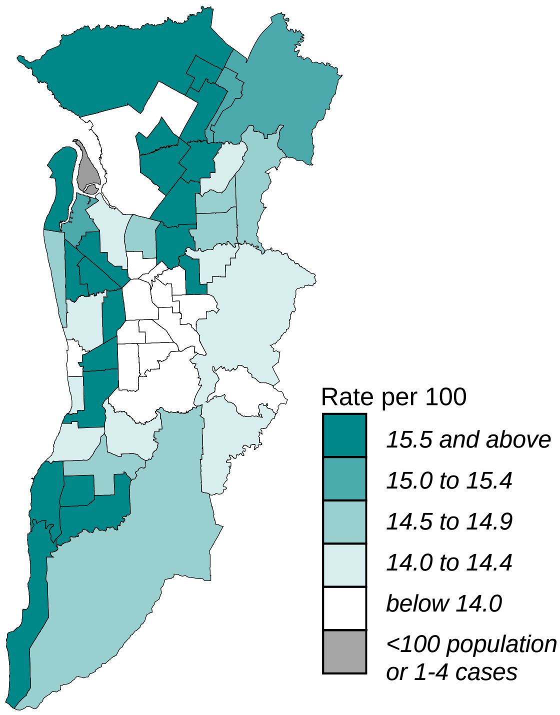
ASR per 100,000 by Statistical Local Area

N

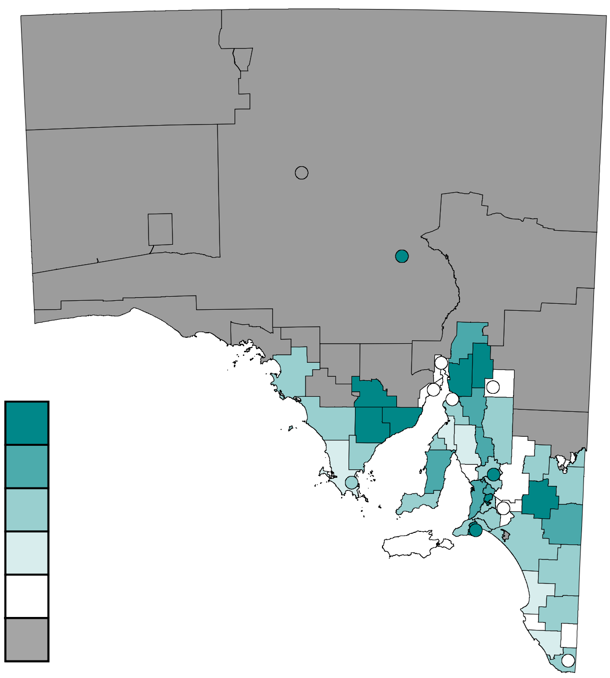
Overweight (not obese) males



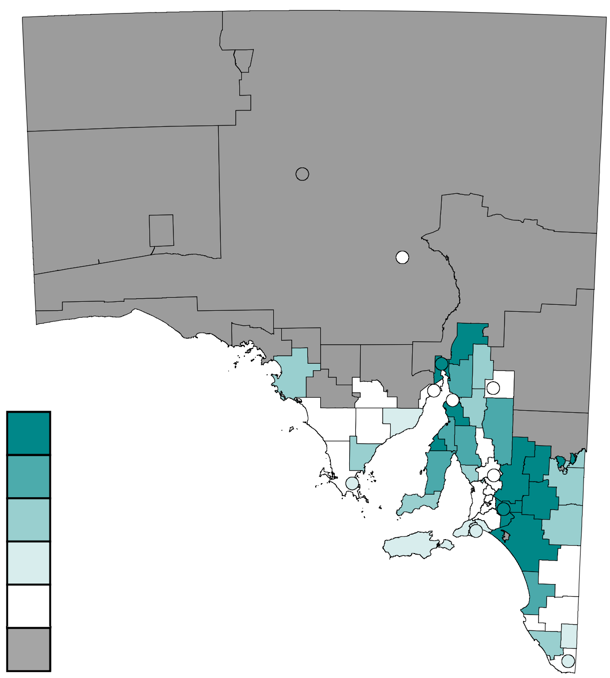
Obese males



Overweight (not obese) males



Obese males



Source: Compiled in PHIDU using unpublished data supplied by ABS (produced as a consultancy)

In contrast, a number of areas, predominantly located around the River Murray, and from Yorke Peninsula to the north of the State, had high proportions of their male population categorised as obese. The first group includes Loxton Waikerie - West (25.4%**), Renmark (24.5%**), Barmera (24.4%**), Murray Bridge (24.2%**), Mid Murray (23.2%**), Karoonda - East Murray (21.0%*) and The Coorong (20.0%**); and the second runs from Copper Coast (24.3%**) to Flinders Ranges (25.2%**), and includes Port Augusta (24.2%**), Port Pirie City and Districts Balance (20.0%**), Mount Remarkable (19.8%*), Yorke Peninsula - North (19.6%**), Wakefield (19.5%**) and Goyder (19.5%*). The lowest proportion of statistical significance was estimated for Roxby Downs (10.9%^^), with the next lowest in SLAs close to Adelaide, in Mount Barker - Central and Balance (both 14.6%^^), Adelaide Hills Balance (15.7%^^) and - North (15.1%^), Barossa - Barossa (15.1%^) and - Angaston (15.3%^), and in Strathalbyn (15.2%^).

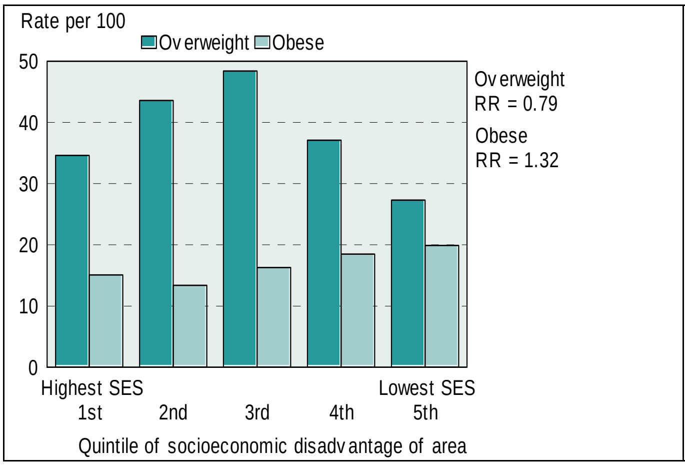
The associations with socioeconomic status mirror those for Metropolitan Adelaide, with a very strong correlation (0.74) between the IRSD and overweight and an inverse correlation of medium strength with obesity -0.43 at the SLA level in non-metropolitan South Australia.

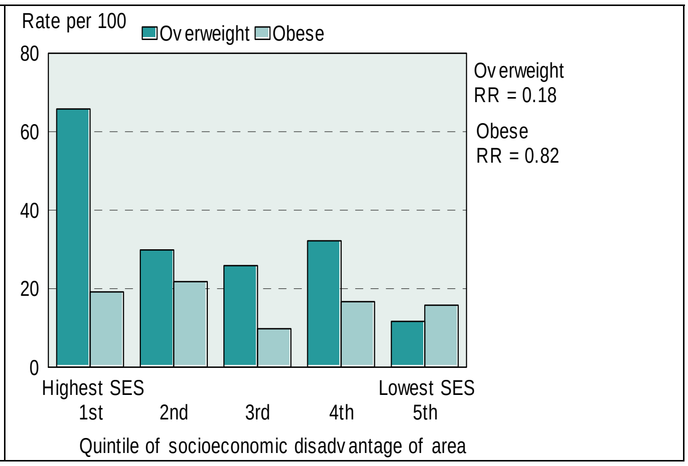
Distribution by socioeconomic status and remoteness

The proportion of the male population aged 18 years and over who were overweight increases markedly to the highest rate in the middle quintile, with rates dropping markedly after that to the lowest rate in the most disadvantaged areas. After a small decline from Quintile 1 to Quintile 2, obesity increases with increasing socioeconomic disadvantage with an overall differential between the lowest and highest socioeconomic status areas of 32%. In the non-metropolitan areas, the patterns are quite different, with the lowest rates for overweight in the most disadvantaged areas and the highest in the most advantaged areas and obesity rates highest in Quintiles 1 and 2.

Figure 4: Overweight and obese males by socioeconomic status, 2007–2008

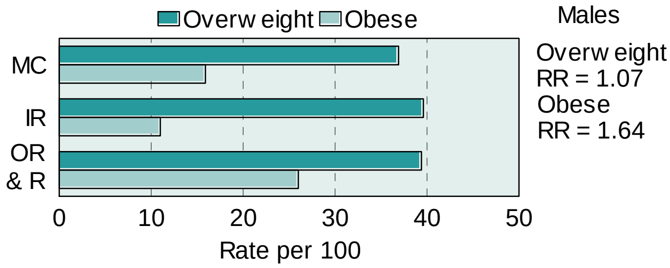
Metropolitan Adelaide | **Non-metropolitan areas**





Overweight varies relatively little across these truncated remoteness classes, and obesity first declines from the Major Cities class then increases to the highest rate in the combined Outer Regional/ Remote areas.

Figure 5: Overweight and obese males by remoteness, 2007–2008



Overweight and obese females aged 18 years and over, 2007–2008

Each increment in a person's body weight above their optimal level is associated with an increase in the risk of ill health. Overweight is associated with higher mortality and morbidity, and those who are already overweight have a higher risk of becoming obese. For adults, the health consequences of obesity include musculoskeletal problems, cardiovascular disease, some cancers, sleep apnoea, type 2 diabetes, and hypertension.[20] In 2007-08, an estimated 32.1% of the South Australian female population were classified as overweight (Body Mass Index (BMI) > 30.0 kg/m²), and an estimated 24.9% were classified as obese (Body Mass Index (BMI) > 30.0 kg/m²).[19]

Indicator definition: Estimated number of females aged 18 years and over who were overweight/ obese based on BMI from self-reported height and weight, expressed as an age-standardised rate per 100 females; further details of these estimates, which were produced using a synthetic prediction process, are in Appendix C.

Geographic distribution

The estimated proportion of the female population who are overweight or obese is similar in Metropolitan Adelaide and in the non-metropolitan areas. Whereas the female obesity rate is similar (although lower) than that for males, the overweight proportions are much lower, at around two thirds of those for males.

Table 5: Overweight and obese females aged 18 years and over, 2007–2008

Per cent (age-standardised rate per 100 population)

	Metropolitan Adelaide	Non-metropolitan	South Australia
Overweight	26.3	27.1	26.5
Obese	17.1	18.1	17.4

As shown for males, the overweight and obesity maps for females in Metropolitan Adelaide have quite distinct patterns. However, whereas obesity is even more concentrated in low socioeconomic status areas to the west and north-west, and the outer north and south (with a very strong inverse correlation, of -0.82), the distribution of overweight females is more complex, including both low socioeconomic status areas in the outer south and areas of moderate-to-high advantage in the north-east and east. This latter distribution has a weak association with socioeconomic advantage, with a correlation coefficient of 0.20.

The association at the SLA level in non-metropolitan areas between socioeconomic status and these two components of unhealthy weight is similar to, although not as strong as, that in Metropolitan Adelaide. The correlation coefficients are 0.17 with overweight (showing a weak association between overweight and socioeconomic advantage) and -0.53 with obesity (showing a strong association between obesity and socioeconomic disadvantage).

Overweight

None of the SLAs in Metropolitan Adelaide estimated to have above-average proportions had scores that were statistically significant; however, Adelaide (22.9%^^), Port Adelaide Enfield – Park (24.3%^^), Norwood Payneham St Peters – West (25.2%^) and Charles Sturt - North-East (25.3%^) had below-average proportions of statistical significance.

There were few SLAs in the non-metropolitan areas with above- or below-average numbers of overweight females in their populations, and none were of statistical significance.

Obese

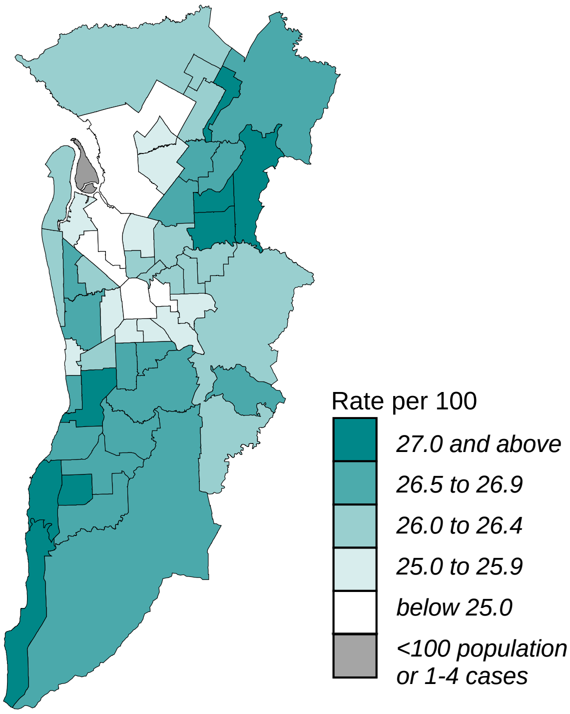
Many of the areas with high proportions of obesity for females had statistically significant proportions; these were, in

- the outer north, the Playford SLAs of - West Central (21.7%**), - Elizabeth (20.8%**), - East Central (20.7%**) and - West (19.9%**), and Salisbury - Inner North (20.7%**), - North-East (19.7%**), - Central (19.7%**), and Balance (19.4%*);
- the outer south, the Onkaparinga - South Coast (20.1%**) and - North Coast (19.7%**); and in

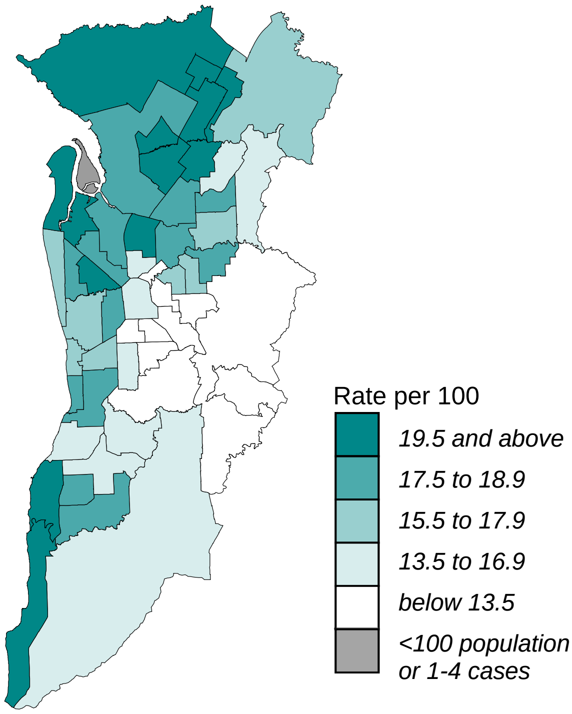
Map 5: Overweight (not obese) and obese females, South Australia, 2007/08

ASR per 100,000 by Statistical Local Area

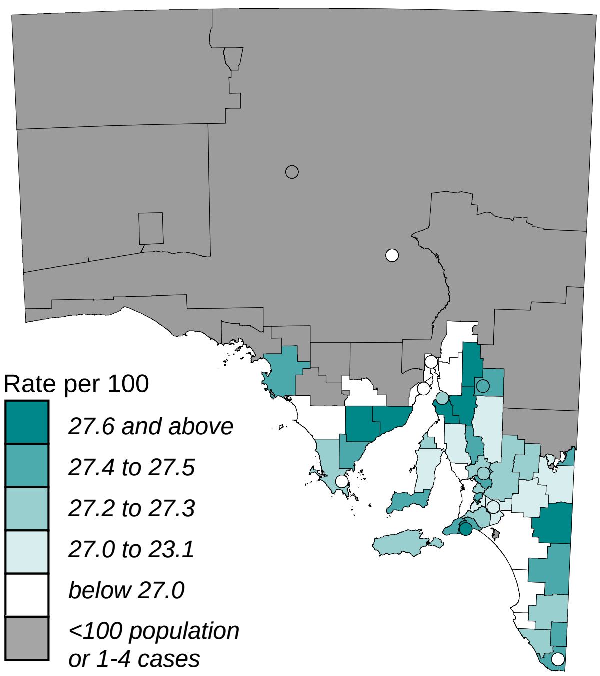
Overweight (not obese) females



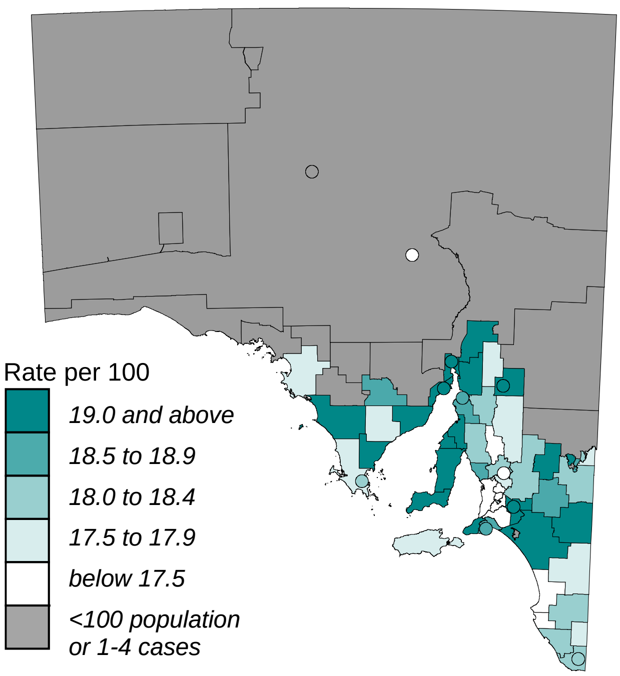
Obese females



Overweight (not obese) females



Obese females



Source: Compiled in PHIDU using unpublished data supplied by ABS (produced as a consultancy)

- the north and north-west, Port Adelaide Enfield - Coast (19.6%**), - Port (19.6%**), - Inner (19.5%**), - East (19.2%**) and - Park (18.5%**), Charles Sturt - Inner East (19.5%**), - Inner West (19.2%**) and - North-East (18.9%**), and West Torrens - East (18.8%**).

Again, as seen for the overweight data, there were many low proportions of statistical significance. These were largely in inner and middle-suburban SLAs, including Mitcham - Hills (12.9%^^), - North-East (13.2%^^) and - West (13.7%^^), Walkerville (12.8%^^), Unley - East (13.0%^^) and - West (13.1%^^), Norwood Payneham St Peters - West (13.3%^^) and Prospect (13.9%^^); and, further out, in Adelaide Hills - Central (13.3%^^) and - Ranges (13.4%^^) and Onkaparinga - Hills (14.0%^^) and - Reservoir (14.1%^^).

Although there were several SLAs with statistically significantly high proportions for obese women, none were far above the average for the non-metropolitan areas. The highest of these were Port Augusta (21.0%**), Peterborough (20.7%*), Whyalla (20.6%**) and Barunga West (20.3%*), in the north of the State; and Southern Mallee (20.8%*), Loxton Waikerie - West (20.2%**), Murray Bridge (20.1%**), Barmera (19.9%*) and The Coorong (19.8%), in the south.

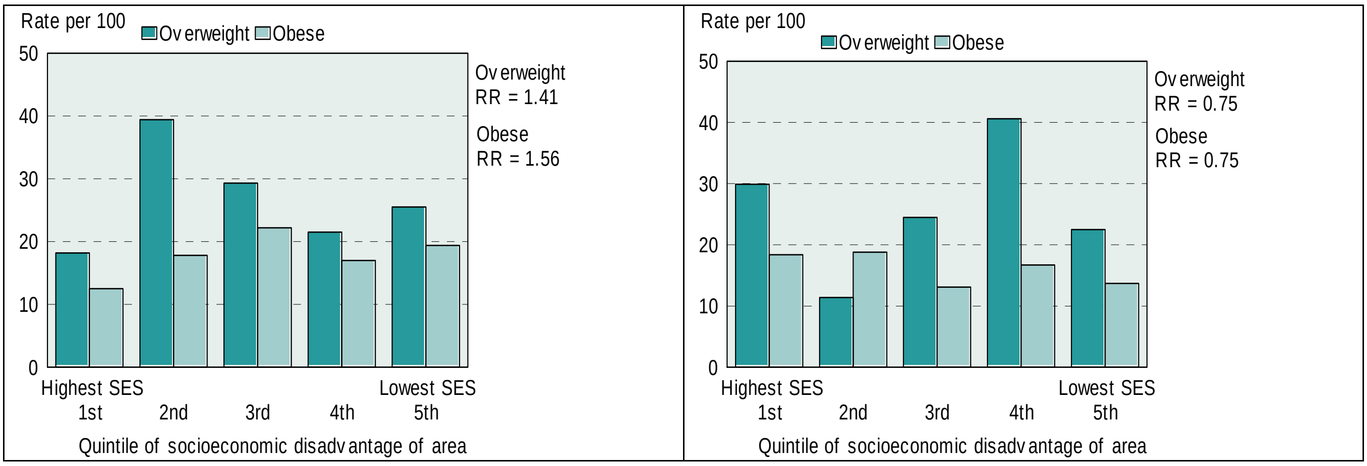
Statistically significantly low proportions were estimated for women in Adelaide Hills Balance (14.4%^^) and - North (14.6%^^), Mount Barker Balance (14.5%^^) and Roxby Downs (14.5%^).

Distribution by socioeconomic status and remoteness

There are no clear patterns in either Metropolitan Adelaide or the non-metropolitan areas in the overweight data. In Metropolitan Adelaide, rates of obesity generally increase with increasing disadvantage, with an overall gap of 56% (a rate ratio of 1.56); whereas in the non-metropolitan areas, rates generally decline with increasing disadvantage, to be 25% lower in the most disadvantaged areas than in the most advantaged areas.

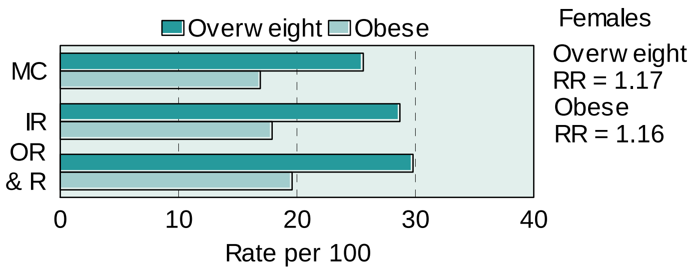
Figure 6: Overweight and obese females by socioeconomic status, 2007–2008

Metropolitan Adelaide **Non-metropolitan areas**



There are moderate increases in rates of both overweight and obesity across the three remoteness classes for which these data were available.

Figure 7: Overweight and obese females by remoteness, 2007–2008



Physical inactivity, people aged15 years and over, 2007–2008

Physical inactivity is linked to poor health, such as certain chronic diseases, injuries, excess body weight and low bone-mineral density.[21] Of the modifiable health risk factors, physical inactivity has been estimated to cause the second highest burden of premature death and illness in Australia, after tobacco smoking.[17] In South Australia in 2007-08, an estimated 39.3% of males aged 15 years and over were physically inactive, compared to 37.2% of females in the same age groups.[19]

Indicator definition: Estimated number of people aged 15 years and over who reported levels of physical activity that resulted in them being assessed as physically inactive (i.e., did not exercise in the two weeks prior to interview through sport, recreation or fitness (including walking)), expressed as an age-standardised rate per 100 people (by sex); further details of these estimates, which were produced using a synthetic prediction process, are in Appendix C. These estimates were not made for the most remote areas of the State.

Geographic distribution

The estimated proportion of the population aged 15 years and over who were physically inactive was slightly higher in the non-metropolitan areas than in Metropolitan Adelaide.

Table 6: Physically inactive people aged 15 years and over, 2007–2008

Per cent (age-standardised rate per 100 population)

	Metropolitan Adelaide	Non-metropolitan	South Australia
Persons	36.6	38.9	37.3

The distribution of SLAs in Metropolitan Adelaide with high levels of physical inactivity is very strongly associated with socioeconomic disadvantage, with a correlation coefficient of -0.94 between high proportions of the population with this characteristic and the IRSD.

Areas with well above-average proportions were, in:

- the north and north-west, Port Adelaide Enfield - Park (48.8%**), - Inner (44.4%**), - Port (44.1%**) and - East (41.8%**), and Charles Sturt - North-East (42.8%**), - Inner East (41.6%**) and - Inner West (41.3%**);
- the outer north, Salisbury - Central (44.7%**), - Inner North (44.3%**), Balance (38.9%*) and - South-East (38.5%**), and Playford - West Central (44.5%**), - Elizabeth (44.5%**) and - West (44.1%**);
- the outer south, Onkaparinga - North Coast (42.2%**), - Hackham (42.2%**) and - Morphett (41.2%**).

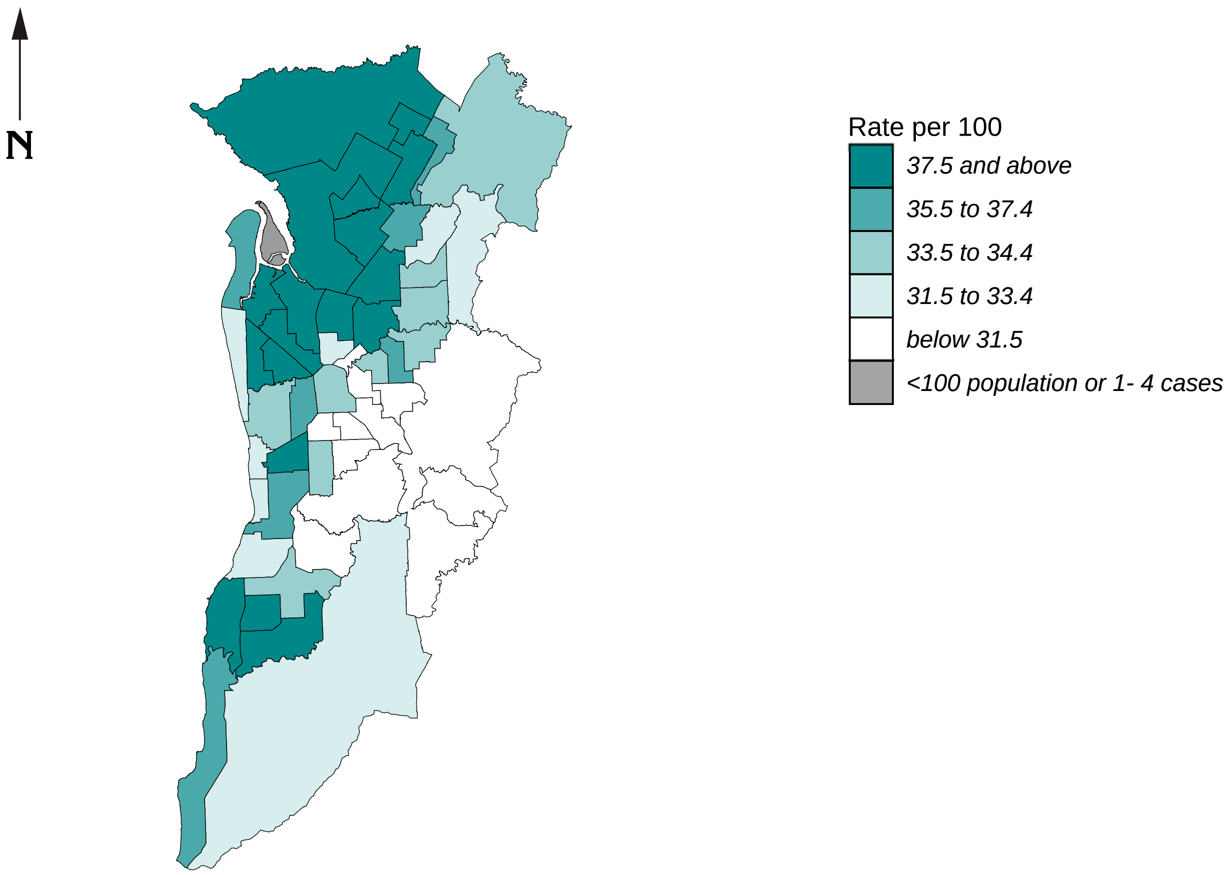
Many SLAs were estimated to have below-average proportions of statistical significance, in particular adjacent to the city, and to the east, north-east and south-east, as well as along the coast. The very lowest of these were in Adelaide Hills - Central (27.8%^^) and - Ranges (29.1%^^), Mitcham - North-East (29.4%^^) and - Hills (29.7%^^), Burnside - South-West (29.5%^^) and - North-East (30.1%^^), and Walkerville (30.6%^^).

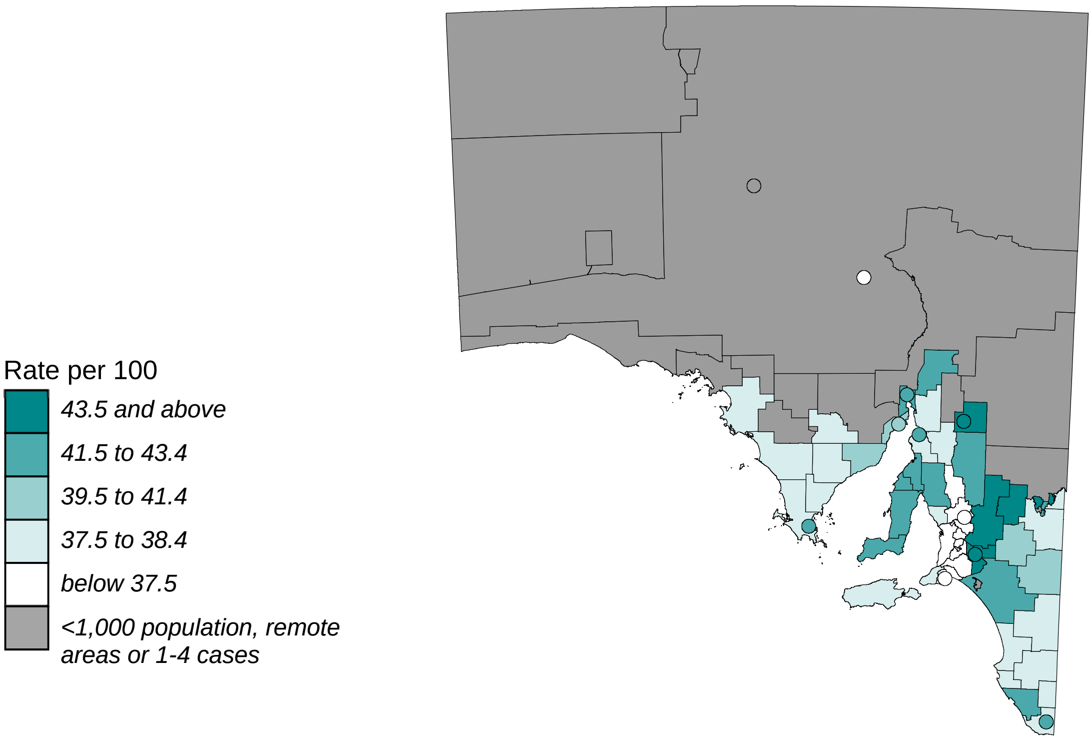
Physical inactivity in the non-metropolitan areas is also very strongly associated with socioeconomic disadvantage at the SLA level, with a correlation coefficient of -0.79 between high proportions of the population with this characteristic and the IRSD. Proportions statistically significantly above the State average were estimated for Loxton Waikerie – West (44.8%**), Renmark (44.7%**), Murray Bridge (44.5%**), Mid Murray (43.6%**), Barmera (43.5%**) and The Coorong (43.3%**); and, to the north of Adelaide, Peterborough (44.7%**), Wakefield (43.4%**), Barunga West (43.4%**) and Goyder and Flinders Ranges (both 43.1%**).

The only below-average proportions of statistical significance were estimated for Roxby Downs (31.4%^^), Adelaide Hills - North (32.7%^^) and Balance (34.4%^^), Mount Barker Balance (33.5%^^) and Central (35.1%^^) and Barossa - Barossa (35.3%^^).

Map 6: Physical inactivity, people aged 15 years and over, Metropolitan Adelaide, 2007–2008

ASR per 100 by Statistical Local Area (synthetic prediction)





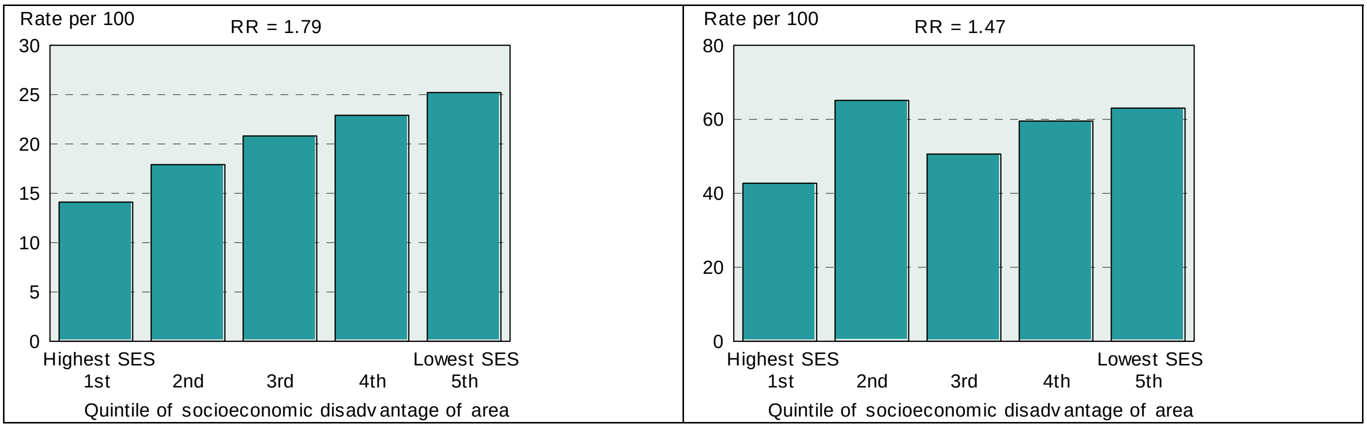
Source: Compiled in PHIDU using unpublished data supplied by ABS (produced as a consultancy)

Distribution by socioeconomic status and remoteness

There is a continuous socioeconomic gradient in rates of physical inactivity and a substantial differential between the most advantaged and least advantaged areas in Metropolitan Adelaide, a rate ratio of 1.79. Although the gradient in rates in the non-metropolitan areas is not continuous, there is still a substantial difference, of 47%, between the most advantaged and least advantaged areas.

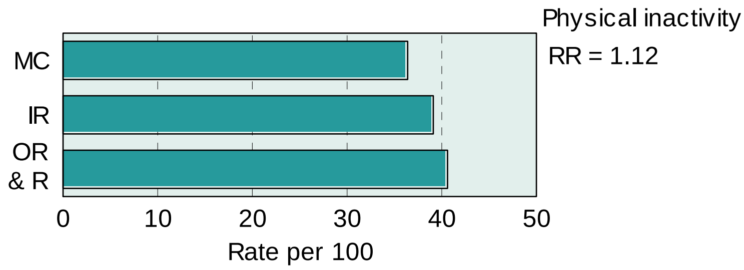
Figure 8: Physical inactivity by socioeconomic status, 2007–2008

Metropolitan Adelaide **Non-metropolitan areas**



There are moderate increases in rates of physical inactivity across the three remoteness classes for which these data were available.

Figure 9: Physical inactivity by remoteness, 2007–2008



Usual daily intake of two or more serves of fruit, people aged 18 years and over, 2007 to 2008

In addition to their nutritious attributes, fruits are valuable for their role in diluting dietary energy intake and decreasing the consumption of less healthy alternatives. However, only a small fraction of South Australians eat the NHMRC recommended two serves of fruit per day (a serve is approximately 150 grams of fresh fruit or 50 grams of dried fruit).[14] In 2007-08, only 49.4% of people aged 15 years and over met or exceeded their recommended daily intake of two serves of fruit.[19]

Indicator definition: Estimated number of people aged 18 years and over who reported usually consuming two serves of fruit (excluding drinks and beverages) each day, expressed as an age-standardised rate per 100 people; further details of these estimates, which were produced using a synthetic prediction process, are in Appendix C.

Geographic distribution

The estimated proportion of the population aged 18 years and over who usually consumed two serves of fruit a day was similar in Metropolitan Adelaide and the non-metropolitan areas.

Table 7: Usual daily intake of fruit, people aged 18 years and over, 2007–2008

Per cent (age-standardised rate per 100 population)

	Metropolitan Adelaide	Non-metropolitan	South Australia
Persons	49.0	46.7	48.3

The distribution of SLAs in Metropolitan Adelaide with adults meeting the recommendation for fruit consumption is strongly associated with socioeconomic advantage, with a correlation coefficient of 0.69 between high proportions of the population with this characteristic and the IRSD; this is clearly evident from the map, with the highest levels concentrated in the higher socioeconomic status SLAs immediately to the east, north-east and south-east of the city.

The highest proportions of the population usually consuming two serves of fruit were estimated for the SLAs of Burnside - South-West (53.0%**) and - North-East (52.9%**), Mitcham - North-East (52.9%**) and - Hills (52.0%**), Walkerville (52.6%**), Unley - East (52.4%**) and - West (51.6%**), Campbelltown - West and - East (both 51.9%**), Norwood Payneham St Peters - West (51.8%**) and - East (51.6%**) and Adelaide Hills - Central (51.8%**).

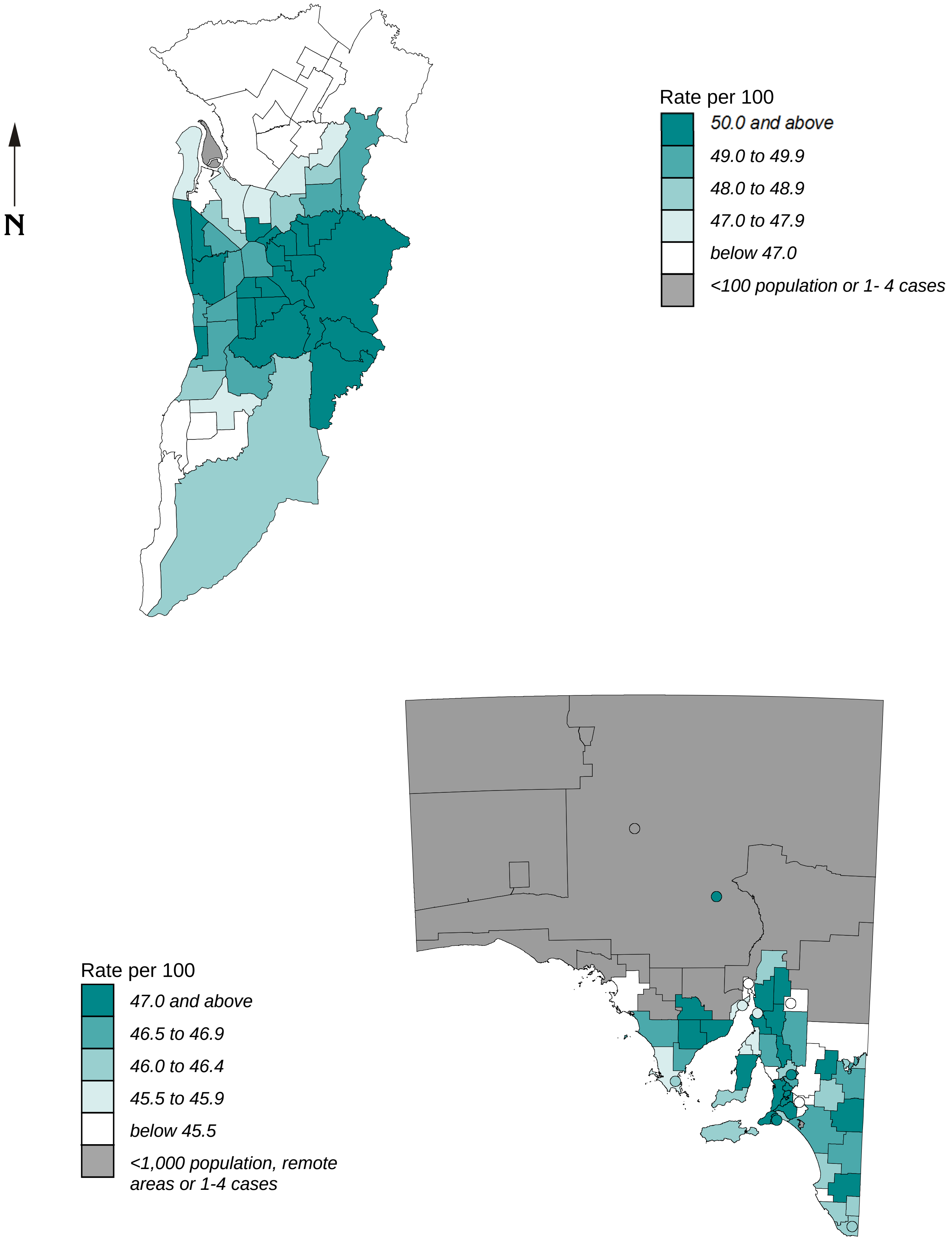
Low proportions of statistical significance were most highly concentrated in the outer north, in Playford - West Central (43.1%^^), Elizabeth (44.6%^^), - East Central (45.0%^^) and - West (45.7%^^) and Salisbury - Inner North (44.9%^^) and, in the outer south, in Onkaparinga - Hackham (45.5%^^) and - North Coast (45.8%^^).

In the non-metropolitan areas, relatively few SLAs were mapped, very few had high proportions of adults consuming two serves of fruit, and none were of statistical significance. Despite this, there was an even stronger association with high socioeconomic status, a correlation coefficient of 0.74, between high proportions of the adult population consuming two serves of fruit and the IRSD at the SLA level.

The lowest proportion of statistical significance was in Robe (44.2%^), with the next lowest in Mid Murray (44.8%^^) and Peterborough, Mallala and Port Augusta (all 44.9%^^).

Map 7: Usual daily intake of two or more serves of fruit, people aged 18 years and over, Metropolitan Adelaide and non-metropolitan areas, 2007–2008

ASR per 100 by Statistical Local Area (synthetic prediction)



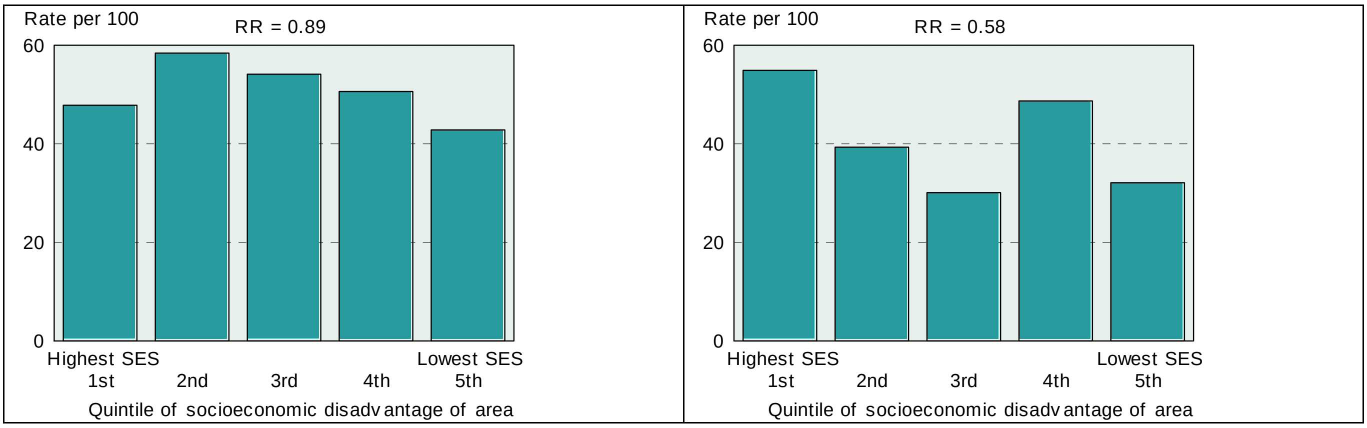
Source: Compiled in PHIDU using unpublished data supplied by ABS (produced as a consultancy)

Distribution by socioeconomic status and remoteness

In both the metropolitan and non-metropolitan areas, the lowest proportions of the adult population who reported consuming the recommended daily intake of fruit was lower in the most disadvantaged areas than in the most advantage areas. In Metropolitan Adelaide, proportions decline from 58.4% in Quintile 2 to 42.8% in Quintile 5; the proportion in Quintile 1 is the second lowest, at 47.8%. In the non-metropolitan areas, the usual daily intake of fruit in the most disadvantaged areas is 42% below that in the least disadvantaged areas.

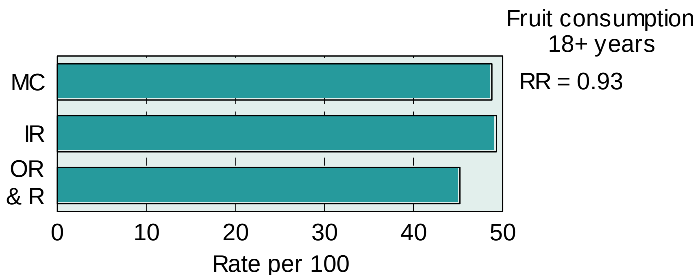
Figure 10: Usual daily intake of two or more serves of fruit, people aged 18 years and over, by socioeconomic status, 2007–2008

Metropolitan Adelaide **Non-metropolitan areas**



Usual daily intake of fruit under this measure drops off from the highest rates in the Inner Regional and Major Cities areas to a slightly lower rate in the combined Outer Regional/ Remote class.

Figure 11: Usual daily intake of two or more serves of fruit, people aged 18 years and over, by remoteness, 2007–2008



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Primary prevention of cancer

Primary prevention involves the elimination or reduction of exposure to recognised risk factors in susceptible populations to prevent a disease or injury from occurring. Evidence of effective primary prevention measures in reducing cancer rates are, for example, the decrease in cases of male lung cancer from a fall in tobacco smoking.[58]

Primary cancer prevention strategies include:

- vaccinating against human papilloma virus (HPV) and hepatitis B virus (HBV);
- controlling occupational and other hazards; and
- reducing harmful exposure to sunlight.[60]

It has been estimated that at least one-third of cancer cases that occur annually throughout the world could be prevented.[57] Primary prevention through behavioural and environmental interventions remains the main way to reduce the burden of cancers, and is by far the most cost-effective and sustainable intervention for reducing the burden of cancer globally.[59,60]

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Sunscreen protection

Australia has the highest rate of skin cancer in the world, with two in every three Australians developing skin cancer at some time during their life.[22] Over-exposure to ultraviolet radiation in sunlight causes permanent damage to skin and increases the risk of skin cancer. The risk of developing skin cancers can be reduced if measures, such as avoiding sun exposure by wearing protective clothing and using appropriate sunscreen products, are used to protect skin from sun damage.[22,23]

Indicator definitions: Number of people reporting (in the Health Omnibus Survey) getting sunburnt in the previous summer, as a proportion of respondents; and the number reporting five sun protection behaviours (namely, wearing a hat, wearing SPF 30+ sunscreen, wearing clothes that covered all of their arms and legs, wearing sunglasses and seeking shade).

Note: The Health Omnibus Survey is a household survey undertaken across South Australia and including urban centres with populations of 1,000 or more: as such, the most remote areas of the State are not included, a potential limitation which users should bear in mind when using the data, in particular those presented by remoteness. The survey has a response rate of around 60%: again, this may impact on the data, in particular that presented by socioeconomic status, as response rates are likely to be lowest in disadvantaged areas.

Geographic distribution

There is little variation between Metropolitan Adelaide and the non-metropolitan areas in the proportion of survey respondents reporting getting sunburnt in the previous summer. The proportion of respondents reporting all five of the sun protection practices (noted above in the definition) was higher in the non-metropolitan areas (13.3%) than in Metropolitan Adelaide (11.2%).

Table 8: Sun protection, 2009–2011

Per cent

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
Skin burnt at all over the past summer	21.3	21.2	21.3
Regular participation in all 5 sun protective behaviours[1]	11.2	13.3	11.8

[1]Includes (hat, shade, sunglasses, clothing and sunscreen)

The data have not been mapped due to the small number of cases at the SLA level.

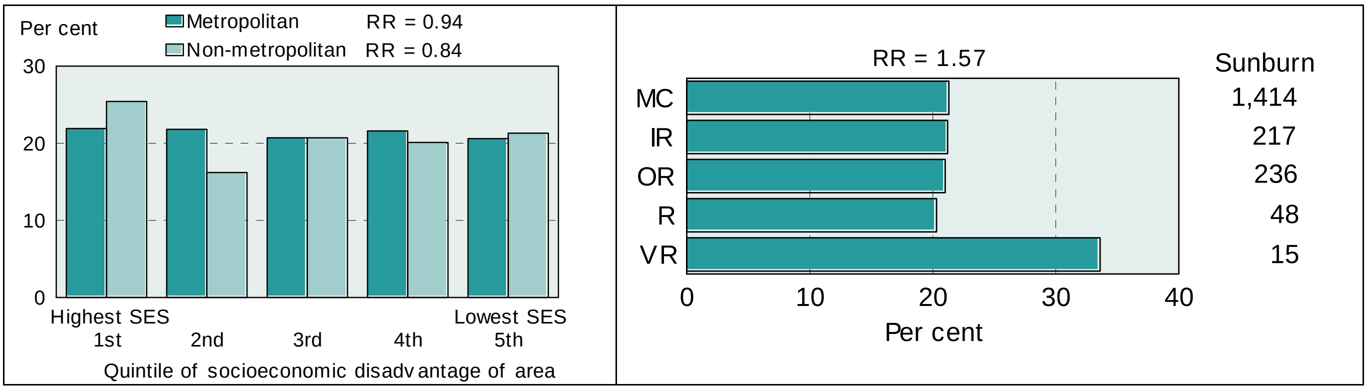
Distribution by socioeconomic status and remoteness

There is little variation across the quintiles of socioeconomic disadvantage in Metropolitan Adelaide in the proportion of respondents reporting getting sunburnt in the previous summer, with the highest rates in Quintiles 1 and 2, and the lowest rates in Quintiles 3 to 5. Rates vary more in the non-metropolitan areas, with the highest and lowest rates in Quintiles 1 and 2, and moderate rates in Quintiles 3 to 5.

The remoteness graph shows an even pattern of responses over the first four remoteness classes, with a substantially higher proportion (over 50% higher) in the Very Remote areas.

Figure 12: Skin burnt at all over the past summer, 2009–2011

Socioeconomic status **Remoteness**

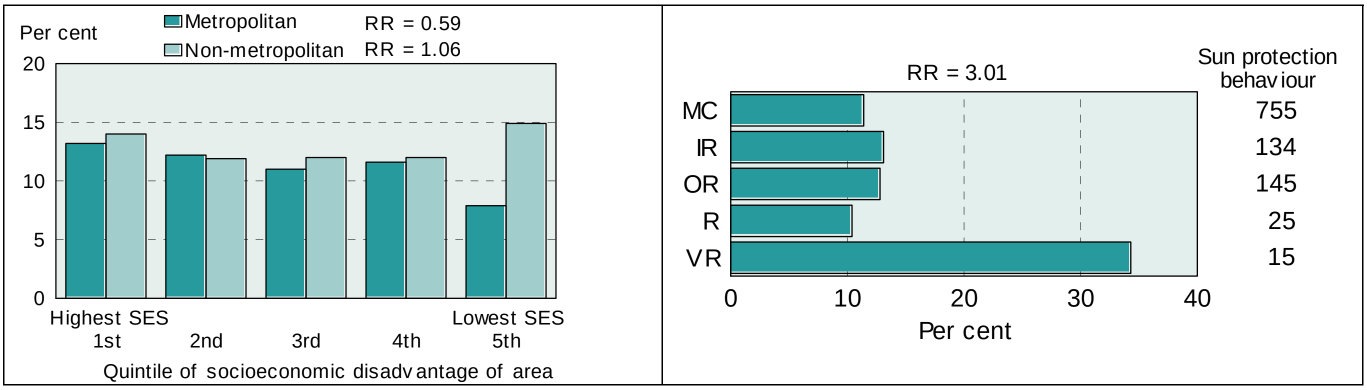


In Metropolitan Adelaide, the rate of respondents who reported that they regularly follow all five sun protection practices (hat, shade, sunglasses, clothing and sunscreen) decreases with increasing socioeconomic disadvantage (other than for a slight increase between Quintiles 3 and 4), with the rate in the most disadvantaged areas 41% below the rate in the most advantaged areas. Rates also decrease with increasing socioeconomic disadvantage in the non-metropolitan areas, with the exception of the marked increase in rates between Quintile 4 and Quintile 5.

The remoteness graph again shows a much different response in the Very Remote areas, in this case of over three times the compliance with these practices as occurs across the first four remoteness classes.

Figure 13: Regular participation in all 5 sun protective behaviours, 2009–2011

Socioeconomic status **Remoteness**



Screening for cancer

Cancer mortality can be reduced if cases are detected and treated early.[61] There are two components of early detection efforts - early diagnosis, and screening. Screening is defined as the systematic application of a test in an asymptomatic and apparently healthy population, to identify individuals with abnormalities suggestive of a specific cancer or pre-cancerous condition and refer them promptly for diagnosis and treatment.[61] Screening is offered to a selected group of the population called the 'target population'. This group is targeted because there is strong scientific evidence that they are most at risk of getting the disease and will get the most health benefit from screening. Screening programmes are especially effective for frequent cancer types for which a cost-effective, affordable, acceptable and accessible screening test is available to the majority of the population at risk.[62]

Population-based screening is where a test is offered systematically to all individuals in the defined target group within a framework of agreed policy, protocols, quality management, monitoring and evaluation. Such screening is planned and coordinated with the aim of bringing maximum health benefits for the community.[28] The programs involved are assessed regularly to make sure they are safe and effective. The Australian Population Based Screening Framework, which is used to decide whether our population should be screened for a disease, advises:

- The screening program will provide more benefit than harm to the people being screened.
- The condition should:
  - be an important health problem.
  - have a recognisable latent or early symptomatic stage.
- The test should:
  - be able to find the early stages of the disease (be highly sensitive).
  - be very accurate in finding the early stages of disease (be highly specific).
  - be able to provide consistent results from the test (be validated).
  - be safe.
  - find most disease present at the time of the screening test (have a relatively high positive predictive value).
  - be normal when there is no disease present (have a relatively high negative predictive value).
  - be acceptable to the target population including important sub groups such as target participants who are from culturally and linguistically diverse backgrounds, Aboriginal and Torres Strait Islander people, people from disadvantaged groups, and people with a disability.
- Systems should be in place for evidence based follow up assessment of all people with a positive screening test regardless of rurality, ethnicity, socioeconomic status or disadvantage status.
- Treatment should be effective, available, easily accessible and acceptable to all patients with the recognised disease or condition.[62]

There are three national population-based screening programs in Australia: BreastScreen Australia, the National Cervical Screening Program, and the National Bowel Cancer Screening Program.

In 1991, BreastScreen Australia and the National Cervical Screening Program were introduced after recommendations from the National Breast Cancer Screening Evaluation and the National Cervical Cancer Screening Evaluation.[28] Data for these two programs are included in this atlas.

The Bowel Cancer Screening Pilot Program was conducted from 2002 until 2004 to test the feasibility, acceptability and cost effectiveness of bowel cancer screening in Australia.[39] The final evaluation report showed that a national bowel cancer screening program would be feasible, acceptable and cost effective. In 2006, the phased introduction of the National Bowel Cancer Screening Program commenced for people turning 55 and 65 years of age. In 2008, this was extended to people turning 50, 55 and 65 years of age between January 2011 and December 2014, who hold a Medicare card or DVA gold card.[39]

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Breast screening participation, 2001–2002 and 2009–2010

Breast cancer is a major health issue for South Australian women and, given current knowledge, there are few scientifically proven strategies for its prevention. However, research has shown that screening mammography is currently the most effective tool for the early detection of breast cancer in women, without symptoms, in the target age group of women aged 50 to 69 years; and that having a screening mammogram every two years reduces the chance of dying from breast cancer.[27] Research indicates that participation in screening in Australia in this way is associated with a reduction in breast cancer mortality of between 32% and 43%.[28] Women in special need showing lower than average screening participation rates include Aboriginal and Torres Strait Islander women, groups from non-English speaking backgrounds, women living in very remote areas and sub-groups of women from major metropolitan settings.[29]

Indicator definition: Number of individual women aged 50 to 69 years screened over a 24 month period ending 31 December 2002 or 31 December 2010, as a proportion of the female population at those ages.

Geographic distribution

Participation rates for females aged 50 to 69 years declined over this eight-year period, by 12.4% in Metropolitan Adelaide and by 11.9% in the non-metropolitan areas.

Table 9: Breast screening participation, females aged 50 to 69 years, 2001–2002 and 2009–2010

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
		Per cent	
2001–2002	63.5	67.6	64.8
2009–2010	55.6	59.5	56.7
		Percentage change	
From first to second period	-12.4	-11.9	-12.5

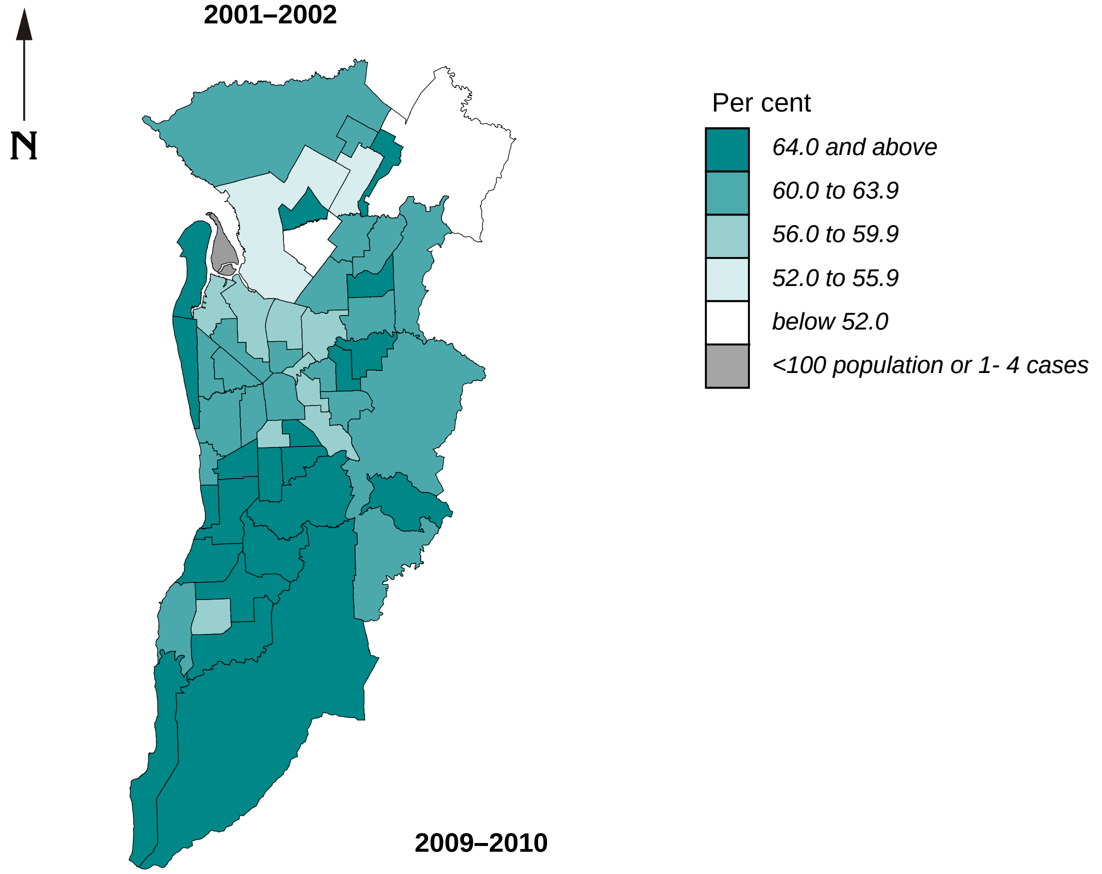
The overall level of change is also reflected in the maps, with participation rates lower across the majority of SLAs in Metropolitan Adelaide, and areas with the highest rates, with a few exceptions, more highly concentrated in 2009–2010 in fringe SLAs to the south-east and north-east, than over the earlier period (2001–2002). A number of middle-suburban SLAs, including some of higher socioeconomic status, also have above-average rates; however, participation of women from the highest socioeconomic status SLAs was variable, with only three of the SLAs with the highest IRSD scores in Metropolitan Adelaide among those with a participation rate in the top ten. The correlation coefficient of 0.56, indicating the existence of a strong association between high participation rates and socioeconomic advantage, supports the contention of the mixed socioeconomic status of the female populations of the participating SLAs. Also of note is the association with breast cancer incidence, as reported in the SA Cancer Register, a weak, positive correlation of 0.28.

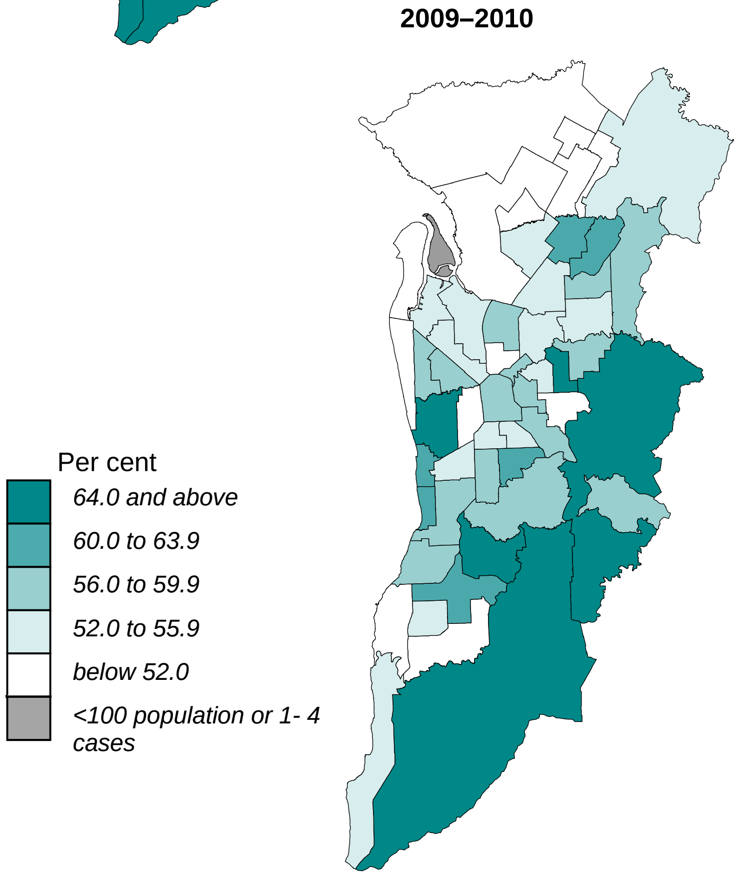
The highest participation rate in 2009–2010 was in West Torrens - West (67.0%), with high rates also in other middle-suburban SLAs of Campbelltown - West (64.9%), Mitcham - North-East (61.3%) and Holdfast Bay - North (60.1%). SLAs on the metropolitan fringe were Adelaide Hills - Ranges (65.2%), Onkaparinga - Hills (64.8%), - Reservoir (64.2%) and - Woodcroft (61.3%), Salisbury - North-East (61.6%) and Tea Tree Gully - North (60.5%). The Playford SLAs of - Elizabeth (42.9%), - West Central (45.0%), - East Central (48.2%) and - West (49.7%) had among the lowest participation rates over the twenty-four months to December 2009, and even in Playford - Hills, with one of the highest IRSD scores in Metropolitan Adelaide, the rate was a below-average 53%. Other SLAs with very low participation among women aged 50 to 69 years were West Torrens - East (43.2%), Salisbury - Inner North (47.4%), Onkaparinga - North Coast (48.2%) and - Hackham (50.1%) and Prospect (50.6%).

The overall decline in participation is also evident in the map of the non-metropolitan areas, with SLAs mapped in the higher ranges more sparsely spread in the second period; the association with socioeconomic disadvantage in the distribution of participation rates at the SLA level is weak (a correlation coefficient of 0.22). It should be noted that participation rates at the SLA level can vary over time; this is particularly likely to occur in remote areas if the mobile screening unit has not visited the area during the 24-month period.

Map 8: Breast screening participation, females aged 50 to 69 years, Metropolitan Adelaide, 2001–2002 and 2009–2010

Per cent by Statistical Local Area



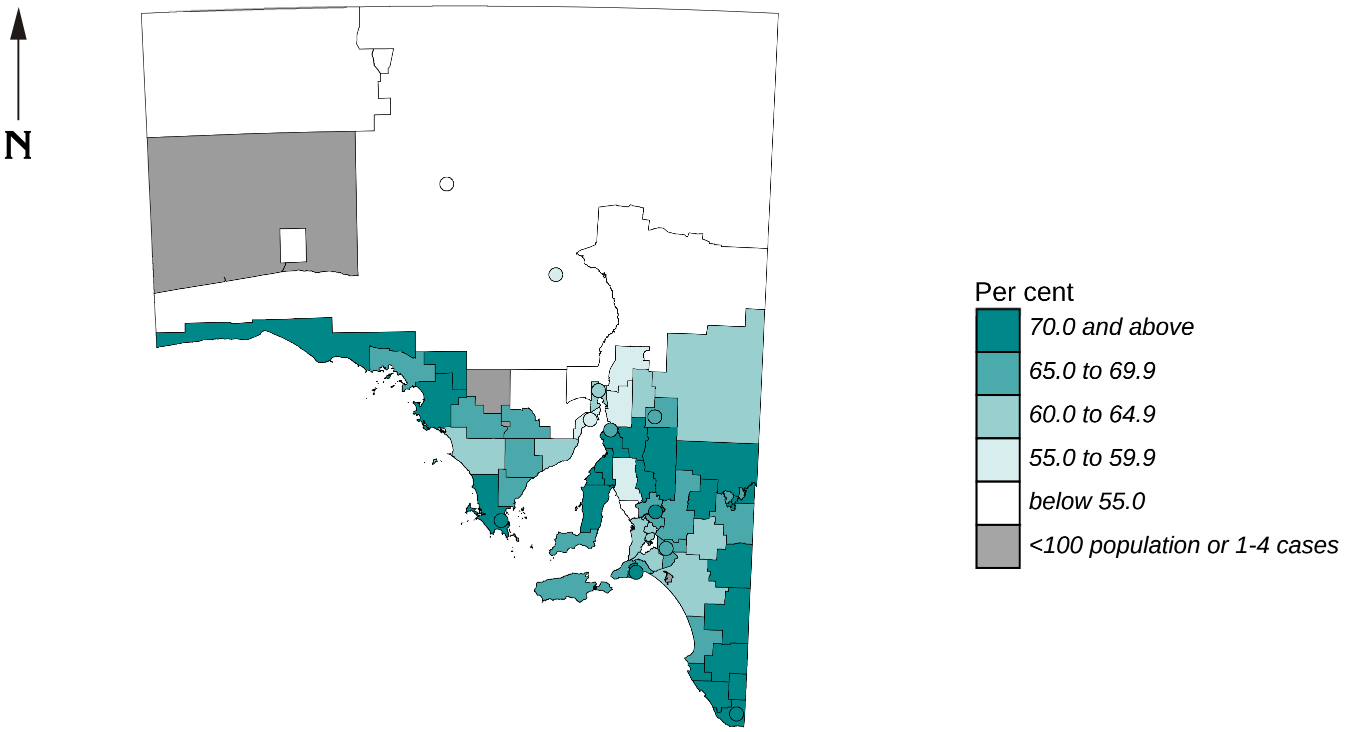


Source: Compiled in PHIDU using data supplied by BreastScreen SA

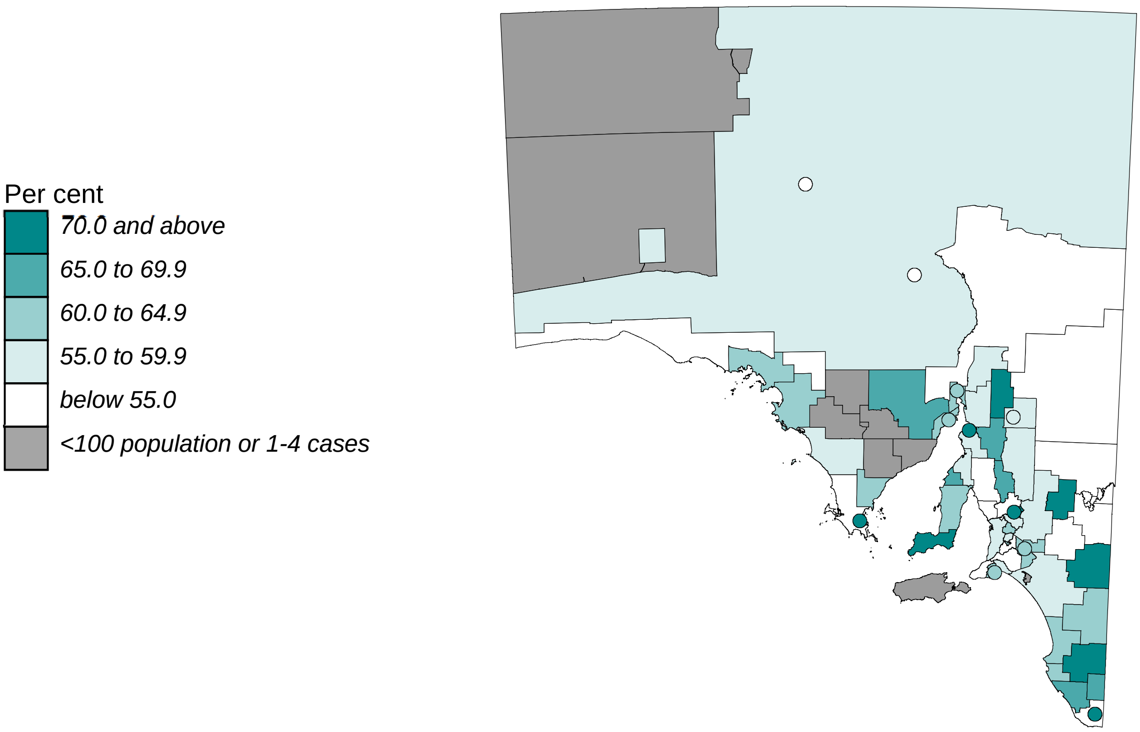
Map 9: Breast screening participation, females aged 50 to 69 years, non-metropolitan areas, 2001–2002 and 2009–2010

Per cent by Statistical Local Area

2001–2002



2009–2010



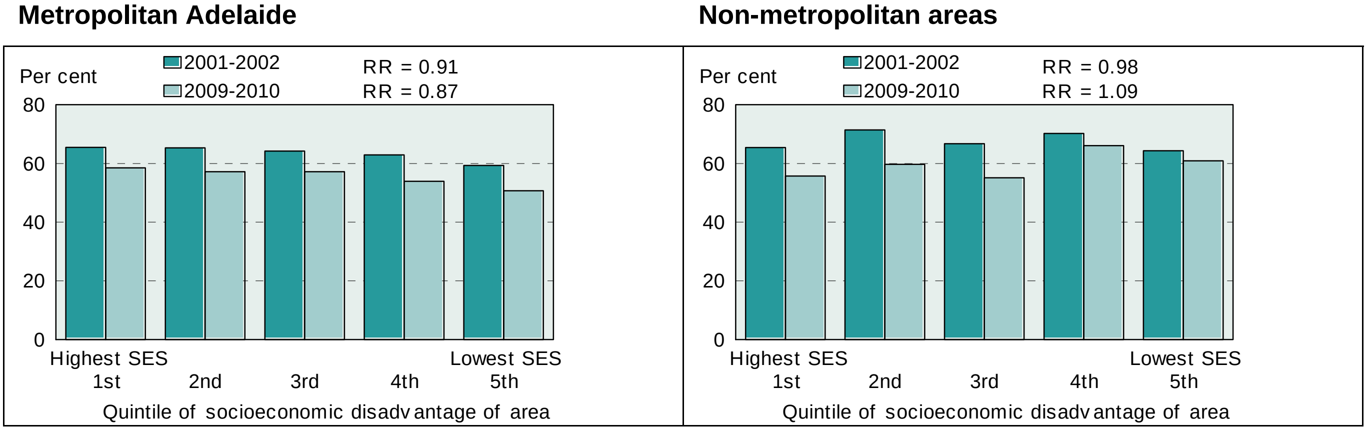
Source: Compiled in PHIDU using data supplied by BreastScreen SA

SLAs with participation rates of 10% or more higher than the non-metropolitan average are Orroroo/Carrieton (86.8%), Southern Mallee (80.0%), Angaston (80.0%), Tanunda (77.8%), Naracoorte and Lucindale (75.4%), Yorke Peninsula - South (75.1%), Mount Gambier (74.6%), Loxton Waikerie West (73.1%), Port Lincoln (71.2%), Port Pirie (70.4%), Wattle Range - West (69.9%), Northern Areas (66.9%) and Copper Coast (66.8%). The lowest participation rates in this latest period were all in remote areas, including the SLAs of Unincorporated areas of West Coast, Pirie and Riverland, each with ten or fewer participants. Of SLAs with larger numbers of participants, the lowest participation rates were in Coober Pedy (42.5%), Grant (43.0%), Mount barker Balance (43.8%) and Roxby Downs (44.0%).

Distribution by socioeconomic status and remoteness

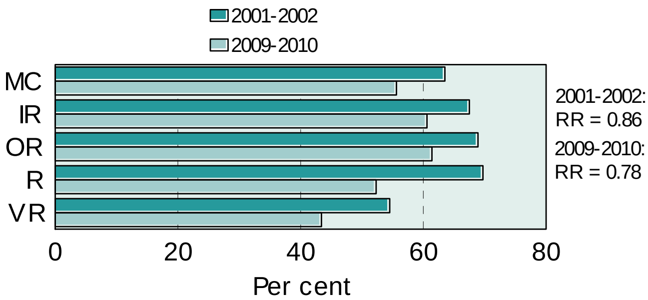
Participation of women in Metropolitan Adelaide aged 50 to 69 years has declined in each of the quintiles over this eight-year period, but with a relatively large decline in the most disadvantaged areas, resulting in a larger gap between the lowest and highest socioeconomic status areas (13% in the latest period, compared with 9% in the earliest period). The situation is somewhat different in the non-metropolitan areas, where the participation rate in the most disadvantaged areas has largely held up, while that in the least disadvantaged areas has dropped; in this case the result is higher participation in the most disadvantaged areas.

Figure 14: Breast screening participation, by socioeconomic status, 2001–2002 and 2009–2010



In 2009–2010, participation increased across the first three remoteness classes to 61.4% in the Outer Regional remoteness class, before declining to 52.3% in the Remote areas and to 43.4% in the Very Remote areas. All of these rates were lower than in 2001–2002, with the largest declines in the Remote and Very Remote areas, down by 25.0% and 20.4%, respectively. Continuing the commentary about the impact of variations over time in participation in the remote areas, although participation rates in 2009–2010 were similar to those in 2006–2007 in the first three remoteness classes, rates in the Remote and Very Remote areas were markedly lower. Once again, such variability needs to be considered in the light of service provision in these remote areas.

Figure 15: Breast screening participation, females, by remoteness, 2001–2002 and 2009–2010



Data for breast cancers detected through this screening program were not available, due to the small number of cases at the SLA level.

Cervical screening participation, 2001–2002 and 2008–2009

Cervical cancer is one of the most preventable and curable cancers. It is estimated that up to 90% of the commonest type of cervical cancer may be prevented if cell changes are detected and treated early.[30] In 1991, Australia adopted an 'organised approach' to preventing cervical cancer, the National Cervical Screening Program, which recommends and encourages women under 70 years of age who have ever been sexually active to have Pap smears every two years. The key objectives of the Program are to reduce mortality and minimise morbidity from these cancers, and to maximise the efficiency of program delivery, as well as equitable access.[30]

Indicator definition: Number of individual women aged 20 to 69 years screened over a 24-month period ending 31 December 2002 or 31 December 2009, as a proportion of the female population at those ages.

Geographic distribution

Participation rates declined slightly over this seven-year period, by 6.5% in Metropolitan Adelaide and by 4.8% in the non-metropolitan areas.

Table 10: Cervical screening participation, females aged 20 to 69 years, 2001–2002 and 2008–2009

Per cent

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
		Per cent	
2001–2002	64.7	64.2	64.6
2008–2009	60.5	61.1	60.7
		Percentage change	
From first to second period	6.5	4.8	6.0

The overall level of change is also reflected in the maps for Metropolitan Adelaide, with SLAs having the highest participation rates more highly concentrated in the higher socioeconomic status eastern and south-eastern SLAs over the twenty-four months from January 2008 to December 2009 than over the earlier period (2001–2002). Several SLAs of greater socioeconomic disadvantage had participation rates in the lowest range, a pattern even more prominent in 2008-09 than in the earlier period of 2001-02. The perception from the map of higher participation rates in SLAs of higher socioeconomic status is supported by the correlation coefficient of 0.77 between high participation rates and the IRSD, showing the existence of a very strong association.

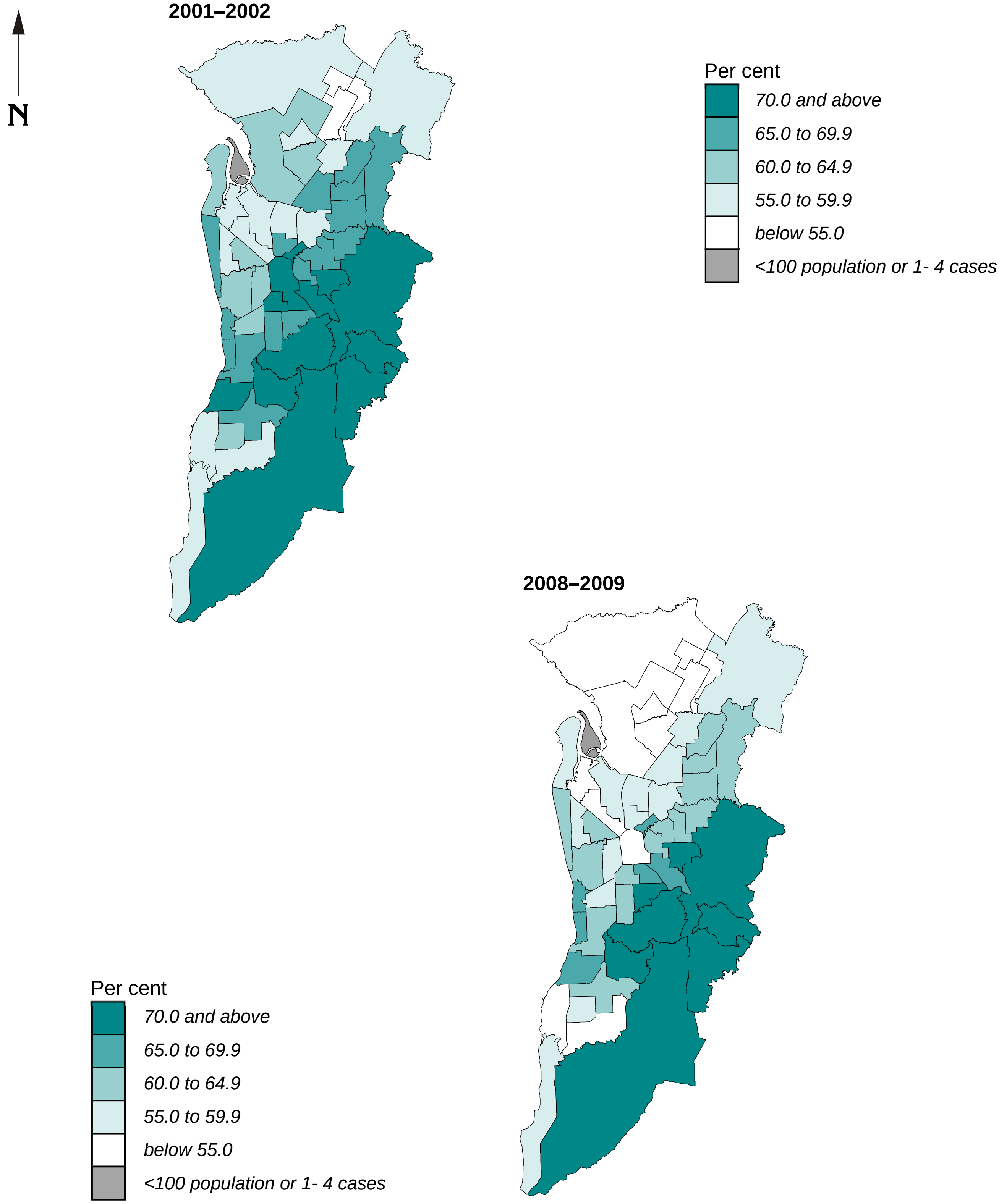
The highest participation rates were in the Adelaide Hills, in the SLAs of Adelaide Hills Central (76.3%) and Ranges (72.2%), Onkaparinga Hills (71.1%) and Mitcham Hills (71.0%), as well as in nearby Burnside - North-East (70.7%), Mitcham - North-East (70.1%) and Onkaparinga - Reservoir (70.6%). SLAs with the lowest rates include many of greatest disadvantage, in the north in the Playford SLAs of Elizabeth (44.1%), - West Central (46.9%), - East Central (48.0%) and - West (53.3%) and Salisbury Balance (50.5%), - Inner North (50.7%) and - Central (54.4%); in the south, in Onkaparinga - Hackham (50.7%) and - North Coast (54.9%); as well as in Adelaide (47.8%) and Port Adelaide Enfield - Port (53.6%).

In the non-metropolitan areas, there is a correlation of 0.56, showing the existence of a strong association at the SLA level between high participation rates and the IRSD. The highest participation rates in 2008–2009 were in two main areas, one in a number of locations across Eyre Peninsula and the other in an area stretching from Adelaide Hills - North to Northern Areas, in the mid–north. On the Eyre Peninsula, the SLAs included Le Hunte (75.7%), Kimba (74.0%), Elliston (72.2%), Port Lincoln (71.1%), Cleve (69.5%), Tumby Bay (67.8%) and Ceduna (66.5%); and, nearer to Adelaide, Tanunda (73.5%), Yankalilla (68.4%), Adelaide Hills - North (68.4%) and Balance (67.6%), Mount Barker - Central (67.1%) and, further north, Northern Areas (65.8%). However, the single highest rate was in Southern Mallee (76.6%), with other high participation rates in Loxton Waikerie - West (69.3%), Mount Gambier (68.7%) and Kangaroo Island (67.4%).

The lowest rates were generally in SLAs in the north of the State, in Maralinga Tjarutja (23.3%, and eight women), Unincorporated Pirie (33.3%, 22 women), Unincorporated Flinders Ranges (42.3%),

Map 10: Cervical screening participation, females aged 20 to 69 years, Metropolitan Adelaide, 2001–2002 and 2008–2009

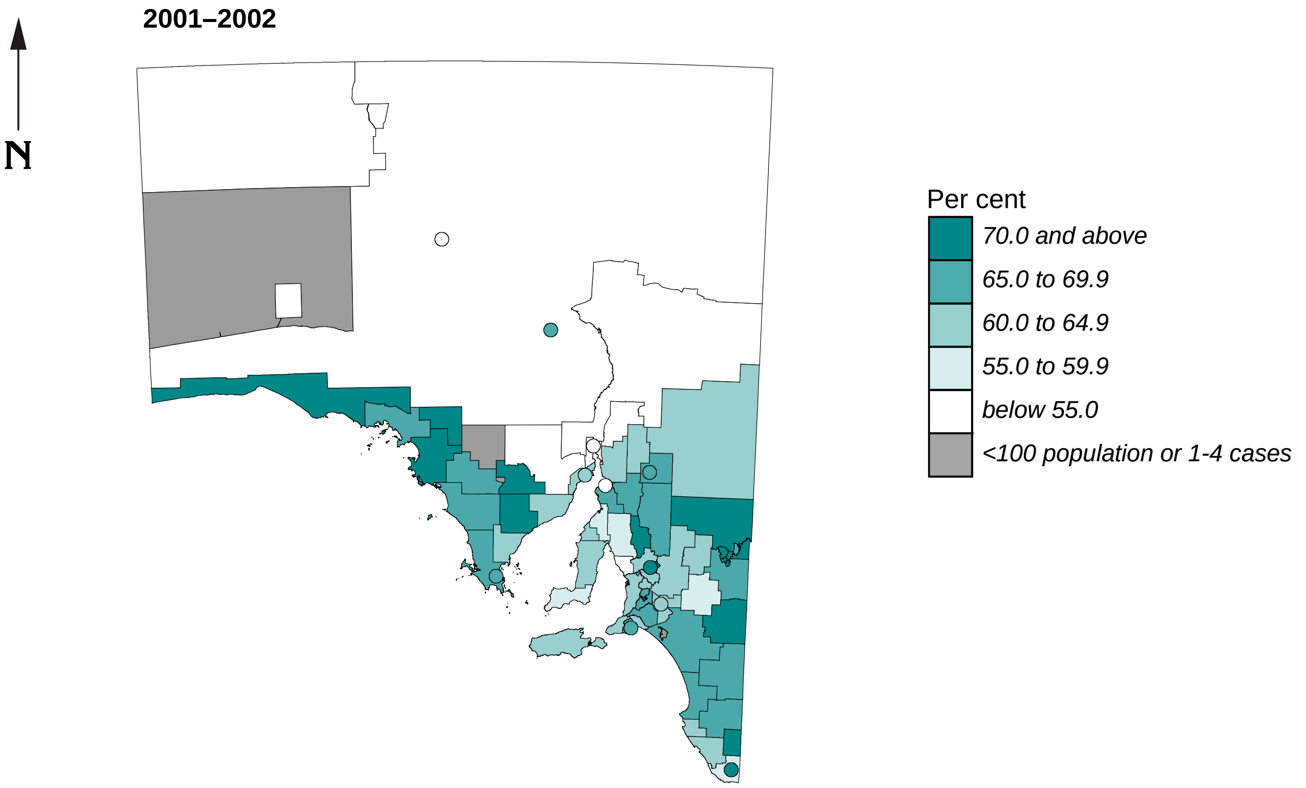
Per cent by Statistical Local Area

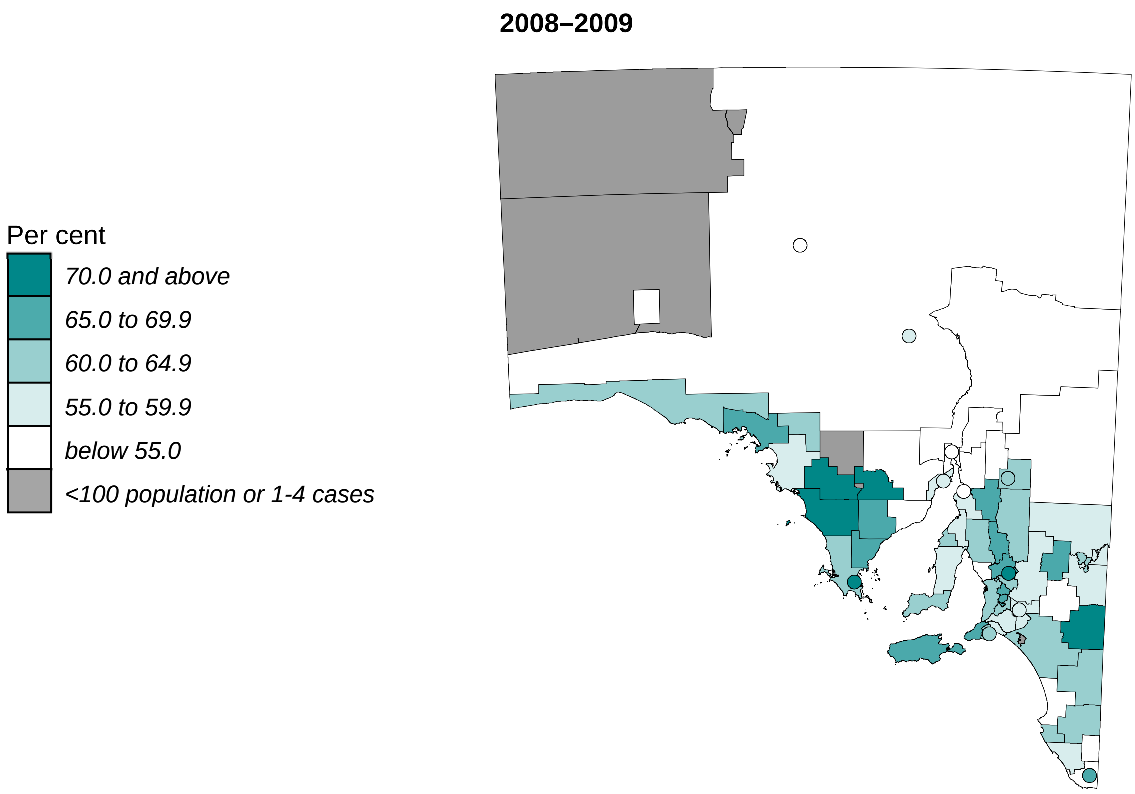


Source: Compiled in PHIDU using data supplied by SA Cervix Screening Program

Map 11: Cervical screening participation, females aged 20 to 69 years, non-metropolitan areas, 2001–2002 and 2008–2009

Per cent by Statistical Local Area





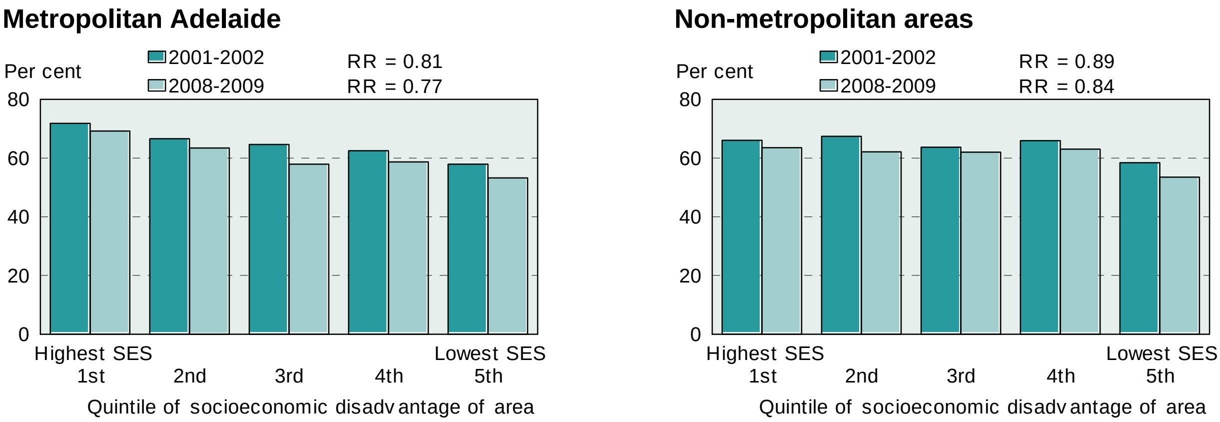
Source: Compiled in PHIDU using data supplied by SA Cervix Screening Program

Unincorporated Far North (44.4%), Port Augusta (46.5%), Finders Ranges (47.3%) and Unincorporated Whyalla (48.6%); other low rates were in the south, in Grant (37.0%) and Karoonda East Murray (42.6%).

Socioeconomic status and remoteness

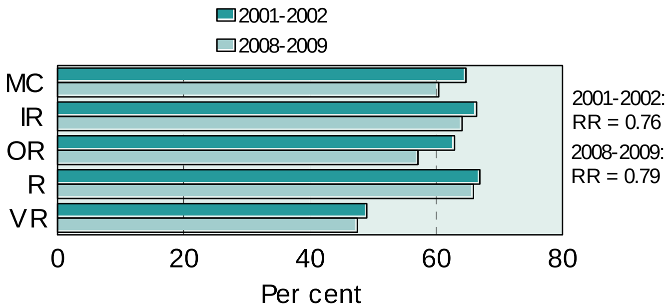
Over this eight-year period, the participation of women in screening for cervical cancer has weakened in each of the five groupings of areas in both Metropolitan Adelaide and the non-metropolitan areas, with the smallest decline in the highest socioeconomic status areas resulting in a wider gap between the highest and lowest socioeconomic status areas.

Figure 16: Cervical screening participation, females aged 20 to 69 years, by socioeconomic status and region, 2001–2002 and 2008–2009



The participation of women in screening for cervical cancer is lower in each of the five remoteness classes in the later period, with the lowest rates in the Very Remote areas.

Figure 17: Cervical screening participation, females aged 20 to 69 years, by remoteness, 2001–2002 and 2008–2009



Cervical screening: cancers detected, 2001–2002 and 2008–2009

It is estimated that up to 90% of the commonest type of cervical cancer may be prevented, if cell changes are detected and treated early.[30] Infection with a high-risk human papillomavirus (HPV) type is necessary, although not sufficient, for the development of cervical cancer.[31] In Australia, age-standardised cervical cancer mortality reduced by over 50% in the 15 years following introduction of an organised approach to screening in 1991. This followed earlier reductions also likely to reflect the impact of cervical screening.[28] On screening, most low-grade cell abnormalities are caused by transient HPV infection, other infections, or occasionally seen in women after menopause (atrophic changes).[30] These minor cell changes usually resolve or require simple medical treatment. High-grade abnormalities are reported when the cell changes on the Pap test look more serious. The probability of a high-grade abnormality progressing to cancer increases with age and the extent of abnormality, but is still a rare outcome, with regression rates for high-grade abnormalities estimated to be at least 80%.[32,33] Incidence and mortality of cervical cancer in Australia remain low; however, incidence for Aboriginal and Torres Strait Islander women has been estimated to be more than twice, and mortality to be five times, that of other Australian women.[34]

Indicator definition: Number of individual women aged 20-69 years with a low grade abnormality or a high grade abnormality detected (by cytology) over a 24-month period ending 31 December 2002 or 31 December 2009, as an age-standardised rate per 1,000 women screened.

Geographic distribution

Low grade abnormalities are more frequently detected during screening operations than are high grade abnormalities, although the latter have shown a substantial growth in detection over this seven year period, increasing by over sixty per cent. Rates of low grade abnormalities are slightly lower in the non-metropolitan areas, whereas rates of high grade abnormalities are similar.

Table 11: Cervical screening: cancers detected, females aged 20 to 69 years, 2001–2002 and 2008–2009

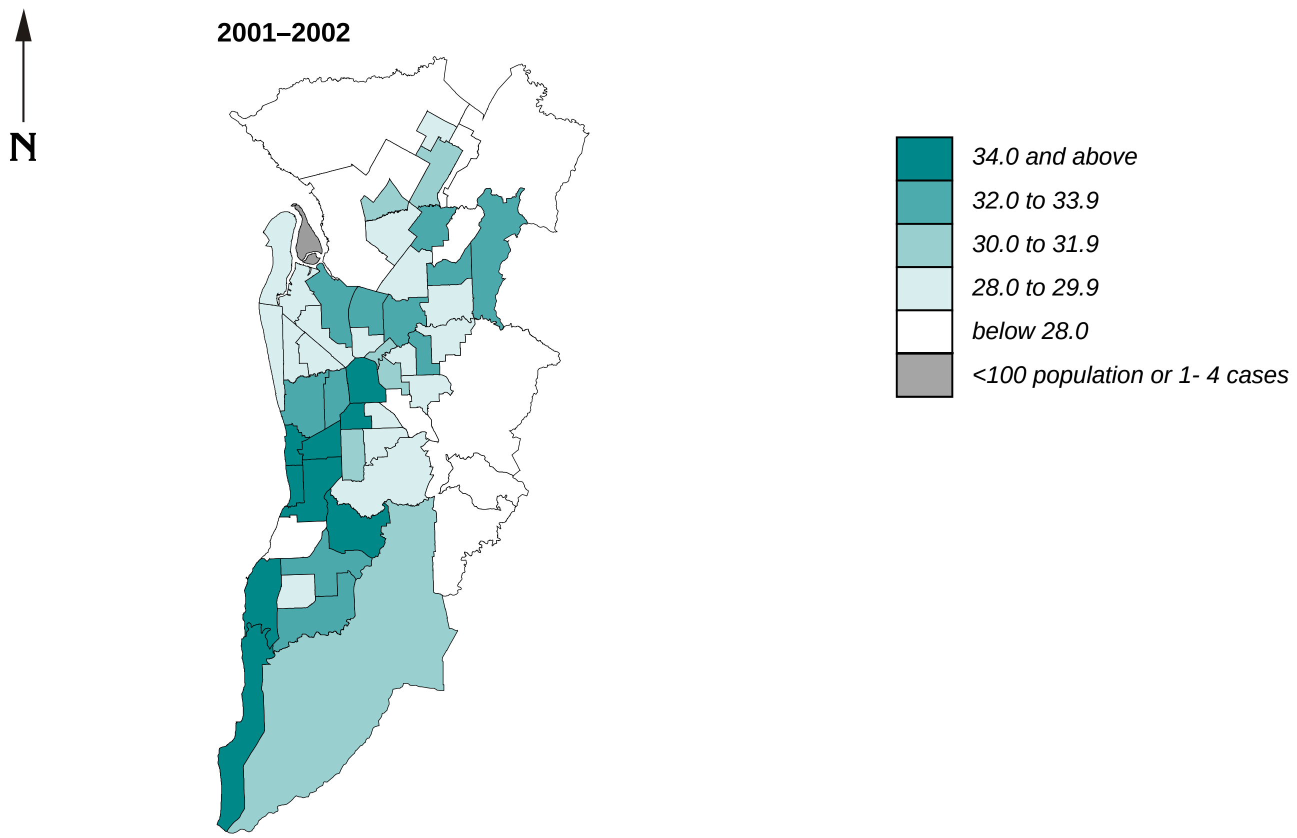
Period	Metropolitan Adelaide	Non-metropolitan	South Australia
	Standardised rate per 1,000 women screened		
Low grade abnormalities			
2001–2002	31.0	28.6	30.4
2008–2009	32.5	29.6	31.8
High grade abnormalities			
2001–2002	6.4	6.0	6.3
2008–2009	10.3	10.0	10.3
	Percentage change		
Low grade abnormalities			
2001–2002	4.8	3.5	4.6
High grade abnormalities			
2001–2002	60.9	66.7	63.5

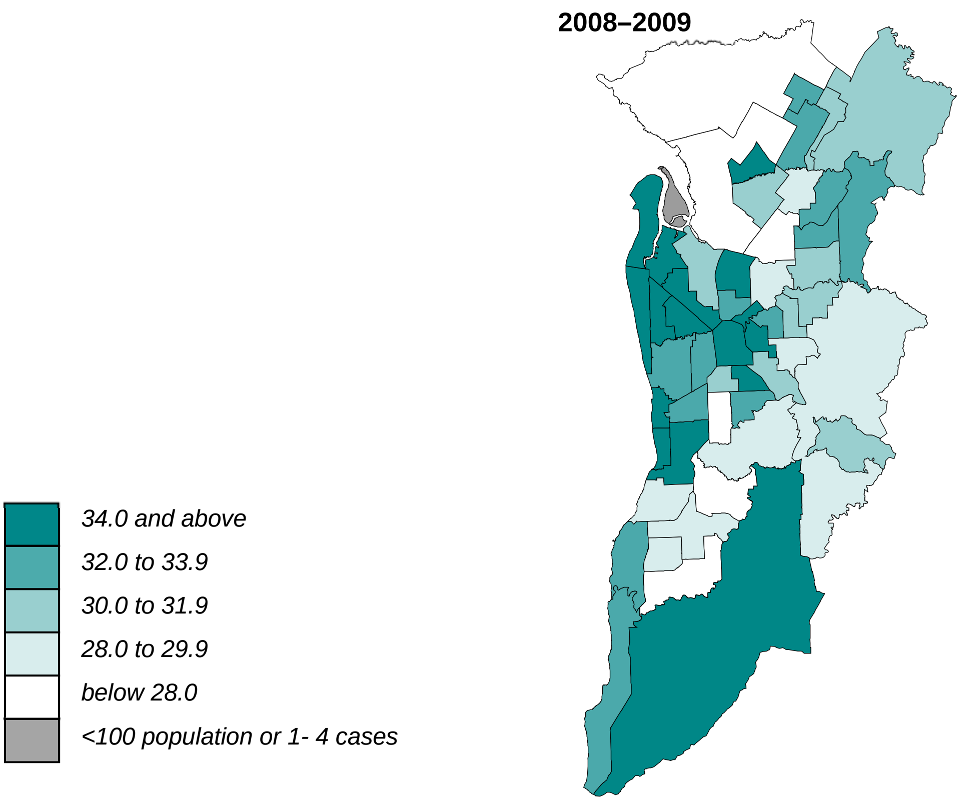
Low grade abnormalities

The distribution in Metropolitan Adelaide of high rates of low grade abnormalities, detected at screening, has undergone a marked change over this seven-year period. In 2001–2002, the highest rates were in the central Adelaide SLA, and in SLAs to the south-west and in the outer south; other rates above the metropolitan average were in a band of SLAs to the north of the city, and in the north-east. However, in the later period, while rates remain high in Adelaide, Marion - Central and Holdfast Bay - North, other SLAs in this range were generally adjacent to the city, or in the north-western suburbs. The correlation analysis showed there to be a very weak association between high rates of low grade anomalies and socioeconomic disadvantage (a correlation coefficient of -0.15 with the IRSD). There is no association between the detection of low grade abnormalities and high rates of participation, with a correlation coefficient of -0.07. This is not to say that cancers were not detected as a result of screening, as clearly they were, but that they were not consistently found among women in areas with high rates of participation in screening.

Map 12: Cervical screening outcome: low grade abnormalities detected, females aged 20 to 69 years, Metropolitan Adelaide, 2001–2002 and 2008–2009

ASR per 1,000 women screened by Statistical Local Area

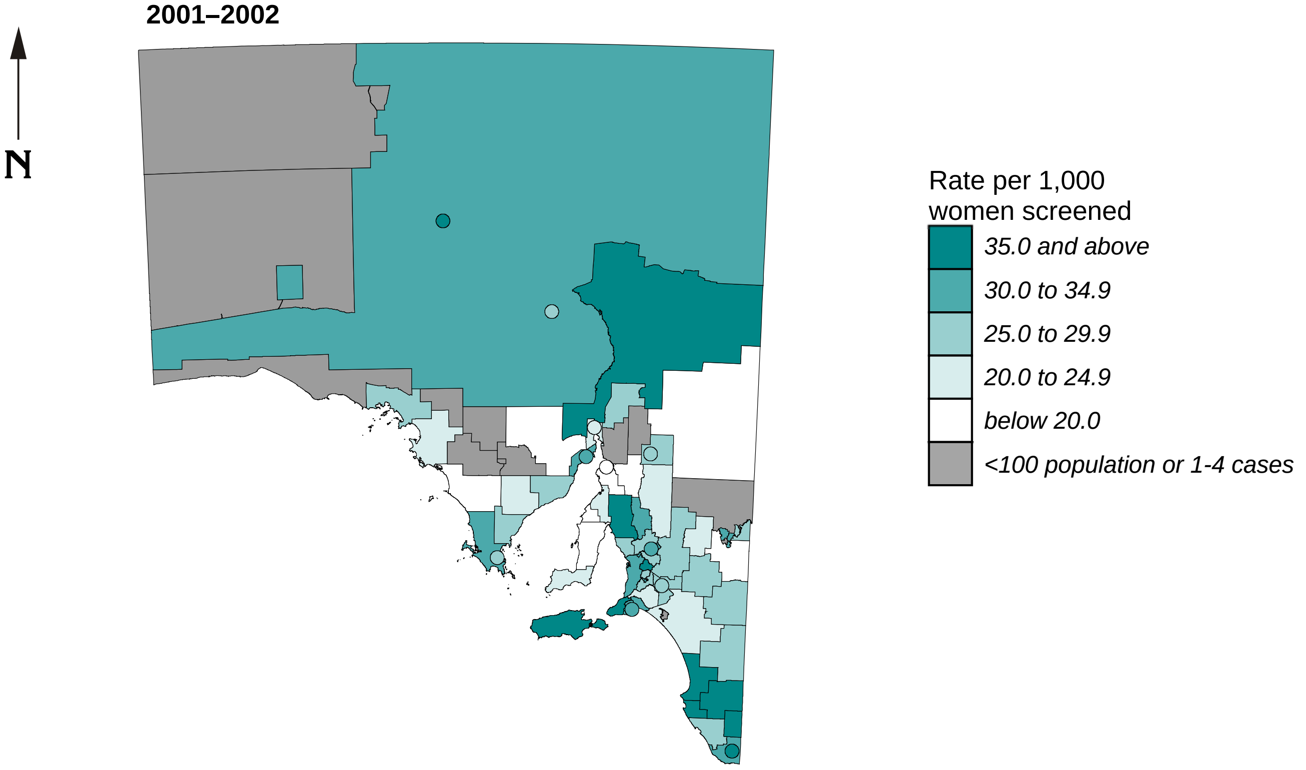


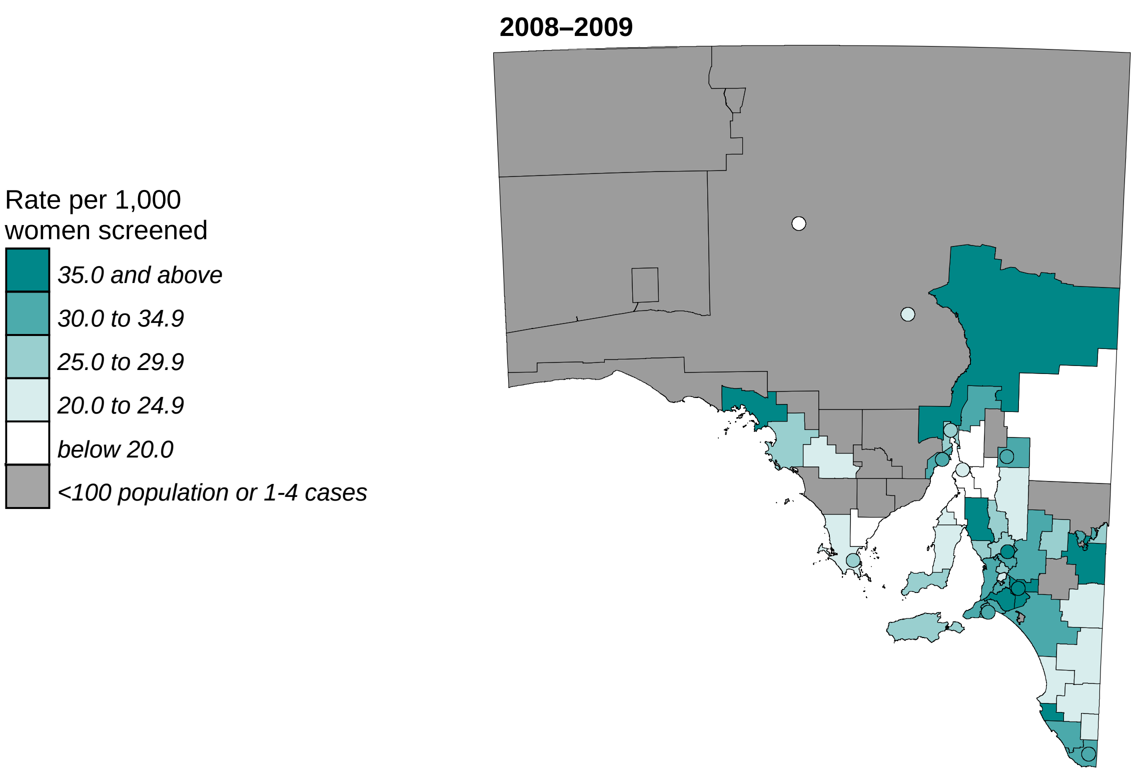


Source: Compiled in PHIDU using data supplied by SA Cervix Screening Program

Map 13: Cervical screening outcome: low grade abnormalities detected, females aged 20 to 69 years, non-metropolitan areas, 2001–2002 and 2008–2009

ASR per 1,000 women screened by Statistical Local Area

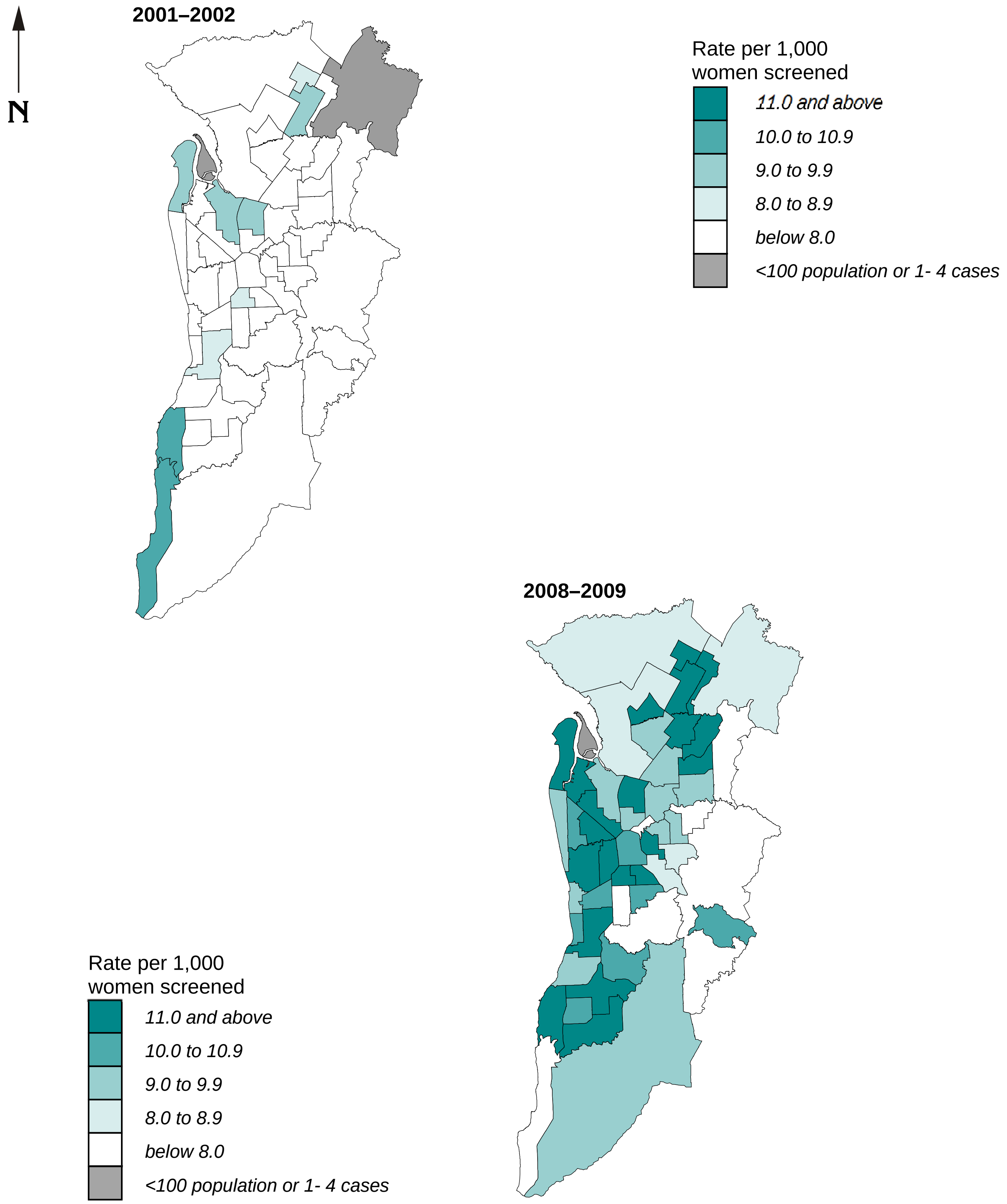




Source: Compiled in PHIDU using data supplied by SA Cervix Screening Program

Map 14: Cervical screening outcome: high grade abnormalities detected, females aged 20 to 69 years, Metropolitan Adelaide, 2001–2002 and 2008–2009

ASR per 1,000 women screened by Statistical Local Area

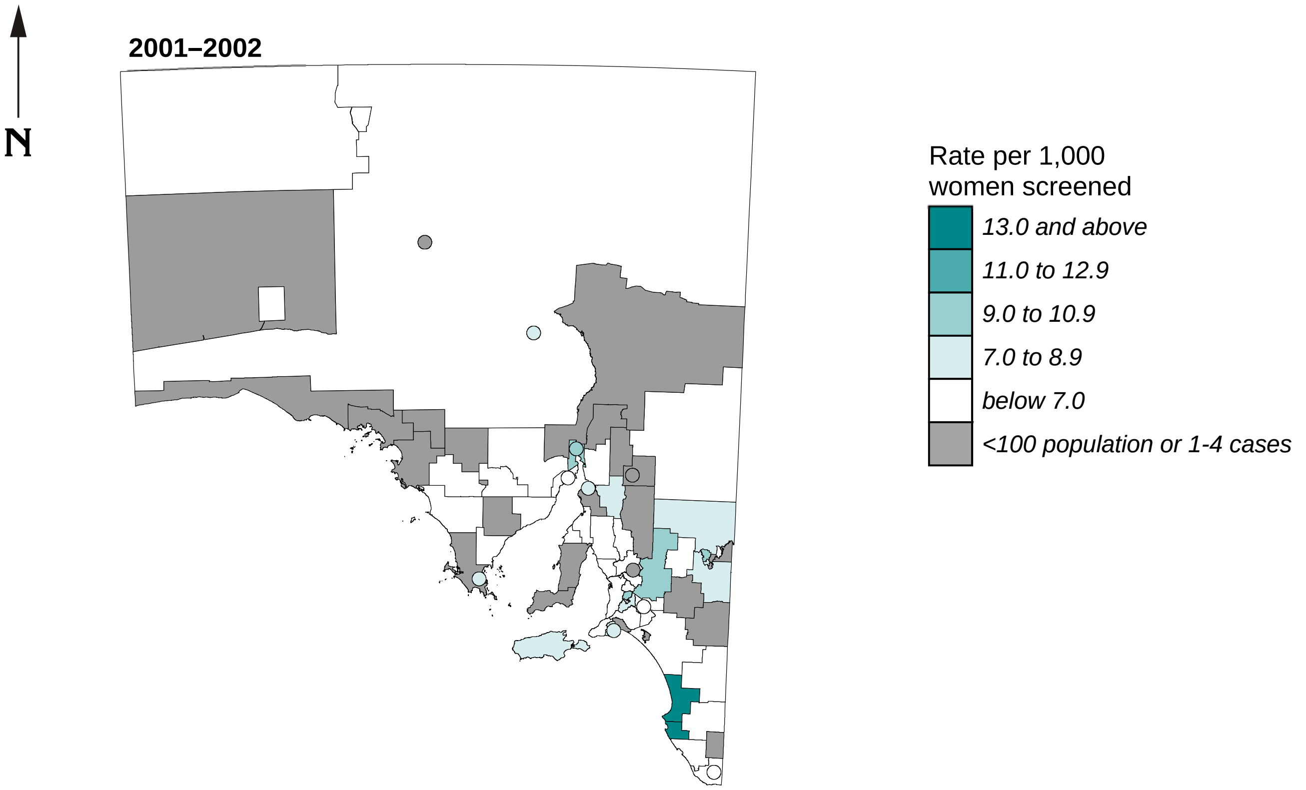


Source: Compiled in PHIDU using data supplied by SA Cervix Screening Program

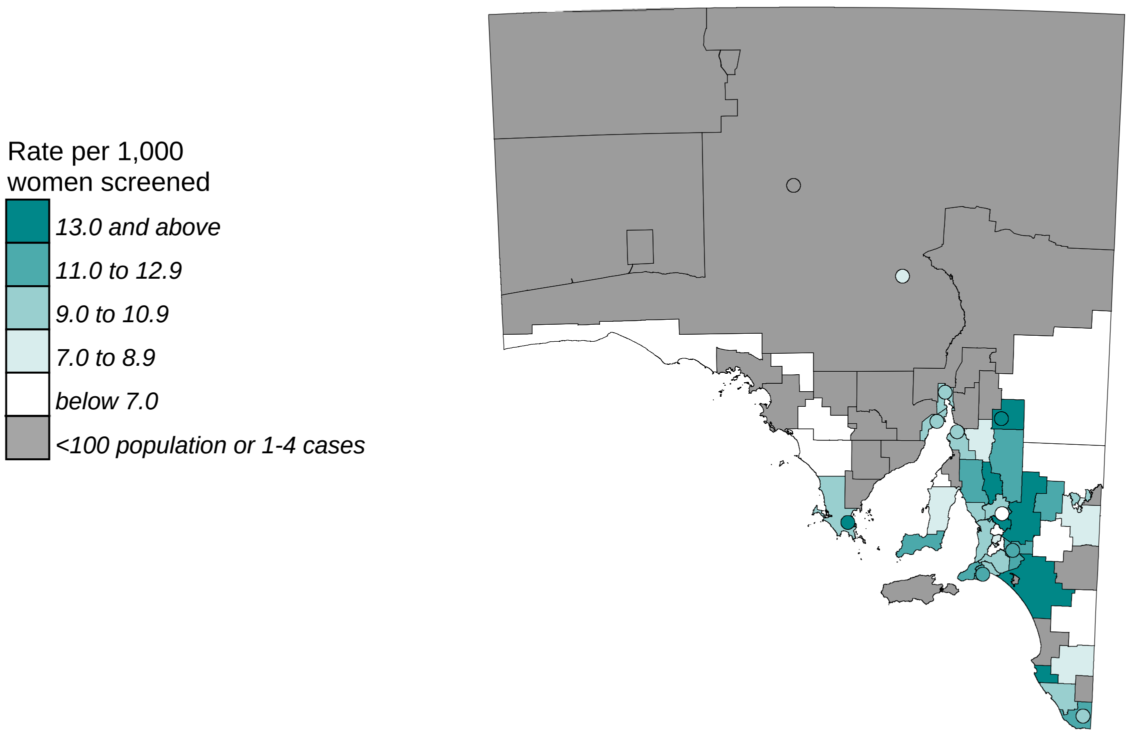
Map 15: Cervical screening outcome: high grade abnormalities detected, females aged 20 to 69 years, non-metropolitan areas, 2001–2002 and 2008–2009

ASR per 1,000 women screened by Statistical Local Area

2001–2002



2008–2009



Source: Compiled in PHIDU using data supplied by SA Cervix Screening Program

In 2008–2009, the highest rates of statistical significance were in Port Adelaide Enfield - Coast (39** cases per 1,000 women screened), Holdfast Bay - North (39*), Charles Sturt – Coastal, - Inner East (both 38*) and - North-East (37*), Adelaide (38*) and Marion - Central (37*). Only Mitcham - West (25*) and Salisbury - South-East (26*) had low rates that were statistically significant.

Although many SLAs had rates above the non-metropolitan average, only in Murray Bridge (45**) was the rate statistically significant. Other high (but not statistically significant) rates were recorded for a number of SLAs with high Aboriginal populations, as well as some close to the metropolitan area. Port Pirie (20** cases per 1,000 women screened) and Copper Coast (21*) had low rates that were statistically significant.

High grade abnormalities

Although the rates in 2008–2009 are much lower for high grade than low grade abnormalities, thereby making change more difficult to detect, marked differences were apparent across this period in the distribution of high grade abnormalities in Metropolitan Adelaide. The highest rates occur in parts of the outer north; across much of the south-western, western and north-western suburbs; and in parts of the outer south. However, only in Playford Elizabeth was the rate statistically significant (18** women with high grade abnormalities per 1,000 women screened). Mitcham West (6^^ per 1,000 women screened) had the only rate statistically significantly below the State average.

There is an inverse correlation between the detection of high grade abnormalities and high rates of participation, with a correlation coefficient of -0.45. This is not to say that cancers were not detected as a result of screening, but that they were not consistently found among women in areas with high rates of participation in screening.

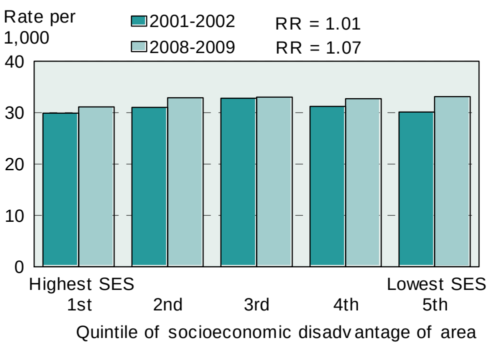
In the non-metropolitan areas, Robe (24* cases per 1,000 population, 5 cases), Mid Murray, Port Lincoln, and Clare and Gilbert Valleys (all with 17* cases per 1,000 population) had the only elevated rates of statistical significance. None of the low rates were statistically significant.

Distribution by socioeconomic status and remoteness

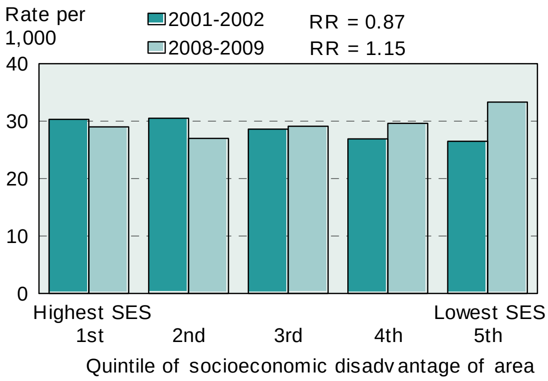
There is a very small socioeconomic gradient in rates of screen-detected low grade abnormalities in Metropolitan Adelaide in 2008–2009, following increases in rates in each quintile, and in particular in the lowest socioeconomic status areas. In the non-metropolitan areas, the gradient is reversed, from a rate 13% lower in the lowest socioeconomic status areas in 2001–2002, to 15% higher in 2008–2009, with the largest change in rates in the most disadvantaged areas.

Figure 18: Cervical screening: low grade abnormalities detected, females aged 20 to 69 years by socioeconomic status and region, 2001–2002 and 2008–2009

Metropolitan Adelaide



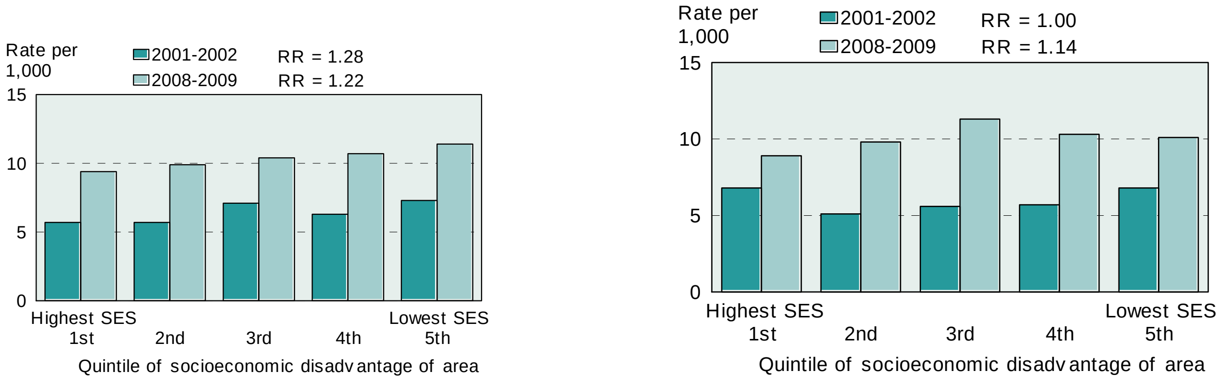
Non-metropolitan areas



High grade abnormalities detected through screening show strong socioeconomic gradients in both periods for Metropolitan Adelaide. The picture in the non-metropolitan areas in 2008–2009 is more mixed, with the highest rate in the middle quintile, although the rate in the most disadvantaged areas is higher, by 14%, than in the most advantaged areas; this represents a marked change from the pattern in 2001–2002.

Figure 19: Cervical screening: high grade abnormalities detected, females aged 20 to 69 years, by socioeconomic status and region, 2001–2002 and 2008–2009

Metropolitan Adelaide **Non-metropolitan areas**



In 2008–2009, rates of screen-detected low grade abnormalities declined with remoteness from the Major Cities to the Remote areas, but with a notably higher rate in the Very Remote areas, albeit still 11% below the rate in the Major Cities areas. For high grade abnormalities, rates were similar across the first three remoteness classes, highest in the Remote class (by 8.0%) and lowest in the Very Remote areas (37% lower).

Figure 20: Cervical screening: low grade abnormalities detected, females aged 20 to 69 years, by remoteness, 2001–2002 and 2008–2009

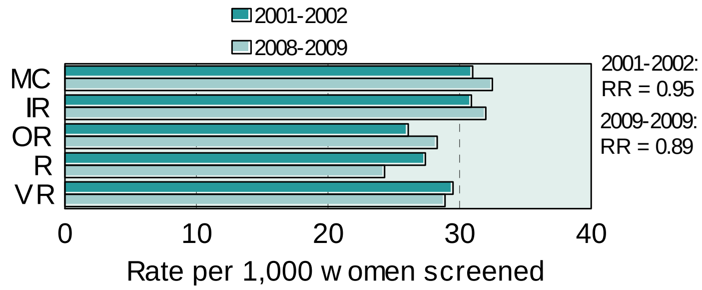
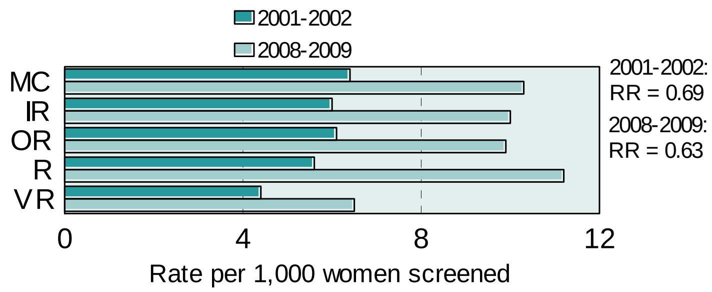


Figure 21: Cervical screening: high grade abnormalities detected, by remoteness, 2001–2002 and 2008–2009



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Bowel screening participation, 2010

Colorectal cancer (CRC), also known as bowel cancer, is one of the commonest forms of cancer in Australia, with around 80 Australians dying each week from the disease.[35] Bowel cancer can be treated successfully if detected in its early stages, but currently fewer than 40 per cent of bowel cancers are detected early. Screening has been shown in randomised trials to reduce the incidence of and mortality from CRC.[35,36] Since 2006, the Australian Government has initiated a limited CRC screening program, which aims to reduce the incidence and death from bowel cancer, by using a one-time immunochemical faecal occult blood test (FOBT) for people aged 50, 55 and 65 years. The second phase of the National Bowel Cancer Screening Program (NBCSP) commenced on 1 July 2008 and offered testing to people turning 50 years of age between January 2008 and December 2010, and those turning 55 or 65 between July 2008 and December 2010. From 2012 the program will be expanded to include Australians turning 60 years of age, and from 2015 those turning 70 years. In 2017-18 the program will introduce biennial screening, commencing with 72 year olds, as per the recommendations by the National Health and Medical Research Council for two-yearly screening.[37,63] A variety of FOBT kits to screen for bowel cancer are available through programs other than the NBCSP; the data contained within this report only represent participation within the NBCSP, and not these other programs.

Indicator definition: Number of people aged 50, 55 or 65 years who participated in the National Bowel Cancer Screening Program in 2010, as a proportion of the population at those ages who were invited to participate.

Notes: Formal publication and reporting of the NBCSP data is undertaken by the Australian Institute of Health and Welfare on behalf of the Department of Health and Ageing. NBCSP data included in this report provided by the Department of Health and Ageing is not part of the formal publication and reporting process for NBCSP data. Cautionary note about small numbers - Due to a larger degree of statistical fluctuation in small numbers, great care should be taken when assessing apparent differences involving small numbers and measures based on small numbers.

Geographic distribution

Participation rates for males were lower than those for females in both Metropolitan Adelaide (12.3% lower) and in the non-metropolitan areas (13.2% lower). Rates in the non-metropolitan areas were slightly above those in Metropolitan Adelaide.

Table 12: Participation in the NBCSP, males and females aged 50, 55 and 65 years, 2010

	Metropolitan Adelaide	Non-metropolitan	South Australia
		Per cent	
Males	38.6	40.1	39.1
Females	44.0	46.2	44.7
		Percentage difference	
Males cf females	-12.3	-13.2	-12.5

The distribution of high participation rates across SLAs in Metropolitan Adelaide for both males and females is highly consistent with the distribution of the population of higher socioeconomic status. There is a strong correlation at the SLA level with high socioeconomic status areas for male participation in the NBCSP (0.64), and a very strong correlation with female participation (0.71).

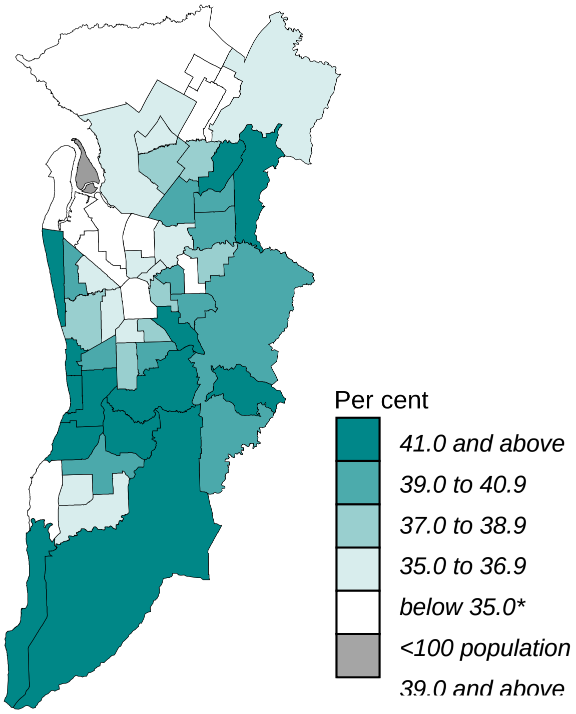
The highest participation rates for males were in SLAs to the west and south-west of the city, in Holdfast Bay - South (45.6%) and - North (45.6%) and Charles Sturt - Coastal and Marion - South (both 45.4%). Similar rates were recorded in Onkaparinga - Hills (45.3%), - Reservoir (44.1%) and - South Coast (42.5%) and Tea Tree Gully - North (45.1%) and - Hills (42.4%). A number of adjacent areas also had rates above the metropolitan average. One third or less of the male population at these ages in Charles Sturt - North-East (30.2%); Port Adelaide Enfield - Port (30.2%), - Park (31.9%) and - Inner (32.3%); Playford - Elizabeth (31.0%) and - West Central (32.1%); and Adelaide (31.2%) participated in the NBCSP.

Although the distribution for females is similar to that for males, the ten SLAs with the highest rates vary, as does their order. The higher metropolitan participation by females shown above is also evident at the SLA level, with participation rates of over 50% in Holdfast Bay - South (53.3%), Walkerville (51.8%), Tea Tree Gully - South (51.7%), and Mitcham - North East (51.6%).

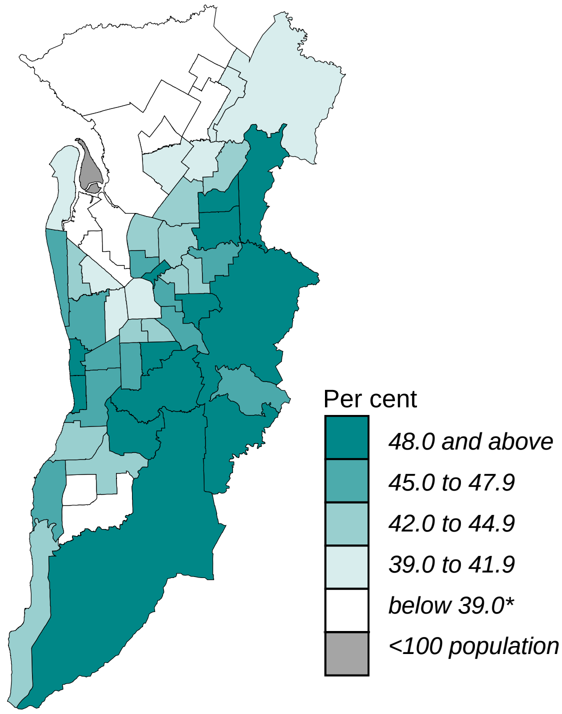
Map 16: Participation in the NBCSP, males and females ages 50, 55 and 65 years, South Australia, 2010

Per cent by Statistical Local Area

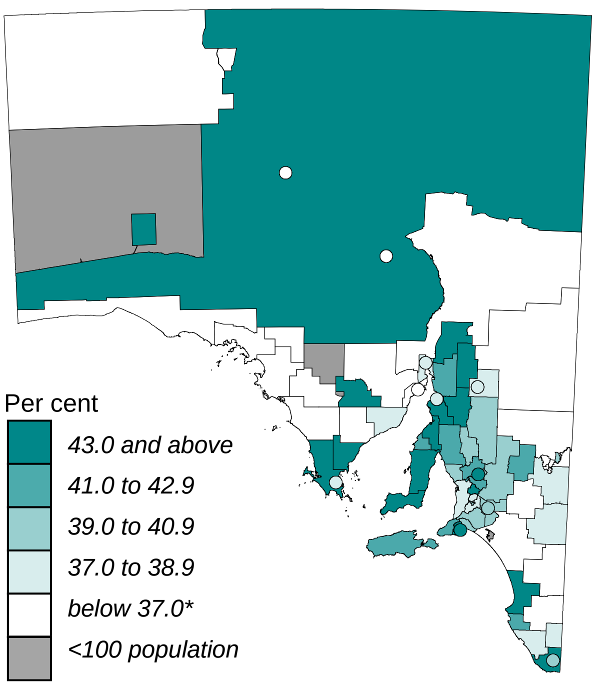
Participation males



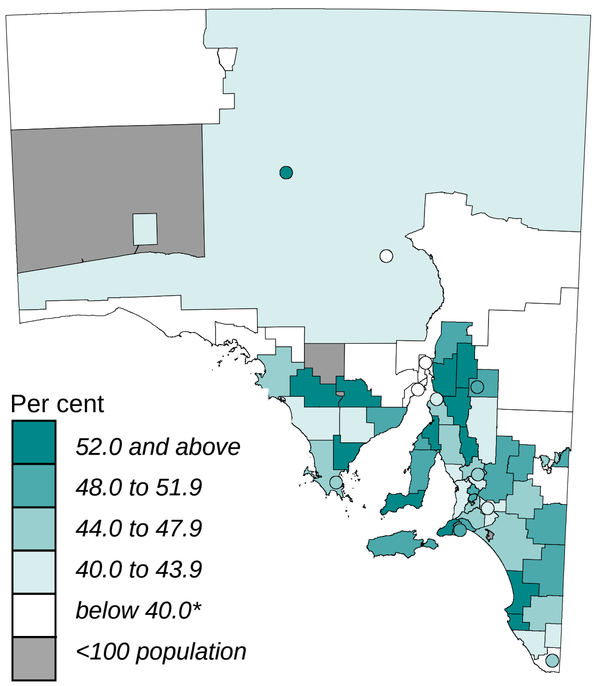
Participation females



Participation, males



Participation, females



N

*Includes areas with values from 0 to 5 for which data were not supplied

Source: Compiled in PHIDU using unpublished data supplied by the Department of Health and Ageing

The next highest rates are in the outer areas of Onkaparinga - Hills (49.7%) and - Reservoir (49.5%), and Tea Tree Gully - Central (49.6%) and - Hills (48.1%); as well as in Holdfast Bay - North (49.3%) and Mitcham - Hills and Burnside - North-East (both 48.1%). Participation was again lowest in the north-west and outer north and south, although only Port Adelaide Enfield - Port (29.2%) and Onkaparinga - Hackham (33.5%) recorded rates of one third or less.

Outside of Adelaide, there is a strong correlation at the SLA level with high socioeconomic status areas for female participation in the NBCSP (0.56).

Although some SLAs in the non-metropolitan areas have very high, and some very low rates, the overall distributions for both males and females are relatively flat, with the majority of rates close to the non-metropolitan average. This compares with a much wider range of rates in Metropolitan Adelaide.

Above-average rates for males are located in SLAs across the State, although with the highest on the Eyre Peninsula (Tumby Bay, 51.1%; Kimba, 46.8%; and Lower Eyre peninsula, 45.2%); Yorke Peninsula (Yorke Peninsula North, 48.0% and South, 47.9%; and Barunga West, 47.3%) and the mid and far north (Port Pirie Balance, 47.4%; Unincorporated far North, 46.4%; Flinders ranges, 46.0%; and Orroroo/Carrieton, 45.2%) and nearer to Metropolitan Adelaide (Adelaide Hills North, 47.4%; and Tanunda, 46.4%). Excluding the small number of areas for which data were not provided, the lowest participation rates for males in non-metropolitan areas were in the SLAs of Coober Pedy, 26.6%; Streaky Bay, 29.2%; Roxby Downs, 32.6%; and Elliston, 32.7%.

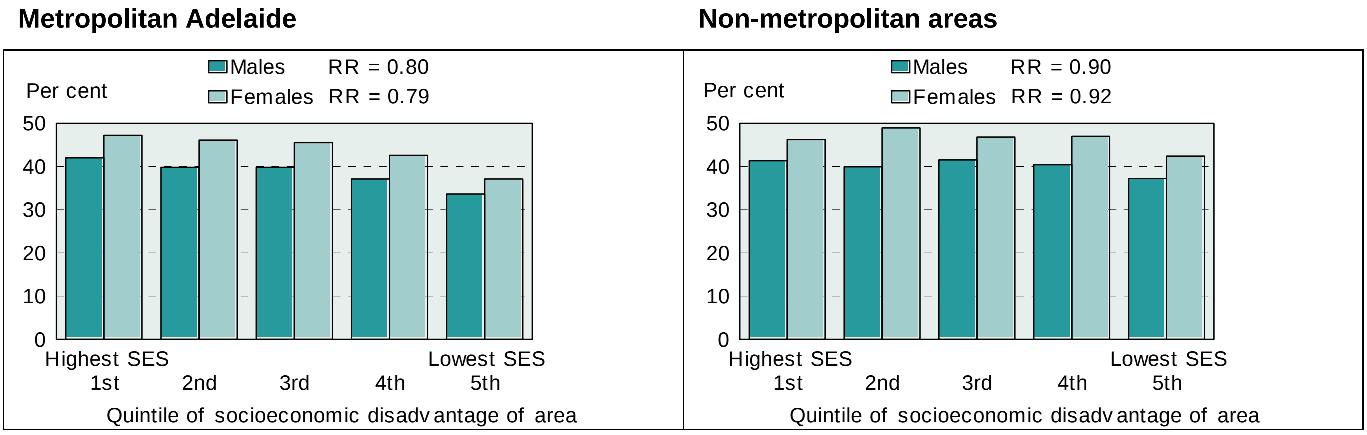
The highest rate of participation for females was recorded for Robe (63.8%), with 53.5% in nearby Kingston. Other above-average rates were in similar areas to those for males, on the Eyre peninsula (in Kimba, 63.6%; Le Hunte, 55.0%; Tumby Bay, 54.4%; and Franklin Harbour, 51.4%); on Yorke Peninsula (in Yorke Peninsula - South, 58.6%; and Barunga - West, 58.2%); in the mid and far north (in Coober Pedy, 55.9%; Northern Areas, 55.5%; Mount Remarkable, 55.3%; Orroroo/Carrieton, 54.3%; and Clare and Gilbert Valleys, 53.2%); and nearer to Adelaide (in Yankalilla, 57.0%; and Adelaide Hills - North, 51.0%).

Roxby Downs had the lowest female participation rate in the NBCSP of 27.6% (16 women), with the next lowest rates in Unincorporated Flinders (34.4%, 11 women), Loxton Waikerie - East (36.0%), Ceduna (36.6%) and Grant (39.9%), as well as in the towns of Port Augusta (39.3%), Berri (39.4%) and Whyalla (39.5%).

Distribution by socioeconomic status and remoteness

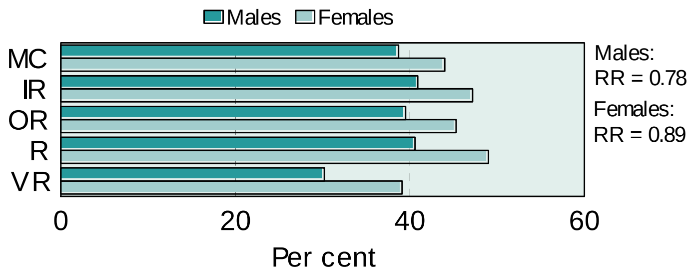
As expected from the distribution in the map, participation is higher in the highest socioeconomic status areas in Metropolitan Adelaide for both males and females, declining by 20% and 21% respectively across the quintiles. There are smaller declines in participation in the non-metropolitan areas for both sexes.

Figure 22: Participation in the NBCSP, by sex and socioeconomic status, 2010



For males, participation increases slightly, albeit irregularly, from the Major Cities remoteness class to the Remote class, then declines sharply (by 25.5%) to its lowest level in the Very Remote class. Participation of females is higher in each remoteness class than for males, increases more sharply across the classes to the Remote areas, then declines (by 20.2%) to 39.1%, marginally above the male rate in Major Cities (38.7%)..

Figure 23: Participation in the NBCSP, by sex and remoteness, 2010



Bowel screening: positive test results, 2010

The outcome indicator presented for bowel cancer is referred to as a 'positive test result'; a positive faecal occult blood test result indicates that blood has been found in the sample provided.

For further information, see notes to Bowel screening participation, 2010, above.

Indicator definition: Number of people aged 50, 55 or 65 years who received a positive test result from a faecal occult blood test in the National Bowel Cancer Screening Program (NBCSP) in 2010, as a rate per 100 population at those ages who participated (this is an age-standardised rate, expressed as a percentage).

Notes: Formal publication and reporting of the NBCSP data is undertaken by the Australian Institute of Health and Welfare on behalf of the Department of Health and Ageing. NBCSP data included in this report provided by the Department of Health and Ageing is not part of the formal publication and reporting process for NBCSP data. Cautionary note about small numbers - Due to a larger degree of statistical fluctuation in small numbers, great care should be taken when assessing apparent differences involving small numbers and measures based on small numbers.

Geographic distribution

Overall, 8.9% of people aged 50, 55 or 65 years who participated in the NBCSP had a positive faecal occult blood test (FOBT) result. The rate in the non-metropolitan areas was 12.9% higher than that in Metropolitan Adelaide.

Table 13: Positive test results, people aged 50, 55 or 65 years who participated in the NBCSP, 2010

	Metropolitan Adelaide	Non-metropolitan	South Australia
	Age-standardised rate per 100 persons		
Persons	8.5	9.6	8.9

In Metropolitan Adelaide, poorer outcomes (i.e., high rates of positive test results) are strongly correlated at the SLA level with socioeconomic disadvantage, a correlation coefficient of -0.62. This result is reflected in the map, with the highest proportions recorded in SLAs in the north-west, outer north and outer south. Areas with statistically significantly high proportions were, in the outer north, the Salisbury SLAs of - North East (13.0%**) and - Inner North (11.8%*), and Playford - Elizabeth (12.0%*); and, in the outer south, Onkaparinga North Coast (12.4%*).

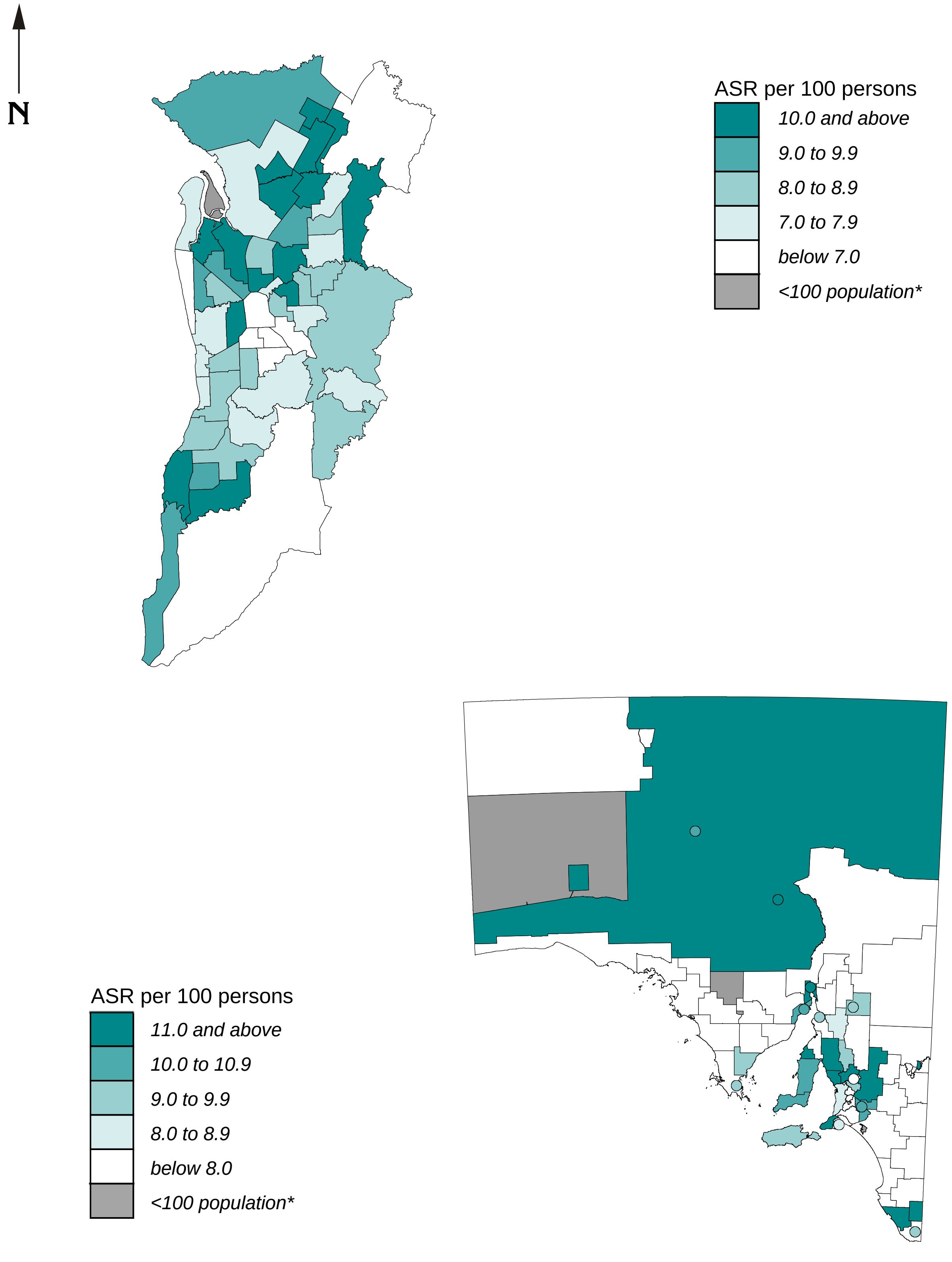
Proportions below the metropolitan average were generally found in inner and middle SLAs, with those of statistical significance in Unley - West (4.3%**), Adelaide (5.2%*) and Charles Sturt - Coastal (6.3%**).

In the non-metropolitan areas many SLAs are mapped in the lowest range, which includes areas with no, or few (between 1 and 4) cases, for which data were not available for this report. Elevated proportions of statistical significance were recorded in Mid Murray (13.9*) and Port Augusta (12.5%*); and proportions below the non-metropolitan average in the Riverland, in Loxton Waikerie - West (3.7%*) and Berri (4.3%*), although with only six and seven cases, respectively.

There is a marked differential in the proportion of participants who had a positive faecal occult blood test result between the most disadvantaged and least disadvantaged area in Metropolitan Adelaide. Proportions increase by 44%, from 7.3% in the highest socioeconomic status areas to 10.5% in the lowest socioeconomic status areas. In the non-metropolitan areas, the proportion of participants who had a positive faecal occult blood test result increased by 21%, from 8.9% in in the highest socioeconomic status areas to 10.8% in the lowest socioeconomic status areas.

Map 17: Positive test results, people aged 50, 55 or 65 years who participated in the NBCSP, South Australia, 2010

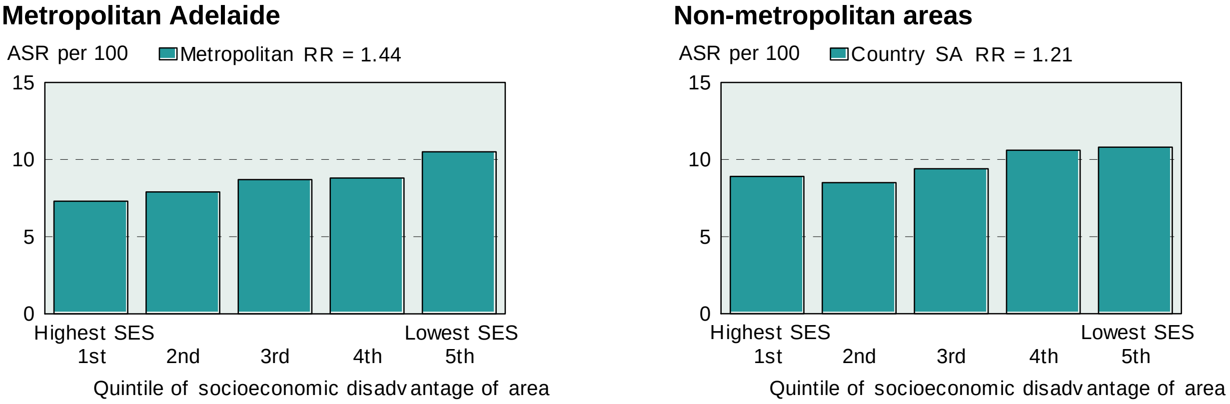
ASR per 100 persons tested by Statistical Local Area



*Includes areas with values from 0 to 5, for which data were not supplied

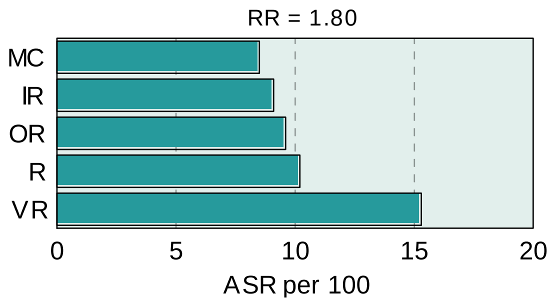
Source: Compiled in PHIDU using data supplied by SA Cervix Screening Program

Figure 24: Positive test results, people aged 50, 55 or 65 years who participated in the NBCSP, by socioeconomic status, 2010



The incidence of positive test results increased steadily with remoteness, from 8.5% in the Major Cities class to 10.2% in the Remote class, but with a substantially higher rate, indicating the poorest outcome, of 15.3% in the Very Remote class. The overall differential in positive FOBT results is 80%.

Figure 25: Positive test results, people aged 50, 55 or 65 years who participated in the NBCSP, by remoteness, 2010



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Cancer incidence

Cancer incidence is defined as the number of new cases of cancer of a specific site/type notified for a specified period (usually a year) and for a specified population.[41] It is usually presented as either the number of new cases or as a rate per 100,000 population. The age-adjusted (Aust. population) incidence rate for South Australia in 2008 was 600.7 new cases per 100,000 for males, and 403.6 for females.[41] Over the last five years, incidence rates have increased by 1.1% per annum in males, due mainly to an increase in the rate of prostate cancer diagnoses.[41] The incidence rate in females has increased by 0.6% per annum over the last five years, due mainly to small increases in the rates of bowel and lung cancers.[41] South Australian rates for all cancer sites have not varied significantly from the national average.[41]

Cancer incidence increases with age. The incidence of cancer is relatively low among people aged less than 50 years, but increases steadily to peak among people aged 80 years and over, among both males and females. The increase in incidence with age is more marked among males.[40]

Overall, males are more likely to develop cancer than females. The incidence of cancer in the age range 30–49 years is higher for females, but is surpassed by male cancer incidence from 60 years and onwards.[40]

In South Australia in 2008, there were 9350 new cases of cancer diagnosed in South Australia, along with 3626 cancer deaths. This represented 362 additional new cases over the previous year and 160 more deaths. The four most commonly diagnosed cancers in men were prostate cancer, colorectal cancer, lung cancer, and melanoma. Breast cancer was the most common cancer in females, followed by colorectal cancer, lung cancer, and melanoma.[41]

The numbers of new cases and deaths are expected to rise in the future as a result of population growth and ageing.[41] Between 2004 and 2008, male incidence rates increased by 1.1% per annum, while female rates increased by 0.6% per annum. Incidence is rising for many cancer sites where population-based or private screening services are leading to earlier detection, as for example, for colorectal cancer and breast cancer. It is also rising for cancer sites where improved diagnostic methods are available, such as kidney cancer.[41]

Advances in screening, diagnostic and treatment technologies and service delivery are leading to improved survivals from many types of cancers in Australia and other developed countries. Marked improvements in all-cancer survival took place in Australia between the periods 1982-1986 and 1998-2004.[43] However, these gains have not been seen in many Aboriginal and Torres Strait Islander populations, where elevated cancer mortality rates continue to be a reality.[42]

Cancers with sufficient numbers to map are included in this section.

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All cancers incidence, males, 1986 to 2008

The numbers of new cases of cancer in males are expected to rise in the future as a result of population growth and ageing.[41] Between 2004 and 2008, incidence rates for all cancers in males increased by 1.1% per annum. Incidence is also rising for many cancer sites where population-based or private screening services are leading to earlier detection.[41]

Indicator definition: Males of all ages with new cases of cancer registered in this period, as an age-standardised rate per 100,000 population.

Geographic distribution

The incidence of cancer increased by over 50% in both Metropolitan Adelaide and the non-metropolitan areas over the period from 1986–1993 to 2003–2008, with over half the increase occurring between the first and second periods. As a result of the larger increase in the non-metropolitan areas, the rate has moved from being just below the metropolitan rate, to marginally above it.

Table 14: All cancers incidence, males, 1986 to 2008

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
	Average annual rate per 100,000 men		
1986–1993	432.0	414.5	427.0
1998–2002	553.7	551.8	553.2
2003–2008	653.4	657.1	654.6
	Percentage change		
From first to second period	28.2	33.1	29.6
From second to third period	18.0	19.1	18.3
From first to third period	51.3	58.5	53.3

The first three maps in Map 18 highlight the impact at the SLA level of the substantial increase in the incidence of all cancers, from only one area being mapped in the highest range in 1986–1993, to some two thirds mapped in that range in 2003–2008. The SLAs of Holdfast Bay - South (774.2**), Port Adelaide Enfield - Coast (745.4**), Playford - Elizabeth (730.4**) and West Torrens - West (708.3*) were the only SLAs with elevated rates that were statistically significant. Significantly low incidence rates were recorded for West Torrens - East (547.3**) and Onkaparinga South - Coast (552.2^^) and - Woodcroft (585.0^).

The 'Change' for Metropolitan Adelaide shows that the increase is almost universal across the SLAs.

Again, the maps of the non-metropolitan areas show increasing numbers of SLAs with higher incidence rates over time, with a majority of the larger regional centres and of the remaining SLAs mapped in the highest range by 2003–2008. The four highest rates of statistical significance in the State were in Renmark Paring - Paringa (881.4*), Peterborough (875.7*), Port Lincoln (804.1**), and Whyalla (801.2**). Other statistically significant rates in these non-metropolitan areas were in Copper Coast (731.2*) and Murray Bridge (725.5*).

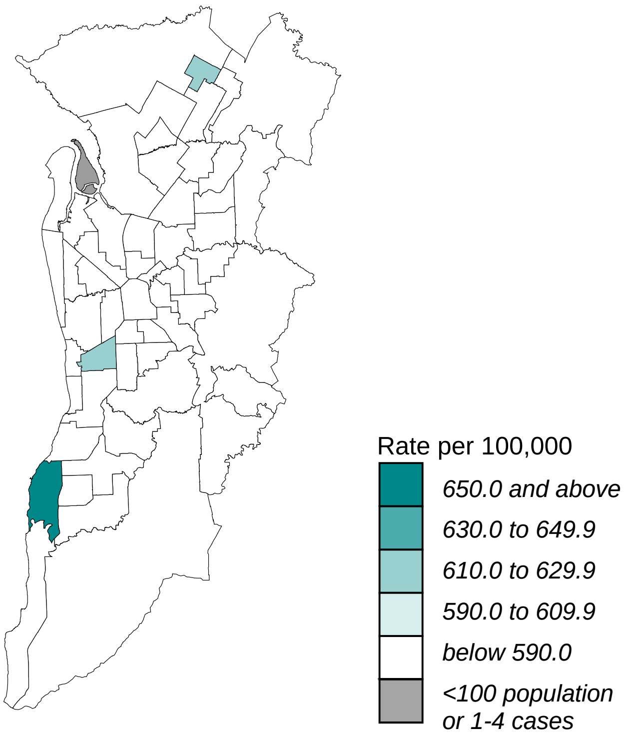
It is timely to recall that low rates, as in Anangu Pitjantjatjara (244.8^^, 9 cases) in the north-west of the State, may in part be the result of incorrect recording of the person's address (see details in *Methods*). Other SLAs with low rates of statistical significance were Mount Remarkable (386.6^^), Mount Barker Balance (398.3^^), Grant (426.1^^), Flinders Ranges (465.1^), Adelaide Hills Balance (468.6^^) and North (504.3^), Barunga West (500.6^), Northern Areas (508.1^), Tanunda (522.8^), Strathalbyn (540.7^) and Light (551.8^).

The 'Change' map is almost entirely covered with areas with increased rates.

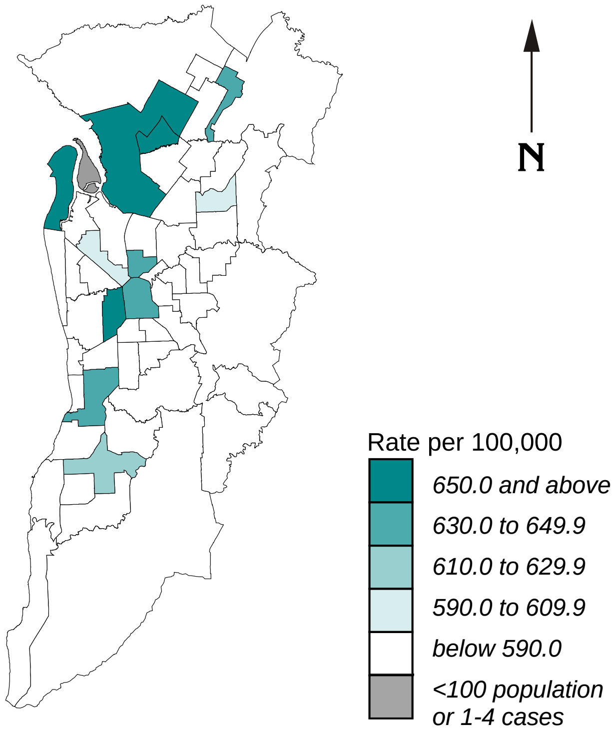
Map 18: All cancers incidence, males, Metropolitan Adelaide, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

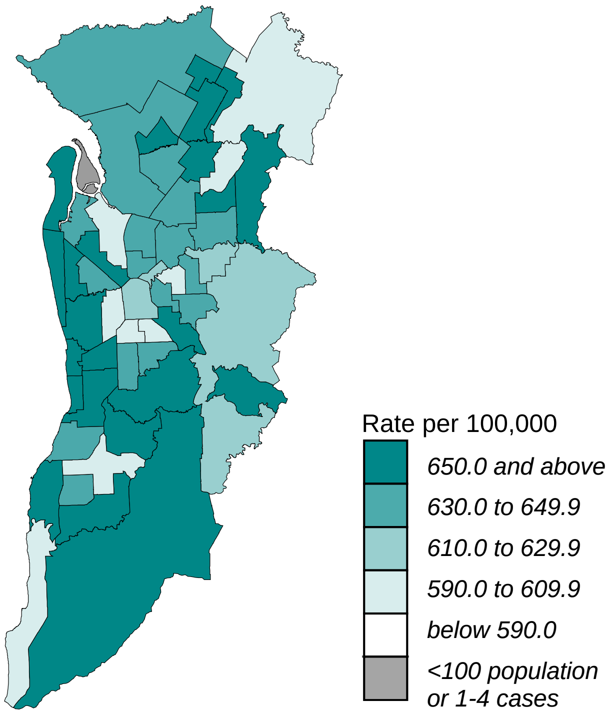
1986–1993



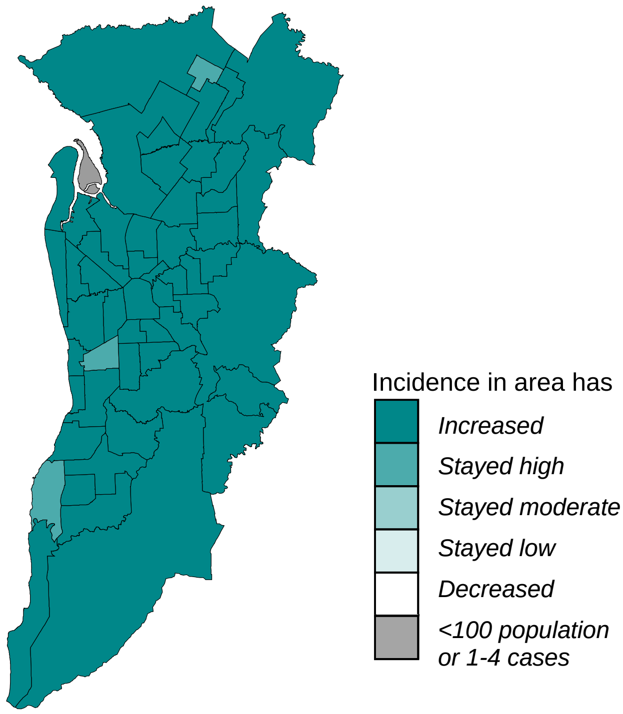
1998–2002



2003–2008



Change: 2003–2008 compared with 1986–1993



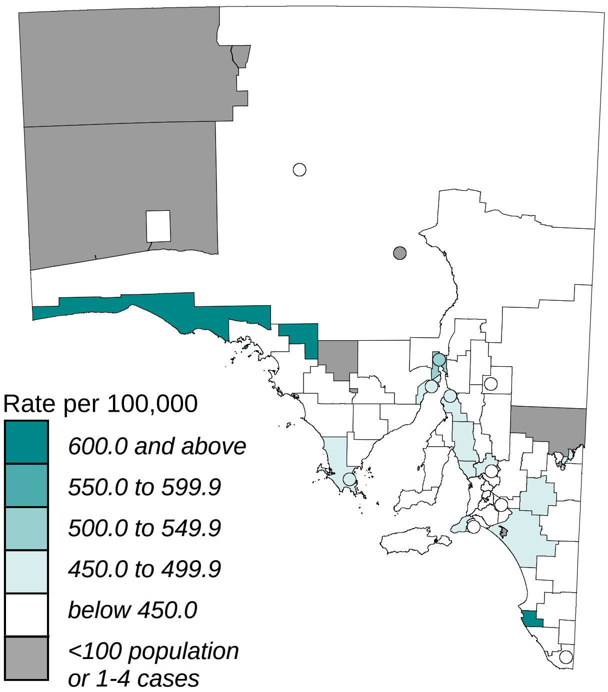
Source: Compiled in PHIDU using data supplied by SA Cancer Registry

Map 19: All cancers incidence, males, non-metropolitan areas, 1986–1993, 1998–2002 and 2003–2008

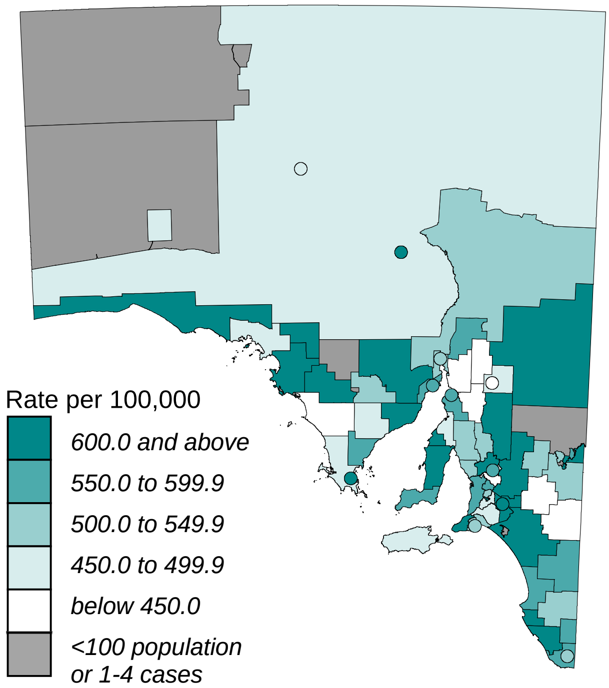
ASR per 100,000 by Statistical Local Area

N

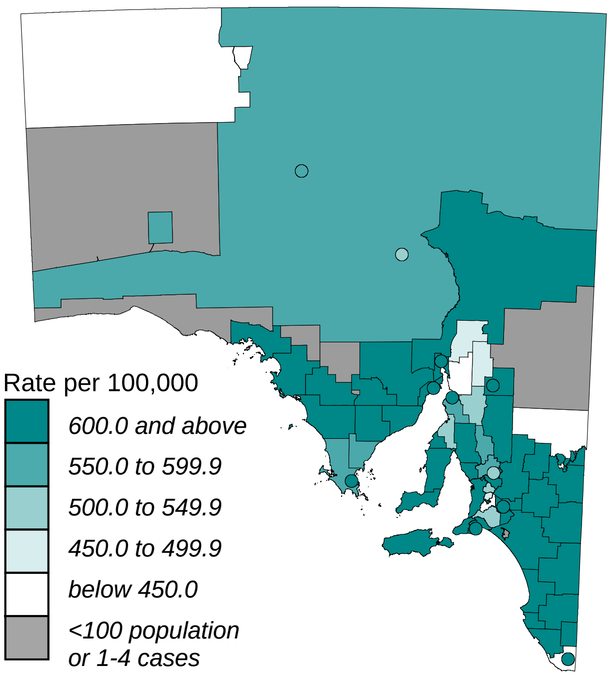
1986–1993



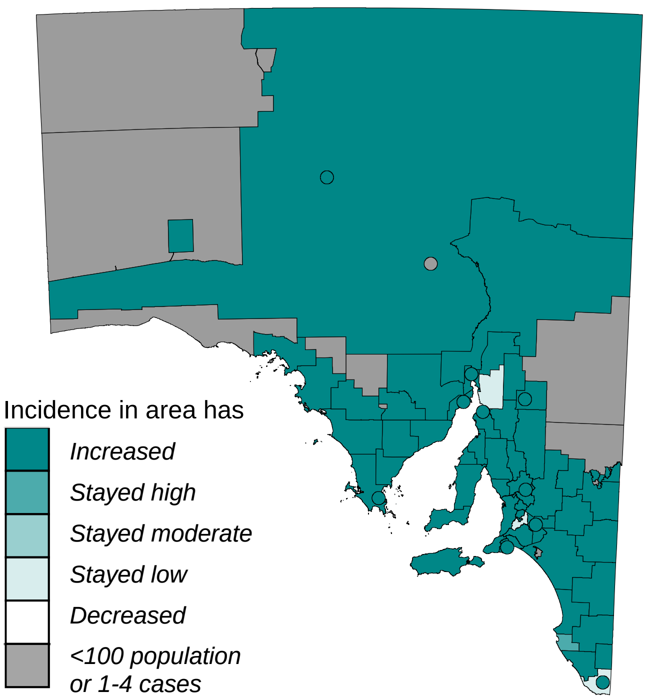
1998–2002



2003–2008



Change: 2003–2008 compared with 1986–1993



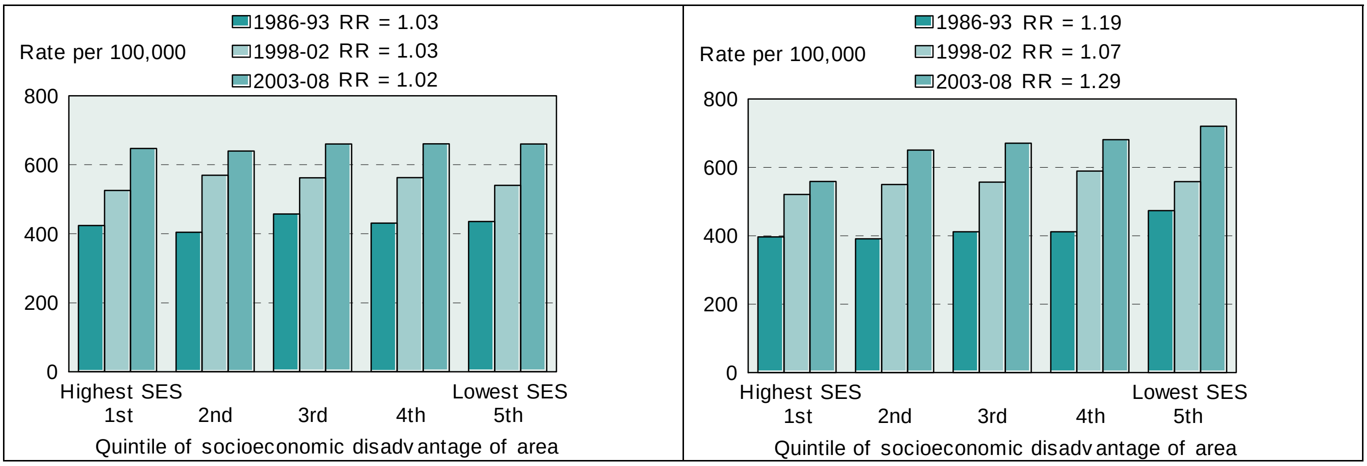
Source: Compiled in PHIDU using data supplied by SA Cancer Registry

Distribution by socioeconomic status and remoteness

The increase in incidence of all cancers, discussed above, is evenly spread across the quintiles in Metropolitan Adelaide, with no differential of note in any of the periods analysed. The data for the non-metropolitan areas are more variable, although in the latest period, there is a marked socioeconomic gradient in incidence, and a differential between the most disadvantaged and least disadvantaged areas, of 29%.

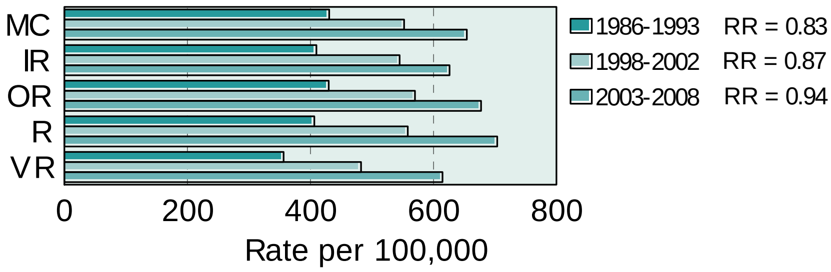
Figure 26: All cancers incidence, males, by socioeconomic status, 1986–1993, 1998–2002 and 2003–2008

Metropolitan Adelaide **Non-metropolitan areas**



In all periods shown, the incidence of cancer (all types collectively) in males was lowest in very remote areas. In part, this is thought to reflect lower rates of detection due to more limited access to screening tests and diagnostic services. Cancer rates may also be a little lower in Aboriginal than other South Australians, with the former more commonly living in very remote areas.

Figure 27: All cancers incidence, males, by remoteness, 1986–1993, 1998–2002 and 2003–2008



All cancers incidence, females, 1986 to 2008

The numbers of new cases of cancer in females are expected to rise in the future as a result of population growth and ageing.[41] Between 2004 and 2008, incidence rates for all cancers in females increased by 0.6% per annum. Incidence is also rising for many cancer sites where population-based or private screening services are leading to earlier detection.[41]

Indicator definition: Females of all ages with new cases of cancer registered in this period, as an age-standardised rate per 100,000 population.

Geographic distribution

The incidence of cancer for females increased by around 40% in both Metropolitan Adelaide and the non-metropolitan areas over the period from 1986–1993 to 2003–2008, with the majority of the increase occurring between the first and second periods. These increases, of which almost three quarters of the overall increase in Metropolitan Adelaide and almost two thirds of that in the non-metropolitan areas occurred in the earlier years, are more substantial than for men, for whom the increases were just over 50%. Rates for females in 2003–2008 are just over three quarters of those for males (Table 14).

Table 15: All cancers incidence, females, 1986 to 2008

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
	Average annual rate per 100,000 women		
1986–1993	361.8	349.1	358.5
1998–2002	466.3	443.2	460.0
2003–2008	509.9	498.5	506.6
	Percentage change		
From first to second period	28.9	27.0	28.3
From second to third period	9.4	12.5	10.1
From first to third period	40.9	42.8	41.3

The lower rate for females when compared with males, and the larger increase in the earlier period, are both evident at the SLA level from a comparison of the maps for 1986–1993 and 1988–2002. The map for 2003–2008 has fewer areas in the highest range than seen for males and, although a number of areas have similar rates for both males and females, there are also some clear differences. Despite this, only West Torrens - West (586.3**), Port Adelaide Enfield - Coast (585.5**) and Mitcham - North-East (586.4*) had elevated incidence rates that were statistically significantly.

The 'Change' map for Metropolitan Adelaide shows the widespread nature of the increase in all cancers incidence for females.

Again, the maps of the non-metropolitan areas show increasing numbers of SLAs with higher incidence rates over time, with a majority of the larger regional centres and of the remaining SLAs mapped in the highest range by 2003–2008. However, the only rates of statistical significance were in Wattle Range West (the highest in the State, at 602.0*) in the south-east, and Whyalla (570.9*) in the north of the State.

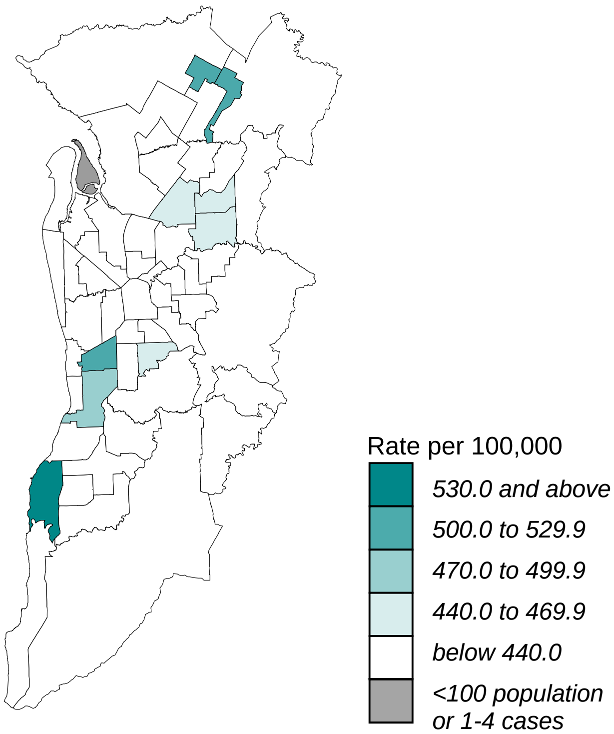
SLAs with low rates of statistical significance were Unincorporated Far North (168.4^^), Renmark Paringa - Paringa (301.3^), Mount Remarkable (323.9^), Loxton Waikerie East (347.1^^), Barunga West (350.1^), Mallala (380.8^), Grant (396.8^^), Mid Murray (419.3^) and Light (421.7^).

The 'Change' map highlights the areas which have seen the greatest change.

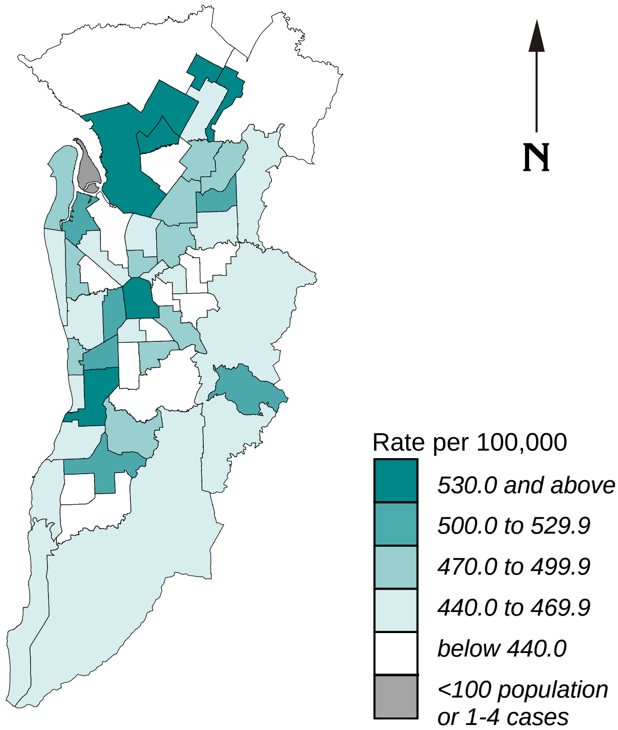
Map 20: All cancers incidence, females, Metropolitan Adelaide, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

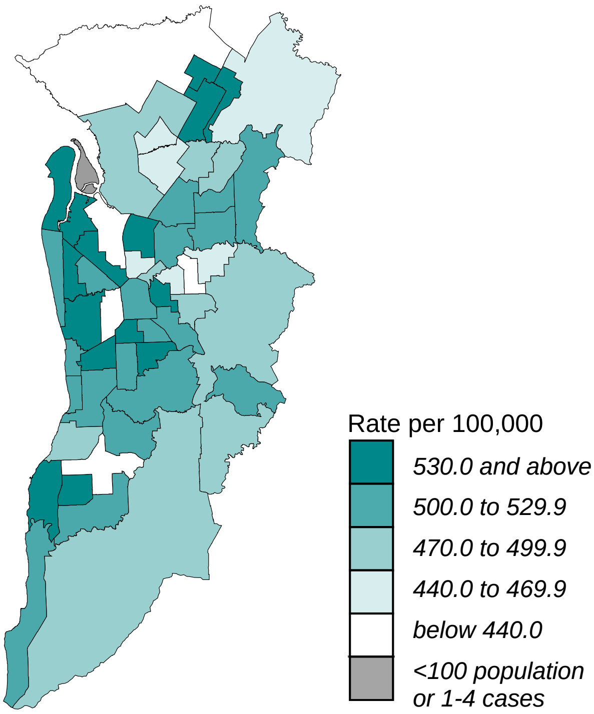
1986–1993



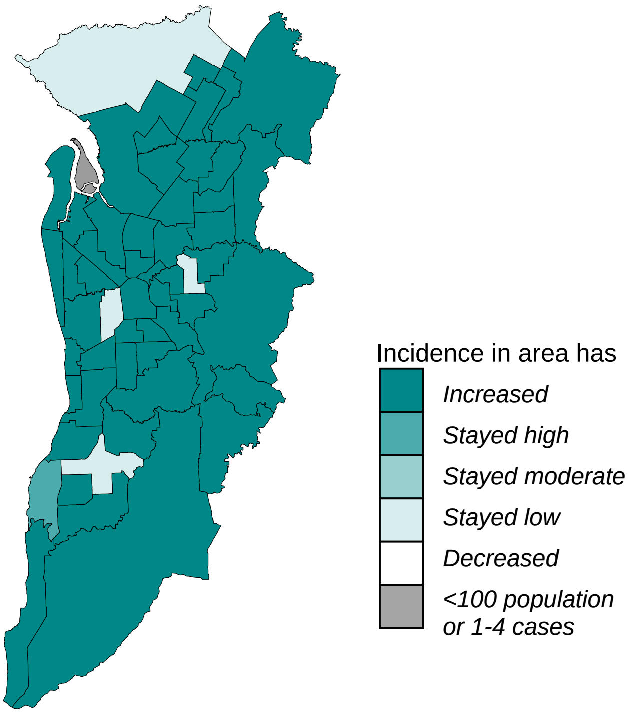
1998–2002



2003–2008



Change: 2003–2008 compared with 1986–1993



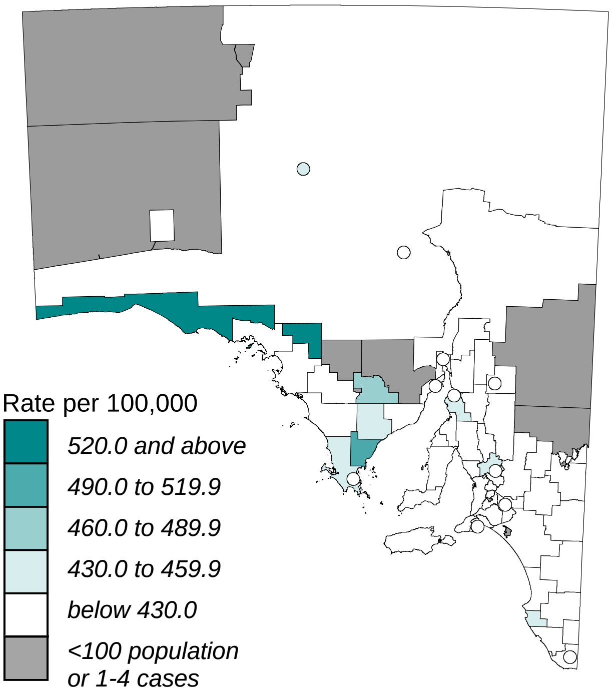
Source: Compiled in PHIDU using data supplied by SA Cancer Registry

Map 21: All cancers incidence, females, non-metropolitan areas, 1986–1993, 1998–2002 and 2003–2008

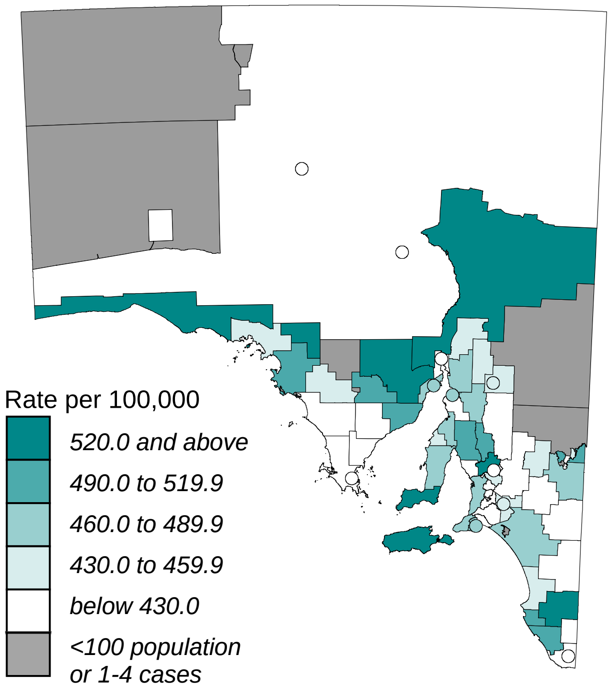
ASR per 100,000 by Statistical Local Area

N

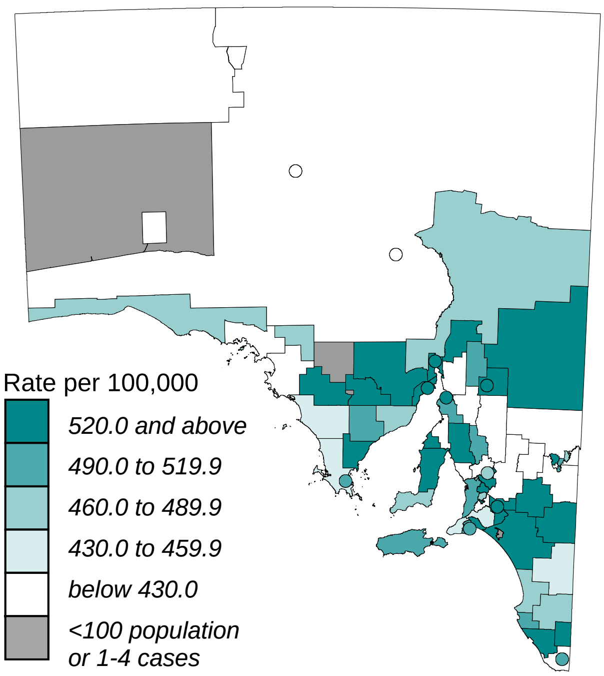
1986–1993



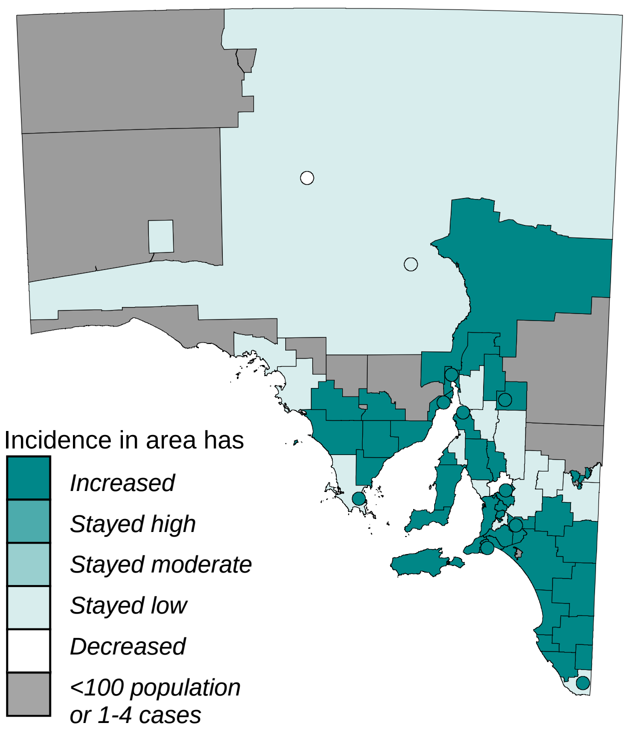
1998–2002



2003–2008



Change: 2003–2008 compared with 1986–1993



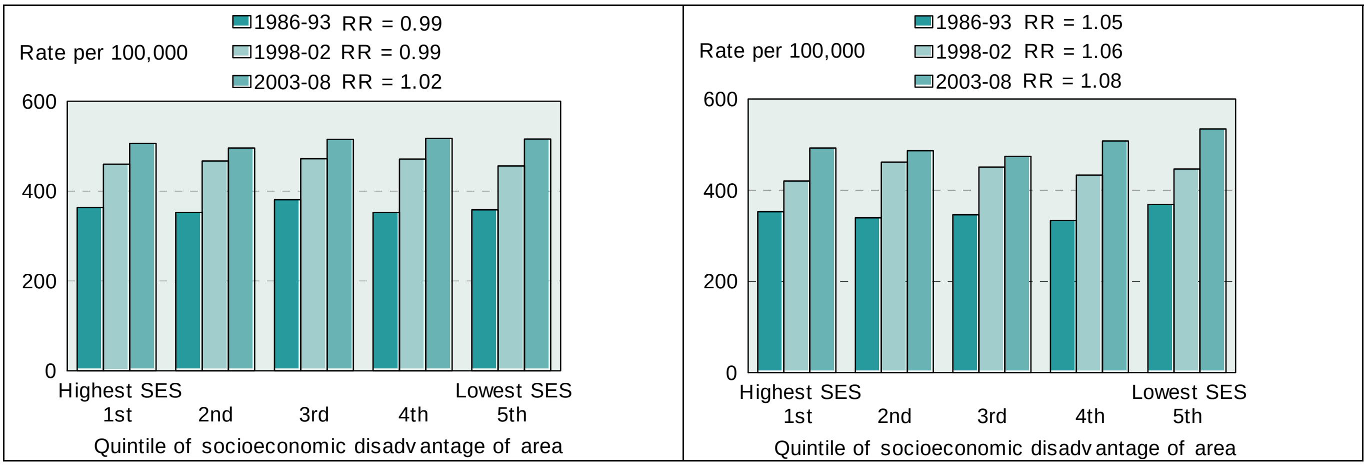
Source: Compiled in PHIDU using data supplied by SA Cancer Registry

Distribution by socioeconomic status and remoteness

As shown for males, the increase in incidence of all cancers for females is evenly spread across the quintiles in Metropolitan Adelaide, with no differential of note in any of the periods analysed. The increase is similarly spread across the quintiles in the non-metropolitan areas, although there is a differential between the most disadvantaged and least disadvantaged areas in each period, of from 5% to 8%.

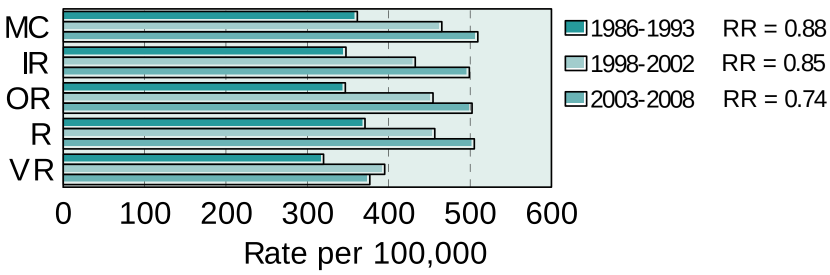
Figure 28: All cancers incidence, females, by socioeconomic status, 1986–1993, 1998–2002 and 2003–2008

Metropolitan Adelaide | **Non-metropolitan areas**



In all periods, the incidence of cancer (all types collectively) in females was lowest in the Very Remote areas. In part, this is thought to reflect lower rates of detection due to more limited access to breast screening, other screening tests and diagnostic services. Also, cancer rates may be a little lower in Aboriginal than other South Australians, with the former more commonly living in very remote areas. Unlike the earlier periods, there is only minimal variation in rates between the first four remoteness classes for 2003–2008.

Figure 29: All cancers incidence, females, by remoteness, 1986–1993, 1998–2002 and 2003–2008



Breast cancer incidence, 1986 to 2008

Breast cancer is the most common cancer diagnosed in South Australian women after non-melanoma skin cancer, and the leading cause of cancer-related death in women. The incidence of breast cancer increases with age. It is also the commonest cancer experienced by Aboriginal and Torres Strait Islander women, although the incidence rate is lower than for the non-Indigenous female population. Women living in high socioeconomic status areas have a significantly higher incidence of breast cancer than women living in low socioeconomic status areas.[44] Possible reasons include differences in reproductive and behavioural risk factors. Other factors implicated in the development of breast cancer include family history, previous history of hormone-based breast disease, early onset of menstruation or late menopause, having a first child after the age of 30, infertility, diethylstilboestrol exposure during pregnancy, alcohol consumption, smoking and diet.[44]

Indicator definition: Females aged 30 years and over with new cases of breast cancer (both invasive and *in situ*) registered in each period, as an age-standardised rate per 100,000 female population at these ages.

Geographic distribution

Breast cancer incidence among females increased by around 40% in both Metropolitan Adelaide and the non-metropolitan areas of the State over the period of data analysed. Incidence in non-metropolitan South Australia remains slightly lower than in Metropolitan Adelaide, being 6.4% lower in 1986–1993, 6.3% lower in 1998–2002 and 4.5% lower in 2003–2008. Breast cancer incidence rates have been higher in Australia since the introduction of the BreastScreen program.[28] The extent to which this reflects lead time effects of screening, over-diagnosis, changes in pathology and other diagnostic practices, and real increases in incidence due to changes in underlying risk factors (e.g., body weight, reproductive behaviour, use of hormone replacement therapy and alcohol consumption) is unclear.[28] However, it is evident that mammography screening in Australia reduces breast cancer mortality in screening participants.[27]

Table 16: Breast cancer incidence, females aged 30 years and over, 1986 to 2008

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
	Average annual rate per 100,000 women		
1986–1993	161.8	151.4	159.0
1998–2002	213.9	200.4	210.0
2003–2008	227.3	217.0	224.3
	Percentage change		
From first to second period	32.2	32.4	32.1
From second to third period	6.3	8.3	6.8
From first to third period	40.5	43.3	41.1

The change in distribution at the SLA level within Metropolitan Adelaide is striking. Whereas there were just two SLAs mapped in the top range, of 225 or more females per 100,000 female population in 1986–1993, by 2003–2008 some 31 of the 51 SLAs had this level of incidence, which is now almost the average for Metropolitan Adelaide. These 31 SLAs include many of the highest socioeconomic status areas (although not all), and some with below-average IRSD scores, but none of the most disadvantaged SLAs. The moderate correlation (0.39) at the SLA level between high rates of breast cancer incidence and socioeconomic advantage supports this reading of the map for 2003–2008.

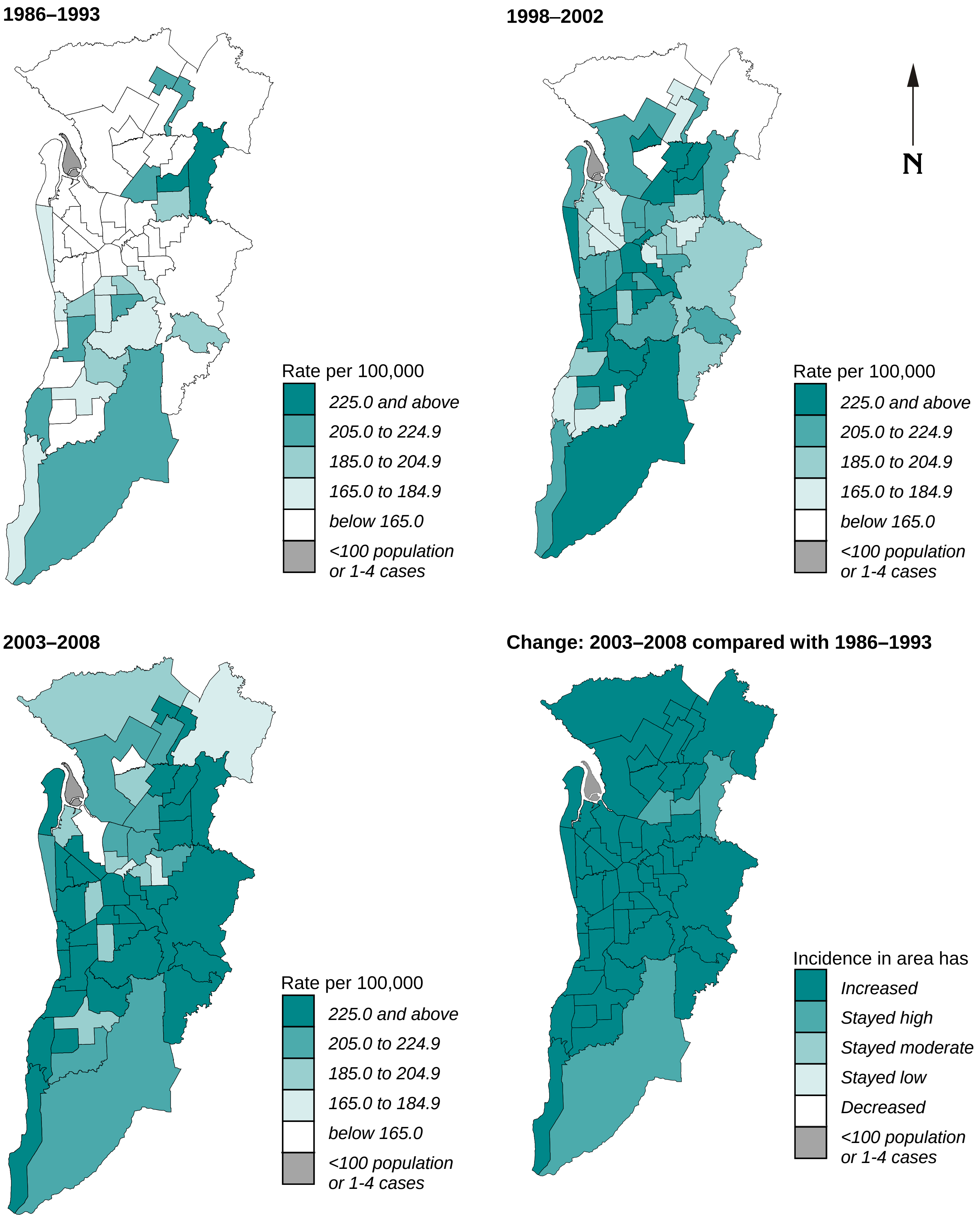
In 2003–2008, the most highly elevated and statistically significant rates were recorded for women in Adelaide Hills - Central (292.8*), Norwood Payneham St Peters - West (275.7*), Mitcham - North-East (270.7*) and Port Adelaide Enfield - Coast (265.1*); the lowest rates of statistical significance were recorded in Port Adelaide Enfield - Park (144.4^^) and Salisbury - Inner North (163.4^).

The 'Change' map highlights the extent of increases in incidence, with only four SLAs not recording an increase in incidence over this period; however, even in these four areas the rates remained high.

Although a number of towns and rural SLAs in the more highly populated non-metropolitan areas had elevated rates, only in Mount Barker - Central (295.4**) and Port Pirie (281.7*) were the rates statistically significant. SLAs with statistically significantly low rates were Grant (83.0^^, with 11 cases), Goyder (102.8^, 9), Loxton Waikerie – East (119.3^^, 17) and Mid Murray (153.1^, 26).

Map 22: Breast cancer incidence, females aged 30 years and over, Metropolitan Adelaide, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

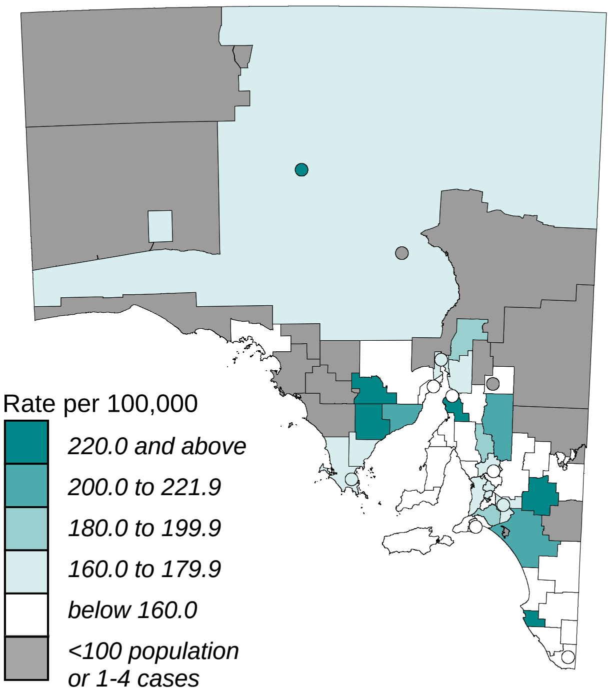


Source: Compiled in PHIDU using data supplied by SA Cancer Registry

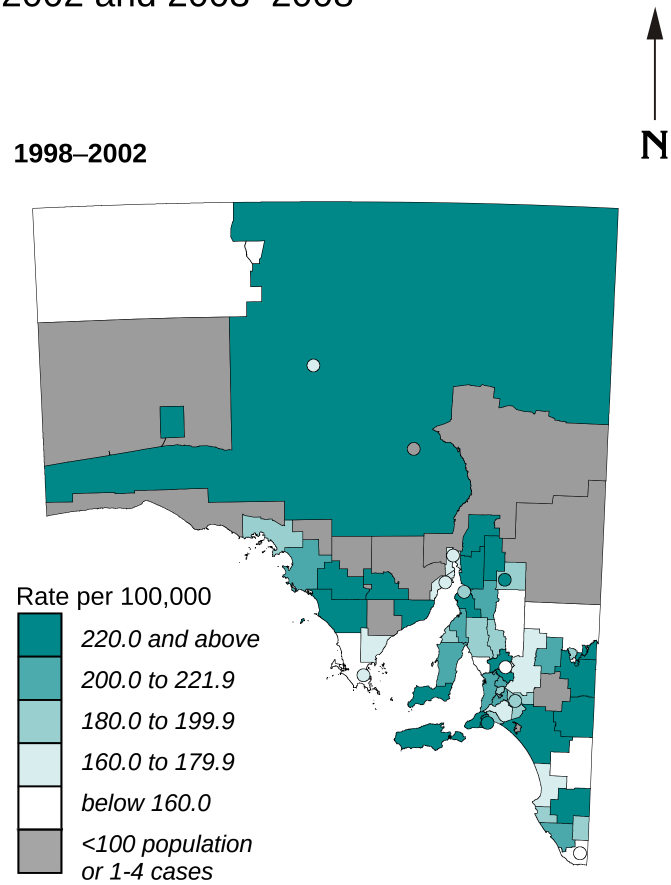
Map 23: Breast cancer incidence, females aged 30 years and over, non-metropolitan areas, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

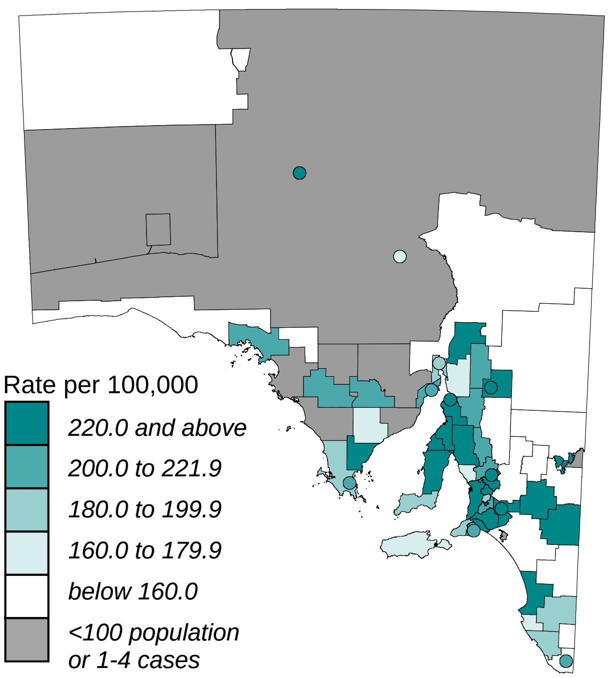
1986–1993



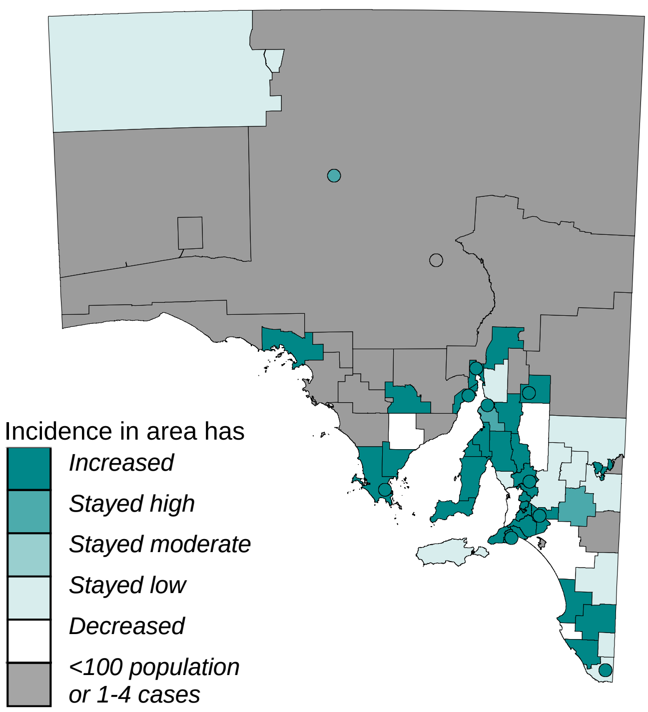
1998–2002



2003–2008



Change: 2003–2008 compared with 1986–1993



Source: Compiled in PHIDU using data supplied by SA Cancer Registry

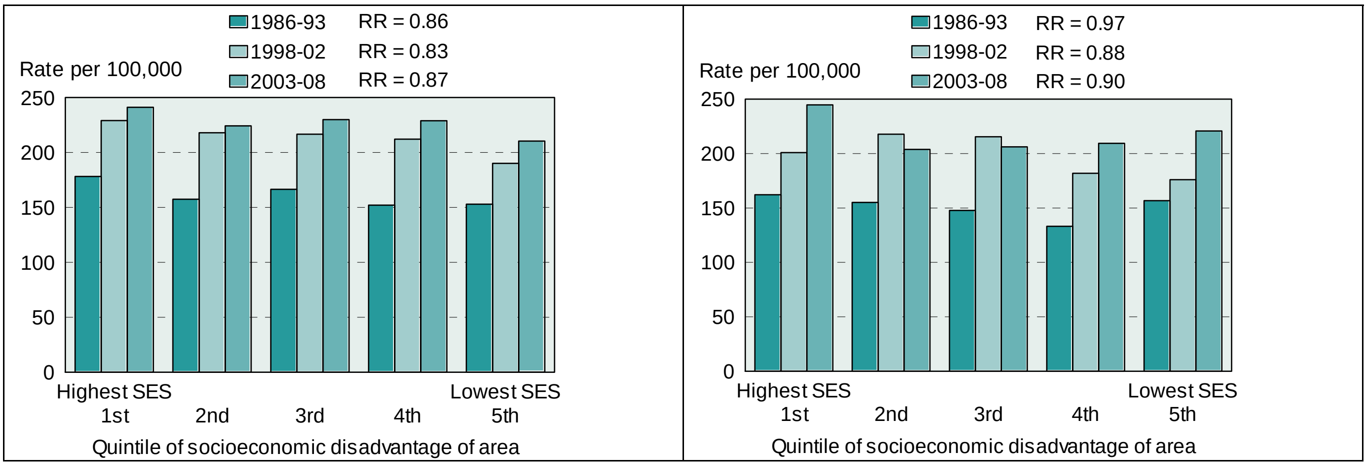
Again, growth is also evident in the increasing number of areas mapped in the 'Change' map as incidence having 'increased', which includes all of the towns (other than Coober Pedy, which is shown as 'stayed high').

Distribution by socioeconomic status and remoteness

In each time period, the highest incidence of female breast cancer in Metropolitan Adelaide was in the highest socioeconomic quintile, whereas the lowest incidence was in the lowest socioeconomic quintile. A clear pattern was not seen, however, in the non-metropolitan areas. In all areas, an increasing incidence was evident over time.

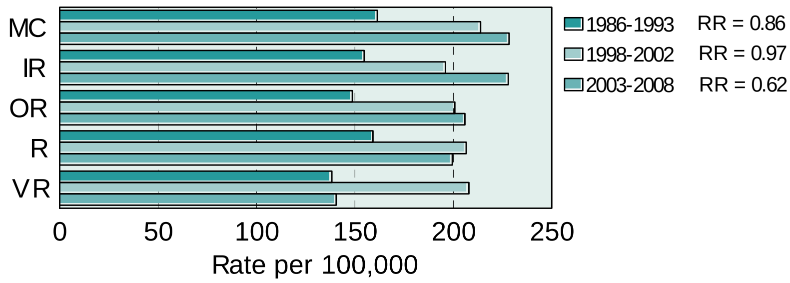
Figure 30: Breast cancer incidence, females aged 30 years and over, by socioeconomic status, 1986–1993, 1998–2002 and 2003–2008

Metropolitan Adelaide **Non-metropolitan areas**



In 2003–2008, rates decrease, with increasing remoteness, in a step-wise fashion, with similar rates in the first two (least remote) classes, notably lower rates in the middle (Outer Regional and Remote) classes and a substantially lower rate in the Very Remote class, some 38% below the rate in Major Cities. There was far less variation in the earlier periods.

Figure 31: Breast cancer incidence, females aged 30 years and over, by remoteness, 1986–1993, 1998–2002 and 2003–2008



Colorectal cancer incidence, 1986 to 2008

Colorectal (bowel) cancer includes cancers of the colon, recto-sigmoid junction, rectum, anus and anal canal. The earlier the stage of cancer at diagnosis, the higher the likelihood generally is of survival. Significantly reduced survival time has been found in lower socioeconomic groups in the South Australian population, and delay in seeking care has been proposed as a contributing factor to such differences.[45] The cause of colorectal cancer is complex and appears to involve interactions between inherited susceptibility and environmental factors.

Indicator definition: People aged 20 years and over with new cases of colorectal cancer (both invasive and *in situ*) registered in this period, as an age-standardised rate per 100,000 population at these ages.

Geographic distribution

The incidence of colorectal cancer increased between each period, with the largest increases between 1986–1993 and 1998–2002. There was a higher overall increase in the non-metropolitan areas of the State, of 38.1%, when compared with Metropolitan Adelaide (26.9%). This greater growth has resulted in incidence in the non-metropolitan areas moving from 3.9% below the level in Metropolitan Adelaide in 1986–1993 to 4.6% above in 2003–2008. This may reflect the impact of greater community awareness through screening where a benefit would be expected, although the likely effectiveness of the existing national screening program is difficult to estimate.[28]

Table 17: Colorectal cancer incidence, people aged 20 years and over, 1986 to 2008

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
	Average annual rate per 100,000 women		
1986–1993	82.5	79.3	81.6
1998–2002	98.4	102.7	99.6
2003–2008	104.7	109.5	106.1
	Percentage change		
From first to second period	19.3	29.5	22.1
From second to third period	6.4	6.6	6.5
From first to third period	26.9	38.1	30.0

The change in distribution at the SLA level within Metropolitan Adelaide has a number of notable features, in particular the increase in incidence between the first and second periods in a contiguous group of SLAs, including the City of Adelaide, Prospect to the north and a number of SLAs through to the coast in the west. Mitcham - North-East, Adelaide Hills Central and Salisbury Balance had similarly high incidence. In the latest period a number of these SLAs were no longer in the highest range. An investigation of the population groups moving into these areas, or ageing in place, could lead to a better understanding of the changes. The greatest change occurred in the latest period, by when just over one third of the SLAs had incidence rates of 110 cases per 100,000 population.

Charles Sturt - North-East (134.3**), West Torrens - West (131.6**) and Port Adelaide Enfield Coast (124.4*) had scores of statistical significance elevated by 17% or more above the level expected from the State rate, and Marion - South (73.0*), West Torrens - East (76.8**) and Onkaparinga - South Coast (83.3**) had rates of 20% or more below the State rate. The correlation analysis shows there to be a weak association (-0.20) with socioeconomic disadvantage at the SLA level.

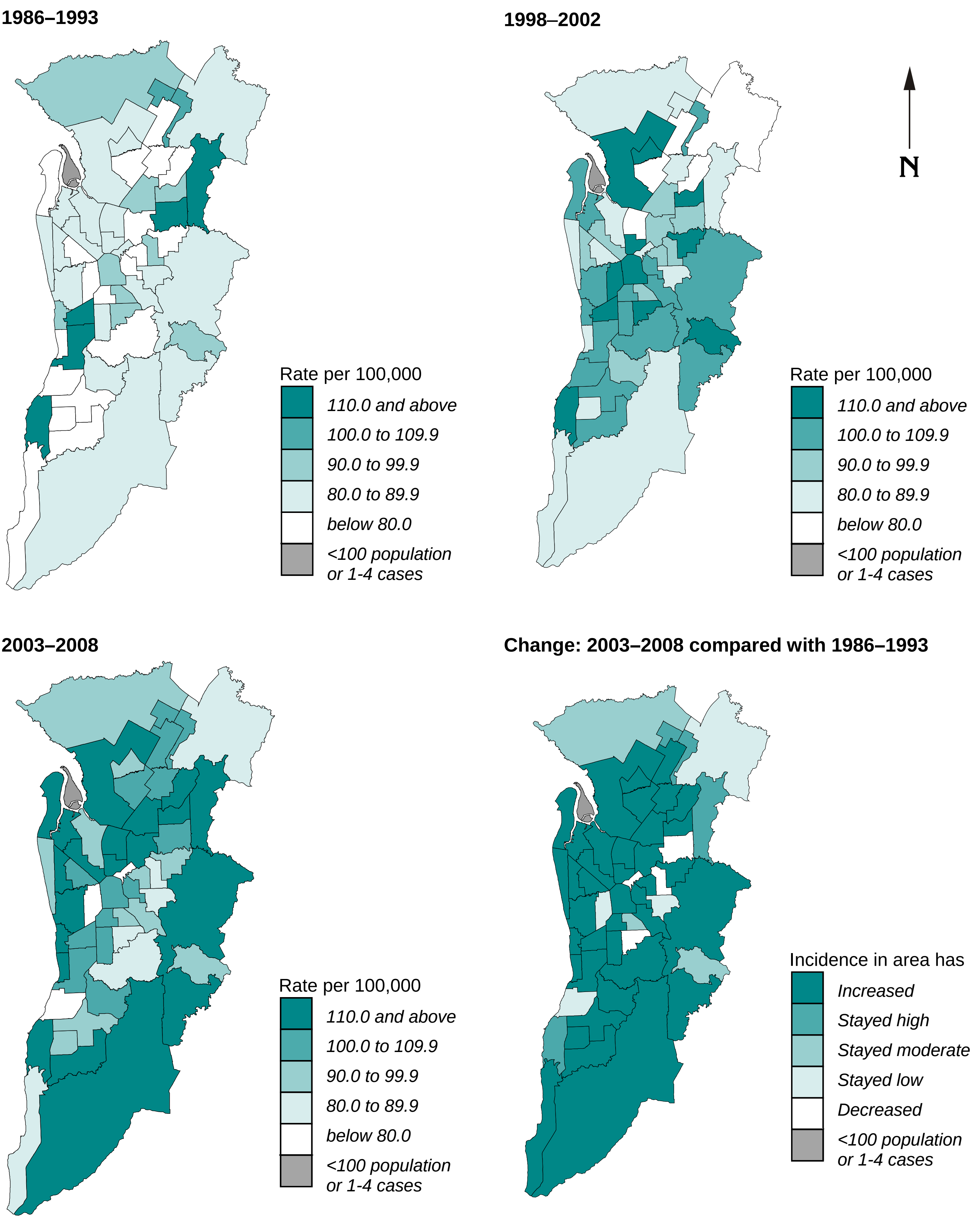
The 'Change' map clearly distinguishes between areas where incidence has increased (the majority of areas), or the few areas marked as incidence having decreased.

In the non-metropolitan areas, Roxby Downs (224.2*, with seven cases), Ceduna (163.7*, 21), Port Lincoln (137.1*, 79) and Murray Bridge (136.8**, 112) all have statistically significantly high rates; Barunga West^ and Mount Remarkable^ (both with fewer than 10 cases) had the lowest rates.

Again, the growth is evident in the increasing number of areas mapped in the highest range. There is a stark difference in incidence of colorectal cancer between a number of SLAs in the Adelaide Hills and Fleurieu Peninsula (low incidence) and the adjacent group of SLAs

Map 24: Colorectal cancer incidence, people aged 20 years and over, Adelaide, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

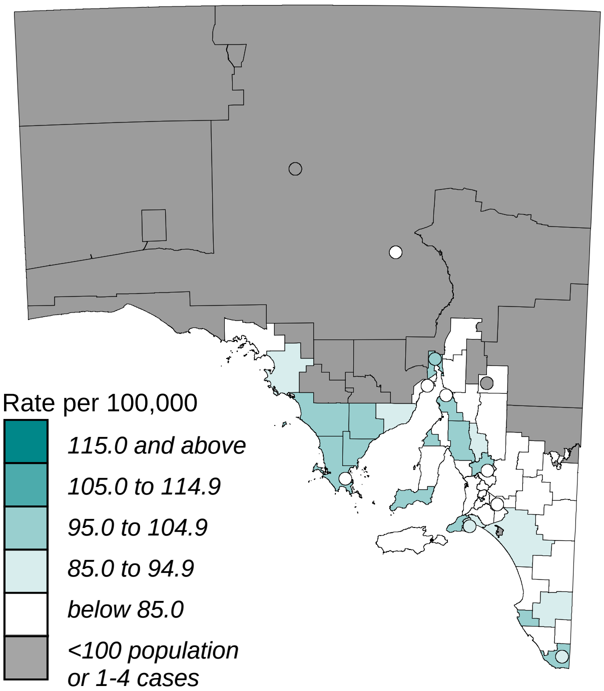


Source: Compiled in PHIDU using data supplied by SA Cancer Registry

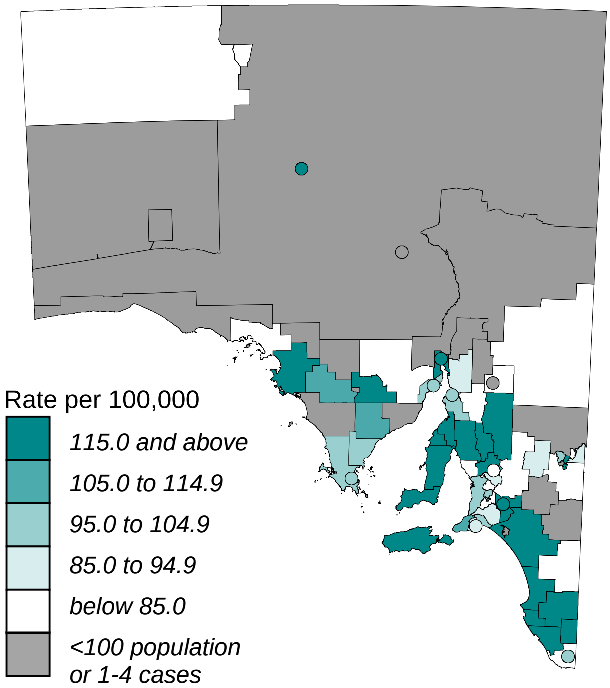
Map 25: Colorectal cancer incidence, people aged 20 years and over, non-metropolitan areas, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

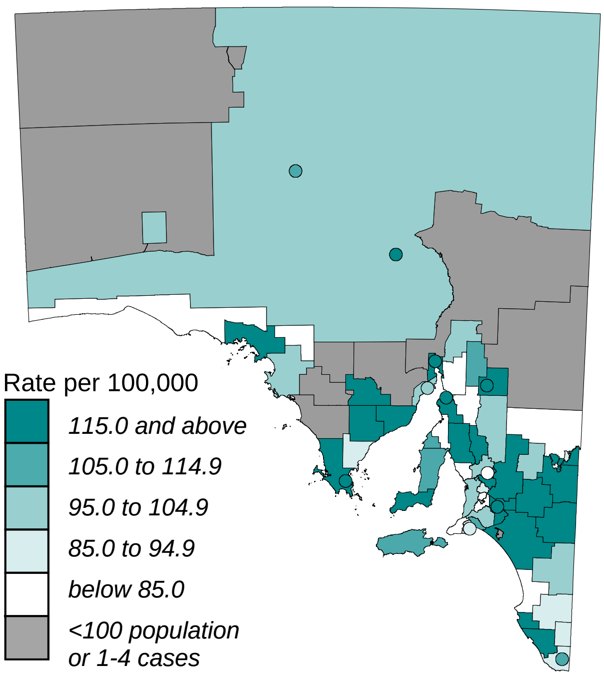
1986–1993



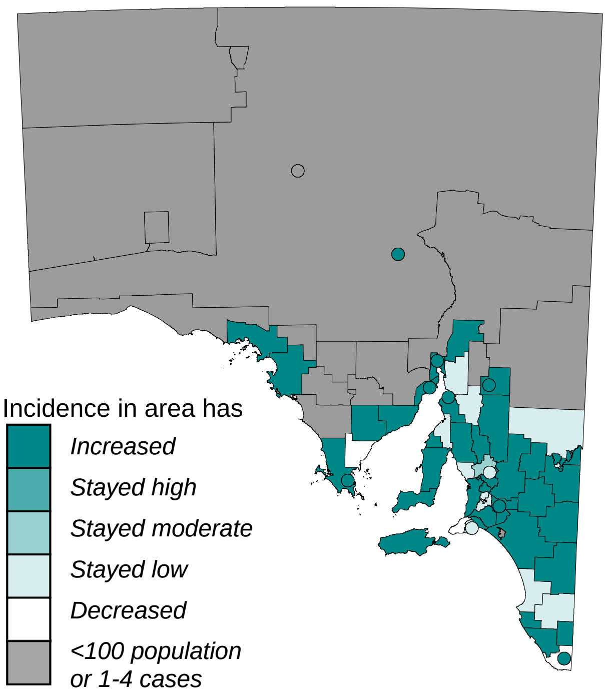
1998–2002



2003–2008



Change: 2003–2008 compared with 1986–1993



Source: Compiled in PHIDU using data supplied by SA Cancer Registry

that covers the area to the eastern State border (high incidence). Other SLAs with an incidence of 115 or more persons per 100,000 population are in the mid-north and upper and lower Yorke Peninsula; Port Augusta; and on the west coast, including in Ceduna; and in the south-east. The correlation analysis shows there to be a weak association (0.25) with socioeconomic disadvantage at the SLA level, unlike the weak correlation with socioeconomic disadvantage in Metropolitan Adelaide.

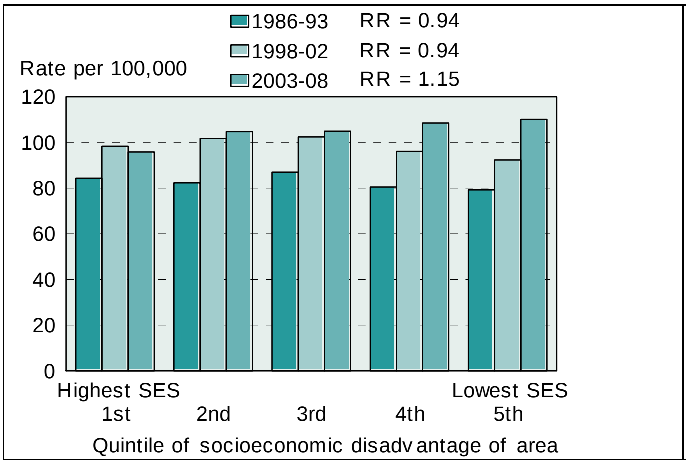
The 'Change' map shows a similar pattern to that described for the period 2003–2008.

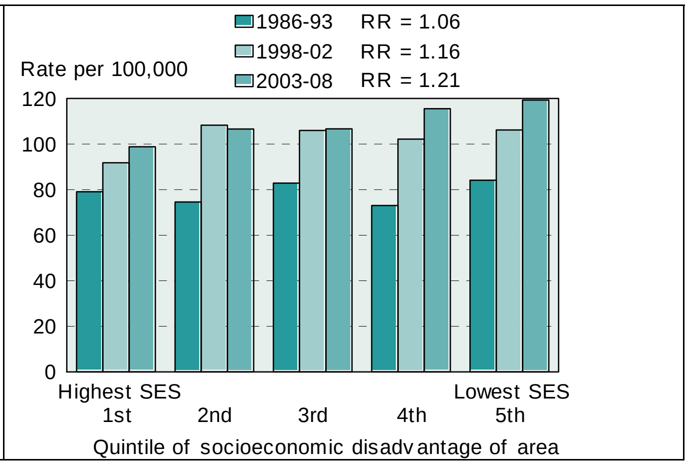
Distribution by socioeconomic status and remoteness

The charts below show a socioeconomic gradient in rates of colorectal cancer incidence for people aged 20 years and over in both Metropolitan Adelaide and non-metropolitan areas in the two later periods. The greatest differential in rates between the most disadvantaged areas and the least disadvantaged areas is in 2003–2008, being 21% in the non-metropolitan areas and 15% in Metropolitan Adelaide.

Figure 32: Colorectal cancer incidence, people aged 20 years and over, by socioeconomic status, 1986–1993, 1998–2002 and 2003–2008

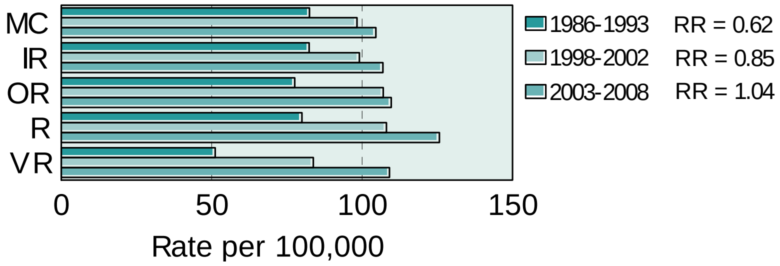
Metropolitan Adelaide **Non-metropolitan areas**





In 2003–2008, rates were similar across the remoteness classes, increasing slightly with increasing remoteness, other than in the Remote class, where the rate is 20% higher than in the Major Cities class. In the earlier periods, rates were similar across the first four remoteness classes, before declining sharply in Very Remote areas.

Figure 33: Colorectal cancer incidence, people aged 20 years and over, by remoteness, 1986–1993, 1998–2002 and 2003–2008



Lung cancer incidence, males, 1986 to 2008

Lung cancer has the third highest incidence of all cancers, and South Australian males have a higher overall rate of lung cancer than females.[46] In older age groups, the differences are even greater, reflecting past smoking rates. There has been a decline in lung cancer incidence in males following the reduction in smoking rates since the 1970s. Other risk factors for lung cancer include exposures to substances such as asbestos, some industrial compounds, radiation, and possibly air pollution.[46]

Indicator definition: Males aged 20 years and over with new cases of lung cancer (both invasive and *in situ*) registered in this period, as an age-standardised rate per 100,000 male population at these ages.

Geographic distribution

Unlike the growth seen for incidence of all cancers and for breast and colorectal cancer, lung cancer incidence for men aged 20 years and over in Metropolitan Adelaide has declined over this 15 year period, with the entire decline occurring between the first and second periods analysed. The experience of men in the non-metropolitan areas was different, with an increase of 3.6% in incidence to 1998–2002, followed by a small fall, of 1.6%, to 2003–2008. A result of this decline in incidence for men in the metropolitan area is that the gap in the metropolitan and non-metropolitan rates evident in the first period has been largely removed.

Table 18: Lung cancer incidence, males aged 20 years and over, 1986 to 2008

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
		Average annual rate per 100,000 men	
1986–1993	95.4	83.2	91.8
1998–2002	85.9	86.2	86.0
2003–2008	86.1	84.8	85.7
		Percentage change	
From first to second period	-10.0	3.6	-6.3
From second to third period	0.2	-1.6	-0.3
From first to third period	-9.7	1.9	-6.6

The decline in rates is also evident from the maps, with the number of SLAs in the higher ranges declining and, in the lower ranges, increasing, from 1986–1993 to 2003–2008. The map for 2003–2008 is highly consistent with the pattern of socioeconomic status across Adelaide, with high rates in many areas of socioeconomic disadvantage and low rates in areas of socioeconomic disadvantage; the correlation coefficient of -0.78, indicates a very strong association at the SLA level between high incidence of lung cancer among men and socioeconomic disadvantage.

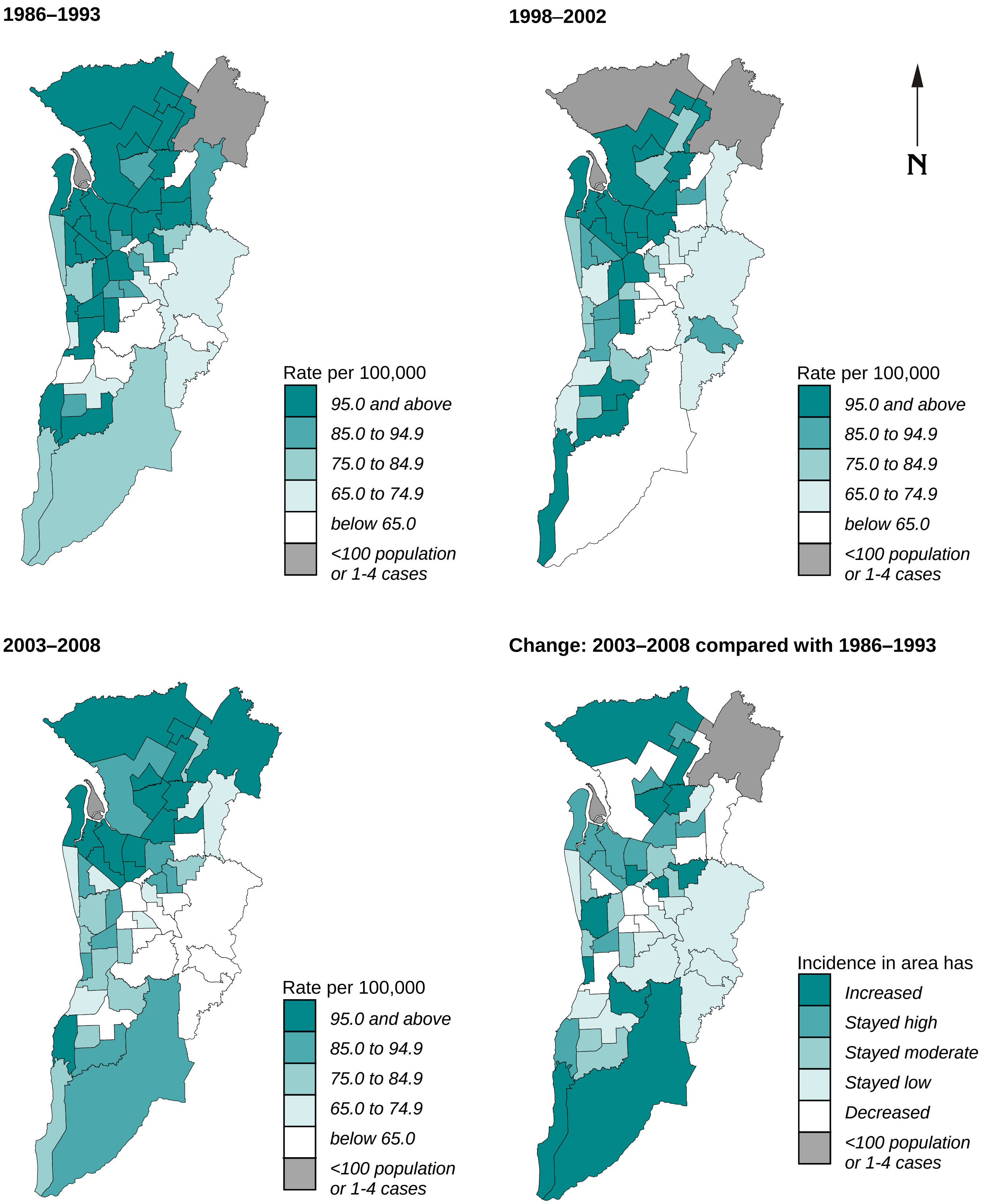
Playford - Elizabeth (148.0**) and - West Central (129.2*), and Salisbury - Inner North (135.8**), - North-East (131.6**) and - Central (111.4*), in the outer north; Onkaparinga - North Coast (120.1*), in the outer south; and Port Adelaide Enfield - Park (117.9*), - Coast (112.2*) and - Inner (112.1*), in the north-west, had the highest rates that were statistically significant. The rate in Playford - Elizabeth was 73% above the level expected from the State rates for a male population of this size and age; the next three highest rates were elevated by over 50%.

SLAs where incidence has increased over this period (shown in the 'Change' map) include a number of very low socioeconomic status under the IRSD, as well as others with moderate IRSD scores; some of these latter areas have above-average proportions of their population born overseas, either in non-English speaking countries, or in English speaking countries.

The lowest incidence rates were in non-metropolitan areas were in the Adelaide Hills - Central (36.7**, nine cases), Mitcham - Hills (44.8**) and - North-East (46.2*), Unley - West (47.4*), Adelaide (50.2*), Burnside - North-East (60.8^), Onkaparinga - Woodcroft (61.3^) and Tea Tree Gully - South (62.5^).

Map 26: Lung cancer incidence, males aged 20 years and over, Adelaide, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

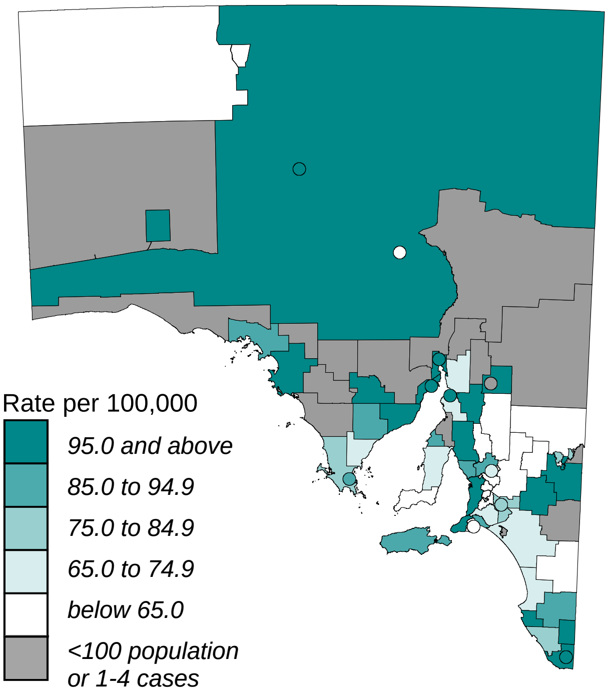


Source: Compiled in PHIDU using data supplied by SA Cancer Registry

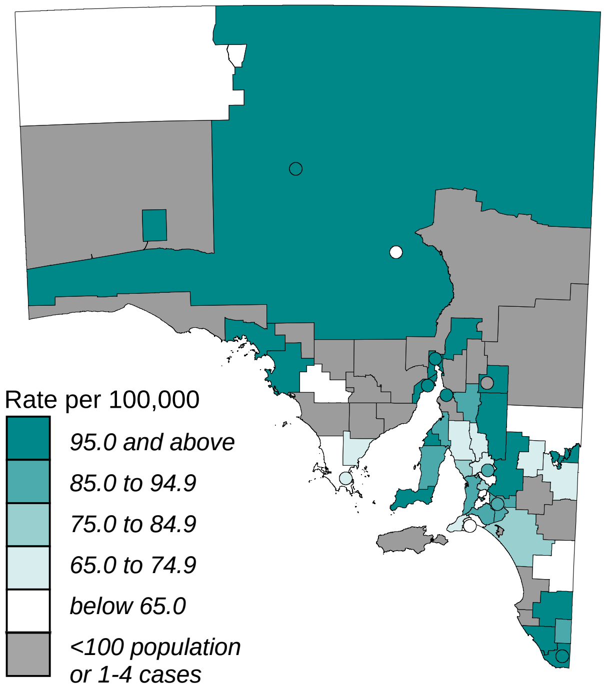
Map 27: Lung cancer incidence, males aged 20 years and over, non-metropolitan areas, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

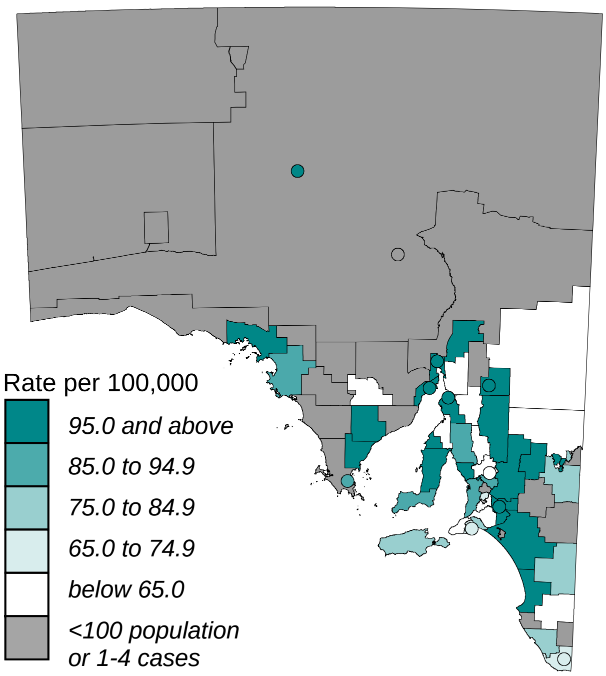
1986–1993



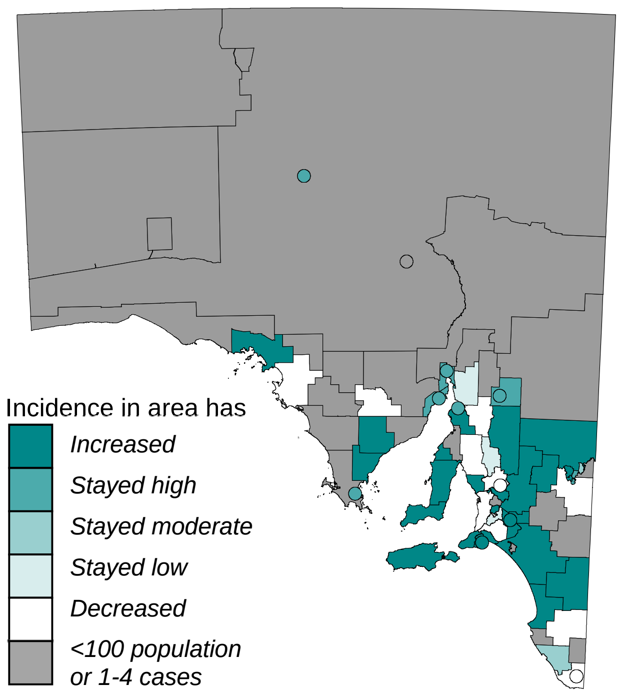
1998–2002



2003–2008



Change: 2003–2008 compared with 1986–1993



Source: Compiled in PHIDU using data supplied by SA Cancer Registry

In non-metropolitan South Australia, other than for the decline in incidence in Unincorporated Far North (the dark-shaded area which dominates the first two maps), change was more variable, with rates in some areas increasing, some declining and others remaining unchanged. The highest statistically significant rates were in Roxby Downs (244.7*, 4 cases), Whyalla (159.1**), Yorke Peninsula - North (126.4*) and Copper Coast (116.4*); and the lowest were in Lower Eyre Peninsula (29.2^, 3 cases), Adelaide Hills - North (31.5^, 4), Mount Barker Balance (33.8^, 5), Naracoorte and Lucindale (35.9^, 6), Angaston (36.5^, 7) and Clare and Gilbert Valleys (45.3^, 10). There was a very weak association at the SLA level between a high incidence of lung cancer among men and socioeconomic disadvantage (a correlation coefficient of -0.15).

Distribution by socioeconomic status and remoteness

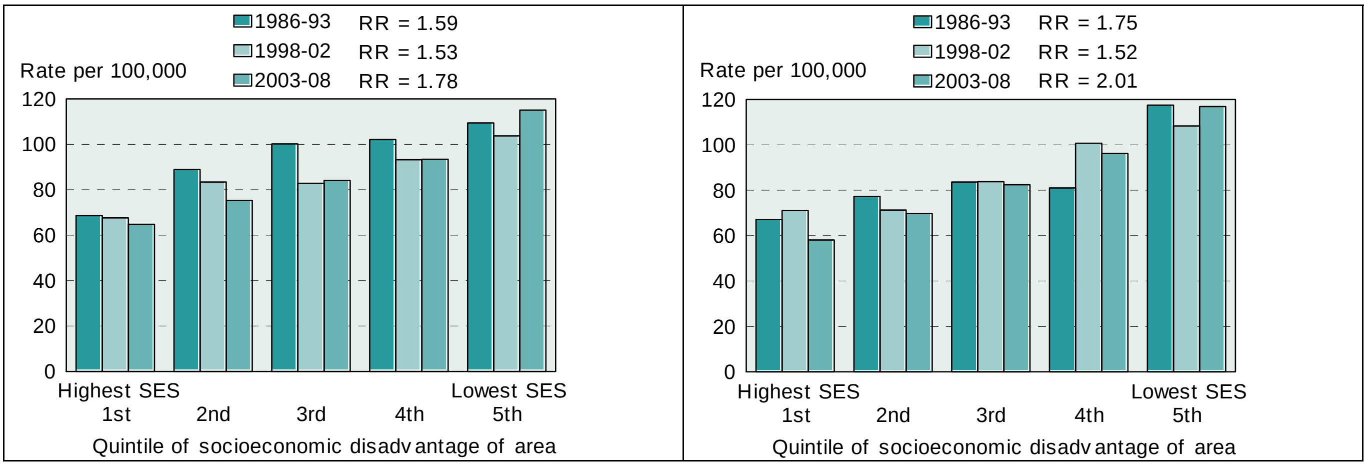
A pronounced socioeconomic gradient in lung cancer incidence for males is evident in both metropolitan and non-metropolitan areas, with the highest rates applying to the lowest socioeconomic categories. The charts also reflect the narrowing of the gap in incidence between residents of the non-metropolitan and metropolitan areas noted above.

In Metropolitan Adelaide, the growth in the gap in incidence between the most disadvantaged and least disadvantaged areas in 2003–2008 is largely the result of an increase in incidence in the most disadvantaged areas, with little contribution from the very small decline in the most advantaged areas. The movements in Quintiles 2, 3 and 4 are also of note, showing the major reduction achieved to 1998–2002 in each case, but only in Quintile 2 is there a further reduction to 2003–2008.

In the non-metropolitan areas, the greater gap in incidence between the most disadvantaged and least disadvantaged areas in 2003–2008 compared with 1986–1993 has occurred as a result of the reduction in incidence in the least disadvantaged areas. In these areas, men living in Quintile 2 areas have had the largest reduction in incidence, whereas in the Quintile 4 areas rates have increased.

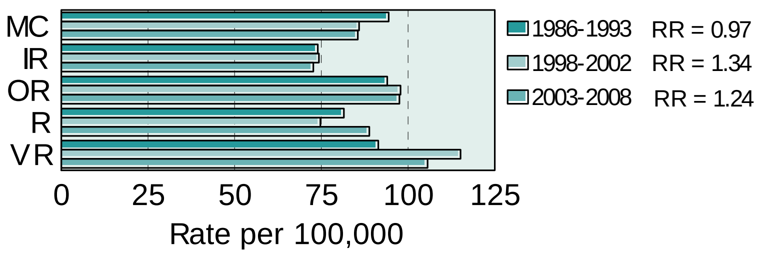
Figure 34: Lung cancer incidence, males aged 20 years and over, by socioeconomic status, 1986–1993, 1998–2002 and 2003–2008

Metropolitan Adelaide | **Non-metropolitan areas**



In 2003–2008, incidence varied inconsistently across the remoteness classes. The lowest rates are in the Inner Regional and Remote classes, with rates increasing steadily from the Major Cities to the Outer Regional and Very Remote classes, with an overall differential of 24%.

Figure 35: Lung cancer incidence, males aged 20 years and over, by remoteness, 1986–1993, 1998–2002 and 2003–2008



Lung cancer incidence, females, 1986 to 2008

Lung cancer has the third highest incidence of all cancers, and South Australian males have a higher overall rate of lung cancer, twice that of females.[46] In older age groups, the differences are even greater reflecting past smoking rates. The decline in lung cancer incidence in males following the reduction in smoking rates since the 1970s has not been observed for females. Other risk factors for lung cancer include exposures to substances such as asbestos, some industrial compounds and radiation; and possibly air pollution.[46]

Indicator definition: Females aged 20 years and over with new cases of lung cancer (both invasive and *in situ*) registered in this period, as an age-standardised rate per 100,000 female population at these ages.

The incidence of lung cancer among women in Metropolitan Adelaide has increased substantially (up by 48.1%) over this period, at a time when incidence rates for men have declined (down by 9.7%). The growth for women in the non-metropolitan areas (up by 83.9%) is even more substantial, from 27% below the metropolitan rate in 1986–1993, to just 10% below in 2003–2008. In both instances, the greater growth occurred between the first and second periods.

Table 19: Lung cancer incidence, females aged 20 years and over, 1986 to 2008

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
	Average annual rate per 100,000 men		
1986–1993	34.3	24.9	31.8
1998–2002	43.8	38.1	42.2
2003–2008	50.8	45.8	49.4
	Percentage change		
From first to second period	27.7	53.0	32.7
From second to third period	16.0	20.2	17.1
From first to third period	48.1	83.9	55.3

Incidence has increased in a majority of SLAs over the period from 1986–1993 to 2003–2008, moving up markedly in some, but by smaller amounts (from one mapped range to the next) in most; incidence has decreased in only a handful of areas.

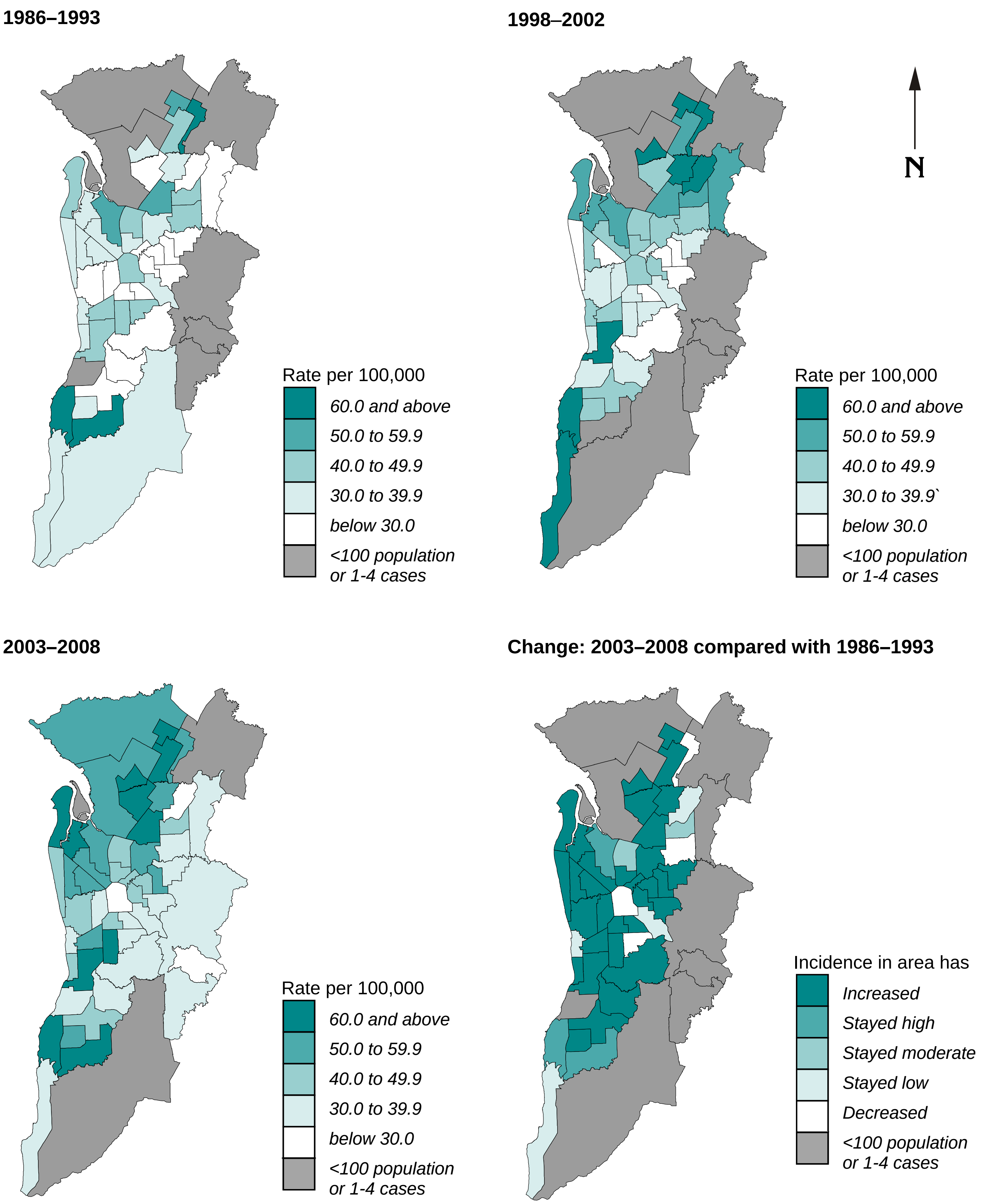
The map for 2003–2008 is highly consistent with the pattern of socioeconomic status across Adelaide, with high rates in many areas of socioeconomic disadvantage and low rates in areas of socioeconomic disadvantage; the correlation coefficient of -0.74, indicates a very strong association at the SLA level between high incidence of lung cancer among men and socioeconomic disadvantage.

Playford - West Central (130.2*) and - Elizabeth (76.4**) and Salisbury - Inner North (107.7**) and - Central (79.1**), in the outer north; Onkaparinga - Hackham (81.9*), in the outer south; Port Adelaide Enfield - Coast (72.5**), in the north-west; and Marion Central (67.3*), had the highest rates that were statistically significant. The rate in Playford - West Central and Salisbury - Inner North were over twice the level expected from the State rates for female populations of their size and age; the next three highest rates were elevated by over one third. The lowest incidence rates were in Onkaparinga - Hills (16.3^, 4 cases), Burnside - South-West (31.2^) and Tea Tree Gully - South (34.1^).

As might be expected, given the substantial increase in incidence, a majority of SLAs for which data were available (that is, for both the first and last periods) are shown in the 'Change' map as having higher incidence. Not only do these areas include a majority of Adelaide's most disadvantaged SLAs, they include SLAs with moderate to high IRSD scores, showing the widespread nature of this disease, the impact of which will be seen for many years to come.

Map 28: Lung cancer incidence, females aged 20 years and over, Adelaide, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

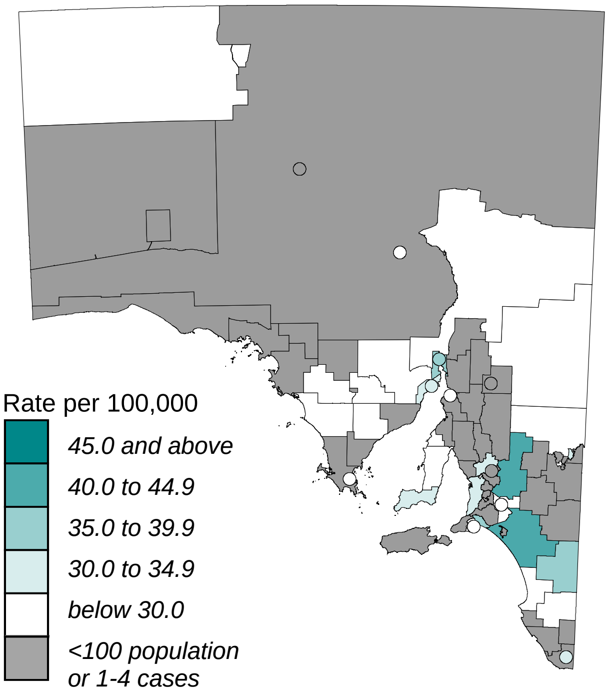


Source: Compiled in PHIDU using data supplied by SA Cancer Registry

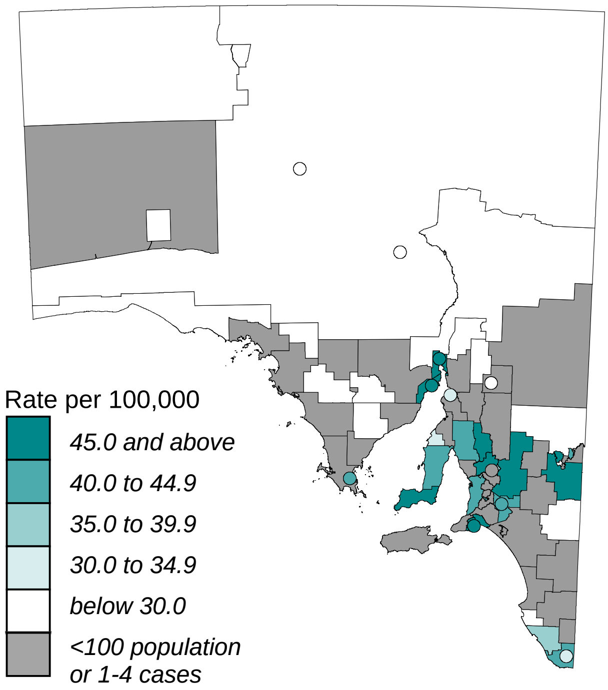
Map 29: Lung cancer incidence, females aged 20 years and over, non-metropolitan areas, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

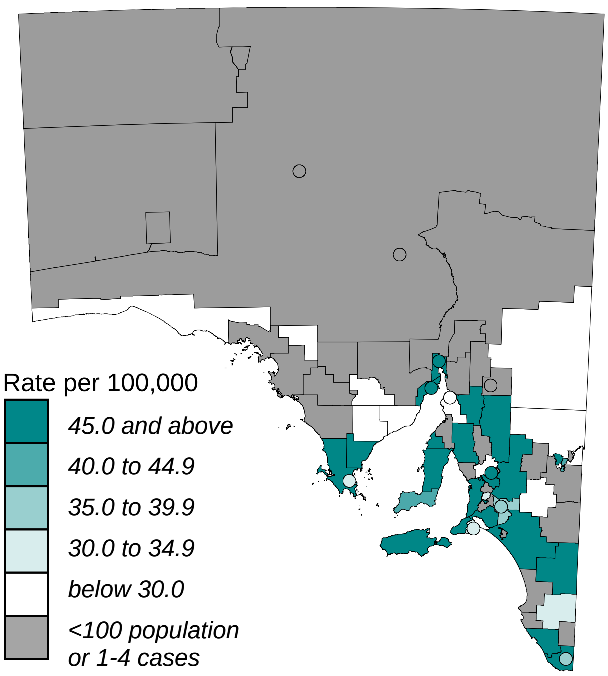
1986–1993



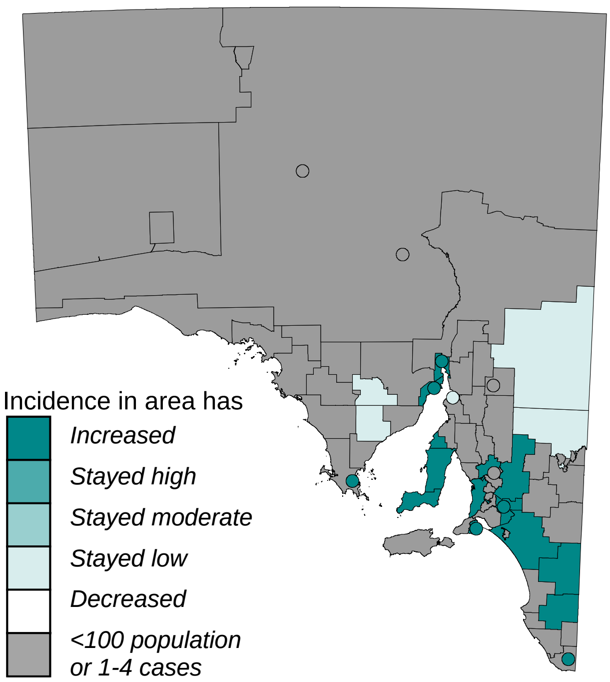
1998–2002



2003–2008



Change: 2003–2008 compared with 1986–1993



Source: Compiled in PHIDU using data supplied by SA Cancer Registry

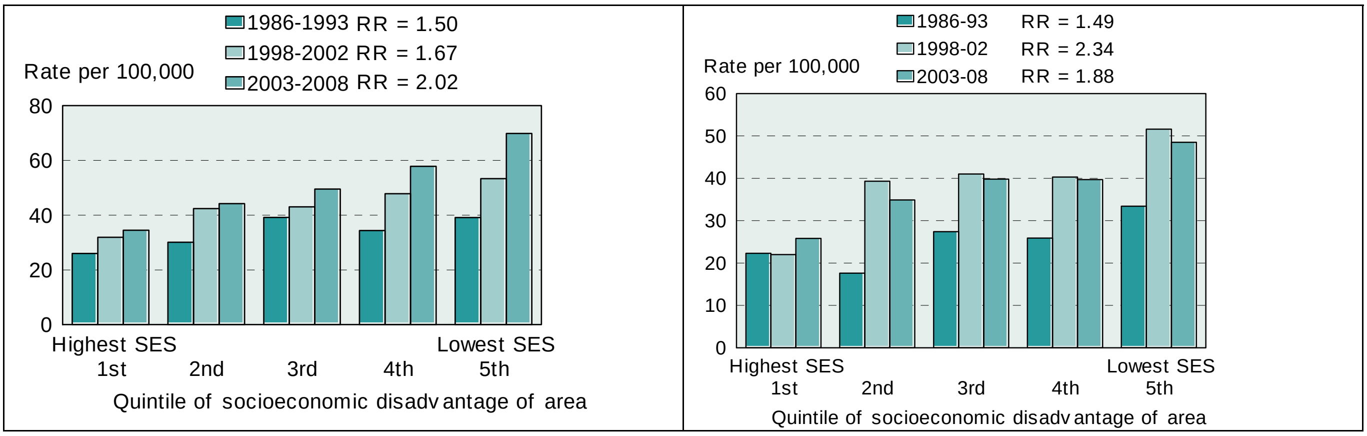
The greater growth in incidence between the first and second periods in non-metropolitan South Australia is evident in the maps, with fewer additional areas shaded in the map for 2003–2008. The highest statistically significant rates were in the regional centres of Port Augusta (102.8^^), Whyalla (100.5^^) and Barmera (93.0^). Only Angaston (10.2^, two cases) and Port Pirie (24.7^, nine cases) had statistically significantly low rates. The correlation analysis showed a very weak association at the SLA level between a high incidence of lung cancer among women and socioeconomic disadvantage (a correlation coefficient of -0.18).

Distribution by socioeconomic status and remoteness

Despite variations between the periods, there are strong socioeconomic gradients in rates of lung cancer incidence for women in both Metropolitan Adelaide and non-metropolitan areas in each period. Although the socioeconomic gradients are not as strong as those shown for men, they build almost uniformly, from 1986–1993 to 1998–2002, and then to 2003–2008 in Metropolitan Adelaide. In the non-metropolitan areas the impact of the greater increase between 1986–1993 and 1998–2002 is evident in all but Quintile 1.

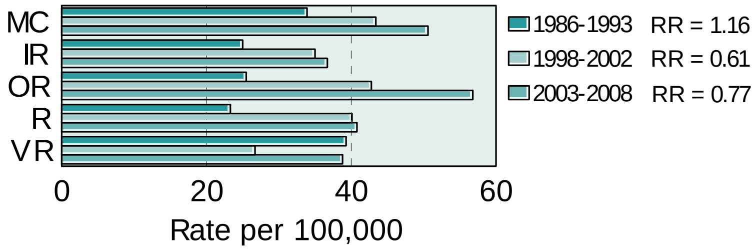
Figure 36: Lung cancer incidence, females aged 20 years and over, by socioeconomic status, 1986–1993, 1998–2002 and 2003–2008

Metropolitan Adelaide **Non-metropolitan areas**



There is no discernible pattern across the remoteness classes in the incidence of lung cancer among females in any of the three periods.

Figure 37: Lung cancer incidence, females aged 20 years and over, by remoteness, 1986–1993, 1998–2002 and 2003–2008



Melanomas of the skin, incidence in males, 1986 to 2008

Skin cancers are generally classified as either melanoma, or non-melanoma types. They account for 80% of all newly diagnosed cancers; and Australia has a very high skin cancer rate, with the melanoma incidence about 13 times the world average and the mortality rate more than five times the world average.[47] Lip cancer and non-melanoma skin cancers are more strongly linked to chronic ongoing excesses in sun exposure, as commonly associated with outdoor occupations and outdoor living, whereas melanomas are more frequently linked to irregular acute sun exposures, often commencing in childhood. Melanoma incidence rates in males increased by 10% over the period 1995-2005.[48] Melanoma mortality rates have been steady for males during that period. Incidence and mortality rates are high in South Australia compared with the rest of the world, and melanoma is the fourth most commonly diagnosed cancer in both males and females.[48]

Indicator definition: Males of all ages with new cases of melanomas of the skin registered in this period, as an age-standardised rate per 100,000 population.

Geographic distribution

The incidence of melanomas of the skin among males in Metropolitan Adelaide increased by 59.2% between the periods 1986–1993 to 1998–2002, then declined slightly (down by 4.1%) to 2003–2008. Rates in the non-metropolitan areas are lower in each period than in Metropolitan Adelaide and, although there have been increases (from the first to the second periods) and decreases (from the second to the third periods), these changes have been smaller than those in the metropolitan areas.

The similar incidence rates seen in males in the two most recent time periods followed earlier marked increases, and are likely to reflect the strenuous efforts of CC SA and other authorities to stem the these increases through the promotion of a range of sun protection initiatives.

Table 20: Incidence of melanomas, males, 1986 to 2008

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
		Average annual rate per 100,000 men	
1986–1993	33.3	30.1	32.3
1998–2002	53.0	46.4	51.0
2003–2008	50.8	45.3	49.1
		Percentage change	
From first to second period	59.2	54.2	57.9
From second to third period	-4.1	-2.4	-3.7
From first to third period	52.5	50.5	52.0

The impact of the increase noted above in the rate for Metropolitan Adelaide is clearly evident, at a spatial level, from a comparison of the maps for 1986–1993 and 1998–2002, with 21 of the 53 SLAs mapped recording rates above the metropolitan average over the later period. There were changes in the distribution of high rates in 2003–2008, although the overall pattern remains, with the highest rates largely in SLAs to the east, south and south-west of the city, as well as in a number of beachside SLAs.

The correlation analysis showed there to be a moderate correlation at the SLA level between high rates of these forms of skin cancer among males and high socioeconomic status (0.30).

Perhaps not surprisingly, the highest rates of these skin cancers among males are in the beachside SLAs of Holdfast Bay - South (103.9** males with skin cancer per 100,000 male population) and - North (81.8**); in nearby Marion North (71.2**) and West Torrens - West (64.9*); and in the outer south, in Onkaparinga Hills (69.3*) and Reservoir (68.8*).

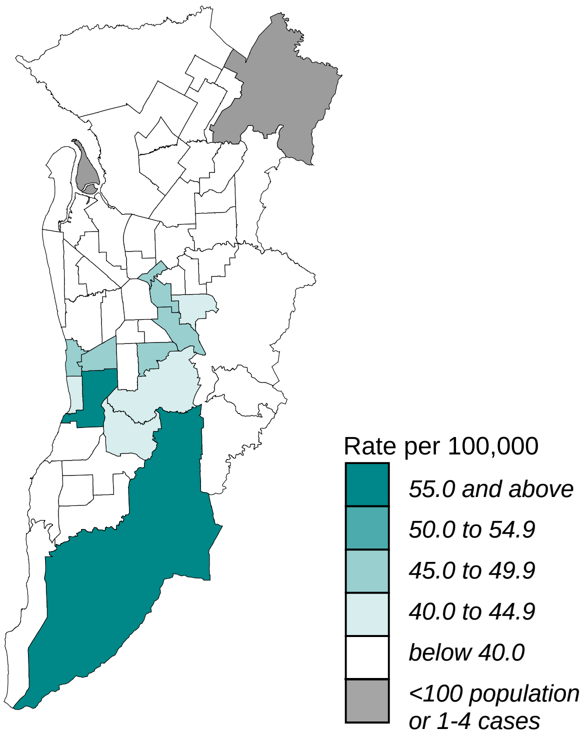
Of the many SLAs with below-average rates, only those in Charles Sturt - North-East (29.5^ males with skin cancer per 100,000 male population) and Playford - Elizabeth (31.6^) were statistically significant.

In the non-metropolitan areas, there was a weak correlation at the SLA level between high rates of these skin cancers among males and high socioeconomic status (0.19). Although many SLAs had rates above the average for the non-metropolitan areas, only those in Wattle Range - East (95.7*) and Port Lincoln (80.8*) were statistically significant; and, similarly, for rates below the average, with only Light (24.4^) and Murray Bridge (30.4^) having rates of statistical significance.

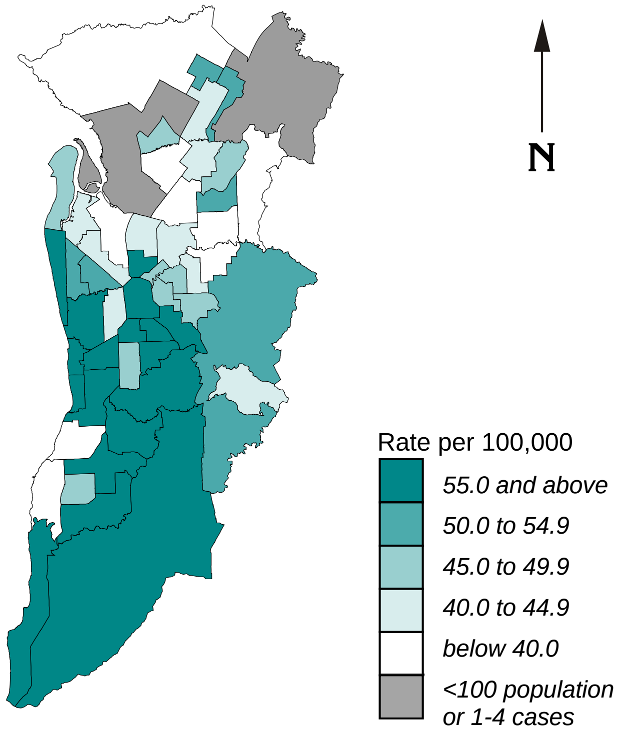
Map 30: Incidence of melanomas of the skin, males, Adelaide, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

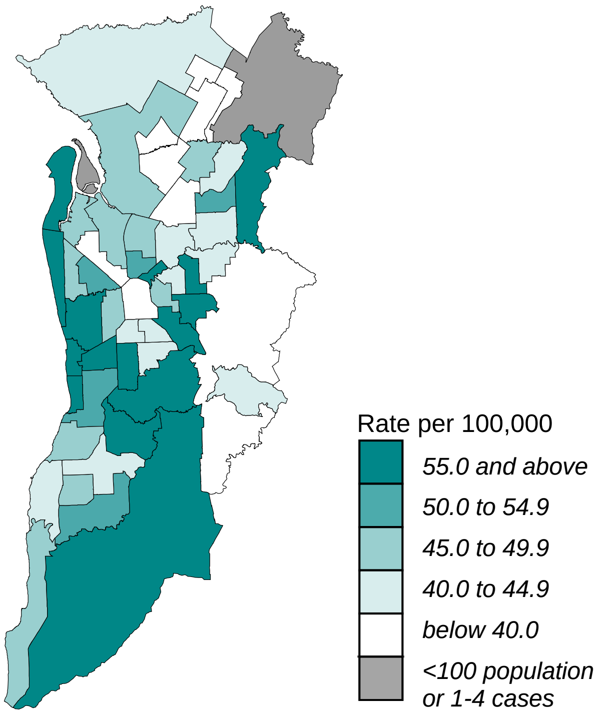
1986–1993



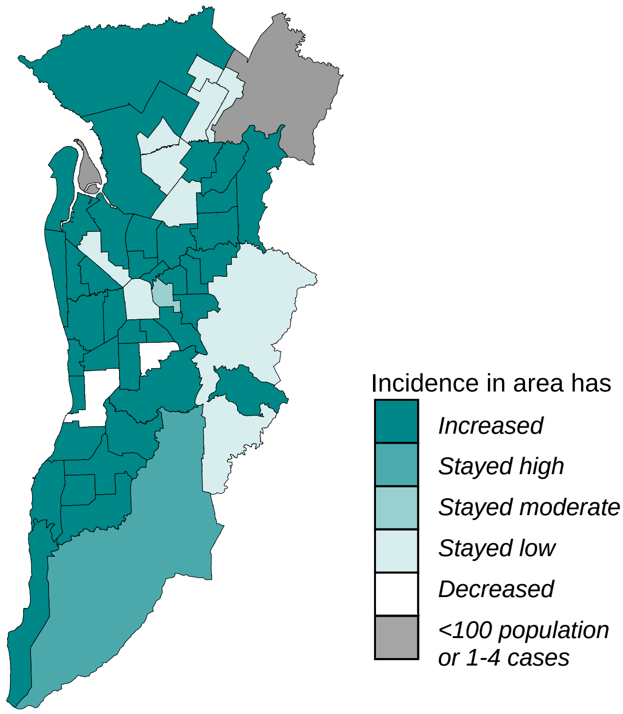
1998–2002



2003–2008



Change: 2003–2008 compared with 1986–1993

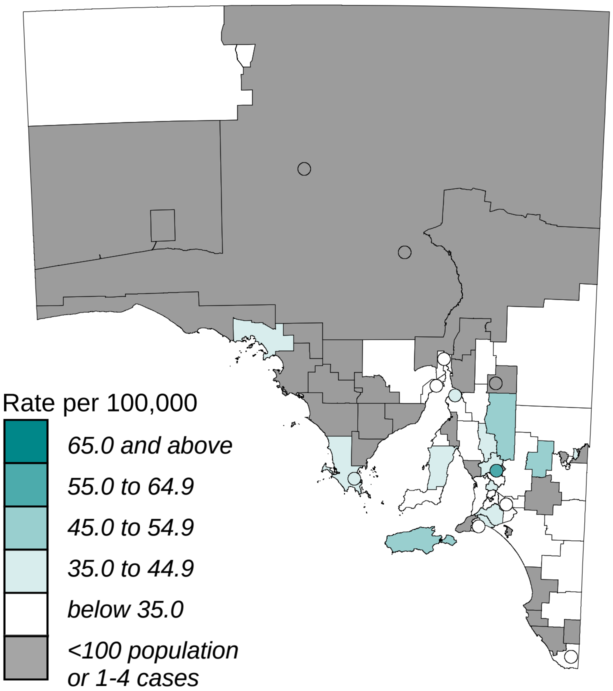


Source: Compiled in PHIDU using data supplied by SA Cancer Registry

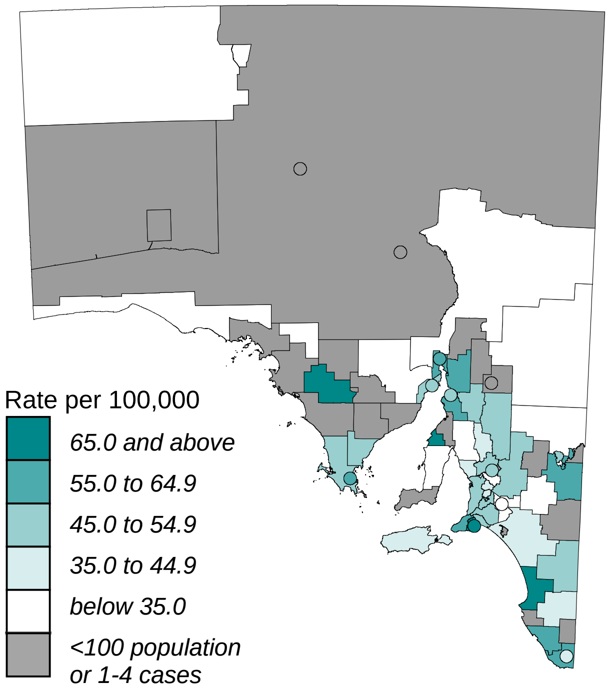
Map 31: Incidence of melanomas of the skin, males, non-metropolitan areas, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

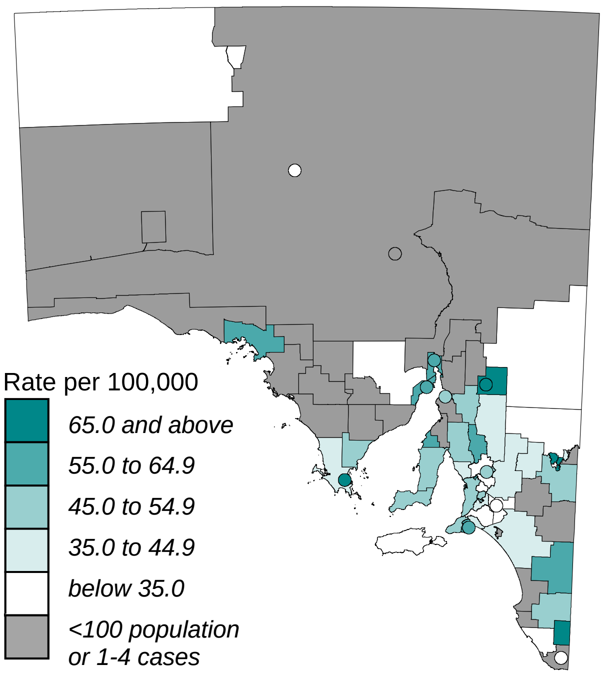
1986–1993



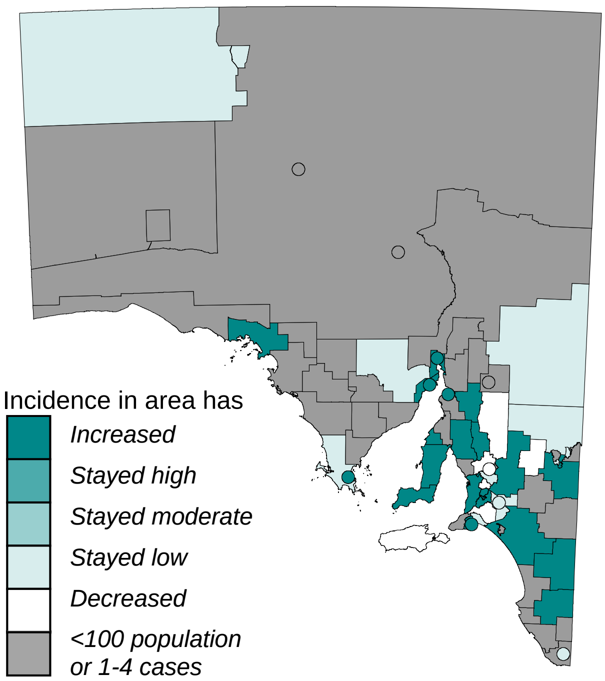
1998–2002



2003–2008



Change: 2003–2008 compared with 1986–1993



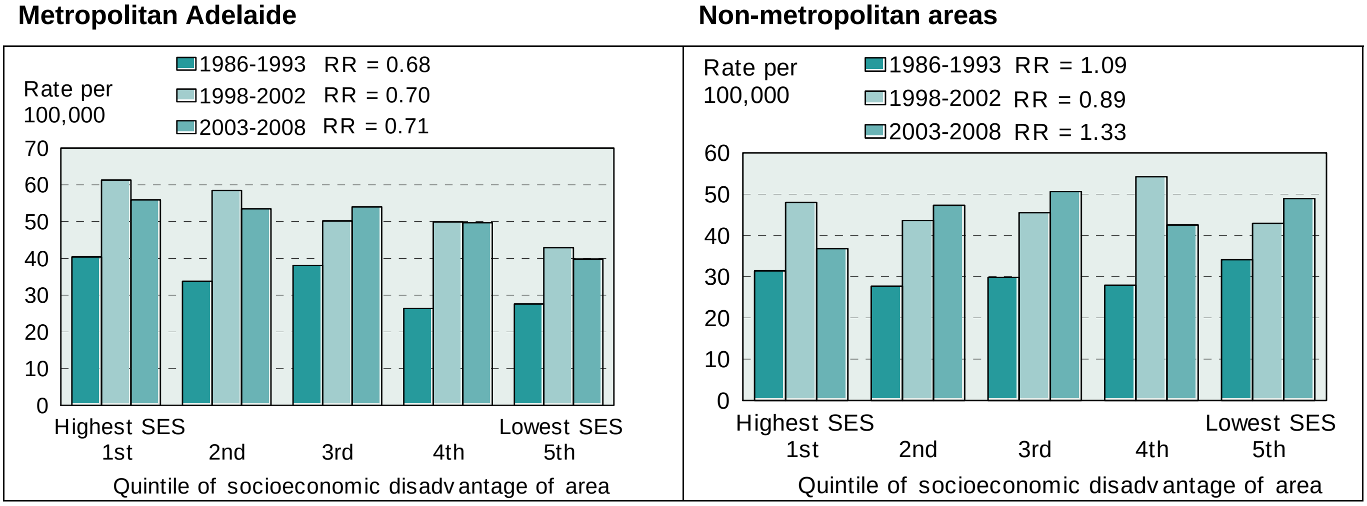
Source: Compiled in PHIDU using data supplied by SA Cancer Registry

Distribution by socioeconomic status and remoteness

There are large differentials in rates of melanomas in each of the three periods in Metropolitan Adelaide, with the highest rate in the highest socioeconomic status areas, and strong, continuous gradients in rates from the highest to the lowest socioeconomic status areas in both 1998–2002 and 2003–2008. The upper socioeconomic gradient of melanoma incidence in Metropolitan Adelaide is consistent with earlier observations and those in other parts of Australia. They are thought to reflect different patterns of sun exposure, with upper socioeconomic groups characterised more by intermittent acute extreme exposures from childhood, when compared with the more chronic ongoing exposure seen among lower socioeconomic groups. This pattern is not seen in non-metropolitan areas, potentially because of the more chronic exposures generally applying in country regions.

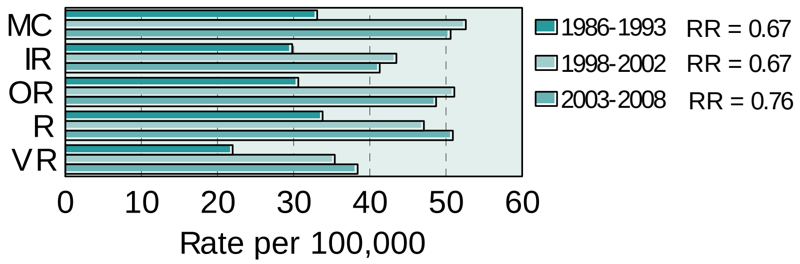
The distribution across the quintiles of socioeconomic disadvantage in the non-metropolitan areas is quite variable within each of the three periods graphed, although there is a marked differential in rates between the lowest and highest socioeconomic status areas in 2003–2008, with the highest rates in the most disadvantaged areas.

Figure 38: Melanoma incidence, males, by socioeconomic status, 1986–1993, 1998–2002 and 2003–2008



The incidence of melanoma among males forms a U-shaped curve over the first four remoteness classes (over three classes in 1998–2002), before the rate drops to the lowest level in the Very Remote areas.

Figure 39: Melanoma incidence, males, by remoteness, 1986–1993, 1998–2002 and 2003–2008



Melanomas of the skin, incidence in females, 1986 to 2008

Skin cancers are generally classified as either melanoma, or non-melanocytic types. They account for 80% of all newly diagnosed cancers; and Australia has a very high skin cancer rate, with the melanoma incidence about 13 times the world average and the mortality rate more than five times the world average.[47] Melanoma incidence rates in females decreased by 10% over the period 1995-2005.[48] Melanoma mortality rates have been steady for females during that period. Incidence and mortality rates are high in South Australia compared with the rest of the world, and melanoma is the fourth most commonly diagnosed cancer in both males and females.[48]

Indicator definition: Females of all ages with new cases of melanomas of the skin registered in this period, as an age-standardised rate per 100,000 population.

Geographic distribution

The incidence of melanomas of the skin among females in Metropolitan Adelaide increased by just over one third (34.9%) over the first two periods, from 1986–1993 to 1998–2002, then declined notably (down by 12.0%) to 2003–2008. The overall rates for females are around 70% of those for males, and the increase, to 1998–2002, was smaller, and the decrease, to 2003–2008, was larger than for males. Rates in the non-metropolitan areas are higher in each period than for females in Metropolitan Adelaide and, although there have been increases (from the first to the second periods) and decreases (from the second to the third periods), these changes have been smaller than those in the metropolitan areas.

As noted for males, the similar incidence rates seen in females in the two most recent time periods followed earlier marked increases and are likely to reflect the efforts of CCSA and other authorities to stem the these increases through the promotion of a range of sun protection initiatives.

Table 21: Melanoma incidence, females, 1986 to 2008

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
	Average annual rate per 100,000 women		
1986–1993	30.4	35.3	31.8
1998–2002	41.0	42.8	41.5
2003–2008	36.1	42.1	37.8
	Percentage change		
From first to second period	34.9	21.2	30.5
From second to third period	-12.0	-1.6	-8.9
From first to third period	18.8	19.3	18.9

At the SLA level, changes in the distribution of incidence rates for melanomas of the skin for females are most evident between 1986–1993 and 1998–2002, with relatively little change to the latest period. In 2003–2008 the highest rates were largely in SLAs to the east, south-east and south-west of the city, as well as in a number of beachside SLAs.

The correlation analysis showed there to be a moderate correlation at the SLA level between high rates of these forms of skin cancer among males and high socioeconomic status (0.33).

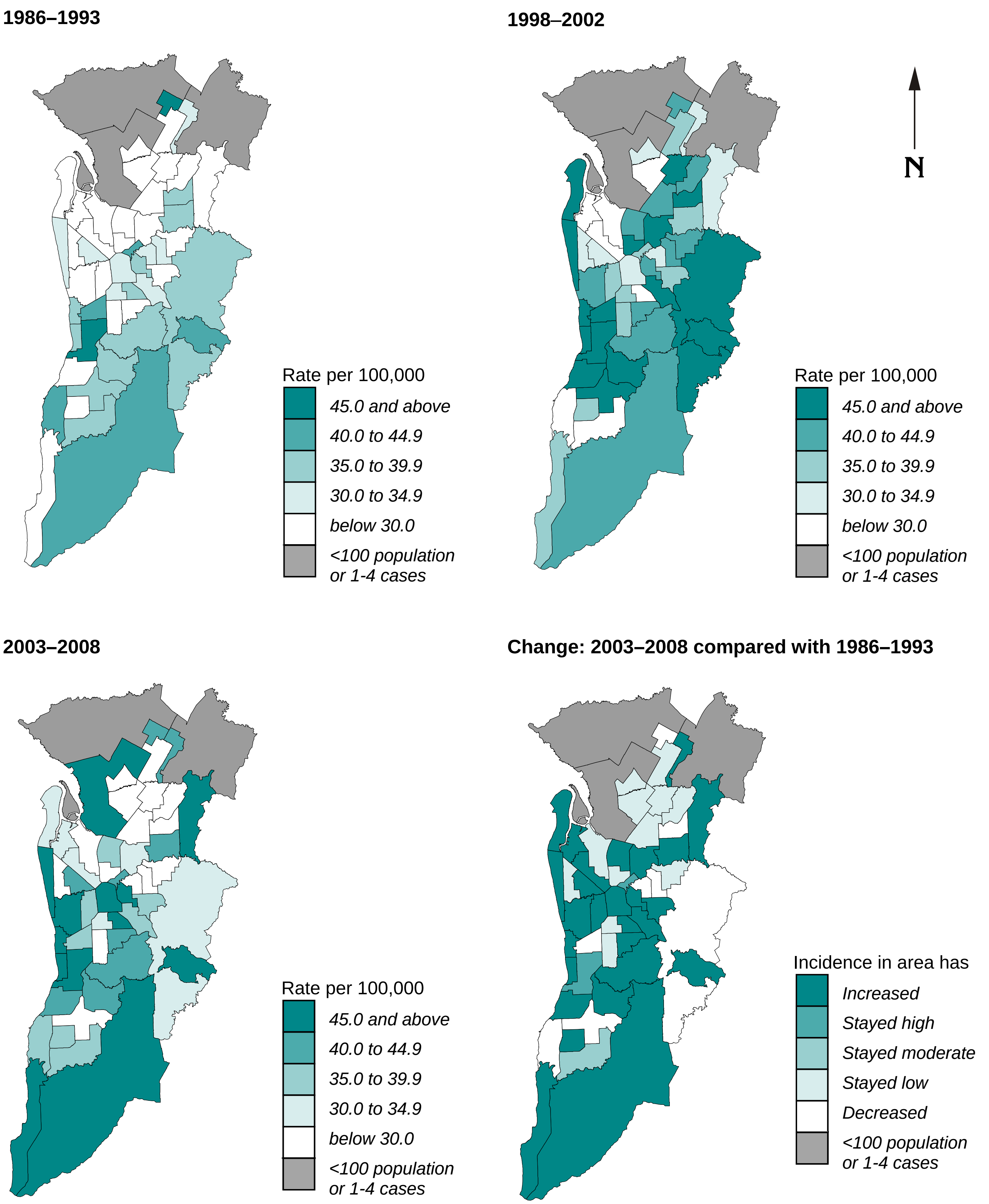
Of the several SLAs with elevated rates, only those in Charles Sturt - Coastal (58.7** females with skin cancer per 100,000 female population) and Holdfast Bay - North (54.6**) were statistically significant.

Of the many SLAs with below-average rates, those with 10 or more females and rates that were statistically significantly low were Norwood Payneham St. Peters - East (19.8^ females with skin cancer per 100,000 female population, 12 females), Tea Tree Gully - Central (22.4^, 16), Playford - Elizabeth (23.3^, 18 females), Salisbury - South-East (25.1^, 26) and Onkaparinga - Woodcroft (25.1^, 24).

In the non-metropolitan areas, there was no association at the SLA level between high rates of these skin cancers among females and high socioeconomic status. Only the SLAs of Cleve (107.0**, six females), Kangaroo Island (84.4**, 11 females), Tanunda (70.1*, 11 females), Yorke Peninsula North (62.3*, 17) and Copper Coast 59.6*, 25), had high rates of statistical significance. None of the low rates were of statistical significance.

Map 32: Incidence of melanomas of the skin, females, Adelaide, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

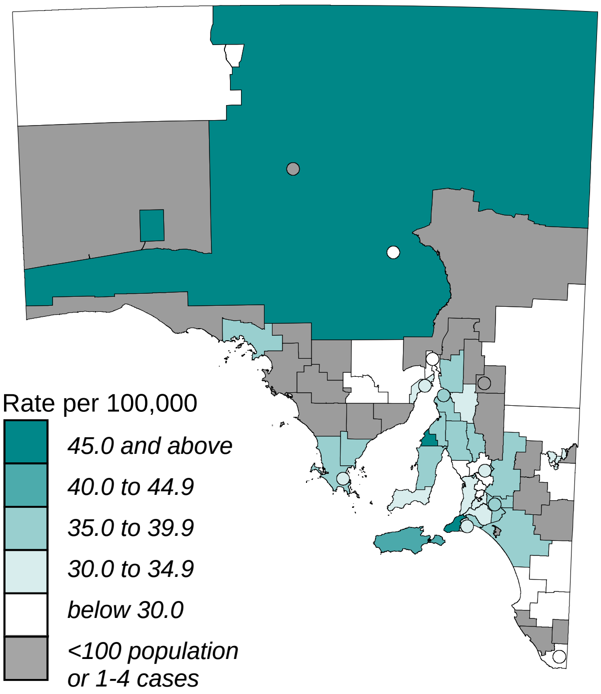


Source: Compiled in PHIDU using data supplied by SA Cancer Registry

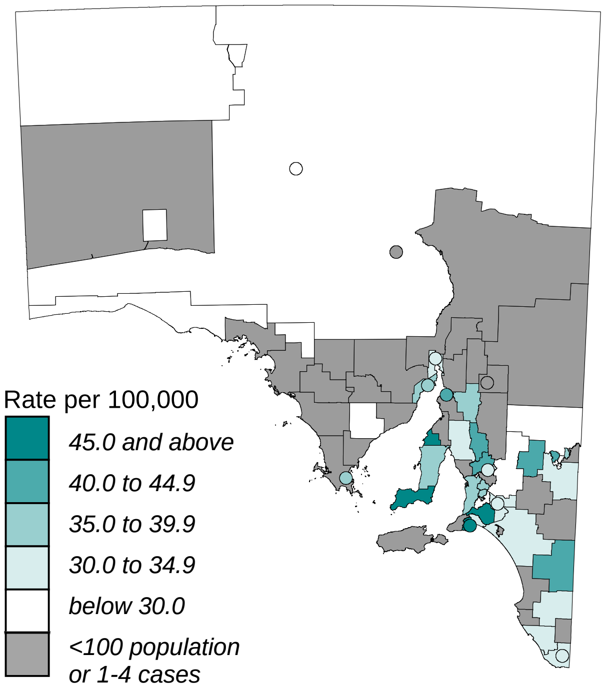
Map 33: Incidence of melanomas of the skin, females, non-metropolitan areas, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

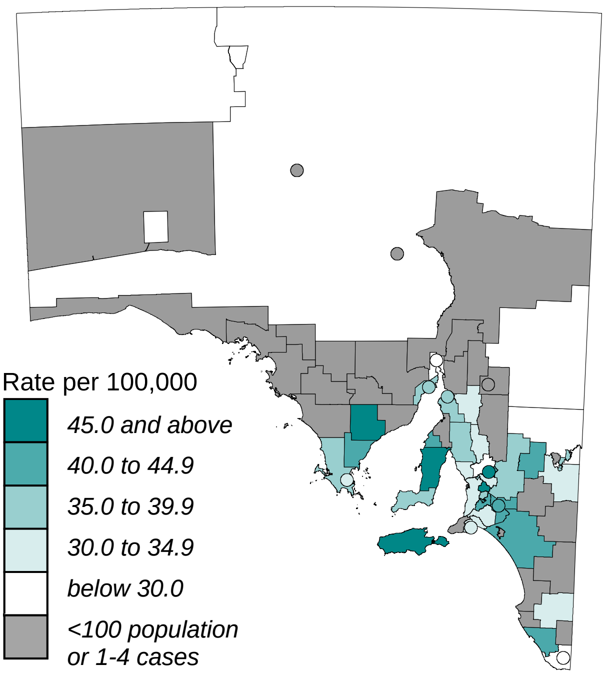
1986–1993



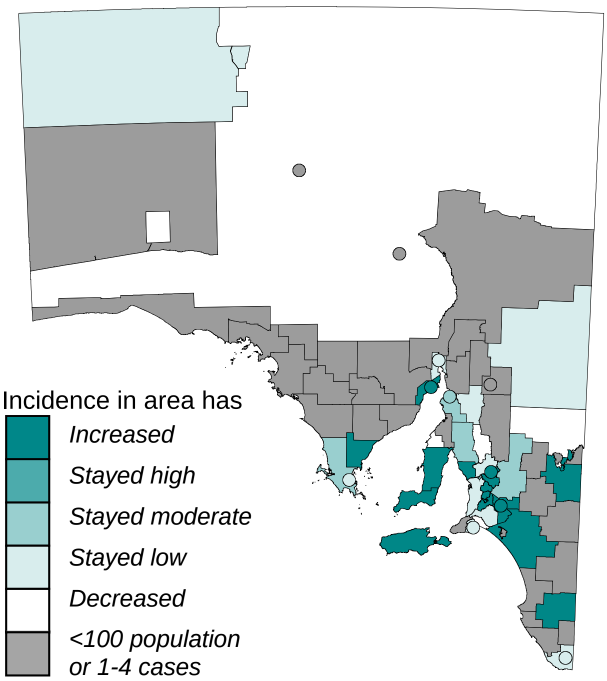
1998–2002



2003–2008



Change: 2003–2008 compared with 1986–1993



Source: Compiled in PHIDU using data supplied by SA Cancer Registry

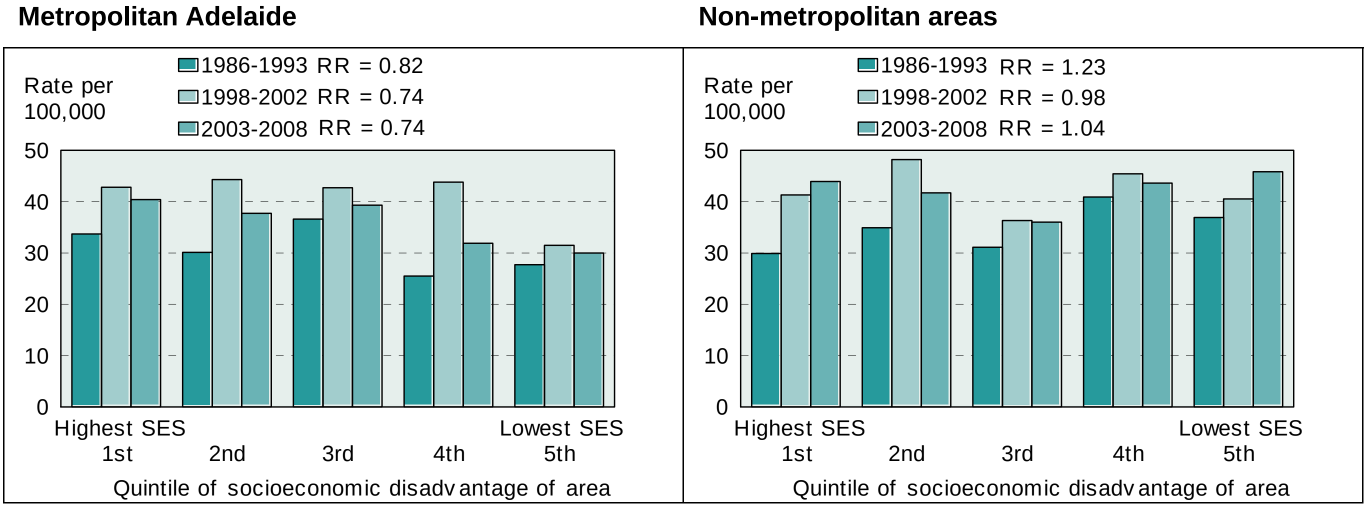
Distribution by socioeconomic status and remoteness

As seen for males, there are large differentials in rates for females between the lowest and highest socioeconomic status areas in each of the three periods in Metropolitan Adelaide, and strong, continuous socioeconomic gradients in both 1998–2002 and 2003–2008. The distribution across the quintiles of socioeconomic disadvantage in the non-metropolitan areas is quite variable, although there is a marked differential in rates between the lowest and highest socioeconomic status areas in 1986–1993.

Although the distribution across the quintiles of socioeconomic disadvantage in Metropolitan Adelaide is quite variable within each of the three periods graphed, there are large differentials in rates in each of the three periods, with the highest rates in the highest socioeconomic status areas. The upper socioeconomic gradient of melanoma incidence in Metropolitan Adelaide is consistent with earlier observations and those in other parts of Australia. They are thought to reflect different patterns of sun exposure, with upper socioeconomic groups characterized more by intermittent acute extreme exposures from childhood when compared with the more chronic ongoing exposure seen among lower socioeconomic groups. This pattern is not seen in non-metropolitan areas, potentially because of the more chronic exposures generally applying in country regions.

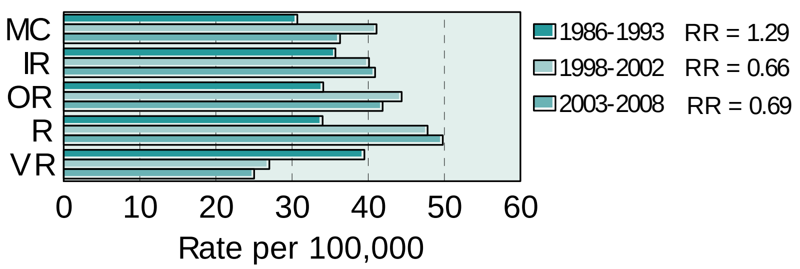
The distribution across the quintiles in the non-metropolitan areas is variable within each of the three periods graphed, although the differential in rates between the lowest and highest socioeconomic status areas is more stable, and very small, over the second and third periods.

Figure 40: Melanoma incidence, females, by socioeconomic status, 1986–1993, 1998–2002 and 2003–2008



In 1986–1993, the incidence of melanoma generally increased with increasing remoteness. In the other two periods graphed, rates increased from the Major Cities areas to the Remote areas (with the highest rate), before dropping sharply (to the lowest rate) in the Very Remote areas.

Figure 41: Melanoma incidence, females, by remoteness, 1986–1993, 1998–2002 and 2003–2008



Prostate cancer incidence, 1986 to 2008

Prostate cancer is infrequently diagnosed in men aged less than 50 years. From 50 years of age onwards, prostate cancer incidence increases steadily and is highest in men aged 80 years and over.[49] The incidence of prostate cancer during 1977–2001 was highest in residents of high socioeconomic areas of South Australia, but the gradient was not consistent across socioeconomic categories.[50] Survival outcomes for men diagnosed with prostate cancer are very favourable with 87% of men diagnosed between 1997 and 2003 surviving for five years or more. Survival rates have improved substantially (from 58% for men diagnosed between 1977 and 1981 surviving five years or more). Increased survival is likely to reflect higher proportions of men being diagnosed with an earlier stage of disease.[49] Causes of prostate cancer are unknown, although diets high in fat, red meat and milk, and low in vegetables have been linked to an increased risk in some studies. Elevated risks have also been observed to correlate with high alcohol intake and occupational exposures to cadmium and rubber.[49]

Indicator definition: Males aged 50 years and over with new cases of prostate cancer (both invasive and *in situ*) registered in this period, as an age-standardised rate per 100,000 male population at these ages.

Geographic distribution

Incidence increased by over 70% in both Metropolitan Adelaide and the non-metropolitan areas of the State over the period of data analysed, with just over half of the increase occurring between the first and second periods. In comparison, the increase for all cancers was just over 50%. Incidence in non-metropolitan South Australia is slightly higher than in Metropolitan Adelaide, being 0.3% higher in 1986–1993 and 0.5% higher in 1998–2002, increasing to 3.4% higher in 2003–2008.

The detected incidence of prostate cancer has, perhaps more than any other cancer, been impacted on by a growing awareness in the community of this cancer, in part as a result of discussion in the general media, leading to more men seeking screening. The increase also correlates strongly with an increased use of prostate-specific antigen tests in screening for prostate cancer.[17] The lack of clear evidence for treatment, versus no treatment, or for a generally accepted pathway once treatment is decided upon, is also a factor influencing the extent to which men seek screening. This should be borne in mind when looking at incidence over time at a geographic level, in particular at the SLA level, or by the socioeconomic status or remoteness groupings of areas.

It is of note that, despite this substantial increase in incidence, the number of deaths from prostate cancer varied little over the period 2001 (262 deaths) to 2010 (263 deaths), with an average of 253 deaths per year.

Table 22: Prostate cancer incidence, males aged 50 years and over, 1986 to 2008

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
	Average annual rate per 100,000		
1986–1993	341.7	342.6	341.9
1998–2002	470.6	473.0	471.3
2003–2008	582.1	602.0	588.4
	Percentage change		
From first to second period	37.7	38.1	37.8
From second to third period	23.7	27.3	24.8
From first to third period	70.4	75.7	72.1

The change in distribution of incidence of prostate cancer at the SLA level within Metropolitan Adelaide is striking. Whereas there was just one SLA mapped in the top range of 550 or more males per 100,000 male population in 1986–1993, by 2003–2008 some 33 of the 51 SLAs had this level of incidence. Despite this, the only elevated rates of statistical significance were in Mitcham - Hills (786.5**) and West Torrens - West (691.9*). The correlation analysis shows there to be a strong association at the SLA level between high rates of prostate cancer incidence identified in Metropolitan Adelaide and socioeconomic advantage (a correlation coefficient of 0.50).

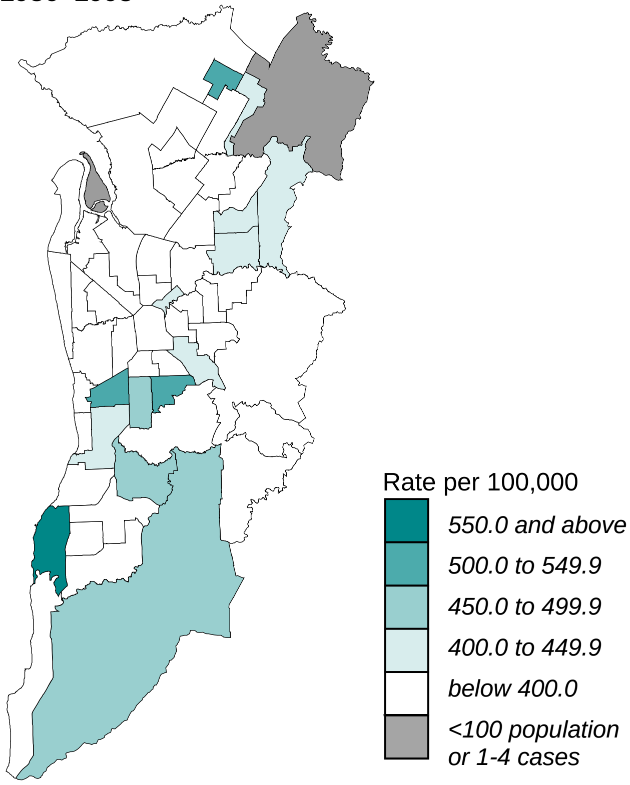
The 'Change' map shows that all but two areas had increased incidence over this 14 to 15 year period, and in both those areas incidence remained high.

The number of non-metropolitan areas reporting high rates of incidence of prostate cancer increased steadily over the three periods shown. In 2003–2008, several areas had rates of 20% or more above the

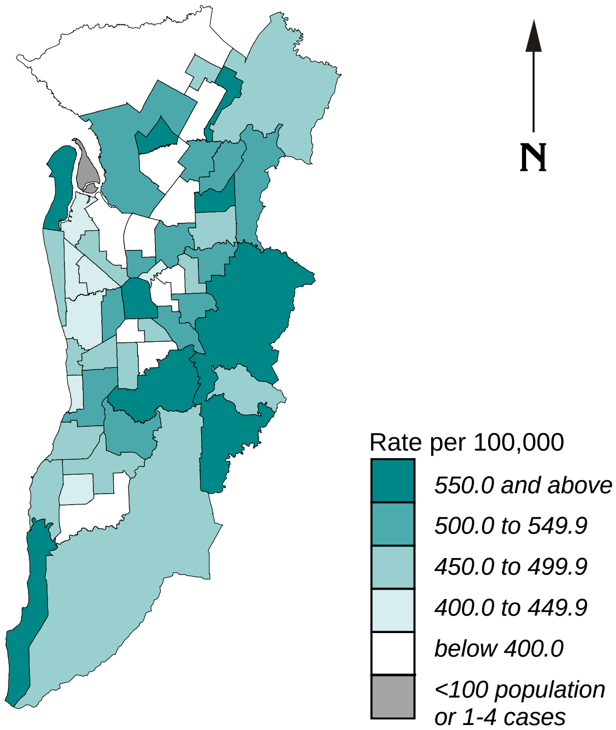
Map 34: Prostate cancer incidence, males aged 50 years and over, Adelaide, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

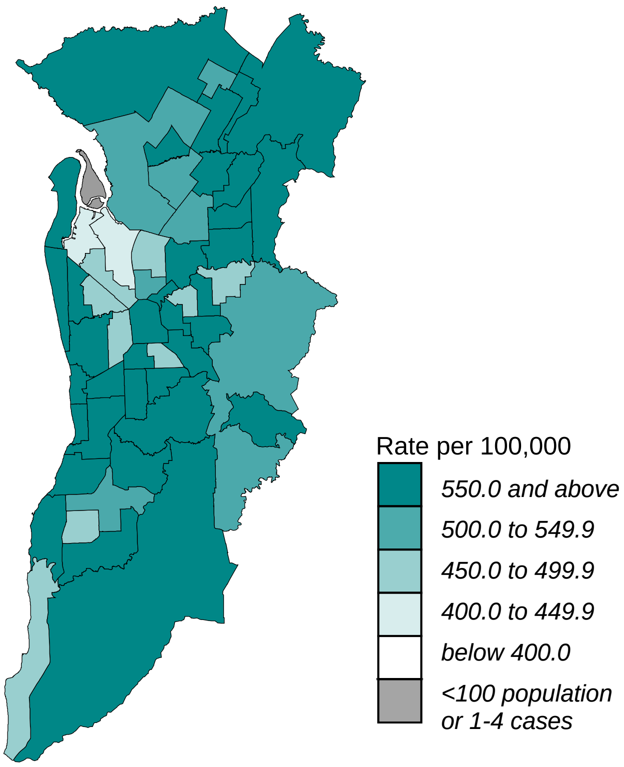
1986–1993



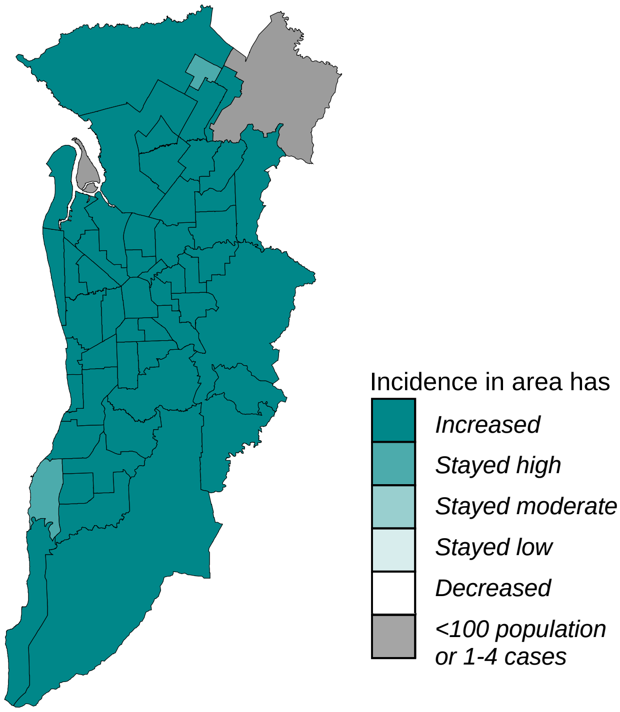
1998–2002



2003–2008



Change: 2003–2008 compared with 1986–1993

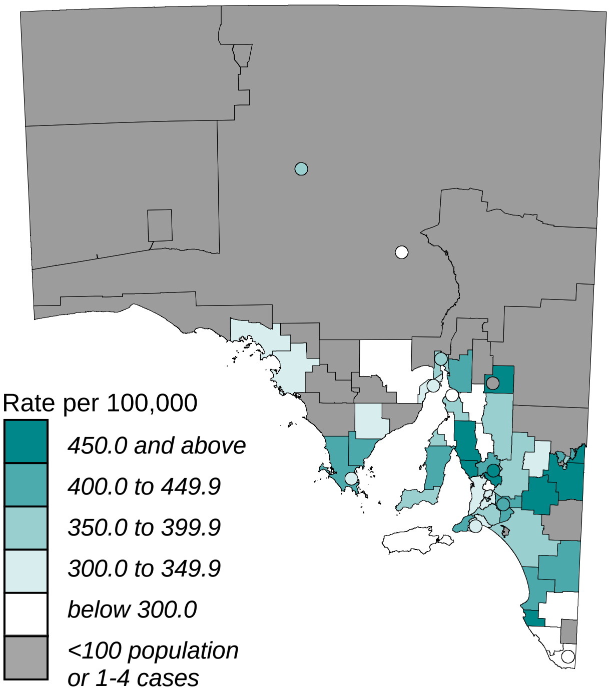


Source: Compiled in PHIDU using data supplied by SA Cancer Registry

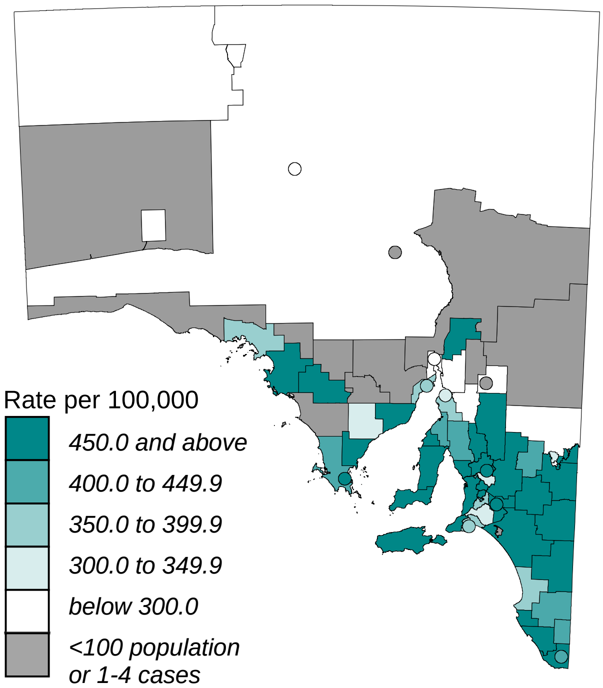
Map 35: Prostate cancer incidence, males aged 50 years and over, non-metropolitan areas, 1986–1993, 1998–2002 and 2003–2008

ASR per 100,000 by Statistical Local Area

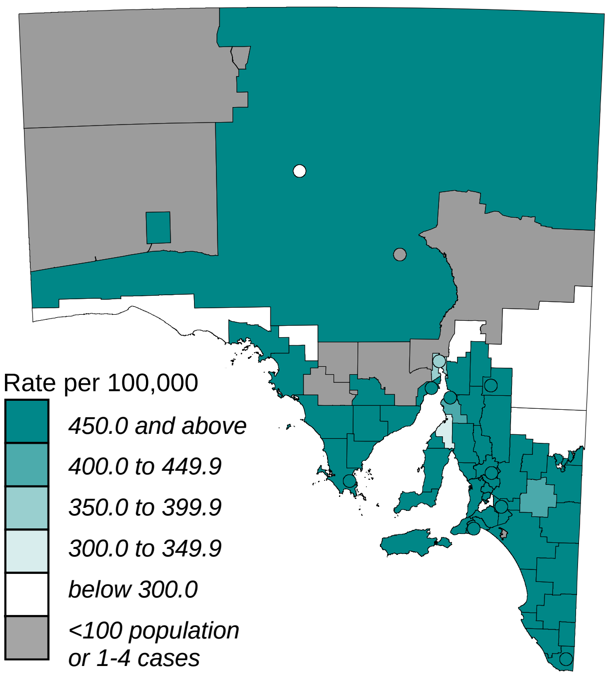
1986–1993



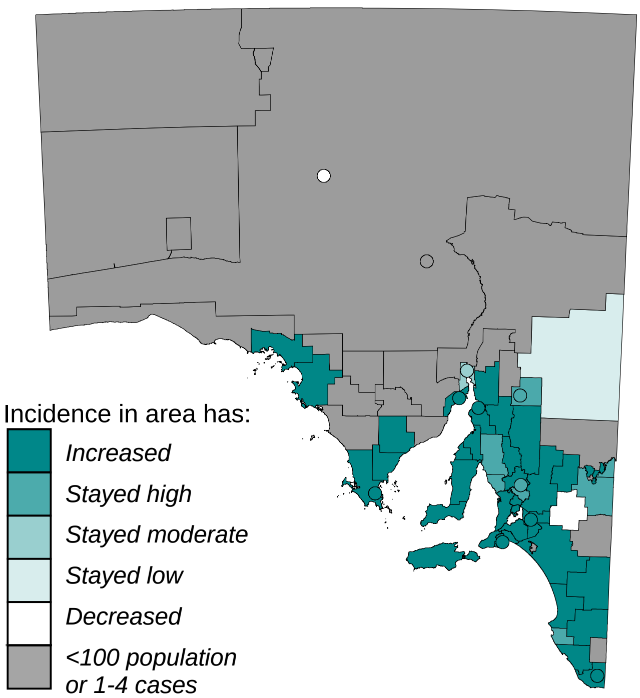
1998–2002



2003–2008



Change: 2003–2008 compared with 1986–1993



Source: Compiled in PHIDU using data supplied by SA Cancer Registry

level expected from the State rate that were statistically significant; they were Renmark Paringa - Paringa (999.0*, with 19 cases) and - Renmark (793.3*, 62), Franklin Harbour (989.6*, 16),Loxton Waikerie - West (816.1*, 42) and - East (791.4*, 61), Victor Harbor (767.4*, 172) and Whyalla (710.1*, 138). There was a weak association at the SLA level in the non-metropolitan of the State between high rates of prostate cancer incidence and socioeconomic advantage (a correlation coefficient of 0.32).

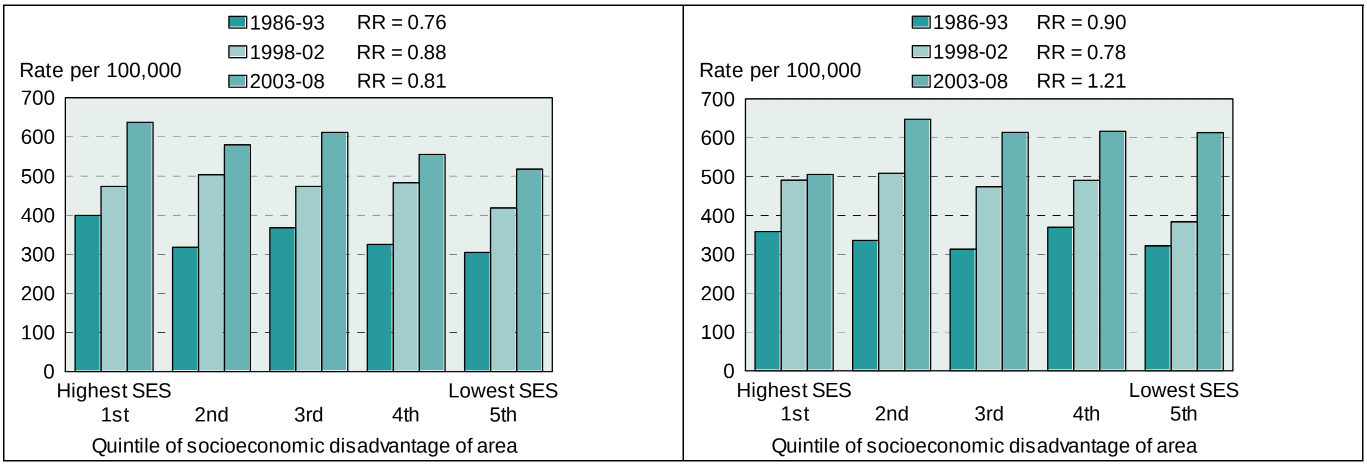
The 'Change' map shows that incidence decreased in very few areas.

Distribution by socioeconomic status

Prostate cancer incidence rates for men aged 50 years and over increased across time periods in all socioeconomic quintiles, both in metropolitan and non-metropolitan areas. Although rates did not differ in a consistent manner between socioeconomic quintiles, there was a tendency for rates to be lower in the lowest quintile. It is thought that lower rates of PSA testing (prostate specific antigen testing) would have contributed to a lower detection rate in these areas. Also, this is thought to underlie lower incidence rates in very remote areas, although it is also thought that higher numbers of Aboriginal residents in these areas also would have led to lower rates (see below).

Figure 42: Prostate cancer incidence, males aged 50 years and over, by socioeconomic status, 1986–1993, 1998–2002 and 2003–2008

Metropolitan Adelaide **Non-metropolitan areas**

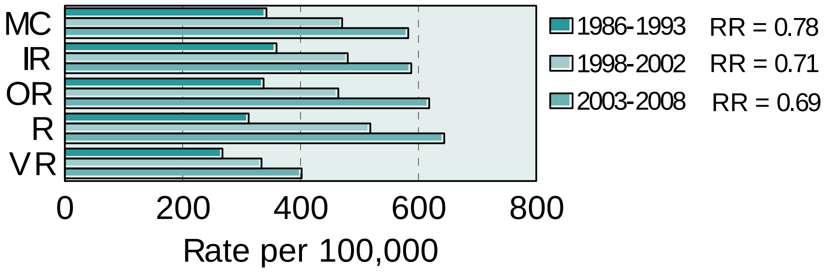


Distribution by remoteness

In 2003–2008, rates increase across the first three remoteness classes, before declining sharply among men in the Very Remote areas. The pattern over 1998–2002 is similar, and only in the earliest period do rates decline more consistently with increasing remoteness. Although the Very Remote areas have the lowest rate in each period, the increase in incidence in this class is the lowest of any in the remoteness classification; up by 50.2%, compared with increases of 63.7% in Inner Regional, 70.3% in Major Cities, 83.3% in Outer Regional and 106.4% in the Remote areas.

However, it is timely to recall the earlier comment that Aboriginal people, who comprise a substantial proportion of the population in the Very Remote areas, move between those areas and the larger towns, many of which fall in the Remote category, as well as to Adelaide (in the Major Cities class). This may lead to some misclassification by remoteness, inflating the rates in these less remote areas and reducing the size of the remoteness differential. The relatively low incidence rate in the Very Remote areas may also be a result of a lack of access to the services necessary for the identification of this cancer.

Figure 43: Prostate cancer incidence, males aged 50 years and over, by remoteness



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Incidence of cancers, by age and sex, 1986–1993 to 2003–2008

All cancers

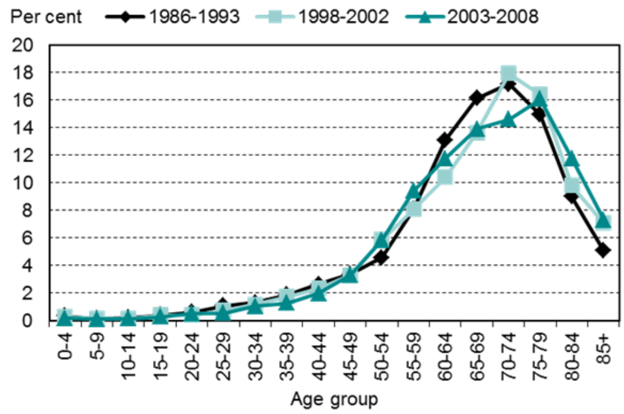
The following graphs describe the age profile of those with cancers of various types over each of the three periods 1986–2003, 1998–2002 and 2003–2008. The graphs are based on the number of people at each age, as a proportion of people of all ages, with cancer; as such, they do not show the growth or decline in overall incidence over time, but are intended to highlight changes in the burden of cancer by age.

The number of males with all cancers was highest in the 70 to 74 year age group in both 1986–1993 (17.2%) and 1998–2002 (17.9%) (Graph a). However, in 2003–2008, the highest proportion occurred in the 75 to 79 year age group, and was lower, at 16.1%. The trend for the two later time periods shows a reversal from the early period, moving to lower proportions for the 60 to 64 and 65 to 69 year age groups (including the 70 to 74 year age group for the latest time period) and, conversely, higher proportions for the 75 to 79 year and onwards age groups. Overall, this demonstrates a general shift in the incidence of all male cancers across the age groups, with a movement towards a higher representation within older age groups, over time.

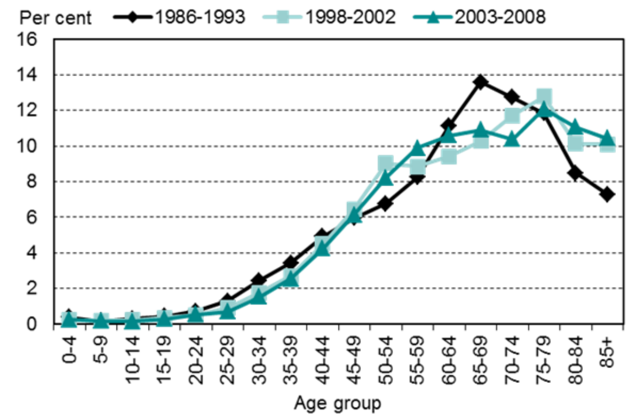
The pattern of cancer incidence by age group over time for females has some similarities to that of males, but with the peak (13.6%) occurring in the 65 to 69 year age group (a little younger) in 1986–1993, and moving to the 75 to 79 year age group in both 1998–2002 and 2003–2008 (with respective proportions of 12.8% and 12.1) (Graph b). However, the increase across the age groups for females commences at younger ages, with higher proportions in the majority of the younger age groups than for males, likely as a result of the impact of breast cancer for females occurring at a younger age compared to prostate cancer for males. Compared to the earliest period, in the two later time periods there are higher proportions of females with cancer in the 50 to 54 and 55 to 59 year age groups, much lower proportions in the 60 to 64, 65 to 69 and 70 to 74 year age groups, and, again, much higher proportions in the 80 to 84 year and 85 years and over age groups.

Figure 44: Incidence of all cancers, by age and sex, 1986–1993, 1998–2002 and 2003–2008

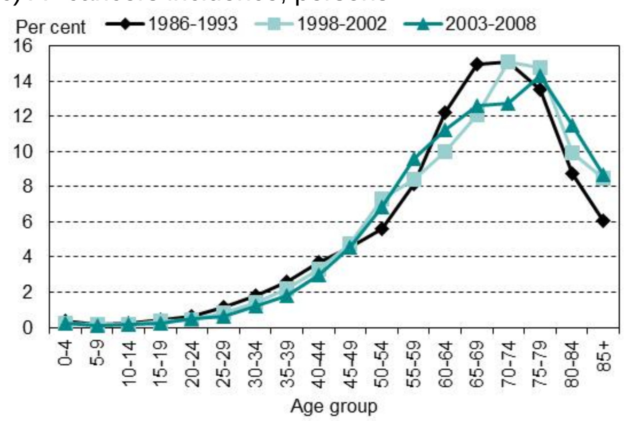
a) All cancers incidence, males



b) All cancers incidence, females



c) All cancers incidence, persons



The combined male and female graph of all cancers incidence shows the highest proportions (15.0% and 15.1%) in 1986–1993 occurred in the 65 to 69 and 70 to 74 year age groups, respectively (Graph c, above). In the 1998–2002 period, the highest proportions (15.1% and 14.8%) had shifted to the 70 to 74 and 75 to 79 year age groups, with the peak (of 14.3%) shifting, again, to the 75 to 79 year age group in the 2003–2008 period. The overall pattern of cancer incidence across the younger and older age groups for persons appears more similar to the male picture, although the increased incidence in the 80 to 84 year and 85 years and over age groups reflects the additional impact of the change in the age of female cancer incidence over time.

Selected cancers

Graph a in the figure below shows the marked change in the distribution of female breast cancer incidence by age group that has occurred over time. In 1986–1993, breast cancer incidence was highest (13.1%) in the 65 to 69 year age group, whilst in 1998–2002 the graph shows a peak (of 14.8%) in proportional incidence in the younger, 50 to 54 year, age group. This pattern is not repeated in the following period, with the graph showing a flattening effect over several age groups, with similar proportions in the 50 to 54, 55 to 59 and 60 to 64 year age groups (12.9%, 13.5% and 13.6%, respectively). Overall, the two later periods show a similar pattern across the majority of age groups compared to the earliest period, with lower proportions across the youngest age groups presented (the 30 to 34 through to 40 to 44 year age groups, extending to 45 to 49 years for the latest period), much higher proportions in the 50 to 54 and 55 to 59 year age groups (extending to the 60 to 64 year age group for the latest period), and lower proportions in the 65 to 69 and 70 to 74 year age groups.

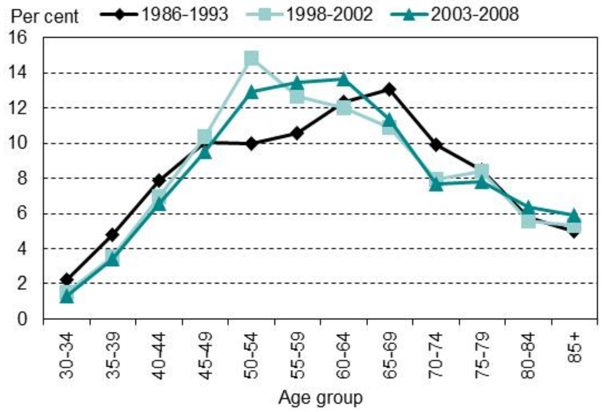
In 1986–1993, the incidence of colorectal cancer was highest (16.4%) in the 70 to 74 year age group (Graph b). However, in both 1998–2002 and 2003–2008, the incidence was highest (17.6% and 16.2%, respectively) in the 75 to 79 year age group, followed by the 70 to 74 year age group (16.9% and 14.9%, respectively). In addition, the earliest period shows higher proportions in the 55 to 59, 60 to 64 and 65 to 69 year age groups, and lower proportions in the 75 to 79 year and onwards age groups than in the two later periods. The difference between the 1998–2002 and 2003–2008 period highlights the more recent trend of a reduction in proportional incidence in the 70 to 74 and 75 to 79 year age groups and an increase in the older 80 to 84 year age group.

The pattern of lung cancer incidence across the age groups has changed markedly over time for both males and females, with a clear movement up the age groups towards a higher representation at older ages over time, but with lower proportions at younger ages, reflecting changed smoking behaviours (Graphs c and d). For males, in 1986–2003, the highest proportion (20.4%) occurred in the 65 to 69 year age group, whereas in 1998–2002 there is a higher peak (22.4%) at ages 70 to 74. In 2003–2008, the highest proportion (now somewhat lower, at 19.8%) has shifted to the 75 to 79 year age group (Graph c). Similarly, for females, in the early period the highest proportion occurred in the 65 to 69 year age group (18.6%) followed by the 70 to 74 year age group (18.4%), in the middle period it was in the 70 to 74 year age group (18.6%) and in the later period the 75 to 79 year age group (19.0%) (Graph d). Notably this latter point, in the 75 to 79 year age group, is the highest proportion for females, unlike for males for whom incidence peaked some five years earlier, and in the 70 to 74 year age group. The graph of lung cancer incidence across the age groups for all persons over time highlights the overall trend for males and females, showing clear peaks moving up the age groups, from the 65 to 69 year age group (with the highest proportion of 19.9%) in 1986–1993, to the 70 to 74 year age group (21.1%) in 1998–2002, to the 75 to 79 year age group (19.5%) in 2003–2008 (Graph e).

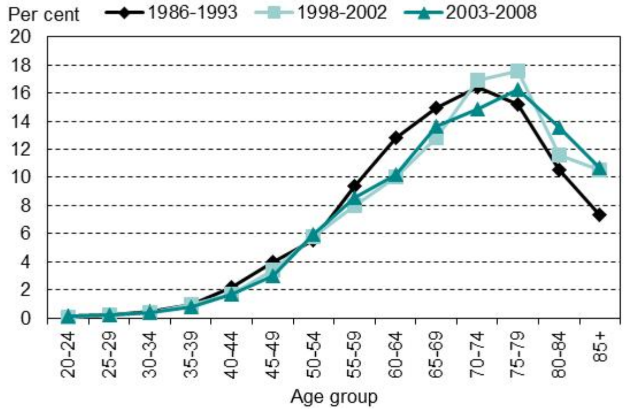
For all three graphs depicting lung cancer incidence, the change in age group incidence over time is most noticeable between the earliest and the middle periods, with the two later periods showing much lower respective proportions in the 55 to 59 (excluding females), 60 to 64 and 65 to 69 year age groups, and, conversely, higher proportions in the 75 to 79 year and onwards age groups. The major development in the latest period is the movement of the peak to the 75 to 79 year age group, and the higher proportions in the 80 to 84 and 85 years and over age groups.

Figure 45: Incidence of selected cancers, by age and sex, 1986–1993, 1998–2002 and 2003–2008

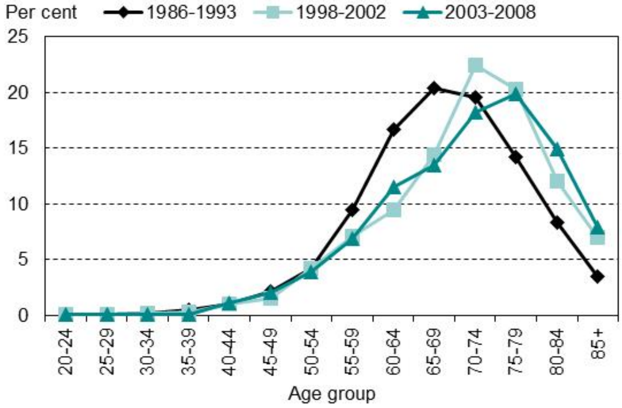
a) Breast cancer incidence, females



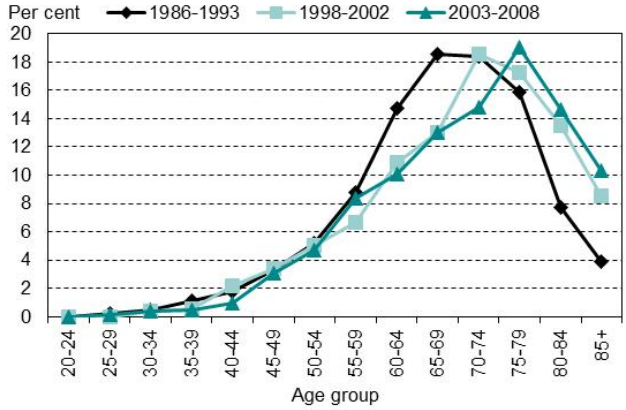
b) Colorectal cancer incidence, persons



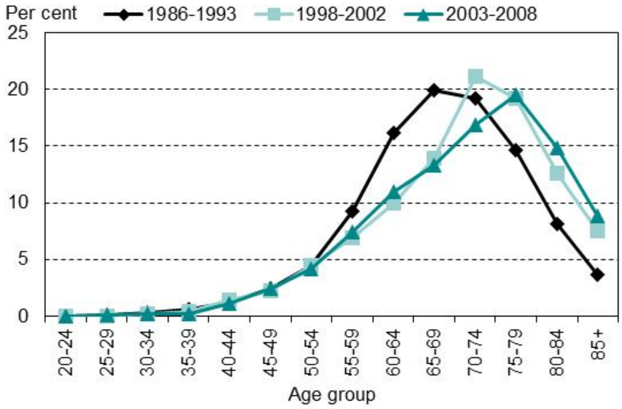
c) Lung cancer incidence, males



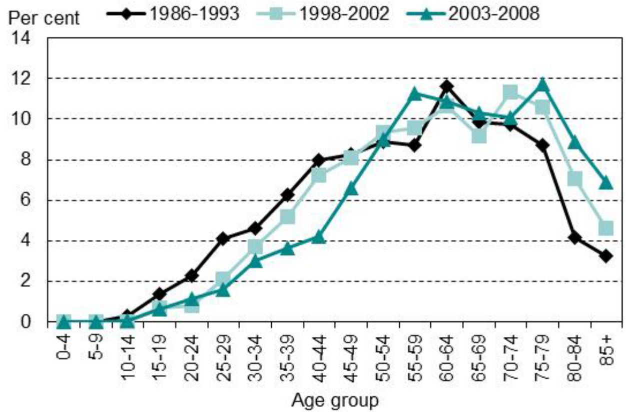
d) Lung cancer incidence, females



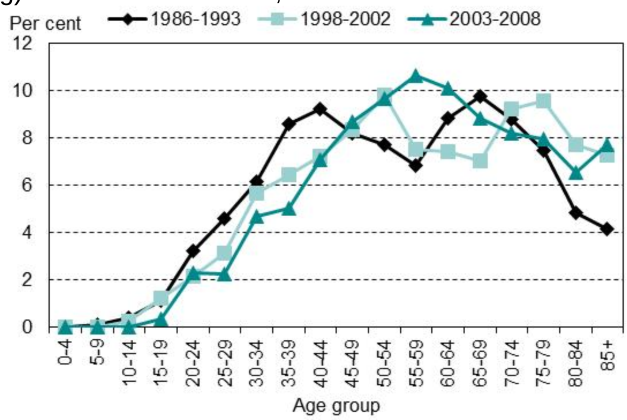
e) Lung cancer incidence, persons



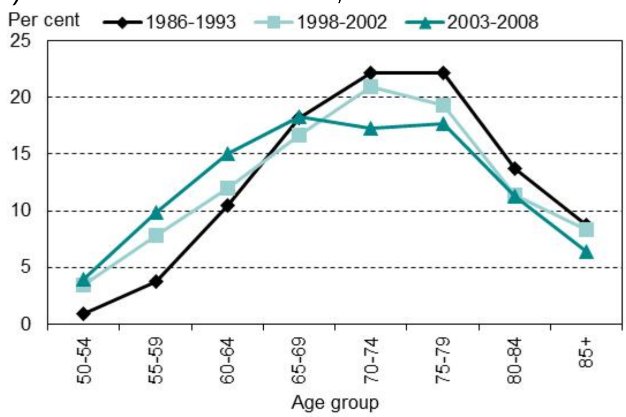
f) Melanoma incidence, males



g) Melanoma incidence, females



h) Prostate cancer incidence, males



In 1986–1993, the incidence of melanoma for males was highest (11.6%) in the 60 to 64 year age group (Graph f in the figure above). However, for both the 1998–2002 and 2003–2008 periods, there were two peaks, in the 60 to 64 and 70 to 74 year age groups in 1998–2002 and 55 to 59 and 75 to 79 year age groups in 2003–2008, with a noticeable decrease in between. For females, in 1986–1993, there were two main peaks, in the 40 to 44 and 65 to 69 year age groups, again with a noticeable drop in between (Graph g). In 1998–2002, this pattern had shifted to the right, closely in line with the ageing of the population, resulting in the highest proportion for females in the 50 to 54 year age group and, again, with a marked decrease before rising in both the 70 to 74 and 75 to 79 year age groups. This pattern was not evident in 2003–2008 and, although the highest proportion shifted as expected to the 55 to 59 year age group, the proportions in the subsequent age groups were lower. For both males and females, the overall trend for melanoma is a decline over time in incidence in the younger age groups, and higher rates at older ages for males aged 70 to 74 years and over. These trends suggest that the various skin care protection campaigns and activities are having an impact on behaviours.

The incidence of prostate cancer over the age groups has shifted across time; in 1986–2003, the highest proportions (both 22.1%) occurred in the 70 to 74 and 75 to 79 age groups (Graph h in the figure above). For the 1998–2002 period, the peak (21.0%) occurred in the 70 to 74 year age group, but with relatively higher proportions in the 50 to 54, 55 to 59 and 60 to 64 year age groups than in the earlier period, and, conversely, lower proportions for the remaining age groups, apart from in the 85 years and over age group with a similar proportion. In 2003–2008, the peak is somewhat flattened, with lower proportions (of 18.3%, 17.3% and 17.7%, respectively) in the 65 to 69, 70 to 74 and 75 to 79 year age groups, but with increases in the proportions in the age groups to 60 to 64 years, along with decreases in the 75 to 79 year and 85 years and over age groups. The rise in screening and earlier detection is likely to be a factor in these shifts in the age curves.

Incidence of lung cancer by age, sex and region, 1986–1993 to 2003–2008

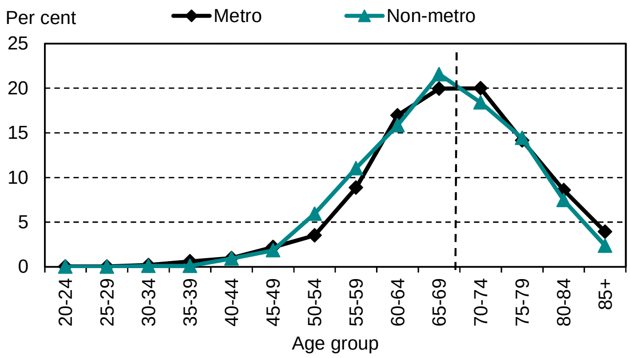
The following figure presents the change in lung cancer incidence by age group over time by regional area to highlight variations in incidence by age between Metropolitan Adelaide and the non-metropolitan areas.

For males, the age group peaks are somewhat more defined (sharper), and slightly higher, in the non-metropolitan areas than in Metropolitan Adelaide; and there are higher proportions in almost all age groups in the non-metropolitan areas than in Metropolitan Adelaide up to the 65 to 69 year age group in 1986–1993, to 70 to 74 years in 1998–2002 and to 75 to 79 years in 2003–2008 (Graphs a, c and e). Beyond those ages, proportions in the non-metropolitan areas are lower. In both the second and, in particular, third periods the curve shifts to the right, as the profile ages, and the proportions in the oldest age groups increase.

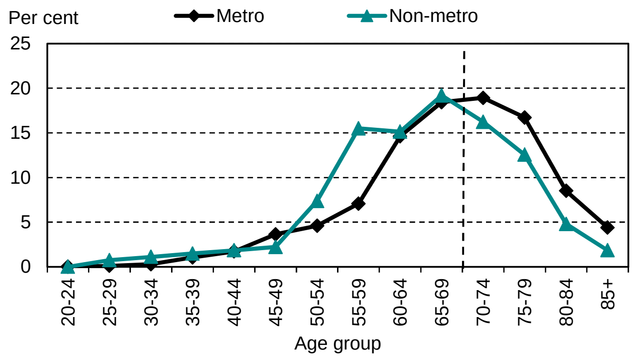
The pattern of lung cancer incidence for females is the same, although the turnaround from higher to lower rates in the non-metropolitan areas occurs in the 65 to 69 year age groups in both 1986–1993 and 1998–2002, and at 70 to 74 years in 2003–2008; and the increase in the proportions at the oldest ages is more marked (Graph b, d and f).

Figure 46: Lung cancer incidence by age, sex and region, 1986–1993, 1998–2002 and 2003–2008

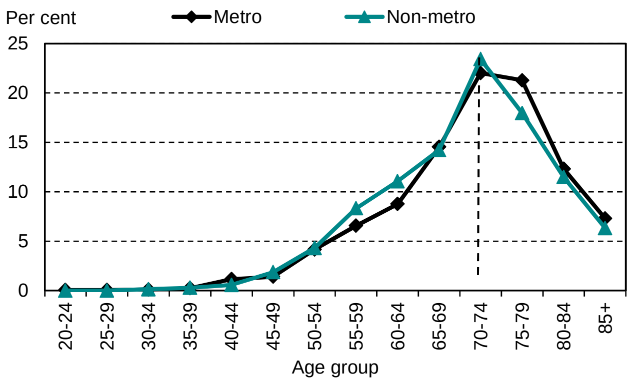
a) Males, 1986–1993



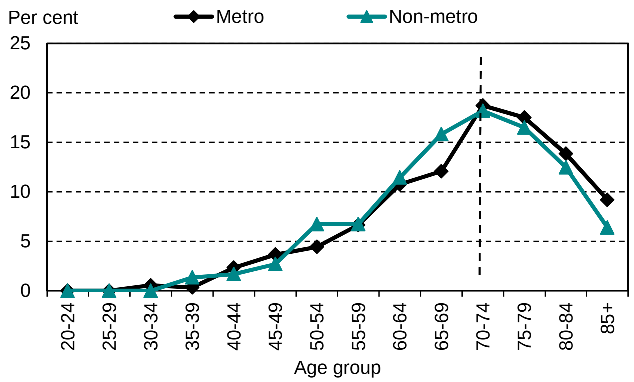
b) Females, 1986–1993



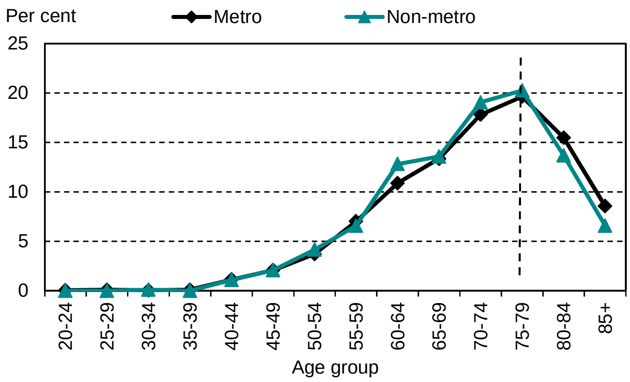
c) Males, 1998–2002



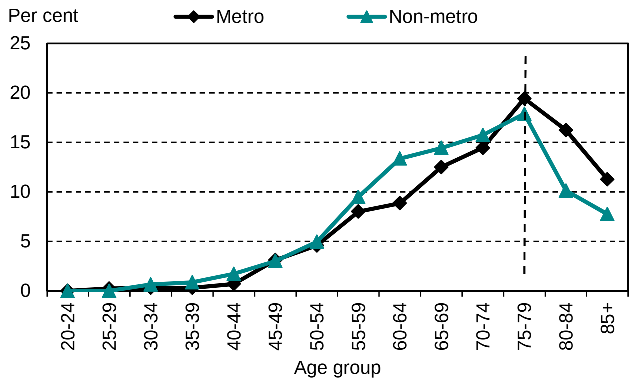
d) Females, 1998–2002



e) Males, 2003–2008



f) Females, 2003–2008



Note: The vertical bar draws attention to the age at which incidence is highest

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Cancer mortality

Premature mortality refers to deaths that occur at a younger age than expected.[51] Cancer remains the largest cause of premature mortality in Australia: the current risk of dying from a cancer before the age of 75 years is 1 in 8 for males and 1 in 12 for females.[17] Both area disadvantage and individual socioeconomic position are independent predictors of premature cancer mortality for men and women, suggesting that interventions to reduce inequalities should focus on places and people.[52] There are a number of possible reasons for the observed association between area disadvantage and cancer mortality in Australia, over and above the composition of the population in disadvantaged areas. Firstly, access to screening, diagnostic tests, and services may vary. Secondly, behavioural factors (diet, exercise, smoking, and alcohol consumption) that are associated with cancer incidence and mortality are socially and geographically patterned.[54] Finally, people with greater wealth are able to access more healthcare resources.

Research in Australia has shown that most of the geographic variation in cancer mortality for the period 1998-2000 was observed at the State and Territory level for both all-cancer and lung cancer mortality in men and women, once age, occupation, and area disadvantage had been accounted for.[52] This indicates that policy and health services' environments, which operate on relatively large geographical and population-based scales, are potential intervention points for reducing cancer mortality in Australia, and should be considered in conjunction with health programs that target individual behavioural risk factors.[52]

For males, the highest death rates from cancers are those from lung cancer, which comprise a higher proportion of all premature deaths than they do of deaths at all ages (31% higher). Similarly, deaths from both colon and pancreatic cancers are also over-represented among premature deaths (when compared with deaths at all ages). Deaths from prostate cancer are less likely to occur before 75 years of age. The burden of premature mortality for females from cancer deaths is even more marked, with premature deaths from the four causes of cancer deaths with the largest numbers comprising a much higher proportion of all premature deaths than they do of deaths at all ages.

Table 23: Cancer deaths in South Australia, by sex, 2003–2007

Site	All ages			Premature[1]			Rate ratio
	Number	Rate	Per cent of 'all causes' deaths	Number	Rate	Per cent of 'all causes' premature deaths	of 'premature' to 'all ages' for per cent of 'all causes'
			Males				
Lung cancer	403	44.1	6.4	212	25.9	8.4	1.31
Prostate cancer	240	25.2	3.8	50	6.1	2.0	0.53
Colorectal cancer	134	14.6	2.1	68	8.3	2.7	1.29
Pancreatic cancer	98	10.8	1.6	62	7.6	2.4	1.50
			Females				
Breast cancer	246	26.7	4.1	149	18.3	10.3	2.51
Lung cancer	229	24.3	3.8	119	14.3	8.2	2.16
Colon cancer	102	10.7	1.7	41	5.0	2.8	1.65
Pancreatic cancer	79	8.3	1.3	37	4.4	2.6	2.00

[1] Deaths before 75 years of age

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Premature mortality, all cancers, 1992 to 2007

In 2007, 83% of all premature deaths in Australia (that is, deaths among people aged less than 75 years) were due to chronic disease.[51] The leading cause of chronic disease premature mortality among females was breast cancer, accounting for 12% of potential years of life lost, followed by lung cancer (9%).[51] Among males, it was coronary heart disease, accounting for 16% of potential years of life lost, followed by lung cancer (8%).[51] Cancer deaths were associated with greater years of life lost among those living in the least disadvantaged areas (55%) compared to those living in the most disadvantaged areas (42%).[51] During the period 1968-2007, changes in potential years of life lost were less apparent for deaths due to cancer, than for those due to cardiovascular disease. In 1968, cancer deaths were associated with 21 and 18 years of life lost for every 1,000 males and females respectively, while in 2007, these figures were 14 and 12, respectively.[51]

Indicator definition: Deaths at ages 0 to 74 years from all cancers, expressed as an age-standardised rate per 100,000 population.

Geographic distribution

In Metropolitan Adelaide, all cancers mortality rates have declined consistently between the three periods, with an overall decline of 11.5%. Rates in the non-metropolitan areas of the State have shown a smaller decline, of 8.6%, with the majority of the decline occurring in the later years.

Table 24: Premature mortality, all cancers, 1992–1995to 2003–2007

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
		Average annual ASR per 100,000	
1992–1995	129.4	126.5	128.6
1997–2001	120.8	124.9	122.0
2003–2007	114.5	115.6	114.9
		Percentage change	
From first to second period	-6.6	-1.3	-5.1
From second to third period	-5.2	-7.4	-5.8
From first to third period	-11.5	-8.6	-10.7

The overall decline in rates has a distinct spatial element, with fewer SLAs recording rates in the highest range in each subsequent period, leading to a concentration of high rates in the north-western and inner and outer northern suburbs in 2003–2007. This observation is supported by the very strong association between premature mortality from all cancers and socioeconomic disadvantage, with an inverse correlation with the IRSD of -0.77.

Although death rates in Metropolitan Adelaide from all cancers have declined, the 'Change' map shows the concentration in the north-west, north and outer north of SLAs where rates have stayed high over this period.

The very strong association with socioeconomic status in Metropolitan Adelaide is evident from the map for 2003–2007, with SLAs to the north and north-west of the city, and in the outer north, having the highest rates, with rates above the metropolitan average also to the south-west, and in the outer north. The highest rates of statistical significance were in Port Adelaide Enfield - Coast (170.0** deaths per 100,000 population), - Inner (148.6**) and - Port (146.4*); Playford - West Central (168.3**) and - Elizabeth (149.4**); Salisbury - Inner North (144.2*) and Tea Tree Gully - South (134.3*). Rates well below average were generally found in SLAs to the east and south-east of the city, with rates of statistical significance in Campbelltown - East (79.1^^ deaths per 100,000 population), Unley - East (81.4^^), Mitcham - North-East (82.7^^) and - Hills (89.3^^) and Burnside - South-West (94.5^), as well as further south, in Onkaparinga - Reservoir (86.9^^).

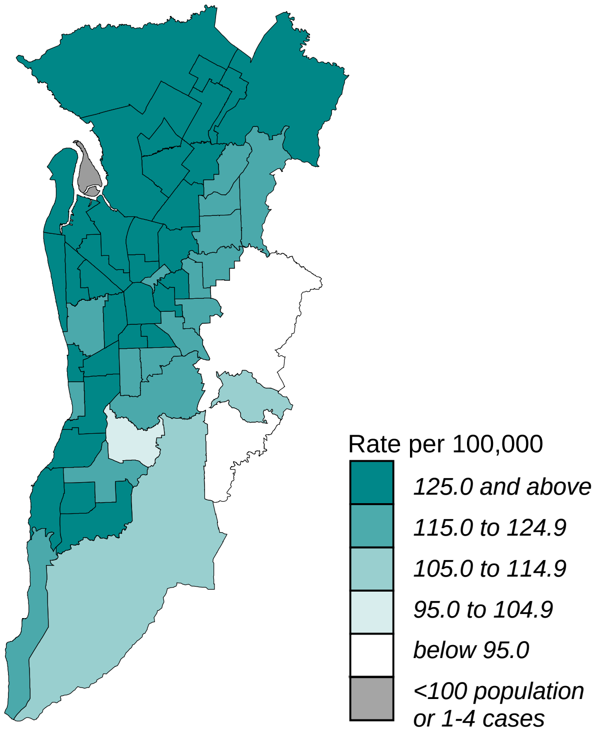
In the non-metropolitan areas of the State, premature deaths from all cancers were very weakly correlated with socioeconomic disadvantage (an inverse correlation with the IRSD of -0.12), unlike all cancers incidence which was weakly correlated with socioeconomic advantage (0.21), although this association was more evident for males (0.24) than for females (0.05).

The 'Change' map for non-metropolitan areas shows a mix of areas where rates have increased and others where rates have decreased.

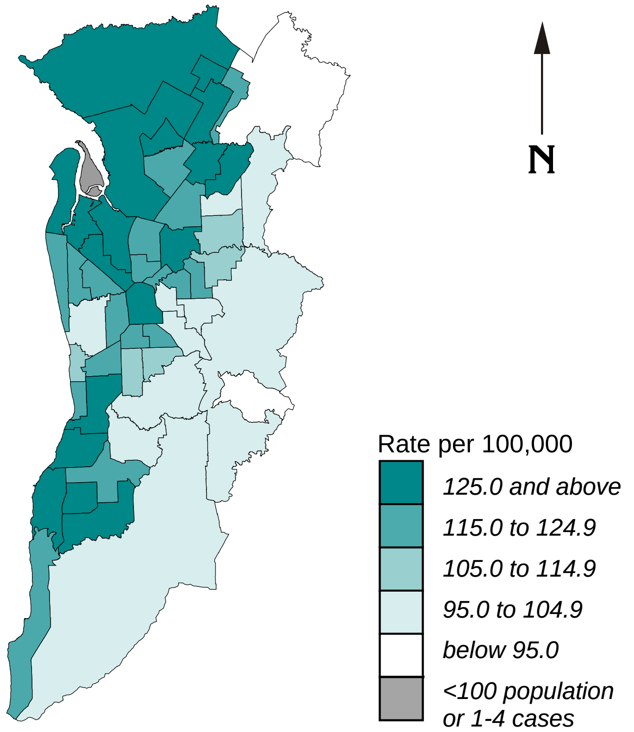
Map 36: Premature mortality, all cancers, Adelaide, 1992–1995, 1997–2001 and 2003–2007

ASR per 100,000 by Statistical Local Area

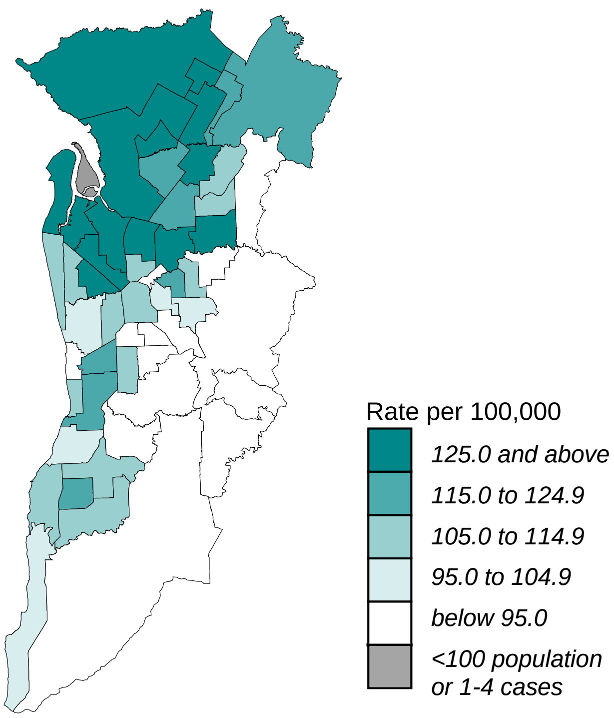
1992-1995



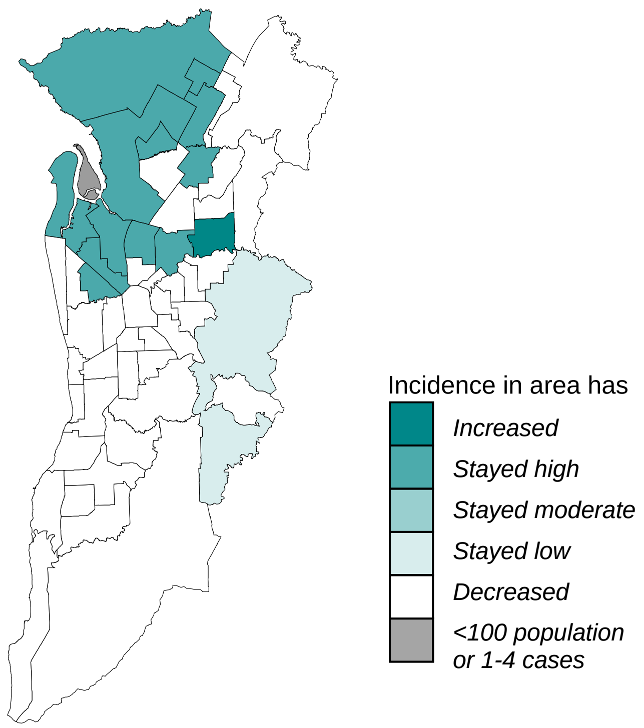
1997-2001



2003–2007



Change: 2003–2007 compared with 1992–95

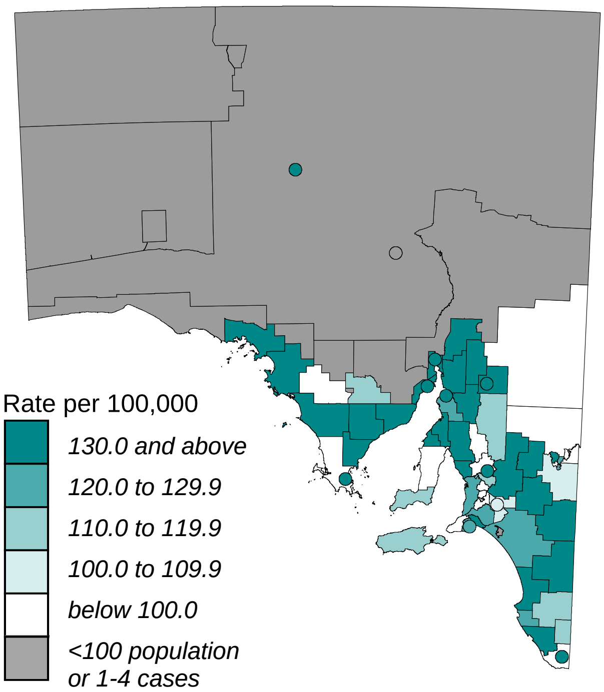


Source: Compiled in PHIDU using data supplied by ABS on behalf of the SA Registrar of Deaths

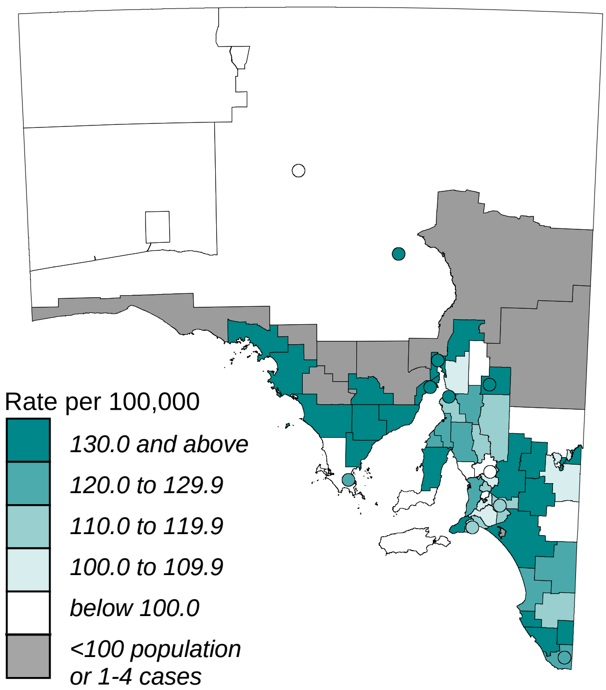
Map 37: Premature mortality, all cancers, non-metropolitan areas, 1992–1995, 1997–2001 and 2003–2007

ASR per 100,000 by Statistical Local Area

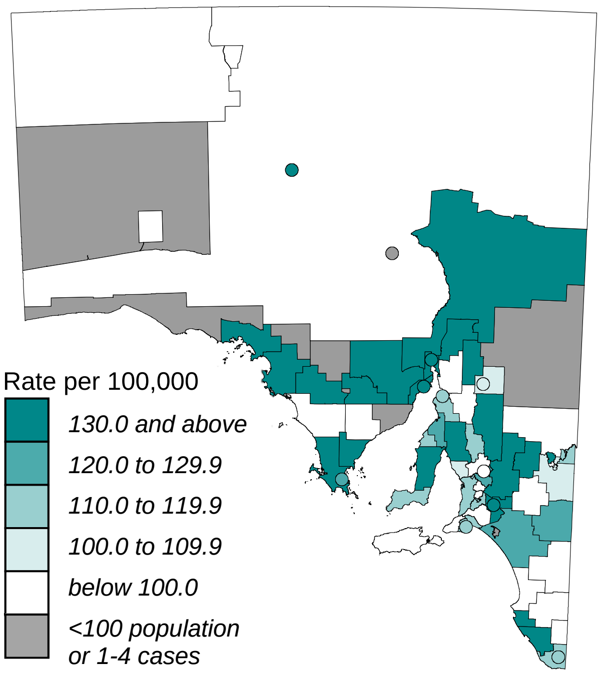
1992-1995



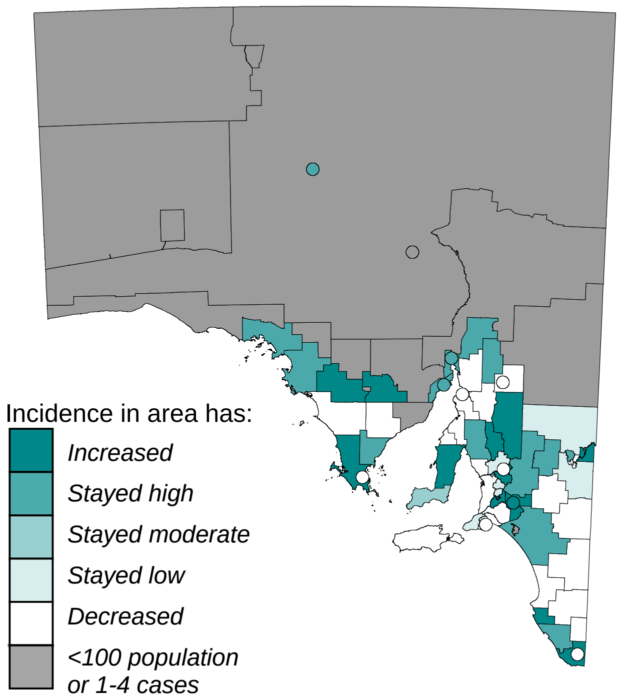
1997–2001



2003–2007



Change: 2003–2007 compared with 1992–95



Source: Compiled in PHIDU using data supplied by ABS on behalf of the SA Registrar of Deaths

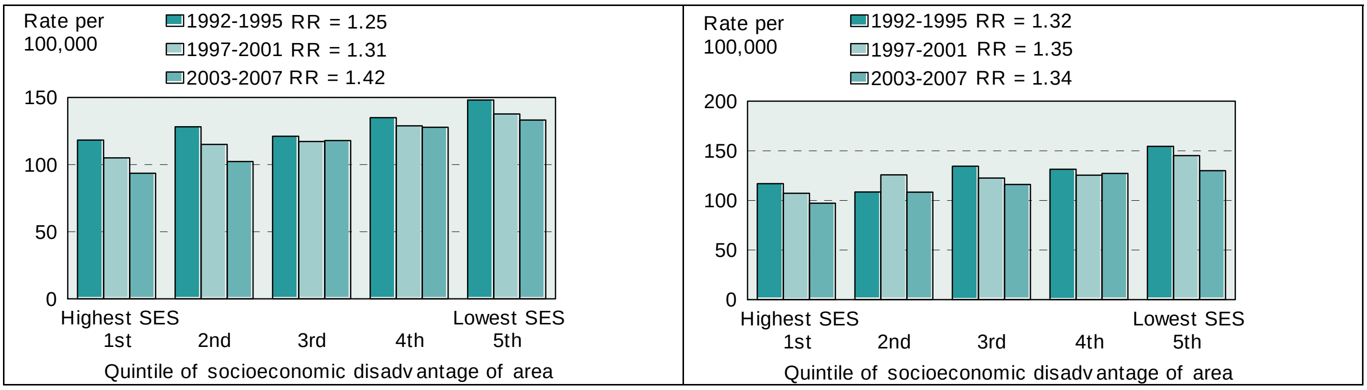
Very high rates of statistical significance were recorded for people in the north of the State, in Unincorporated Whyalla (348.3** deaths per 100,000 population, five deaths), Coober Pedy (184.3*) and Whyalla (142.7**); on the Eyre Peninsula in Le Hunte (273.7**, 15 deaths) and Tumby Bay (184.7**); and in Wakefield (179.5**). Lowe rates of statistical significance were recorded in Kangaroo Island (59.6^ deaths per 100,000 population, 13 deaths), Naracoorte and Lucindale (66.9^^), Adelaide Hills - Central (67.7^^) and - Ranges (81.2^), and Strathalbyn (79.2^).

Distribution by socioeconomic status

There are marked socioeconomic gradients in Metropolitan Adelaide in each period, with the differential in rates increasing to be the largest in 2003–2007. The widening socioeconomic gap is a result of a larger decline in rates in Quintile 1 areas than in Quintile 5 areas. In the non-metropolitan areas, there has been little change in the gap in rates between the lowest and highest socioeconomic status areas, with similar rates of decline in both Quintile 1 and Quintile 5.

Figure 47: Premature mortality, all cancers, by socioeconomic status, 1992–1995, 1997–2001 and 2003–2007

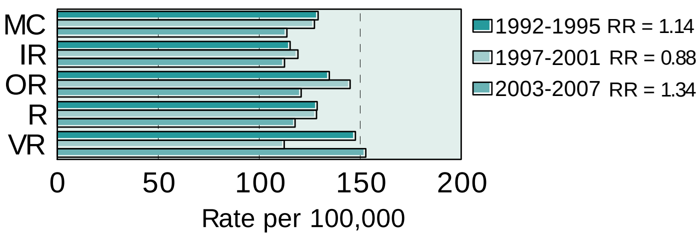
Metropolitan Adelaide **Non-metropolitan areas**



Distribution by remoteness

Premature death rates from all cancers in 2003–2007 increased slightly between the Major Cities and Inner Regional remoteness classes (with rates of around 113 deaths per 100,000 population) and the Outer Regional and Remote classes (with rates of around 119 deaths per 100,000 population), before increasing markedly in the Very Remote areas to a rate of 152.8 deaths per 100,000 population. The overall differential in rates between the Very Remote and Major Cities areas is 34% (a rate ratio of 1.34). The pattern in the earlier years was generally similar, other than for the very low rate in the Very Remote areas in 1997–2001, which resulted in a lower rate than in the Major Cities areas.

Figure 48: Premature mortality, all cancers, by remoteness, 1992–1995, 1997–2001 and 2003–2007



Premature mortality, breast cancer, 1992 to 2007

In 2010, breast cancer was the leading cancer cause of burden of disease for females, accounting for 61,100 disability-adjusted life years (DALYs) (40,600 years of life lost due to premature death and 20,500 years of healthy life lost due to disease, disability or injury).[55]

Indicator definition: Deaths of women at ages 0 to 74 years from breast cancer, expressed as an age-standardised rate per 100,000 females.

Geographic distribution

After an initial increase of 7.9%, rates of premature mortality from female breast cancer in Metropolitan Adelaide decreased by 23.5% between 1997-2001 and 2003–2007. In the non-metropolitan areas the initial increase was larger, and the subsequent decline smaller, resulting in an overall higher rate in 2003–2007.

Table 25: Premature mortality, breast cancer, 1992–1995 to 2003–2007

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
	Average annual ASR per 100,000		
1992–1995	24.1	23.0	23.8
1997–2001	26.0	26.1	26.0
2003–2007	19.9	21.8	20.5
	Percentage change		
From first to second period	7.9	13.5	9.2
From second to third period	-23.5	-16.5	-21.2
From first to third period	-17.4	-5.2	-13.9

Premature deaths of females from breast cancer were weakly correlated with socioeconomic disadvantage (-0.14), whereas breast cancer incidence was moderately correlated with socioeconomic advantage (0.39). This may indicate different access to treatment, either overall or in relation to timing.

The pattern of rates has changed markedly over the years shown, with the initial increase (noted above) resulting in more SLAs being mapped in the highest range over 1997-2001, before a substantial decline in the number of SLAs in this range in 2003-2007.

The 'Change' map shows a mixed picture, with many inner and middle suburbs more likely to have lower rates in the latest period, and outer suburbs more likely to have rates that stayed high: however this is not universally the case, in particular in the western suburbs.

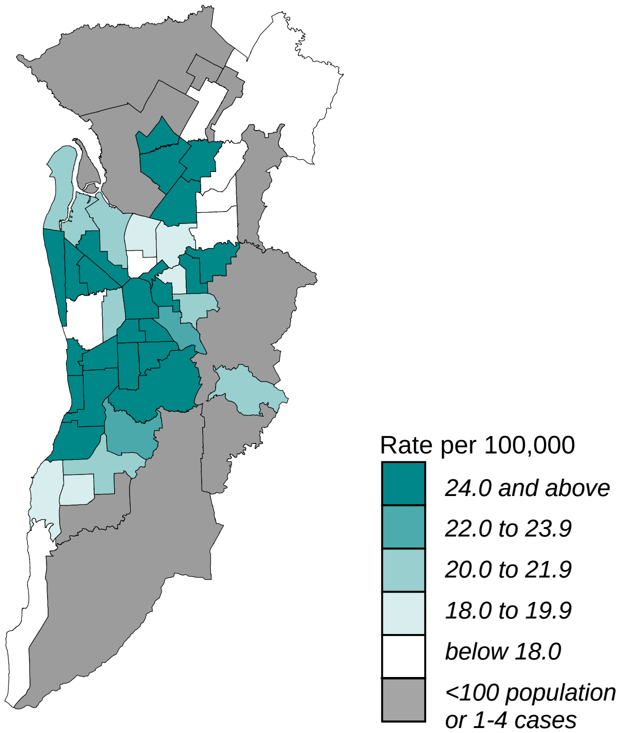
Of the SLAs with the highest rates, only Charles Sturt - Inner East (34.2* deaths per 100,000 females) and Tea Tree Gully - South (31.1*) had above-average rates of statistical significance, and only in Campbelltown - East (8.5^) were rates significantly below average.

Many non-metropolitan SLAs had fewer than five deaths of females before 75 years of age from breast cancer over this five-year period, and were not included in the map. As a result, only Loxton Waikerie West (56.4^^) and Mount Barker Balance (47.7^^) had rates of statistical significance above the State average; and none of the low rates were statistically significant. There is also little data that can be shown in the 'Change' map.

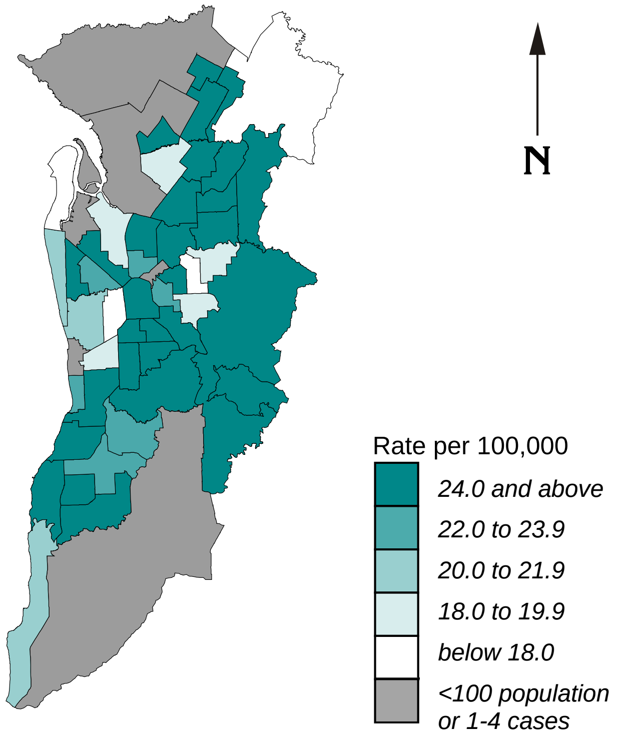
Map 38: Premature mortality, breast cancer, Adelaide, 1992–1995, 1997–2001 and 2003–2007

ASR per 100,000 by Statistical Local Area

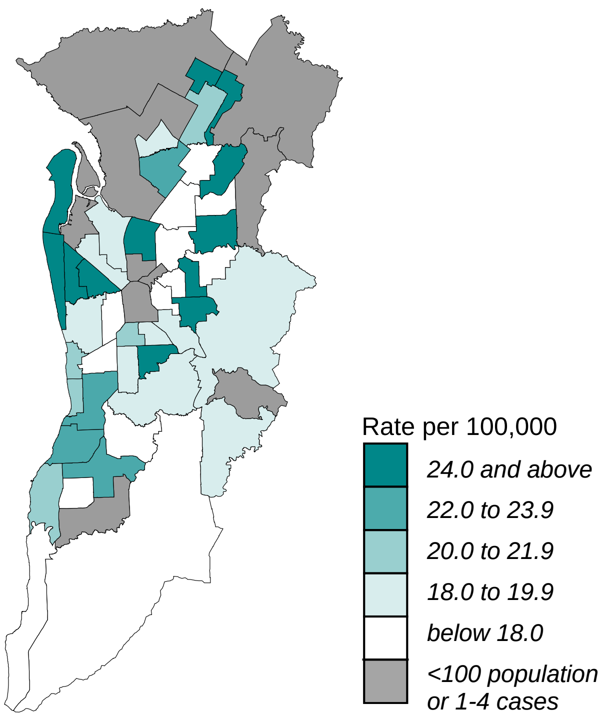
1992-1995



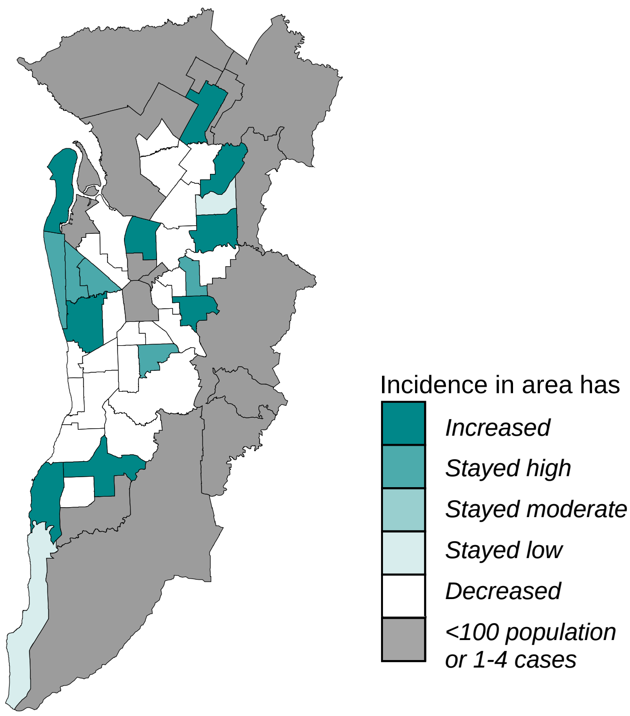
1997-2001



2003–2007



Change: 2003–2007 compared with 1992–95

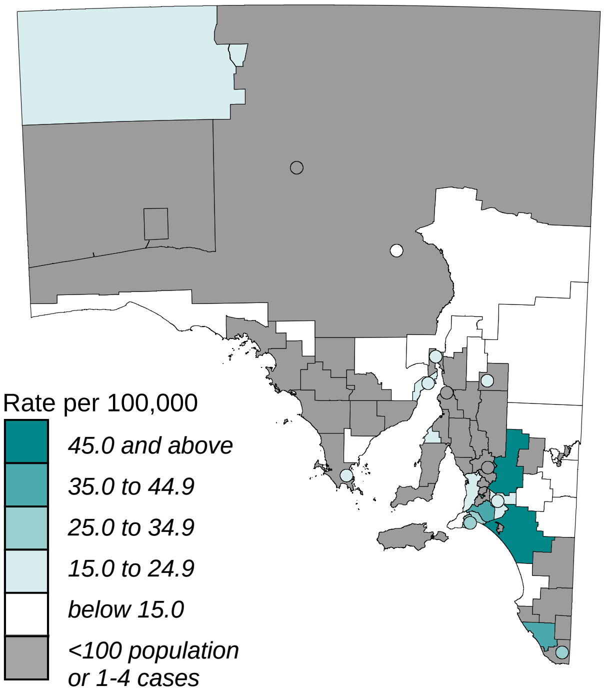


Source: Compiled in PHIDU using data supplied by ABS on behalf of the SA Registrar of Deaths

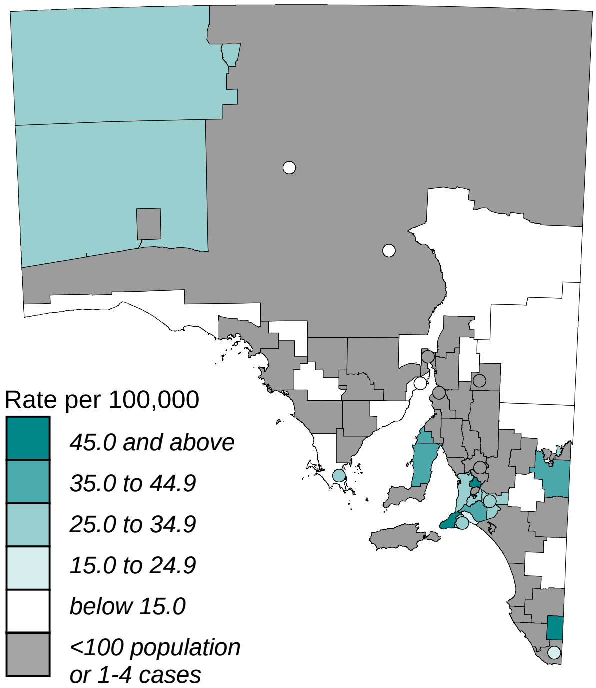
Map 39: Premature mortality, breast cancer, non-metropolitan areas, 1992–1995, 1997–2001 and 2003–2007

ASR per 100,000 by Statistical Local Area

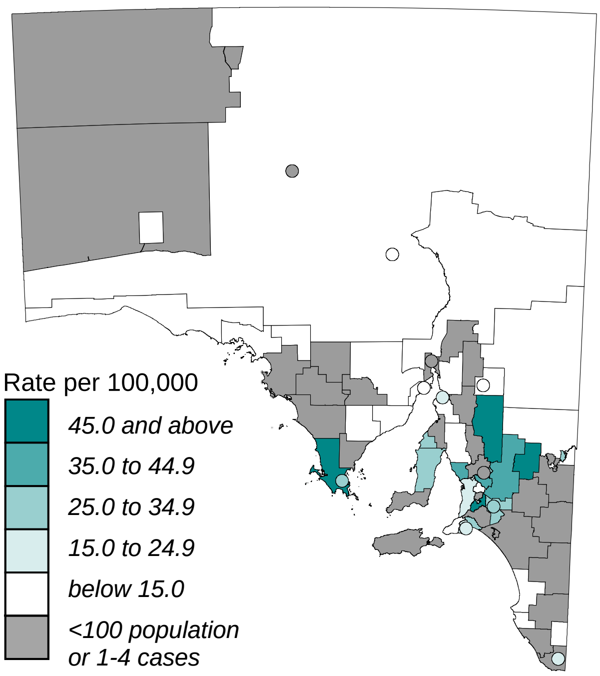
1992-1995



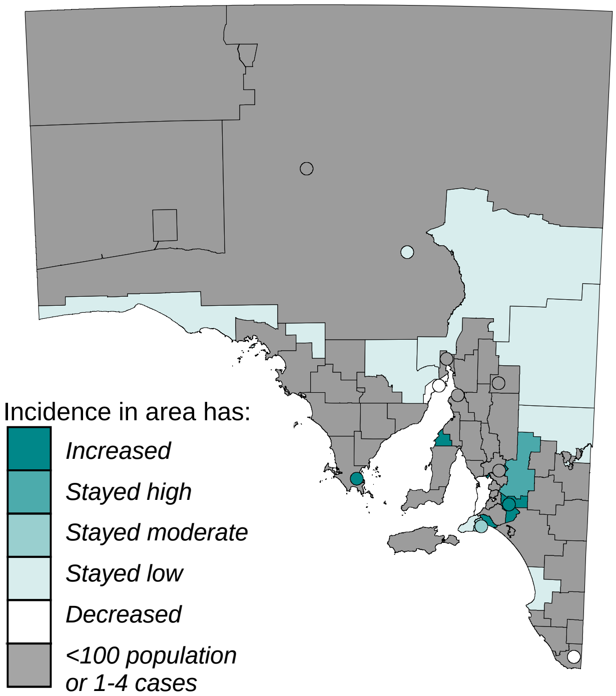
1997–2001



2003–2007



Change: 2003–2007 compared with 1992–1995



Source: Compiled in PHIDU using data supplied by ABS on behalf of the SA Registrar of Deaths

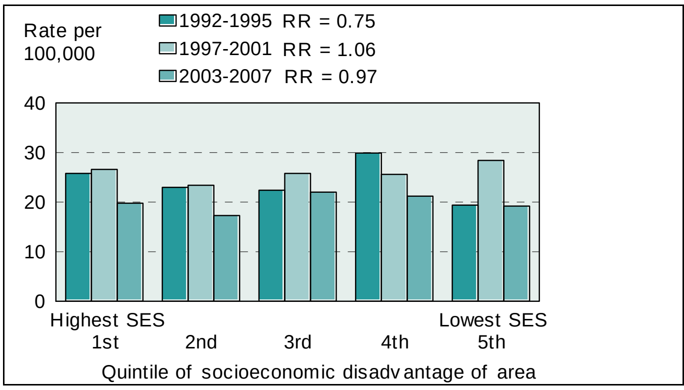
Distribution by socioeconomic status

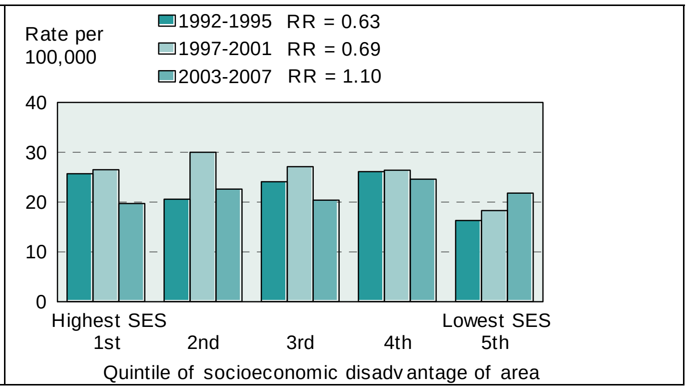
There is no consistent pattern in premature mortality rates for breast cancer across the areas of socioeconomic disadvantage in Metropolitan Adelaide in 2003–2007, with the highest rates in Quintiles 3 and 4, and only a very small differential in rates between Quintile 5 and Quintile 1. This is in contrast to the situation in 1992–1995, when there was a marked gap in rates between the lowest and highest socioeconomic status areas.

In the non-metropolitan areas in 2003–2007, rates vary with increasing socioeconomic disadvantage, with an overall differential in rates between the most disadvantaged and the least disadvantaged areas of 10%, although the highest rate is in Quintile 4 (24.6 deaths per 100,000 females), some 25% above the rate in Quintile 1. Again, this is in marked contrast to the situation in earlier periods when, although rates varied inconsistently across the quintiles, they were over 30% lower in the most disadvantage areas.

Figure 49: Premature mortality, breast cancer, by socioeconomic status, 1992–1995, 1997–2001 and 2003–2007

Metropolitan Adelaide **Non-metropolitan areas**

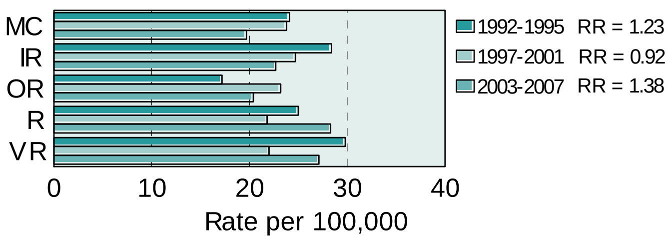




Premature mortality from female breast cancer tended to be elevated in the Remote and Very Remote areas in 2003-07, with an overall differential of 38% (a rate ratio of 1.38) in 2003–2007. However, the highest rate is in the Remote areas (28.3 deaths per 100,000 females aged 0 to 74 years), slightly above the rate in the Very Remote areas (27.1). This could reflect random fluctuations due to small numbers, but poorer outcomes due to less ready access to screening, specialist diagnostic and treatment services also could have contributed.

This marked differential (38%) in 2003–2007 is in sharp contrast to the markedly lower incidence of female breast cancer in the Very Remote areas, which is 38% lower than in the Major Cities areas (a rate ratio of 0.62). As noted above for prostate cancer incidence, the movement of Aboriginal people, who comprise a substantial proportion of the population in the Very Remote areas between those areas and the larger towns, many of which fall in the Remote category, as well as to Adelaide (in the Major Cities class), may have affected the reliability of this classification by remoteness. The impact of such movement is to inflate the rates in these less remote areas, thereby reducing the size of the remoteness differential. Determining the extent to which these differences in outcomes are a result of misclassification to remoteness areas, reflect poorer access to services in a timely fashion, or other factors could benefit from further analysis linking the deaths and cancer registry data. The pattern in the earlier years was more variable, in particular the very low rate in the Very Remote areas in 1997–2001, which resulted in a lower rate than in the Major Cities areas.

Figure 50: Premature mortality, breast cancer, by remoteness, 1992–1995, 1997–2001 and 2003–2007



Premature mortality, colorectal cancer, 1992 to 2007

In 2010, 13% of the cancer disease burden in males was attributable to colorectal cancer and in females, 12% of the cancer disease burden was due to colorectal cancer.[55] Colorectal cancer also accounts for the second highest number of years lost of the total cancer burden due to premature death, and the third highest number of years lost of the total cancer burden due to disease, disability or injury.[55]

Indicator definition: Deaths at ages 0 to 74 years from colorectal cancer, expressed as an age-standardised rate per 100,000 population.

Geographic distribution

Premature mortality from colorectal cancer has declined markedly in Metropolitan Adelaide, with the larger decline in the later period. In the non-metropolitan areas, there is a markedly larger overall decline, despite a small increase in premature mortality between the first two periods, resulting in a lower overall rate in 2003–2007.

Table 26: Premature mortality, colorectal cancer, 1992–1995 to 2003–2007

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
	Average annual ASR per 100,000		
1992–1995	16.9	16.9	16.9
1997–2001	15.8	17.5	16.3
2003–2007	13.2	10.5	12.3
	Percentage change		
From first to second period	-6.5	3.6	-3.6
From second to third period	-16.5	-40.0	-24.5
From first to third period	-21.9	-37.9	-27.2

The distribution at the SLA level of premature mortality from colorectal cancer in Metropolitan Adelaide shows no particular association with socioeconomic status, with an inverse correlation (-0.10) with the IRSD.

There has been a considerable degree of change in the spatial distribution of premature mortality from colorectal cancer, and fewer SLAs in the highest range, over the periods of the maps.

This is also evident from the small number of SLAs with above-average rates of statistical significance, SLAs which are generally of moderate to high socioeconomic status, as indicated by their IRSD score. These are Charles Sturt - North-East (22.1** deaths per 100,000 population, and an IRSD score of 916), Tea Tree Gully - Central (21.3**, 1034), Prospect (21.1*, 1037) and West Torrens - West (18.7*, 998). None of the low rates was of statistical significance.

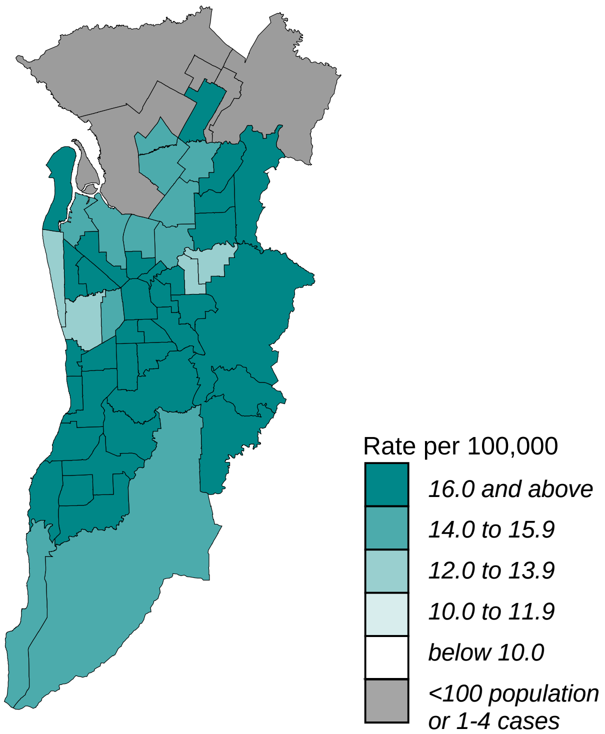
The impact of the large decline in rates in the non-metropolitan areas is obvious in the smaller number of SLAs in the highest range in each period.

In the non-metropolitan areas, or SLAs with five or more deaths over this period, only Loxton Waikerie - East (28.2** deaths per 100,000 population) and Port Augusta (22.4*) had rates of statistical significance. None of the low rates were of statistical significance.

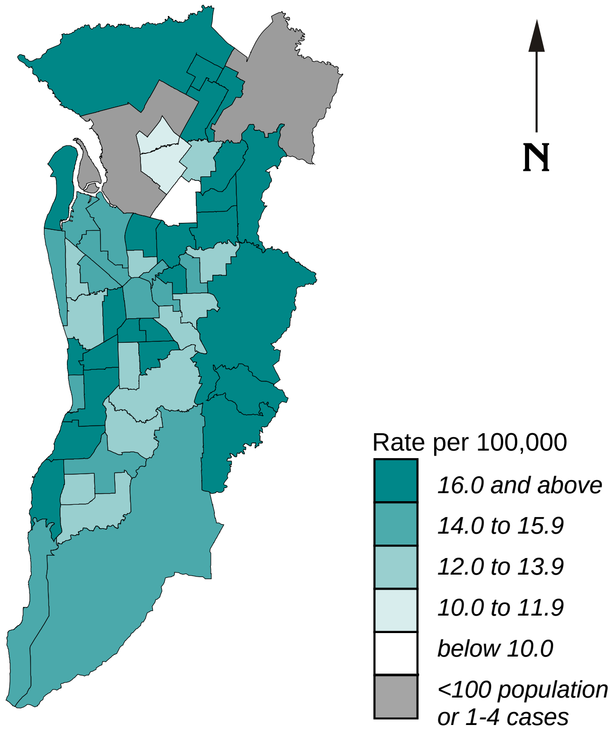
Map 40: Premature deaths, colorectal cancer, Adelaide, 1992–1995, 1997–2001 and 2003–2007

ASR per 100,000 by Statistical Local Area

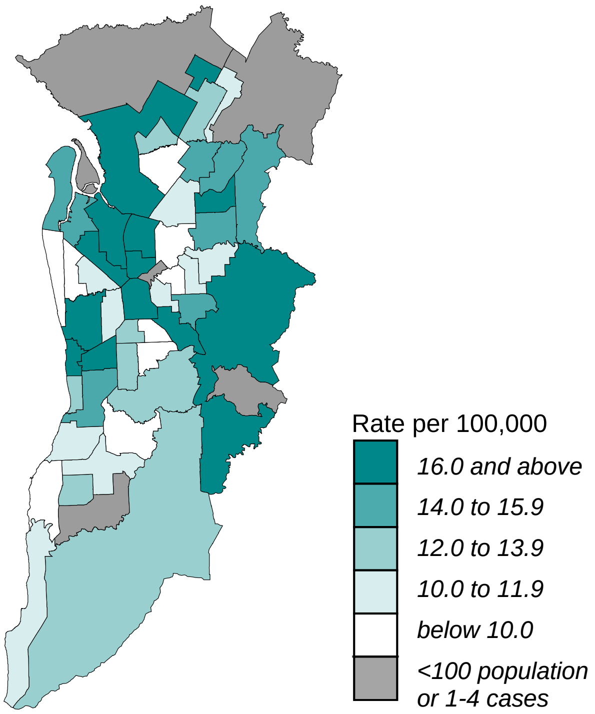
1992-1995



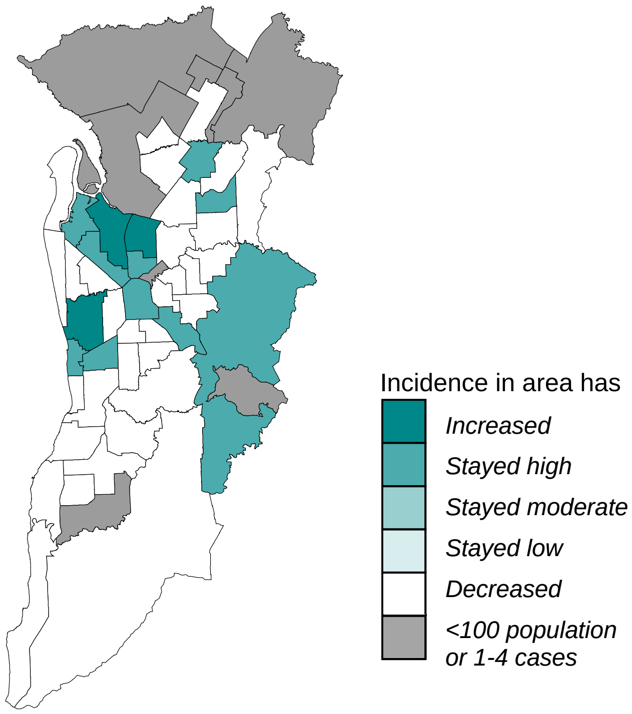
1997-2001



2003–2007



Change: 2003–2007 compared with 1992–95

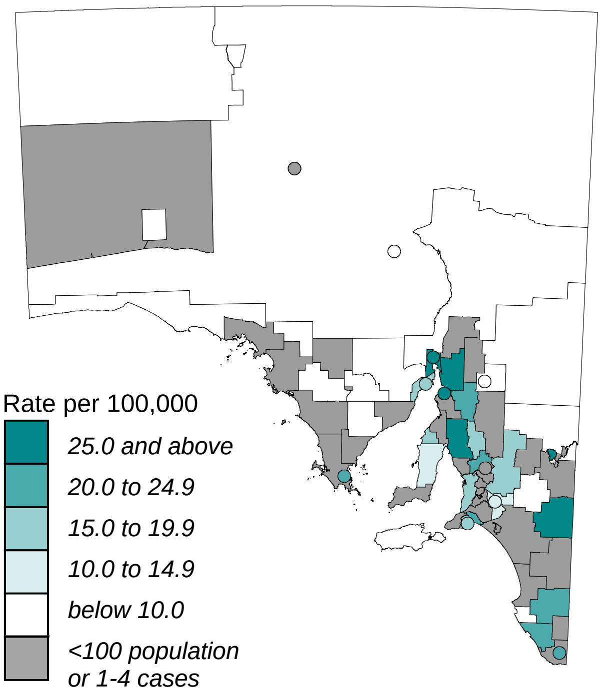


Source: Compiled in PHIDU using data supplied by ABS on behalf of the SA Registrar of Deaths

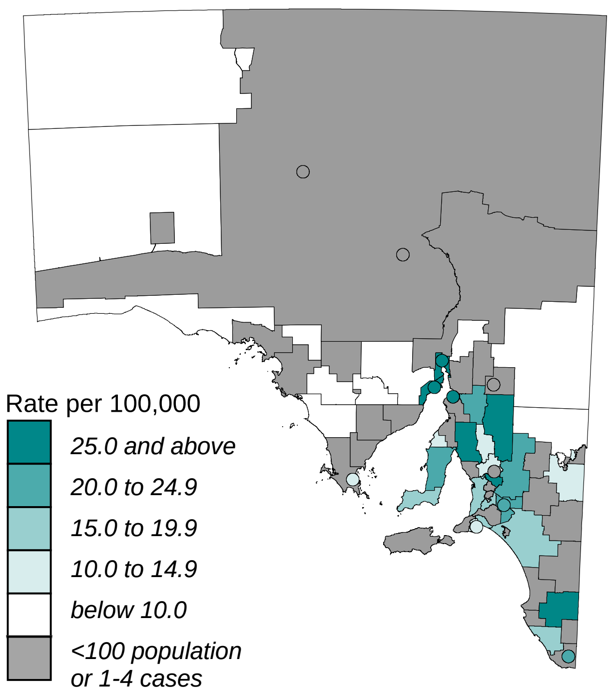
Map 41: Premature mortality, colorectal cancer, non-metropolitan areas, 1992–1995, 1997–2001 and 2003–2007

ASR per 100,000 by Statistical Local Area

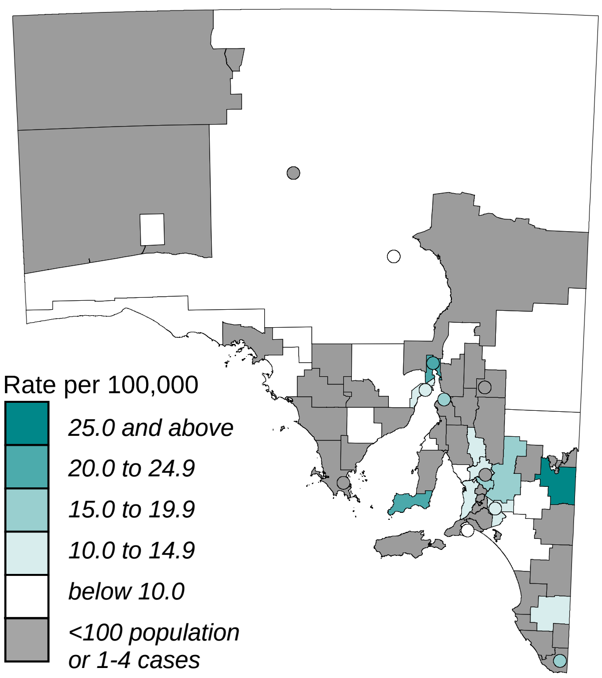
1992-1995



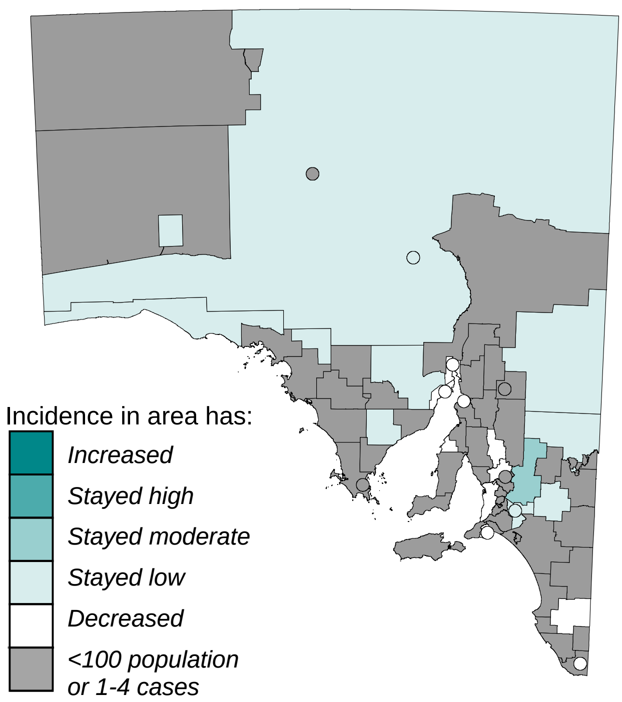
1997–2001



2003–2007



Change: 2003–2007 compared with 1992–95



Source: Compiled in PHIDU using data supplied by ABS on behalf of the SA Registrar of Deaths

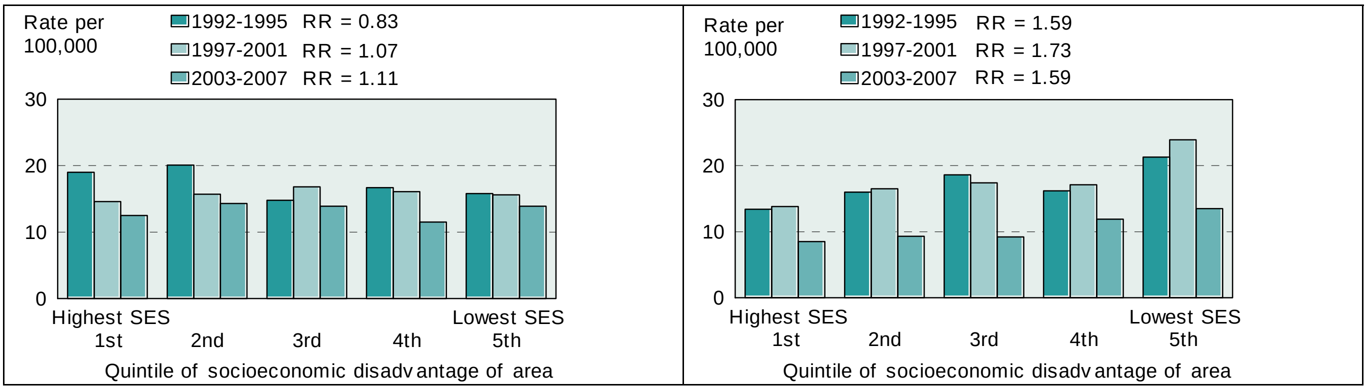
Distribution by socioeconomic status and remoteness

Premature mortality from colorectal cancer varied substantially across the quintiles of socioeconomic disadvantage in the non-metropolitan areas in 2003–2007, with the rate in the most disadvantaged areas 59% higher than in the least disadvantaged areas. This substantial gap is relatively consistent over time.

The gap in Metropolitan Adelaide is smaller, but sill of a notable size, at 11% in 2003–2007, markedly different from the gap in 1992–1995, when the rate in the most disadvantaged areas was 17% lower than in the least disadvantaged areas.

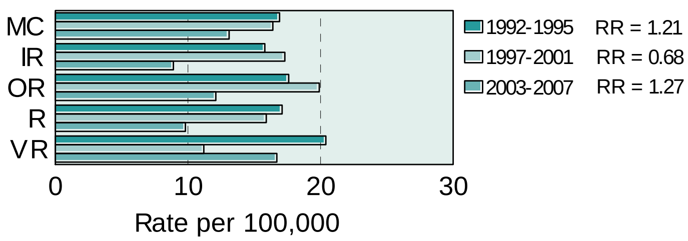
Figure 51: Premature mortality, colorectal cancer, by socioeconomic status, 1992–1995, 1997–2001 and 2003–2007

Metropolitan Adelaide **Non-metropolitan areas**



Although rates vary markedly between the quintiles in 2003–2007, there is a marked differential in rates between the Major Cities and Very Remote areas, with the latter recording rates some 27% higher. The lowest rates are in the Inner Regional and Remote areas. The pattern in the earlier years was more variable, in particular the very low rate in the Very Remote areas in 1997–2001, which resulted in a lower rate than in the Major Cities areas.

Figure 52: Premature mortality, colorectal cancer, by remoteness, 1992–1995, 1997–2001 and 2003–2007



Premature mortality, lung cancer, males, 1992 to 2007

For lung cancer, the vast majority (94% for males and 93% for females) of the burden of disease is due to premature death.[56] For males in 2011, lung cancer is expected to be the leading cause of burden of disease due to cancer (20% of the burden due to cancer), accounting for 57,100 disability-adjusted life years.[56]

Indicator definition: Deaths of males at ages 0 to 74 years from lung cancer, expressed as an age-standardised rate per 100,000 population.

Geographic distribution

Male premature mortality from lung cancer in Metropolitan Adelaide declined markedly between each period, with an overall decline of 30.6%. The decline in the non-metropolitan rate was lower (23.8%), and was more evident in the later period.

Table 27: Premature mortality, lung cancer, males, 1992–1995 to 2003–2007

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
	Average annual ASR per 100,000		
1992–1995	42.1	36.5	40.5
1997–2001	34.6	33.9	34.4
2003–2007	29.2	27.8	28.8
	Percentage change		
From first to second period	-17.8	-7.1	-15.1
From second to third period	-15.6	-18.0	-16.3
From first to third period	-30.6	-23.8	-28.9

As noted for all cancers, the overall decline in rates has a distinct spatial element, with fewer SLAs recording rates in the highest range in each subsequent period, leading to a concentration of high rates in the north-western and inner and outer northern suburbs in 2003–2007. This observation is supported by the strong association between premature mortality of males from lung cancer and socioeconomic disadvantage, with an inverse correlation with the IRSD of -0.63.

The extent of decline is also evident in many SLAs in the 'Change' map, although rates remain stubbornly high in the north-west and outer-north.

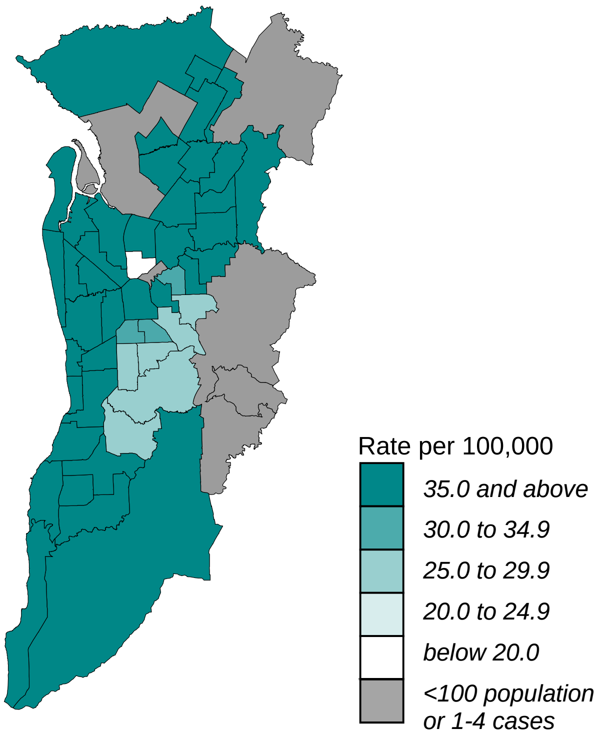
The highest rates of statistical significance were recorded for Salisbury - Inner North (71.0** deaths per 100,000 population) and - North-East (49.2**) and Playford - West Central (62.2**), in the outer north; Port Adelaide Enfield - Port (65.8**), - Park (56.4**), - Inner (51.9**) and - Coast (48.2**), in the north-west; and in Prospect (47.1*). SLAs with low rates all had small numbers over this five-year period: they were Burnside - North-East (8.9^^ deaths per 100,000 males, with 5 deaths), Mitcham - Hills (12.1^, 8), Holdfast Bay - North (13.0^, 6) and Campbelltown - East (14.9^, 11).

There is a weak association at the SLA level in the non-metropolitan areas between premature mortality of males from lung cancer and socioeconomic disadvantage, with an inverse correlation of -0.26. However only Barmera (101.3** deaths per 100,000 population, 12 deaths) and Whyalla (54.1**) had rates of statistical significance and five or more deaths from this cause.

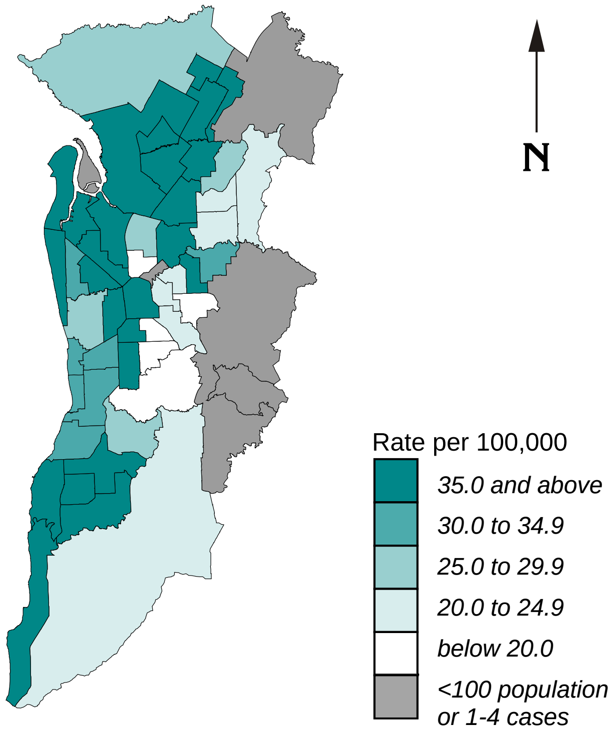
Map 42: Premature deaths, lung cancer, males. Adelaide, 1992–1995, 1997–2001 and 2003–2007

ASR per 100,000 by Statistical Local Area

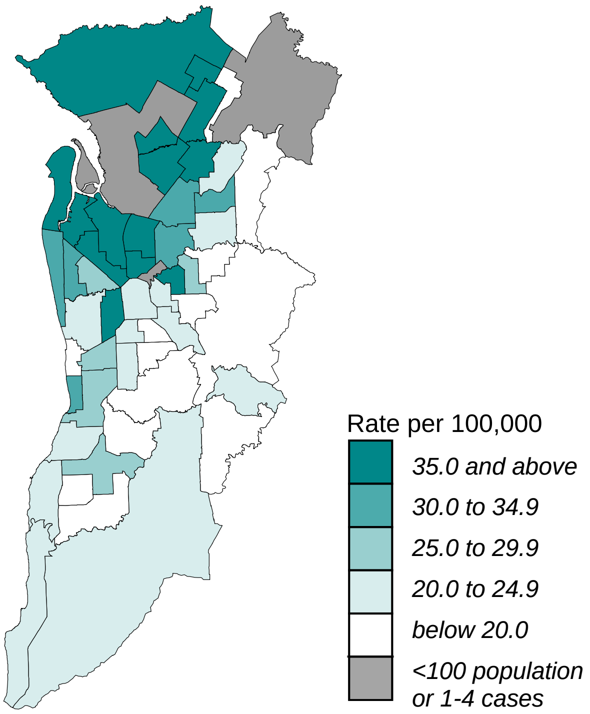
1992-1995



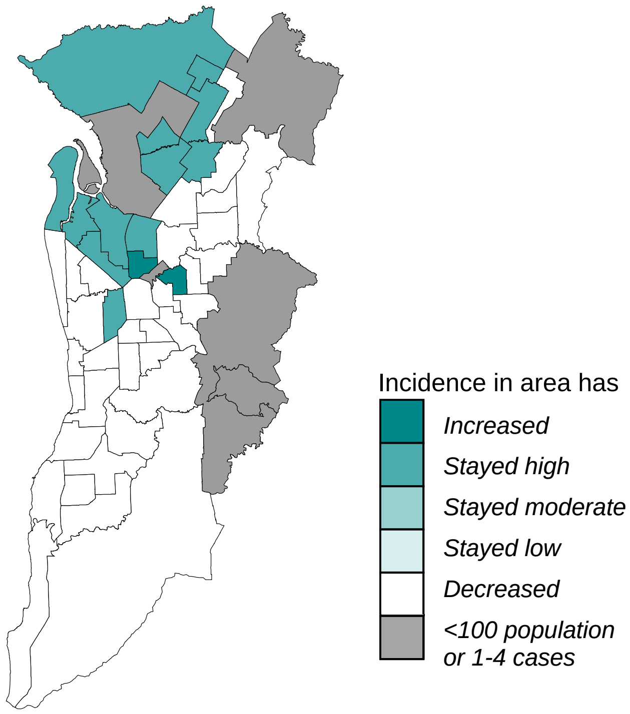
1997-2001



2003–2007



Change: 2003–2007 compared with 1992–95

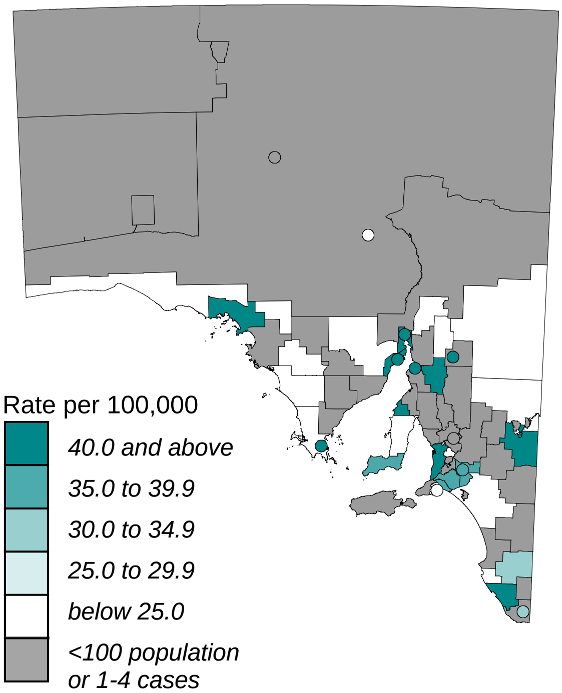


Source: Compiled in PHIDU using data supplied by ABS on behalf of the SA Registrar of Deaths

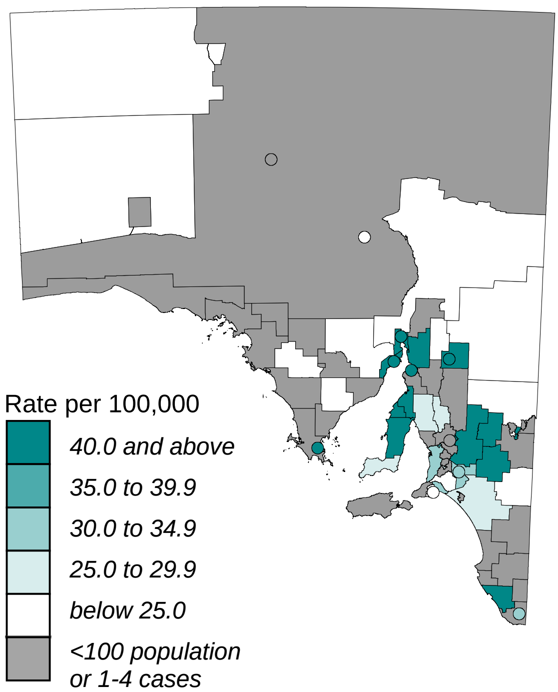
Map 43: Premature mortality, lung cancer, males, non-metropolitan areas, 1992–1995, 1997–2001 and 2003–2007

ASR per 100,000 by Statistical Local Area

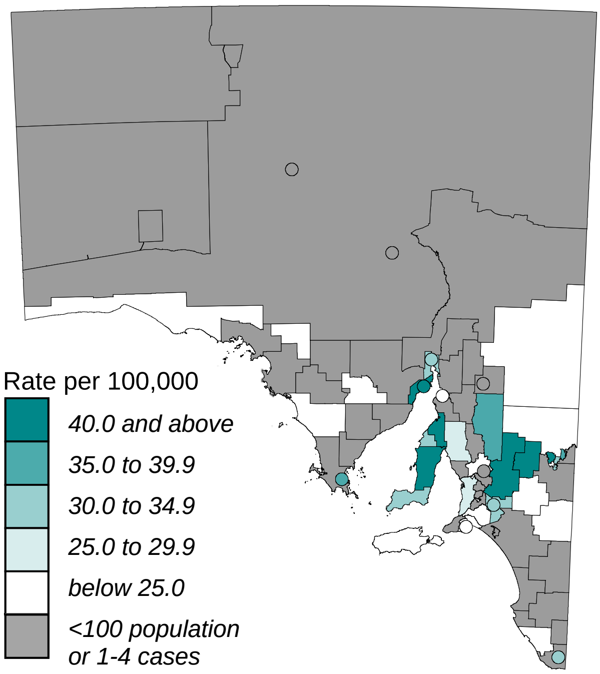
1992-1995



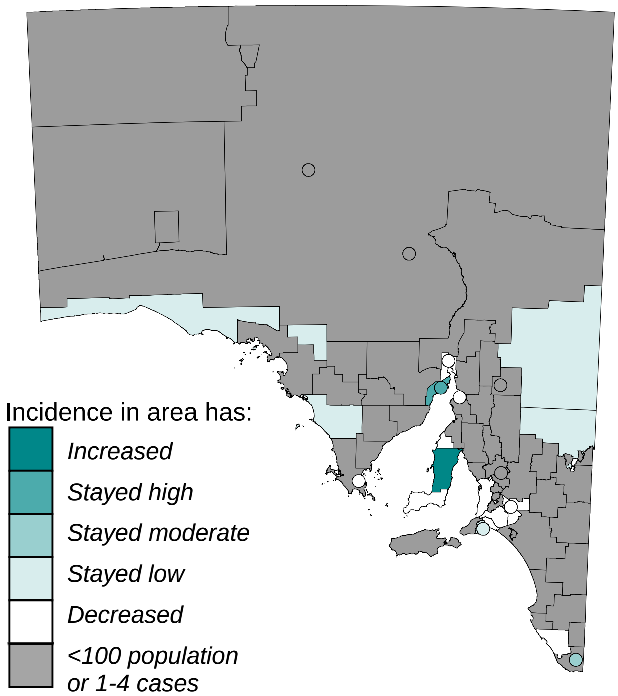
1997–2001



2003–2007



Change: 2003–2007 compared with 1992–95



Source: Compiled in PHIDU using data supplied by ABS on behalf of the SA Registrar of Deaths

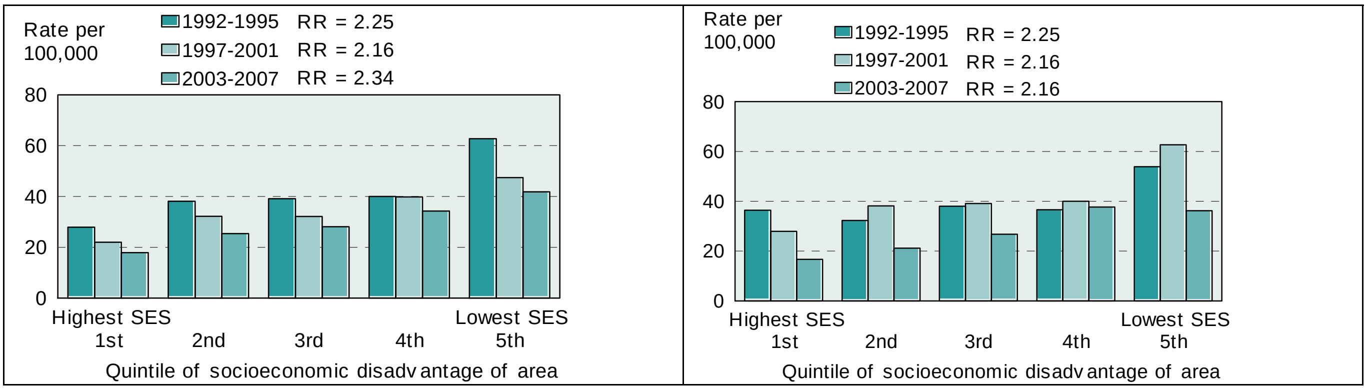
Distribution by socioeconomic status and remoteness

The premature mortality rate from lung cancer for males in the most disadvantaged areas is over twice (2.34 times) that in the least disadvantaged areas in Metropolitan Adelaide, and there is a consistent increase in rates across the quintiles of socioeconomic disadvantage. There were similar differentials in rates in the earlier periods. The pattern in the non-metropolitan areas is similar.

These differentials in rates, together with the socioeconomic gap in smoking rates, are among the largest seen for South Australian males at these ages.

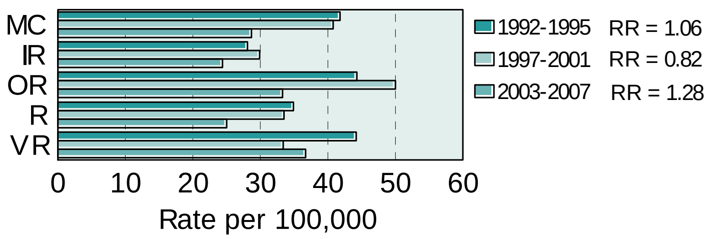
Figure 53: Premature mortality, lung cancer, males, by socioeconomic status, 1992–1995, 1997–2001 and 2003–2007

Metropolitan Adelaide **Non-metropolitan areas**



There is a continuous gradient in rates from the Major Cities to the Outer Regional and the Very Remote areas in 2003–2007, with an overall differential of 28%. Rates in the Inner Regional and Remote areas are lower, at around 24.5 deaths per 100,000 males. The high premature mortality rate in the Very Remote areas is consistent with the incidence of lung cancer for males. The pattern in the earlier years was more variable, in particular the very low rate in the Very Remote areas in 1997–2001, which resulted in a lower rate than in the Major Cities areas.

Figure 54: Premature mortality, lung cancer, males, by remoteness, 1992–1995, 1997–2001 and 2003–2007



Premature mortality, lung cancer, females, 1992 to 2007

For lung cancer, the vast majority (94% for males and 93% for females) of the burden of disease is due to premature death.[56] For females in 2011, lung cancer is expected to be the second leading cause of the burden of disease due to cancer (17% of the burden due to cancer), only exceeded by breast cancer, accounting for 42,300 disability-adjusted life years.[56]

Indicator definition: Deaths of females at ages 0 to 74 years from lung cancer, expressed as an age-standardised rate per 100,000 population

Geographic distribution

In 2003–2007, female premature mortality from lung cancer in the non-metropolitan areas of the State was 12.2% higher than in Metropolitan Adelaide, in contrast with incidence, which was 9.8% lower. Further analysis linking the deaths and cancer registry data could assist in understanding the extent to which these differences relate to differences in access to services, or to other factors.

The change in incidence between the periods is quite variable, between the first and second, and second and third periods, and between Metropolitan Adelaide and the non-metropolitan areas.

Table 28: Premature mortality, lung cancer, females, 1992–1995 to 2003–2007

Period	Metropolitan Adelaide	Non-metropolitan	South Australia
	Average annual ASR per 100,000		
1992–1995	14.4	11.5	13.6
1997–2001	13.5	15.2	14.8
2003–2007	15.6	17.5	16.2
	Percentage change		
From first to second period	-6.3	32.2	8.8
From second to third period	15.6	15.1	9.5
From first to third period	8.3	52.2	19.1

The maps for Metropolitan Adelaide show an increasing number of SLAs with high rates from 1995–1995 to 2003–2007.

Although very few areas had five or more premature deaths of females from lung cancer in 2003–2007, those that were included in the analysis show a strong association at the SLA level in Metropolitan Adelaide with socioeconomic disadvantage (an inverse correlation with the IRSD of -0.62).

The 'Change' map graphically highlights the SLAs with the largest increases, and those with the greatest decreases in premature deaths of females from lung cancer over this period.

Of areas that were mapped, high rates of statistical significance were found in Playford West Central (64.1** deaths per 100,000 females, with 15 deaths) and Elizabeth (30.5**, 20), Onkaparinga North Coast (28.0*, 30) and Port Adelaide Enfield East (27.4**, 21).

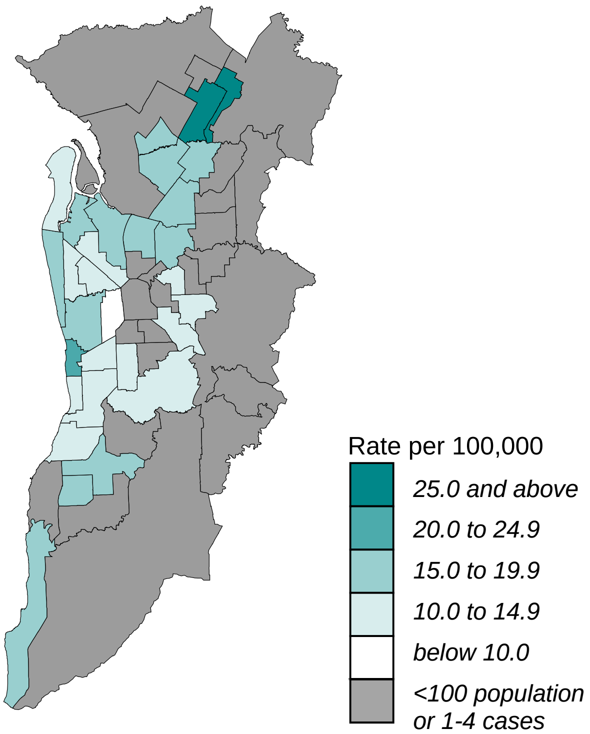
Rates below the State average and of statistical significance were only recorded for a few SLAs with fewer than five deaths.

In the non-metropolitan areas only Port Augusta (43.7** deaths per 100,000 females, with 13 deaths) and Whyalla (38.5**, 19) had statistically significantly high rates; none of the low rates were statistically significant.

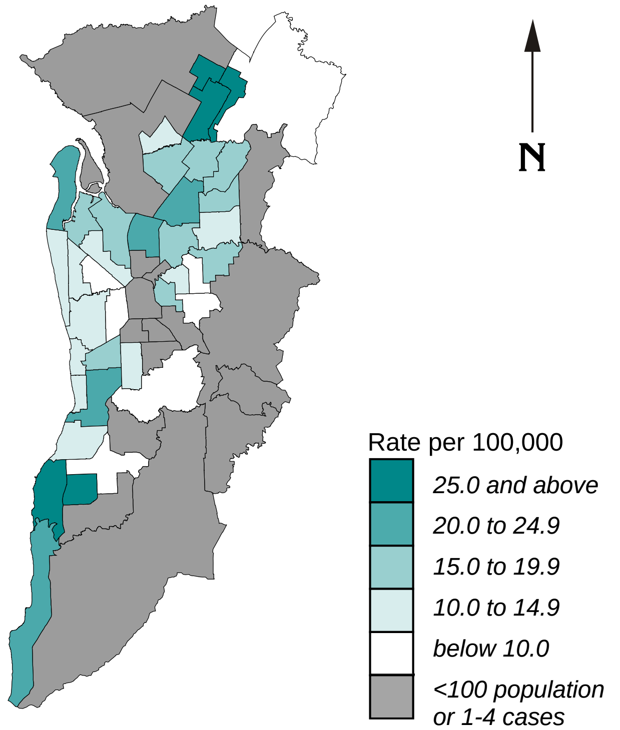
Map 44: Premature deaths, lung cancer, females. Adelaide, 1992–1995, 1997–2001 and 2003–2007

ASR per 100,000 by Statistical Local Area

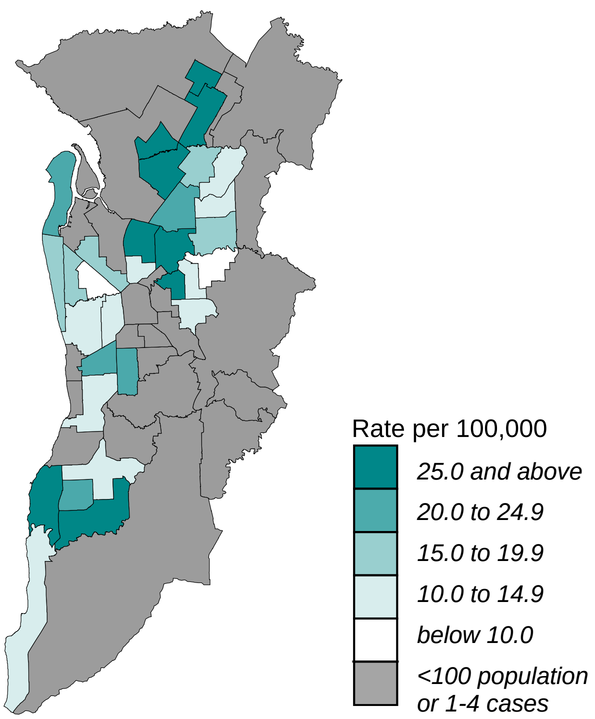
1992-1995



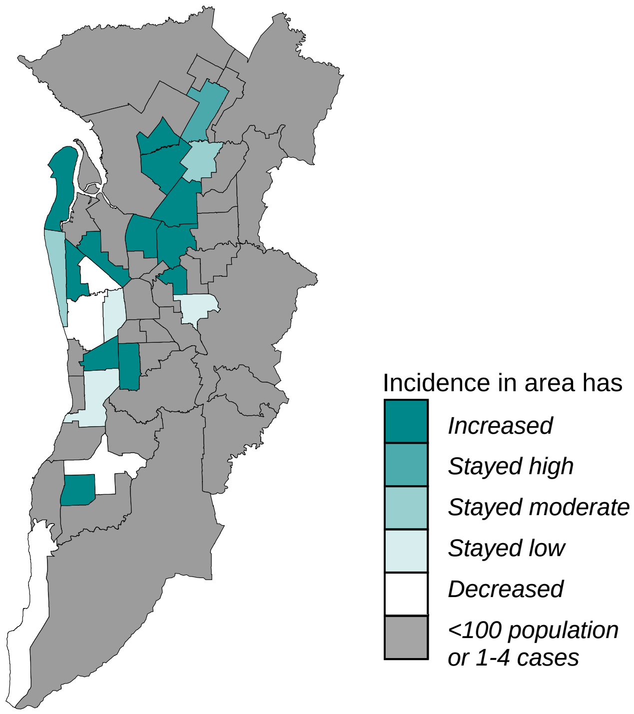
1997-2001



2003–2007



Change: 2003–2007 compared with 1992–95

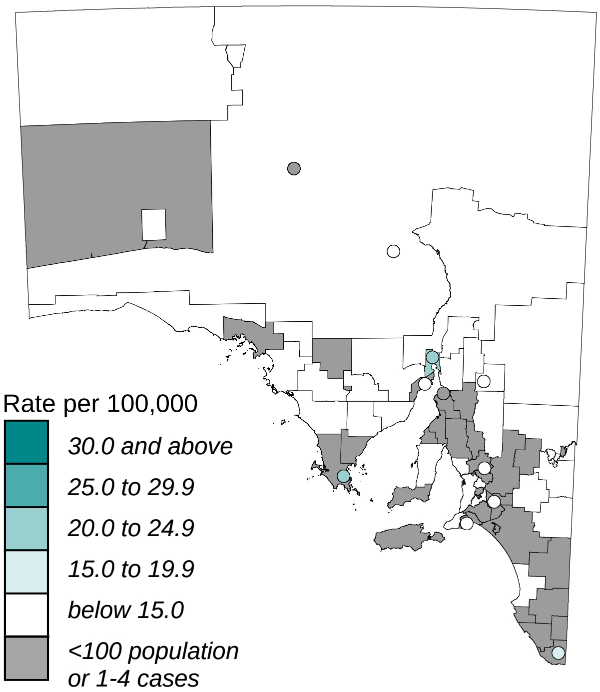


Source: Compiled in PHIDU using data supplied by ABS on behalf of the SA Registrar of Deaths

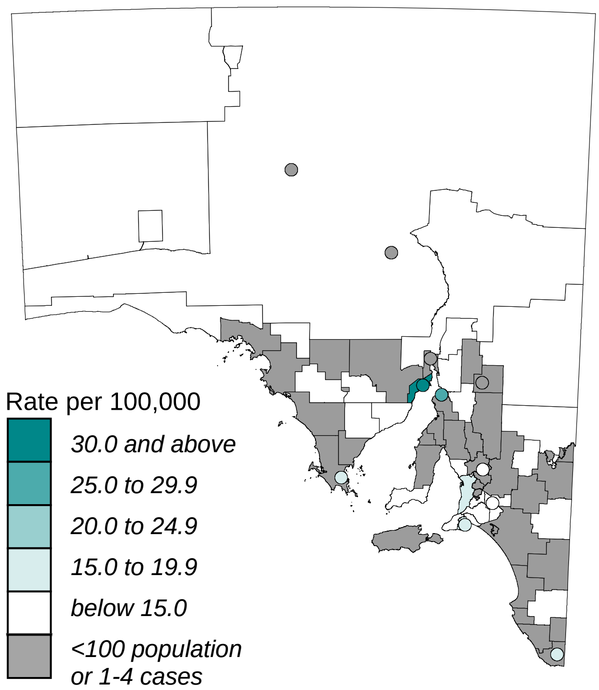
Map 45: Premature mortality, lung cancer, females, non-metropolitan areas, 1992–1995, 1997–2001 and 2003–2007

ASR per 100,000 by Statistical Local Area

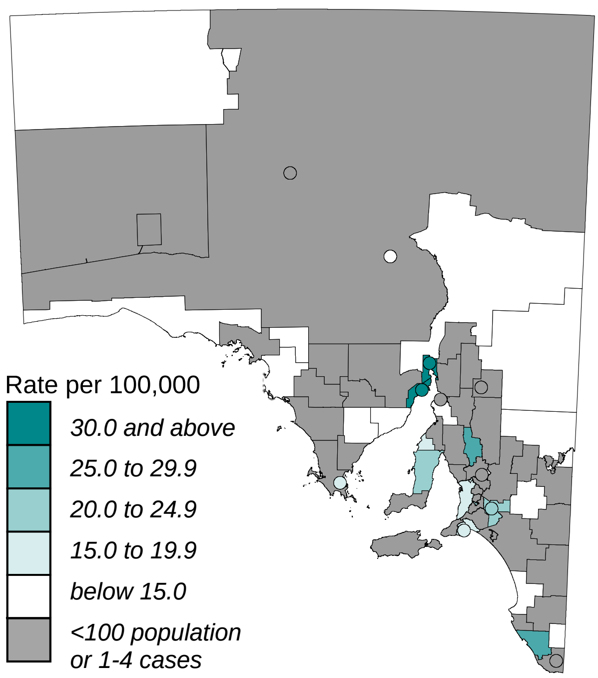
1992-1995



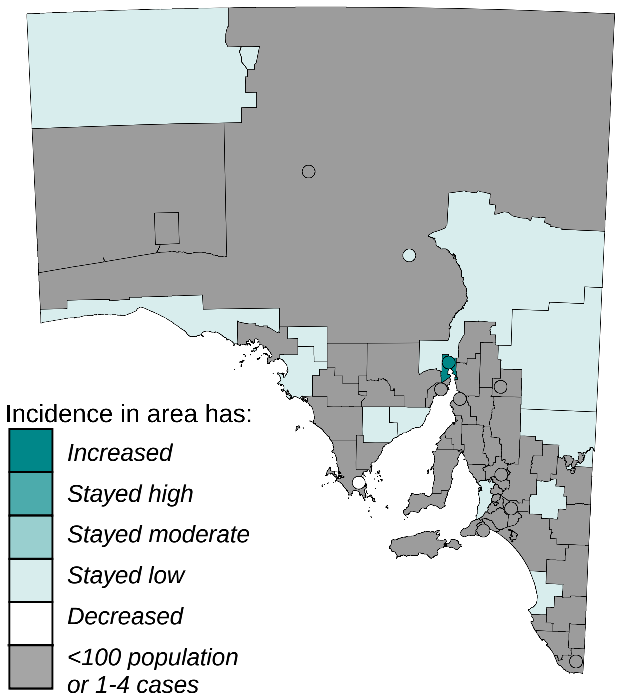
1997–2001



2003–2007



Change: 2003–2007 compared with 1992–95



Source: Compiled in PHIDU using data supplied by ABS on behalf of the SA Registrar of Deaths

Distribution by socioeconomic status and remoteness

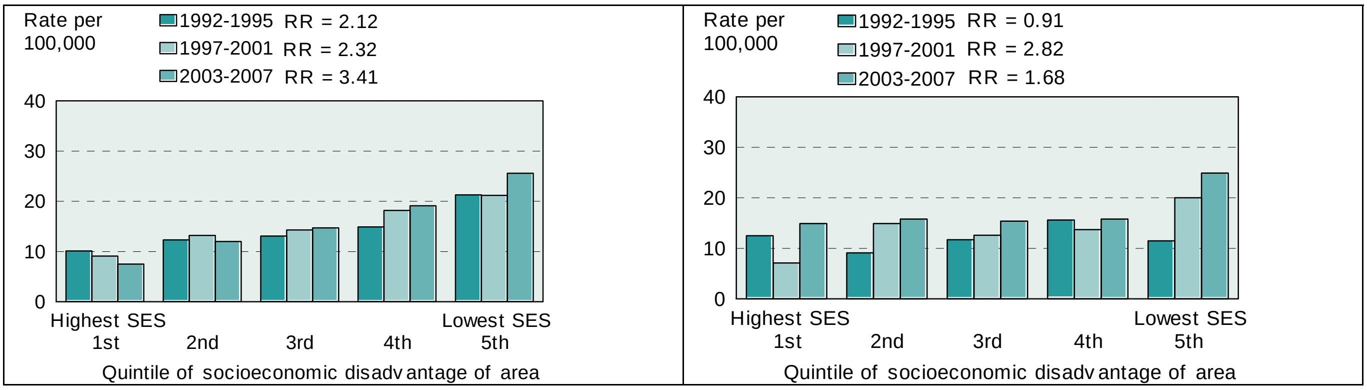
The premature mortality rate from lung cancer for females in the most disadvantaged areas in 2003–2007 is over three times (3.41 times) that in the least disadvantaged areas in Metropolitan Adelaide, and there is a consistent increase in rates across the quintiles of socioeconomic disadvantage. This differential in rates is higher than in 1992–1995 (2.12) or 1997–2001 (2.32).

The pattern in the non-metropolitan areas is somewhat different, in that rates across the first four quintiles are similar, before increasing substantially in the most disadvantaged areas, resulting in an overall differential of 68% when compared with the most advantaged areas. The gap in rates has varied widely over the three periods shown.

These differentials in rates, together with the socioeconomic gap in overall smoking rates and rates of females smoking during pregnancy, are among the largest seen for South Australian females at these ages.

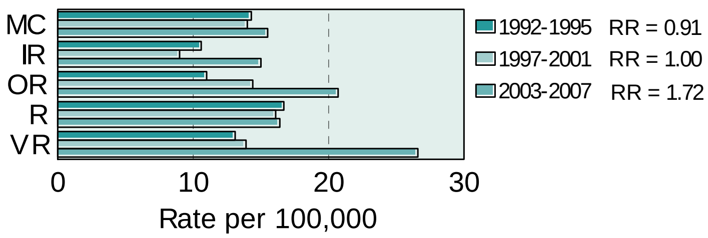
Figure 55: Premature mortality, lung cancer, females, by socioeconomic status, 1992–1995, 1997–2001 and 2003–2007

Metropolitan Adelaide **Non-metropolitan areas**



There are similar rates in the Major Cities, Inner Regional and Remote areas in 2003–2007, all being at around the State average, with higher rates in the Outer Regional and Very Remote areas, with an overall differential of 72%. The very high rate in the Very Remote areas is not consistent with the incidence of lung cancer for females, which is 38% lower than in the Major Cities areas. Again, further analysis linking the deaths and cancer registry data could assist in understanding the extent to which these differences reflect poorer access to services in a timely fashion, or are a result of misclassification to remoteness areas, or other factors. The pattern in the earlier years was more variable, in particular the relatively low rate in the Very Remote areas, similar to that in the Major Cities areas in 1997–2001, and lower in 1992–1995.

Figure 56: Premature mortality, lung cancer, females, by remoteness, 1992–1995, 1997–2001 and 2003–2007



Summary of variations by remoteness and socioeconomic status

Findings by remoteness

The extent to which there are poorer outcomes for people living in the most remote areas of the State, as well as differences in outcomes for people living in the non-metropolitan areas of the State compared with those living in Metropolitan Adelaide, are highlighted in summary form in Table 29 for the indicators mapped in this atlas. The data show there are poorer outcomes by remoteness for:

- all of the risk factors other than fruit consumption (see note to Table 29 as to the different groupings of remoteness classes available for these survey data);
- both measures of sun protection;
- participation in the breast screening, cervical and bowel cancer screening programs;
- incidence of all cancers for males, of colorectal cancer for persons and of lung cancer for males and females, melanoma for females, and prostate cancer;
- premature mortality from all cancers, breast cancer (females), colorectal cancer, and lung cancer (males and females); and
- incidence of non-melanocytic lip cancer, stage at diagnosis for breast cancer (females) and melanoma, and case survivals for all cancers.

The difference in rates in the non-metropolitan areas compared with rates in Metropolitan Adelaide is minimal, other than for higher rates for:

- smoking (males and females), high risk alcohol consumption, obesity for males and sun protective behaviours;
- incidence of melanoma for females; and
- premature mortality from colorectal cancer and lung cancer for females.

As noted above, the population of the Very Remote areas is small, and there are many challenges faced in providing services or access to services across the very large area of the State classed as Very Remote; however, this does not excuse those with responsibility for developing strategies to provide services in these areas from working to reduce the inequalities evident in these data.

Findings by socioeconomic status

Similar data are shown in Table 30 by socioeconomic status, highlighting the extent of poorer outcomes for people living in the most disadvantaged areas of Metropolitan Adelaide and the non-metropolitan areas of the State. There are poorer outcomes by socioeconomic status for:

- smoking (males and females), overweight for females and obesity for males and females, and physical inactivity;
- sun protective behaviours;
- participation in breast and cervical screening, and both low and high grade abnormalities detected for cervical screening;
- incidence of colorectal cancer and of lung cancer for males and females; and
- premature mortality from all cancers, colorectal cancer, and lung cancer (males and females).

In the non-metropolitan areas of the State, poorer outcomes were found for people living in the most disadvantaged areas (compared with the most advantaged areas) for:

- smoking (males and females), and physical inactivity;
- participation in, and abnormalities (both low and high grade) detected through, the cervical screening program;
- participation in, and positive faecal occult blood test (FOBT) results for the National Bowel Cancer Screening Program;
- incidence of all cancers (males and females), , colorectal cancer, lung cancer (males and females), melanoma for males and prostate cancer; and
- premature mortality from all cancers, breast cancer (females), colorectal cancer, and lung cancer (males and females).

Table 29: Summary of differences in selected indicators by remoteness, and between Metropolitan Adelaide and the non-metropolitan areas of South Australia

Topic and Indicator	Poorer outcome by remoteness[1]		Variation between country & city		
	Yes/No	RR[2]	Non-metro	Metropolitan	RR[3]
Risk factors[4] (%)					
Smoking					
- males	'Yes'	1.11	26.5	23.6	**1.12**
- females	Yes	1.77	20.8	16.5	**1.26**
High risk alcohol consumption	Yes	1.70	5.9	4.3	**1.37**
Overweight					
- males	Yes	1.07	37.2	37.8	0.98
- females	Yes	1.17	27.1	26.3	1.03
Obese					
- males	'Yes'	1.64	18.3	16.2	**1.13**
- females	Yes	1.16	18.1	17.1	1.06
Physical inactivity	Yes	1.12	38.9	36.6	1.06
Fruit consumption, recommended levels	Yes	0.93	46.7	49.0	0.95
Primary prevention					
Sun protection[3] (%)					
- Skin burnt at all over the past summer	'Yes'	1.57	21.2	21.3	1.00
- Sun protective behaviours	No	3.01	13.3	11.2	**1.19**
Screening for cancer					
Participation (%)					
- Breast screening	'Yes'	0.78	59.5	55.6	1.07
- Cervical screening	Yes	0.79	61.1	60.5	1.01
- Bowel screening: males	'Yes'	0.78	40.1	38.6	1.04
- Bowel screening: females	'Yes'	0.89	46.2	44.0	1.05
Outcome					
- cervical screening: (ASR)					
--low grade abnormalities	No	0.69	29.6	32.5	0.91
--high grade abnormalities	No	0.63	10.0	10.3	0.97
- bowel screening: (ASR)					
--positive FOBT result	Yes	1.80	9.6	8.5	1.13
Cancer incidence (ASR)					
All cancers, males	No	0.94	657.1	653.4	1.01
All cancers, females	No	0.74	498.5	509.9	0.98
Breast cancer (females)	No	0.62	217.0	227.3	0.95
Colorectal cancer	**..**	**..**	109.5	104.7	1.05
Lung cancer, males	'Yes'	1.24	84.8	86.1	0.98
Lung cancer, females	No	0.77	45.8	50.8	**0.90**
Melanoma, males	No	0.76	45.3	50.8	**0.89**
Melanoma, females	No	0.69	42.1	36.1	**1.17**
Prostate cancer	No	0.69	602.0	582.1	1.03
Premature mortality from cancers (ASR)					
All cancers	Yes	1.34	115.6	114.5	1.01
Breast cancer (females)	Yes	1.38	21.8	19.9	**1.10**
Colorectal cancer	'Yes'	1.27	10.5	13.2	**0.80**
Lung cancer, males	'Yes'	1.28	27.8	29.2	0.95
Lung cancer, females	Yes	1.72	17.5	15.6	**1.12**

[1]Yes indicates a poorer outcome in areas in the Very Remote class, compared with the Major Cities class: for the Risk factors, comparison is between the combined Outer Regional and Remote areas and the Major Cities class. Use of quotation marks indicates that Yes is equivocal: for example, incidence may generally increase with remoteness, but decline sharply in the Very Remote areas, which may reflect data quality issues. See individual indicators for details.

[2]RR is the percentage/ASR in the Very Remote areas (or Outer Regional and Remote areas for risk factors) compared with the percentage/ASR in the Major Cities areas.

[3]RR is the percentage/ASR in the non-metropolitan areas compared with the percentage/ASR in Metropolitan Adelaide: **bolded figures** indicate non-metropolitan ASR is 10% or more above, or below, the percentage/ASR in Metropolitan Adelaide.

[4]Based on sample surveys: remainder of indicators based on administrative data.

.. variation is less than 5%

Note: For details of calculation of measures (per cent, rate) for each indicator, see Chapter 4.

The largest socioeconomic differentials in rates in both Metropolitan Adelaide and the non-metropolitan areas were found for smoking (males and females), lung cancer incidence (males and females) and premature mortality (males and females). Other marked differentials in Metropolitan Adelaide were found for overweight females, obese males and females; physical inactivity; high grade abnormalities detected through cervical screening and positive faecal occult blood test results from bowel screening; and premature mortality from all cancers. In the non-metropolitan areas, marked differentials were recorded for physical inactivity; positive faecal occult blood test results from bowel screening; incidence of all cancers for males, colorectal cancer, melanoma for males and prostate cancer; and premature mortality from all cancers and colorectal cancer.

Table 30: Summary of differences in selected indicators by socioeconomic disadvantage of area, Metropolitan Adelaide and non-metropolitan areas, South Australia

Topic and Indicator	Poorer outcome by SES[1]		Rate ratio by SES[2]	
	Metropolitan Adelaide	Non-metropolitan	Metropolitan Adelaide	Non-metropolitan
Risk factors[3] (%)				
Smoking				
- males	Yes	Yes	**2.62**	**1.39**
- females	Yes	Yes	**2.37**	**2.06**
High risk alcohol consumption	n.a.	n.a.	n.a.	n.a.
Overweight				
- males	No	No	**0.79**	**0.18**
- females	'Yes'	No	**1.41**	**0.75**
Obese				
- males	Yes	No	**1.32**	**0.82**
- females	Yes	No	**1.56**	**0.75**
Physical inactivity	Yes	Yes	**1.79**	**1.47**
Fruit consumption at recommended levels	No	**..**	**0.89**	**0.58**
Primary prevention				
Sun protection[3] (%)				
- Skin burnt at all over the past summer	No	No	**0.94**	**0.84**
- Sun protective behaviours	Yes	No	**0.59**	1.06
Screening for cancer				
Participation (%)				
- Breast screening	Yes	No	**0.87**	1.09
- Cervical screening	Yes	Yes	**0.77**	**0.84**
- Bowel screening: males	Yes	Yes	**0.80**	**0.90**
- Bowel screening: females	Yes	Yes	**0.79**	0.92
Outcome: (ASR)				
- Cervical screening: low grade abnormalities	Yes	Yes	1.07	**1.15**
- Cervical screening: high grade abnormalities	Yes	Yes	**1.22**	**1.14**
- Bowel cancer: positive FOBT results	Yes	Yes	**1.44**	**1.21**
Cancer incidence (rate)				
All cancers, males	'No'	Yes	1.02	**1.29**
All cancers, females	''No'	Yes	1.02	1.08
Breast cancer (females)	No	No	**0.87**	**0.90**
Colorectal cancer	Yes	Yes	**1.15**	**1.21**
Lung cancer, males	Yes	Yes	**1.78**	**2.01**
Lung cancer, females	Yes	Yes	**2.02**	**1.88**
Melanoma, males	No	Yes	**0.71**	**1.33**
Melanoma, females	No	**..**	**0.74**	1.04
Prostate cancer	No	Yes	**0.81**	**1.21**
Premature mortality from cancers (rate)				
All cancers	Yes	Yes	**1.42**	**1.34**
Breast cancer (females)	No	Yes	0.97	**1.10**
Colorectal cancer	'Yes'	Yes	**1.11**	**1.59**
Lung cancer, males	Yes	Yes	**2.34**	**2.16**
Lung cancer, females	Yes	Yes	**3.41**	**1.68**

[1]Yes indicates a poorer outcome in the most disadvantaged areas (Quintile 5) when compared with the least disadvantaged areas (Quintile 1). Use of quotation marks indicates that Yes is equivocal: for example, incidence may be higher in the most disadvantaged areas but there may not be a gradient in percentages/ASRs across the middle quintiles. See individual indicators for details.

[2]Rate ratio is the percentage/ASR in the most disadvantaged areas compared with the percentage/ASR in the least disadvantaged areas: **bolded figures** indicate the differential in percentage/ASR is 10% or more.

[3]Based on sample surveys: remainder of indicators based on administrative data.

.. variation is less than 5%

Note: For details of calculation of measures (per cent, rate) for each indicator, see Chapter 4.

n.a. not available

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Section 3

Cancer incidence, stage and survival by region of South Australia: An analysis of supplementary data for selected cancers

In this section …

- Introduction
- Findings
- Discussion
- References

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Introduction

The information in this Section is based on a report provided by the SA Cancer Registry. A full copy of that report is at Appendix D.
Annual reports of the SA Cancer Registry have for many years shown differences in incidence and survival for cancers by residential area of South Australia.[3, 4] In general, the data have shown survivals to be a little lower for non-metropolitan than metropolitan patients, although differences generally were very small, often not statistically significant, and when statistically significant, normally too small in magnitude to be of public health significance.[4] Only minor differences in incidence have normally applied, although an exceptional finding has been the much higher incidence of cancer of the lip in non-metropolitan areas.[5] Lip cancers occur on the outer vermilion border of the lower lip and their higher incidence in non-metropolitan areas is attributed to excess sun exposure.[5] International data often show a similar pattern of incidence of lip cancer and non-melanoma skin cancers (basal and squamous cell carcinomas) probably because both are sun-related.[5] The elevated incidence of lip cancer in non-metropolitan residents is likely therefore to be a marker of an elevated risk of non-melanoma skin cancers as well. While rarely a cause of death, non-melanoma skin cancers are a major cost to the health system, accounting for more hospital admissions than any other cancer type.[6]

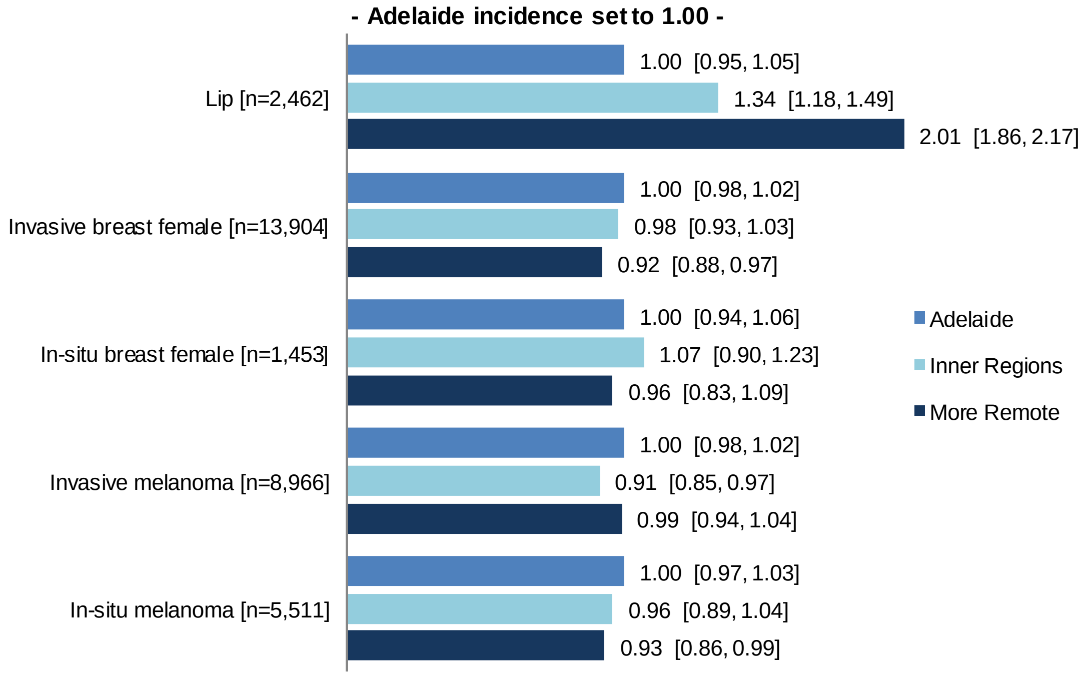
To complement the data compiled by PHIDU in this atlas, Cancer Council South Australia (CCSA) requested data from the SA Cancer Registry on the incidence of certain cancers, stage of progression at diagnosis and survival by residential area of South Australia. Registry data were analysed for the 1995-2008 diagnostic period for Adelaide, Inner Regions and More Remote areas (Outer Regional, Remote and Very Remote areas combined), using the Australian Standard Geographical Classification. The full paper (including details of the methodology) is contained in Appendix D.

Findings

Incidence

The mean annual age-standardised incidence rate (ASR) for lip cancer was higher for people living in Inner Regions and More Remote areas than in Adelaide, with elevations of 34% and 101% respectively. The approximate two-fold elevation for More Remote areas is consistent with elevations observed in previous Registry reports.[3, 5, 10]

Figure 57: Mean annual age-standardised incidence (95% CLs); South Australia, 1995–2008*



* Age-standardized to Australian population 2001. Regions classified using ASGC 2007.

Non-melanoma skin cancers (NMSC, i.e., basal and squamous cell carcinomas) are not recorded by the Registry but elevations in their ASR have often accompanied an elevation in ASR for lip cancer, presumably because excess sun exposure contributes to both. The elevated lip cancer ASR in Very Remote areas of South Australia is probably indicative of an elevated NMSC ASR as well. These cancers are rarely a cause of death, but they are the leading cause of hospitalisations for cancer and impose a large burden on the health system. This underlines the need for an emphasis on More Remote areas in sun protection programs.

By comparison, the invasive female breast cancer ASR was approximately 8% lower in More Remote areas than in Adelaide, which is similar to findings in previous Registry reports and nationally. This has generally been attributed to differences in reproductive history (earlier childbirth and higher parity in more remote areas), although use of hormone replacement therapy and/or other risk factors may have contributed.

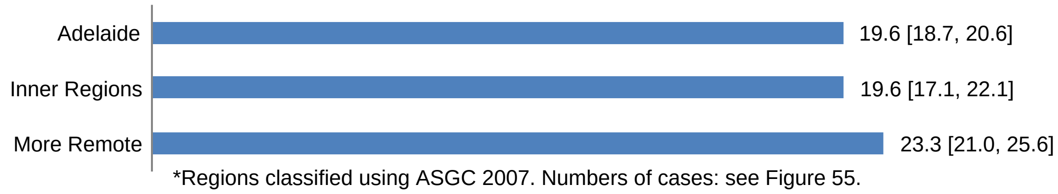
Apart from a lower invasive melanoma incidence in Inner Regions than in Adelaide (9% lower), there were no other statistically significant differences in incidence by region.

Data related to diagnostic stage

Breast cancer diameters

The percentage of invasive breast cancers classified as large (i.e., 30+ mm diameter) was higher in More Remote than other areas of South Australia (i.e., 23.3% compared with 19.6%) . A more detailed analysis of diameter distribution (<15, 15-19, 20-29 and 30+mm) by region, with adjustment for age at diagnosis (<40, 40-49, 50-69, 70+ years), confirmed that there was an elevation in proportion of invasive cancers with larger diameters in areas that were more remote from Adelaide (p<0.001).

Figure 58: Percentage of invasive females breast cancers of large size (diameters 30+mm) (95% CLs); South Australia, 1995–2008*



*Regions classified using ASGC 2007. Numbers of cases: see Figure 55.

While this trend applied to 40-49 year olds (p=0.002) and 70+ year olds (p<0.001), it was not evident for the BreastScreen target group of 50-69 year olds (p=0.994). Among 50-69 year olds, all of whom are eligible for screening, the percentages of breast cancers classified as large were 17.1% for Adelaide residents, 16.1% for Inner Regions, and 16.7% for More Remote areas. These data are not suggestive of more advanced stages in non-metropolitan areas.

There was no statistically significant variation, however, in the proportion of breast cancers detected at an in-situ as opposed to invasive stage by region, the proportions being 9.3% for Adelaide, 10.2% for Inner Regions and 9.9% for More Remote areas. This was confirmed in more detailed analyses of in-situ percentages by region when adjusting for age at diagnosis (<40, 40-49, 50-69, 70+ years) (p=0.366). Moreover, there was no difference by region within specific age categories (p>0.250), including in the 50-69 year screening target (p=0.508).

Figure 59: Percentage of invasive breast cancers detected at in-situ stage (95% CLs); South Australia, 1995–2008*

*Regions classified using ASGC 2007. Numbers of cases: see Figure 55. In-situ % estimated from 15,357 cases.

There is a need to give emphasis to Very Remote areas when promoting earlier detection, especially for those age groups outside the screening target age range. This would apply to Aboriginal and Torres Strait Islander women in particular, since they have more advanced breast cancers at diagnosis and lower survivals from this cancer than other women.

Melanoma thickness

The percentage of invasive melanomas that were thick at diagnosis (i.e., thickness >1.5mm) was higher in non-metropolitan areas (22.9% in More Remote and 22.7% in Inner Regions, compared with 20.2% in Adelaide). Confidences intervals overlapped and differences were not statistically significant (p>0.05). However when a more detailed analysis was undertaken of thickness (<=0.75, 0.76-1.50, 1.51-3.00, >3.00mm) by region, adjusting for age at diagnosis (<40, 40-49, 50-59, 60-69, 70+ years), thickness was found to be greater in areas that were more remote from Adelaide (p=0.001) and a similar trend presented in all age groups that achieved statistical significance in 50-59 year olds (p=0.038) and 60-69 year olds (p<0.001). This indicates the need to give special attention to these localities when promoting early detection.

Figure 60: Percentage of invasive melanomas of thickness greater than 1.5mm (95% CLs); South Australia, 1995–2008*

*Regions classified using ASGC 2007. Numbers of cases: see Figure 55

There was no statistically significant variation however in the proportion of melanomas detected at an in-situ as opposed to invasive cancer stage by region, with these proportions being 38.1% in Adelaide, 39.8% in Inner Regions, and 36.5% in More Remote areas. This null finding was confirmed in more detailed analysis of in-situ percentage by region, when adjusting for age at diagnosis (<40, 40-49, 50-59, 60-69, 70+ years) (p=0.383). No differences were found within individual age categories (p>0.189).

Figure 61: Percentage of melanomas detected at in-situ stage (95% CLs); South Australia, 1995–2008*

*Regions classified using ASGC 2007. Numbers of cases: see Figure 55 In -situ % estimated from 14,477 cases.

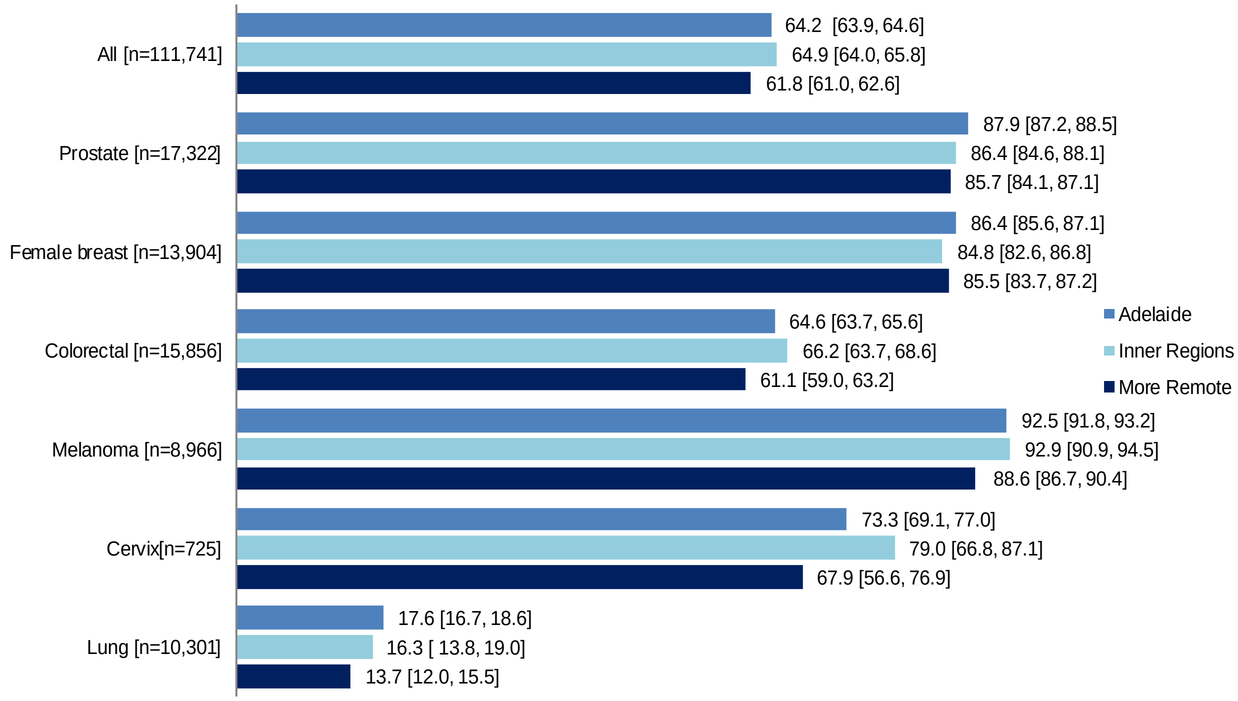
Survival

Survivals from cancer are high in South Australia by world standards with 5-year survivals for all cancers collectively of 61% for 1997-2003. This is similar to the leading survival figure of 63% reported for USA centres for an equivalent diagnostic period and greatly exceeds the corresponding 48% survival for Europe.

Case survivals for all cancers combined were a little lower for people living in in More Remote areas than in Adelaide, both at five years from diagnosis (62% compared with 64%) and at 10 years (58% compared with 60%). These were influenced by poorer survivals from cancers of the female breast (86.4% compared with 85.5%), colon/rectum (61.1% compared with 64.6%), prostate (85.7% compared with 87.9%), skin (melanoma) (88.6% compared with 92.5%) and lung (13.7% compared with 17.6%). Similar findings have been reported nationally.

These differences, while potentially of little importance in public health terms, were probably real, in that 95% confidence intervals did not overlap. A similar difference was suggested for cancer of the cervix, but this was more likely to be a chance event. In no comparison was a non-random difference in survival indicated between patients from Inner Regions and Adelaide.

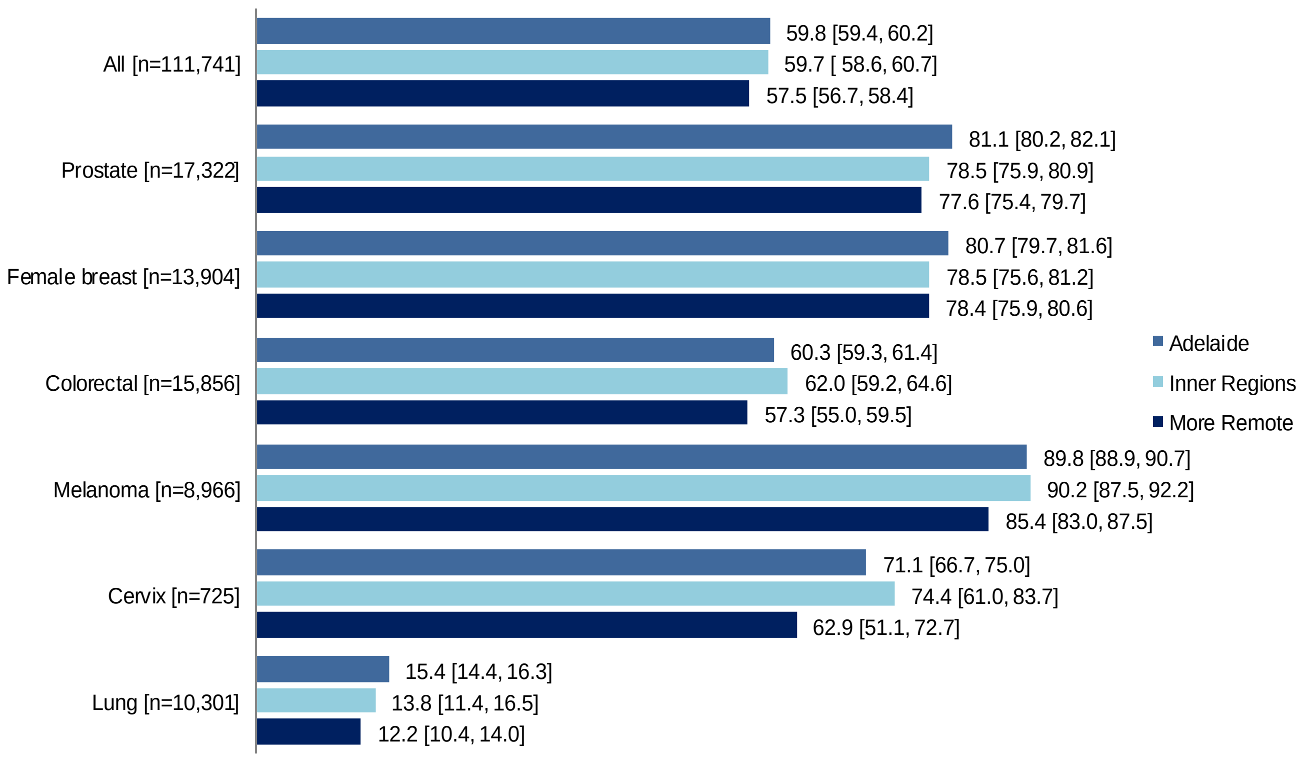
Figure 62: Percentage 5-year survival (95% CLs); South Australia, 1995–2008*



* Date of censoring of live cases, December 31,2008. Invasive cancers only.

Similarly 10-year survivals were marginally lower for patients from More Remote areas than Adelaide. This applied for all cancers collectively (57.5% compared with 59.8%) and cancers of the prostate (77.6% compared with 81.1%), skin (melanoma) (85.4% compared with 89.8%) and lung (12.2% compared with 15.4%). Again, differences were very small and potentially of little importance in public health terms but probably real, in that 95% confidence intervals did not overlap. Similar differences were suggested for cancers of the female breast, colon/rectum, and cervix, but they were more likely to be chance events. In no comparison was a non-random difference in survival indicated between patients from Inner Regions and Adelaide.

Figure 63: Percentage 10-year survival (disease specific) (95% CLs); South Australia, 1995–2008*



*Date of censoring live cases, December 31 , 2008. Invasive cases only.

When multivariable Cox proportional hazards regression analyses were performed, with relative risks of death (i.e., hazards ratios) from the index cancer assessed by region of residence after adjusting for age at diagnosis (classified as <40, 40-49, 50-59, 60-69, 70-79 and 80+ years), and where relevant by gender, the relative risk was higher for patients from More Remote areas than Adelaide for all cancers collectively and each cancer type shown in Figures x and y ($p<0.05$). Generally, there was no difference in risk between patients from Inner Regions and Adelaide ($p>0.05$), apart from prostate cancer patients where an elevated risk was suggested in patients from Inner Regions (relative risk 1.15 (95% Confidence Limits (CLs): 1.01, 1.30).

Discussion

The two-fold incidence of lip cancer in More Remote areas than Adelaide is consistent with observations reported in SA Cancer Registry reports since the 1980s.[3, 5, 10] Lip cancer is sun-related and its incidence is often high in populations with a high incidence of sun-related non-melanoma skin cancers (basal and squamous cell carcinomas).[5] While these cancers rarely are a cause of death,[4] they account for more hospital admissions in Australia than any other cancer type.[6] There is a general need to promote sun protection to lower the incidence of these cancers, especially in More Remote areas with elevated risks.

Conversely, the risk of invasive breast cancer is lower in More Remote areas than in Adelaide. This is consistent with national observations of geographic differences and data previously reported for South Australia.[11] Differences in reproductive history are thought to have contributed to this pattern, with earlier first full-term pregnancy and higher parity being protective for this cancer. Another possible contributing factor would be use of hormone replacement therapy, if this were to vary by Region.[11]

Invasive breast cancers were more likely to be large (30+mm diameter) in More Remote areas (23%) than for Adelaide residents (20%). It is notable however that this difference did not apply to the BreastScreen SA target age range of 50-69 years, which probably reflects the effect of BreastScreen SA in reducing socio-demographic inequalities. There is a need to promote earlier detection in More Remote areas for women outside the screening target age range. This would apply in particular to Aboriginal and Torres Strait Islander women who have more advanced stages at diagnosis and poorer survival outcomes.[11, 12]

Invasive melanomas were more likely to be thick (>1.50mm) in residents of Inner Regions and More Remote areas (23%) than for Adelaide residents (20%). This trend applied in each age category and was statistically significant in 50-59 and 60-69 year olds. Again, this highlights a need for a special emphasis in early detection programs on non-metropolitan regions.

Case survivals for all cancers combined were a little lower in More Remote areas than in Adelaide both at five years from diagnosis (62% compared with 64%) and at 10 years (58% compared with 60%). Multivariable analysis confirmed that case fatality rates were higher in Very Remote areas for all invasive cancers collectively, and that cancers of the female breast, cervix, colon/rectum, prostate, skin (melanoma) and lung contributed to these higher case fatalities. It is clear though that the differences were very small and generally would have been of little or no public health significance. That said, there would be some sub-groups who would have contributed disproportionately to poorer outcomes in More Remote areas, including Aboriginal and Torres Strait Islander patients where barriers to better outcomes require special attention.[11]

Less ready access to treatment is likely to apply in many of these More Remote areas, despite the attempts already made to optimize care availability through telemedicine and support for transport services and accommodation for those who require specialist services in Adelaide. Present initiatives to strengthen service availability in major non-metropolitan centres should also facilitate better access to care for many non-metropolitan patients.

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Section 4

Correlation analysis

In this section …

- Introduction
- Results

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Introduction

A correlation analysis has been undertaken to illustrate the extent of association at the SLA level between the indicators in this Atlas. Separate analyses were undertaken for Metropolitan Adelaide and non-metropolitan areas.

The results of the correlation analysis are shown in the following tables. As a general rule, correlation coefficients of plus or minus 0.71 or above are of substantial statistical significance, because this higher value represents at least fifty per cent shared variation (r^2 greater than or equal to 0.5): these are referred to as being 'very strong' correlations, while those of 0.50 to 0.70 are of meaningful statistical significance, and are referred to as being 'strong' correlations. Correlations from plus or minus 0.30 to less than 0.50 are referred to in the text as being 'moderate'; and those just below plus or minus 0.30 are referred to as 'weak'.

Readers should note that correlations between socioeconomic disadvantage (as measured by the IRSD) and poor health outcomes (e.g., high rates of premature death) appear in the matrix as negative numbers. This occurs because low numbers (under 1000) indicate high levels of relative socioeconomic disadvantage under the IRSD and high numbers (above 1000) indicate low levels of relative socioeconomic disadvantage.

Results

Metropolitan Adelaide

Socioeconomic status

The correlation analysis showed there to be

- <u>very strong</u> associations at the SLA level between socioeconomic <u>disadvantage</u> and:
  - lung cancer incidence for males and females (inverse correlations of -0.78 and -0.74, respectively);
  - premature deaths from all cancers (-0.77);
- <u>strong</u> associations between socioeconomic <u>disadvantage;</u> and
  - high grade abnormalities detected through cervical screening;
  - premature deaths from lung cancer for males and females;
- <u>very strong</u> associations between socioeconomic <u>advantage;</u> and
  - cervical cancer participation rates (0.77);
- <u>strong</u> associations between socioeconomic <u>advantage;</u> and
  - breast screening participation rates (0.56);
  - prostate cancer incidence (0.50).

Screening

There is a weak correlation (0.28) between participation in breast cancer screening and breast cancer incidence.

For cervical screening the association between high rates of participation and abnormalities detected is inverse for both low grade (-0.07) and high grade (-0.45) abnormalities. This is not to say that cancers were not detected as a result of screening, but that they were not consistently found among women in areas with high rates of participation in screening.

Participation in screening in the National Bowel Cancer Screening Program is strongly associated with high socioeconomic status for males (0.64) and very strongly associated for females (0.71). Poorer outcomes (i.e., high rates of positive faecal occult blood test results) are strongly correlated at the SLA level with socioeconomic disadvantage, a correlation coefficient of -0.62.

Incidence

Lung cancer incidence among males is very strongly correlated with the risk factor estimates for males smoking (0.80), physical inactivity (0.76) and (inversely) with the population meeting the recommended levels of fruit consumption (-0.71) and with premature deaths from all cancers (0.74) and lung cancer (0.77). There is also a strong correlation with obesity among males (0.52) and a strong inverse correlation with overweight males (-0.68).

For females with lung cancer, the only very strong correlations are with smoking (0.74) and premature deaths from lung cancer (0.75). There were strong correlations with physical activity (0.69), obesity among females (0.66) and premature deaths from all cancers (0.69).

The incidence of prostate cancer has few correlations of note, the strongest being an inverse correlation with physical inactivity (-0.51); there are also inverse correlations with premature deaths from all cancers (-0.33) and, for males, from all causes (-0.42).

There were only moderate to weak correlations for incidence of melanomas of the skin.

Non-metropolitan areas

Correlation coefficients are generally lower (indicating weaker associations) in non-metropolitan areas, in part as a result of the smaller populations at the SLA level.

Socioeconomic status

There were no strong or very strong associations between socioeconomic disadvantage and the data for cancer screening, cancer incidence or for cancer mortality. However, participation in cervical cancer screening was strongly correlated at the SLA level with socioeconomic advantage (0.56).

Screening

There were strong associations at the SLA level between high rates of high level abnormalities from cervical cancer screening and areas with high rates of breast cancer incidence, lung cancer incidence (for males and females), and deaths of females from lung cancer (and a very strong association with deaths of males from lung cancer).

Incidence

Other than the associations between incidence and cervical cancer screening noted above there were no strong or very strong associations.

Table 31: Correlation matrix, Metropolitan Adelaide

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	V31	V32	V33	V34	V35	V36
V1	1.00	-0.88	-0.87	-0.88	-0.26	-0.94	0.86	-0.58	0.19	-0.82	0.25	0.69	0.56	0.77	-0.54	-0.15	0.64	0.71	-0.62	-0.15	-0.11	-0.16	0.39	-0.20	-0.78	-0.74	0.50	0.30	0.33	-0.84	-0.83	-0.77	-0.14	-0.10	-0.63	-0.62
V2	-0.88	1.00	0.98	1.00	0.51	0.90	-0.82	0.66	-0.04	0.89	-0.10	-0.91	-0.55	-0.87	0.46	0.01	-0.57	-0.74	0.56	0.10	0.01	0.17	-0.40	0.26	0.80	0.68	-0.42	-0.40	-0.36	0.75	0.74	0.77	0.10	0.10	0.63	0.64
V3	-0.87	0.98	1.00	0.99	0.58	0.86	-0.78	0.67	0.09	0.89	-0.06	-0.92	-0.57	-0.84	0.53	0.00	-0.51	-0.73	0.59	0.14	0.08	0.25	-0.33	0.22	0.80	0.74	-0.37	-0.40	-0.36	0.73	0.74	0.77	0.17	0.04	0.62	0.68
V4	-0.88	1.00	0.99	1.00	0.54	0.89	-0.81	0.66	0.01	0.89	-0.09	-0.92	-0.56	-0.86	0.49	0.01	-0.55	-0.74	0.58	0.12	0.04	0.21	-0.37	0.25	0.80	0.71	-0.40	-0.40	-0.36	0.75	0.75	0.78	0.13	0.08	0.63	0.66
V5	-0.26	0.51	0.58	0.54	1.00	0.20	-0.19	0.40	0.55	0.43	0.14	-0.65	-0.23	-0.30	0.35	0.04	0.12	-0.12	0.33	0.34	0.30	0.45	0.15	0.25	0.36	0.36	0.08	0.04	0.09	0.24	0.18	0.30	0.00	-0.05	0.10	0.32
V6	-0.94	0.90	0.86	0.89	0.20	1.00	-0.84	0.66	-0.19	0.84	-0.26	-0.72	-0.54	-0.78	0.38	0.04	-0.64	-0.76	0.56	0.08	-0.03	0.08	-0.49	0.23	0.76	0.69	-0.51	-0.35	-0.42	0.76	0.78	0.75	0.15	0.08	0.65	0.59
V7	0.86	-0.82	-0.78	-0.81	-0.19	-0.84	1.00	-0.47	0.40	-0.67	0.21	0.75	0.52	0.77	-0.40	-0.12	0.69	0.76	-0.46	0.01	0.00	-0.08	0.38	-0.13	-0.68	-0.61	0.46	0.43	0.28	-0.77	-0.77	-0.71	-0.03	-0.22	-0.67	-0.58
V8	-0.58	0.66	0.67	0.66	0.40	0.66	-0.47	1.00	0.15	0.63	-0.23	-0.59	-0.36	-0.50	0.31	-0.06	-0.29	-0.57	0.44	0.17	-0.04	0.14	-0.22	0.10	0.52	0.62	-0.22	-0.27	-0.37	0.41	0.43	0.45	0.06	-0.15	0.36	0.43
V9	0.19	-0.04	0.09	0.01	0.55	-0.19	0.40	0.15	1.00	0.04	0.17	-0.09	0.14	0.29	-0.06	-0.28	0.46	0.32	0.12	0.20	0.12	0.25	0.23	-0.08	-0.02	0.05	0.28	0.11	-0.03	-0.33	-0.28	-0.15	0.13	-0.31	-0.21	0.02
V10	-0.82	0.89	0.89	0.89	0.43	0.84	-0.67	0.63	0.04	1.00	-0.18	-0.76	-0.53	-0.79	0.42	0.12	-0.48	-0.62	0.56	0.20	0.07	0.23	-0.27	0.23	0.74	0.66	-0.37	-0.29	-0.30	0.69	0.68	0.76	0.22	0.06	0.60	0.57
V11	0.25	-0.10	-0.06	-0.09	0.14	-0.26	0.21	-0.23	0.17	-0.18	1.00	-0.07	-0.05	0.03	0.03	-0.07	0.14	0.18	-0.14	-0.13	-0.05	-0.03	-0.05	-0.03	-0.03	-0.08	0.16	-0.10	-0.09	-0.15	-0.09	0.00	-0.06	0.14	0.04	0.00
V12	0.69	-0.91	-0.92	-0.92	-0.65	-0.72	0.75	-0.59	-0.09	-0.76	-0.07	1.00	0.50	0.77	-0.40	0.09	0.41	0.69	-0.45	-0.11	0.00	-0.26	0.29	-0.21	-0.71	-0.63	0.24	0.42	0.29	-0.58	-0.63	-0.69	-0.11	-0.10	-0.56	-0.62
V13	0.56	-0.55	-0.57	-0.56	-0.23	-0.54	0.52	-0.36	0.14	-0.53	-0.05	0.50	1.00	0.68	-0.36	-0.08	0.51	0.54	-0.37	0.03	0.06	0.00	0.28	0.11	-0.48	-0.55	0.24	0.40	0.18	-0.63	-0.57	-0.55	0.02	0.03	-0.45	-0.49
V14	0.77	-0.87	-0.84	-0.86	-0.30	-0.78	0.77	-0.50	0.29	-0.79	0.03	0.77	0.68	1.00	-0.45	-0.07	0.72	0.75	-0.45	-0.04	-0.01	-0.13	0.40	-0.20	-0.67	-0.64	0.32	0.49	0.32	-0.76	-0.73	-0.76	-0.07	-0.19	-0.59	-0.64
V15	-0.54	0.46	0.53	0.49	0.35	0.38	-0.40	0.31	-0.06	0.42	0.03	-0.40	-0.36	-0.45	1.00	0.29	-0.33	-0.40	0.28	0.28	0.30	0.34	0.06	0.18	0.45	0.40	-0.10	-0.15	-0.08	0.55	0.44	0.43	0.16	-0.02	0.32	0.29
V16	-0.15	0.01	0.00	0.01	0.04	0.04	-0.12	-0.06	-0.28	0.12	-0.07	0.09	-0.08	-0.07	0.29	1.00	-0.12	0.04	-0.06	0.19	0.27	0.17	-0.01	0.11	0.06	0.06	-0.05	0.12	0.33	0.30	0.18	0.17	0.12	0.12	0.21	-0.09
V17	0.64	-0.57	-0.51	-0.55	0.12	-0.64	0.69	-0.29	0.46	-0.48	0.14	0.41	0.51	0.72	-0.33	-0.12	1.00	0.71	-0.31	0.13	0.00	0.05	0.33	-0.16	-0.50	-0.47	0.42	0.56	0.38	-0.72	-0.60	-0.58	0.01	-0.23	-0.50	-0.42
V18	0.71	-0.74	-0.73	-0.74	-0.12	-0.76	0.76	-0.57	0.32	-0.62	0.18	0.69	0.54	0.75	-0.40	0.04	0.71	1.00	-0.41	0.10	0.10	-0.01	0.38	-0.16	-0.57	-0.56	0.48	0.53	0.43	-0.64	-0.61	-0.62	-0.03	-0.09	-0.62	-0.47
V19	-0.62	0.56	0.59	0.58	0.33	0.56	-0.46	0.44	0.12	0.56	-0.14	-0.45	-0.37	-0.45	0.28	-0.06	-0.31	-0.41	1.00	0.13	0.03	0.10	-0.10	0.18	0.51	0.52	-0.40	-0.17	-0.37	0.46	0.37	0.38	-0.19	-0.10	0.26	0.24
V20	-0.15	0.10	0.14	0.12	0.34	0.08	0.01	0.17	0.20	0.20	-0.13	-0.11	0.03	-0.04	0.28	0.19	0.13	0.10	0.13	1.00	0.47	0.83	0.24	0.38	0.26	0.31	0.46	0.46	0.15	0.16	0.17	0.21	0.13	0.08	0.08	0.07
V21	-0.11	0.01	0.08	0.04	0.30	-0.03	0.00	-0.04	0.12	0.07	-0.05	0.00	0.06	-0.01	0.30	0.27	0.00	0.10	0.03	0.47	1.00	0.77	0.60	0.44	-0.06	0.16	0.17	0.15	0.44	0.18	0.14	0.13	0.16	0.13	-0.14	0.15
V22	-0.16	0.17	0.25	0.21	0.45	0.08	-0.08	0.14	0.25	0.23	-0.03	-0.26	0.00	-0.13	0.34	0.17	0.05	-0.01	0.10	0.83	0.77	1.00	0.46	0.48	0.19	0.33	0.38	0.21	0.28	0.18	0.21	0.26	0.23	0.13	0.06	0.22
V23	0.39	-0.40	-0.33	-0.37	0.15	-0.49	0.38	-0.22	0.23	-0.27	-0.05	0.29	0.28	0.40	0.06	-0.01	0.33	0.38	-0.10	0.24	0.60	0.46	1.00	0.22	-0.45	-0.30	0.27	0.15	0.40	-0.25	-0.39	-0.30	0.03	0.04	-0.48	-0.28
V24	-0.20	0.26	0.22	0.25	0.25	0.23	-0.13	0.10	-0.08	0.23	-0.03	-0.21	0.11	-0.20	0.18	0.11	-0.16	-0.16	0.18	0.38	0.44	0.48	0.22	1.00	0.20	0.13	-0.24	0.13	0.03	0.25	0.16	0.24	-0.08	0.46	0.10	0.13
V25	-0.78	0.80	0.80	0.80	0.36	0.76	-0.68	0.52	-0.02	0.74	-0.03	-0.71	-0.48	-0.67	0.45	0.06	-0.50	-0.57	0.51	0.26	-0.06	0.19	-0.45	0.20	1.00	0.69	-0.31	-0.24	-0.54	0.74	0.76	0.74	0.12	0.18	0.77	0.64
V26	-0.74	0.68	0.74	0.71	0.36	0.69	-0.61	0.62	0.05	0.66	-0.08	-0.63	-0.55	-0.64	0.40	0.06	-0.47	-0.56	0.52	0.31	0.16	0.33	-0.30	0.13	0.69	1.00	-0.17	-0.28	-0.33	0.64	0.69	0.69	0.18	-0.02	0.59	0.75
V27	0.50	-0.42	-0.37	-0.40	0.08	-0.51	0.46	-0.22	0.28	-0.37	0.16	0.24	0.24	0.32	-0.10	-0.05	0.42	0.48	-0.40	0.46	0.17	0.38	0.27	-0.24	-0.31	-0.17	1.00	0.25	0.28	-0.42	-0.33	-0.33	0.09	-0.19	-0.30	-0.19
V28	0.30	-0.40	-0.40	-0.40	0.04	-0.35	0.43	-0.27	0.11	-0.29	-0.10	0.42	0.40	0.49	-0.15	0.12	0.56	0.53	-0.17	0.46	0.15	0.21	0.15	0.13	-0.24	-0.28	0.25	1.00	0.44	-0.29	-0.26	-0.28	-0.08	0.07	-0.31	-0.42
V29	0.33	-0.36	-0.36	-0.36	0.09	-0.42	0.28	-0.37	-0.03	-0.30	-0.09	0.29	0.18	0.32	-0.08	0.33	0.38	0.43	-0.37	0.15	0.44	0.28	0.40	0.03	-0.54	-0.33	0.28	0.44	1.00	-0.28	-0.27	-0.36	-0.03	-0.04	-0.50	-0.26
V30	-0.84	0.75	0.73	0.75	0.24	0.76	-0.77	0.41	-0.33	0.69	-0.15	-0.58	-0.63	-0.76	0.55	0.30	-0.72	-0.64	0.46	0.16	0.18	0.18	-0.25	0.25	0.74	0.64	-0.42	-0.29	-0.28	1.00	0.84	0.85	0.12	0.25	0.69	0.55
V31	-0.83	0.74	0.74	0.75	0.18	0.78	-0.77	0.43	-0.28	0.68	-0.09	-0.63	-0.57	-0.73	0.44	0.18	-0.60	-0.61	0.37	0.17	0.14	0.21	-0.39	0.16	0.76	0.69	-0.33	-0.26	-0.27	0.84	1.00	0.86	0.31	0.23	0.68	0.72
V32	-0.77	0.77	0.77	0.78	0.30	0.75	-0.71	0.45	-0.15	0.76	0.00	-0.69	-0.55	-0.76	0.43	0.17	-0.58	-0.62	0.38	0.21	0.13	0.26	-0.30	0.24	0.74	0.69	-0.33	-0.28	-0.36	0.85	0.86	1.00	0.36	0.31	0.77	0.67
V33	-0.14	0.10	0.17	0.13	0.00	0.15	-0.03	0.06	0.13	0.22	-0.06	-0.11	0.02	-0.07	0.16	0.12	0.01	-0.03	-0.19	0.13	0.16	0.23	0.03	-0.08	0.12	0.18	0.09	-0.08	-0.03	0.12	0.31	0.36	1.00	-0.04	0.19	0.21
V34	-0.10	0.10	0.04	0.08	-0.05	0.08	-0.22	-0.15	-0.31	0.06	0.14	-0.10	0.03	-0.19	-0.02	0.12	-0.23	-0.09	-0.10	0.08	0.13	0.13	0.04	0.46	0.18	-0.02	-0.19	0.07	-0.04	0.25	0.23	0.31	-0.04	1.00	0.26	0.14
V35	-0.63	0.63	0.62	0.63	0.10	0.65	-0.67	0.36	-0.21	0.60	0.04	-0.56	-0.45	-0.59	0.32	0.21	-0.50	-0.62	0.26	0.08	-0.14	0.06	-0.48	0.10	0.77	0.59	-0.30	-0.31	-0.50	0.69	0.68	0.77	0.19	0.26	1.00	0.55
V36	-0.62	0.64	0.68	0.66	0.32	0.59	-0.58	0.43	0.02	0.57	0.00	-0.62	-0.49	-0.64	0.29	-0.09	-0.42	-0.47	0.24	0.07	0.15	0.22	-0.28	0.13	0.64	0.75	-0.19	-0.42	-0.26	0.55	0.72	0.67	0.21	0.14	0.55	1.00

V1 IRSD
V2 Smokers - males
V3 Smokers - females
V4 Smokers - persons
V5 Alcohol use - high risk to heal
V6 Physical inactivity
V7 Overweight - males
V8 Obese - males
V9 Overweight - females
V10 Obese - females
V11 Fruit consumtion - 5-17yrs
V12 Fruit consumtion - 18+years
V13 Breast screen participation
V14 Cervical screen participation
V15 Outcome - high grade abnormalities
V16 Outcome - low grade abnormalities
V17 Bowel screen participation - males
V18 Bowel screen participation - females
V19 Outcome - positive FOBT result
V20 All cancers incidence - males
V21 All cancers incidence - females
V22 All cancers incidence - persons
V23 Breast cancer incidence
V24 Colorectal cancer incidence
V25 Lung cancer incidence - males
V26 Lung cancer incidence - females
V27 Prostate cancer incidence
V28 Skin cancer incidence - males
V29 Skin cancer incidence - females
V30 Total premature deaths - males
V31 Total premature deaths - females
V32 Premature deaths - all cancers
V33 Premature deaths - breast cancers
V34 Premature deaths - colorectal cancers
V35 Premature deaths - lung cancers - males
V36 Premature deaths - lung cancers - females

Table 32: Correlation matrix, non-metropolitan areas

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	V31	V32	V33	V34	V35	V36
V1	1.00	-0.88	-0.77	-0.90	0.01	-0.79	0.74	-0.43	0.17	-0.53	0.14	0.73	0.22	0.56	-0.18	-0.07	0.54	0.56	-0.20	0.24	0.05	0.21	0.14	0.25	-0.15	-0.18	0.32	0.19	0.04	-0.62	-0.65	-0.12	0.07	0.01	-0.26	-0.14
V2	-0.88	1.00	0.68	0.90	-0.02	0.75	-0.65	0.54	-0.31	0.48	-0.09	-0.77	0.04	-0.42	0.36	0.39	-0.19	-0.17	0.23	-0.05	0.04	-0.06	0.00	-0.07	0.22	0.30	-0.19	-0.11	-0.04	0.62	0.53	0.19	-0.17	-0.07	0.28	0.19
V3	-0.77	0.68	1.00	0.93	0.48	0.74	-0.48	0.41	-0.02	0.59	-0.23	-0.55	-0.02	-0.21	0.35	0.22	-0.22	-0.33	-0.03	0.19	0.15	0.18	0.12	0.00	0.44	0.34	0.05	0.06	0.26	0.66	0.39	0.27	-0.07	0.02	0.41	0.32
V4	-0.90	0.90	0.93	1.00	0.28	0.82	-0.61	0.51	-0.17	0.58	-0.17	-0.71	0.01	-0.34	0.40	0.32	-0.25	-0.29	0.10	0.09	0.12	0.08	0.07	-0.02	0.37	0.35	-0.08	-0.03	0.13	0.70	0.51	0.26	-0.13	-0.02	0.39	0.28
V5	0.01	-0.02	0.48	0.28	1.00	0.11	0.23	-0.05	0.03	0.12	-0.21	0.08	-0.35	0.02	-0.07	-0.30	-0.23	-0.01	-0.22	0.13	0.12	0.17	-0.14	0.34	0.16	0.00	0.05	-0.09	0.26	0.04	0.19	0.04	0.12	0.04	0.05	0.06
V6	-0.79	0.75	0.74	0.82	0.11	1.00	-0.59	0.67	-0.06	0.66	-0.15	-0.52	0.12	-0.26	0.39	0.32	-0.27	-0.23	0.04	0.26	0.28	0.27	0.14	0.07	0.30	0.30	0.05	0.03	0.21	0.71	0.40	0.46	0.05	0.05	0.42	0.32
V7	0.74	-0.65	-0.48	-0.61	0.23	-0.59	1.00	-0.33	0.14	-0.36	0.13	0.81	-0.14	0.04	-0.35	-0.46	0.05	0.13	-0.05	0.04	-0.03	0.06	-0.09	0.39	0.03	-0.20	-0.01	-0.12	-0.15	-0.50	-0.39	-0.22	0.10	0.02	-0.25	-0.22
V8	-0.43	0.54	0.41	0.51	-0.05	0.67	-0.33	1.00	-0.03	0.56	-0.09	-0.30	0.11	-0.20	0.00	0.06	0.15	0.11	0.04	0.18	0.00	0.10	0.02	-0.11	0.09	0.08	0.24	0.10	-0.02	0.41	0.02	0.24	0.23	0.10	0.08	0.02
V9	0.17	-0.31	-0.02	-0.17	0.03	-0.06	0.14	-0.03	1.00	0.24	0.11	0.44	0.17	0.12	0.33	0.09	-0.03	-0.40	-0.05	0.33	0.46	0.46	0.52	0.03	0.36	0.16	0.35	0.10	0.53	0.05	-0.34	0.40	0.08	-0.15	0.41	0.35
V10	-0.53	0.48	0.59	0.58	0.12	0.66	-0.36	0.56	0.24	1.00	-0.20	-0.31	0.20	-0.04	0.24	0.18	0.01	-0.11	-0.06	0.39	0.26	0.37	0.30	-0.09	0.29	0.30	0.30	0.20	0.30	0.51	0.06	0.40	0.25	0.18	0.29	0.40
V11	0.14	-0.09	-0.23	-0.17	-0.21	-0.15	0.13	-0.09	0.11	-0.20	1.00	0.22	0.31	-0.03	0.13	0.04	-0.18	-0.21	0.58	0.04	0.26	0.17	0.04	0.19	0.14	0.24	-0.09	0.17	-0.02	-0.13	-0.03	0.15	-0.27	-0.25	0.12	0.09
V12	0.73	-0.77	-0.55	-0.71	0.08	-0.52	0.81	-0.30	0.44	-0.31	0.22	1.00	0.01	0.18	-0.19	-0.34	-0.08	0.01	-0.11	0.13	0.28	0.27	0.16	0.37	-0.01	-0.12	0.12	-0.01	0.10	-0.44	-0.38	-0.01	0.11	-0.03	-0.06	0.01
V13	0.22	0.04	-0.02	0.01	-0.35	0.12	-0.14	0.11	0.17	0.20	0.31	0.01	1.00	0.27	0.27	0.21	0.36	0.25	0.10	0.16	0.18	0.18	0.42	0.10	0.04	0.27	0.29	0.21	-0.04	-0.22	-0.22	0.13	0.07	-0.07	0.12	0.21
V14	0.56	-0.42	-0.21	-0.34	0.02	-0.26	0.04	-0.20	0.12	-0.04	-0.03	0.18	0.27	1.00	-0.03	0.20	0.46	0.49	-0.11	0.35	0.08	0.26	0.29	-0.03	-0.03	-0.13	0.36	0.42	0.32	-0.26	-0.40	0.08	0.19	0.15	-0.11	0.07
V15	-0.18	0.36	0.35	0.40	-0.07	0.39	-0.35	0.00	0.33	0.24	0.13	-0.19	0.27	-0.03	1.00	0.61	-0.16	-0.25	0.28	0.24	0.55	0.42	0.54	0.22	0.54	0.62	0.05	-0.18	0.35	0.15	0.20	0.53	-0.19	-0.10	0.80	0.70
V16	-0.07	0.39	0.22	0.32	-0.30	0.32	-0.46	0.06	0.09	0.18	0.04	-0.34	0.21	0.20	0.61	1.00	-0.09	-0.30	0.09	0.27	0.37	0.36	0.40	0.03	0.41	0.45	0.05	0.09	0.39	0.14	-0.02	0.35	-0.28	-0.10	0.51	0.44
V17	0.54	-0.19	-0.22	-0.25	-0.23	-0.27	0.05	0.15	-0.03	0.01	-0.18	-0.08	0.36	0.46	-0.16	-0.09	1.00	0.83	0.04	0.18	-0.33	-0.09	0.18	-0.16	-0.34	-0.11	0.51	0.15	-0.19	-0.54	-0.66	-0.24	0.16	0.15	-0.35	-0.20
V18	0.56	-0.17	-0.33	-0.29	-0.01	-0.23	0.13	0.11	-0.40	-0.11	-0.21	0.01	0.25	0.49	-0.25	-0.30	0.83	1.00	-0.12	0.17	-0.24	-0.06	0.11	0.06	-0.54	-0.26	0.48	0.03	-0.32	-0.63	-0.52	-0.19	0.25	0.30	-0.42	-0.24
V19	-0.20	0.23	-0.03	0.10	-0.22	0.04	-0.05	0.04	-0.05	-0.06	0.58	-0.11	0.10	-0.11	0.28	0.09	0.04	-0.12	1.00	-0.06	-0.01	-0.03	0.12	0.07	0.29	0.20	-0.19	-0.02	-0.09	-0.01	0.17	-0.19	-0.22	-0.30	-0.16	0.00
V20	0.24	-0.05	0.19	0.09	0.13	0.26	0.04	0.18	0.33	0.39	0.04	0.13	0.16	0.35	0.24	0.27	0.18	0.17	-0.06	1.00	0.40	0.89	0.31	0.43	0.31	0.17	0.71	0.48	0.32	-0.13	-0.49	0.34	-0.02	0.36	0.20	0.14
V21	0.05	0.04	0.15	0.12	0.12	0.28	-0.03	0.00	0.46	0.26	0.26	0.28	0.18	0.08	0.55	0.37	-0.33	-0.24	-0.01	0.40	1.00	0.76	0.66	0.44	0.35	0.48	0.05	0.02	0.57	0.03	0.00	0.61	-0.02	-0.05	0.63	0.61
V22	0.21	-0.06	0.18	0.08	0.17	0.27	0.06	0.10	0.46	0.37	0.17	0.27	0.18	0.26	0.42	0.36	-0.09	-0.06	-0.03	0.89	0.76	1.00	0.53	0.54	0.42	0.36	0.48	0.34	0.50	-0.05	-0.35	0.55	-0.02	0.23	0.44	0.39
V23	0.14	0.00	0.12	0.07	-0.14	0.14	-0.09	0.02	0.52	0.30	0.04	0.16	0.42	0.29	0.54	0.40	0.18	0.11	0.12	0.31	0.66	0.53	1.00	0.17	0.30	0.35	0.19	-0.05	0.38	-0.16	-0.20	0.41	0.13	-0.06	0.53	0.57
V24	0.25	-0.07	0.00	-0.02	0.34	0.07	0.39	-0.11	0.03	-0.09	0.19	0.37	0.10	-0.03	0.22	0.03	-0.16	0.06	0.07	0.43	0.44	0.54	0.17	1.00	0.13	0.15	0.13	-0.14	-0.08	-0.30	0.00	0.14	-0.12	0.14	0.18	0.10
V25	-0.15	0.22	0.44	0.37	0.16	0.30	0.03	0.09	0.36	0.29	0.14	-0.01	0.04	-0.03	0.54	0.41	-0.34	-0.54	0.29	0.31	0.35	0.42	0.30	0.13	1.00	0.46	-0.07	0.04	0.49	0.41	0.03	0.43	-0.16	-0.21	0.58	0.42
V26	-0.18	0.30	0.34	0.35	0.00	0.30	-0.20	0.08	0.16	0.30	0.24	-0.12	0.27	-0.13	0.62	0.45	-0.11	-0.26	0.20	0.17	0.48	0.36	0.35	0.15	0.46	1.00	-0.08	0.00	0.21	0.13	0.11	0.51	-0.04	-0.04	0.65	0.70
V27	0.32	-0.19	0.05	-0.08	0.05	0.05	-0.01	0.24	0.35	0.30	-0.09	0.12	0.29	0.36	0.05	0.05	0.51	0.48	-0.19	0.71	0.05	0.48	0.19	0.13	-0.07	-0.08	1.00	0.31	0.11	-0.46	-0.58	-0.05	0.05	0.30	-0.07	-0.08
V28	0.19	-0.11	0.06	-0.03	-0.09	0.03	-0.12	0.10	0.10	0.20	0.17	-0.01	0.21	0.42	-0.18	0.09	0.15	0.03	-0.02	0.48	0.02	0.34	-0.05	-0.14	0.04	0.00	0.31	1.00	0.22	0.11	-0.45	0.04	-0.02	0.12	-0.16	-0.11
V29	0.04	-0.04	0.26	0.13	0.26	0.21	-0.15	-0.02	0.53	0.30	-0.02	0.10	-0.04	0.32	0.35	0.39	-0.19	-0.32	-0.09	0.32	0.57	0.50	0.38	-0.08	0.49	0.21	0.11	0.22	1.00	0.17	-0.11	0.37	0.05	-0.22	0.39	0.39
V30	-0.62	0.62	0.66	0.70	0.04	0.71	-0.50	0.41	0.05	0.51	-0.13	-0.44	-0.22	-0.26	0.15	0.14	-0.54	-0.63	-0.01	-0.13	0.03	-0.05	-0.16	-0.30	0.41	0.13	-0.46	0.11	0.17	1.00	0.46	0.36	-0.07	-0.04	0.24	0.22
V31	-0.65	0.53	0.39	0.51	0.19	0.40	-0.39	0.02	-0.34	0.06	-0.03	-0.38	-0.22	-0.40	0.20	-0.02	-0.66	-0.52	0.17	-0.49	0.00	-0.35	-0.20	0.00	0.03	0.11	-0.58	-0.45	-0.11	0.46	1.00	0.13	-0.02	-0.11	0.26	0.28
V32	-0.12	0.19	0.27	0.26	0.04	0.46	-0.22	0.24	0.40	0.40	0.15	-0.01	0.13	0.08	0.53	0.35	-0.24	-0.19	-0.19	0.34	0.61	0.55	0.41	0.14	0.43	0.51	-0.05	0.04	0.37	0.36	0.13	1.00	0.29	0.28	0.71	0.69
V33	0.07	-0.17	-0.07	-0.13	0.12	0.05	0.10	0.23	0.08	0.25	-0.27	0.11	0.07	0.19	-0.19	-0.28	0.16	0.25	-0.22	-0.02	-0.02	-0.02	0.13	-0.12	-0.16	-0.04	0.05	-0.02	0.05	-0.07	-0.02	0.29	1.00	0.32	-0.07	0.17
V34	0.01	-0.07	0.02	-0.02	0.04	0.05	0.02	0.10	-0.15	0.18	-0.25	-0.03	-0.07	0.15	-0.10	-0.10	0.15	0.30	-0.30	0.36	-0.05	0.23	-0.06	0.14	-0.21	-0.04	0.30	0.12	-0.22	-0.04	-0.11	0.28	0.32	1.00	-0.01	0.03
V35	-0.26	0.28	0.41	0.39	0.05	0.42	-0.25	0.08	0.41	0.29	0.12	-0.06	0.12	-0.11	0.80	0.51	-0.35	-0.42	-0.16	0.20	0.63	0.44	0.53	0.18	0.58	0.65	-0.07	-0.16	0.39	0.24	0.26	0.71	-0.07	-0.01	1.00	0.77
V36	-0.14	0.19	0.32	0.28	0.06	0.32	-0.22	0.02	0.35	0.40	0.09	0.01	0.21	0.07	0.70	0.44	-0.20	-0.24	0.00	0.14	0.61	0.39	0.57	0.10	0.42	0.70	-0.08	-0.11	0.39	0.22	0.28	0.69	0.17	0.03	0.77	1.00

V1 IRSD
V2 Smokers - males
V3 Smokers - females
V4 Smokers - persons
V5 Alcohol use - high risk to heal
V6 Physical inactivity
V7 Overweight - males
V8 Obese - males
V9 Overweight - females
V10 Obese - females
V11 Fruit consumtion - 5-17yrs
V12 Fruit consumtion - 18+years
V13 Breast screen participation
V14 Cervical screen participation
V15 Outcome - high grade abnormalities
V16 Outcome - low grade abnormalities
V17 Bowel screen participation - males
V18 Bowel screen participation - females
V19 Outcome - positive FOBT result
V20 All cancers incidence - males
V21 All cancers incidence - females
V22 All cancers incidence - persons
V23 Breast cancer incidence
V24 Colorectal cancer incidence
V25 Lung cancer incidence - males
V26 Lung cancer incidence - females
V27 Prostate cancer incidence
V28 Skin cancer incidence - males
V29 Skin cancer incidence - females
V30 Total premature deaths - males
V31 Total premature deaths - females
V32 Premature deaths - all cancers
V33 Premature deaths - breast cancers
V34 Premature deaths - colorectal cancers
V35 Premature deaths - lung cancers - males
V36 Premature deaths - lung cancers - females

Appendix

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- Appendix A: Notes on the data
- Appendix B: Synthetic predictions of chronic diseases and associated risk factors
- Appendix C: SA Cancer Registry paper (summary in Section 3)

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Appendix B: Notes on the data

General notes

Prevalence of smoking among males, 2007-08 (synthetic predictions)/ Prevalence of smoking among females, 2007-08 (synthetic predictions)

The data presented are the estimated number of males and females, respectively, aged 18 years and over who were current smokers, expressed as an age-standardised rate per 100 males and females, respectively.

The data are self-reported data, reported to interviewers in the 2007-08 NHS. A current smoker is defined as an adult who reported, at the time of interview, that they smoked cigarettes, cigars or pipes at least once a week.

For further information on these synthetic estimates, refer to Appendix B.

Source: Compiled in PHIDU using data estimated from the 2007-08 National Health Survey (NHS), ABS (unpublished - produced as a consultancy); and ABS Estimated Resident Population, average of 30 June 2007 and 2008.

Prevalence of high risk alcohol consumption, 2007-08 (synthetic predictions)

The data presented are the estimated number of people, aged 18 years and over whose alcohol consumption was assessed as putting their health at risk, expressed as an age-standardised rate per 100 persons.

The data are self-reported data, reported to interviewers in the 2007-08 NHS. Using the estimated average daily alcohol consumption over the previous week, respondents were grouped into three categories of relative risk level: low, risky or high risk, based on the 2001 NHMRC guidelines for minimising risk in the longer term. Individuals whose consumption placed them in the risky and high risk categories had exceeded the recommended guidelines.

For further information on these synthetic estimates, refer to Appendix B.

Source: Compiled in PHIDU using data estimated from the 2007-08 National Health Survey (NHS), ABS (unpublished - produced as a consultancy); and ABS Estimated Resident Population, average of 30 June 2007 and 2008.

Prevalence of overweight and obesity among males, 2007-08 (page 143)/ Prevalence of overweight and obesity among females, 2007-08 (page 147) (synthetic predictions)

The data presented are the estimated number of males and females, respectively, aged 18 years and over who were obese, based on BMI from self-reported height and weight, expressed as an age-standardised rate per 100 males and females, respectively.

The data are self-reported data, reported to interviewers in the 2007-08 NHS. The BMI was calculated from self-reported height and weight data, and grouped as follows, to allow reporting against both WHO and NHMRC guidelines:- healthy range: 18.5 to less than 20.0 and 20.0 to less than 25.0; overweight: 25.0 to less than 30.0; obese: 30.0 and greater.

For further information on these synthetic estimates, refer to Appendix B.

Source: Compiled in PHIDU using data estimated from the 2007-08 National Health Survey (NHS), ABS (unpublished - produced as a consultancy); and ABS Estimated Resident Population, average of 30 June 2007 and 2008.

Prevalence of physical inactivity, 2007-08 (synthetic predictions)

The data presented are the estimated number of people, aged 15 years and over who were physically inactive, expressed as an age-standardised rate per 100 persons.

The data are self-reported data, reported to interviewers in the 2007-08 NHS. The National Physical Activity Guidelines for Adults recommend at least a moderate level of physical activity, most days of the week, for a total of 30 minutes or more on each of those days, and with each session lasting 10 minutes or more. Based on these guidelines, people who are sedentary or exercise at low levels will not be achieving the amount of physical activity required to obtain the associated health benefits.

For further information on these synthetic estimates, refer to Appendix B.

Source: Compiled in PHIDU using data estimated from the 2007-08 National Health Survey (NHS), ABS (unpublished - produced as a consultancy); and ABS Estimated Resident Population, average of 30 June 2007 and 2008.

Prevalence of fruit consumption, 2007-08 (synthetic predictions)

The data presented are the estimated number of people, aged 18 years and over who met the NHMRC recommendation for consumption of fruit, expressed as an age-standardised rate per 100 persons.

The data are self-reported data, reported to interviewers in the 2007-08 NHS. The NHMRC Dietary Guidelines recommend that adults consume two serves of fruit per day (a serve is approximately 150 grams of fresh fruit or 50 grams of dried fruit).

For further information on these synthetic estimates, refer to Appendix B.

Source: Compiled in PHIDU using data estimated from the 2007-08 National Health Survey (NHS), ABS (unpublished - produced as a consultancy); and ABS Estimated Resident Population, average of 30 June 2007 and 2008.

Sun protection, 2009-11

The data presented are the number of people aged 18 years and over who reported getting sunburnt in the previous summer; and the number reporting using the five sun protection behaviours (namely, wearing a hat, wearing SPF 30+ sunscreen, wearing clothes that covered all of their arms and legs, wearing sunglasses and seeking shade), as a proportion of all respondents.

The data are self-reported data, reported to interviewers in the Health Omnibus Survey, a household survey undertaken across South Australia and including urban centres with populations of 1,000 or more: as such, the most remote areas of the State are not included, a potential limitation which users should bear in mind when using the data, in particular those presented by remoteness. The survey has a response rate of around 60%: again, this may impact on the data, in particular that presented by socioeconomic status, as response rates are likely to be lowest in disadvantaged areas.

Source: Compiled in PHIDU using data supplied by Cancer Council SA.

Breast screening participation, 2001-02 and 2009-10

The data presented are the number of individual women aged 50 to 69 years screened over a 24-month period ending on 31 December 2007 (Victoria and SA) or 31 December 2008 (Qld, WA and ACT), as a proportion of the female population at those ages.

The participation rate for the 24-month period to the end of each calendar year is based on the actual number of women screened, as a percentage of the average of the ABS Estimated Resident Population (ERP) for the two corresponding calendar years. If a woman attended more than once in the 24 months, she is counted once only, and her age is that at her first visit.

Data are currently available for Victoria, Queensland, South Australia, Western Australia and the Australian Capital Territory. The data do not include women who undergo private screening; the extent to which women use such alternatives is not known.

Source: Compiled in PHIDU using data supplied by BreastScreen SA.

Screen-detected breast cancer, 2001-02 and 2009-10

The data presented are the number of individual women aged 50-69 years diagnosed with screen-detected breast cancers over a 24-month period, ending on 31 December 2010, as an age-standardised rate per 10,000 women screened.

The breast screening outcomes for the 24-month period to the end of each calendar year is based on the actual number of women with cancer outcomes, as an age-standardised rate of the actual number of women screened for the two corresponding calendar years. If a woman has attended more than once in the 24 months, she is counted once only, and her age is that at her first visit.

Breast cancers include both invasive cancers and ductal carcinoma-*in-situ* (DCIS).

Source: Compiled in PHIDU using data supplied by BreastScreen SA.

Cervical screening participation, 2001-02 and 2008-09

The data presented are the number of individual women aged 20 to 69 years screened over a 24-month period ending on 31 December 2009, as a proportion of the eligible female population at those ages who have not undergone a hysterectomy.

The participation rate for the 24-month period to the end of each calendar year, is based on the actual number of women screened as a percentage of the average of the ABS Estimated Resident Population (ERP) for the two corresponding calendar years, adjusted for the proportion of females who have undergone a hysterectomy according to the ABS 2001 National Health Survey. If a woman attended more than once in the 24 months, she is counted once only, and her age is that at her first visit.

Source: Compiled in PHIDU using data supplied by SA Cervix Screening Program.

Abnormalities detected in cervical cancer screening, 2001-02 and 2008-09

The data presented are the number of low grade abnormalities detected through cytology among women aged 20 to 69 year, over a 24 month period ending on 31 December 2009, as an age-standardised rate per 1,000 women screened. If a woman has more than one test in the 24 months in which a low grade is detected, she is counted once only, and the age is taken from the first visit.

The data presented are the number of high grade abnormalities detected through cytology among women aged 20 to 69 year, over a 24 month period ending on 31 December 2009, as an age-standardised rate per 1,000 women screened. If a woman has more than one test in the 24 months in which a high grade is detected, she is counted once only, and the age is taken from the first visit.

Source: Compiled in PHIDU using data supplied by SA Cervix Screening Program.

Cancer incidence, 1986-93, 1998-2002 and 2003-08

The data presented are the number of new cases of cancer registered in each period, expressed as an age-standardised rate per 100,000 population.

Indicators are all cancers (males, females), breast cancer (females aged 30 years and over, both invasive and *in situ*), colorectal (people aged 20 years and over), lung cancer (males, females aged 20 years and over), melanoma (males, females), prostate (both invasive and *in situ*). The data presented have been analysed by age, sex, and region.

Source: Compiled in PHIDU using data supplied by SA Cancer Registry.

Premature mortality, 1992-95, 1997-2001 and 2003-07

The data presented are the number of deaths at ages 0 to 74 years, expressed as an age-standardised rate per 100,000 population.

Indicators are all cancers, breast cancer (females), colorectal cancer and lung cancer (males, females)

Source: Compiled in PHIDU using data supplied by ABS on behalf of the South Australian Registrar of Deaths; and ABS Estimated Resident Population.

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Appendix C: Synthetic predictions of chronic diseases and associated risk factors

Overview

The synthetic predictions presented in this report for the Priority Areas include:

- Prevalence of smoking among males, females
- High risk alcohol consumption
- Prevalence of overweight and of obesity among males, females
- Physical inactivity
- Usual daily intake of fruit

Further information on the indicators is contained in Appendix A.

Synthetic predictions modelling

The synthetic predictions of the prevalence of psychological distress, chronic disease and associated risk factors have been produced for a majority of SLAs in South Australia, using modelled survey data collected in the 2007-08 ABS NHS and known characteristics of the area.

A synthetic prediction can be interpreted as the likely value for a 'typical' area with those characteristics: the SLA is the area level of interest for this project (where SLAs had small populations they were grouped to larger areas). This work was undertaken by the Australian Bureau of Statistics (ABS), as they hold the NHS unit record files on which the model is based: the predictor data at the SLA level were compiled by PHIDU.

The approach used is to undertake an analysis of the survey data for Australia to identify associations in the NHS data between the variables that we wish to predict at the small area level (e.g., prevalence of chronic conditions and risk factors) and the data we have at the small area level (e.g., socioeconomic status, use of health services). The relationship between these variables for which we have area level data (the predictors) and the reporting of chronic conditions in the NHS is also a part of the model that is developed by the ABS. For example, such associations might be between the number of people reporting specified chronic conditions in the NHS and:

- the number of visits to a general medical practitioner,
- the proportion of the population receiving a pension or benefit and
- socioeconomic status (as indicated by a range of variables from Census data, including the IRSD).

The results of the modelling exercise are then applied to the SLA counts of the predictors. The prediction is, effectively, the likely value for a typical area with those characteristics. This modelling technique can be considered as a sophisticated prorating of Australian estimates to the small area level. The raw numbers were then age-standardised, to control for the effects of differences in the age profiles of areas.

The numbers are estimates for an area, not measured events: they should be used as <u>indicators</u> of likely levels of a condition or risk factor in an area.

Further, the National Health Survey sample includes the majority of people living in private households, but excludes the most remote areas of Australia. Thus it has not been possible to produce estimates for Statistical Local Areas (SLAs) with relatively high proportions of their population in these remote areas. Data for areas with a population of less than 1,000 are also not shown, as well as areas with greater than 75% Aboriginal population, as the authors believe results in these instances are likely to be less reliable.

Remoteness and quintile estimates

For the remoteness graphs for these eight variables, the data for the Outer Regional, Remote and Very Remote classes were combined, due to the limited number of remote areas included in the National Health Survey. The data for the remoteness classes and the quintiles of socioeconomic disadvantage of area were produced by the ABS, directly from the main unit record file; that is, they are not based on the synthetic predictions.

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Appendix C: SA Cancer Registry paper (summary presented in Section 3)

Cancer incidence, stage and survival by region of South Australia

An analysis of supplementary data for selected cancers

Abstract

Cancer Council South Australia (CCSA) requested data from the South Australian Cancer Registry on incidence, stage of progression at diagnosis and survival by residential area of South Australia to complement data provided by the Public Health Information Development Unit (PHIDU) of the University of Adelaide. Registry data were analysed for the 1995-2008 diagnostic period for Adelaide, Inner Regions and More Remote areas, using the Australian Standard Geographical Classification. The following results presented:

- The age-standardized incidence rate (ASR) for lip cancer was 34% higher in Inner Regions and 101% higher in More Remote areas than in Adelaide. This pattern has been reported in Registry publications since the 1980s. Non-melanoma skin cancers (NMSC, i.e., basal and squamous cell carcinomas) are not recorded by the Registry but elevations in their ASR has often accompanied an elevation in ASR for lip cancer, presumably because excess sun exposure contributes to both. The elevated lip cancer ASR in Very Remote areas of South Australia is probably indicative therefore of an elevated NMSC ASR as well. These cancers are rarely a cause of death but they are the leading cause of hospitalization for cancer and impose a large burden on the health system. This underlines the need for an emphasis on More Remote areas in sun protection programs.
- The invasive female breast cancer ASR was approximately 8% lower in More Remote areas than in Adelaide, which is similar to findings in previous Registry reports and nationally. This has generally been attributed to differences in reproductive history (earlier childbirth and higher parity in more remote areas), although use of hormone replacement therapy and/or other risk factors may have contributed.
- A higher proportion of invasive female breast cancers were large (≥30mm) at diagnosis in patients from More Remote areas than Adelaide (23% c/f 20%). This did not apply to the BreastScreen SA target age range of 50-69 years however, which may be a BreastScreen SA effect in reducing socio-demographic inequalities. There is a need to give emphasis to Very Remote areas when promoting earlier detection, especially for those age groups outside the screening target age range. This would apply to Aboriginal and Torres Strait Islander women in particular, since they have more advanced breast cancers at diagnosis and lower survivals from this cancer than other women.
- A higher proportion of invasive melanomas were found to be thicker than 1.5mm in patients from Inner Regions and More Remote areas (23%) than Adelaide (20%), indicating the need to give special attention to these localities when promoting early detection.
- Case survivals for all cancers combined were a little lower in More Remote areas than in Adelaide both at five years from diagnosis (62% c/f 64%) and at 10 years (58% c/f 60%), which were influenced by poorer survivals from cancers of the female breast, cervix, colon/rectum, prostate, skin (melanoma) and lung. Similar findings have been reported nationally. However the differences were very small overall and generally would have been of little or no public health significance. However, this may not have applied to all population sub-groups. For example, Aboriginal and Torres Strait Islander patients have much poorer survivals than other patients and likely would have contributed disproportionately to the poorer survivals in More Remote areas. The barriers preventing better outcomes in these patients warrant special investigation and attention.

Introduction

Cancer Council South Australia (CCSA) has sought data from the SA Cancer Registry on incidence, stage of progression of cancer at diagnosis and survival by residential region for specified cancers in South Australia. This followed reports of less favourable cancer outcomes in rural and remote than urban areas in some interstate locations.[1, 2] The data in this report are a response to that request. They are not intended to be complete in stand-alone terms but complementary to data compiled separately by PHIDU to meet CCSA needs. The present data should therefore be regarded as selective and complementary.

Annual reports of the SA Cancer Registry have for many years shown differences in incidence and survival for cancers by residential area of South Australia.[3, 4] In general the data have shown survivals to be a little lower for non-metropolitan than metropolitan patients although differences generally were very small, often not statistically significant, and when statistically significant, normally too small in magnitude to be of public health significance.[4] Also, only minor differences in incidence have normally applied, although an exceptional finding has been the much higher incidence of cancer of the lip in non-metropolitan areas.[5] This has been demonstrated in annual Registry reports for many years.[3, 5] Lip cancers occur on the outer vermilion border of the lower lip and their higher incidence in non-metropolitan areas is attributed to excess sun exposure.[5]

International data often show a similar pattern of incidence of lip cancer and non-melanoma skin cancers (basal and squamous cell carcinomas) probably because both are sun related.[5] The elevated incidence of lip cancer in non-metropolitan residents is likely therefore to be a marker of an elevated risk of non-melanoma skin cancers as well. While rarely a cause of death, non-melanoma skin cancers are a major cost to the health system, accounting for more hospital admissions than any other cancer type.[6]

In this report incidence data are provided for cancers of the lip, female breast, cervix and skin (melanoma) by residential area of South Australia. These cancers were chosen to complement data from PHIDU. They were selected either because of their relevance to sun exposure (lip and skin) or screening (female breast and cervix). Data on staging characteristics available from the SA Cancer Registry for cancers of the breast and melanoma are provided, but staging data were not collected for cancers of the lip and cervix.

In addition five- and 10- year survivals are presented for all cancers collectively and for cancers of the prostate, female breast, colon/rectum (large bowel), skin (melanoma), cervix and lung. These cancers were selected either because they had relevance to early detection initiatives or in the case of all cancers collectively and cancers of the colon/rectum, lung, and potentially prostate, breast and cervix, because they have been found to have comparatively low survivals in remote geographic areas of Australia in national studies.[7]

Methods

SA Cancer Registry data were analysed for the 1995-2008 diagnostic period. This period was chosen to gain enough cancer data for incidence analyses and sufficient follow-up time for survival estimation. For comparison by geographical region, the population of South Australia was classified using the Australian Standard Geographical Classification as Adelaide, Inner Regions, and More Remote.[7]

Incidence data were age standardized directly using the 2001 Australian age distribution as the reference standard.[8] Mean annual rates were provided by place of residence together with 95% confidence limits calculated using the traditional method described by Cochran.[9]

Staging data included in-situ and invasive stage for female breast cancer and melanoma, plus invasive breast cancer diameter and invasive melanoma thickness. Differences by region of residence were analysed using relevant rank-order tests (i.e., Mann Whitney U Test and Kendall tau b correlation coefficients, as appropriate).[8]

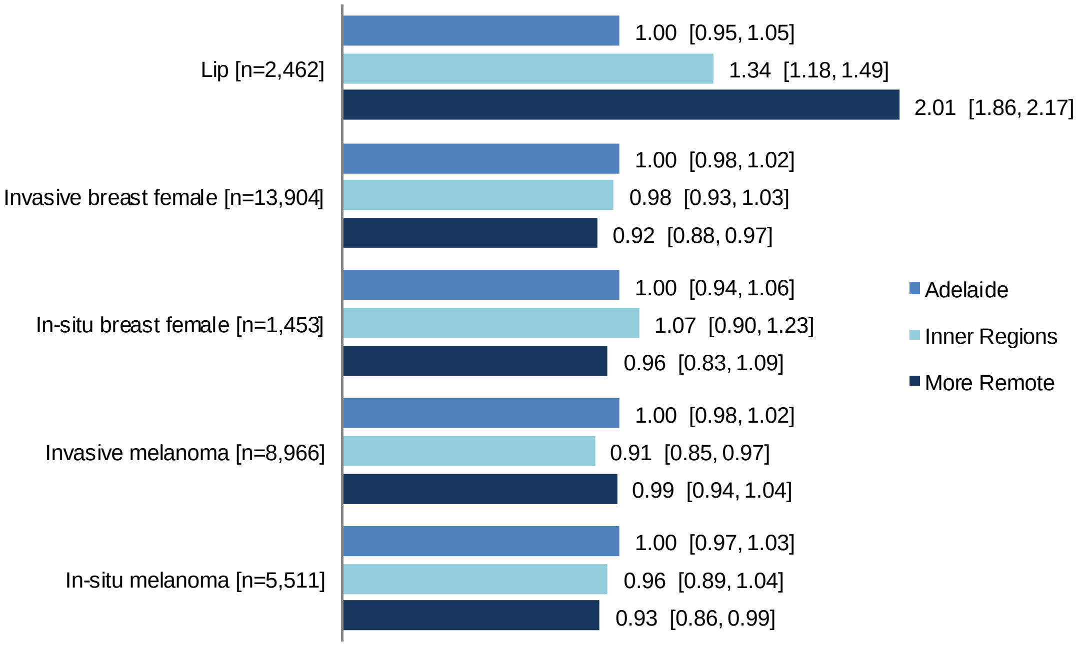
Disease-specific survivals were calculated for invasive cancers.[8] Disease-specific survival has been shown to be a good proxy in South Australia for relative survival and was used because life tables were not readily available for the regional groupings employed.[10] The date of censoring of live cases in the survival analyses was December 31st, 2008. Standard uni-variable survival analyses were undertaken, plus multi-variable Cox proportional hazards regression to adjust for potential confounding from differences in age at diagnosis and gender in comparisons across regions.[8]

Results

Incidence

As observed in previous annual reports of the SA Cancer Registry, [3, 5, 10] the mean annual incidence rate for lip cancer was higher in Inner Regions and More Remote areas than in Adelaide, with elevations of 34% and 101% respectively (Figure 1). The approximate 2-fold elevation for More Remote areas is consistent with elevations observed in previous Registry reports. [3, 5, 10]

Figure 1: Mean annual age-standardized incidence (95% CLs); South Australia, 1995-2008*
- Adelaide incidence set to 1.00 -



* Age-standardized to Australian population 2001. Regions classified using ASGC 2007.

By comparison, the incidence of invasive breast cancer was about 8% lower in More Remote areas than in Adelaide (Figure 1). The incidence of invasive breast cancer in Inner Regions tended to be a little lower than for Adelaide (2 % lower) but confidence intervals overlapped and the difference was not statistically significant (p>0.05). The lower incidence observed in More Remote areas is considered to be real and is consistent with national reporting.[11]

Apart from a lower invasive melanoma incidence in Inner Regions than in Adelaide (9% lower), there were no other statistically significant differences in incidence by region.

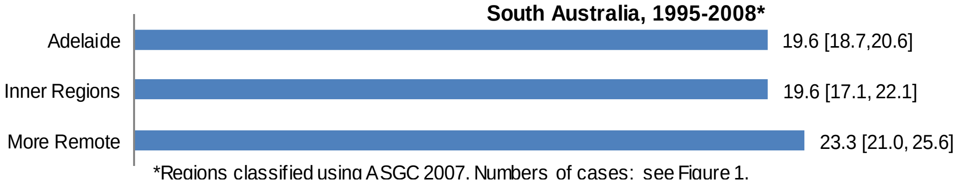
Data related to diagnostic stage

Breast cancer diameters

The percentage of invasive breast cancers classified as large (i.e., 30+ mm diameter) was higher in More Remote than other areas of South Australia (i.e., 23.3% compared with 19.6%) (Figure 2). A more detailed analysis of diameter distribution (<15, 15-19, 20-29 and 30+mm) by region, with adjustment for age at diagnosis (<40, 40-49, 50-69, 70+ years), confirmed that there was an elevation in proportion of invasive cancers with larger diameters in areas that were more remote from Adelaide (p<0.001).

While this trend applied to 40-49 year olds (p=0.002) and 70+ year olds (p<0.001), it was not evident for the 50-69 year old screening target (p=0.994). Among 50-69 year olds, all of whom are eligible for screening, the percentages of breast cancers classified as large were 17.1% for Adelaide residents, 16.1% for Inner Regions, and 16.7% for More Remote areas. These data are not suggestive of more advanced stages in non-metropolitan areas.

Figure 2: Percentage of invasive female breast cancers of large size (diameters 30+mm) (95%CLs); South Australia, 1995-2008*



*Regions classified using ASGC 2007. Numbers of cases: see Figure 1.

There was not a statistically significant variation however in the proportion of breast cancers detected at an in-situ as opposed to invasive stage by region, the proportions being 9.3% for Adelaide, 10.2% for Inner Regions and 9.9% for More Remote areas (Figure 3). This was confirmed in more detailed analyses of in-situ percentages by region when adjusting for age at diagnosis (<40, 40-49, 50-69, 70+ years) (p=0.366). Moreover, there was no difference by region within specific age categories (p≥0.250), including in the 50-69 year screening target (p=0.508).

Figure 3: Percentage of breast cancers detected at in-situ stage (95% CLs); South Australia, 1995-2008*

*Regions classified using ASGC 2007. Numbers of cases: see Figure 1. In-situ % estimated from 15,357 cases.

Melanoma thickness

The percentage of invasive melanomas that were thick at diagnosis (i.e., thickness >1.5mm) was higher in non-metropolitan areas (22.9% in More Remote and 22.7% in Inner Regions compared with 20.2% in Adelaide). Confidences intervals overlapped and differences were not statistically significant (p>0.05) (Figure 4). However when a more detailed analysis was undertaken of thickness (<=0.75, 0.76-1.50, 1.51-3.00, >3.00mm) by region, adjusting for age at diagnosis (<40, 40-49, 50-59, 60-69, 70+ years), thickness was found to be greater in areas that were more remote from Adelaide (p=0.001) and a similar trend presented in all age groups that achieved statistical significance in 50-59 year olds (p=0.038) and 60-69 year olds (p<0.001).

Figure 4: Percentage of invasive melanomas of thickness greater than 1.5mm (95%CLs); South Australia, 1995-2008*

*Regions classified using ASGC 2007. Numbers of cases: see Figure 1.

There was no statistically significant variation however in the proportion of melanomas detected at an in-situ as opposed to invasive cancer stage by region, with these proportions being 38.1% in Adelaide, 39.8% in Inner Regions, and 36.5% in More Remote areas (Figure 5). This null finding was confirmed in more detailed analysis of in-situ percentage by region, when adjusting for age at diagnosis (<40, 40-49, 50-59, 60-69, 70+ years) (p=0.383). Also no differences were found within individual age categories (p≥0.189).

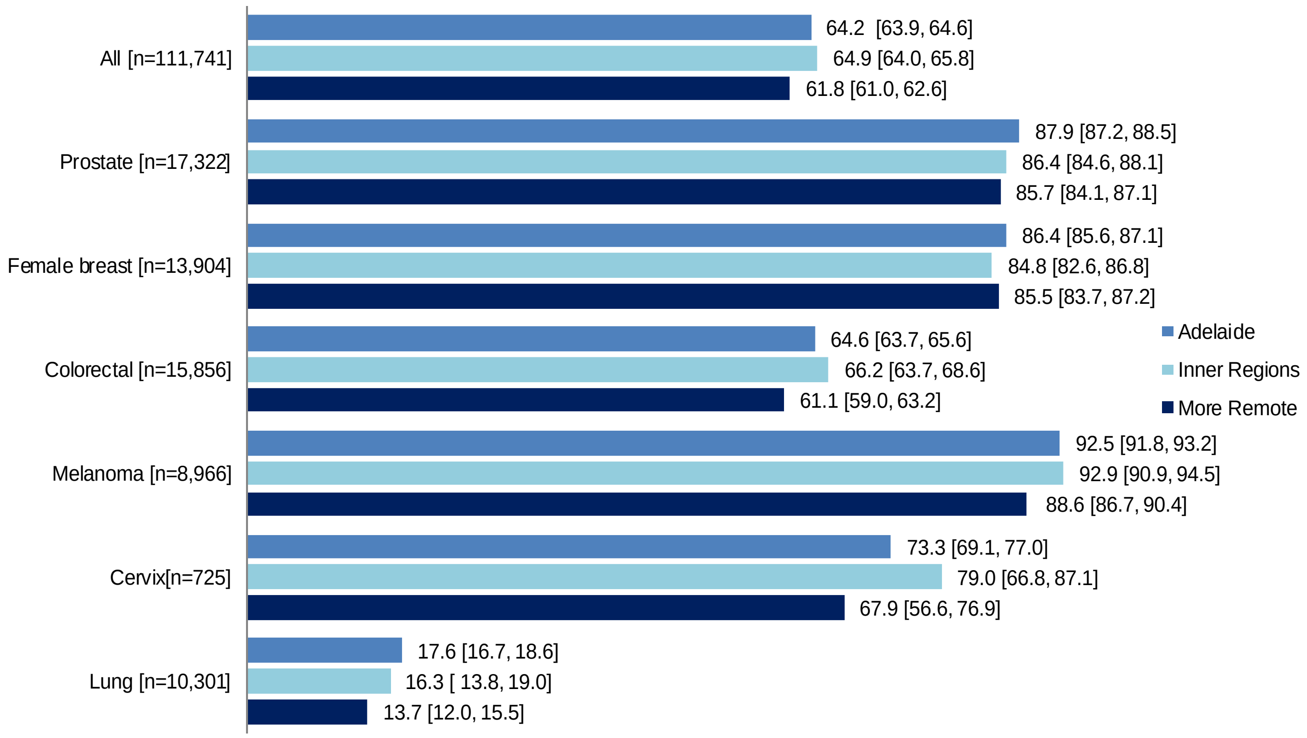
Figure 5: Percentage of melanomas detected at in-situ stage (95% CLs); South Australia, 1995-2008*

*Regions classified using ASGC 2007. Numbers of cases: see Figure 1. In-situ % estimated from 14,477 cases.

Survival

Generally 5-year survivals were a little lower for patients from More Remote areas than Adelaide. This applied for all cancers collectively (61.8% c/f 64.2%) and cancers of the prostate (85.7% c/f 87.9%), colon/rectum (61.1% c/f 64.6%), skin (melanoma) (88.6% c/f 92.5%) and lung (13.7% c/f 17.6%). These differences, while potentially of little importance in public health terms, were probably real, in that 95% confidence intervals did not overlap (Figure 6). A similar difference was suggested for cancer of the cervix, but this was more likely to be a chance event. In no comparison was a non-random difference in survival indicated between patients from Inner Regions and Adelaide.

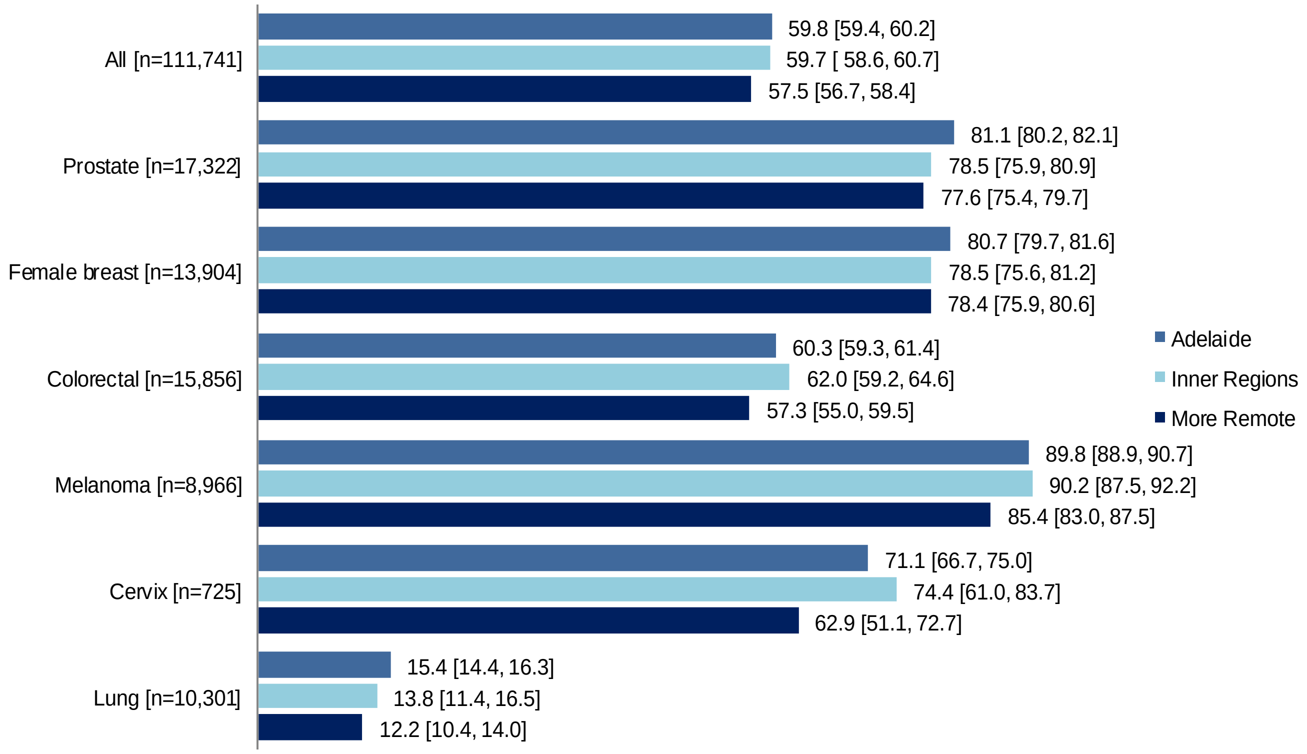
Figure 6: Percentage 5-year survival (disease specific) (95% CLs); South Australia, 1995-2008*



* Date of censoring of live cases, December 31,2008. Invasive cancers only.

Similarly 10-year survivals were marginally lower for patients from More Remote areas than Adelaide. This applied for all cancers collectively (57.5% c/f 59.8%) and cancers of the prostate (77.6% c/f 81.1%), skin (melanoma) (85.4% c/f 89.8%) and lung (12.2% c/f 15.4%). Again, differences were very small and potentially of little importance in public health terms but probably real, in that 95% confidence intervals did not overlap (Figure 7). Similar differences were suggested for cancers of the female breast, colon/rectum, and cervix, but they were more likely to be chance events. In no comparison was a non-random difference in survival indicated between patients from Inner Regions and Adelaide.

Figure 7: Percentage 10-year survival (disease specific) (95% CLs); South Australia, 1995-2008*



*Date of censoring live cases, December 31 , 2008. Invasive cases only.

When multivariable Cox proportional hazards regression analyses were performed, with relative risks of death (i.e., hazards ratios) from the index cancer assessed by region of residence after adjusting for age at diagnosis (classified as <40, 40-49, 50-59, 60-69, 70-79 and 80+ years), and where relevant by gender, the relative risk was higher for patients from More Remote areas than Adelaide for all cancers collectively and each cancer type shown in Figures 6/7 (p<0.05). Generally there was no difference in risk between patients from Inner Regions and Adelaide (p>0.05), apart from prostate cancer patients where an elevated risk was suggested in patients from Inner Regions (relative risk 1.15 (95% CLs: 1.01, 1.30).

Discussion

The two-fold incidence of lip cancer in More Remote areas than Adelaide is consistent with observations reported in SA Cancer Registry reports since the 1980s.[3, 5, 10] Lip cancer is sun-related and its incidence is often high in populations with a high incidence of sun-related non-melanoma skin cancers (basal and squamous cell carcinomas).[5] While these cancers rarely are a cause of death,[4] they account for more hospital admissions in Australia than any other cancer type.[6] There is a general need to promote sun protection to lower the incidence of these cancers, especially in More Remote areas with elevated risks.

Conversely the risk of invasive breast cancer is lower in More Remote areas than in Adelaide. This is consistent with national observations of geographic differences and data previously reported for South Australia.[11] Differences in reproductive history are thought to have contributed to this pattern, with earlier first full-term pregnancy and higher parity being protective for this cancer. Another possible contributing factor would be use of hormone replacement therapy, if this were to vary by Region.[11]

Invasive breast cancers were more likely to be large (30+mm diameter) in More Remote areas (23%) than for Adelaide residents (20%). It is notable however that this difference did not apply to the BreastScreen SA target age range of 50-69 years, which probably reflects the effect of BreastScreen SA in reducing socio-demographic inequalities. There is a need to promote earlier detection in More Remote areas for women outside the screening target age range. This would apply in particular to Aboriginal and Torres Strait Islander women who have more advanced stages at diagnosis and poorer survival outcomes.[11, 12]

Invasive melanomas were more likely to be thick (>1.50mm) in residents of Inner Regions and More Remote areas (23%) than for Adelaide residents (20%). This trend applied in each age category and was statistically significant in 50-59 and 60-69 year olds. Again, this highlights a need for a special emphasis in early detection programs on non-metropolitan regions.

Case survivals for all cancers combined were a little lower in More Remote areas than in Adelaide both at five years from diagnosis (62% c/f 64%) and at 10 years (58% c/f 60%). Multivariable analysis confirmed that case fatality rates were higher in Very Remote areas for all invasive cancers collectively, and that cancers of the female breast, cervix, colon/rectum, prostate, skin (melanoma) and lung contributed to these higher case fatalities. It is clear though that the differences were very small and generally would have been of little or no public health significance. That said, there would be some sub-groups who would have contributed disproportionately to poorer outcomes in More Remote areas, including Aboriginal and Torres Strait Islander patients where barriers to better outcomes require special attention.[11]

Less ready access to treatment is likely to apply in many of these More Remote areas, despite the attempts already made to optimize care availability through telemedicine and support for transport services and accommodation for those who require specialist services in Adelaide. Present initiatives to strengthen service availability in major non-metropolitan centres should also facilitate better access to care for many non-metropolitan patients.

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Key to areas mapped for indicators, Adelaide and South Australia

Alphabetical Key to Statistical Local Areas in Adelaide

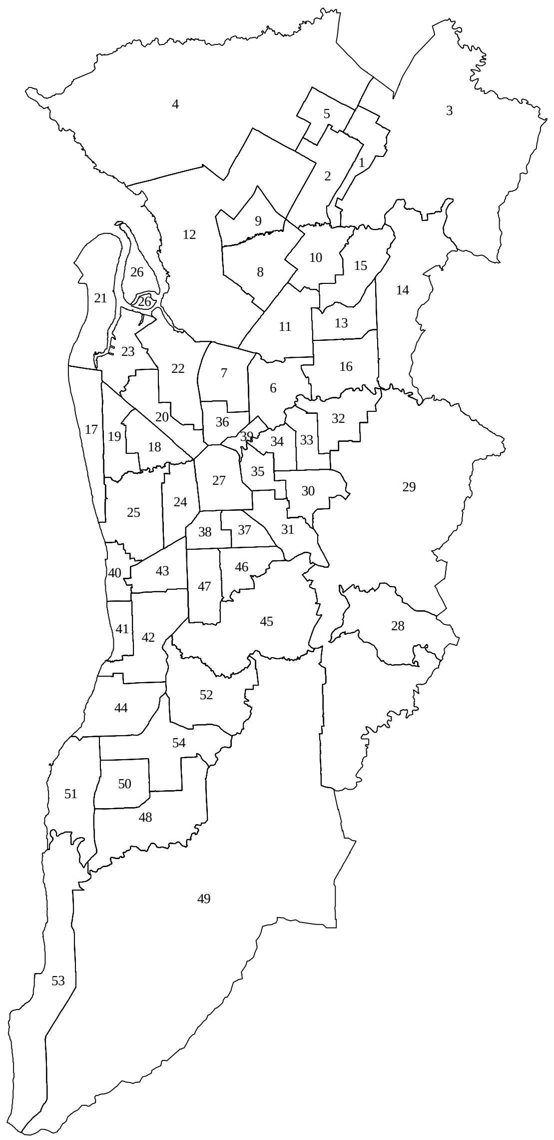
27 Adelaide (C)
28 Adelaide Hills (DC) - Central
29 Adelaide Hills (DC) - Ranges
30 Burnside (C) - North-East
31 Burnside (C) - South-West
32 Campbelltown (C) - East
33 Campbelltown (C) - West
17 Charles Sturt (C) - Coastal
18 Charles Sturt (C) - Inner East
19 Charles Sturt (C) - Inner West
20 Charles Sturt (C) - North-East
40 Holdfast Bay (C) - North
41 Holdfast Bay (C) - South
42 Marion (C) - Central
43 Marion (C) - North
44 Marion (C) - South
45 Mitcham (C) - Hills
46 Mitcham (C) - North-East
47 Mitcham (C) - West
34 Norw. P'ham St Ptrs (C) - East
35 Norw. P'ham St Ptrs (C) - West
48 Onkaparinga (C) - Hackham
49 Onkaparinga (C) - Hills
50 Onkaparinga (C) - Morphett
51 Onkaparinga (C) - North Coast
52 Onkaparinga (C) - Reservoir
53 Onkaparinga (C) - South Coast
54 Onkaparinga (C) - Woodcroft
1 Playford (C) - East Central
2 Playford (C) - Elizabeth
3 Playford (C) - Hills
4 Playford (C) - West
5 Playford (C) - West Central
21 Port Adel. Enfield (C) - Coast
6 Port Adel. Enfield (C) - East
7 Port Adel. Enfield (C) - Inner
22 Port Adel. Enfield (C) - Park
23 Port Adel. Enfield (C) - Port
36 Prospect (C)
8 Salisbury (C) - Central
9 Salisbury (C) - Inner North
10 Salisbury (C) - North-East
11 Salisbury (C) - South-East
12 Salisbury (C) Bal
13 Tea Tree Gully (C) - Central
14 Tea Tree Gully (C) - Hills
15 Tea Tree Gully (C) - North
16 Tea Tree Gully (C) - South
26 Unincorp. Western
37 Unley (C) - East
38 Unley (C) - West
39 Walkerville (M)
24 West Torrens (C) - East
25 West Torrens (C) - West

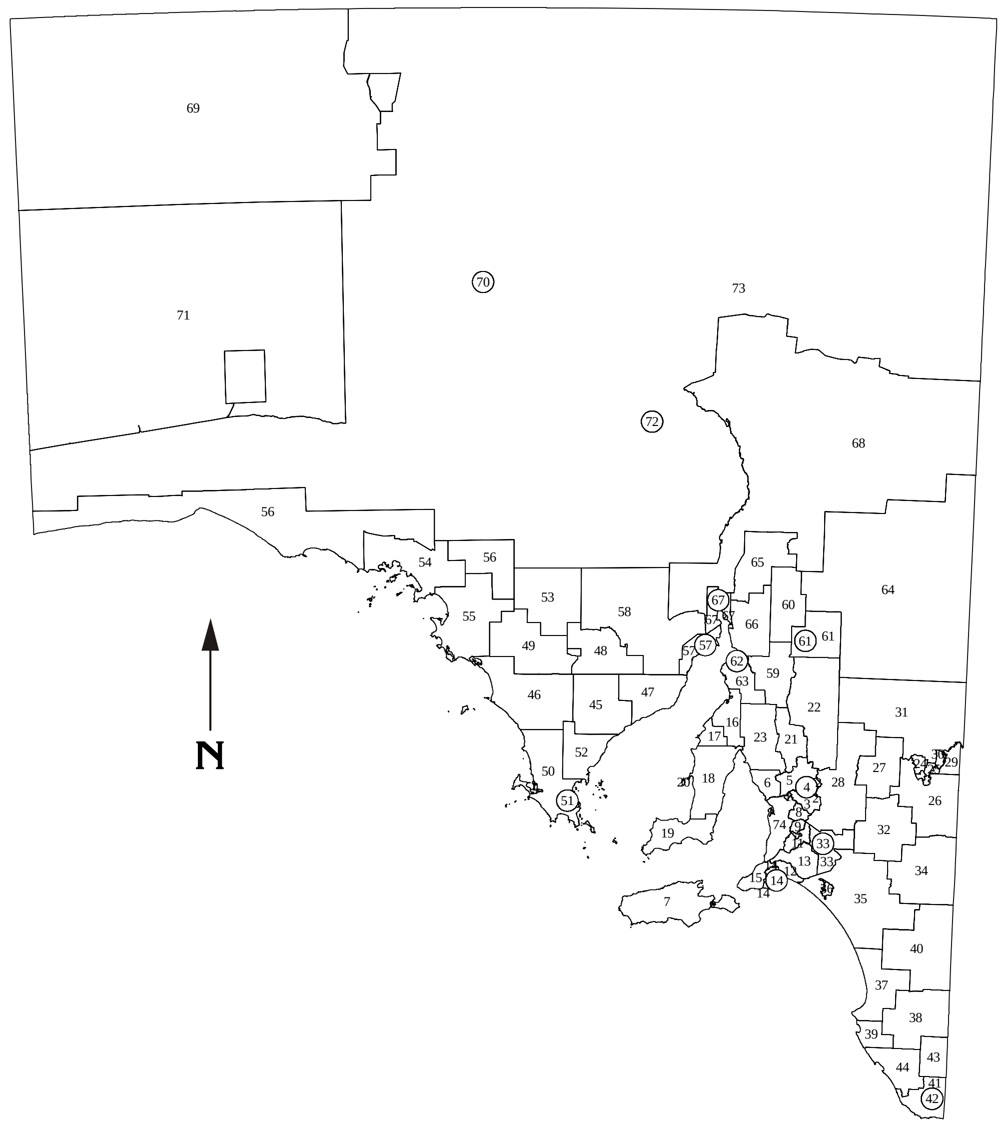
Note: See overleaf for Numerical Key

Alphabetical Key to Statistical Local Areas in non-metropolitan South Australia

8 Adelaide Hills (DC) - North
9 Adelaide Hills (DC) Bal
12 Alexandrina (DC) - Coastal
13 Alexandrina (DC) - Strathalbyn
69 Anangu Pitjantjatjara (AC)
2 Barossa (DC) - Angaston
3 Barossa (DC) - Barossa
4 Barossa (DC) - Tanunda
16 Barunga West (DC)
24 Berri & Barmera (DC) - Barmera
25 Berri & Barmera (DC) - Berri
54 Ceduna (DC)
21 Clare and Gilbert Valleys (DC)
45 Cleve (DC)
70 Coober Pedy (DC)
17 Copper Coast (DC)
46 Elliston (DC)
65 Flinders Ranges (DC)
47 Franklin Harbour (DC)
1 Gawler (T)
22 Goyder (DC)
41 Grant (DC)
7 Kangaroo Island (DC)
32 Karoonda East Murray (DC)
48 Kimba (DC)
37 Kingston (DC)
49 Le Hunte (DC)
5 Light (RegC)
50 Lower Eyre Peninsula (DC)
26 Loxton Waikerie (DC) - East
27 Loxton Waikerie (DC) - West
6 Mallala (DC)
71 Maralinga Tjarutja (AC)
28 Mid Murray (DC)
10 Mount Barker (DC) - Central
11 Mount Barker (DC) Bal
42 Mount Gambier (C)
66 Mount Remarkable (DC)
33 Murray Bridge (RC)
33 Murray Bridge (RC)
38 Naracoorte and Lucindale (DC)
59 Northern Areas (DC)
60 Orroroo/Carrieton (DC)
61 Peterborough (DC)
61 Peterborough (DC)
67 Port Augusta (C)
67 Port Augusta (C)
51 Port Lincoln (C)
63 Port Pirie C Dists (M) Bal
62 Port Pirie C Dists (M) City
29 Renmark Paringa (DC) - Paringa
30 Renmark Paringa (DC) - Renmark
39 Robe (DC)
72 Roxby Downs (M)
34 Southern Mallee (DC)
55 Streaky Bay (DC)
40 Tatiara (DC)
35 The Coorong (DC)
52 Tumby Bay (DC)
73 Unincorp. Far North
68 Unincorp. Flinders Ranges
53 Unincorp. Lincoln
36 Unincorp. Murray Mallee
64 Unincorp. Pirie
31 Unincorp. Riverland
56 Unincorp. West Coast
58 Unincorp. Whyalla
20 Unincorp. Yorke
14 Victor Harbor (C)
14 Victor Harbor (C)
23 Wakefield (DC)
43 Wattle Range (DC) - East
44 Wattle Range (DC) - West
57 Whyalla (C)
57 Whyalla (C)
15 Yankalilla (DC)
18 Yorke Peninsula (DC) - North
19 Yorke Peninsula (DC) - South
74 Metro Adelaide

Note: See overleaf for Numerical Key





SLA status key: Cities (C), Rural Cities (RC), Municipalities/Municipal Councils (M), District Councils (DC), Regional Councils (RegC) and Aboriginal Councils (AC)

Key to areas mapped for indicators, Adelaide and South Australia …*cont*

Numerical Key to Statistical Local Areas in Adelaide

1 Playford (C) - East Central
2 Playford (C) - Elizabeth
3 Playford (C) - Hills
4 Playford (C) - West
5 Playford (C) - West Central
6 Port Adel. Enfield (C) - East
7 Port Adel. Enfield (C) - Inner
8 Salisbury (C) - Central
9 Salisbury (C) - Inner North
10 Salisbury (C) - North-East
11 Salisbury (C) - South-East
12 Salisbury (C) Bal
13 Tea Tree Gully (C) - Central
14 Tea Tree Gully (C) - Hills
15 Tea Tree Gully (C) - North
16 Tea Tree Gully (C) - South
17 Charles Sturt (C) - Coastal
18 Charles Sturt (C) - Inner East
19 Charles Sturt (C) - Inner West
20 Charles Sturt (C) - North-East
21 Port Adel. Enfield (C) - Coast
22 Port Adel. Enfield (C) - Park
23 Port Adel. Enfield (C) - Port
24 West Torrens (C) - East
25 West Torrens (C) - West
26 Unincorp. Western
27 Adelaide (C)
28 Adelaide Hills (DC) - Central
29 Adelaide Hills (DC) - Ranges
30 Burnside (C) - North-East
31 Burnside (C) - South-West
32 Campbelltown (C) - East
33 Campbelltown (C) - West
34 Norw. P'ham St Ptrs (C) - East
35 Norw. P'ham St Ptrs (C) - West
36 Prospect (C)
37 Unley (C) - East
38 Unley (C) - West
39 Walkerville (M)
40 Holdfast Bay (C) - North
41 Holdfast Bay (C) - South
42 Marion (C) - Central
43 Marion (C) - North
44 Marion (C) - South
45 Mitcham (C) - Hills
46 Mitcham (C) - North-East
47 Mitcham (C) - West
48 Onkaparinga (C) - Hackham
49 Onkaparinga (C) - Hills
50 Onkaparinga (C) - Morphett
51 Onkaparinga (C) - North Coast
52 Onkaparinga (C) - Reservoir
53 Onkaparinga (C) - South Coast
54 Onkaparinga (C) - Woodcroft

Numerical Key to Statistical Local Areas in non-metropolitan South Australia

1 Gawler (T)
2 Barossa (DC) - Angaston
3 Barossa (DC) - Barossa
4 Barossa (DC) - Tanunda
5 Light (RegC)
6 Mallala (DC)
7 Kangaroo Island (DC)
8 Adelaide Hills (DC) - North
9 Adelaide Hills (DC) Bal
10 Mount Barker (DC) - Central
11 Mount Barker (DC) Bal
12 Alexandrina (DC) - Coastal
13 Alexandrina (DC) - Strathalbyn
14 Victor Harbor (C)
14 Victor Harbor (C)
15 Yankalilla (DC)
16 Barunga West (DC)
17 Copper Coast (DC)
18 Yorke Peninsula (DC) - North
19 Yorke Peninsula (DC) - South
20 Unincorp. Yorke
21 Clare and Gilbert Valleys (DC)
22 Goyder (DC)
23 Wakefield (DC)
24 Berri & Barmera (DC) - Barmera
25 Berri & Barmera (DC) - Berri
26 Loxton Waikerie (DC) - East
27 Loxton Waikerie (DC) - West
28 Mid Murray (DC)
29 Renmark Paringa (DC) - Paringa
30 Renmark Paringa (DC) - Renmark
31 Unincorp. Riverland
32 Karoonda East Murray (DC)
33 Murray Bridge (RC)
33 Murray Bridge (RC)
34 Southern Mallee (DC)
35 The Coorong (DC)
36 Unincorp. Murray Mallee
37 Kingston (DC)
38 Naracoorte and Lucindale (DC)
39 Robe (DC)
40 Tatiara (DC)
41 Grant (DC)
42 Mount Gambier (C)
43 Wattle Range (DC) - East
44 Wattle Range (DC) - West
45 Cleve (DC)
46 Elliston (DC)
47 Franklin Harbour (DC)
48 Kimba (DC)
49 Le Hunte (DC)
50 Lower Eyre Peninsula (DC)
51 Port Lincoln (C)
52 Tumby Bay (DC)
53 Unincorp. Lincoln
54 Ceduna (DC)
55 Streaky Bay (DC)
56 Unincorp. West Coast
57 Whyalla (C)
57 Whyalla (C)
58 Unincorp. Whyalla
59 Northern Areas (DC)
60 Orroroo/Carrieton (DC)
61 Peterborough (DC)
61 Peterborough (DC)
62 Port Pirie C Dists (M) City
63 Port Pirie C Dists (M) Bal
64 Unincorp. Pirie
65 Flinders Ranges (DC)
66 Mount Remarkable (DC)
67 Port Augusta (C)
67 Port Augusta (C)
68 Unincorp. Flinders Ranges
69 Anangu Pitjantjatjara (AC)
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74 Metro Adelaide