Cancer Council Queensland

Atlas of cancer in Queensland

Geographical variation in incidence and survival 1998-2007

50 YEARS OF HOPE

FOR A CANCER FREE FUTURE

VCRCC
Viertel Centre for Research in Cancer Control


Inner regional
Outer regional
Remote
0
100
200
50
66
80

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Geographical variation in incidence and survival 1998-2007

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Foreword

50 years of hope

In 1961, a small group of concerned people set forth with a mission to do something about cancer in Queensland, by forming what was originally known as the Queensland Cancer Fund.

Many feared cancer more than any other disease, knowing that the fight for survival could be unpredictable and painful. Many endured their diagnosis alone, afraid to tell loved ones and friends.

We have come a long way since then.

Today, our fight against cancer is one of hope, inspired by the rapid pace of research and compelled by community concern for those affected. Today, cancer patients are much less likely to suffer the indignity, anxiety, and distress of being stigmatized.

I am proud to say that Cancer Council Queensland is with them every step of the way, and has been for 50 years.

Much has changed in that time. In 1961 there were about 1.5 million people living in Queensland, compared to 4.5 million people today. We have no way of knowing how many people were diagnosed with cancer in 1961, but we estimate there may have been about 5,000 Queenslanders newly diagnosed with cancer in 1961.

Since the inception of the Queensland Cancer Registry in 1982, we have vastly improved our capacity to monitor cancer incidence and mortality in Queensland, providing researchers with the data they need to investigate the causes of and possible treatments for cancer. The data also provides a source for comparison of local, national and international cancer trends, informing the development of cancer services. The information collected by the Queensland Cancer Registry is fundamental to understanding the cancer burden in our State and for planning the delivery of comprehensive and integrated cancer services.

And the need has never been so great, with well over 21,000 new diagnoses each year and forecasts that more than 30,000 Queenslanders will be newly diagnosed each year by 2016. Despite this, we can take reassurance from the fact that cancer survival rates have increased, in relative terms, by more than 30 per cent over the past twenty years. With continuing research, awareness and support, we can be confidently optimistic that survival rates will continue to improve.

The publication of the first Atlas of Cancer in Queensland is a historic milestone for cancer control in Queensland. This Atlas is significant for its contribution to our understanding of how cancer incidence and survival affects Queenslanders differently depending on where a person lives. It showcases how far we have come and provides an inspiring reminder that we have more work to do.

The first Atlas of Cancer in Queensland is dedicated to the many thousands of Queenslanders who have been involved in our work over the years and to the estimated 160,000 Queenslanders who are alive today after a cancer diagnosis.

Thank you for being a part of our vision for a cancer free Queensland.

Warm regards,

Professor Jeff Dunn

List of Abbreviations

ABS	Australian Bureau of Statistics
ARIA	Accessibility / Remoteness Index of Australia
ASGC	Australian Standard Geographical Classification
BYM	Besag, York and Mollié
CAR	Conditional AutoRegressive
CCQ	Cancer Council Queensland
CI	Credible Interval
DIC	Deviance Information Criterion
ICD-O3	International Classification of Diseases for Oncology, 3rd edition
IQR	Interquartile Range
IRSAD	Index of Relative Socioeconomic Advantage and Disadvantage
LGA	Local Government Area
MCMC	Markov Chain Monte Carlo
MEET	Maximised Excess Events Test
NSW	New South Wales
PSA	Prostate-Specific Antigen
QCR	Queensland Cancer Registry
RER	Relative Excess Risk of death
SEIFA	Socioeconomic Indexes for Areas
SES	Socioeconomic Status
SIR	Standardised Incidence Ratio
SLA	Statistical Local Area

Executive Summary

An understanding of spatial patterns of cancer helps health planners, service providers, other health professionals and the general public to assess current needs and understand the relative health burdens caused by each type of cancer. While there were many advances in health care during the 20th century, these benefits have not been shared equally across all population subgroups, particularly for people living in rural and disadvantaged areas.

This report describes the variation in cancer incidence and survival across small geographical areas (defined by Statistical Local Areas) in Queensland. Maps for incidence and survival are provided separately for males and females for all invasive cancers combined and the 18 most common cancers. This is an update and extension to an earlier Cancer Council Queensland publication examining geographic differentials in cancer incidence and survival in Queensland.[1]

Two important considerations when dealing with data from small geographical areas are confidentiality and possible spurious fluctuations due to small numbers. Bayesian hierarchical models were used to assess variation across areas; these models are specifically designed to produce more robust and reliable estimates by "borrowing" information from surrounding geographical areas. In addition, to preserve confidentiality, no information about the number of cancer cases in each geographical area is provided in this report; instead emphasis is placed on the overall patterns of variation across the State. Cancer data were obtained from the Queensland Cancer Registry following specific approval from Queensland Health.

Variations in cancer incidence and survival may be caused by a range of factors, including environmental factors, access to screening and diagnostic services, access to effective treatment and care, migration of cancer patients, the mix of cancer types present in that region, or even chance. This *Atlas of Cancer in Queensland* focuses specifically on describing the variation in incidence and survival; identifying the causes behind any variation is beyond the scope of this report, but remains the focus of other current and planned research efforts.

Strong evidence of geographical variation was found in the incidence of all invasive cancers (males and females), specifically oesophageal cancer (males), lung cancer (males and females), melanoma (males and females), breast cancer (females), uterine cancer (females), prostate cancer (males), kidney cancer (males), bladder cancer (males), thyroid cancer (females), and non-Hodgkin lymphoma (males and females). In addition there was moderate evidence of geographical variation across Queensland for the incidence of leukaemia (males and females) and cervical cancer (females).

The direction of the variation in incidence rates across socioeconomic and rurality categories differed by type of cancer. For some cancers, such as prostate and breast, the incidence was higher than the Queensland average in urban or affluent areas, while for others, such as lung, oesophageal and cervical cancers, incidence was higher in more remote or disadvantaged areas compared to the State average.

There was also strong evidence for geographical variation across Queensland in survival for all invasive cancers (males and females), in particular for colorectal cancer (males and females), lung cancer (males and females), breast cancer (females), prostate cancer (males) and non-Hodgkin lymphoma (females). In addition there was moderate evidence of geographical variation among males for stomach cancer, non-Hodgkin lymphoma and leukaemia.

The typical pattern was for there to be lower survival among cancer patients living in more rural or disadvantaged areas compared to the Queensland average. If survival outcomes in these areas were raised to the current Queensland average, an estimated 1,223 cancer-related deaths within five years of diagnosis (795 males, 428 females) could have been prevented. This represents 9% of cancer related deaths during this period (similar for males and females).

This *Atlas of Cancer in Queensland* is the first to systematically present cancer incidence and survival maps for Queensland at such a comprehensive level. It is hoped that this report will stimulate the generation of further research hypotheses about the possible causes of these variations in cancer outcomes and enable targeted resource allocation to improve detection and survival outcomes for cancer patients in this State.

Introduction

Advances in the health of Australians diagnosed with cancer during the 20th century have not resulted in similar health outcomes across all population subgroups. Australians living in rural and disadvantaged areas are generally more likely to be diagnosed with advanced cancer and have lower prospects of survival.[2,3] They often have higher prevalence of risk factors such as smoking, obesity and lower levels of physical activity.[4,5] Impact of distance is also important, with cancer patients in rural areas experiencing greater difficulty accessing cancer care services.[6-8]

Achieving health equity for all Australians, regardless of race, income and place of residence, has been identified as one of the greatest health challenges Australia faces.[9] To effectively address this challenge the extent of health inequalities needs to be quantified, as was recommended by the World Health Organization Commission on the Social Determinants of Health.[10] Specifically, an understanding of spatial patterns of cancer helps health planners, service providers, other health professionals and the general public to assess current needs and understand the relative health burdens caused by each type of cancer.

A previous Cancer Council Queensland (CCQ) report[1] had a substantial impact in highlighting the geographical inequalities in cancer outcomes across the State and promoting research activities. The increasing application of emerging statistical and spatial techniques by other Australian[11] and international[12] cancer agencies to model small-area geographical data, as well as the relevance of the latest available statistics of geographical variation for informing policy and research priorities, increased the motivation for CCQ to produce a small-area cancer atlas showing the most recent spatial patterns in cancer incidence and survival outcomes for cancer patients in Queensland.

This report displays maps of incidence and survival by type of cancer and gender. Providing a visual representation of cancer outcomes is particularly useful for describing geographic patterns of disease as well as enabling targeted policy development and resource allocation to improve prevention, early detection and outcomes.[13]

Scope of this report

To provide more meaningful and stable estimates, the previous CCQ report[1] presented cancer incidence and survival estimates for only 14 broad geographical areas across Queensland. However the expanding application of Bayesian statistical methods and spatial mapping capability now makes it possible to generate robust estimates of variations in cancer outcomes using smaller, more detailed geographic areas.

This report examines the geographical variation in cancer incidence and survival in Queensland between 1998 and 2007 across Statistical Local Areas (SLAs) for the most common types of cancer. SLAs are spatial units defined by the Australian Standard Geographical Classification (ASGC). They are often based on the incorporated bodies of local governments, which are used to delineate responsibility for service provision and infrastructure. The SLA is also used as the standard area definition by most relevant data providers, in particular the Queensland Cancer Registry and Australian Bureau of Statistics. All SLA boundaries were adjusted to match the 2006 ASGC definitions. In 2006 there were 478 SLAs in Queensland with a median population of 5,810 (range: 7 to 77,523).

Cautions

The estimates presented in the maps have been adjusted (or smoothed) to account for small numbers of cancers and population sizes. Although maps allow for rapid visual assessment of large amounts of information, they have the potential to be visually misleading; the largest regions which may dominate the image are often the most sparsely populated and involve the smallest numbers of cancer cases.

Results are based on the area where people lived when they were diagnosed with cancer. Since cancer may develop many years before a diagnosis, it is possible that area of residence at diagnosis does not reflect where any initial exposure may have occurred.

It is important to note that the estimates presented in this report do not indicate the level of risk for any specific individual living within a particular area; rather they reflect the average risk for all people within an area after accounting for the risk in neighbourhood areas, the age and sex distribution of people diagnosed with cancer and, for survival, the underlying mortality rate.

The statistical evidence level for geographical variation was categorised as “Strong”, “Moderate”, “Weak” or “None” (see Methods). For the categories of “Weak” and “None”, it is likely that any observed variation is random variation, or primarily due to chance. However, even when there is “Moderate” or “Strong” statistical evidence of geographical variation, there remains some small possibility that the observed variation is due to chance.

Limitations

This report is not designed to identify clusters of cancers or provide definitive reasons for any observed geographical variation, as it is based solely on data from the Queensland Cancer Registry. It is unable to consider all the local environmental, clinical and public health issues that may be relevant to a detailed cluster investigation. For this reason any spatial patterns that are identified need to be viewed as areas for further research or investigation, and not as an end in themselves. Dedicated research studies are required to properly investigate and explain any significant findings in this report. Such studies could include investigating various person-specific factors such as smoking history, diet, alcohol consumption, residential and family history, as well as area-level factors such as access to and quality of health services and environmental exposures.

No adjustment for stage or spread of cancer at diagnosis has been included in this report. Complete staging data is not routinely collected by the Queensland Cancer Registry, as is the case for all cancer registries in Australia (although New South Wales collects a measure of degree of cancer spread). Therefore it is not possible to determine whether differences in the spread of disease at diagnosis (possibly due to screening for certain cancers), or differences in management strategies, are the predominant reasons for observed variations. Cancer Council Queensland is currently undertaking several research studies to examine these issues in more detail for specific cancers. Published results from New South Wales[3] found that similar levels of regional variation were observed regardless of adjusting for spread of disease at diagnosis, suggesting that earlier diagnosis was not the only explanation for geographical variations.

Cancer outcomes were examined by area-level socioeconomic status. Socioeconomic status was based on the Australian Bureau of Statistics Socioeconomic Indexes for Areas (SEIFA) classification, using the Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD). These are area-based measures, and therefore may not reflect the socioeconomic status of all individuals living within those areas.

To preserve confidentiality, the number of cancer cases in each SLA is not provided in this report; instead emphasis is placed on the overall patterns of variation across the State, and patterns by rurality and area-level socioeconomic status.

Methods

Full details of the data sources and statistical analyses are described in Appendix B. A summary of the methodology is provided below.

Data sources

De-identified data on all cancers diagnosed among people living in Queensland during 1996 to 2007 were obtained from the Queensland Cancer Registry (QCR). The QCR is a population-based cancer registry that maintains a register of all cancers (excluding basal and squamous cell carcinomas) diagnosed among Queensland residents since 1982. Ethical approval to conduct this study was obtained from the Queensland Health Human Research Ethics Committee. Approval to extract the data was obtained from Queensland Health.

Population estimates[14,15] and general population mortality data[16] were obtained from the Australian Bureau of Statistics.

Geographical areas

In 2006, there were 478 SLAs in Queensland defined by the ASGC.[17] Incident cancer cases were assigned to an SLA based on place of residence at diagnosis. To account for changes in SLA boundaries over time, the SLA definitions for people diagnosed in other years were adjusted to the 2006 ASGC definition using suburb and postcode at diagnosis. Boundary adjustments could only be made from 1996 onwards due to major differences in the SLA definitions prior to that date. This adjustment of SLA definitions was conducted within the Queensland Cancer Registry before the data were extracted for analysis. SLAs were also grouped into broad categories of rurality (using the ARIA+ classification[18]) and area-level socioeconomic status (using the IRSAD[19]) (Appendix D).

Statistical analysis

When examining cancer data by small geographical areas, crude estimates tend to be unreliable and fluctuate widely due to the few cases observed among a small population. Since neighbouring SLAs are likely to have similar characteristics, statistical methods that "borrow strength" from the data in these neighbouring SLAs have been shown to produce more reliable estimates than those methods relying solely on the data within a specific SLA. One such method is Bayesian hierarchical modelling.

The effect of using Bayesian hierarchical models is to "smooth" the estimate of incidence or survival for a particular SLA towards the State average and the average of the surrounding (or neighbourhood) areas. For some areas, even though the crude estimate might be higher than the Queensland average, the impact of the neighbouring areas may mean that the smoothed estimate is lower than the State average, and vice versa. Generally the "smoothing" effect is more pronounced when there are a smaller number of cases in a particular geographical area.

The statistical evidence for spatial variation was assessed using Tango's Maximised Excess Events Test (MEET).[20] A low p-value (< 0.05) from this test suggests that the observed geographical differences are likely to be real. Higher p-values (≥ 0.05) suggest that chance is more likely to be a plausible explanation for any apparent variation. The statistical evidence for spatial variation was categorised into "Strong" ($p < 0.01$), "Moderate" ($0.01 \leq p < 0.05$), "Weak" ($0.05 \leq p < 0.10$) and "None" ($p \geq 0.10$).

Incidence

Incidence refers to the number of new cancer cases diagnosed within a certain time period. All primary invasive cancers diagnosed in the 10-year period between 1998 and 2007 were included. Since variation between geographical areas may be simply due to differences in the age distribution of the population, incidence rates were standardised by age and sex. Due to the small number of cancer cases in some geographical areas indirect standardisation was used.

Indirectly standardised incidence ratios (SIR) were calculated for each SLA by dividing the observed number of cancer cases by the expected number and multiplying the result by 100, where the expected number of cases was calculated by applying the age- and sex-specific incidence rates for total Queensland to the corresponding components of the SLA population.

Smoothed SIR estimates were then generated by entering the components of the 'crude' SIR (i.e. observed and expected cases) into a specific type of Bayesian model known as the Besag, York and

Mollié (BYM) model.[21] This model is currently the standard Bayesian model for disease mapping research studies.[22] For this analysis we have not incorporated a time component into the model to see if the geographical variation has changed over time, however this is an avenue for future investigation.

When there was strong or moderate evidence for spatial variation in cancer incidence, the combined observed and expected counts from the Bayesian model were used to calculate the overall risk of being diagnosed with cancer by broad rurality and area-level socioeconomic categories.

Survival

Relative survival compares the survival of cancer patients against a comparable group from the general population, taking into account age, sex and year of diagnosis. Relative survival is the preferred measure of estimating survival from population-based Cancer Registry data as it removes the impact of any inaccuracies inherent in cause of death coding while still providing an estimate of the mortality burden caused by the specific cancer.[23]

Cancer patients were considered "at risk" of death if they were diagnosed with cancer between 1996 and 2007, and were a prevalent case (that is, were alive after being diagnosed with cancer) for at least some time between 1 January 1998 to 31 December 2007. These "at risk" patients were included in the relative survival calculations, with survival calculated up to five years after diagnosis using the period method.

As is standard practice, reporting of survival information is expressed in terms of Relative Excess Risk of death. Areas with lower survival are those that have higher excess risk of death, and those areas that have higher survival will have lower excess deaths.

The "five-year mortality" is the complement of survival (i.e. one minus relative survival), and is expressed as a percentage. This represents the percentage of patients who died within five years after diagnosis in the hypothetical situation where the cancer of interest is the only possible cause of death.

The Bayesian model used for this part of the analysis was based on the relative survival model recommended by Dickman et al,[23] including additional random effects to account for differences in the geographical areas.[24] The model assumes constant hazards within each follow-up time (years) and was adjusted for age group. Survival estimates from this model were presented in terms of Relative Excess Risk (RER), which reflect the ratio of the smoothed estimate of excess deaths in a specific SLA to the Queensland average.

For cancers with strong or moderate evidence of spatial variation in cancer survival, the overall excess risk of death by broad rurality and area-level socioeconomic categories was calculated using the observed and expected number of deaths within five years of diagnosis from the Bayesian model, as well as an estimate of the number of excess deaths that could be attributable to geographic location.

Guide to Interpretation

This report presents maps, graphs and tables by cancer type separately for males and females, providing an overview of geographical variations in cancer outcomes in Queensland between 1998 and 2007.

The results are based on the smoothed estimates.

The Standardised Incidence Ratio (SIR) provides an estimate of the risk of being diagnosed with a specific cancer in an SLA compared to the Queensland average.

The Relative Excess Risk of death (RER) reflects the risk of cancer patients dying from their cancer within five years of diagnosis in an SLA compared to the Queensland average.

For both values, estimates greater than 100 mean the SLA-specific risk is higher (or worse) than the Queensland average, while estimates below 100 indicate the risk is lower (or better) than the Queensland average. *Note that if an SLA has a high RER estimate, then people diagnosed while living in that SLA have low survival*.

These estimates reflect comparisons with the Queensland average. Therefore estimates for two SLAs should not be directly compared, as in saying incidence in Area A is greater than in Area B. However it can be said, for example, that incidence in Area A is greater than the Queensland average while incidence in Area B is lower than the Queensland average.

Incidence and survival estimates for total Queensland are shown in Appendix C.

Maps

Smoothed SIR or RER values were categorised into five groups centred around the Queensland average of 100. To reduce the likelihood of reporting spurious differences, comparatively broad categories of 10% and 30% higher were used as cut-off values for the categories, and the inverse of these (9.1% and 23.1% lower) for the lower categories.

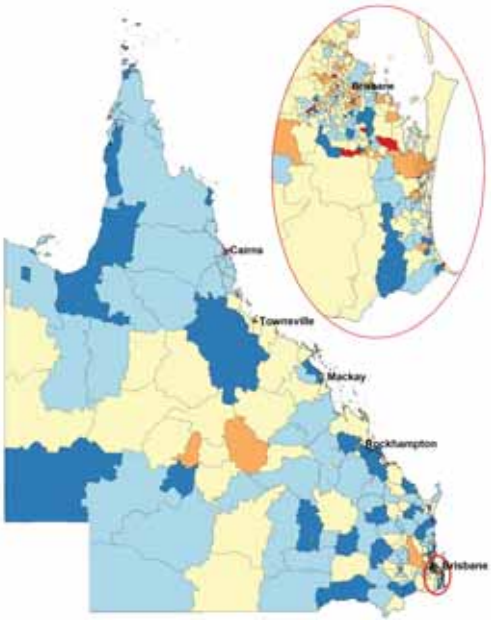
The values for the categories were:

SIR	RER		
		130+	Very high
		110 to <130	High
		90.9 to <110	Average
		76.9 to <90.9	Low
		<76.9	Very low

When the variation is statistically significant, red/brown tones indicate higher values (high risk of diagnosis or high risk of dying within five years of diagnosis), while blue/green tones indicate lower values (low risk of diagnosis or low risk of dying within five years of diagnosis).

Maps for which there was only weak or no statistical evidence of spatial variation have been shaded in muted tones.

Since South-East Queensland has a large number of SLAs in a small geographical area, an inset of this region is provided for greater detail.

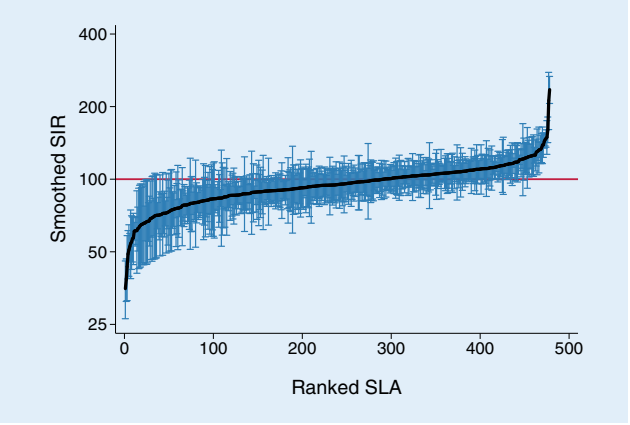


Graphs

Level of Uncertainty Plot

All estimates are calculated with some level of uncertainty. This plot shows how much reliance can be placed on the estimates. The black line is the SIR or RER for each SLA. This is the value used in the map. The blue/green vertical lines are the 95% credible intervals, and indicate the amount of uncertainty associated with each estimate. The red line shows the Queensland average (set to 100).

Plots with wider blue/green lines reflect higher uncertainty in the estimates, while those plots with more narrow blue/green lines reflect greater precision and confidence in the smoothed estimates.



Distribution plots

Distribution plots reflect the general patterns in the smoothed incidence and survival estimates across the area-based categories of socioeconomic status and rurality.

These plots show the proportion of SIR or RER estimates that are above or below the Queensland average (vertical red line) within each of the area-based categories.

In the incidence example on the left, the rectangular box (containing 50% of the estimates) for “Remote” is to the left of the red line, which suggests that the incidence among remote areas is generally lower than the Queensland average. SLAs classified as “Outer regional” also have a similar distribution.

These plots only present the range of point estimates, so do not take the amount of uncertainty associated with each SLA-specific estimate into account. They reflect the comparison of each category against the Queensland average, so should not be compared against each other. The y-axis for these plots is presented on a log scale to ensure the space between 50 and 100 on the y-axis is the same as between 100 and 200. A more detailed explanation of how to interpret these plots is contained in Appendix B.

SIR and RER estimates by rurality and socioeconomic categories are shown in Appendix E.

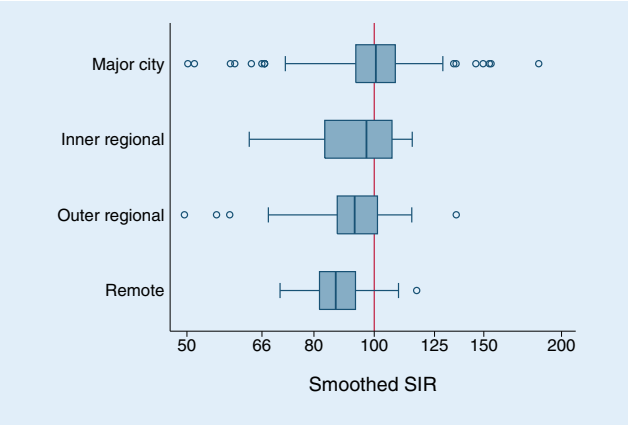


Table of Summary Statistics

Beside each map is a summary table showing the statistical measures associated with that map. The interpretation of the values in these tables is described below.

Term	Explanation
New cases/year	Average number of cases diagnosed each year in Queensland (Incidence maps only).
Rate/100,000	Age-standardised incidence rate per 100,000 population (Incidence maps only).
5-year mortality	1 minus 5-year relative survival, expressed as a percentage. Estimate is for total Queensland (Survival maps only).
Smoothed SIR or RER distribution	
Highest	Highest value of the smoothed SIR or RER estimates.
75%	One quarter (25%) of all smoothed SIRs or RERs are above this value.
Median (50%)	Median or middle smoothed SIR or RER.
25%	One quarter (25%) of all smoothed SIRs or RERs are below this value.
Lowest	Lowest value of the smoothed SIR or RER estimates.
Geographical variation	
Evidence level	**Strong** – Tango's MEET p-value is below 0.01. **Moderate** – Tango's MEET p-value is between 0.05 and 0.01. **Weak** – Tango's MEET p-value is between 0.10 and 0.05. **None** – Tango's MEET p-value is greater than or equal to 0.10.
p-value	Tango's Maximised Excess Events Test (MEET) adjusted p-value.

Results and Maps

Overview

When disparities in cancer incidence and survival are evident, there are a number of potential explanations, including but not restricted to differences in environmental risk factors, access to screening and diagnostic services, access to effective treatment and care, migration of cancer patients, the mix of cancer types present in that region (when comparing rates for all invasive cancers), or even random chance.

The table below presents the summary of observed geographic variation for incidence and survival by type of cancer and gender.

	Incidence		Survival	
Cancer site	**Males**	**Females**	**Males**	**Females**
All invasive cancers	Strong	Strong	Strong	Strong
Oesophagus	Strong	None	None	None
Stomach	Weak	None	Moderate	None
Colorectal	None	None	Strong	Strong
Pancreas	None	None	None	None
Lung	Strong	Strong	Strong	Strong
Melanoma	Strong	Strong	None	None
Breast – females only		Strong		Strong
Cervical		Moderate		None
Uterus		Strong		None
Ovary		None		Weak
Prostate	Strong		Strong	
Kidney	Strong	Weak	None	None
Bladder	Strong	None	None	None
Brain	None	None	None	None
Thyroid	None	Strong	None	None
Non-Hodgkin lymphoma	Strong	Strong	Moderate	Strong
Leukaemia	Moderate	Moderate	Moderate	None
Myeloma	Weak	None	None	None

A recent report from New South Wales (NSW)[11] examining geographic differences in cancer incidence and mortality found similar evidence for geographical variation in many of the same cancers. There were some differences however. While Queensland had strong or moderate evidence of geographical variation in incidence for non-Hodgkin lymphoma, kidney cancer (males only) and leukaemia, there was no corresponding evidence of variation for NSW. There are many potential explanations for these discrepancies, including differences between the methodologies used to estimate the variation.

These results are also similar to that observed in the previous CCQ report.[1] The main exceptions are a current lack of evidence for geographic variation in colorectal cancer incidence, as well as no significant geographic variation in survival for ovarian cancer, kidney cancer and myeloma. In addition there is now strong evidence for geographical variation in female breast cancer survival. As in the comparisons with the NSW report, differences in the results could be due to the methodological differences, or the much broader geographical areas used in the 2005 CCQ report.

The following discussion provides an overview of the results by type of cancer:

All invasive cancers (Pages 14-17)

There was strong spatial variation throughout the State in the incidence of all invasive cancers for both males and females. More remote areas tended to have lower incidence (8% lower in remote areas than the Queensland average for both males and females).

Survival differed throughout the State also, with survival decreasing as disadvantage and/or remoteness increased for both genders. These results are similar to those observed in the United Kingdom[25] and the United States of America.[26]

Among males, the risk of dying within five years after being diagnosed with cancer while living in outer regional and remote areas was an estimated 12% and 31% higher respectively than the Queensland average. Corresponding figures for females were 11% higher and 20% higher. Combined, this meant that 795, or 9% of cancer deaths within five years of diagnosis among males living in these areas could have been prevented if smoothed survival estimates matched the Queensland average, and 428 deaths (9%) among females.

Possible reasons for these disparities include reduced access to health care and diagnostic or screening services as well as differences in cancer risk factors such as tobacco smoking, diet, alcohol consumption and physical activity. Differences in the mix of cancer types between areas may also result in survival disparities, for example, if one area has many melanoma cases (high survival), while another area has a large number of lung cancer cases (low survival) then the overall survival will differ between these regions.

Oesophageal cancer (Pages 18-21)

There was strong evidence of geographical variation in the incidence of oesophageal cancer for males only. Males in outer regional (15% higher) and remote (17% higher) areas generally had higher incidence of oesophageal cancer than the Queensland average. Recognised risk factors for oesophageal cancer include tobacco smoking, moderate to heavy alcohol intake, low or infrequent consumption of raw fruits and vegetables, acid reflux and obesity.[27]

There was no evidence of geographical variation in incidence among females, or for survival among either males or females.

Stomach cancer (Pages 22-25)

Males had moderate evidence of geographical variation in stomach cancer survival, but only weak evidence of spatial variation in stomach cancer incidence. Females had no evidence for geographical variation in either incidence or survival across Queensland. Risk factors for stomach cancer include high consumption of pickled, smoked or salty foods, current or previous infection with *Helicobacter pylori*, or a family history of stomach cancer.[28]

Among males, remote regions tended to have lower survival (13% higher risk of death) than the Queensland average, as did outer regional areas (9% higher risk of death). Combined, this meant that 25, or 8% of deaths due to stomach cancer within five years of diagnosis among males living in these areas could have been prevented if smoothed survival estimates matched the Queensland average.

Colorectal cancer (Pages 26-29)

No spatial variation in the incidence of colorectal (bowel) cancer was apparent for either males or females. Recognised risk factors for colorectal cancer include increasing age, family history and unhealthy behaviours such as lack of exercise, obesity, excessive alcohol consumption, or tobacco smoking.[29] Diseases such as diabetes mellitus, inflammatory bowel diseases or inherited diseases such as familial adenomatous polyposis or hereditary non-polyposis coli also increase the risk of developing colorectal cancer.[29]

However, there was strong evidence of geographical variation in colorectal cancer survival across Queensland. Survival tended to be lower than the Queensland average in more rural, remote or disadvantaged areas.

The risk of dying within five years after being diagnosed with cancer while living in outer regional and remote areas among males was an estimated 13% and 17% higher respectively than the Queensland average. Corresponding figures for females were 10% higher and 12% higher. Combined, this meant that 134, or 11% of deaths due to colorectal cancer within five years of diagnosis among males living in outer regional or remote areas could have been prevented if smoothed survival estimates matched the Queensland average, and 71 deaths (9%) among females.

Socioeconomically advantaged regions had higher survival than the State average (6% and 5% lower risk of death among males and females in the most socioeconomically advantaged areas, respectively), while disadvantaged areas had lower survival (5% higher risk of death among males).

It is currently unknown whether this survival differential is due to colorectal cancer patients in socioeconomically disadvantaged or more remote areas being diagnosed at a more advanced stage, or having differential access to treatment. Socioeconomic inequalities in survival for colorectal cancer have also been observed in other Australian States.[1,3,30-32]

Pancreatic cancer (Pages 30-33)

There were no geographical differences in pancreatic cancer incidence or survival for either males or females. Apart from tobacco smoking and a family history of pancreatic cancer, which are well-established risk factors, the causes of this cancer are unclear.[33] Chronic pancreatitis and diabetes mellitus have been consistently associated with pancreatic cancer.[33]

Lung cancer (Pages 34-37)

There was strong evidence of geographical variation in both the incidence of lung cancer and survival from lung cancer for males and females throughout Queensland.

Among males living in the socioeconomically most advantaged (14% lower) or advantaged areas (10% lower), incidence was below the Queensland average, while males living in the disadvantaged (5% higher), most disadvantaged (15% higher), outer regional (6% higher) or remote areas (18% higher) had incidence risks above the Queensland average. Although there was strong evidence of variation in incidence among females across Queensland, these patterns by remoteness and area-level socioeconomic status were not evident.

Since tobacco smoke exposure is the strongest risk factor,[34] differences in lung cancer incidence by socioeconomic status are most likely due to geographical differences in the prevalence of smoking.[35] Studies in Queensland and throughout Australia have consistently reported substantially higher rates of smoking among people living in lower SES areas.[36-38] Differences between the incidence patterns for males and females may reflect their different smoking prevalence 20 to 30 years ago.[39]

Similar patterns were observed for both males and females for survival disparities, with those residing in affluent or urban areas having higher survival, while those in disadvantaged, outer regional or remote areas had lower survival.

Males diagnosed with lung cancer while living in outer regional and remote areas had an estimated 11% and 17% higher risk of death within five years respectively than the Queensland average. Corresponding figures for females were 12% and 18% higher. Combined, this meant that 200, or 9% of deaths due to lung cancer within five years of diagnosis among males living in these areas could have been prevented if smoothed survival estimates matched the Queensland average, and 80 deaths (9%) among females.

Potential reasons for these differences in survival outcomes may include access to treatment services, the type of treatment available, and cultural considerations among Indigenous persons including beliefs about cancer and language barriers.[40]

Melanoma (Pages 38-41)

There was strong evidence for geographical variation in melanoma incidence for both males and females. Remote (22% lower for males and 11% lower for females) and disadvantaged areas (6% lower and 7% lower for males in disadvantaged and most disadvantaged areas, respectively) generally had incidence rates below the Queensland average, while males in the most advantaged areas had 4% higher incidence. This incidence pattern is largely consistent with other States in Australia showing higher incidence of melanoma in coastal regions.[11,41] The main risk factors for developing melanoma are exposure to ultraviolet radiation, the presence of many moles, and a family history of melanoma.[42]

There was no evidence for spatial variation throughout Queensland in survival after a melanoma diagnosis for males or females.

Breast cancer – females only (Pages 42-43)

There was strong evidence for geographical variation in female breast cancer incidence and survival across Queensland.

The incidence of breast cancer among women living in affluent areas was higher than the Queensland average (10% higher for most advantaged and 2% higher for advantaged areas), while the incidence among women living in disadvantaged (4% lower), most disadvantaged (6% lower), outer regional (10% lower) or remote (15% lower) areas was below the Queensland average. Variations in incidence by socioeconomic status have been linked mainly to lifestyle factors, with women in affluent areas being more likely to delay childbearing, have fewer children and/or use hormone replacement therapy, which are all risk factors for developing breast cancer.[43-45]

There was also a marked gradient for survival, which decreased with increasing remoteness of residence and greater disadvantage. Females diagnosed with breast cancer while residing in affluent areas had higher survival (11% lower risk of death for the most advantaged areas), while the risk of dying within five years after diagnosis among females in outer regional and remote areas was an estimated 12% and 14% higher respectively than the Queensland average. Combined, this meant that 73, or 10% of deaths due to breast cancer within five years of diagnosis among females living in these areas could have been prevented if smoothed survival estimates matched the Queensland average.

Research studies examining socioeconomic disparities suggest this is likely to reflect differences in stage at diagnosis, but may also be influenced by treatment access or quality.[46-48]

Cervical cancer (Pages 44-45)

There was moderate evidence of geographical variation in cervical cancer incidence across Queensland, with incidence rates for remote regions being 15% above the Queensland average.

Papanicolaou screening (pap smear) tests are likely to impact on the incidence, as they detect and enable treatment of precancerous lesions resulting from sexually transmitted human papillomaviruses. Therefore, if there is high screening utilisation of pap smears, this can result in lower incidence of cervical cancer. In Queensland, as in Australia, the participation rates for cervical cancer screening are lower in remote communities and areas of low socioeconomic status.[49,50] Women in Indigenous communities – many of which are in the Far Northern areas of the State – are also more likely to have lower participation in cervical cancer screening.[51]

There was no evidence of geographical differences for survival from cervical cancer.

Uterine cancer (Pages 46-47)

There was strong evidence of spatial variation in the incidence of uterine cancer throughout Queensland, however there did not seem to be a consistent pattern according to rurality or socioeconomic status. Nonetheless, women living in the most disadvantaged areas had a 7% higher incidence of uterine cancer. Reproductive factors such as early age at menarche, late menopause and no children increase the risk of developing uterine cancer, as does obesity, hypertension and diabetes.[52] Physical activity and low-fat diets seem to decrease the risk.[52]

There was no evidence of geographical variation in survival from uterine cancer.

Ovarian cancer (Pages 48-49)

There was no evidence of spatial variation in ovarian cancer incidence, and only weak evidence of geographical differences for survival throughout the State. The causes of this cancer are unclear, but protective factors include childbearing, oral contraceptive use and hysterectomy.[53]

Prostate cancer (Pages 50-51)

Prostate cancer incidence and survival showed strong evidence of geographical variation.

Incidence was higher in the most advantaged areas (5% higher risk of diagnosis), and lower in the most disadvantaged areas (3% lower).

Remote regions tended to have lower incidence rates (an estimated 14% lower) and survival (18% higher risk of death) than the Queensland average. Outer regional areas also had lower survival (8% higher risk of death) than the State average. Combined, this meant that 94, or 7% of deaths due to prostate cancer within five years of diagnosis among males living in these

areas would not have occurred if smoothed survival estimates matched the Queensland average.

Prostate-specific antigen (PSA) testing, which is used to detect asymptomatic prostate cancer, can inflate the reported incidence of prostate cancer. PSA testing is less common in more rural areas than in capital cities throughout Australia,[7] and this could be contributing to these observed patterns. Increased prostate cancer incidence in the United States has also been associated with higher socioeconomic status, and this was also considered to be largely due to socioeconomic differences in PSA testing.[54]

Kidney cancer (Pages 52-55)

There was strong evidence of spatial variation in the incidence of kidney cancer among males, but only weak evidence of variation among females. For males, incidence rates in outer regional (12% lower) and remote (15% lower) tended to be lower than the Queensland average. Known risk factors for kidney cancer include tobacco smoking, obesity and hypertension.[55]

There was no evidence for geographical variation in survival among males or females.

Bladder cancer (Pages 56-59)

There was strong evidence of geographical variation in bladder cancer incidence among males, but no evidence of variation among females. For males, the incidence rates for bladder cancer in outer regional (7% lower) and remote (18% lower) areas tended to be below the Queensland average. Risk factors for developing bladder cancer include exposure to tobacco smoke and other toxic chemicals.[56]

There was no evidence of spatial variation in survival for bladder cancer among either males or females.

Brain cancer (Pages 60-63)

There was no evidence of geographical differences in brain cancer incidence or survival for either males or females. The causes of brain cancers are unknown, although exposure to high dose ionizing radiation is a risk factor, as are certain inherited or genetic conditions.[57]

Thyroid cancer (Pages 64-67)

There was strong evidence of geographical variation in thyroid cancer incidence among females, but no evidence of variation among males. Among females, thyroid cancer incidence in more remote areas was below the Queensland average (10% lower for outer regional areas), while it tended to be higher in SLAs classified as most advantaged (11% higher). The main risk factors for developing thyroid cancer are iodine deficiency and exposure to ionising radiation.[58] It is possible that increased utilisation of medical procedures may be influencing these differentials, as elsewhere many small, sub-clinical thyroid cancers are now being detected, often while undergoing neck imaging for other reasons.[59]

There was no evidence of spatial variation in thyroid cancer survival across Queensland.

Non-Hodgkin lymphoma (Pages 68-71)

There was strong evidence of geographical variation in the incidence of non-Hodgkin lymphoma across Queensland among both males and females. Incidence was lower in outer regional (10% lower and 12% lower among males and females respectively) and remote (16% lower males, 13% lower females) areas. Females also experienced incidence differentials by socioeconomic status, with incidence 8% higher for advantaged areas, and lower for disadvantaged areas, but these were not evident for males. Risk factors for developing non-Hodgkin lymphoma include disorders of immune dysfunction or acquired states of severe immunosuppression, family history of lymphoma or infection with viruses such as Epstein-Barr virus.[60]

There was moderate (for males) to strong (for females) evidence of geographical variation in survival from non-Hodgkin lymphoma, with the affluent or urban areas having higher survival, while the socioeconomically disadvantaged (7% and 10% higher risk of dying for males and females, respectively), outer regional and remote areas had lower survival compared to the Queensland average.

Among males, the risk of dying within five years after being diagnosed with non-Hodgkin lymphoma while living in outer regional and remote areas was 13% higher and 21% higher respectively than the Queensland average. Corresponding figures for females were 22% higher and 26% higher. Combined, this meant that 29, or 11% of deaths among males due to non-Hodgkin lymphoma within five years of diagnosis living in these areas could have been prevented if smoothed survival estimates matched the Queensland average, and 29 deaths (16%) among females.

Leukaemia (Pages 72-75)

There was moderate evidence of spatial variation in the incidence of leukaemia across Queensland for males and females. Males and females in the most affluent areas had incidence above the Queensland average, while incidence tended to be lower in remote areas. Recognised risk factors for developing leukaemia include exposure to benzene, tobacco smoke or high levels of ionising radiation, certain chemotherapy drugs, genetic disorders such as Down syndrome, or some blood diseases.[61]

There was also moderate evidence of geographical differences in survival for males, but no evidence for females.

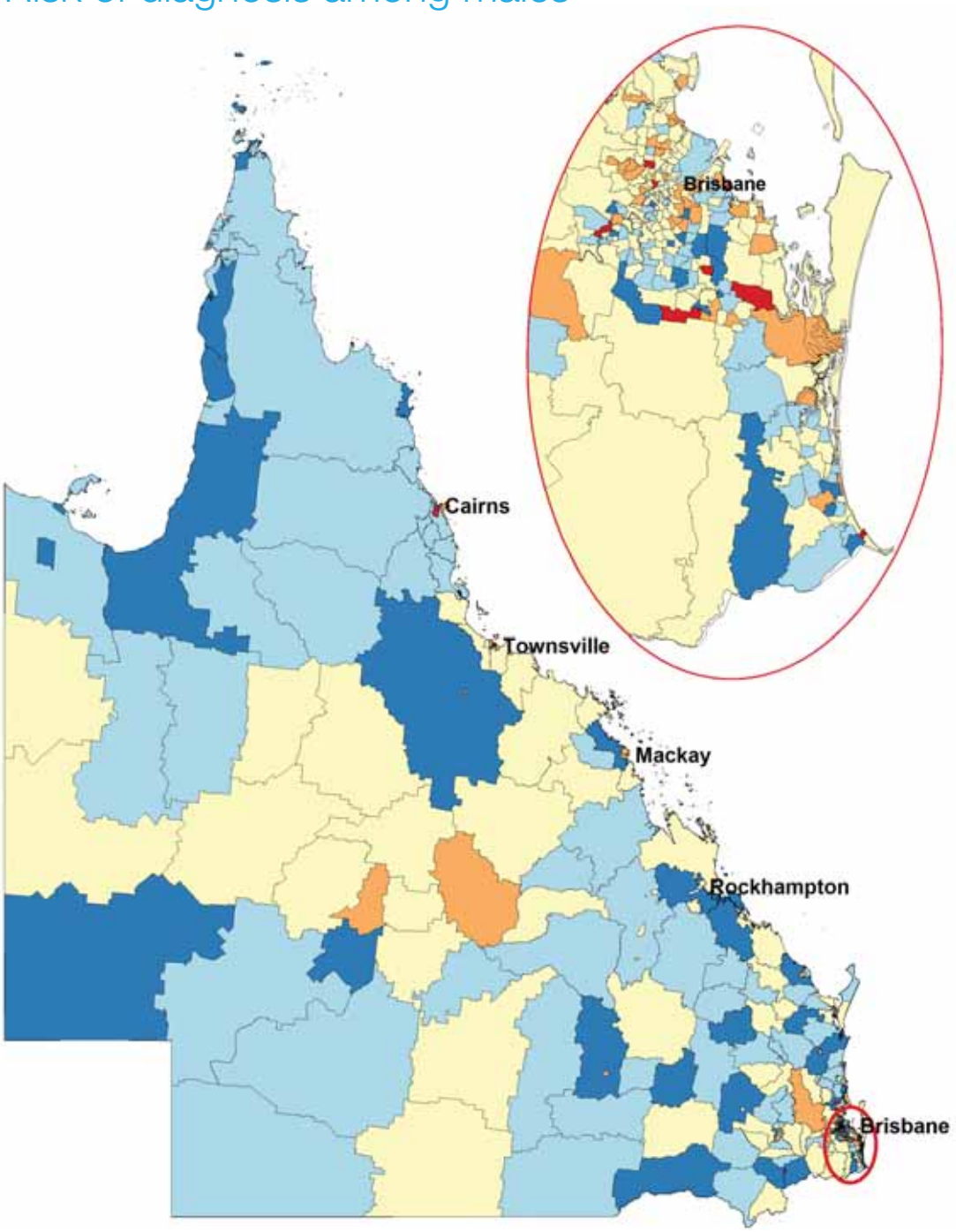
Among males, the risk of dying within five years after being diagnosed with leukaemia while living in outer regional and remote areas was 10% higher and 3% higher respectively than the Queensland average (remote was non-significant). Combined, this meant that 28, or 9% of deaths among males due to leukaemia living in these areas within five years of diagnosis could have been prevented if smoothed survival estimates matched the Queensland average.

Myeloma (Pages 76-79)

There was only weak evidence of geographical variation in myeloma incidence among males, and no evidence for variation among females. There was no evidence of spatial variation in myeloma survival across Queensland. The causes of this cancer are largely unknown, although risk factors include a family history of myeloma and increasing age.[62]

All invasive cancers

Risk of diagnosis among males

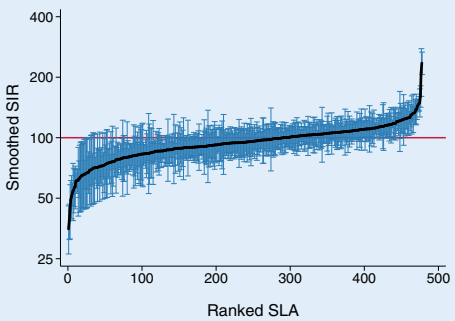


SIR

- Very high
- High
- Average
- Low
- Very low

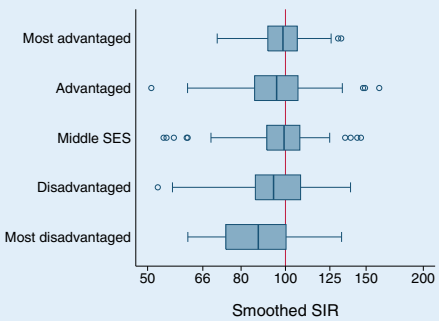
New cases/year	10,505
Rate/100,000	610.4
Smoothed SIR distribution	
Highest	235.4
75%	105.9
Median (50%)	95.0
25%	85.7
Lowest	35.2
Geographical variation	
Evidence level	
Strong	
(p-value 0.001)	

Level of Uncertainty

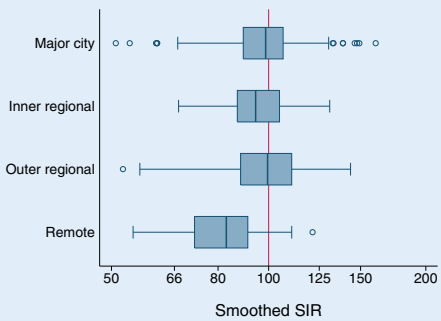


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



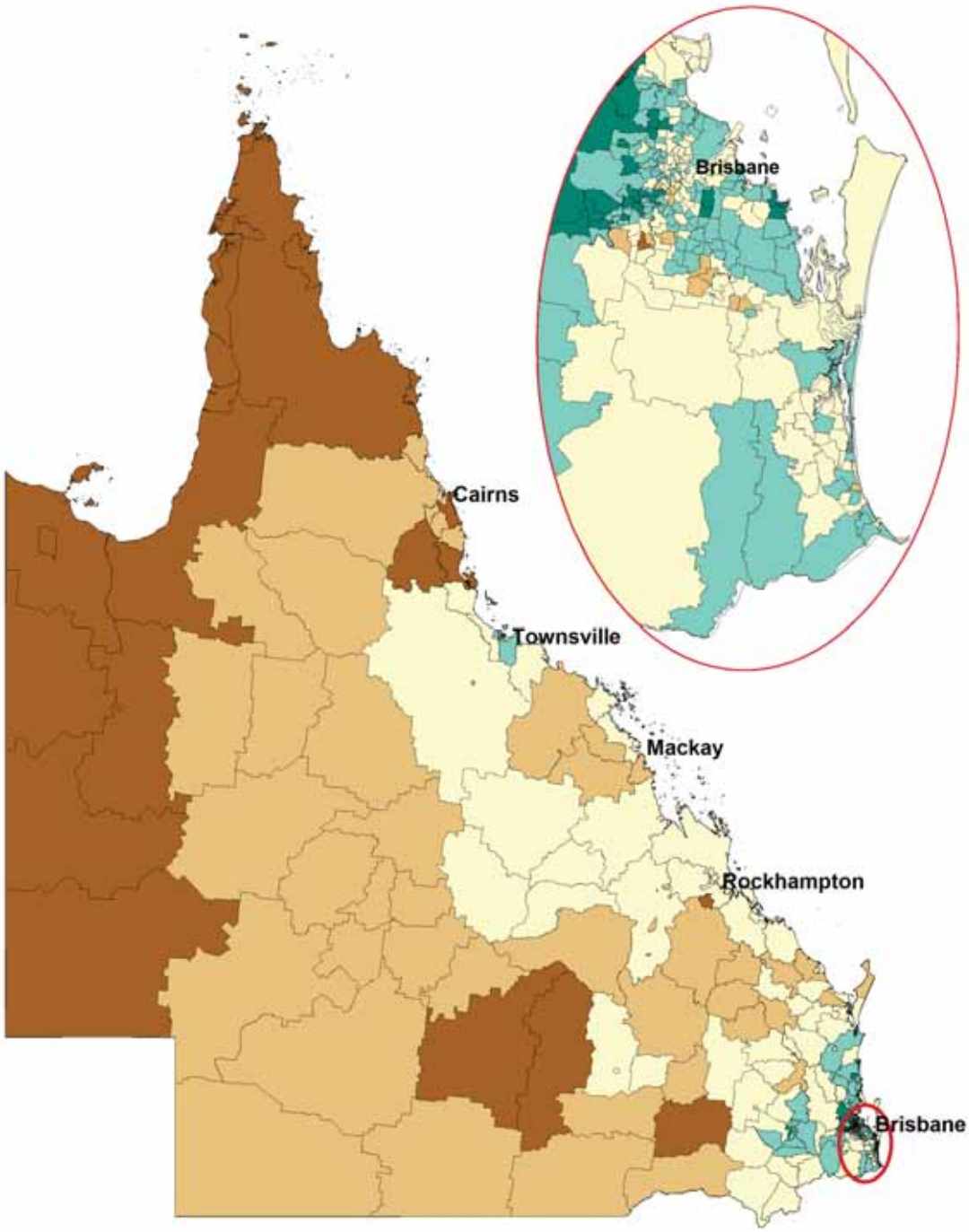
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

All invasive cancers

Risk of death within five years of diagnosis among males



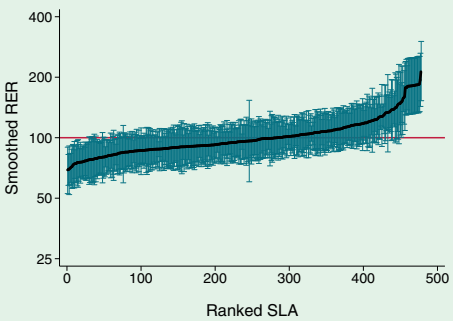
5-year mortality	37.1%
Smoothed RER distribution	
Highest	213.1
75%	109.0
Median (50%)	95.9
25%	87.7
Lowest	69.1
Geographical variation	

Evidence level:

Strong

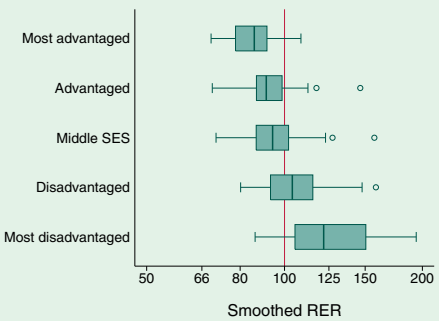
(p-value 0.001)

Level of Uncertainty

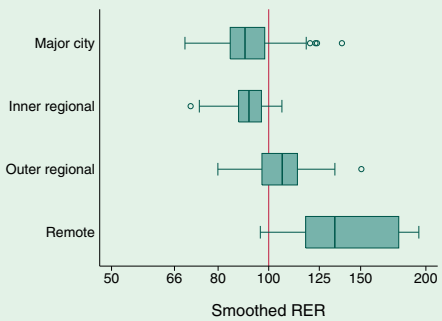


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



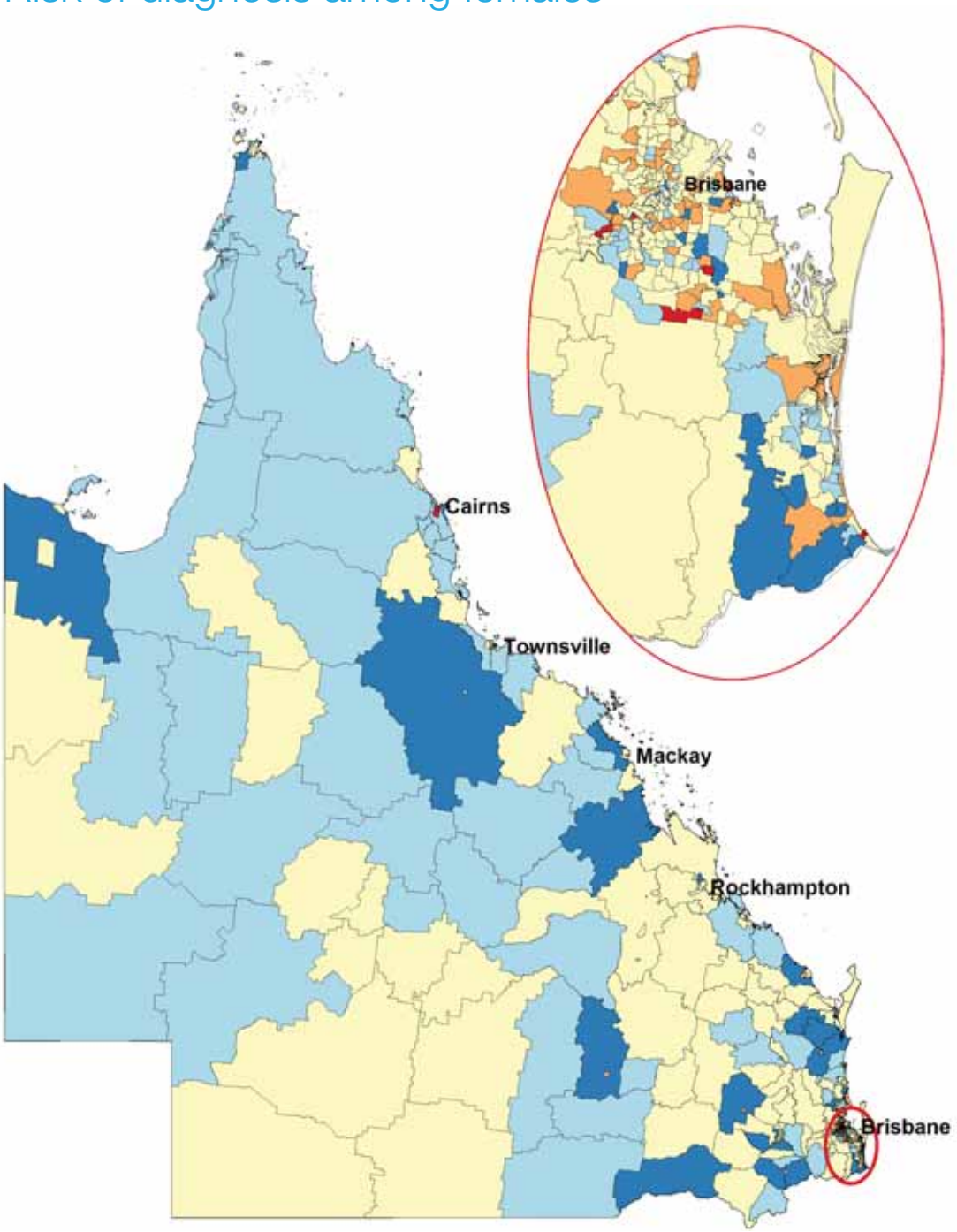
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

All invasive cancers

Risk of diagnosis among females

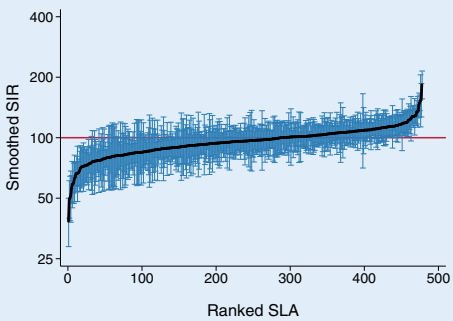


SIR

- Very high
- High
- Average
- Low
- Very low

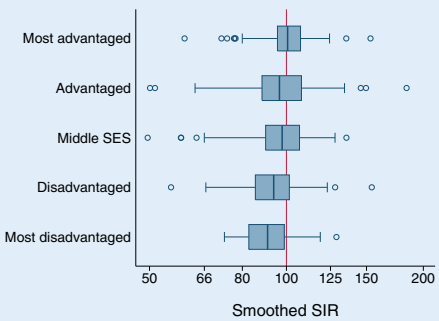
New cases/year	8,247
Rate/100,000	426.6
Smoothed SIR distribution	
Highest	183.8
75%	105.1
Median (50%)	96.3
25%	87.2
Lowest	38.4
Geographical variation	
Evidence level	
Strong	
(p-value 0.001)	

Level of Uncertainty

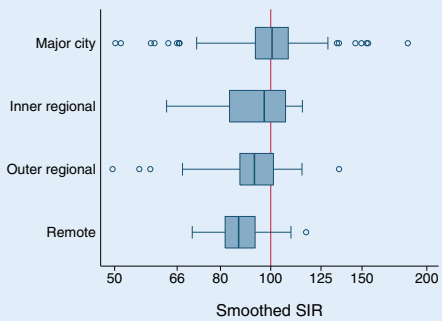


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



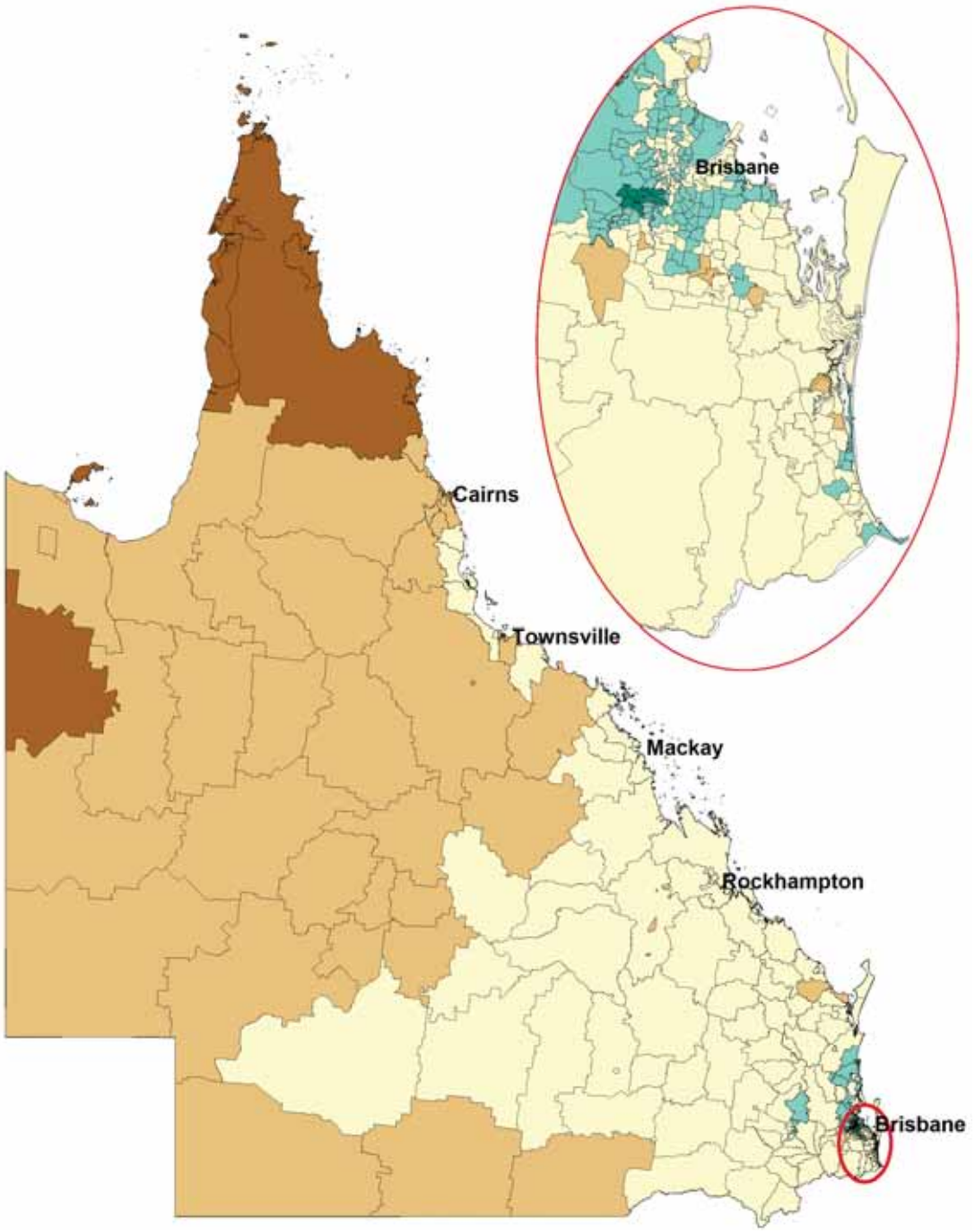
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

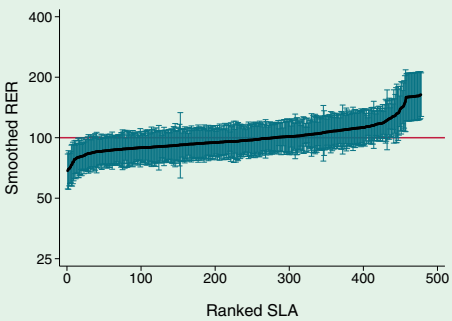
All invasive cancers

Risk of death within five years of diagnosis among females



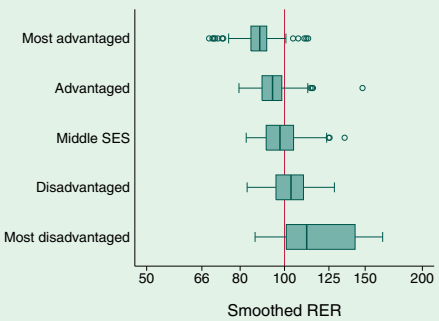
5-year mortality	31.1%
Smoothed RER distribution	
Highest	163.8
75%	107.8
Median (50%)	96.8
25%	90.1
Lowest	68.5
Geographical variation	
Evidence level:	**Strong** (p-value 0.001)

Level of Uncertainty

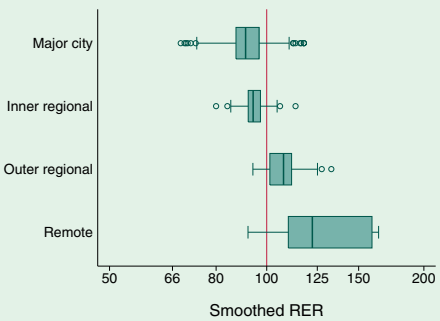


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



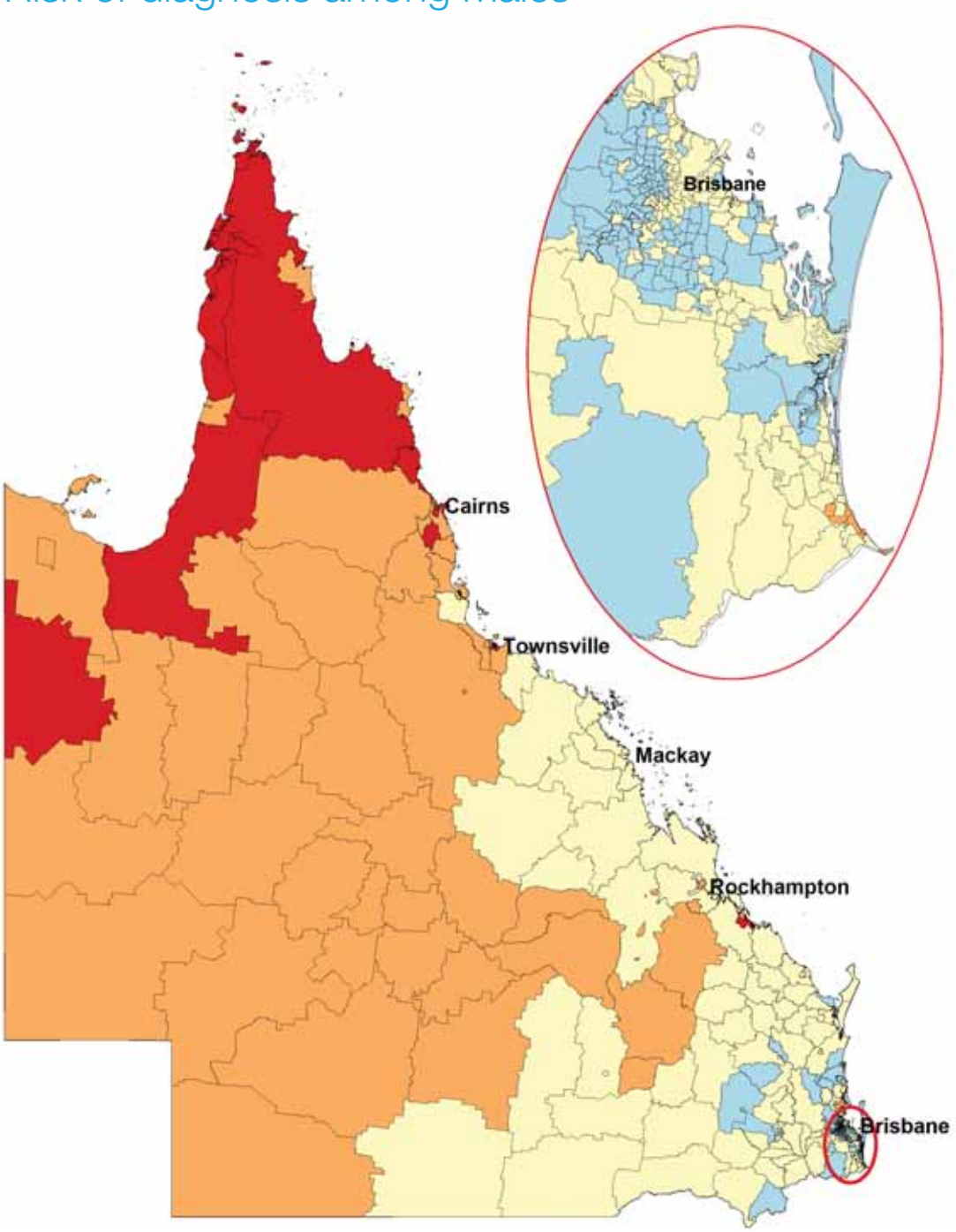
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Oesophageal cancer

Risk of diagnosis among males

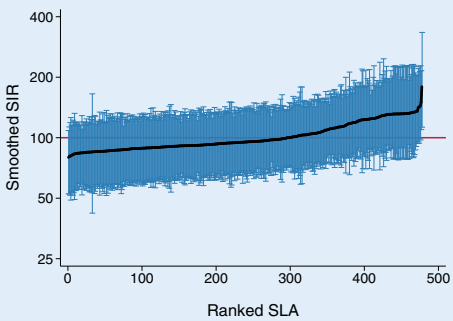


SIR

- Very high
- High
- Average
- Low
- Very low

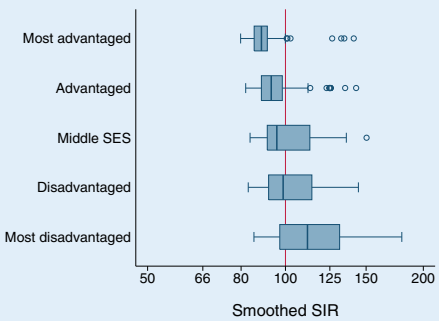
New cases/year	146
Rate/100,000	8.6
Smoothed SIR distribution	
Highest	179.5
75%	111.7
Median (50%)	95.2
25%	89.4
Lowest	79.8
Geographical variation	
Evidence level	
Strong	
(p-value 0.004)	

Level of Uncertainty

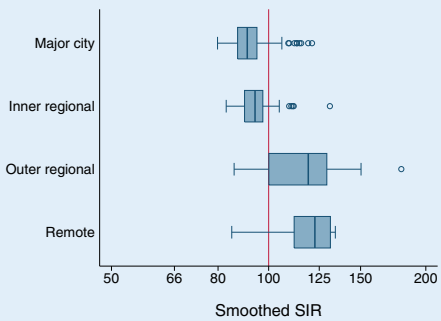


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



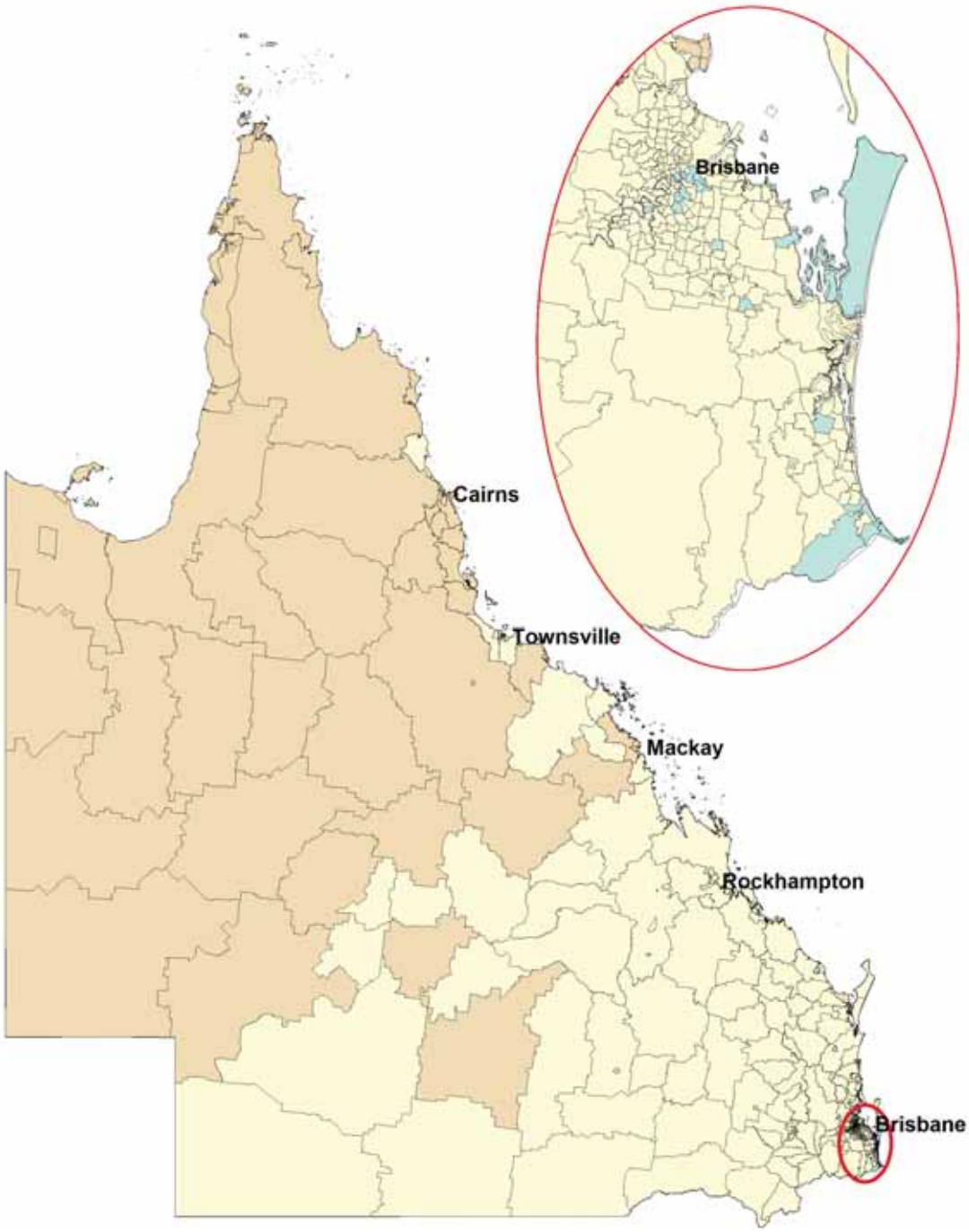
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

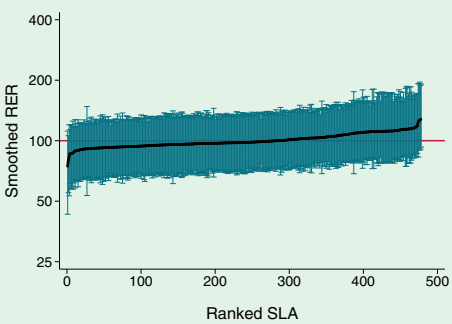
Oesophageal cancer

Risk of death within five years of diagnosis among males



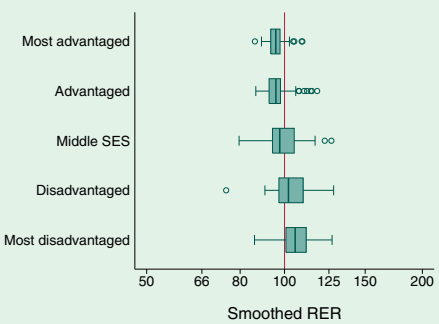
5-year mortality	81.7%
Smoothed RER distribution	
Highest	128.0
75%	105.1
Median (50%)	98.0
25%	94.9
Lowest	74.6
Geographical variation	
Evidence level:	**None**
(p-value 0.254)	

Level of Uncertainty

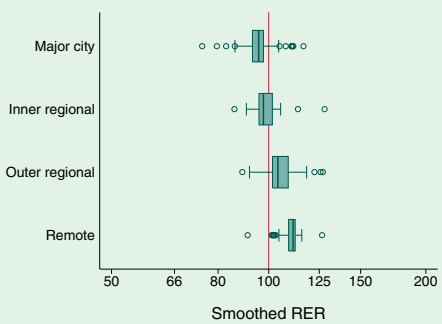


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



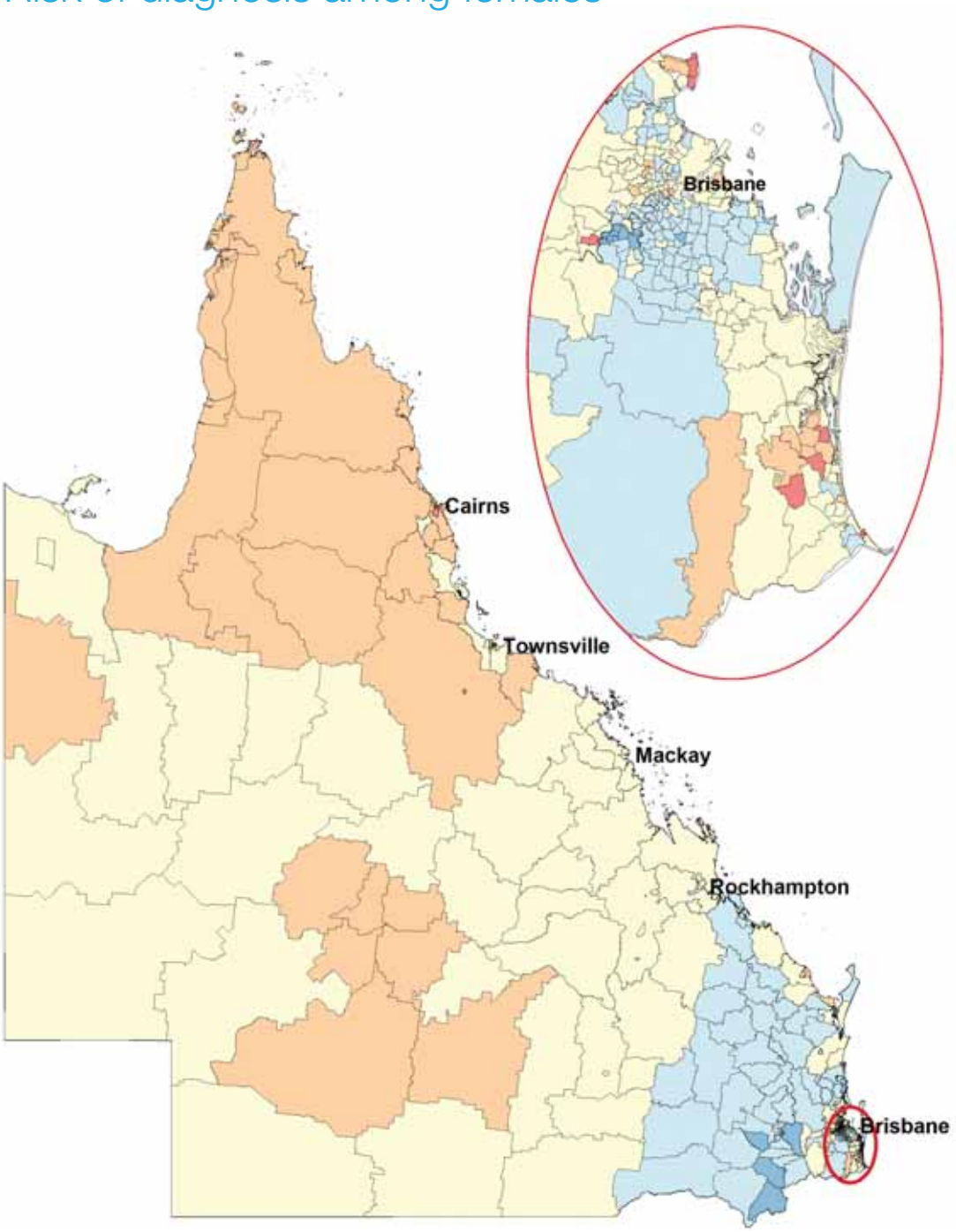
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Oesophageal cancer

Risk of diagnosis among females

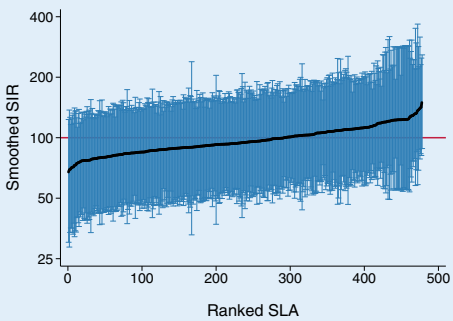


SIR

- Very high
- High
- Average
- Low
- Very low

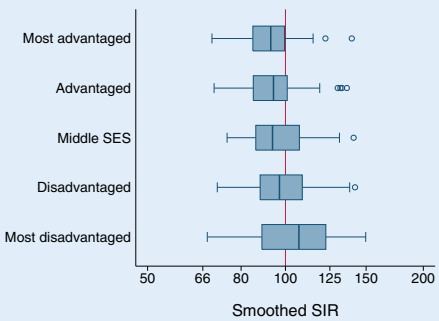
New cases/year	64
Rate/100,000	3.2
Smoothed SIR distribution	
Highest	149.7
75%	107.8
Median (50%)	94.8
25%	86.8
Lowest	67.5
Geographical variation	
Evidence level	
None	
(p-value 0.439)	

Level of Uncertainty

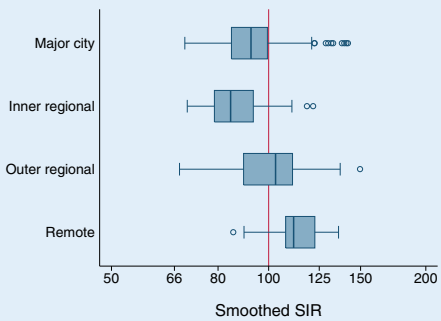


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Oesophageal cancer

Risk of death within five years of diagnosis among females

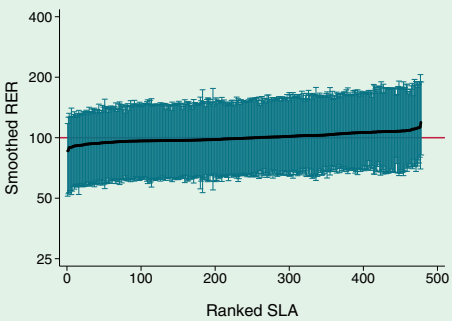
5-year mortality	79.9%
Smoothed RER distribution	
Highest	119.3
75%	103.8
Median (50%)	99.4
25%	96.5
Lowest	85.9
Geographical variation	

Evidence level:

None

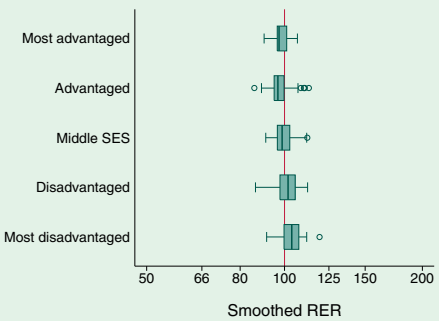
(p-value 0.953)

Level of Uncertainty

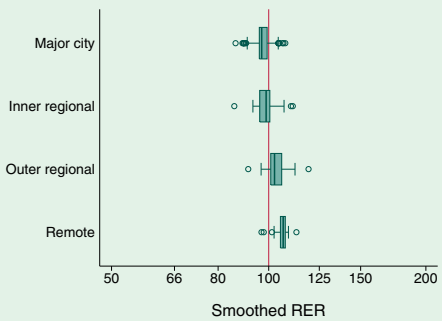


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Stomach cancer

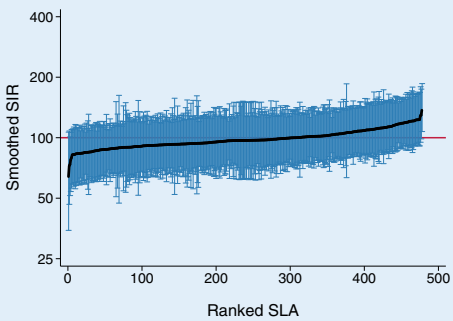
Risk of diagnosis among males

SIR

- Very high
- High
- Average
- Low
- Very low

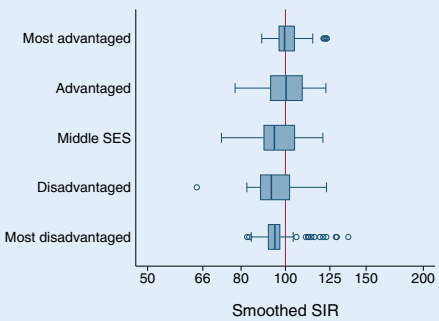
New cases/year	219
Rate/100,000	13.2
Smoothed SIR distribution	
Highest	137.1
75%	103.5
Median (50%)	97.0
25%	91.8
Lowest	64.0
Geographical variation	
Evidence level	
Weak	
(p-value 0.083)	

Level of Uncertainty

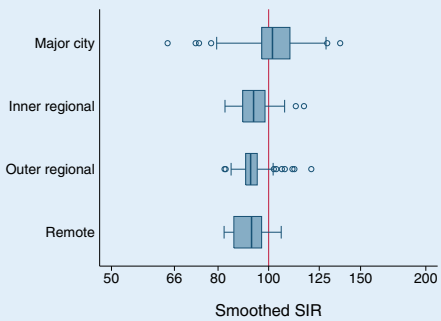


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



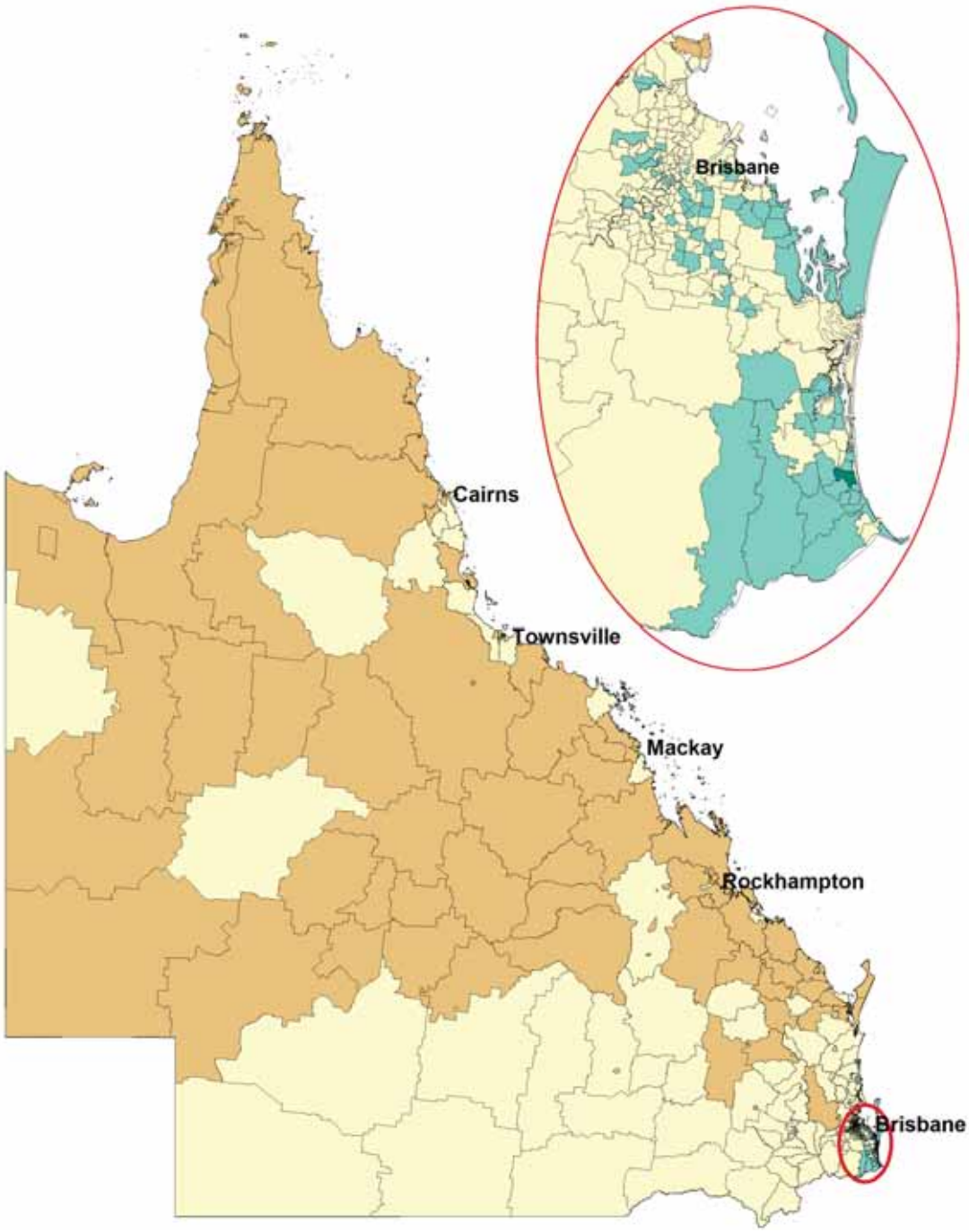
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Stomach cancer

Risk of death within five years of diagnosis among males



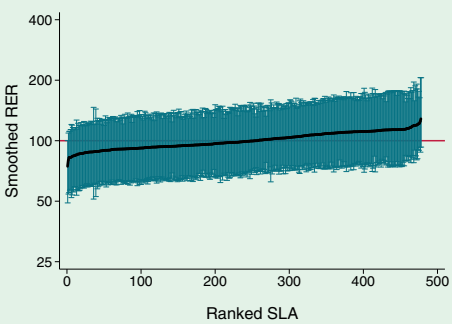
5-year mortality	74.1%
Smoothed RER distribution	
Highest	128.6
75%	109.0
Median (50%)	99.1
25%	93.0
Lowest	74.5
Geographical variation	

Evidence level:

Moderate

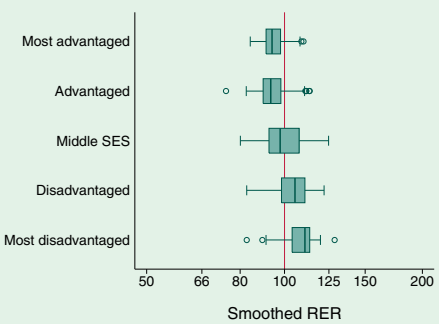
(p-value 0.025)

Level of Uncertainty

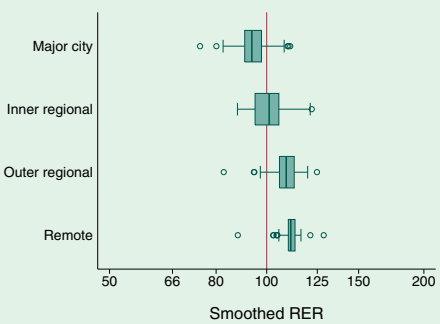


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



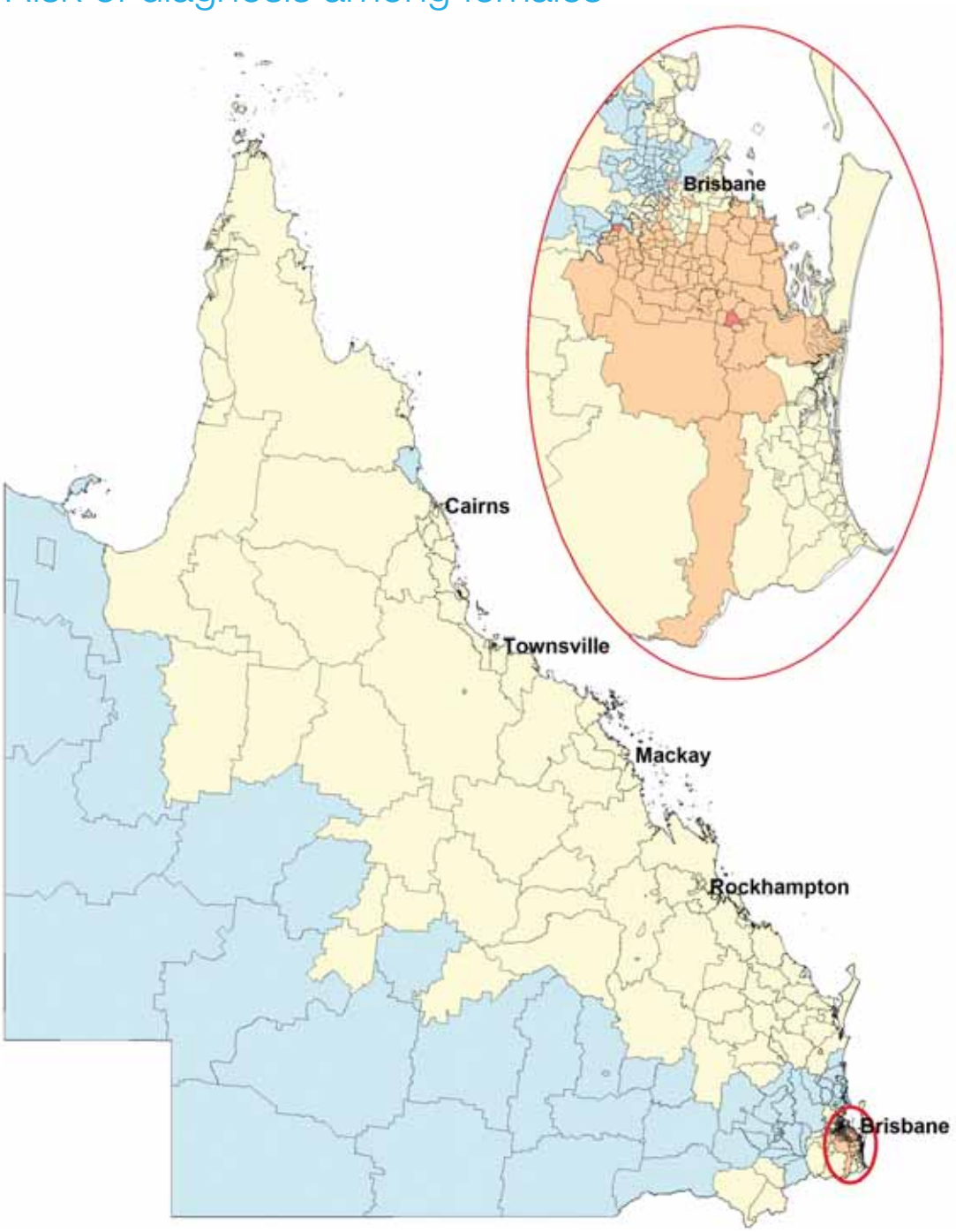
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Stomach cancer

Risk of diagnosis among females

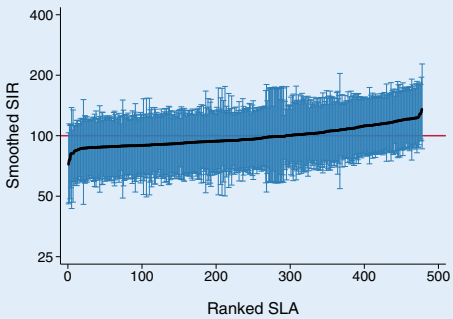


SIR

- Very high
- High
- Average
- Low
- Very low

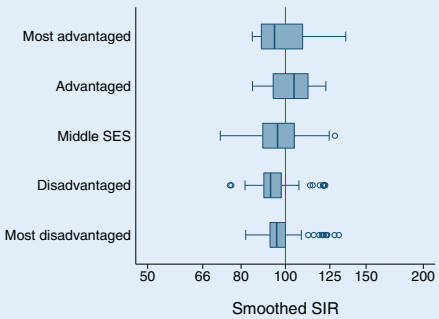
New cases/year	107
Rate/100,000	5.4
Smoothed SIR distribution	
Highest	135.4
75%	105.8
Median (50%)	95.7
25%	90.4
Lowest	72.1
Geographical variation	
Evidence level	
None	
(p-value 0.674)	

Level of Uncertainty

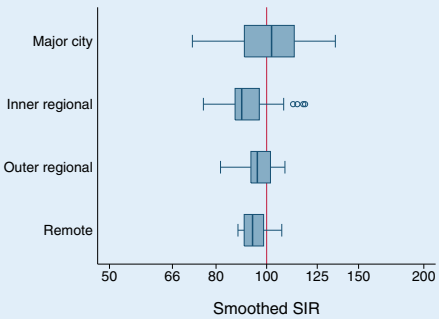


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Stomach cancer

Risk of death within five years of diagnosis among females

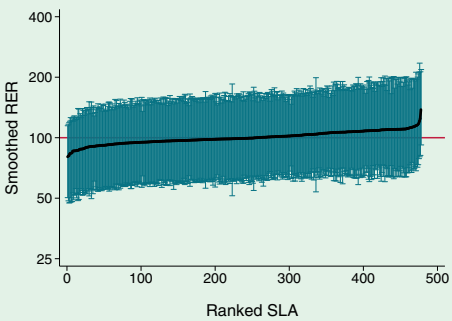
5-year mortality	71.6%
Smoothed RER distribution	
Highest	138.1
75%	106.1
Median (50%)	99.3
25%	95.7
Lowest	80.4
Geographical variation	

Evidence level:

None

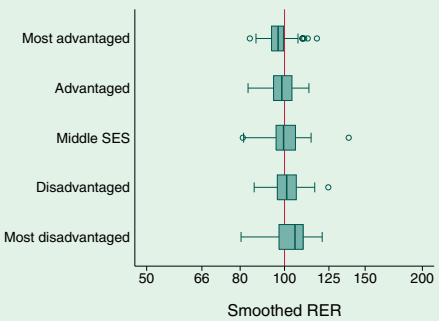
(p-value 0.743)

Level of Uncertainty

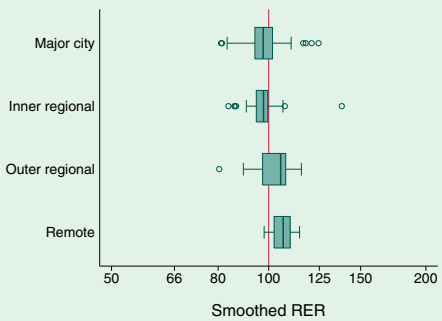


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



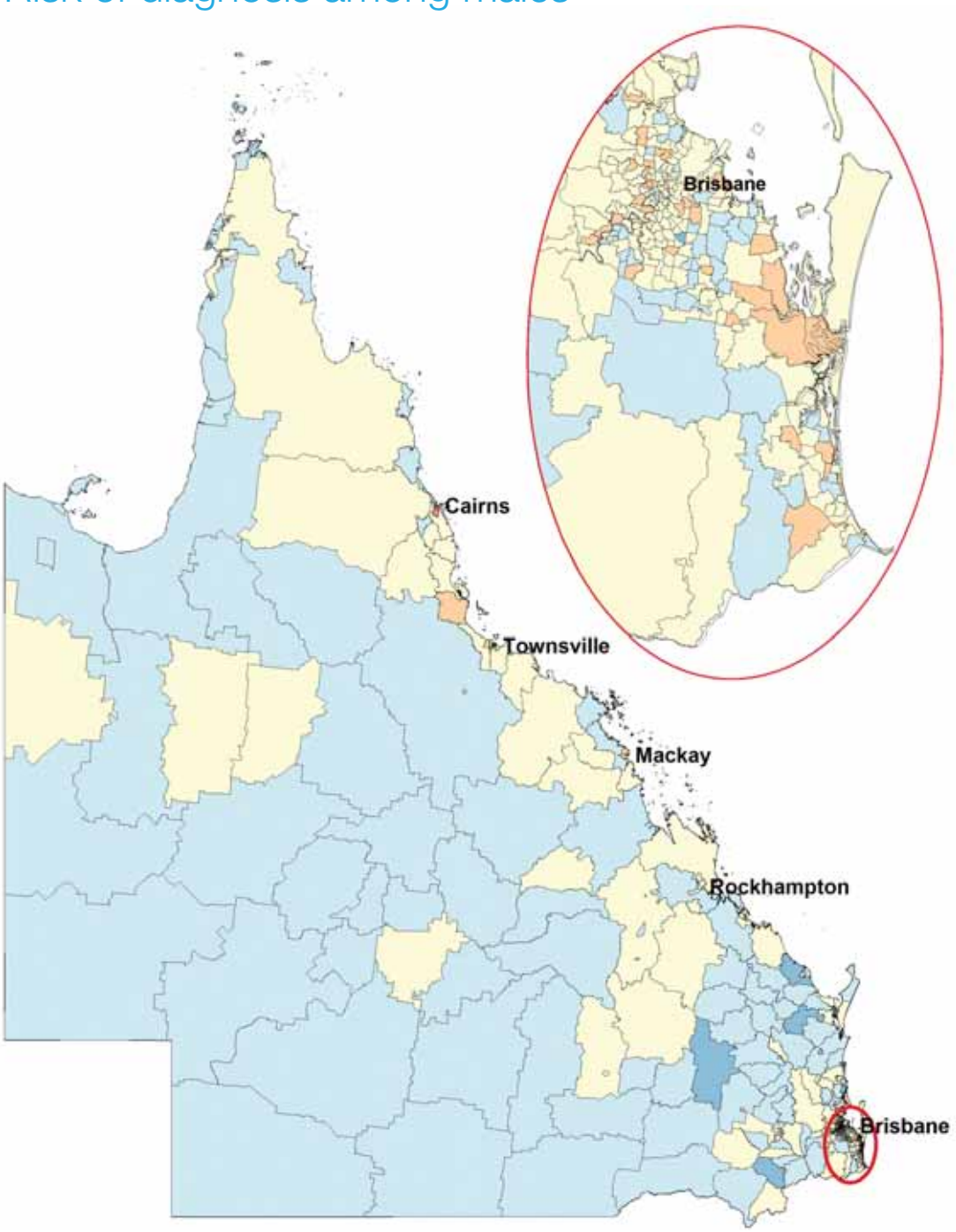
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Colorectal cancer

Risk of diagnosis among males

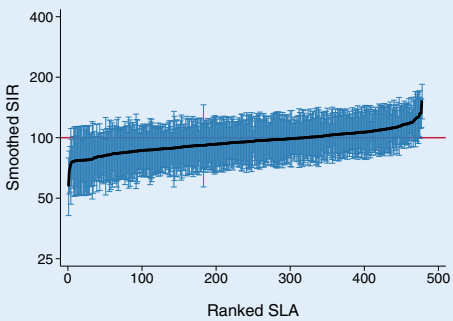


SIR

- Very high
- High
- Average
- Low
- Very low

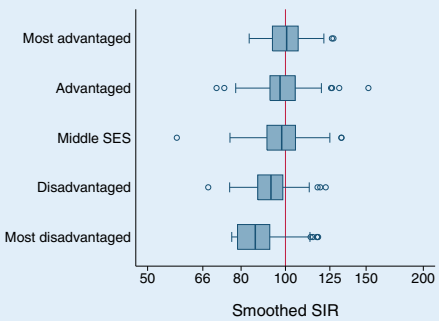
New cases/year	1,341
Rate/100,000	78.1
Smoothed SIR distribution	
Highest	151.7
75%	103.5
Median (50%)	95.3
25%	87.5
Lowest	57.9
Geographical variation	
Evidence level	
None	
(p-value 0.693)	

Level of Uncertainty

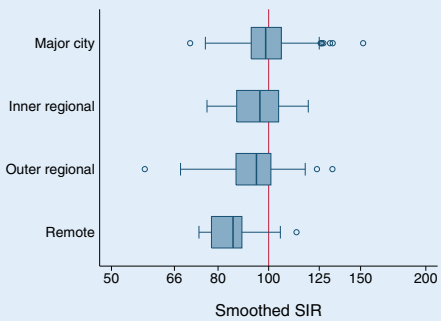


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



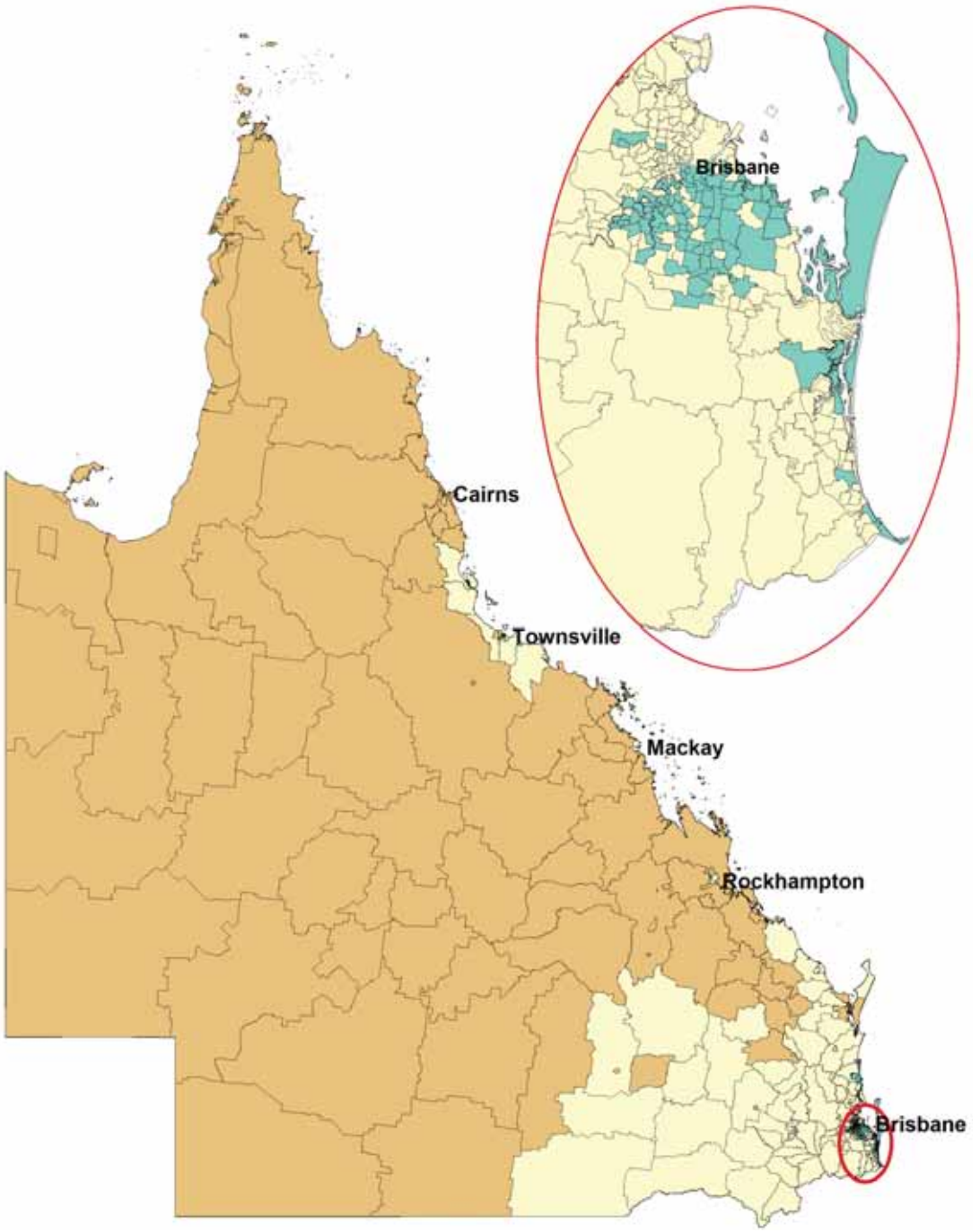
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

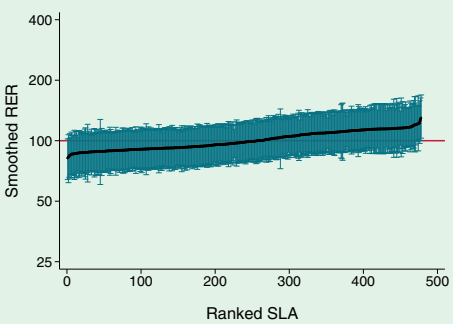
Colorectal cancer

Risk of death within five years of diagnosis among males



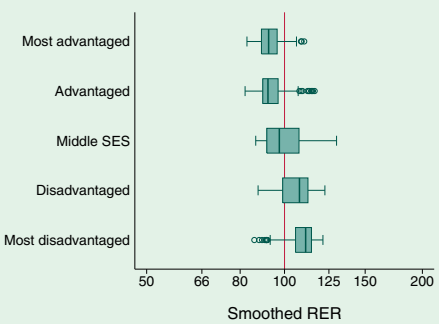
5-year mortality	36.2%
Smoothed RER distribution	
Highest	129.9
75%	110.0
Median (50%)	98.3
25%	91.5
Lowest	82.0
Geographical variation	
Evidence level:	**Strong** (p-value 0.001)

Level of Uncertainty

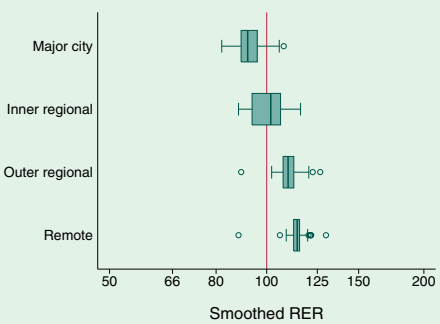


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



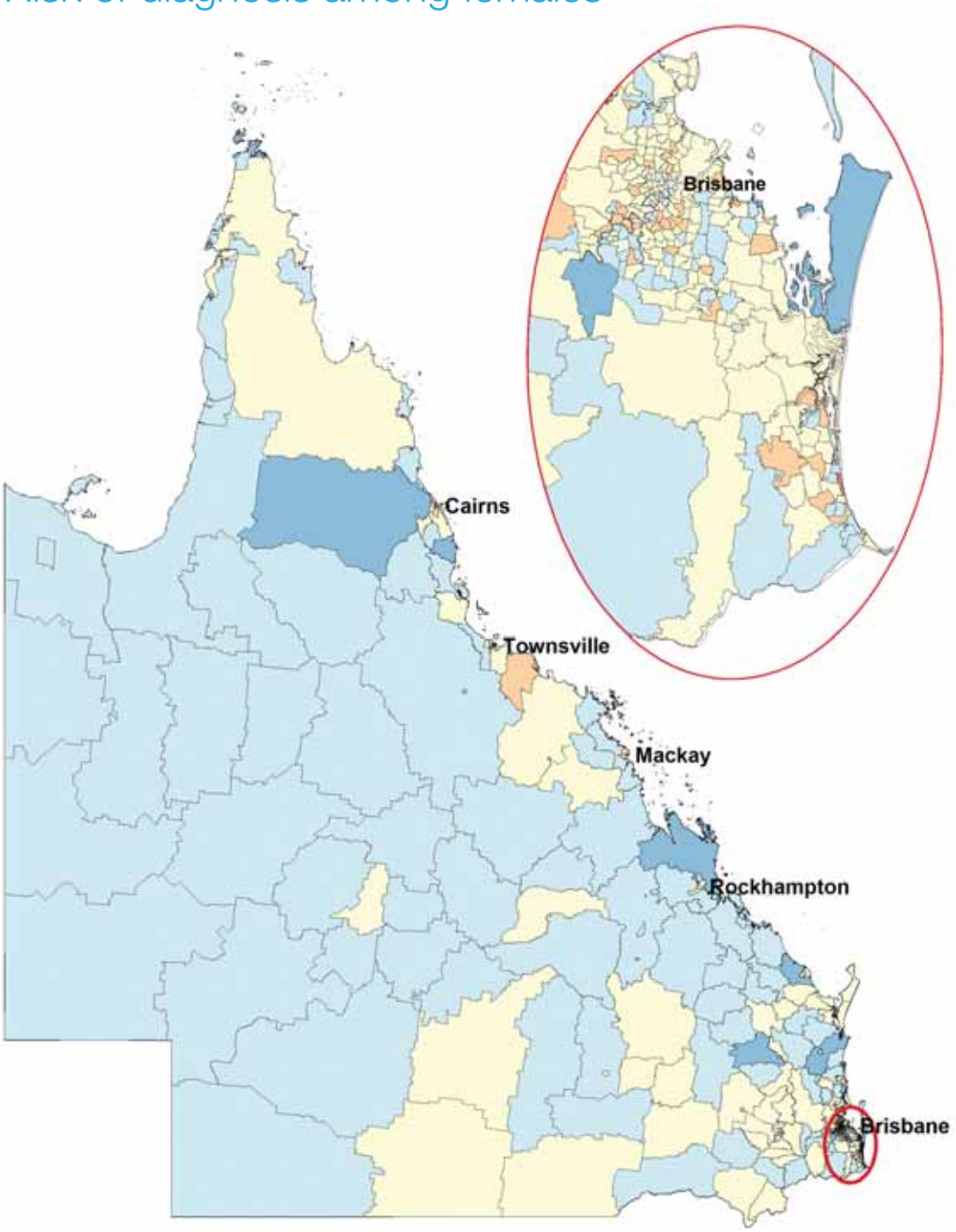
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Colorectal cancer

Risk of diagnosis among females

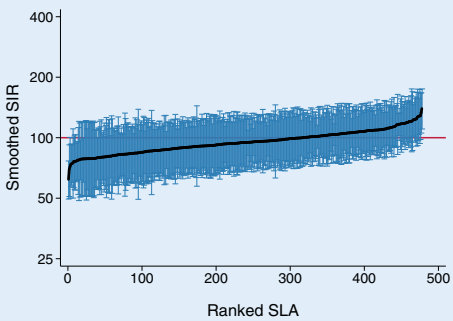


SIR

- Very high
- High
- Average
- Low
- Very low

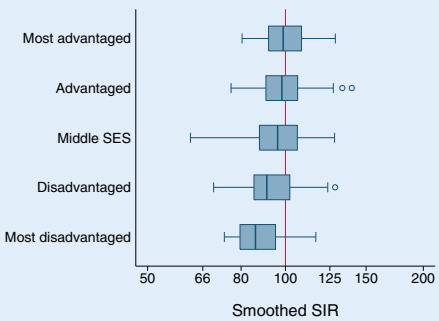
New cases/year	1,087
Rate/100,000	55.8
Smoothed SIR distribution	
Highest	139.6
75%	103.8
Median (50%)	94.7
25%	86.4
Lowest	62.0
Geographical variation	
Evidence level	
None	
(p-value 0.216)	

Level of Uncertainty

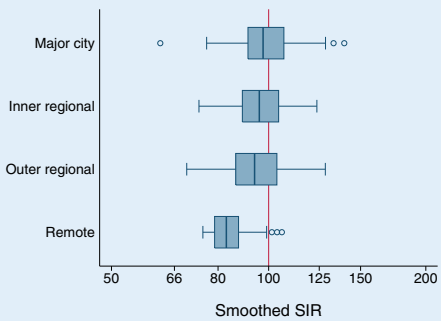


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



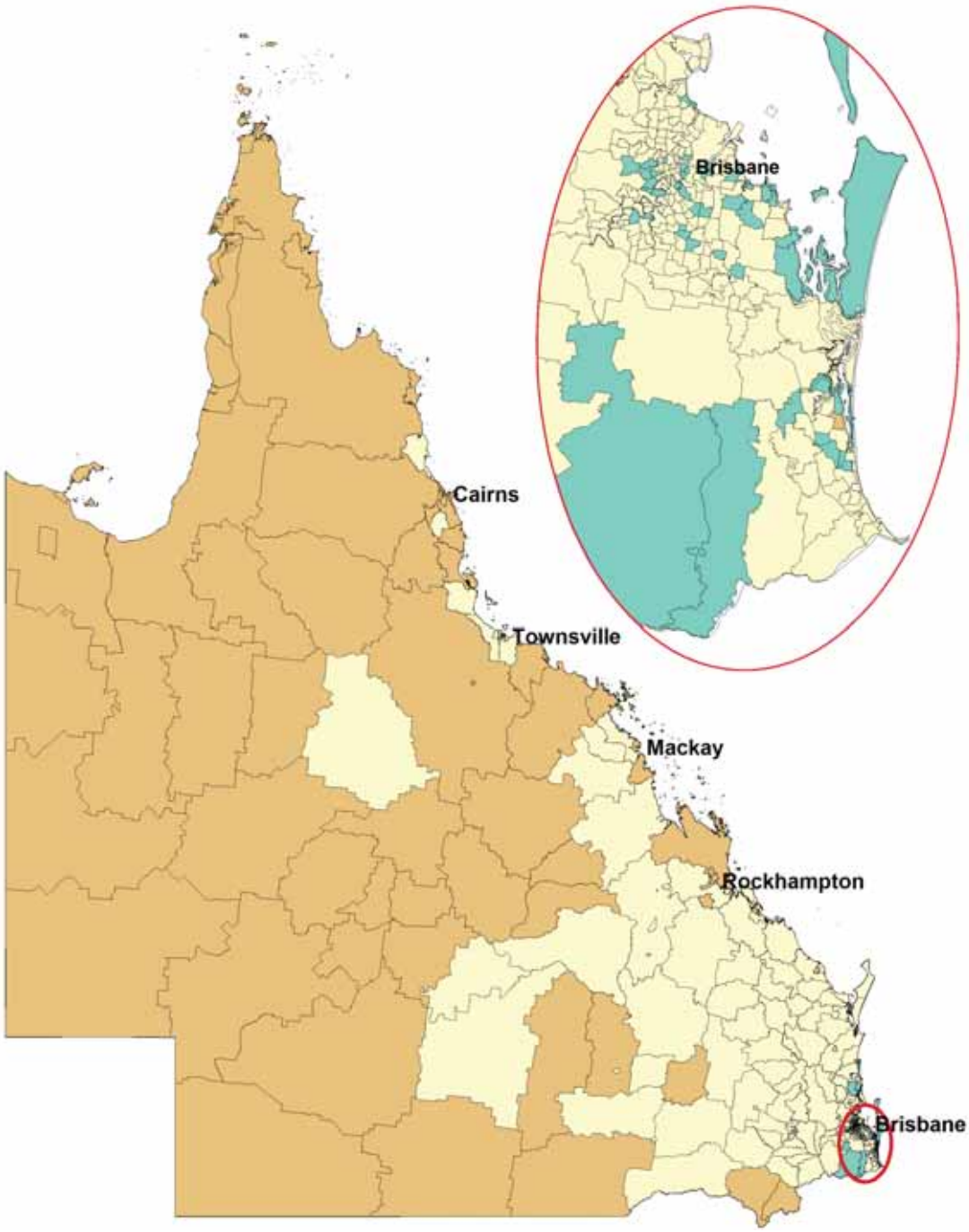
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Colorectal cancer

Risk of death within five years of diagnosis among females



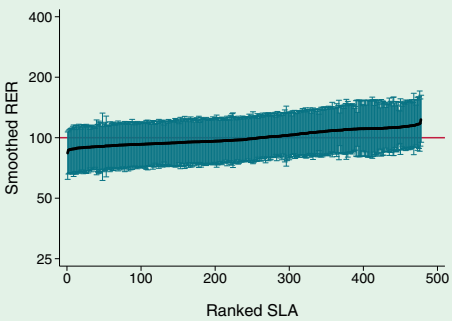
5-year mortality	34.5%
Smoothed RER distribution	
Highest	123.1
75%	108.5
Median (50%)	97.8
25%	93.5
Lowest	83.8
Geographical variation	

Evidence level:

Strong

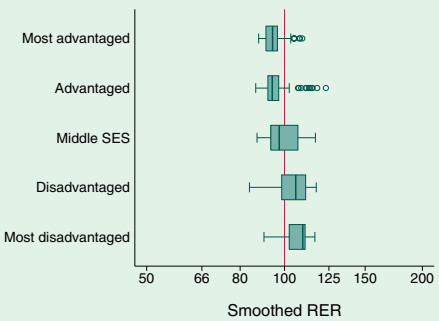
(p-value 0.001)

Level of Uncertainty

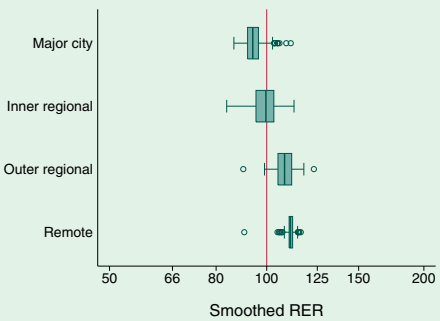


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Pancreatic cancer

Risk of diagnosis among males

SIR

- Very high
- High
- Average
- Low
- Very low

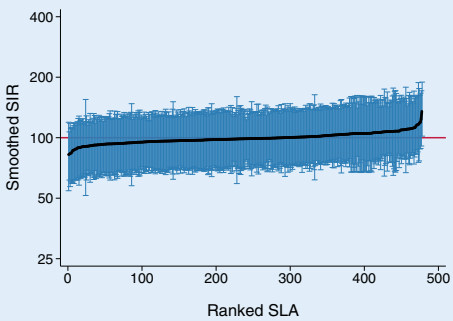
New cases/year	194
Rate/100,000	11.5
Smoothed SIR distribution	
Highest	135.3
75%	103.1
Median (50%)	98.8
25%	95.9
Lowest	82.4
Geographical variation	

Evidence level

None

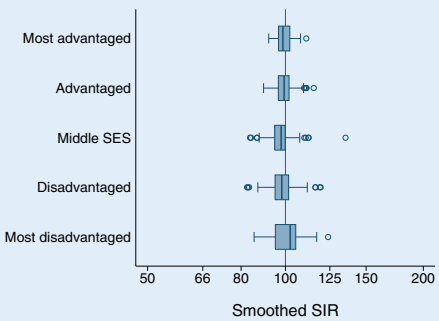
(p-value 0.773)

Level of Uncertainty

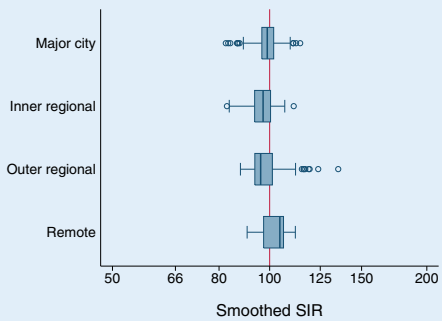


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Pancreatic cancer

Risk of death within five years of diagnosis among males

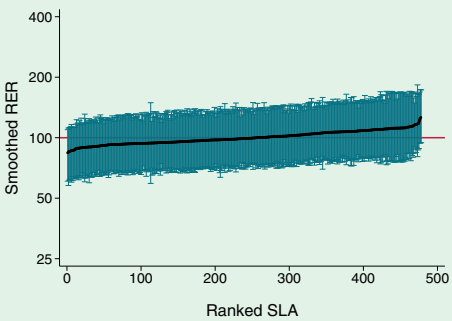
5-year mortality	94.7%
Smoothed RER distribution	
Highest	126.4
75%	106.6
Median (50%)	99.2
25%	94.3
Lowest	84.1
Geographical variation	

Evidence level:

None

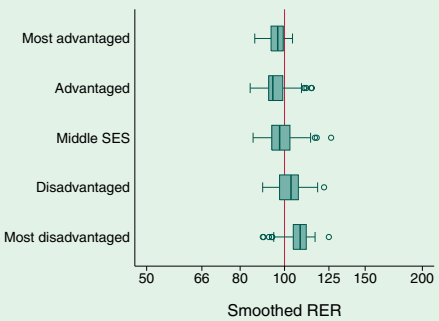
(p-value 0.108)

Level of Uncertainty



Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



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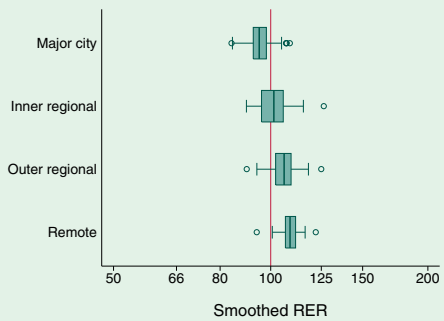


Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Pancreatic cancer

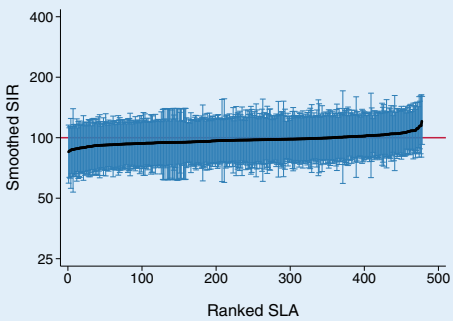
Risk of diagnosis among females

SIR

- Very high
- High
- Average
- Low
- Very low

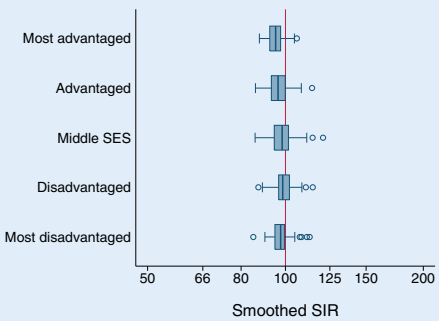
New cases/year	171
Rate/100,000	8.6
Smoothed SIR distribution	
Highest	120.8
75%	100.1
Median (50%)	97.4
25%	94.4
Lowest	85.0
Geographical variation	
Evidence level	
None	
(p-value 1.000)	

Level of Uncertainty

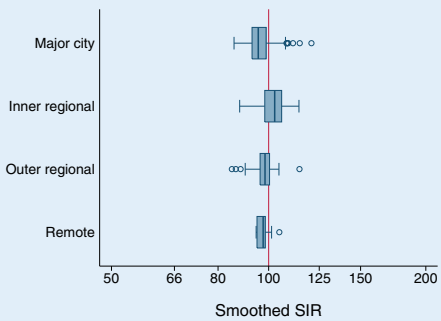


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Pancreatic cancer

Risk of death within five years of diagnosis among females

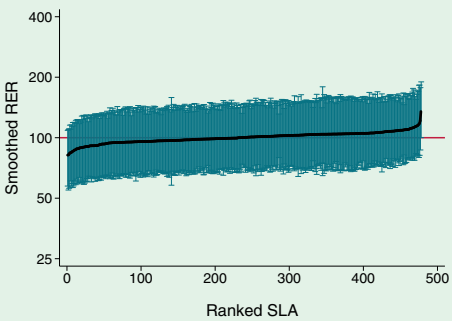
5-year mortality	93.7%
Smoothed RER distribution	
Highest	135.1
75%	104.3
Median (50%)	100.4
25%	96.3
Lowest	81.9
Geographical variation	

Evidence level:

None

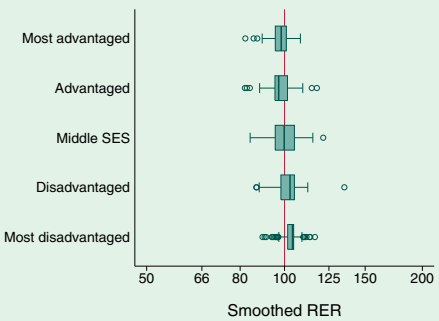
(p-value 0.502)

Level of Uncertainty

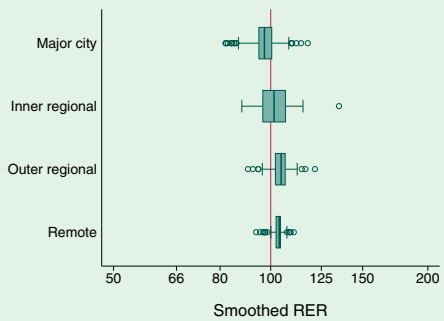


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



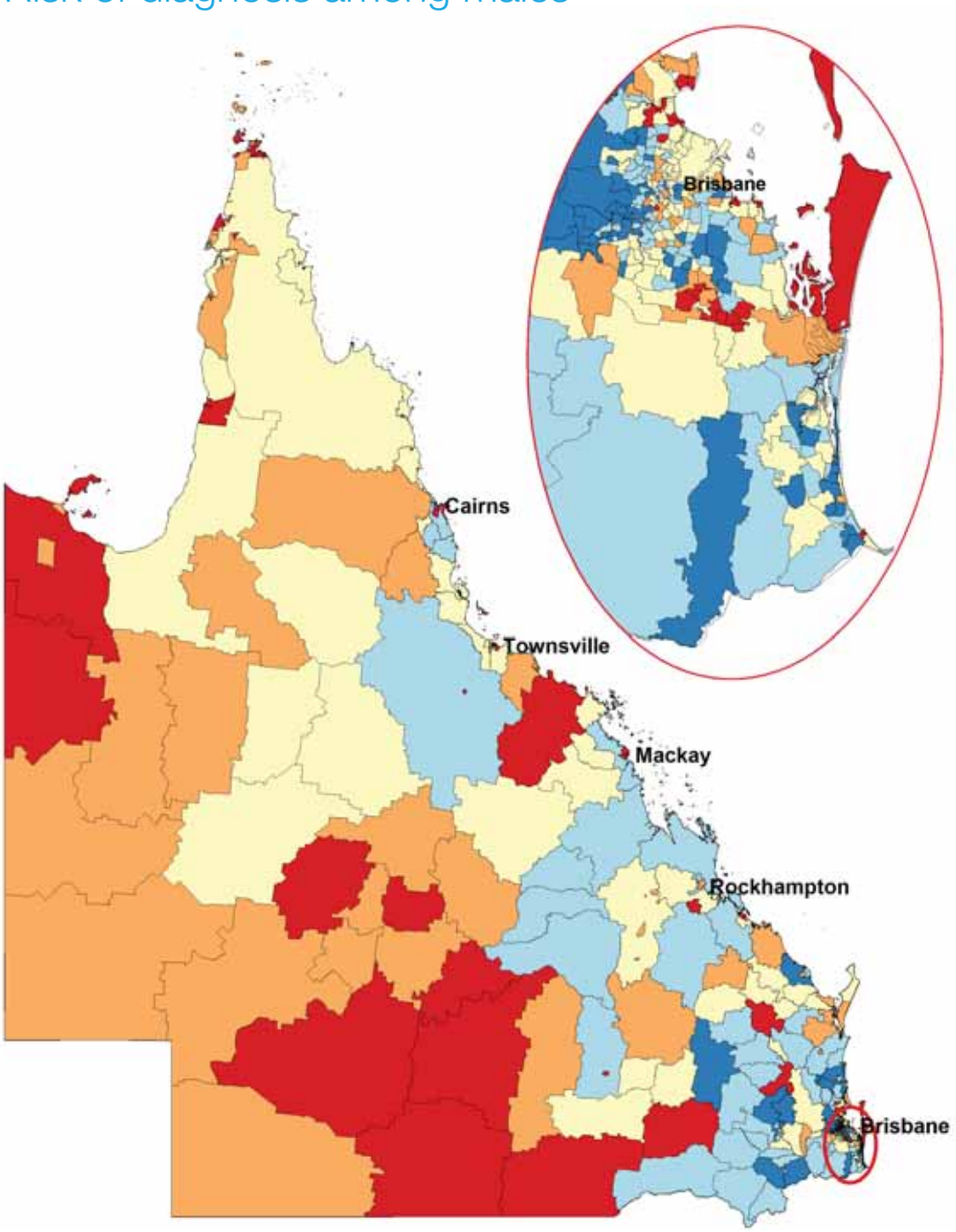
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Lung cancer

Risk of diagnosis among males

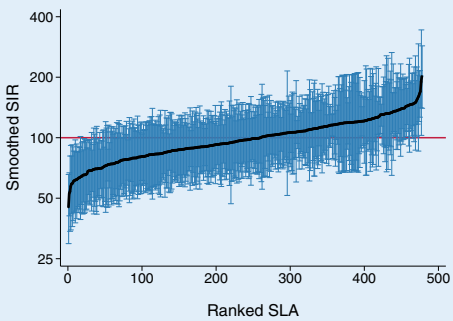


SIR

- Very high
- High
- Average
- Low
- Very low

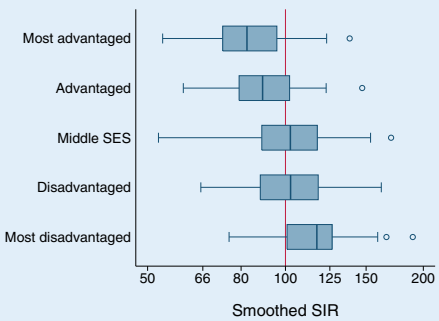
New cases/year	1,115
Rate/100,000	65.7
Smoothed SIR distribution	
Highest	201.8
75%	116.0
Median (50%)	97.5
25%	83.0
Lowest	45.2
Geographical variation	
Evidence level	**Strong** (p-value 0.001)

Level of Uncertainty

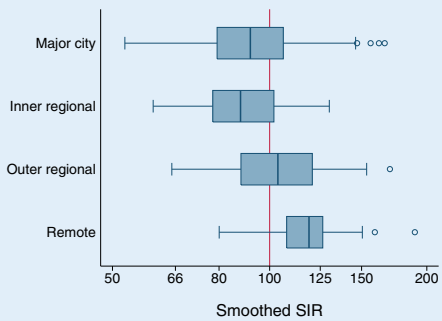


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



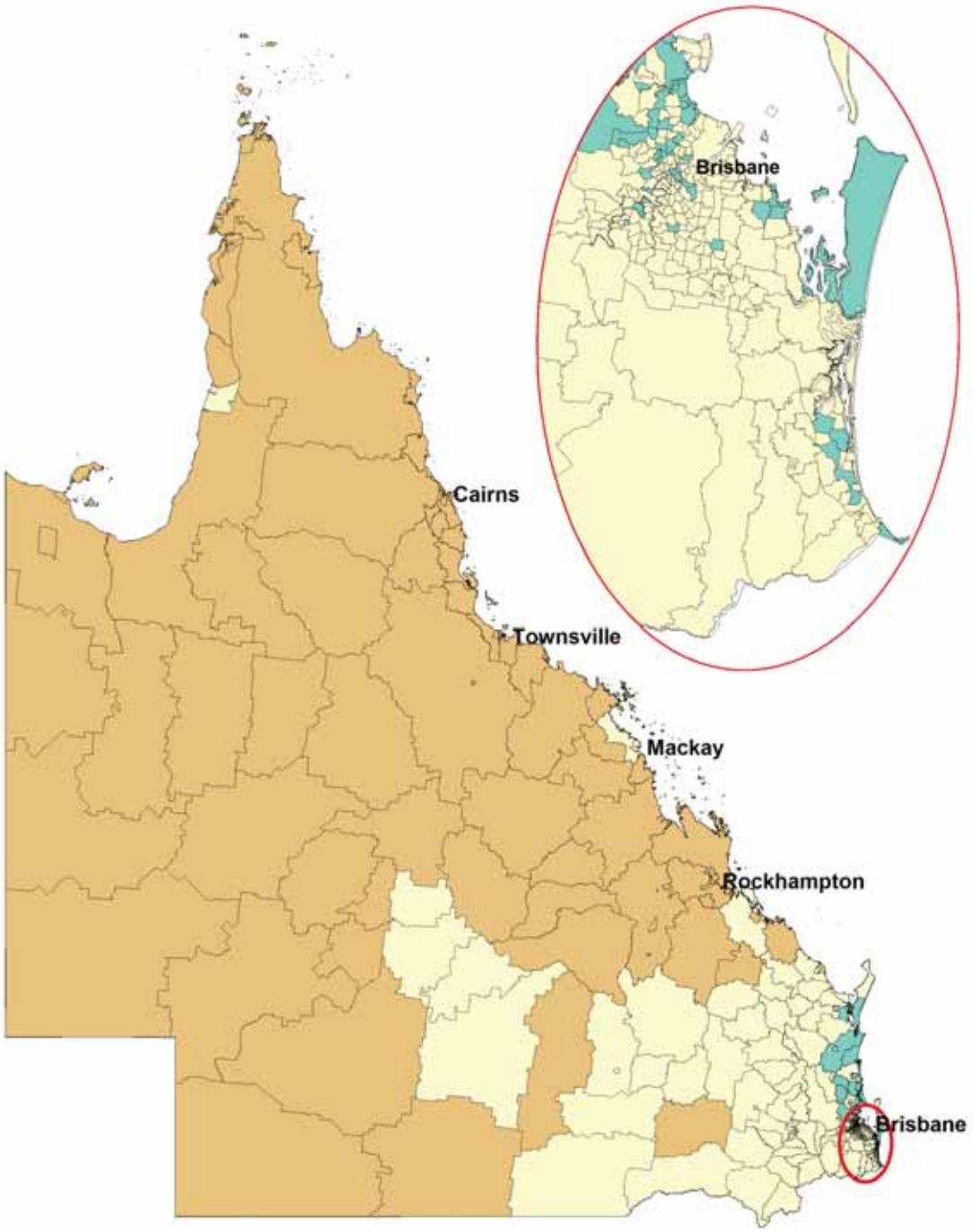
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

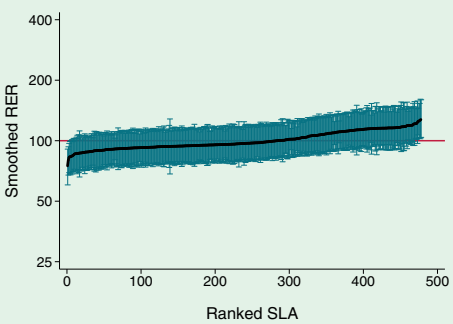
Lung cancer

Risk of death within five years of diagnosis among males



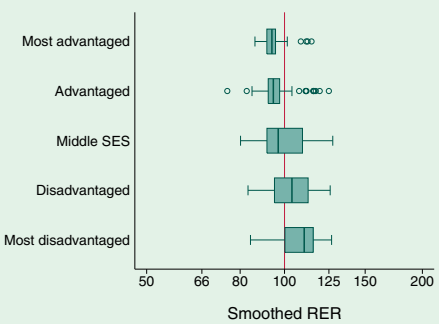
5-year mortality	88.5%
Smoothed RER distribution	
Highest	127.5
75%	109.4
Median (50%)	96.9
25%	93.0
Lowest	75.0
Geographical variation	
Evidence level:	**Strong**
(p-value 0.001)	

Level of Uncertainty

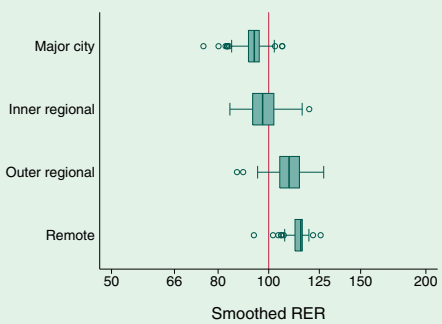


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



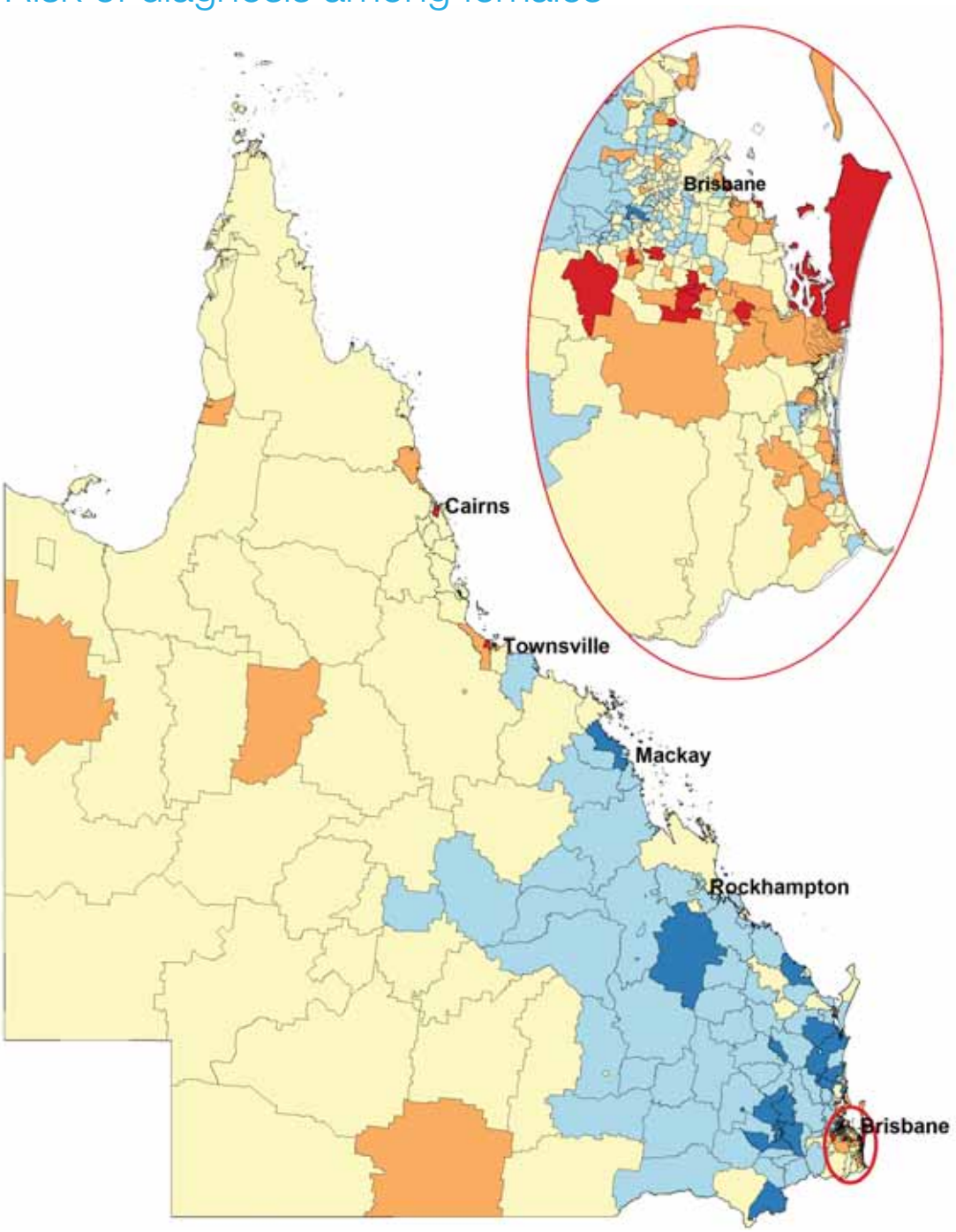
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Lung cancer

Risk of diagnosis among females

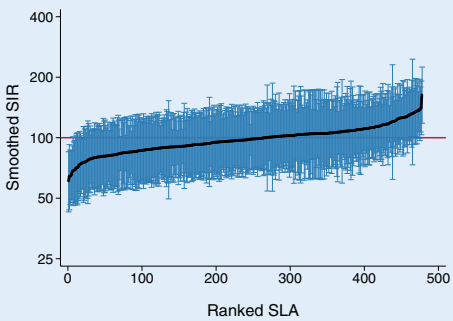


SIR

- Very high
- High
- Average
- Low
- Very low

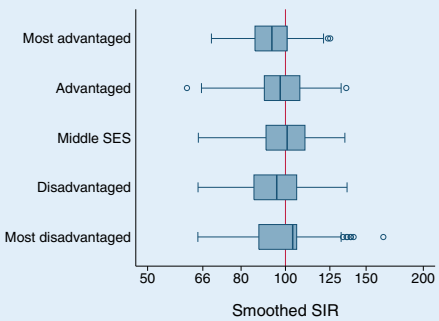
New cases/year	568
Rate/100,000	29.5
Smoothed SIR distribution	
Highest	163.6
75%	105.8
Median (50%)	97.4
25%	88.5
Lowest	60.9
Geographical variation	
Evidence level	
Strong	
(p-value 0.001)	

Level of Uncertainty

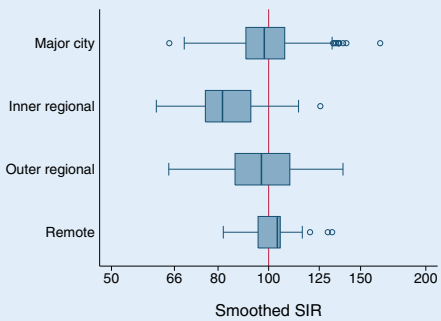


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



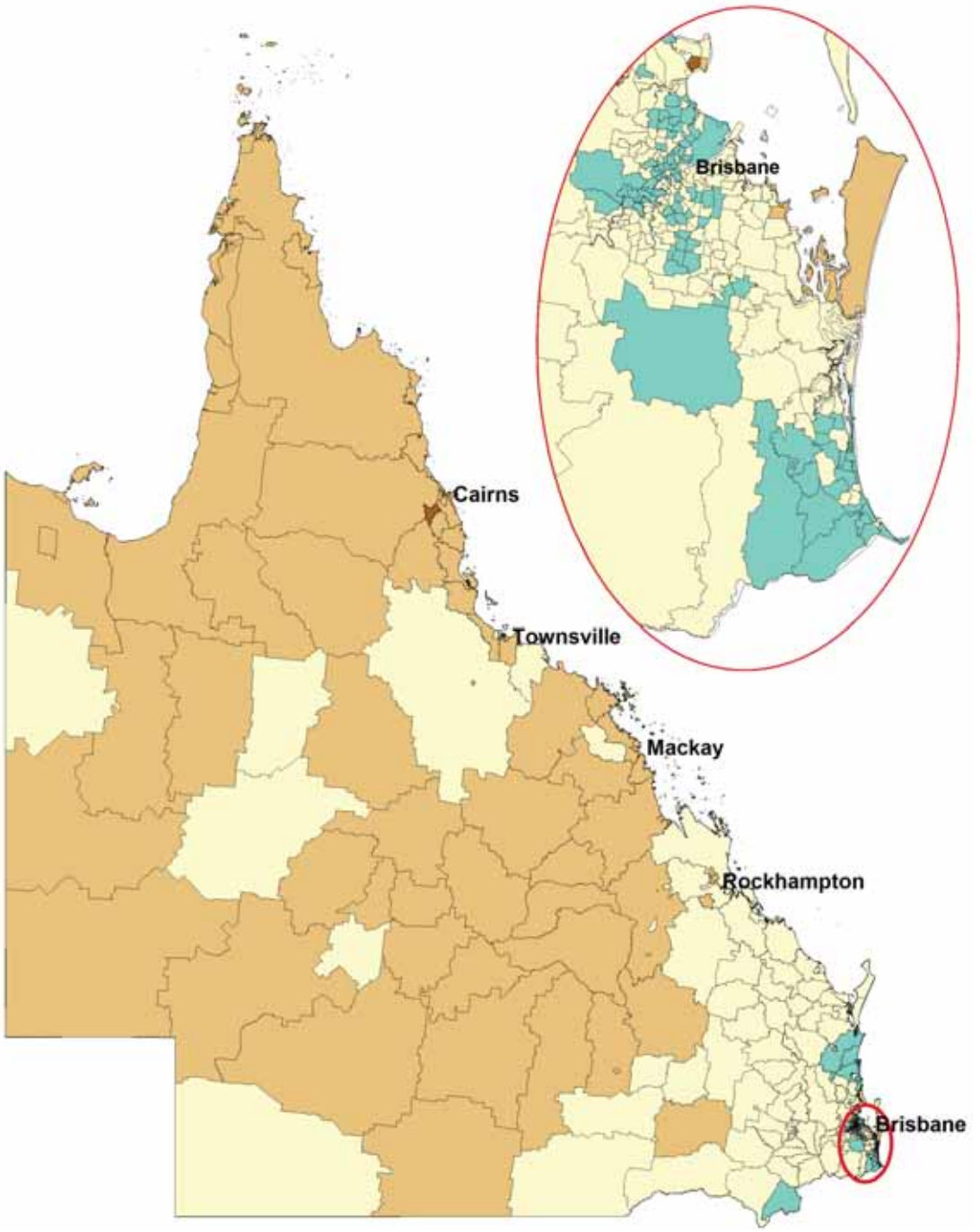
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Lung cancer

Risk of death within five years of diagnosis among females



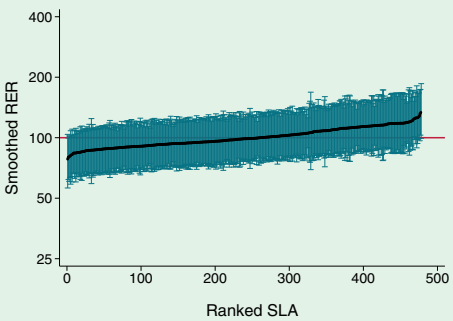
5-year mortality	84.9%
Smoothed RER distribution	
Highest	133.8
75%	109.5
Median (50%)	98.8
25%	92.0
Lowest	78.2
Geographical variation	

Evidence level:

Strong

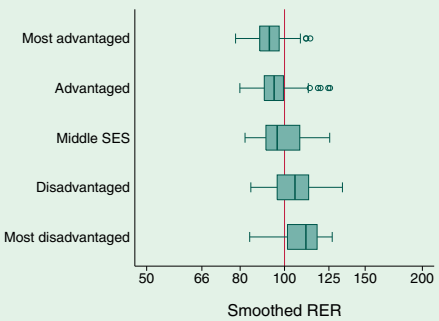
(p-value 0.001)

Level of Uncertainty

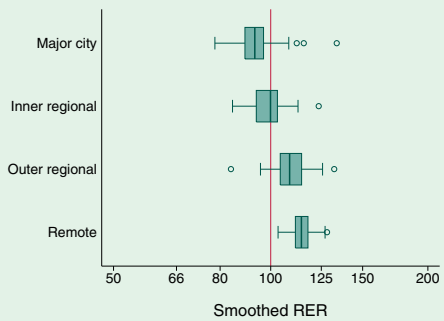


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



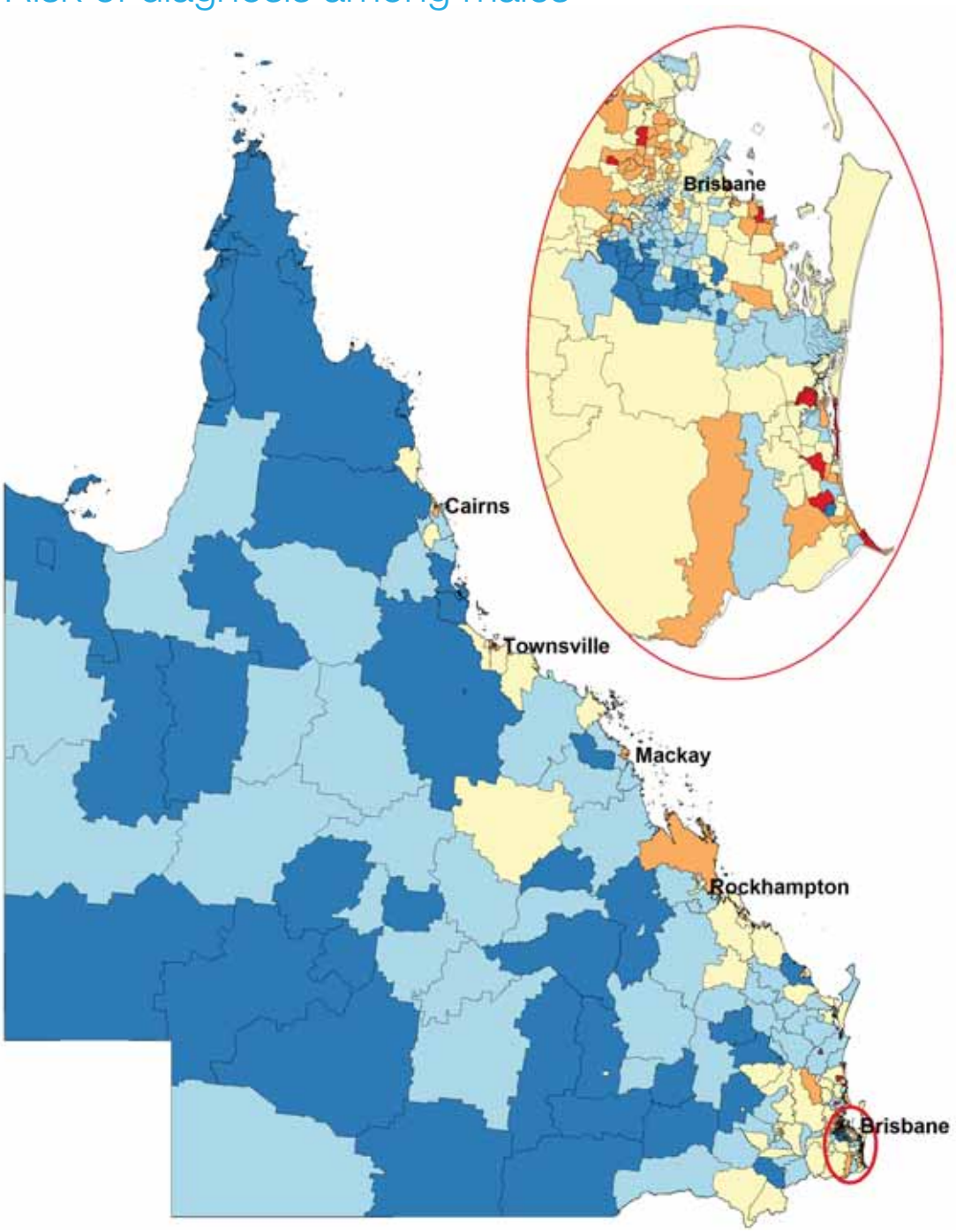
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Melanoma

Risk of diagnosis among males



SIR

- Very high
- High
- Average
- Low
- Very low

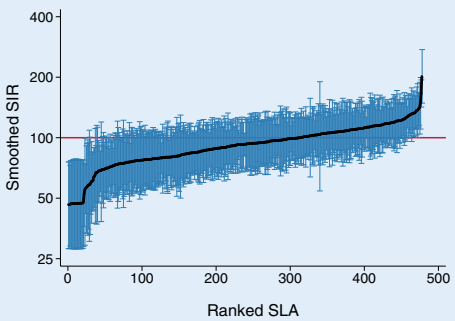
New cases/year	1,379
Rate/100,000	77.8
Smoothed SIR distribution	
Highest	201.7
75%	106.3
Median (50%)	92.8
25%	79.0
Lowest	46.4
Geographical variation	

Evidence level

Strong

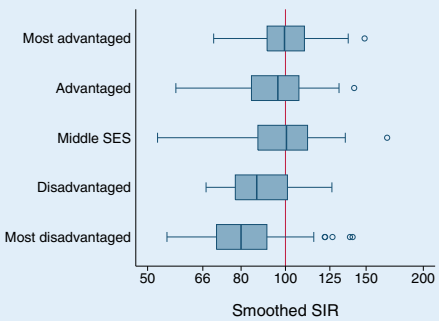
(p-value 0.001)

Level of Uncertainty

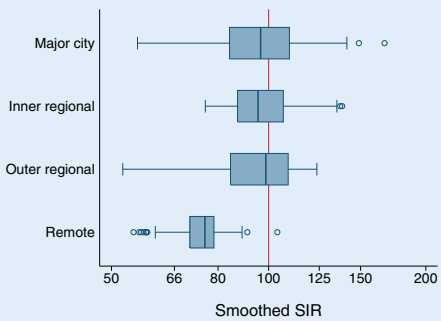


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Melanoma

Risk of death within five years of diagnosis among males

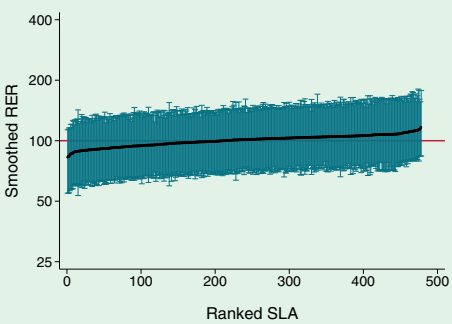
5-year mortality	7.4%
Smoothed RER distribution	
Highest	116.8
75%	104.8
Median (50%)	101.2
25%	95.4
Lowest	82.8
Geographical variation	

Evidence level:

None

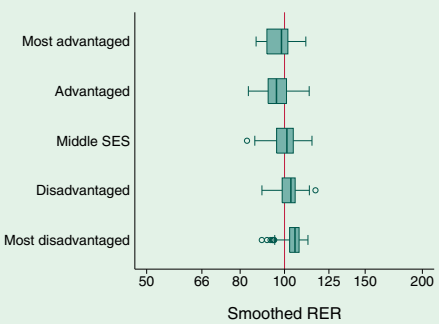
(p-value 0.448)

Level of Uncertainty

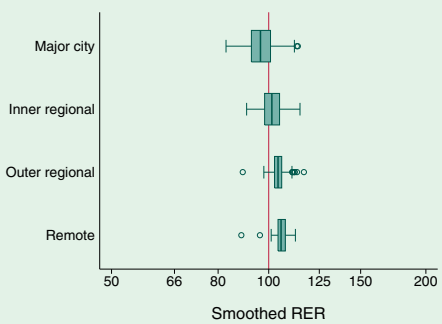


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



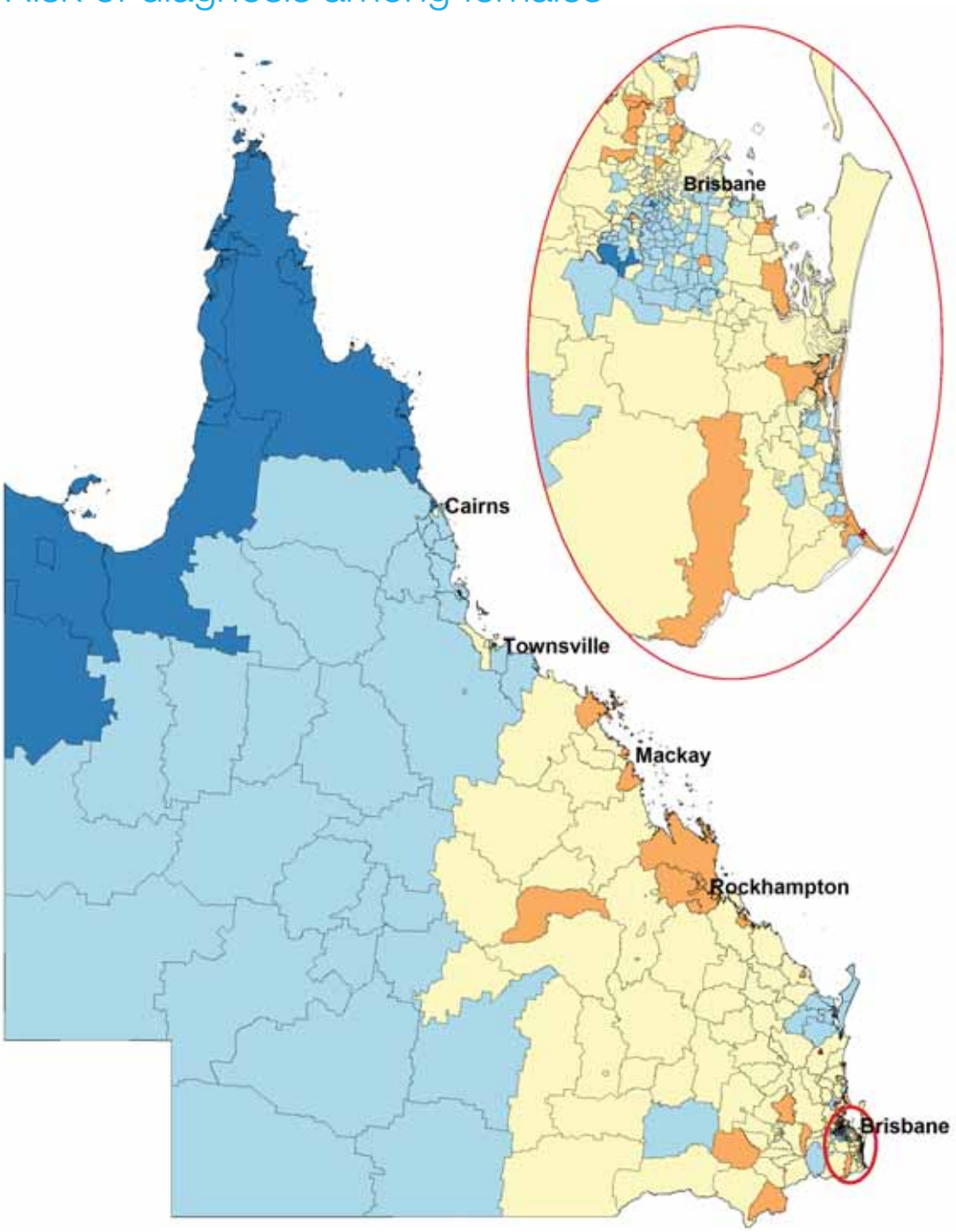
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Melanoma

Risk of diagnosis among females

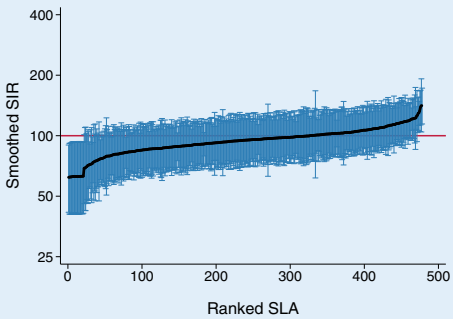


SIR

- Very high
- High
- Average
- Low
- Very low

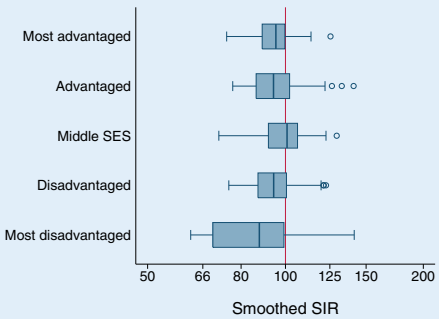
New cases/year	1,011
Rate/100,000	52.8
Smoothed SIR distribution	
Highest	141.3
75%	102.5
Median (50%)	95.1
25%	86.3
Lowest	62.1
Geographical variation	
Evidence level	
Strong	
(p-value 0.001)	

Level of Uncertainty

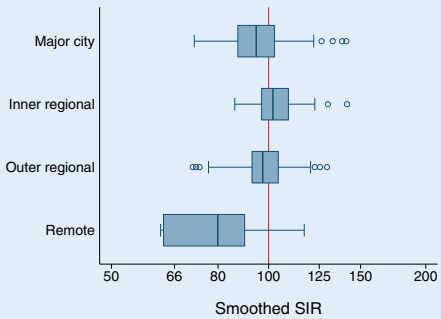


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Melanoma

Risk of death within five years of diagnosis among females

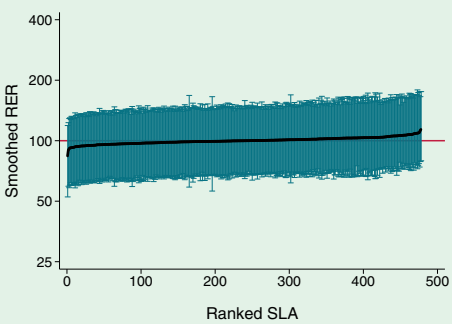
5-year mortality	4.5%
Smoothed RER distribution	
Highest	113.8
75%	102.5
Median (50%)	99.9
25%	97.6
Lowest	84.0
Geographical variation	

Evidence level:

None

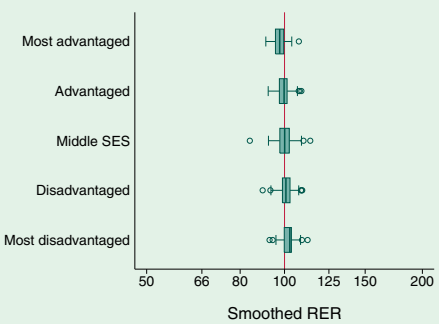
(p-value 1.000)

Level of Uncertainty

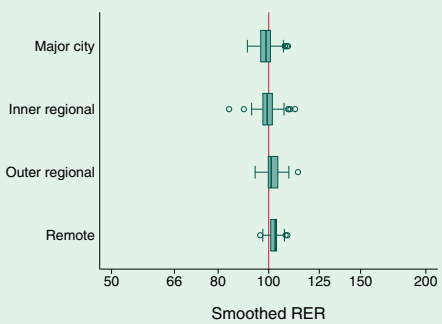


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



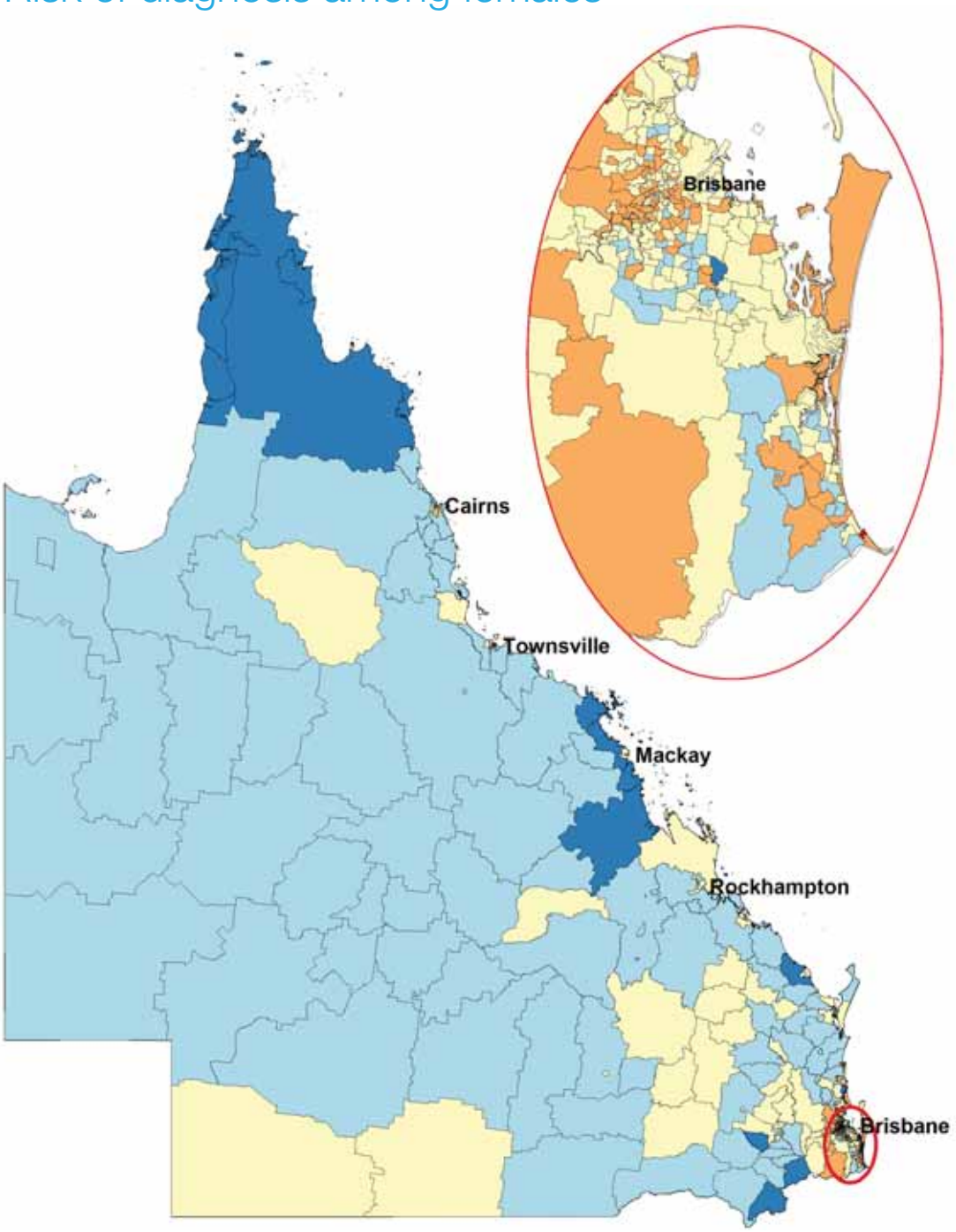
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Breast cancer

Risk of diagnosis among females

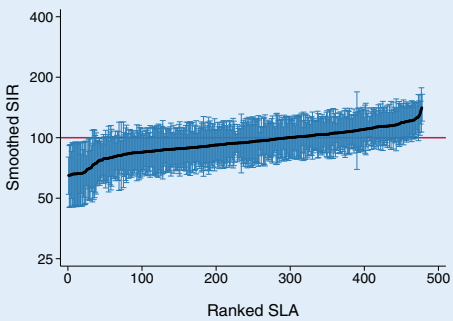


SIR

- Very high
- High
- Average
- Low
- Very low

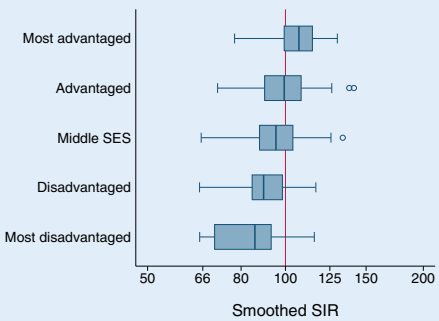
New cases/year	2,242
Rate/100,000	116.8
Smoothed SIR distribution	
Highest	141.1
75%	105.4
Median (50%)	94.7
25%	86.3
Lowest	64.9
Geographical variation	
Evidence level	
Strong	
(p-value 0.001)	

Level of Uncertainty

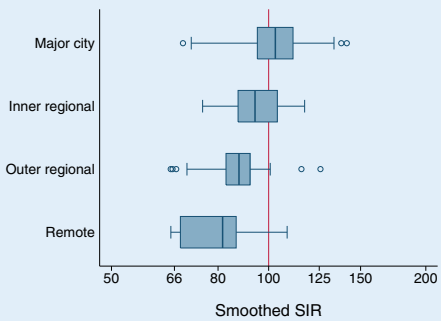


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



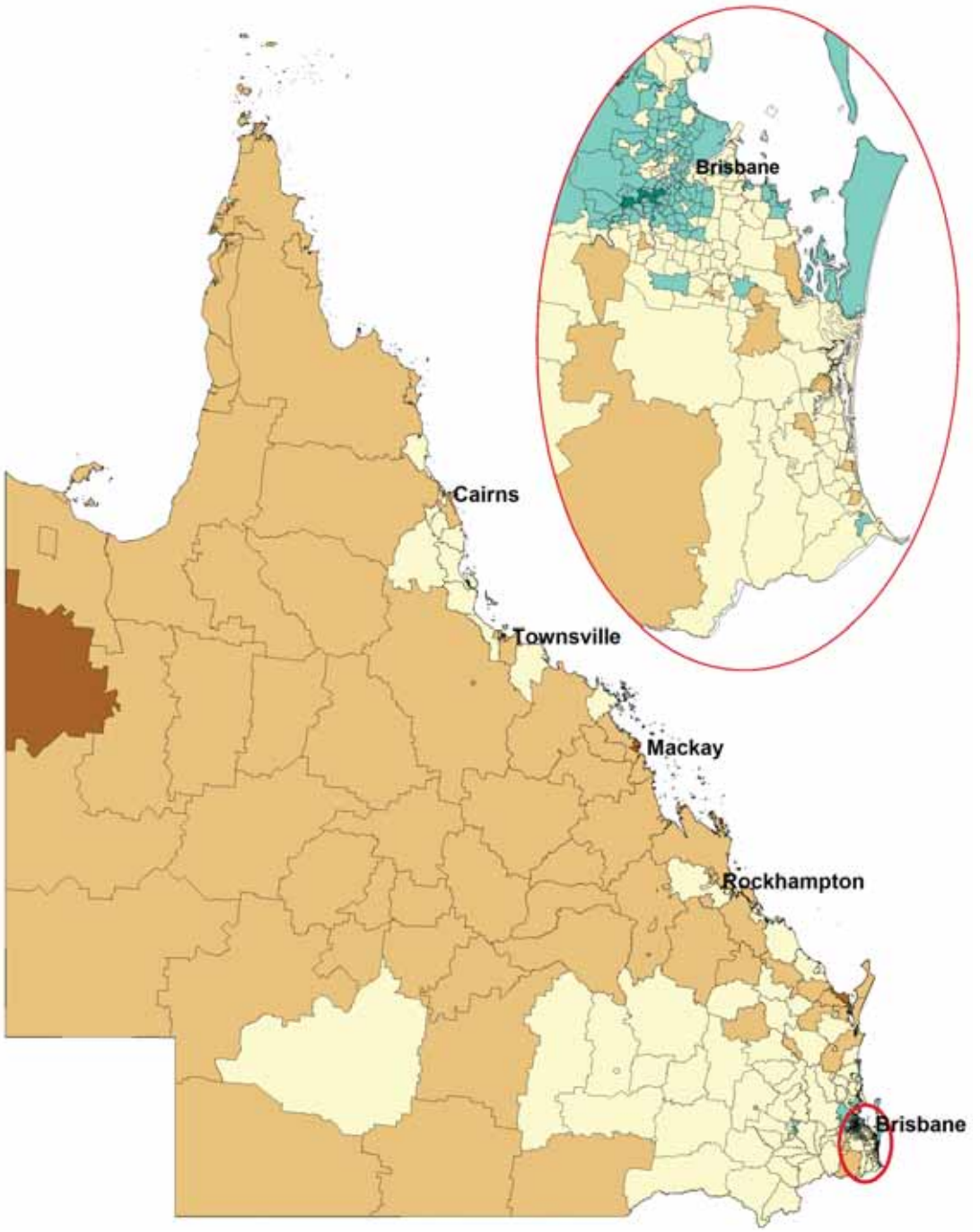
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Breast cancer

Risk of death within five years of diagnosis among females



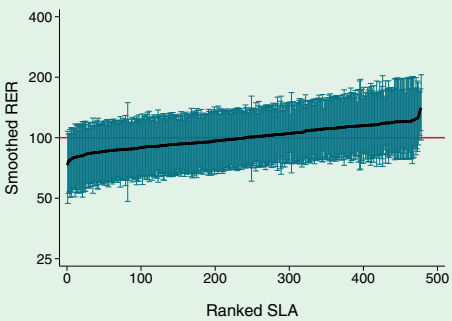
5-year mortality	12.1%
Smoothed RER distribution	
Highest	138.9
75%	111.4
Median (50%)	99.6
25%	90.6
Lowest	73.8
Geographical variation	

Evidence level:

Strong

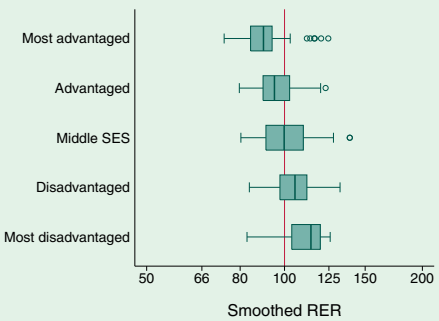
(p-value 0.001)

Level of Uncertainty

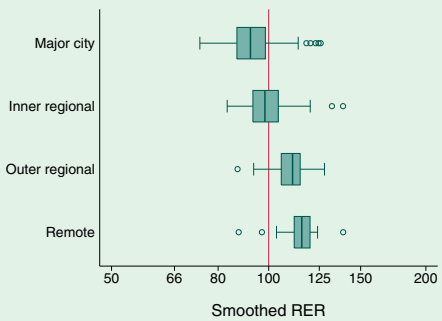


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



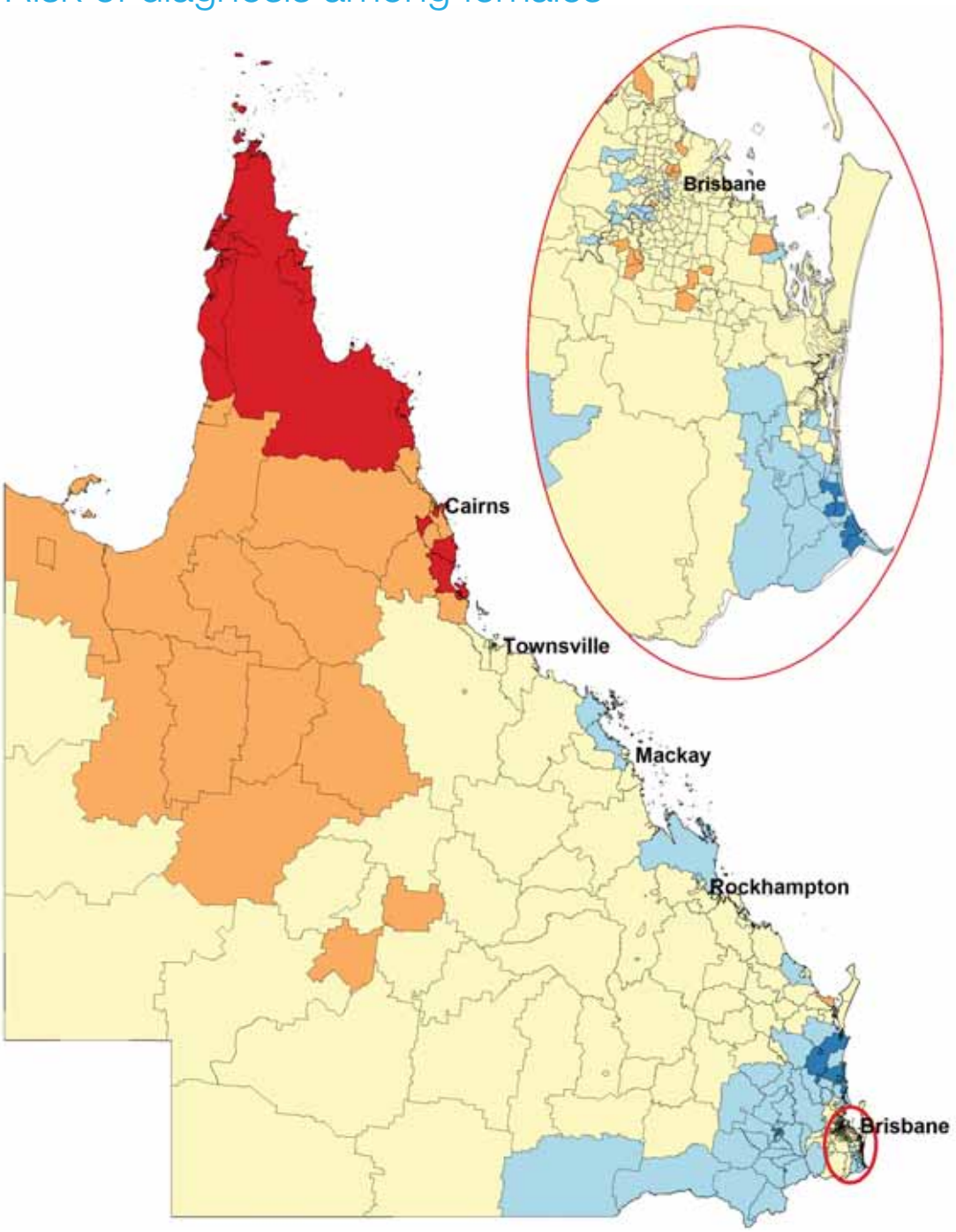
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Cervical cancer

Risk of diagnosis among females

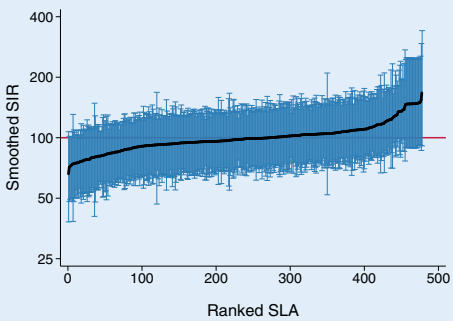


SIR

- Very high
- High
- Average
- Low
- Very low

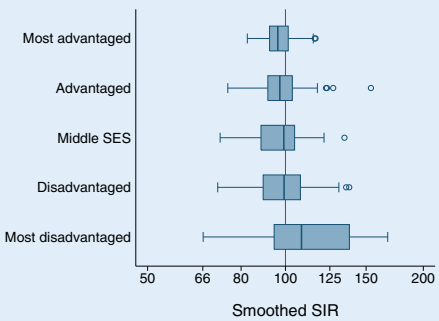
New cases/year	164
Rate/100,000	8.6
Smoothed SIR distribution	
Highest	167.2
75%	105.5
Median (50%)	98.8
25%	92.1
Lowest	66.1
Geographical variation	
Evidence level	
Moderate	
(p-value 0.027)	

Level of Uncertainty

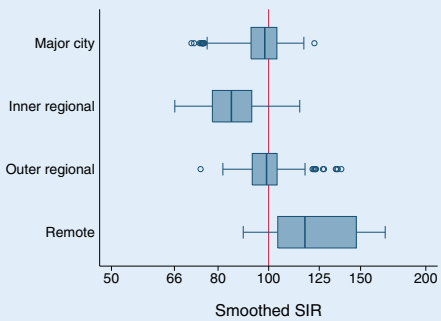


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Cervical cancer

Risk of death within five years of diagnosis among females

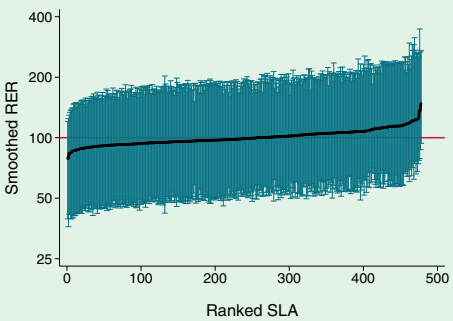
5-year mortality	24.6%
Smoothed RER distribution	
Highest	148.1
75%	105.5
Median (50%)	98.9
25%	94.5
Lowest	79.0
Geographical variation	

Evidence level:

None

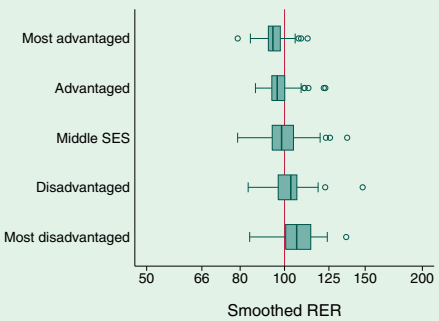
(p-value 0.658)

Level of Uncertainty

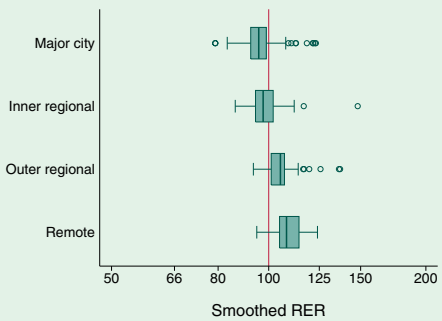


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



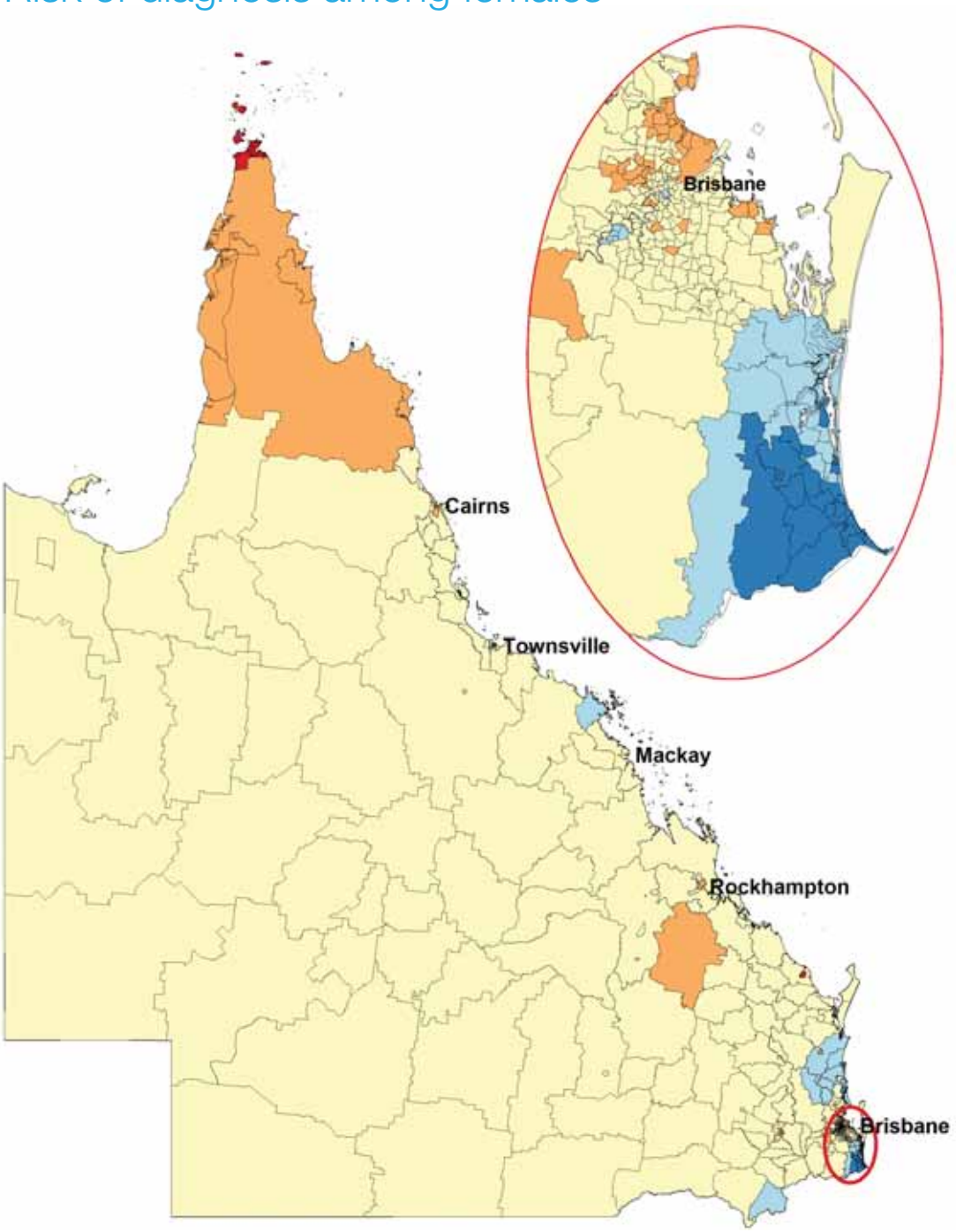
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Uterine cancer

Risk of diagnosis among females

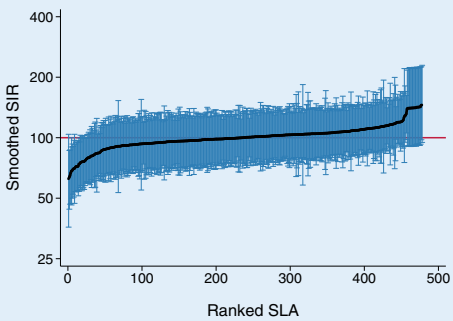


SIR

- Very high
- High
- Average
- Low
- Very low

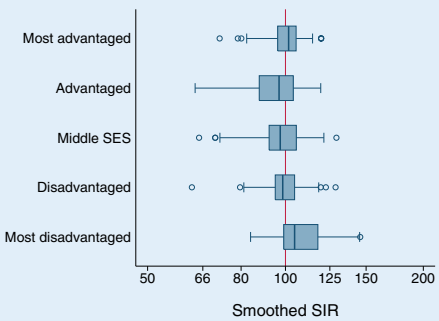
New cases/year	311
Rate/100,000	16.2
Smoothed SIR distribution	
Highest	145.6
75%	106.1
Median (50%)	100.3
25%	94.4
Lowest	62.5
Geographical variation	
Evidence level	
Strong	
(p-value 0.001)	

Level of Uncertainty

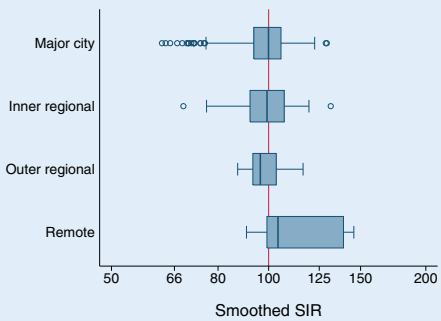


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



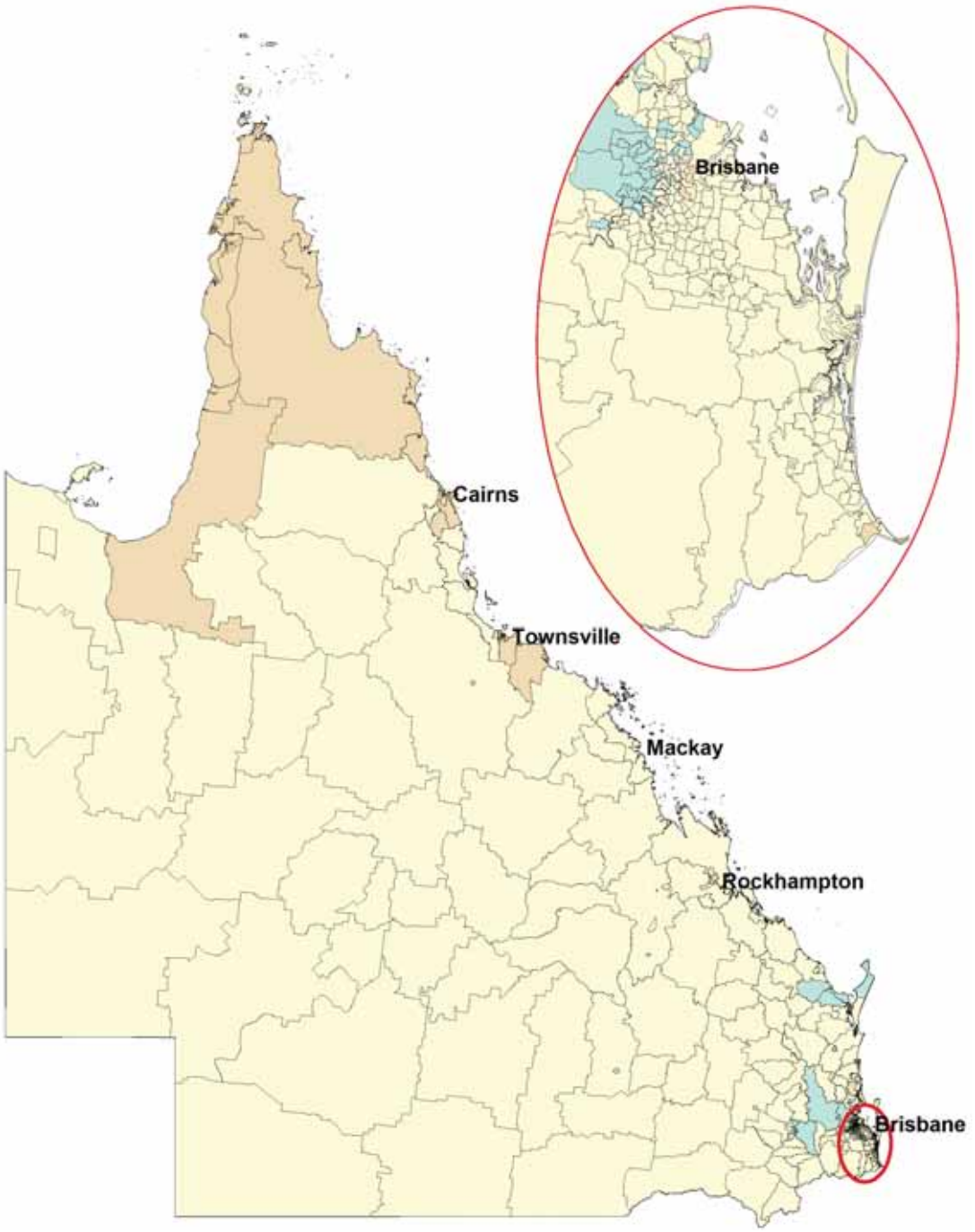
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

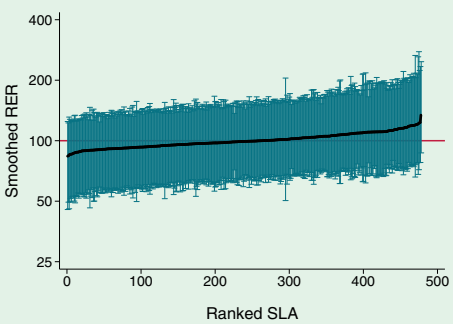
Uterine cancer

Risk of death within five years of diagnosis among females



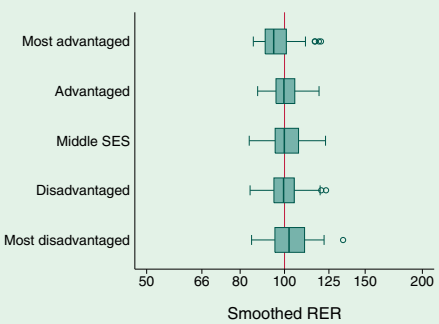
5-year mortality	17.8%
Smoothed RER distribution	
Highest	134.2
75%	106.0
Median (50%)	99.3
25%	93.9
Lowest	83.7
Geographical variation	
Evidence level:	
None	
(p-value 0.810)	

Level of Uncertainty

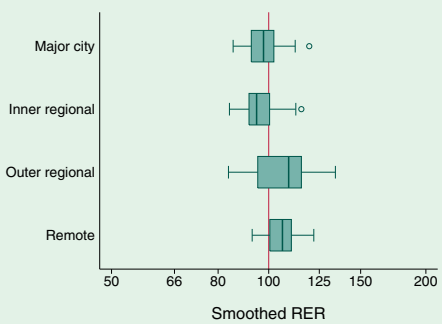


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Ovarian cancer

Risk of diagnosis among females

SIR

- Very high
- High
- Average
- Low
- Very low

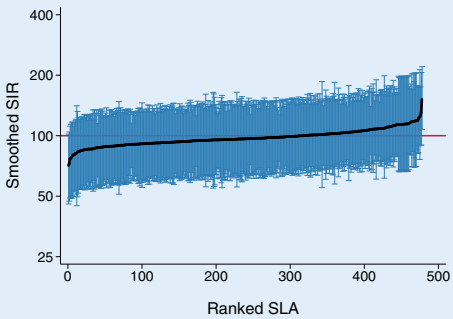
New cases/year	212
Rate/100,000	11.0
Smoothed SIR distribution	
Highest	151.8
75%	102.6
Median (50%)	96.5
25%	92.1
Lowest	71.1
Geographical variation	

Evidence level

None

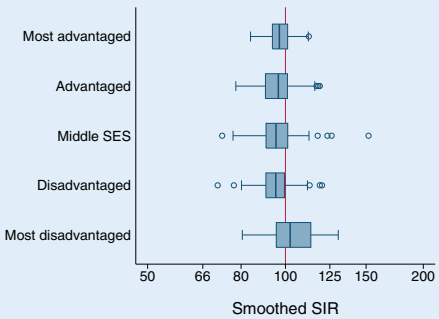
(p-value 0.770)

Level of Uncertainty

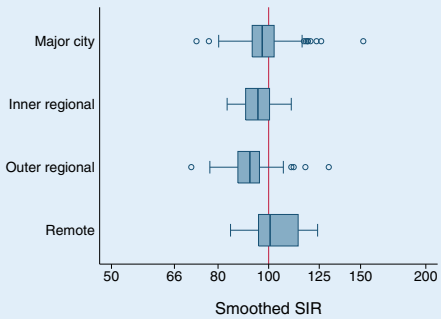


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



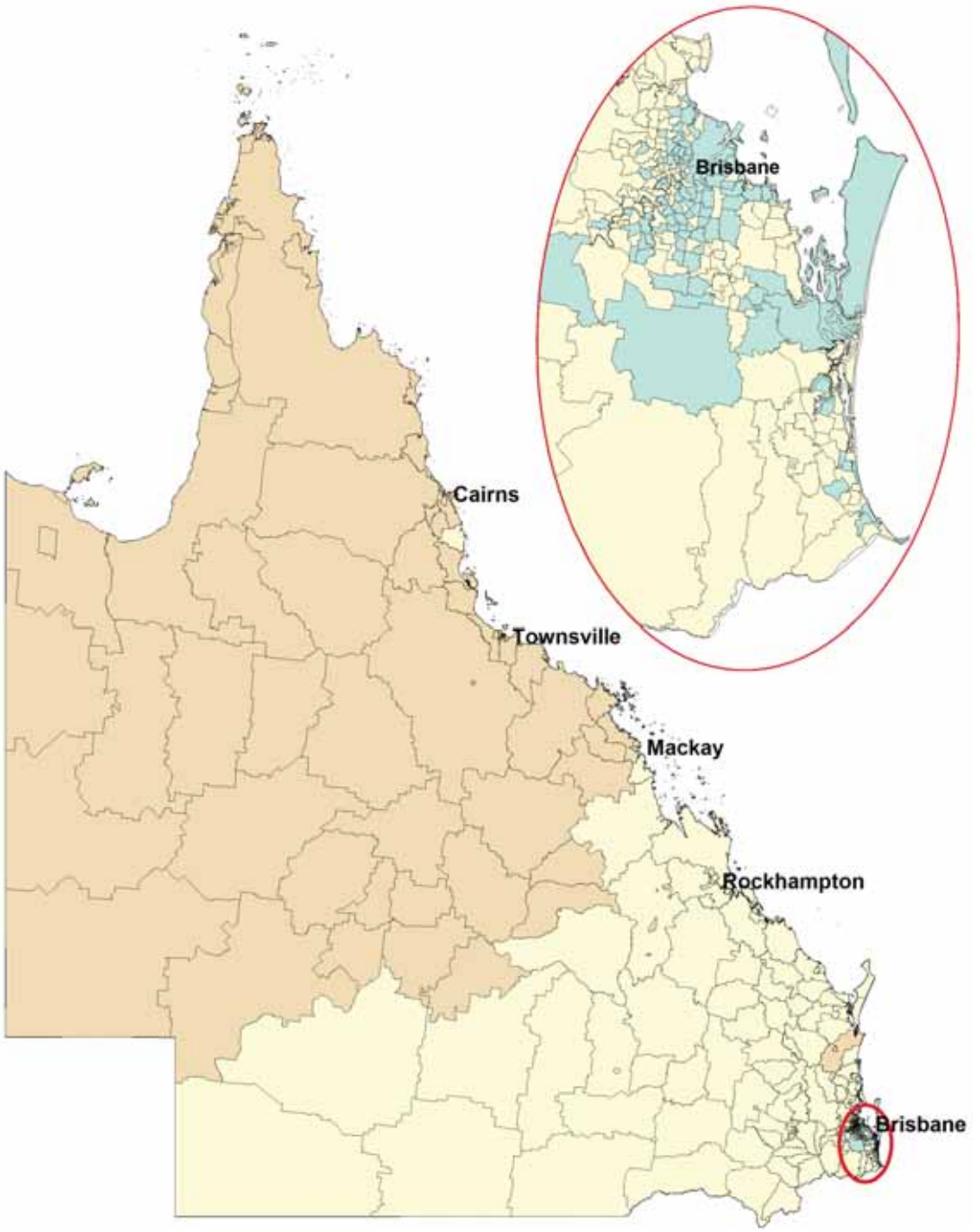
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Ovarian cancer

Risk of death within five years of diagnosis among females



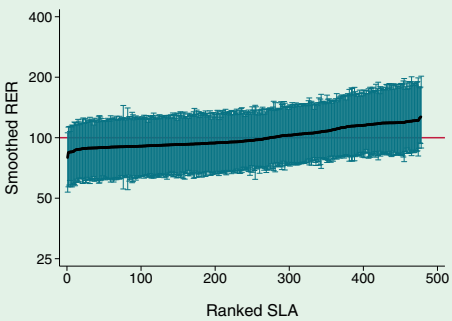
5-year mortality	54.1%
Smoothed RER distribution	
Highest	127.1
75%	109.5
Median (50%)	96.3
25%	91.4
Lowest	79.7
Geographical variation	

Evidence level:

Weak

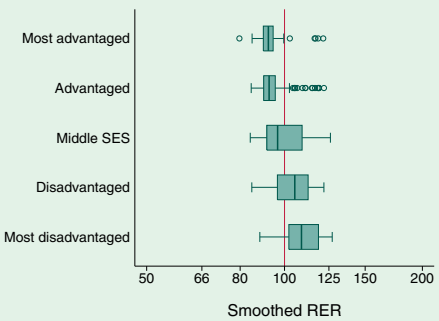
(p-value 0.060)

Level of Uncertainty

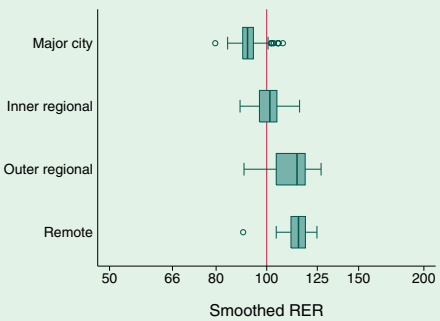


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



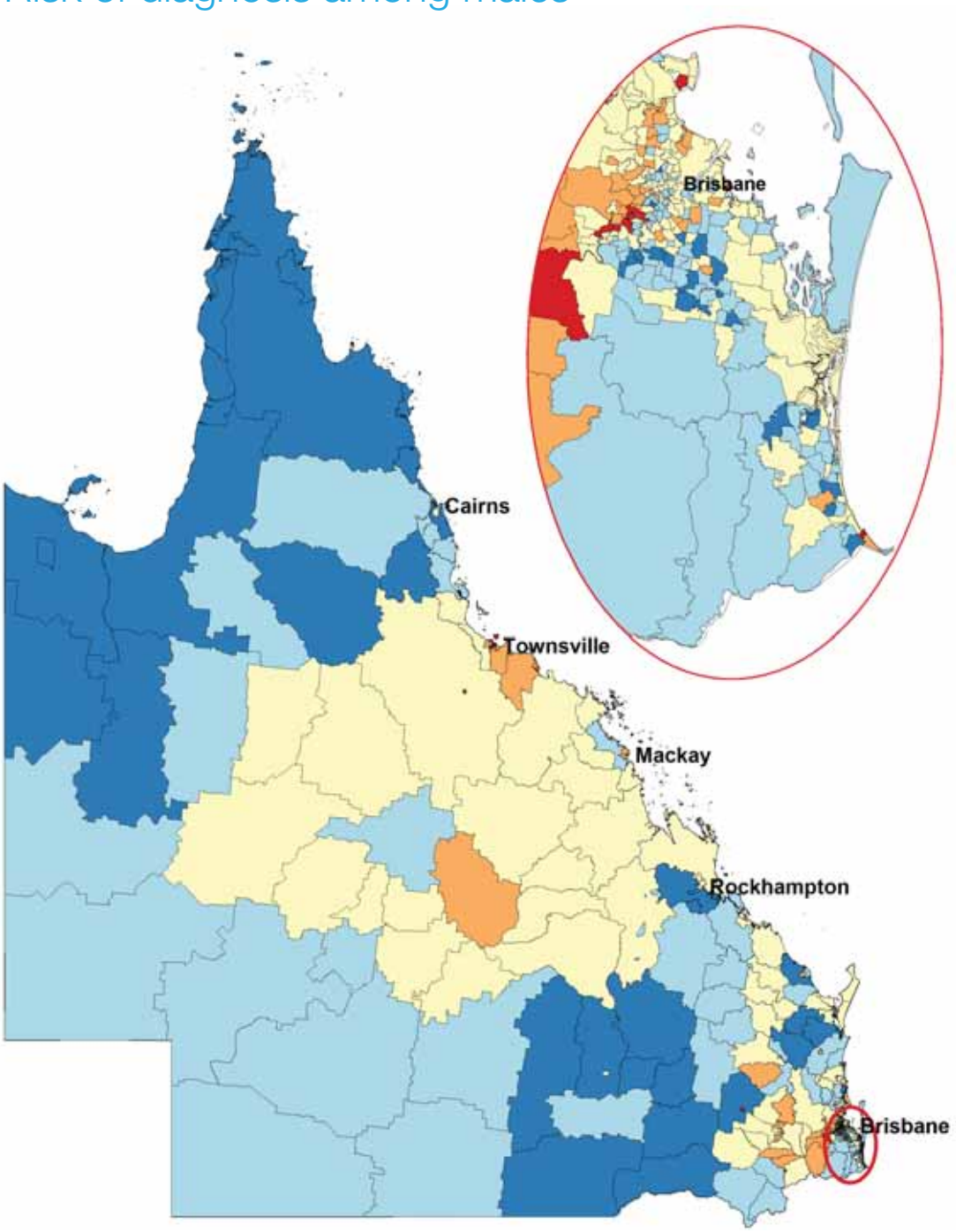
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Prostate cancer

Risk of diagnosis among males

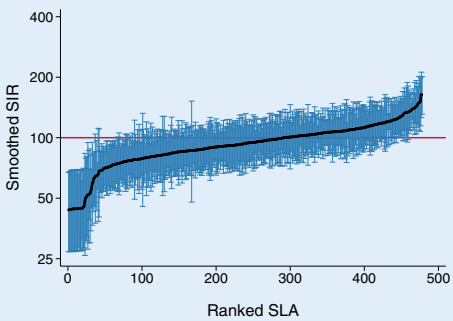


SIR

- Very high
- High
- Average
- Low
- Very low

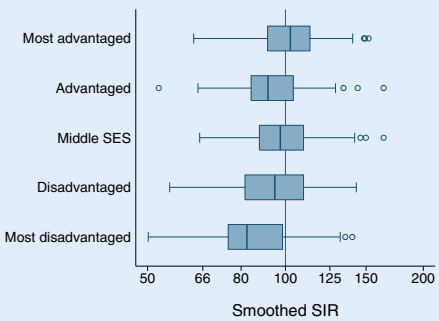
New cases/year	2,522
Rate/100,000	147.2
Smoothed SIR distribution	
Highest	163.8
75%	107.1
Median (50%)	93.7
25%	81.3
Lowest	43.7
Geographical variation	
Evidence level	
Strong	
(p-value 0.001)	

Level of Uncertainty

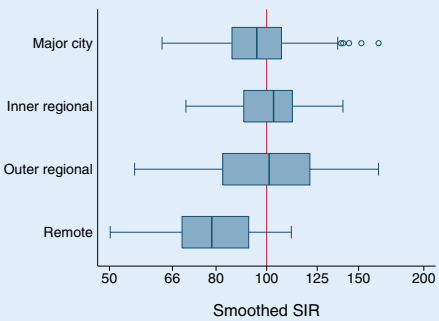


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



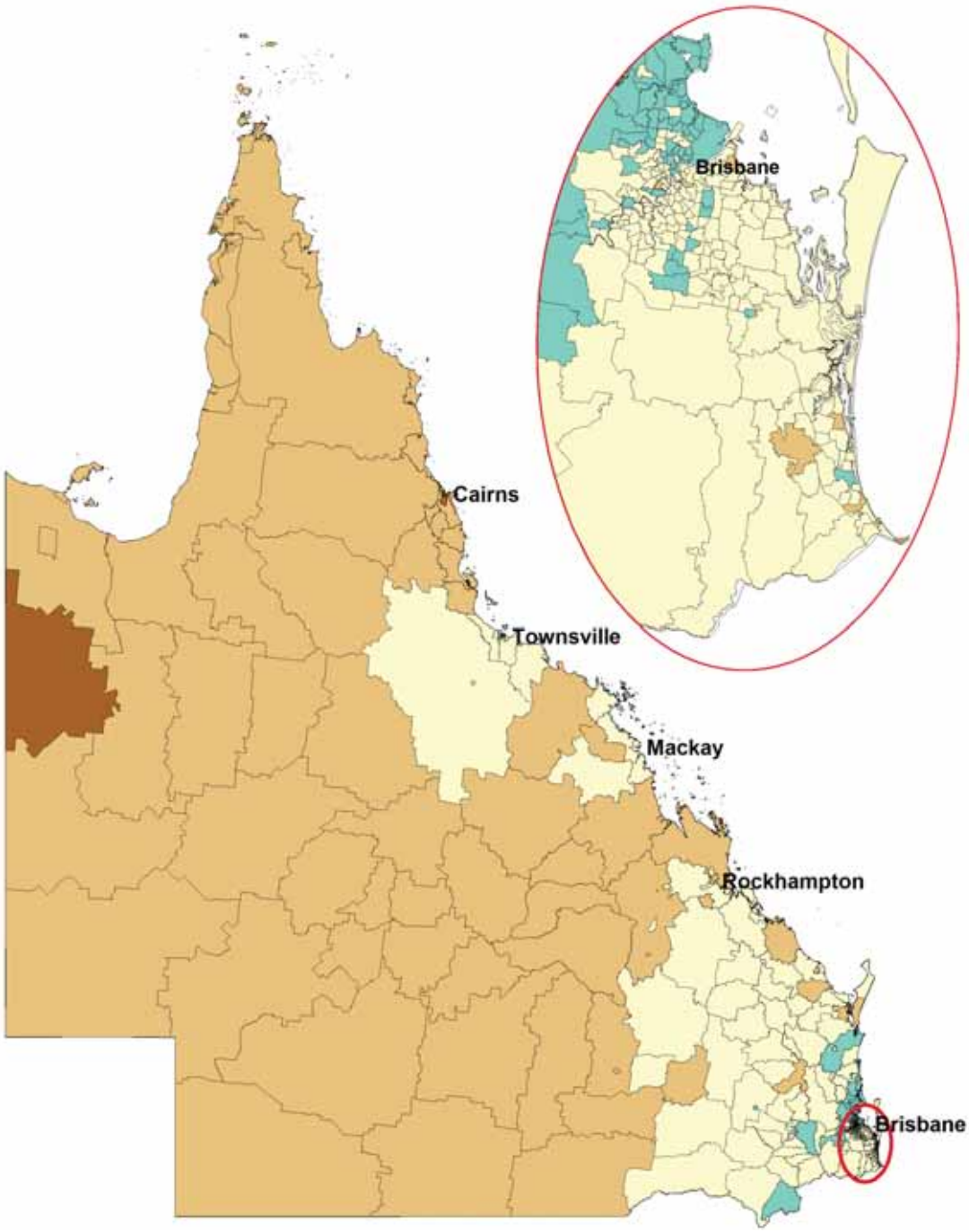
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Prostate cancer

Risk of death within five years of diagnosis among males



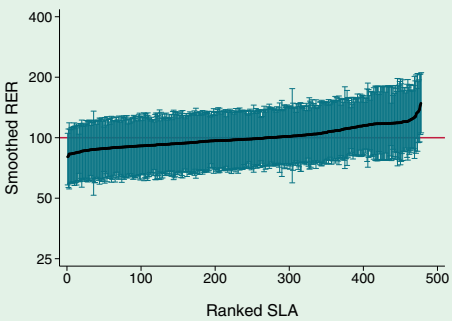
5-year mortality	14.8%
Smoothed RER distribution	
Highest	148.4
75%	107.8
Median (50%)	98.2
25%	91.9
Lowest	80.4
Geographical variation	

Evidence level:

Strong

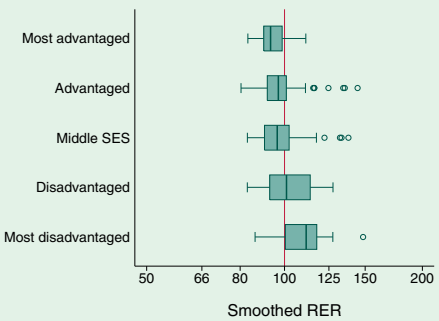
(p-value 0.001)

Level of Uncertainty

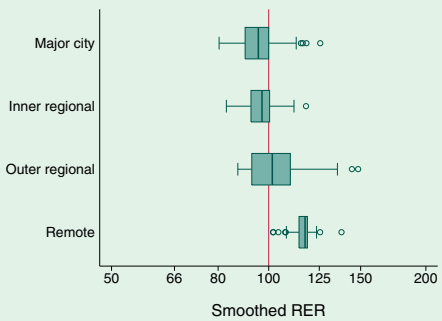


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



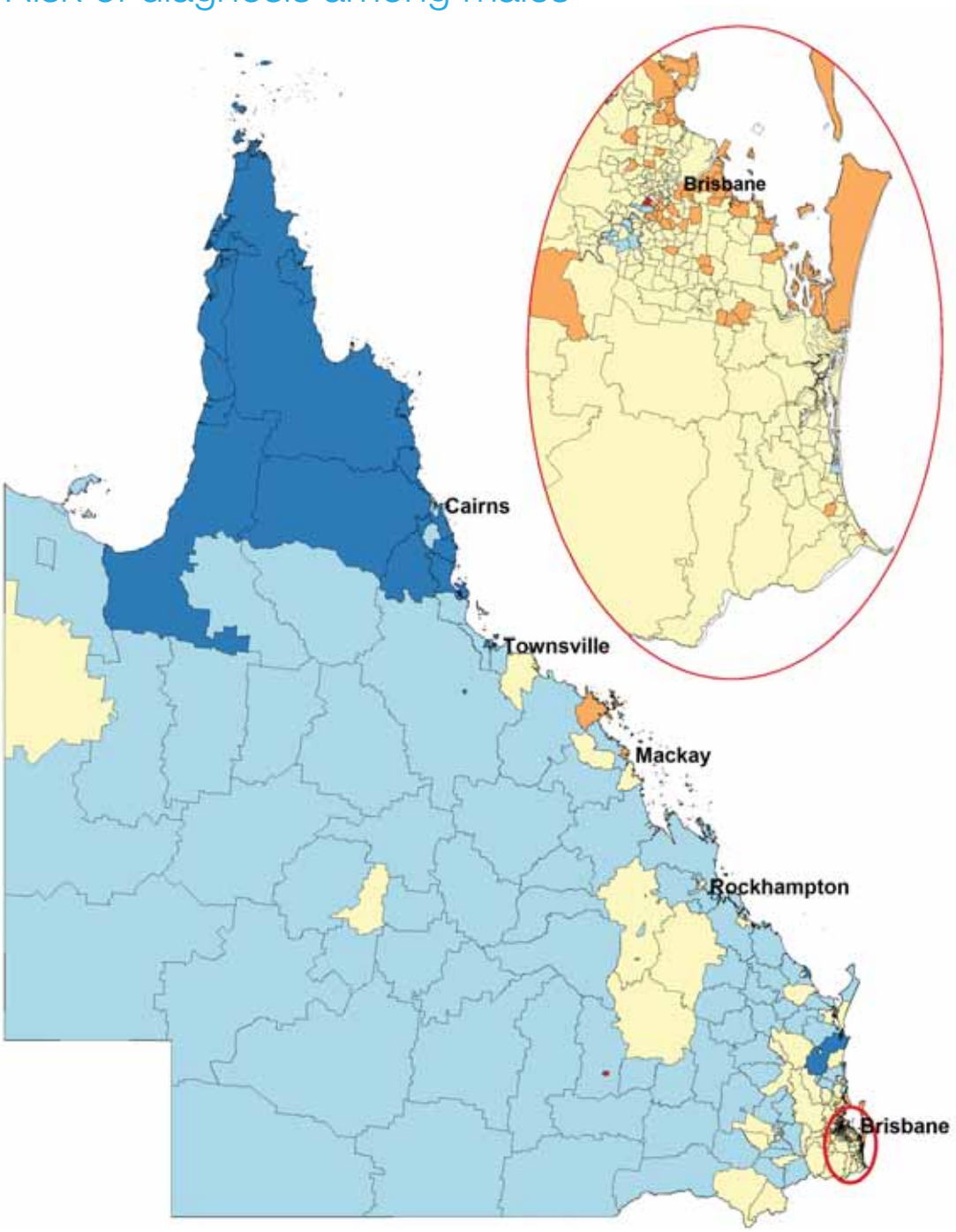
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Kidney cancer

Risk of diagnosis among males

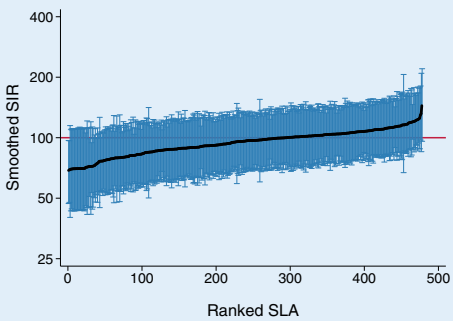


SIR

- Very high
- High
- Average
- Low
- Very low

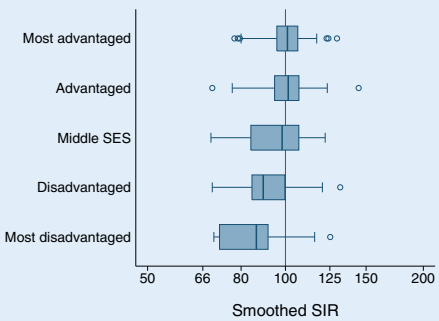
New cases/year	312
Rate/100,000	17.9
Smoothed SIR distribution	
Highest	144.5
75%	104.2
Median (50%)	96.3
25%	86.0
Lowest	68.8
Geographical variation	
Evidence level	
Strong	
(p-value 0.001)	

Level of Uncertainty

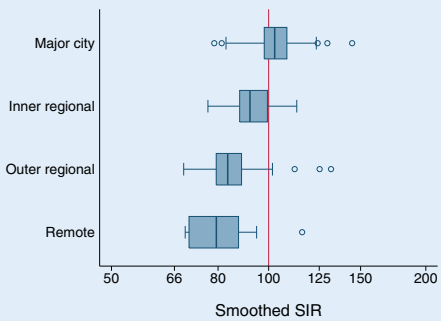


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Kidney cancer

Risk of death within five years of diagnosis among males

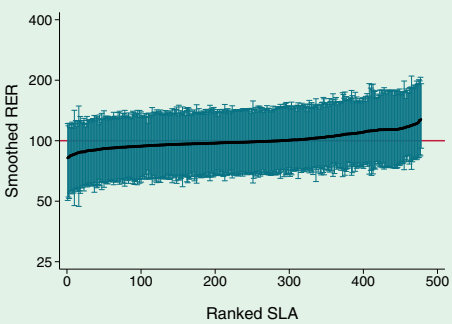
5-year mortality	33.7%
Smoothed RER distribution	
Highest	127.8
75%	105.2
Median (50%)	98.4
25%	94.9
Lowest	82.2
Geographical variation	

Evidence level:

None

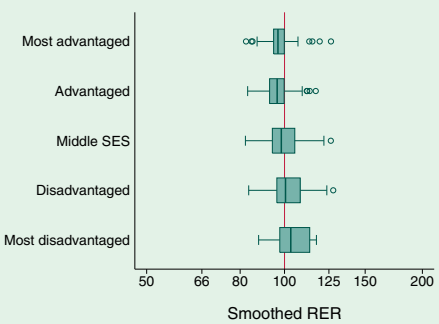
(p-value 0.234)

Level of Uncertainty

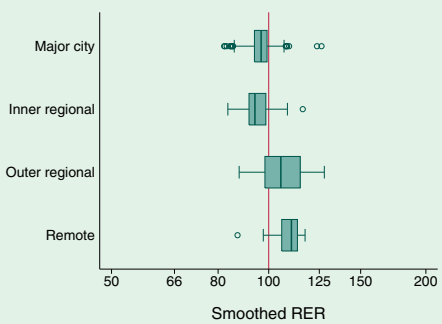


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



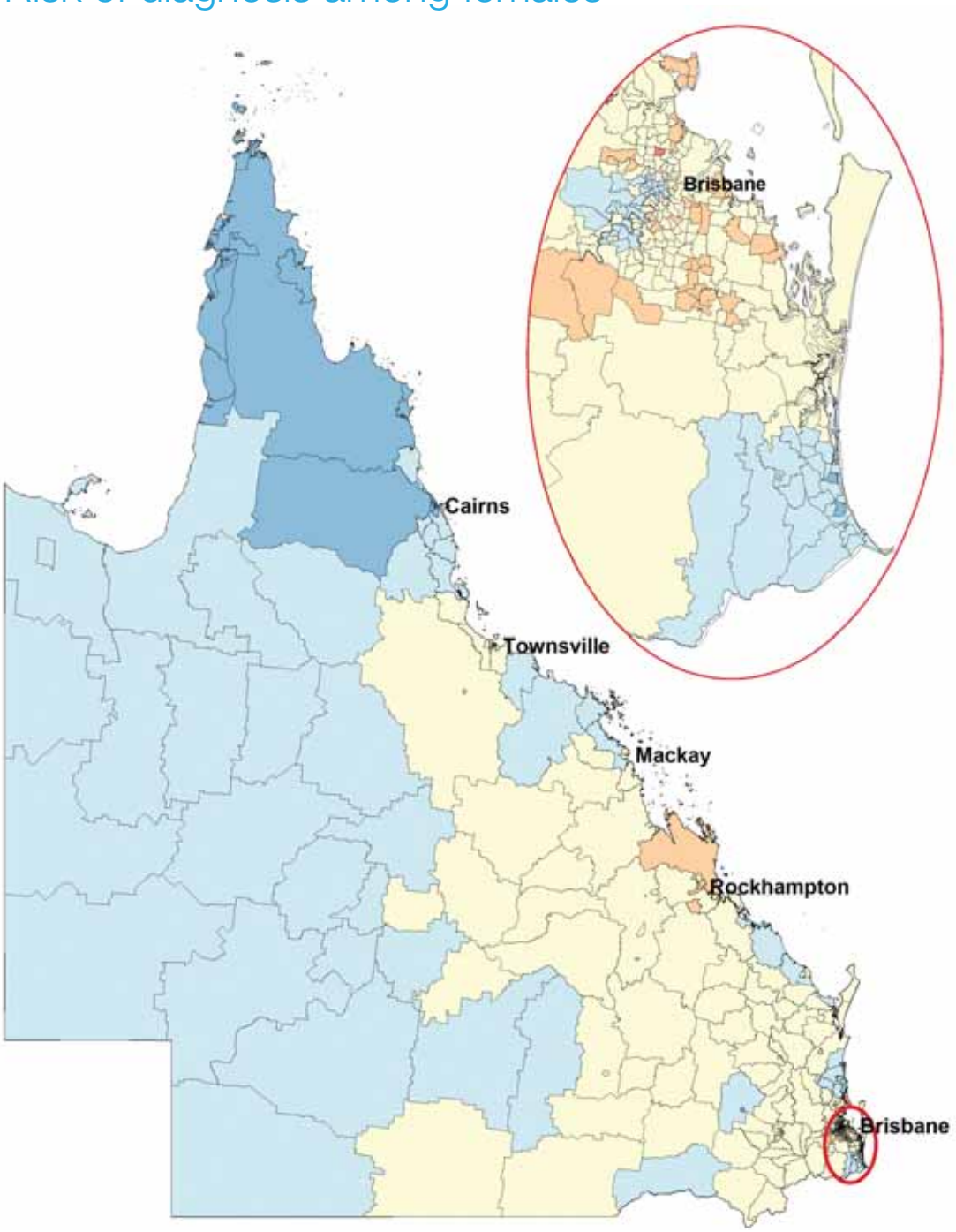
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Kidney cancer

Risk of diagnosis among females

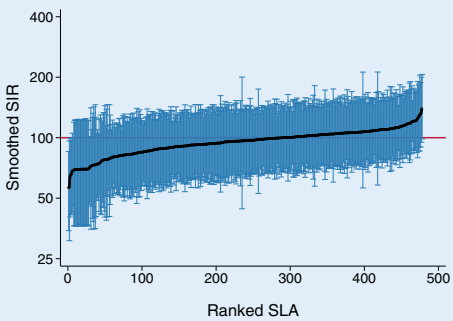


SIR

- Very high
- High
- Average
- Low
- Very low

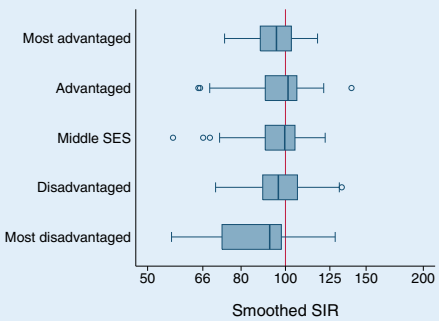
New cases/year	188
Rate/100,000	9.7
Smoothed SIR distribution	
Highest	139.4
75%	104.3
Median (50%)	96.7
25%	87.7
Lowest	56.4
Geographical variation	
Evidence level	
Weak	
(p-value 0.055)	

Level of Uncertainty

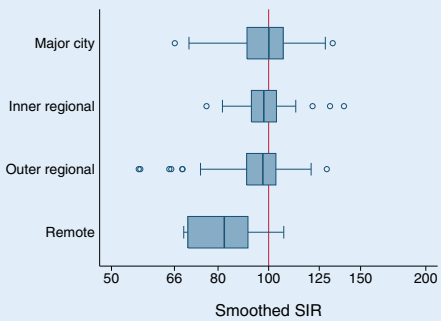


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



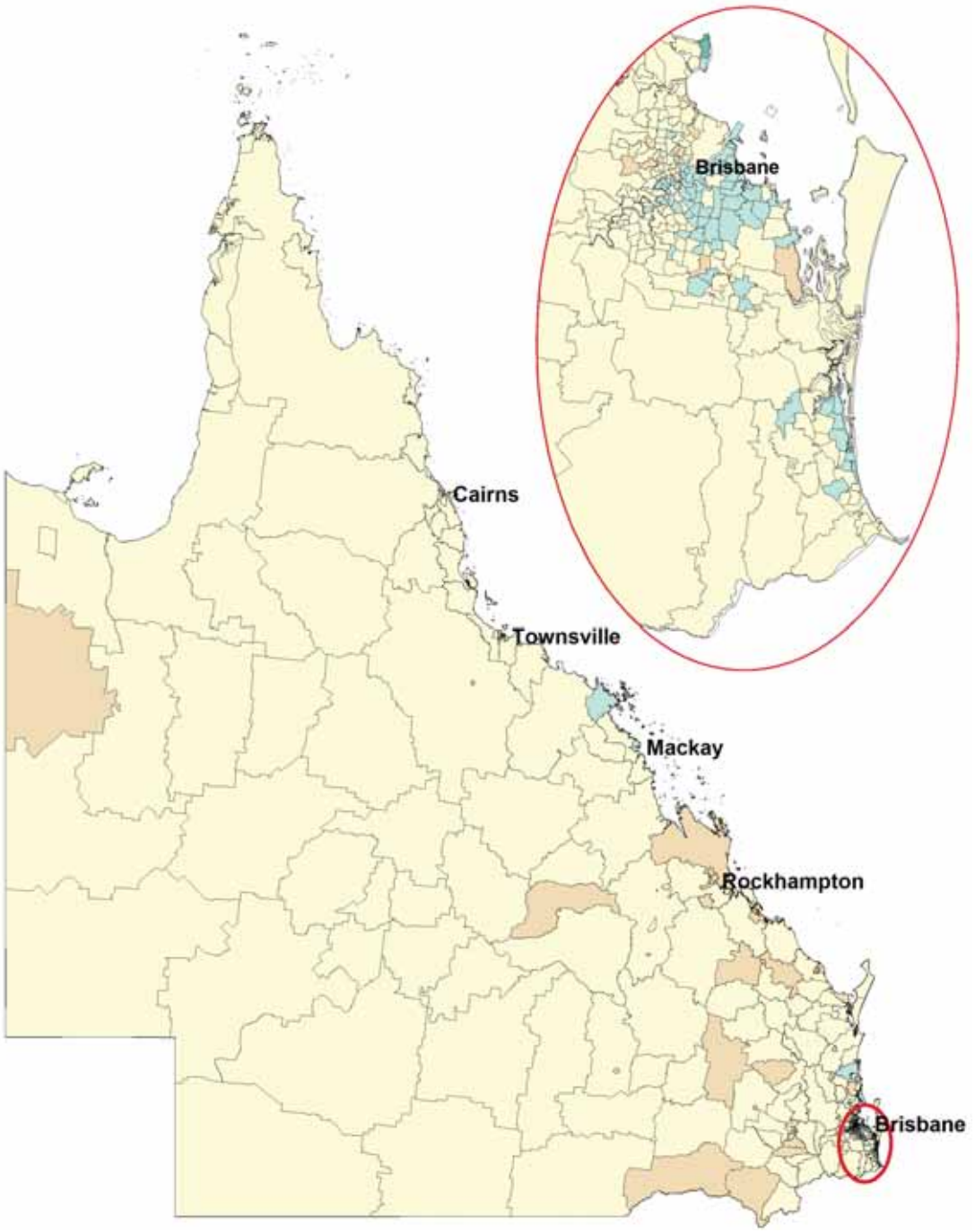
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Kidney cancer

Risk of death within five years of diagnosis among females



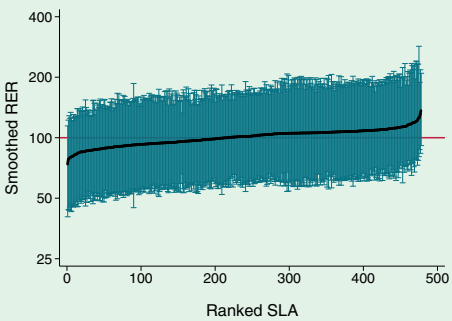
5-year mortality	37.5%
Smoothed RER distribution	
Highest	136.4
75%	106.7
Median (50%)	101.5
25%	93.8
Lowest	73.9
Geographical variation	

Evidence level:

None

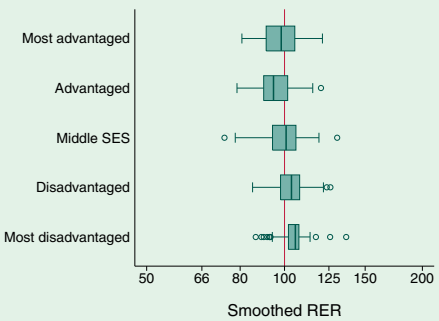
(p-value 0.408)

Level of Uncertainty

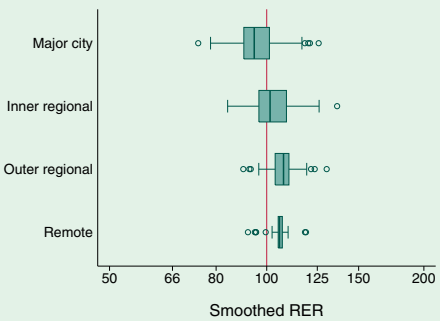


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



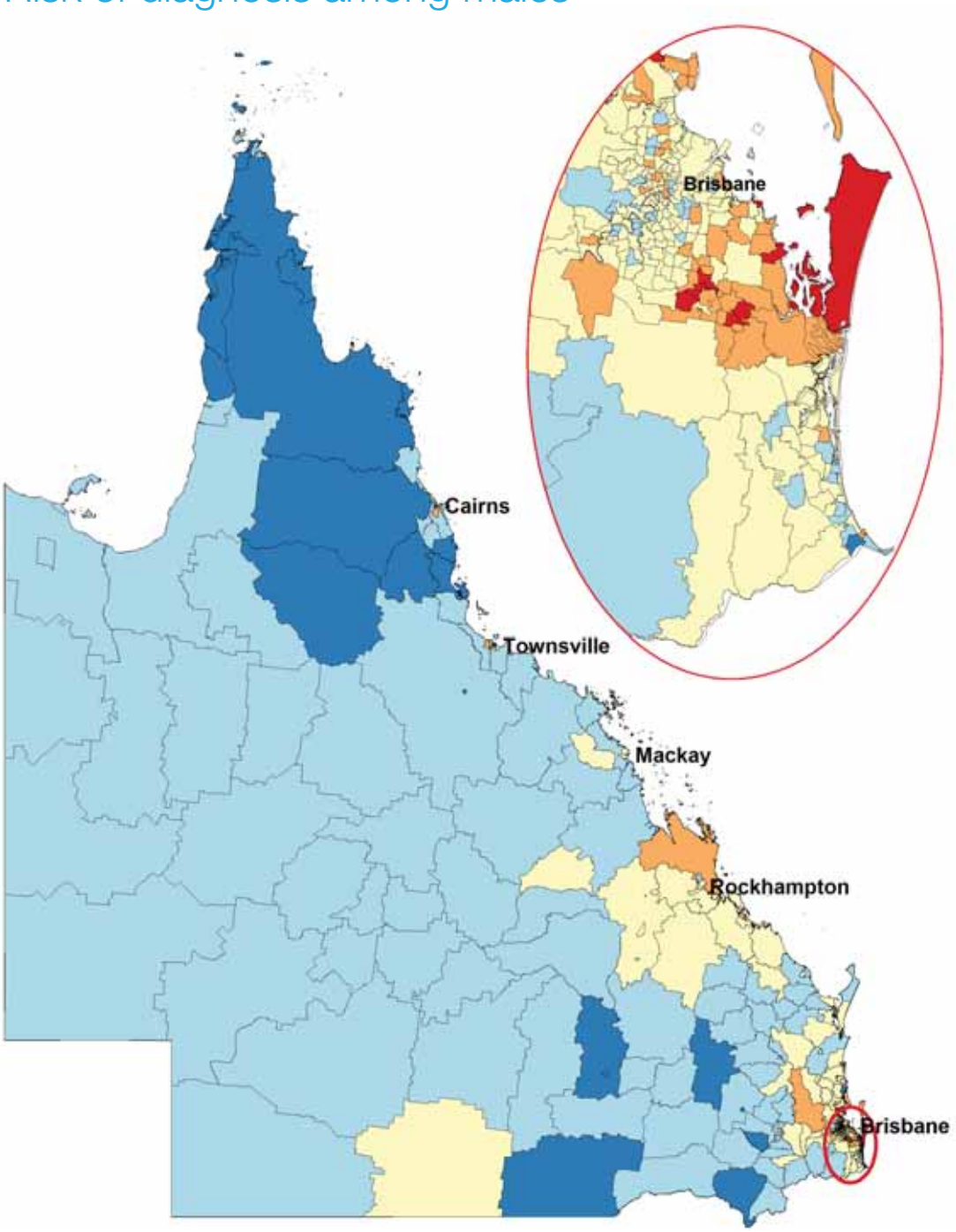
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Bladder cancer

Risk of diagnosis among males

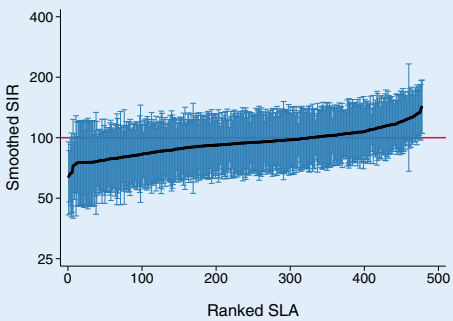


SIR

- Very high
- High
- Average
- Low
- Very low

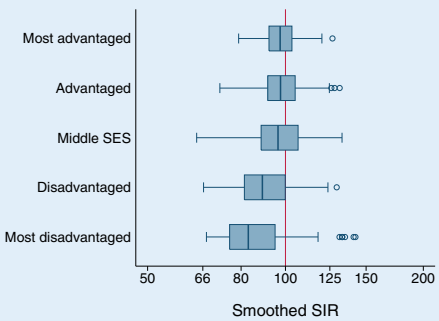
New cases/year	503
Rate/100,000	30.5
Smoothed SIR distribution	
Highest	142.2
75%	102.9
Median (50%)	94.2
25%	85.1
Lowest	64.0
Geographical variation	
Evidence level	
Strong	
(p-value 0.001)	

Level of Uncertainty

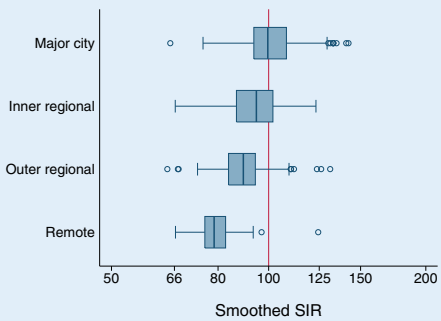


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



(b) Rurality



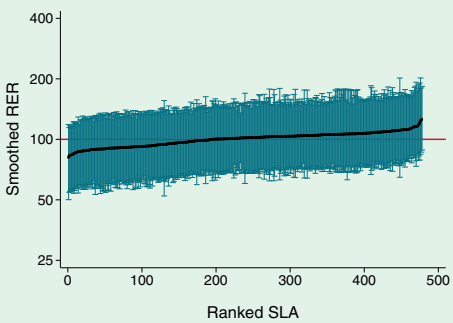
Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Bladder cancer

Risk of death within five years of diagnosis among males

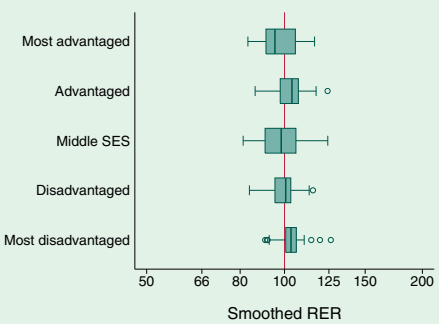
5-year mortality	24.0%
Smoothed RER distribution	
Highest	126.2
75%	105.8
Median (50%)	101.8
25%	93.8
Lowest	81.2
Geographical variation	
Evidence level:	
None	
(p-value 0.759)	

Level of Uncertainty

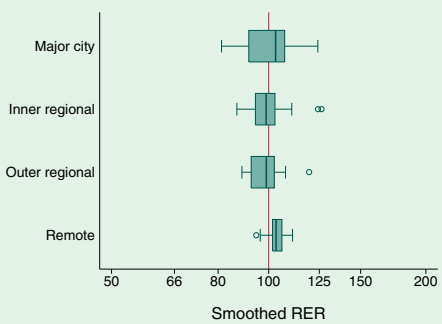


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Bladder cancer

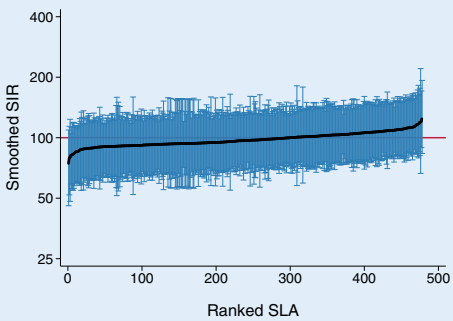
Risk of diagnosis among females

SIR

- Very high
- High
- Average
- Low
- Very low

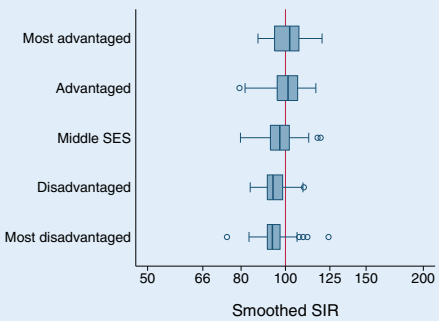
New cases/year	157
Rate/100,000	8.0
Smoothed SIR distribution	
Highest	124.2
75%	103.2
Median (50%)	96.8
25%	92.5
Lowest	74.5
Geographical variation	
Evidence level	
None	
(p-value 0.676)	

Level of Uncertainty

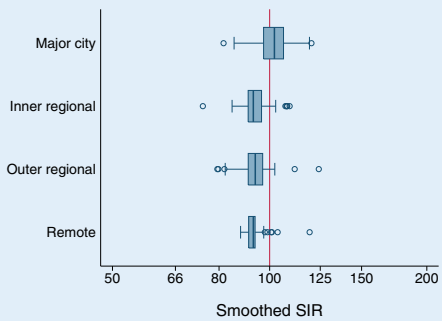


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Bladder cancer

Risk of death within five years of diagnosis among females

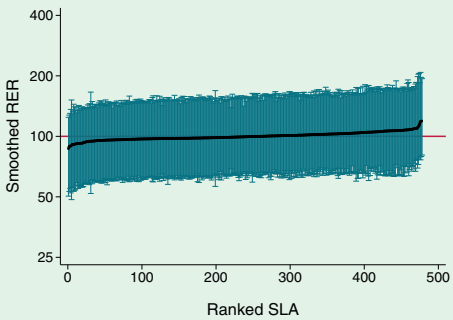
5-year mortality	28.1%
Smoothed RER distribution	
Highest	119.3
75%	102.8
Median (50%)	99.5
25%	97.3
Lowest	86.8
Geographical variation	

Evidence level:

None

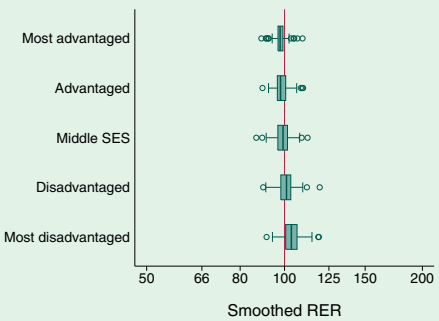
(p-value 1.000)

Level of Uncertainty

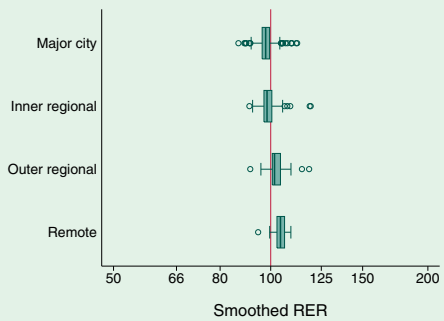


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



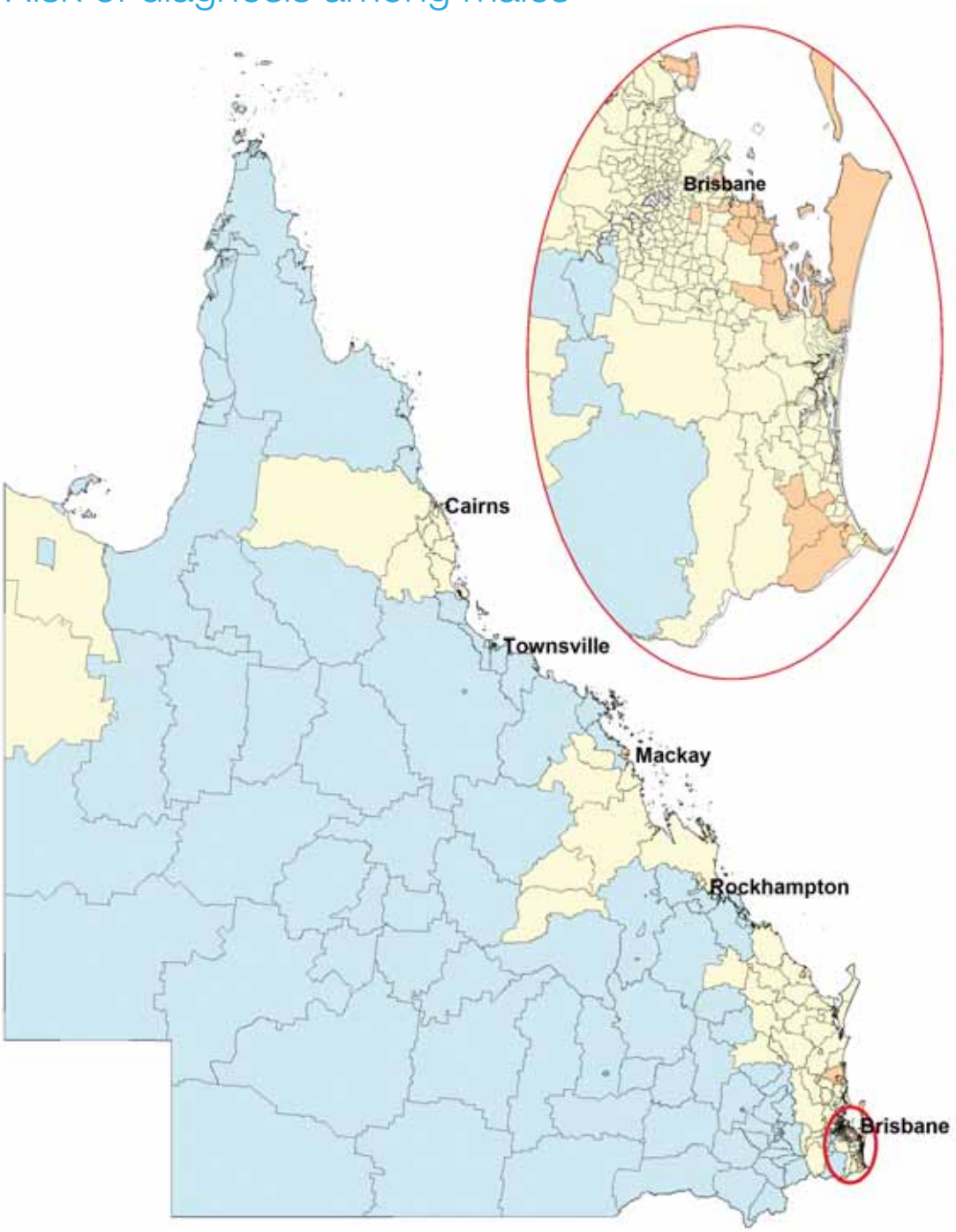
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Brain cancer

Risk of diagnosis among males

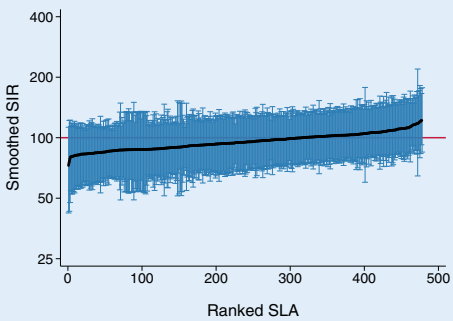


SIR

- Very high
- High
- Average
- Low
- Very low

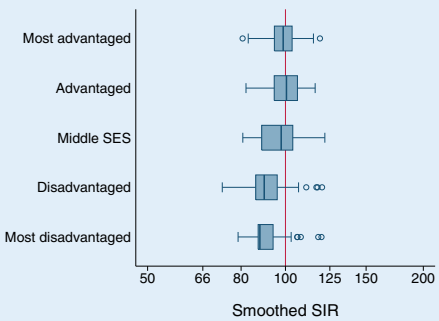
New cases/year	150
Rate/100,000	8.3
Smoothed SIR distribution	
Highest	121.9
75%	102.3
Median (50%)	95.1
25%	88.0
Lowest	72.8
Geographical variation	
Evidence level	
None	
(p-value 0.328)	

Level of Uncertainty

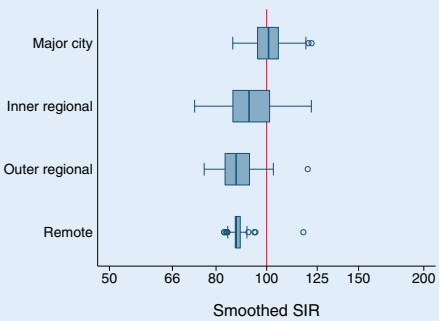


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Brain cancer

Risk of death within five years of diagnosis among males

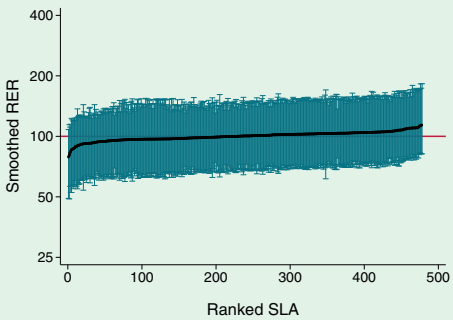
5-year mortality	77.2%
Smoothed RER distribution	
Highest	114.0
75%	103.4
Median (50%)	100.5
25%	96.9
Lowest	78.9
Geographical variation	

Evidence level:

None

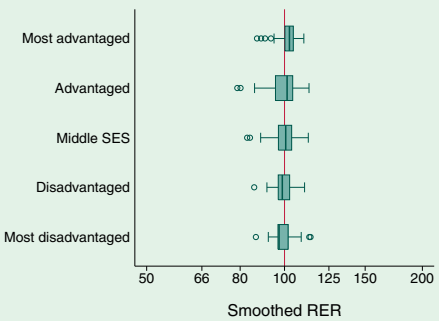
(p-value 0.985)

Level of Uncertainty

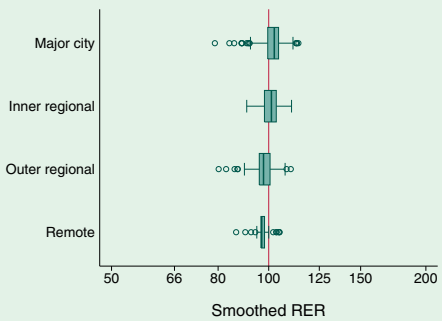


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Brain cancer

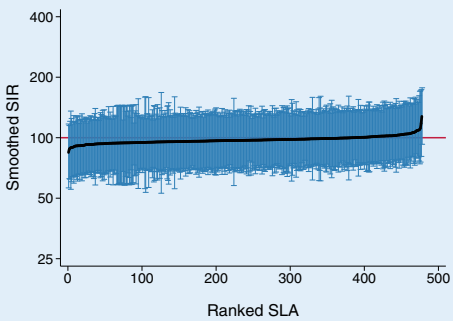
Risk of diagnosis among females

SIR

- Very high
- High
- Average
- Low
- Very low

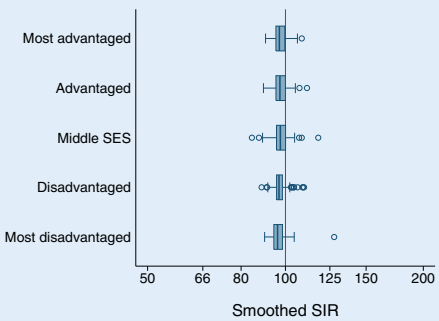
New cases/year	107
Rate/100,000	5.6
Smoothed SIR distribution	
Highest	127.7
75%	99.3
Median (50%)	97.1
25%	95.2
Lowest	84.4
Geographical variation	
Evidence level	
None	
(p-value 1.000)	

Level of Uncertainty

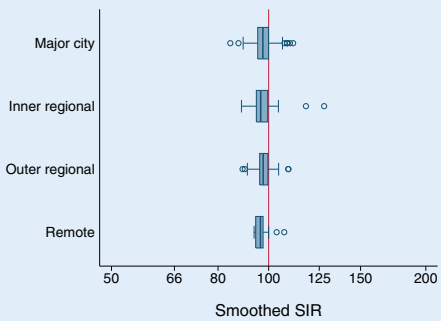


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



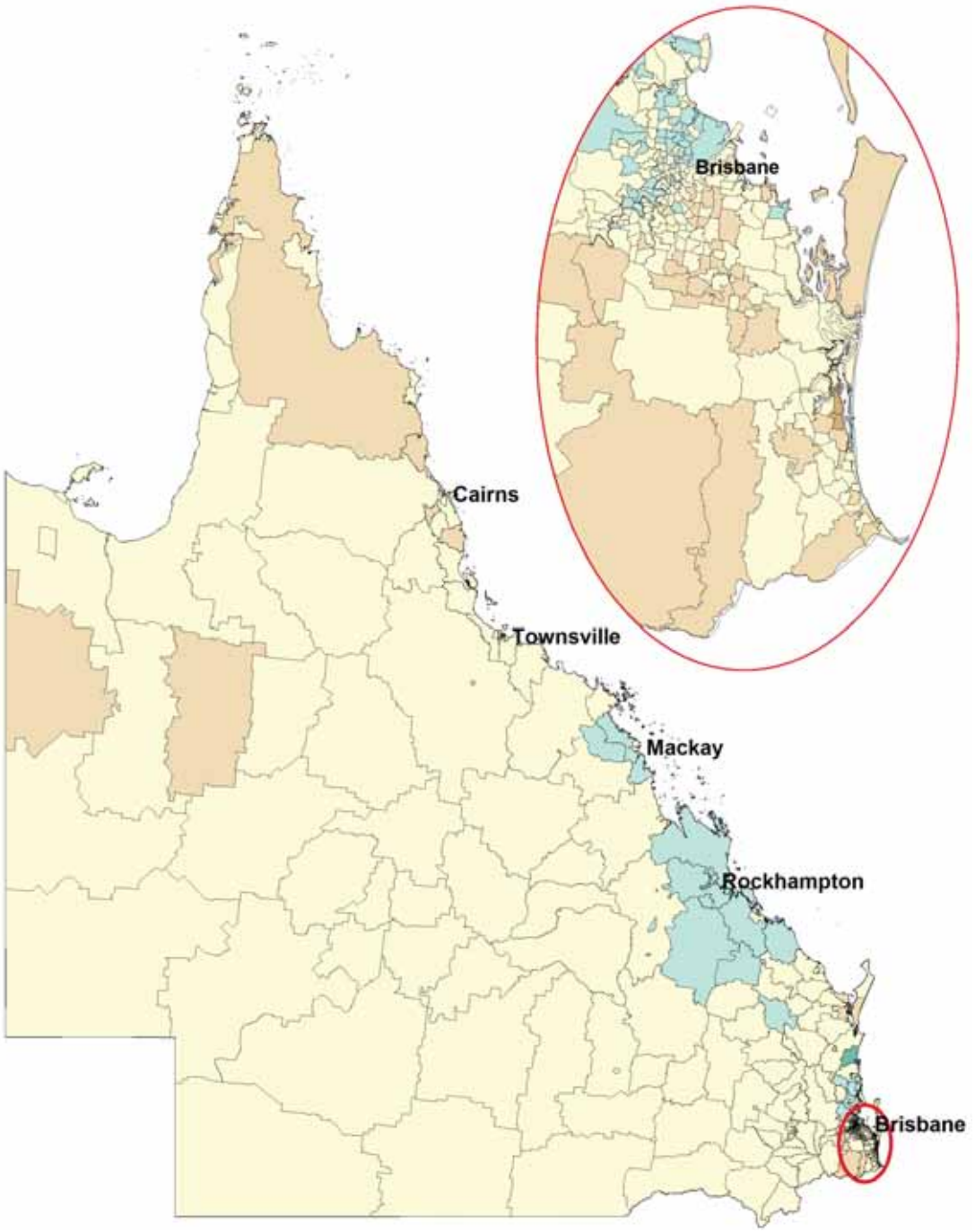
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Brain cancer

Risk of death within five years of diagnosis among females



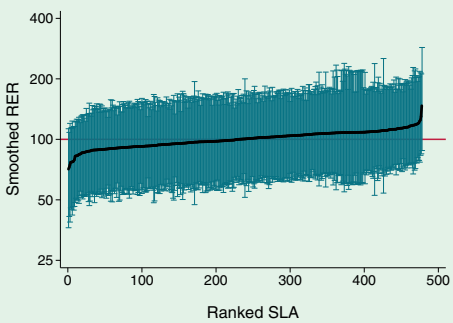
5-year mortality	76.4%
Smoothed RER distribution	
Highest	147.1
75%	107.6
Median (50%)	100.5
25%	93.4
Lowest	71.1
Geographical variation	

Evidence level:

None

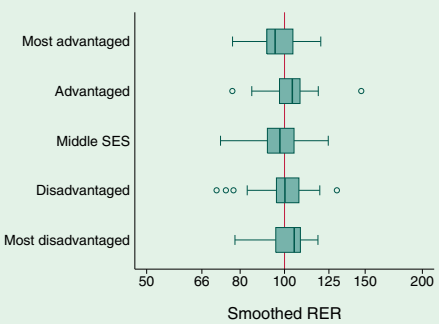
(p-value 0.971)

Level of Uncertainty

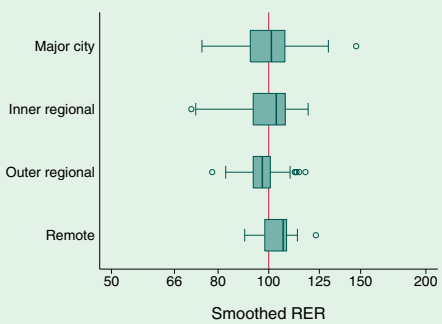


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



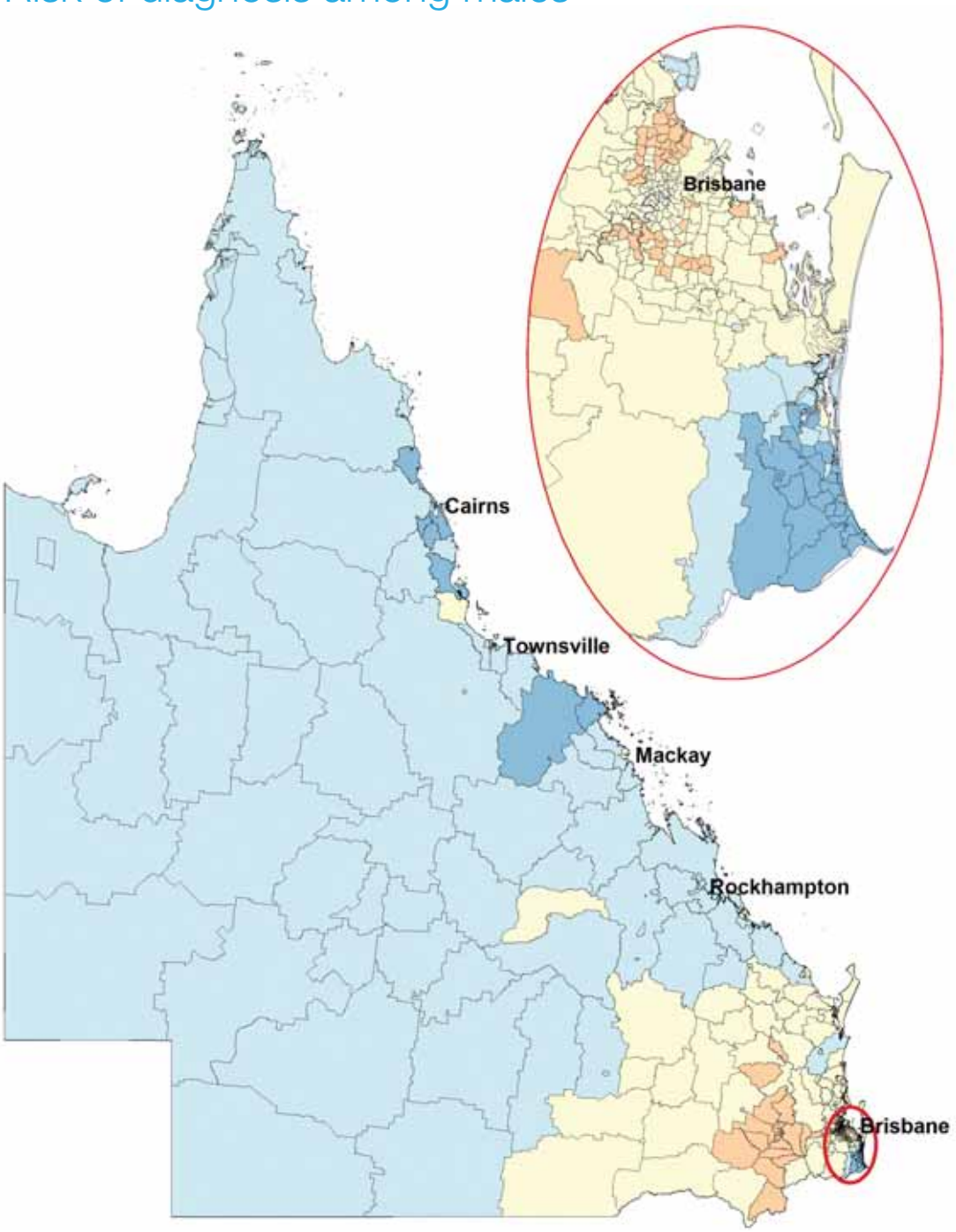
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Thyroid cancer

Risk of diagnosis among males

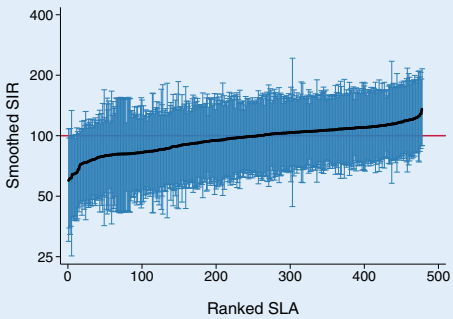


SIR

- Very high
- High
- Average
- Low
- Very low

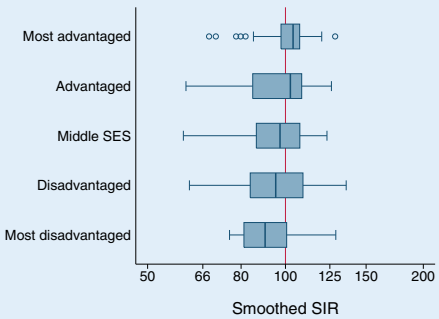
New cases/year	77
Rate/100,000	4.2
Smoothed SIR distribution	
Highest	135.7
75%	107.0
Median (50%)	98.6
25%	84.5
Lowest	59.9
Geographical variation	
Evidence level	
None	
(p-value 0.167)	

Level of Uncertainty

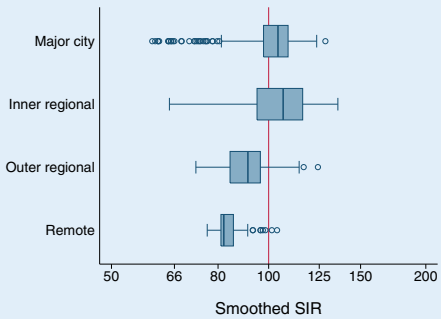


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



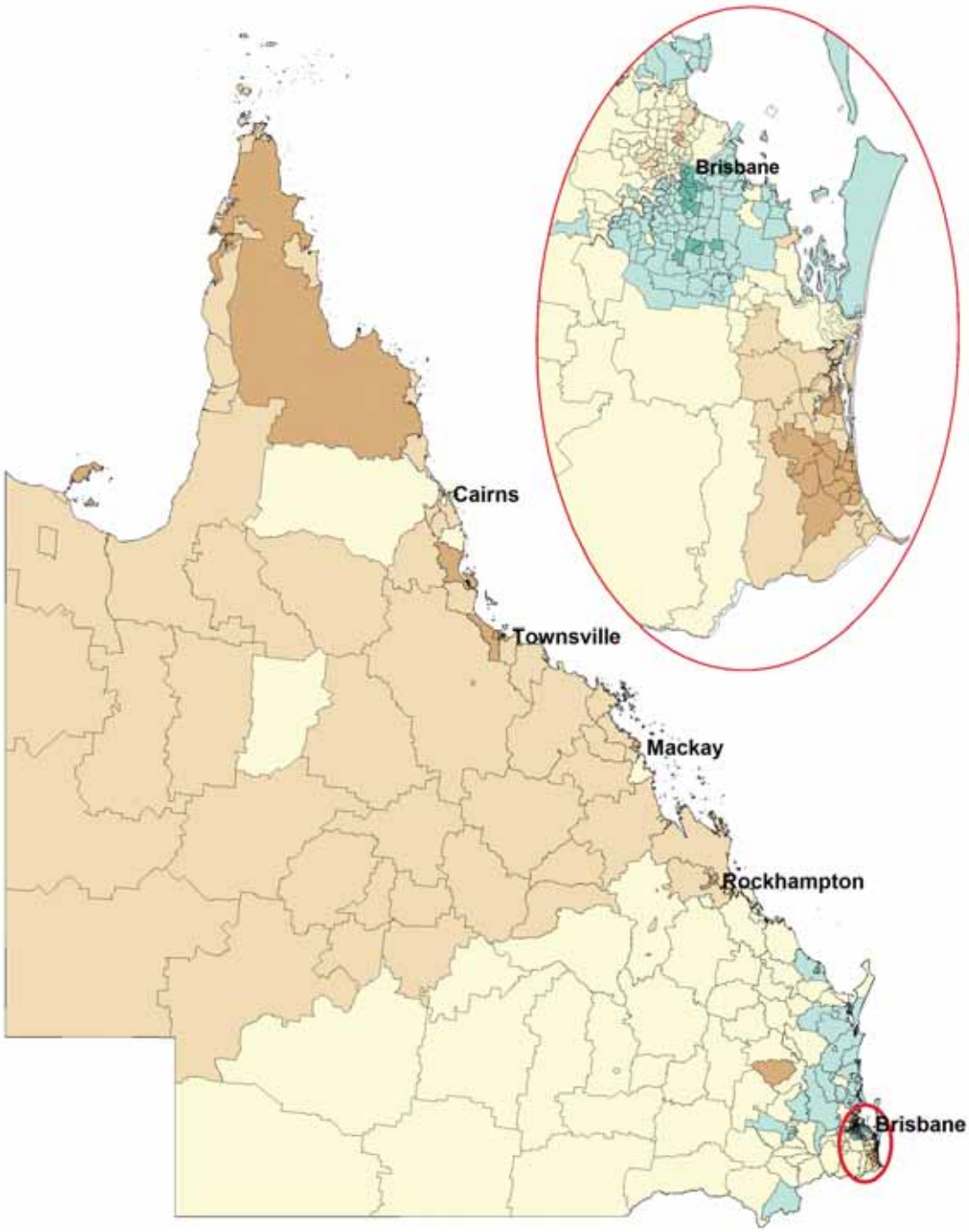
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Thyroid cancer

Risk of death within five years of diagnosis among males



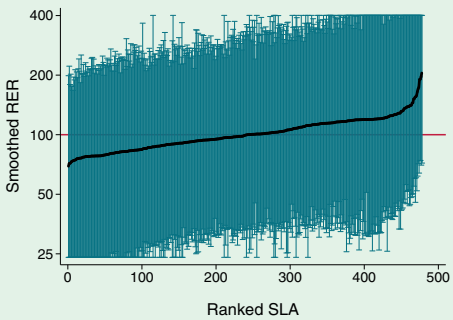
5-year mortality	7.9%
Smoothed RER distribution	
Highest	205.1
75%	114.9
Median (50%)	99.4
25%	87.5
Lowest	69.3
Geographical variation	

Evidence level:

None

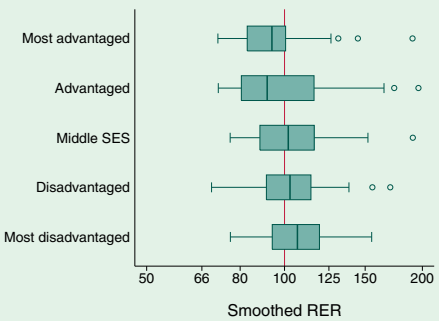
(p-value 0.740)

Level of Uncertainty

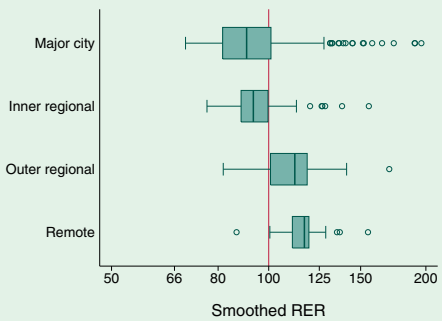


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



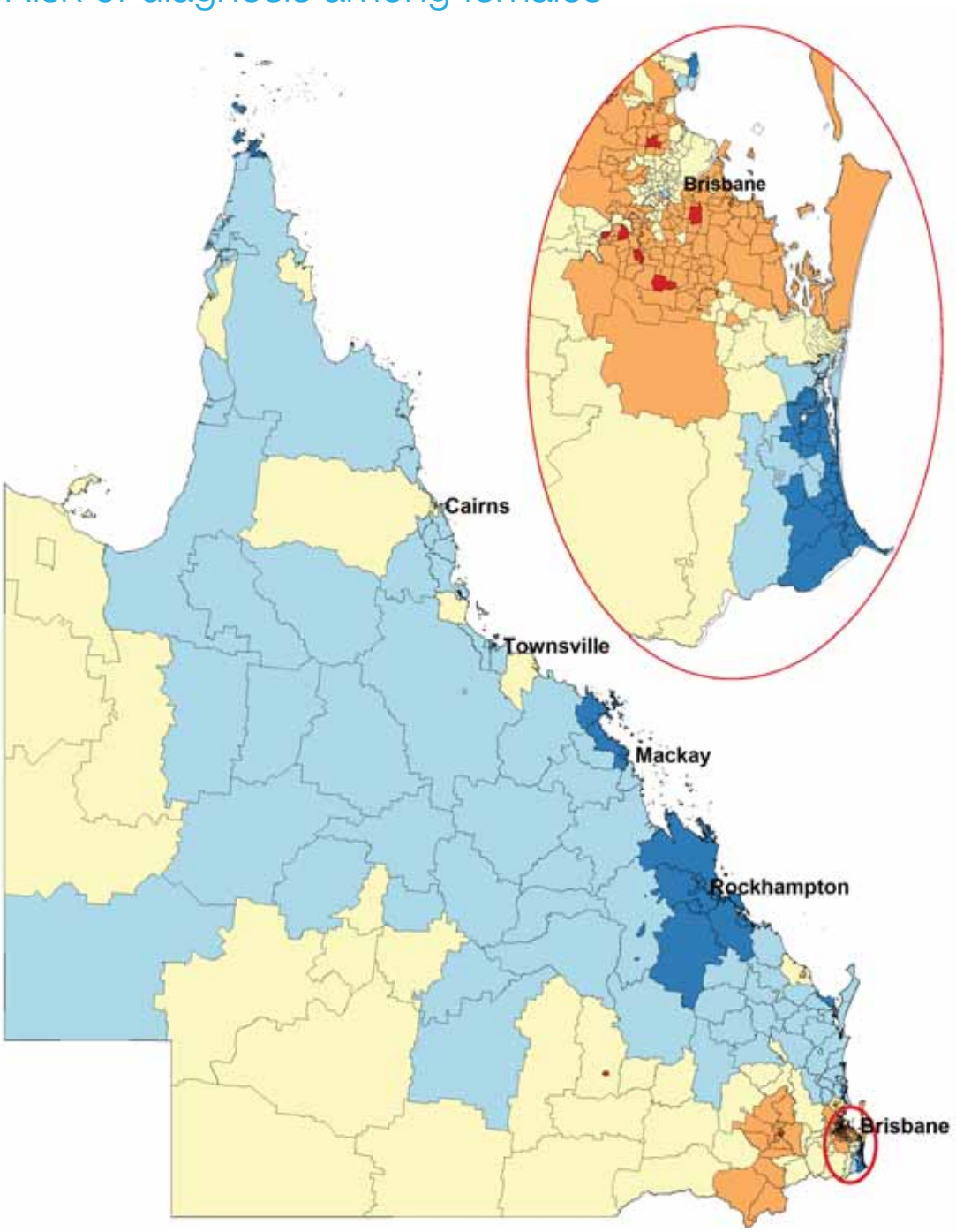
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Thyroid cancer

Risk of diagnosis among females

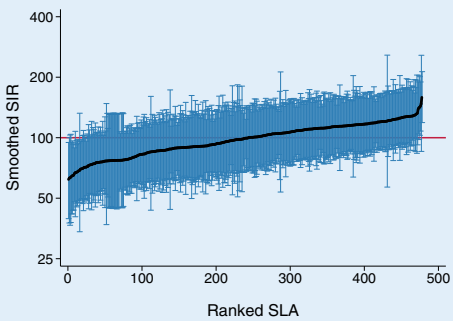


SIR

- Very high
- High
- Average
- Low
- Very low

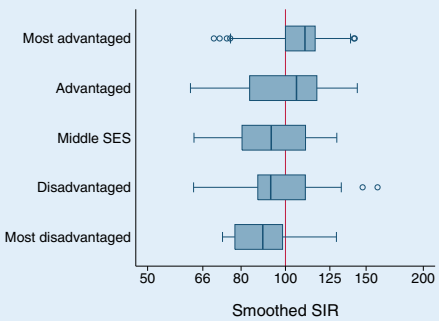
New cases/year	222
Rate/100,000	11.7
Smoothed SIR distribution	
Highest	158.9
75%	113.4
Median (50%)	99.5
25%	86.0
Lowest	62.0
Geographical variation	
Evidence level	
Strong	
(p-value 0.001)	

Level of Uncertainty

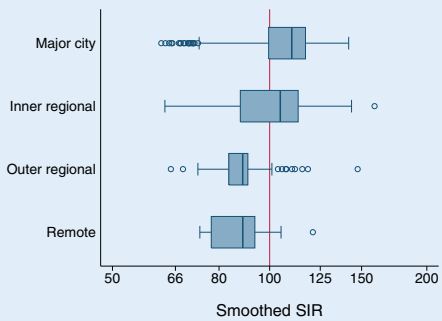


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



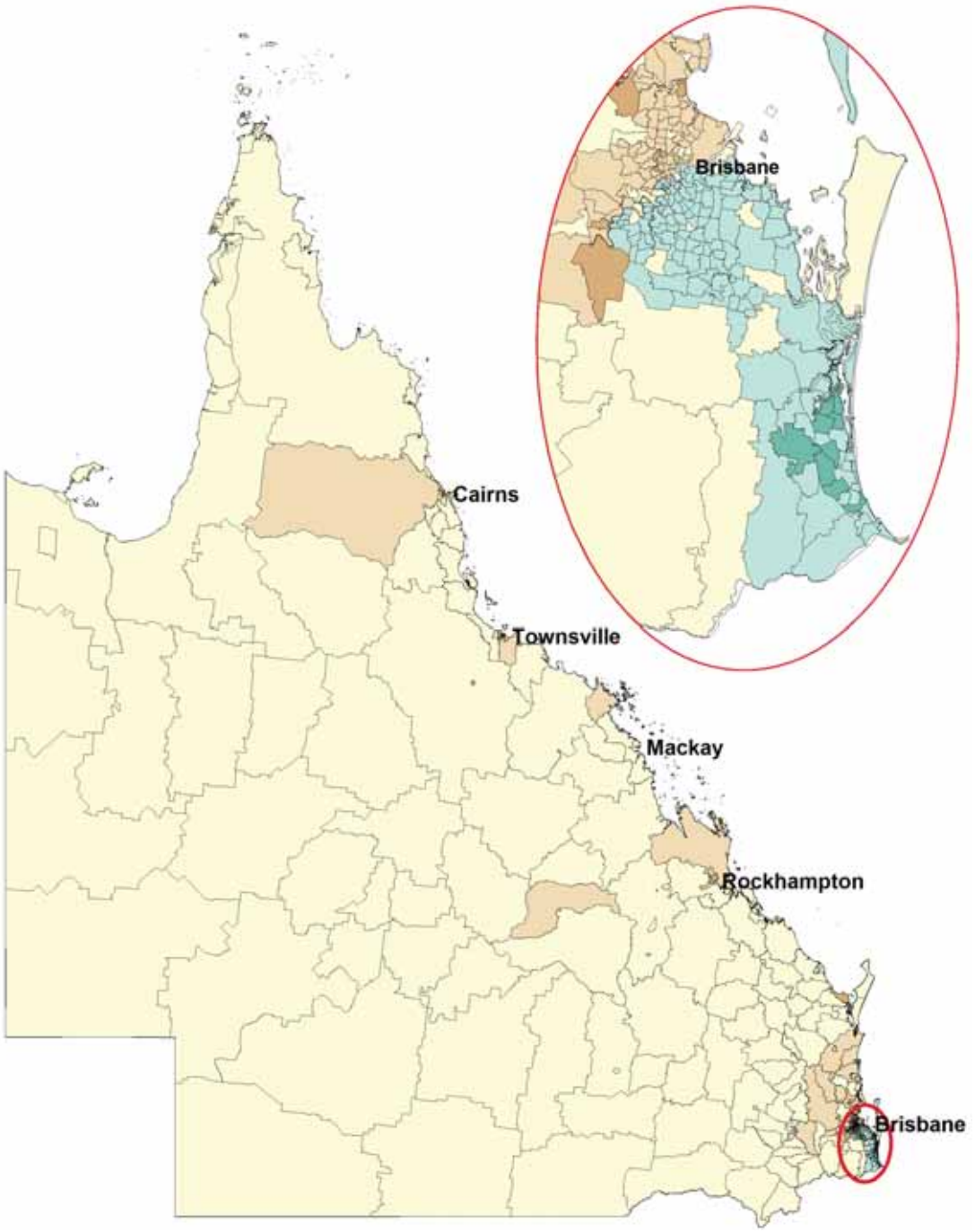
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Thyroid cancer

Risk of death within five years of diagnosis among females



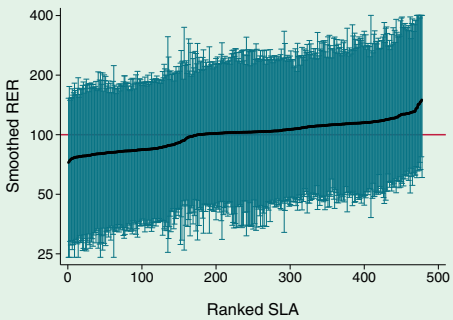
5-year mortality	2.4%
Smoothed RER distribution	
Highest	150.0
75%	112.4
Median (50%)	103.0
25%	85.3
Lowest	72.3
Geographical variation	

Evidence level:

None

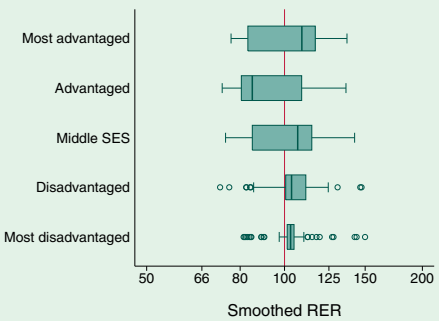
(p-value 1.000)

Level of Uncertainty

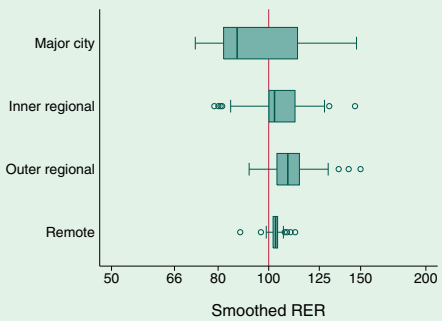


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



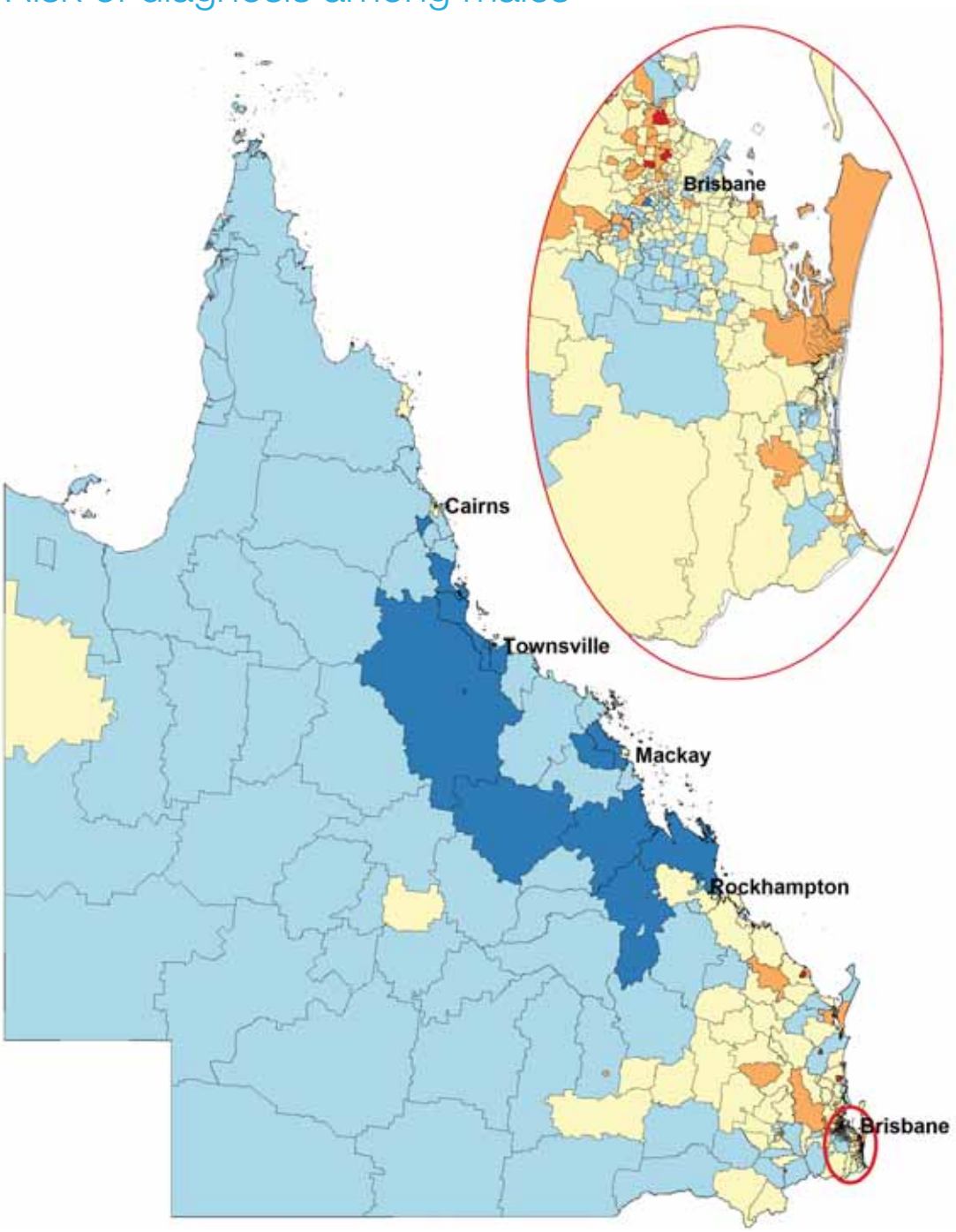
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Non-Hodgkin lymphoma

Risk of diagnosis among males

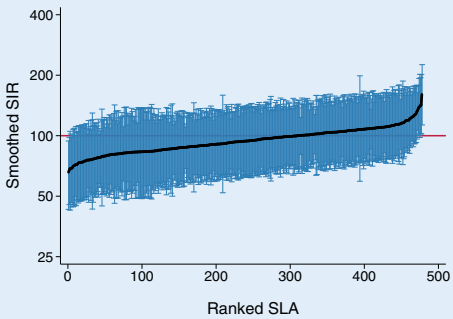


SIR

- Very high
- High
- Average
- Low
- Very low

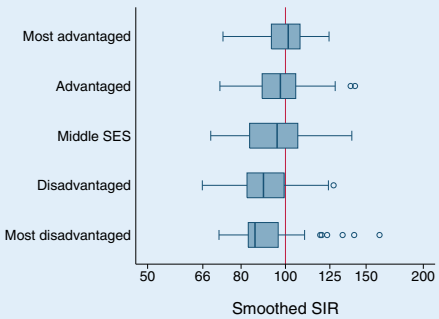
New cases/year	355
Rate/100,000	20.4
Smoothed SIR distribution	
Highest	160.5
75%	104.1
Median (50%)	94.0
25%	84.2
Lowest	65.8
Geographical variation	
Evidence level	
Strong	
(p-value 0.002)	

Level of Uncertainty

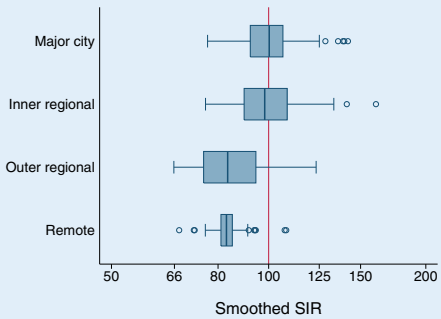


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



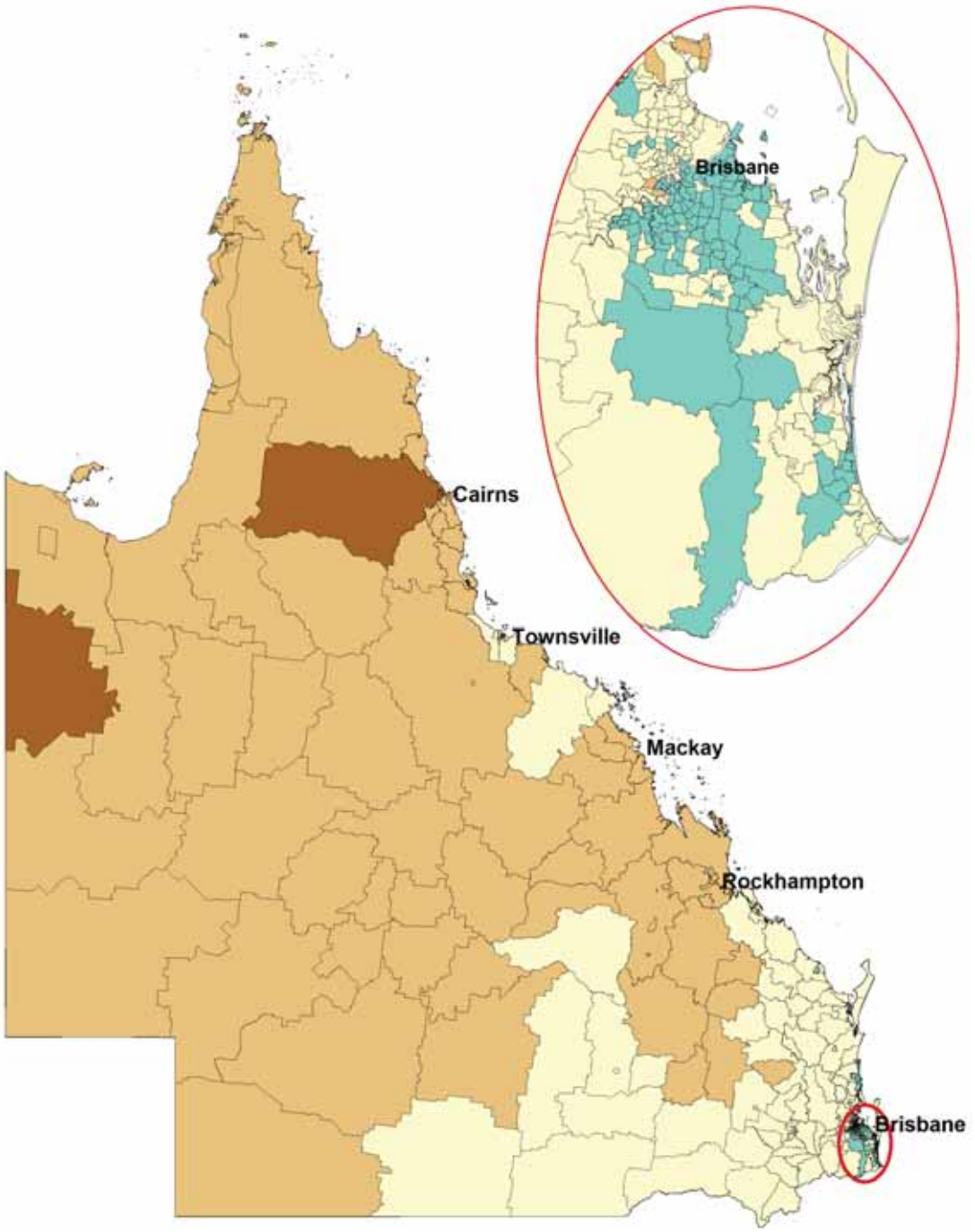
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Non-Hodgkin lymphoma

Risk of death within five years of diagnosis among males



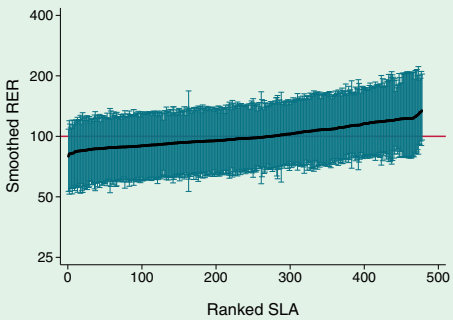
5-year mortality	35.6%
Smoothed RER distribution	
Highest	134.3
75%	108.9
Median (50%)	97.7
25%	90.7
Lowest	79.6
Geographical variation	

Evidence level:

Moderate

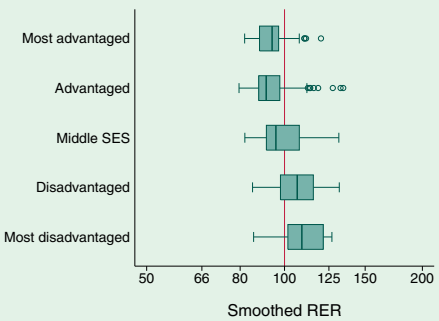
(p-value 0.030)

Level of Uncertainty

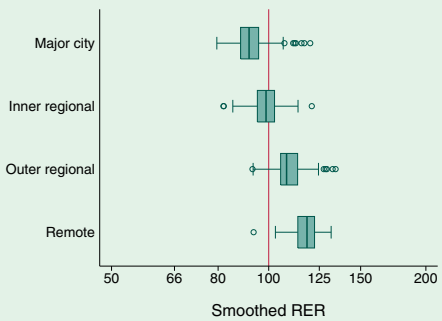


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



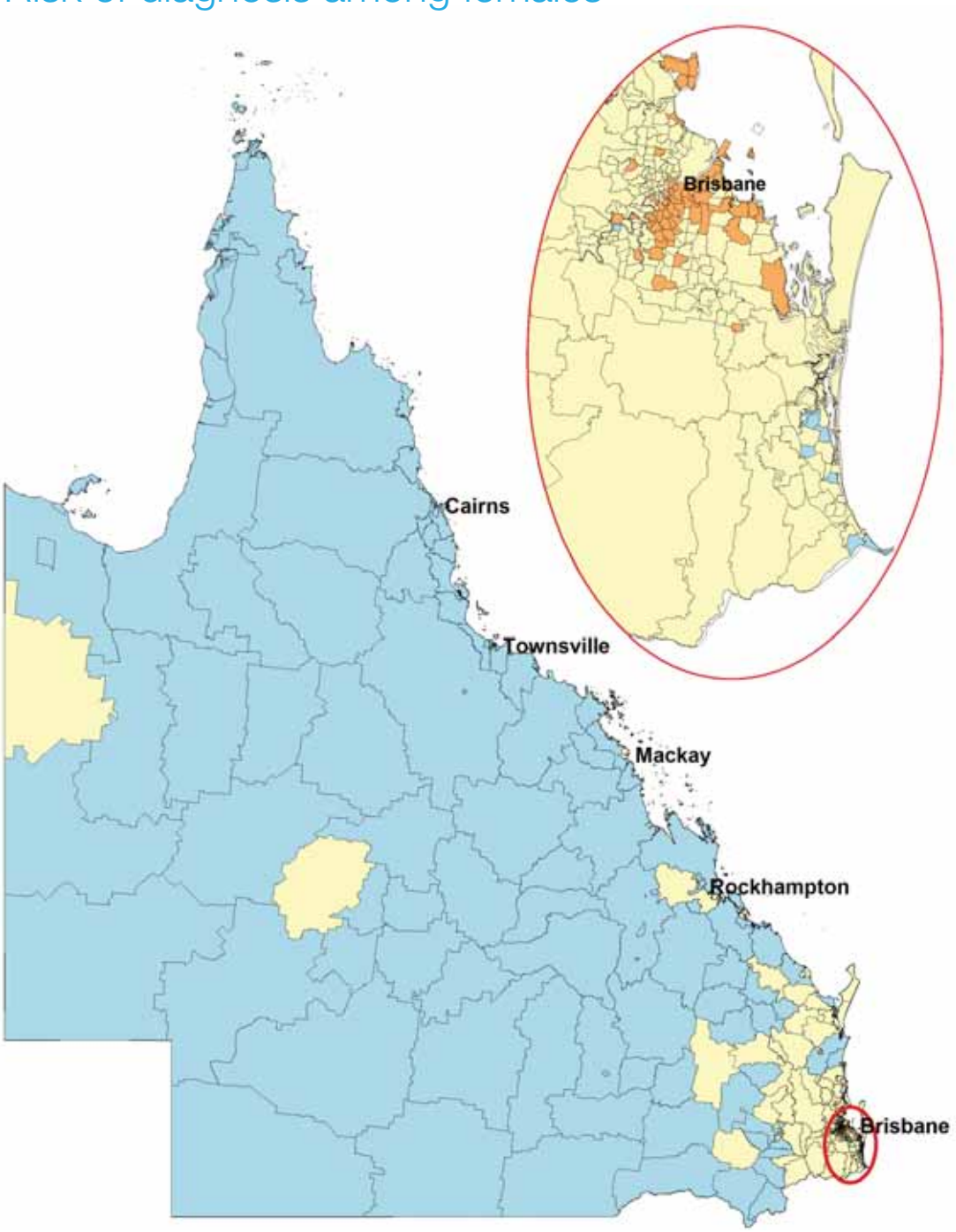
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Non-Hodgkin lymphoma

Risk of diagnosis among females



SIR

- Very high
- High
- Average
- Low
- Very low

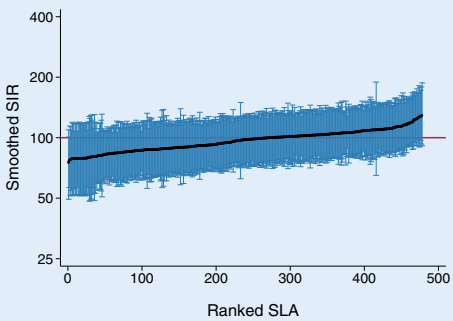
New cases/year	289
Rate/100,000	14.9
Smoothed SIR distribution	
Highest	129.4
75%	105.0
Median (50%)	97.9
25%	87.5
Lowest	75.2
Geographical variation	

Evidence level

Strong

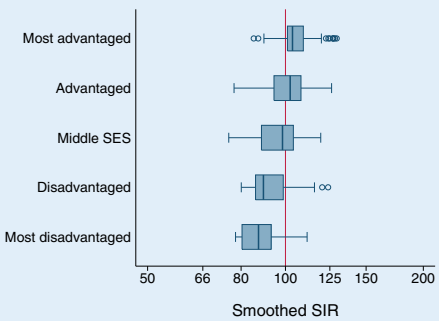
(p-value 0.001)

Level of Uncertainty

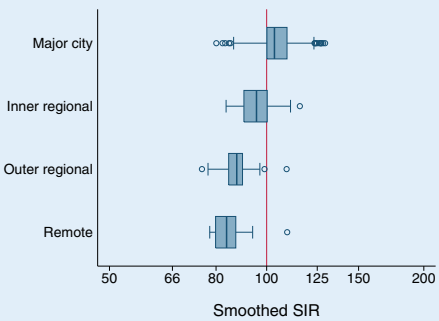


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



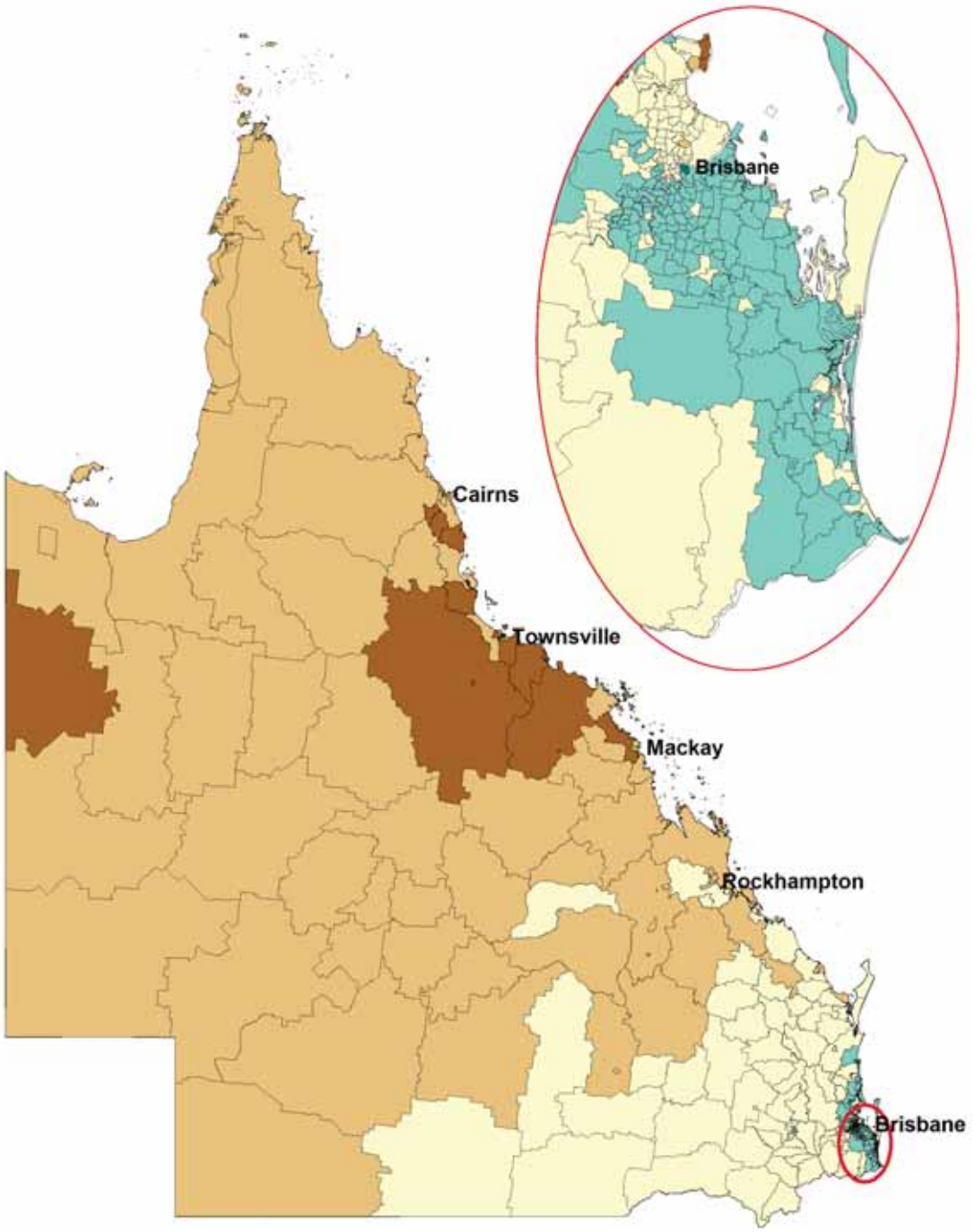
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Non-Hodgkin lymphoma

Risk of death within five years of diagnosis among females



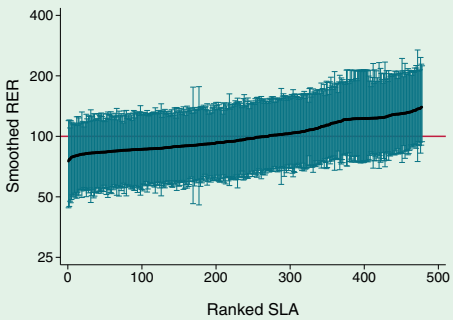
5-year mortality	33.9%
Smoothed RER distribution	
Highest	139.9
75%	116.5
Median (50%)	96.6
25%	87.0
Lowest	75.3
Geographical variation	

Evidence level:

Strong

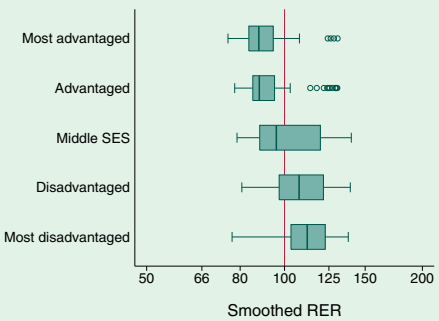
(p-value 0.002)

Level of Uncertainty

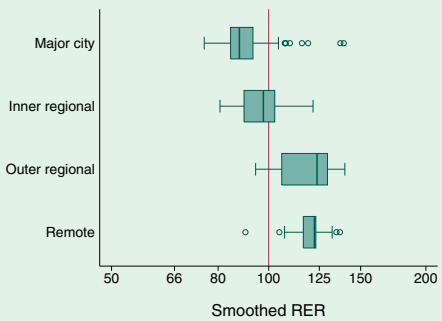


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



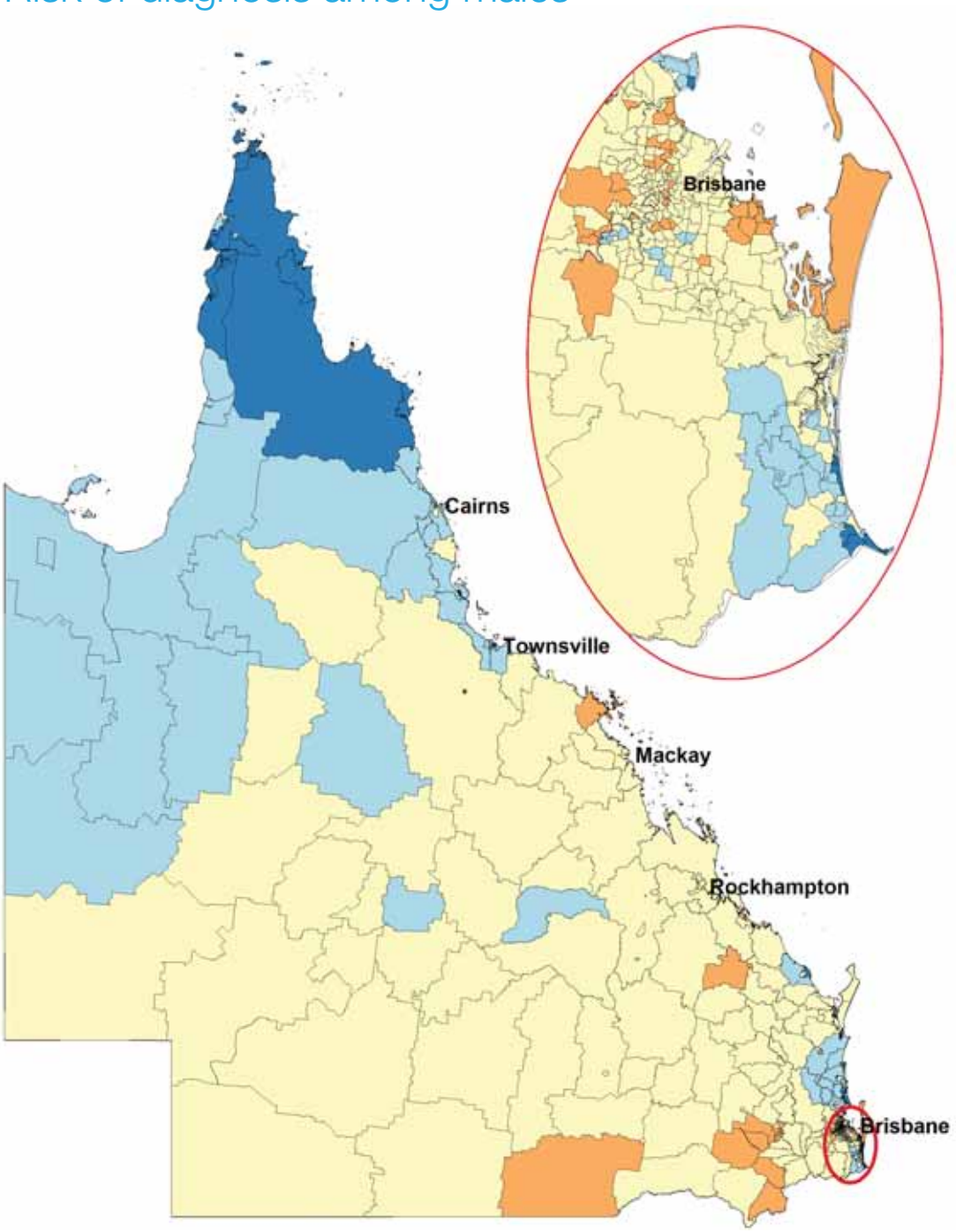
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Leukaemia

Risk of diagnosis among males

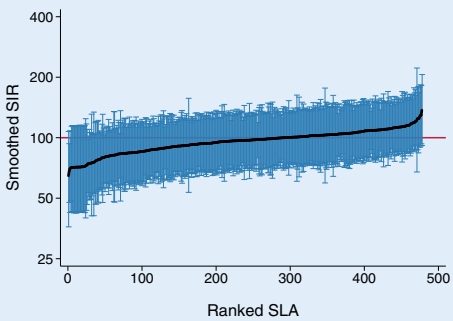


SIR

- Very high
- High
- Average
- Low
- Very low

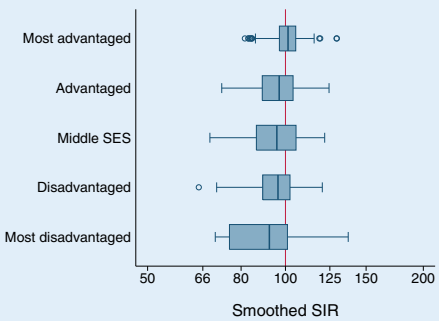
New cases/year	308
Rate/100,000	17.9
Smoothed SIR distribution	
Highest	137.1
75%	103.7
Median (50%)	97.1
25%	87.7
Lowest	64.7
Geographical variation	
Evidence level	
Moderate	
(p-value 0.037)	

Level of Uncertainty

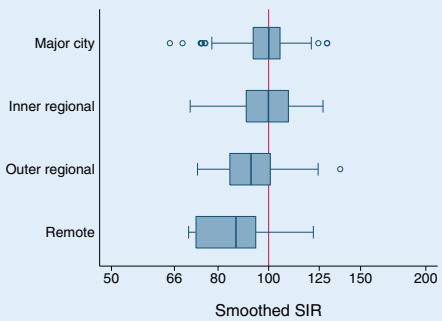


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



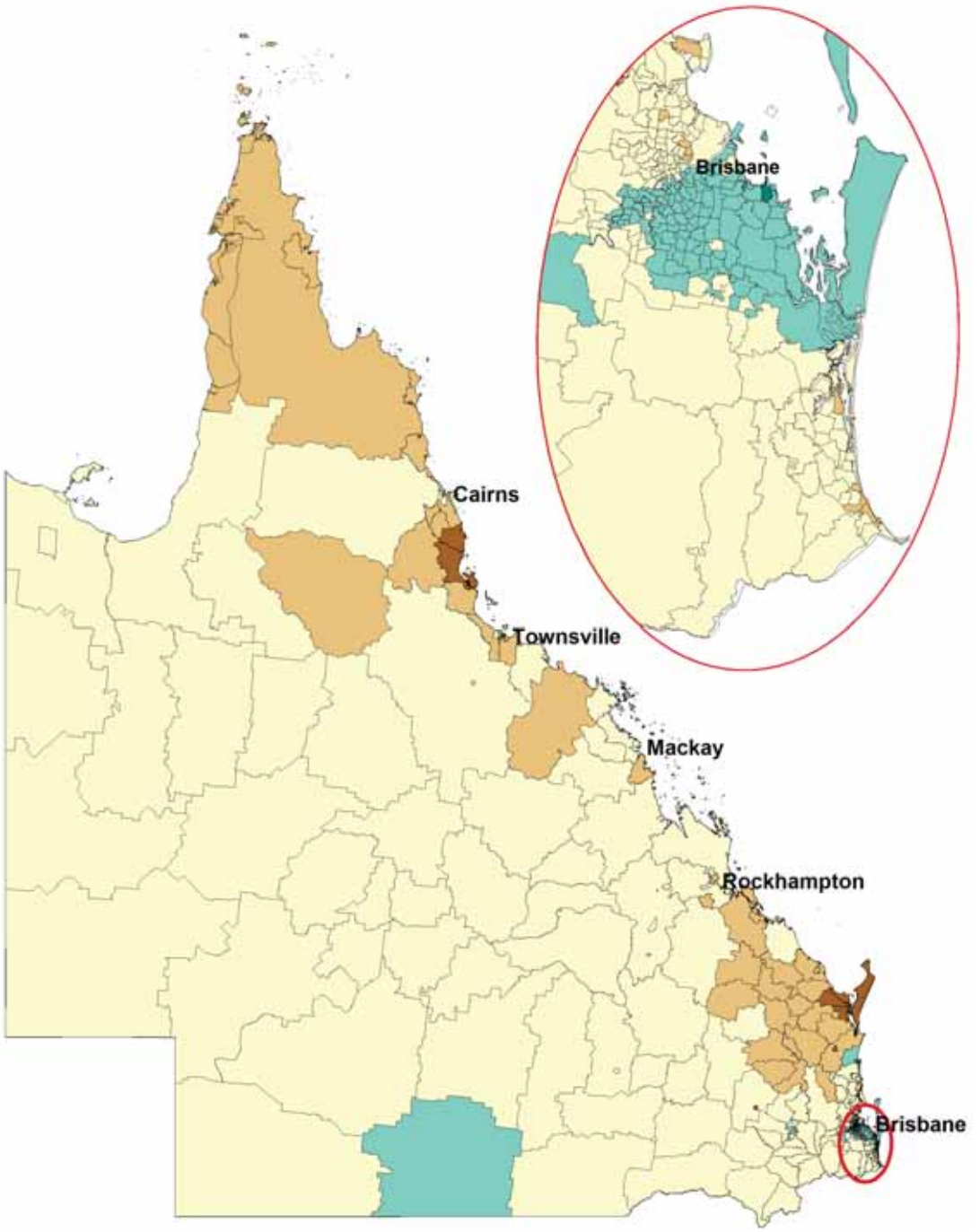
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Leukaemia

Risk of death within five years of diagnosis among males



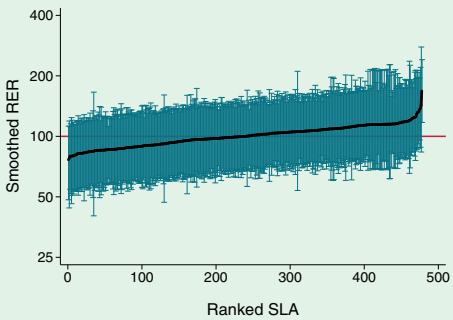
5-year mortality	43.2%
Smoothed RER distribution	
Highest	168.2
75%	109.0
Median (50%)	100.0
25%	90.8
Lowest	76.5
Geographical variation	

Evidence level:

Moderate

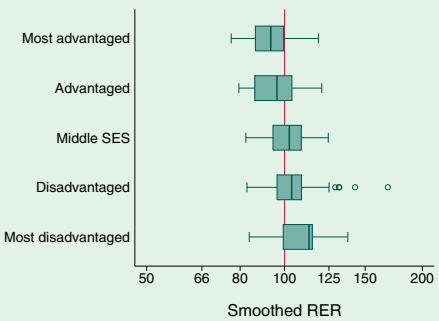
(p-value 0.013)

Level of Uncertainty

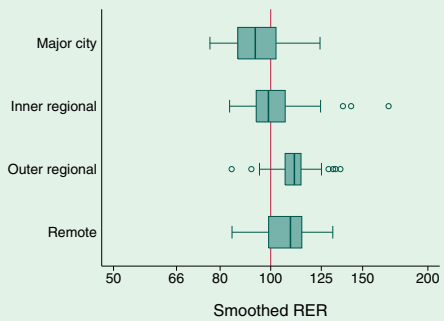


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



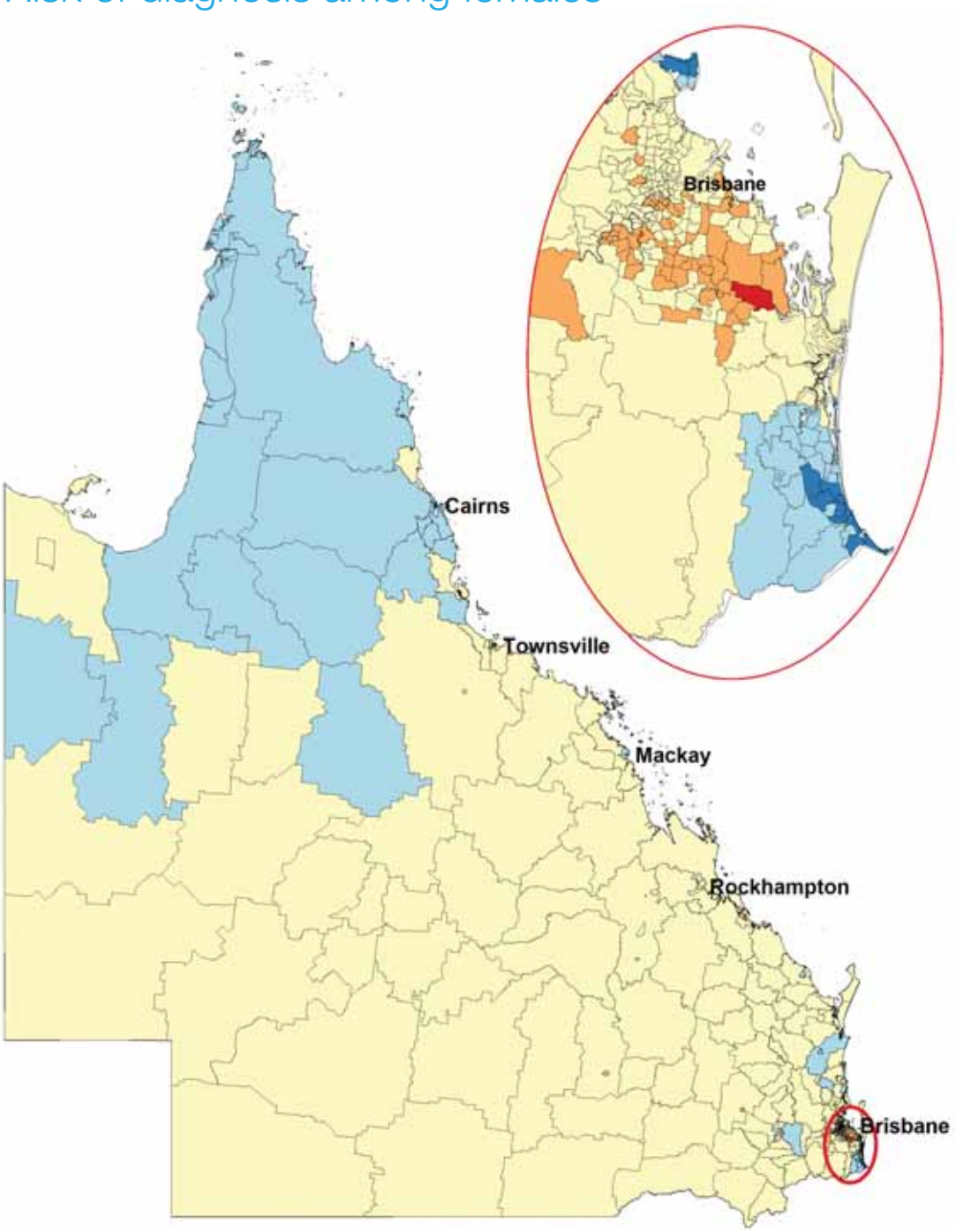
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Leukaemia

Risk of diagnosis among females

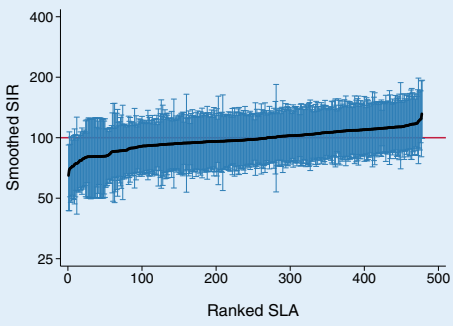


SIR

- Very high
- High
- Average
- Low
- Very low

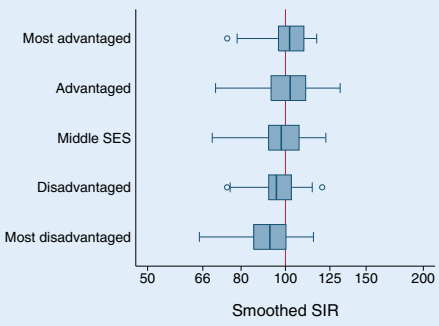
New cases/year	209
Rate/100,000	10.8
Smoothed SIR distribution	
Highest	131.7
75%	106.9
Median (50%)	97.5
25%	91.9
Lowest	64.9
Geographical variation	
Evidence level	
Moderate	
(p-value 0.011)	

Level of Uncertainty

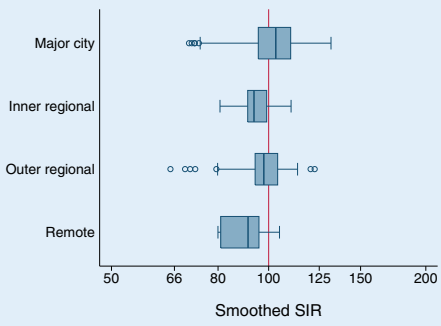


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Leukaemia

Risk of death within five years of diagnosis among females

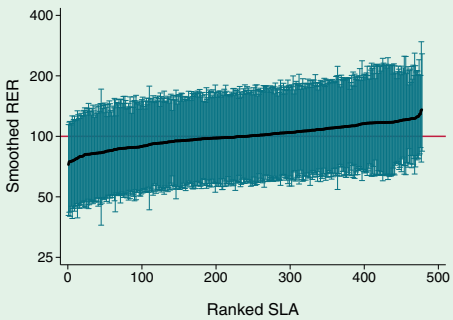
5-year mortality	40.6%
Smoothed RER distribution	
Highest	135.8
75%	110.2
Median (50%)	100.1
25%	92.2
Lowest	72.4
Geographical variation	

Evidence level:

None

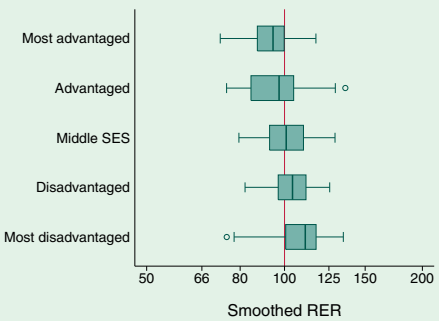
(p-value 0.291)

Level of Uncertainty

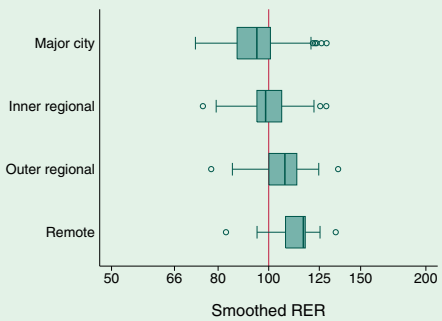


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



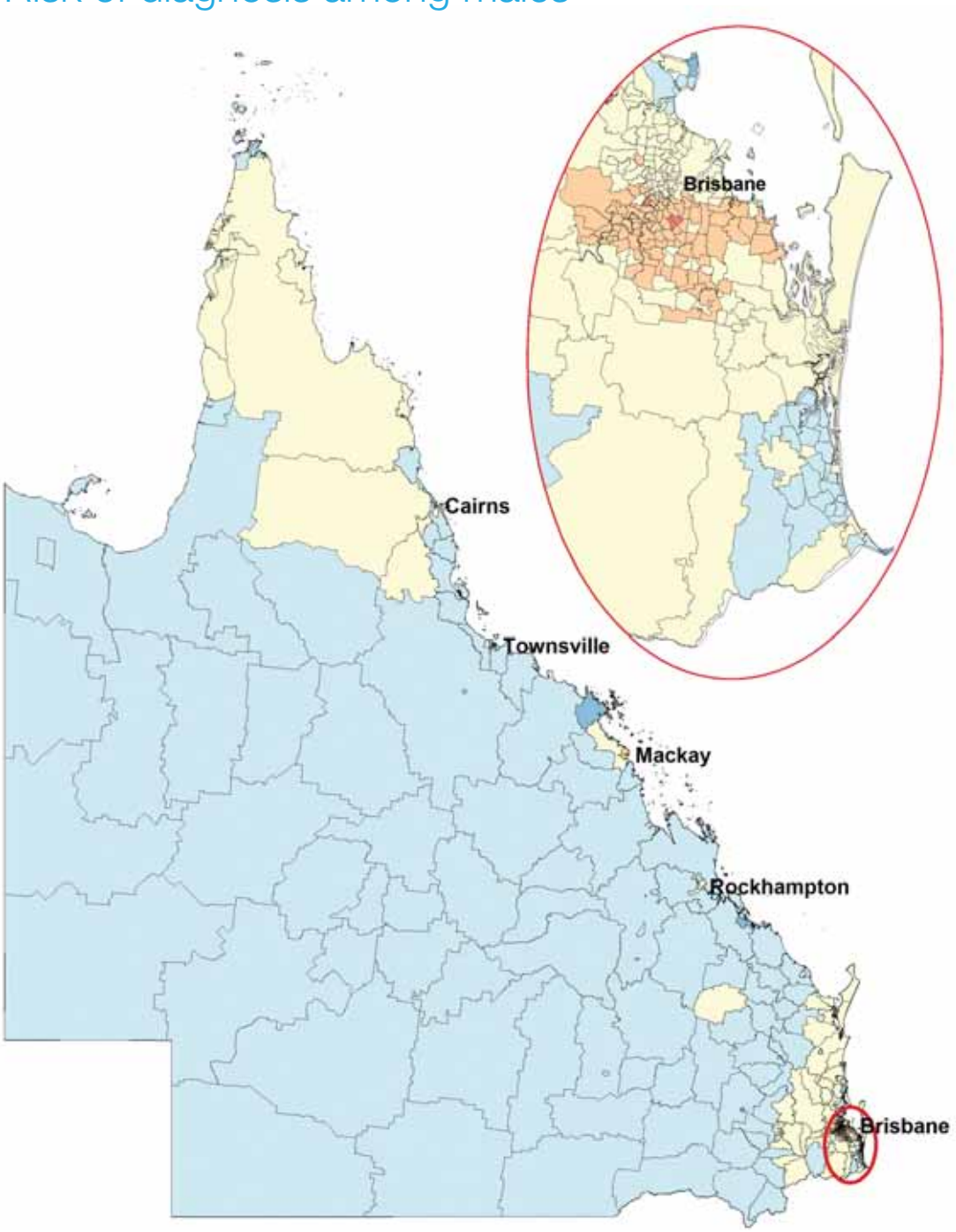
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Myeloma

Risk of diagnosis among males

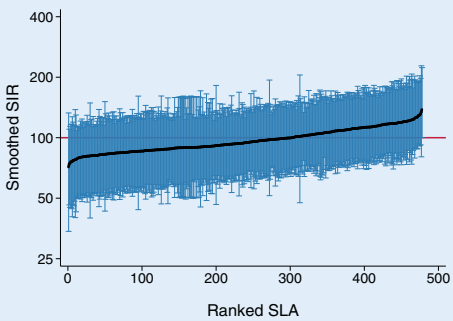


SIR

- Very high
- High
- Average
- Low
- Very low

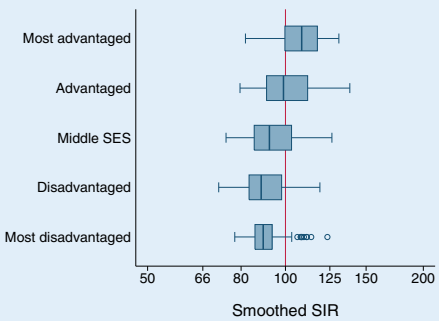
New cases/year	119
Rate/100,000	7.1
Smoothed SIR distribution	
Highest	138.2
75%	107.8
Median (50%)	94.5
25%	87.0
Lowest	71.5
Geographical variation	
Evidence level	
Weak	
(p-value 0.084)	

Level of Uncertainty

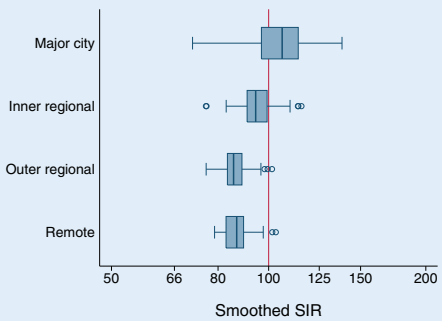


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



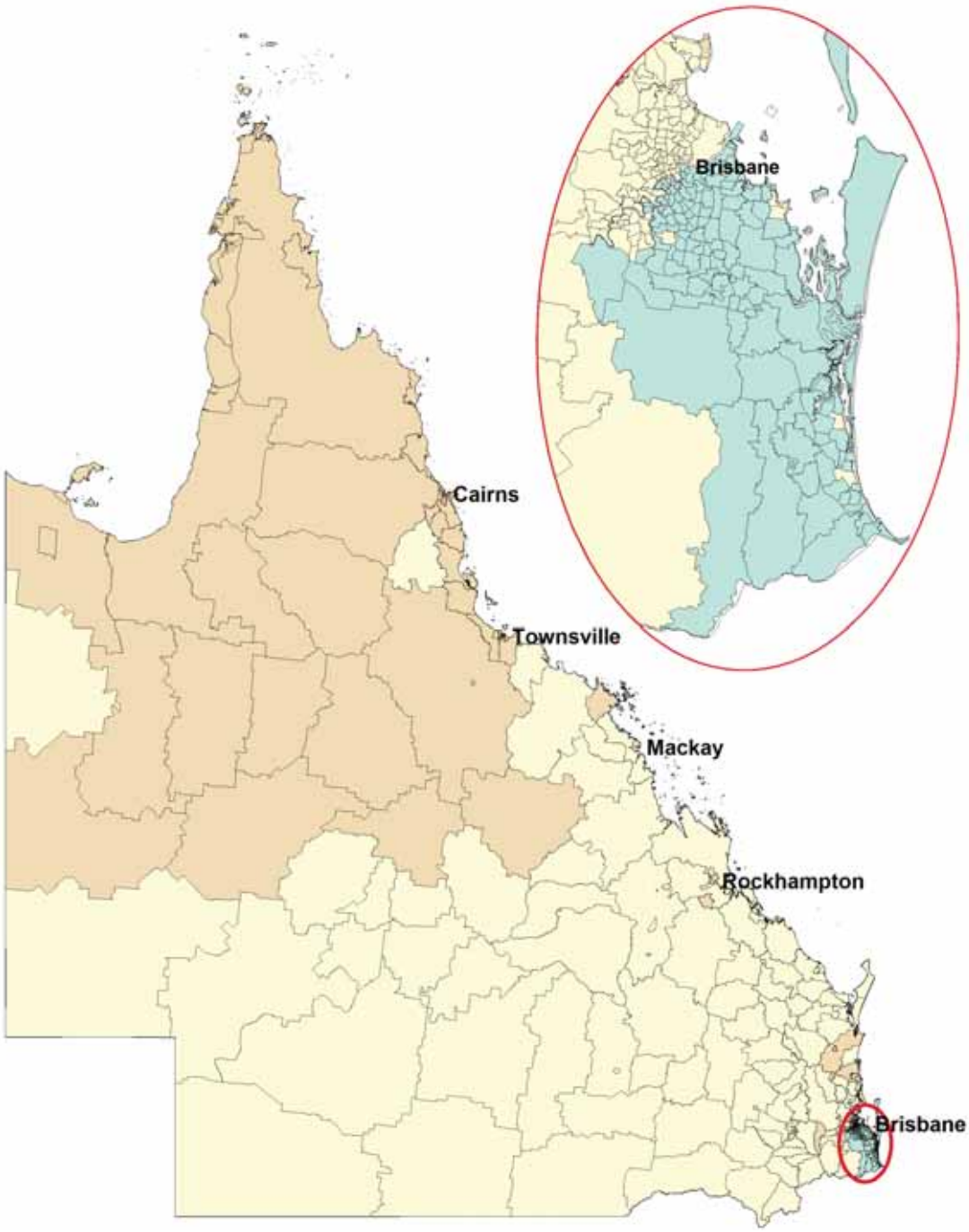
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Myeloma

Risk of death within five years of diagnosis among males



RER
- Very high
- High
- Average
- Low
- Very low

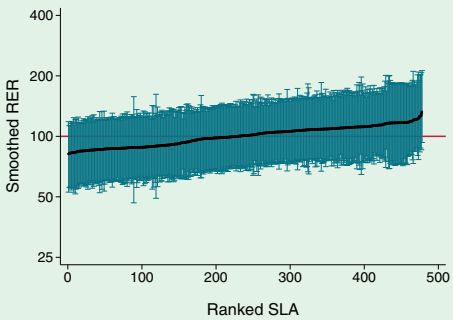
5-year mortality	58.2%
Smoothed RER distribution	
Highest	132.5
75%	109.3
Median (50%)	100.9
25%	89.6
Lowest	81.8
Geographical variation	

Evidence level:

None

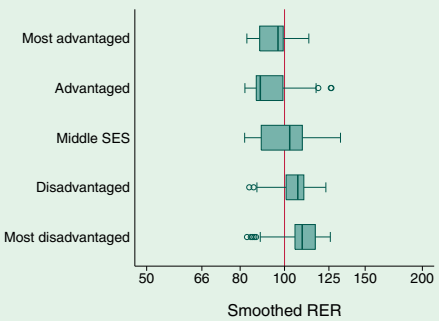
(p-value 0.222)

Level of Uncertainty

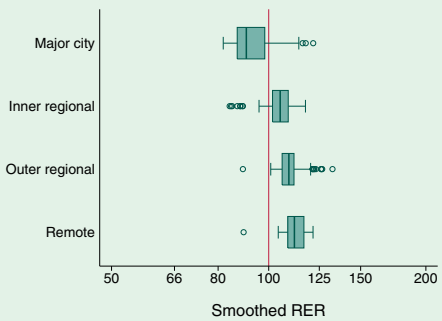


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



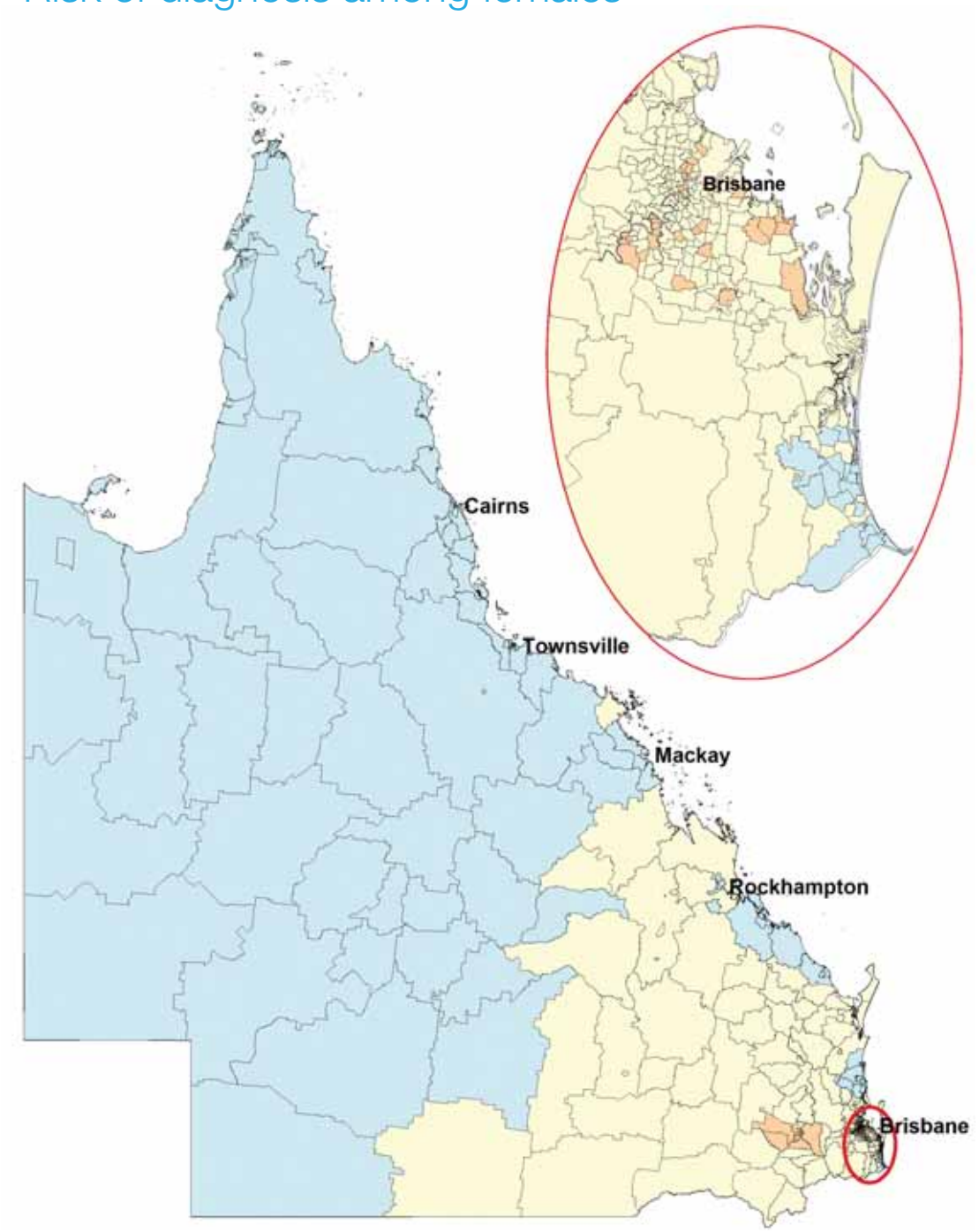
(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Myeloma

Risk of diagnosis among females

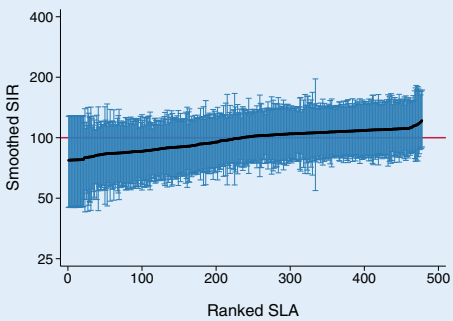


SIR

- Very high
- High
- Average
- Low
- Very low

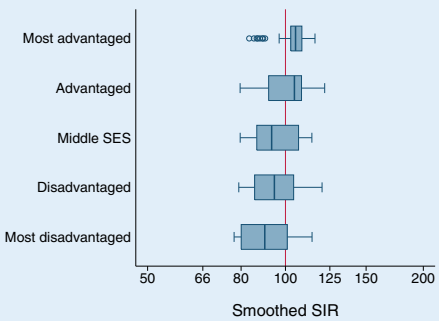
New cases/year	91
Rate/100,000	4.7
Smoothed SIR distribution	
Highest	121.8
75%	106.9
Median (50%)	100.7
25%	87.3
Lowest	77.2
Geographical variation	
Evidence level	
None	
(p-value 0.183)	

Level of Uncertainty

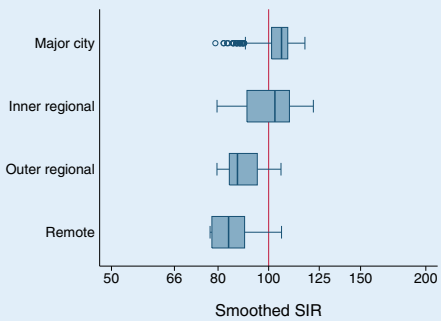


Distribution of smoothed SIR estimates according to:

(a) Socioeconomic status



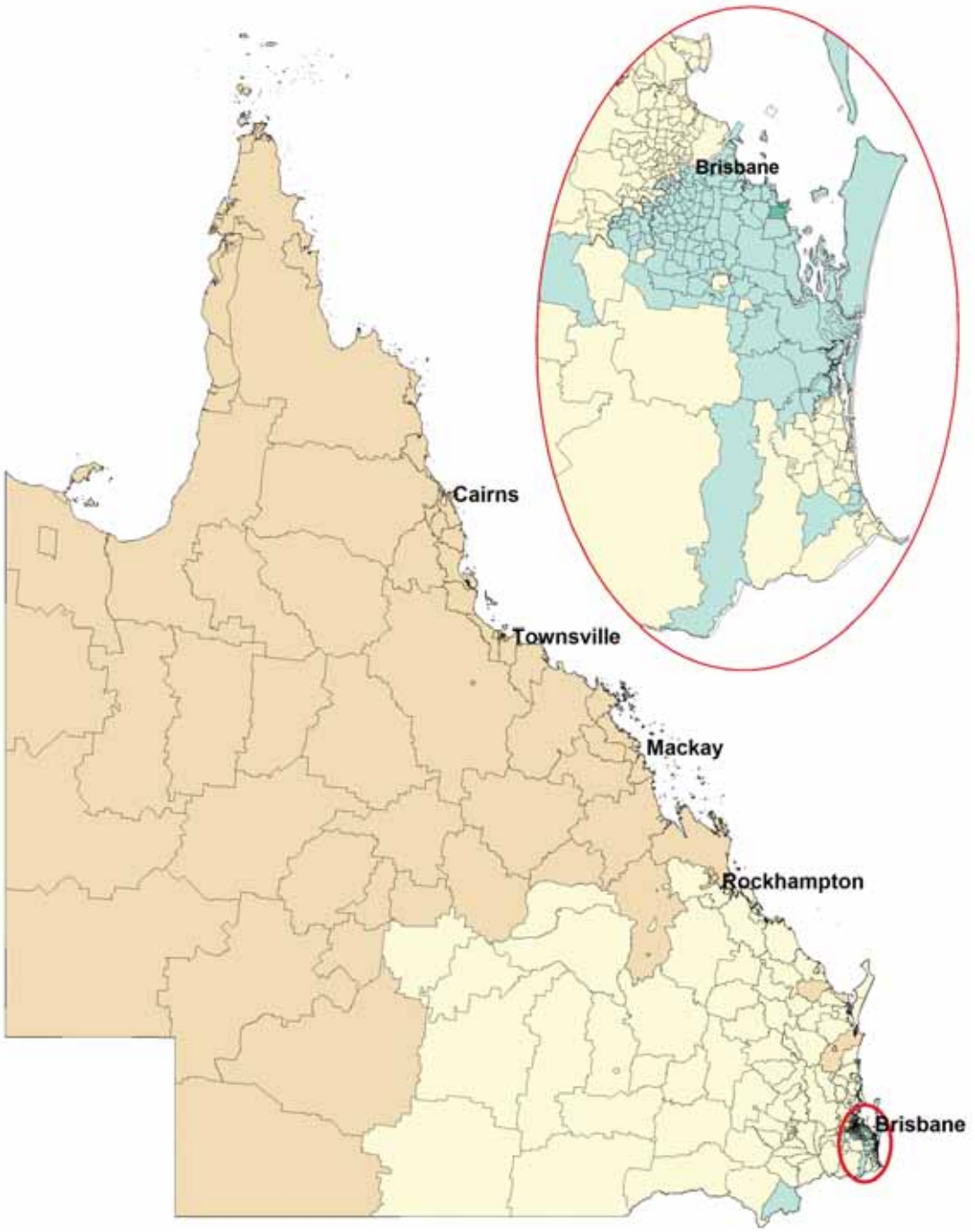
(b) Rurality



Notes: Smoothed SIR (Standardised Incidence Ratio) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for cases diagnosed between 1998 and 2007.

Myeloma

Risk of death within five years of diagnosis among females



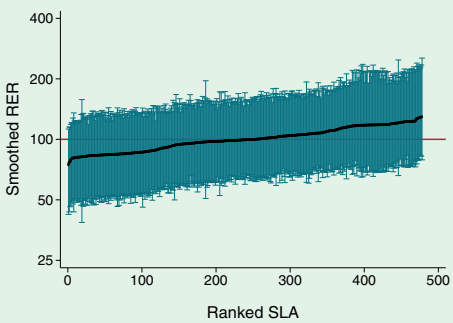
5-year mortality	55.6%
Smoothed RER distribution	
Highest	129.8
75%	110.9
Median (50%)	99.6
25%	88.8
Lowest	74.7
Geographical variation	

Evidence level:

None

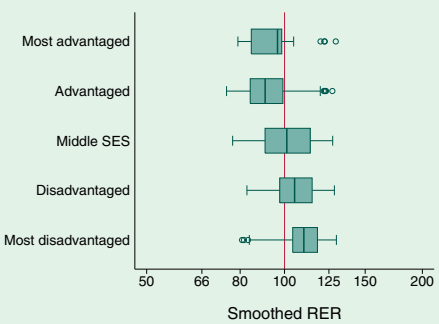
(p-value 0.225)

Level of Uncertainty

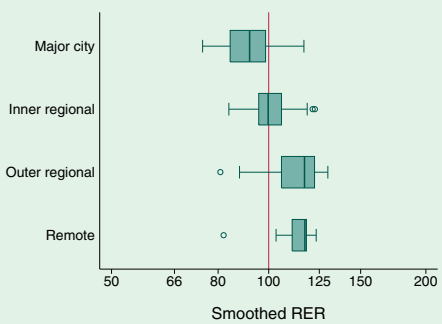


Distribution of smoothed RER estimates according to:

(a) Socioeconomic status



(b) Rurality



Notes: Smoothed RER (Relative Excess Risk) estimates are in comparison to the Queensland average (red line on graphs), and should not be directly compared between SLAs (Statistical Local Areas). Data are for 'at risk' cases in the period 1998 and 2007.

Appendix A – Related Cancer Council Queensland reports

Queensland Cancer Registry. *Cancer in Queensland: Incidence, Mortality, Survival and Prevalence 1982 to 2007*. QCR, Cancer Council Queensland and Queensland Health, June 2010 (www.cancerqld.org.au/pdf/qcr_report/).

Youlden DR, Cramb SM, Baade PD. *Current status of female breast cancer in Queensland: 1982 to 2006*. Viertel Centre for Research in Cancer Control, Cancer Council Queensland, April 2009 (www.cancerqld.org.au/pdf/breast_report.pdf).

Youlden DR, Cramb SM, Baade PD. *Current status of colorectal cancer in Queensland: 1982 to 2005*. Viertel Centre for Research in Cancer Control, Cancer Council Queensland, September 2008 (www.cancerqld.org.au/pdf/colorectal_report.pdf).

Youlden DR, Cramb SM, Baade PD. *Current status of lung cancer in Queensland: 1982 to 2004*. Viertel Centre for Research in Cancer Control, The Cancer Council Queensland, December 2007 (www.cancerqld.org.au/pdf/lung_report.pdf).

Baade PD, Steginga SK, Aitken JF. *Current status of prostate cancer in Queensland, 1982 to 2002*. Viertel Centre for Research in Cancer Control, Queensland Cancer Fund, October 2005 (www.cancerqld.org.au/downloads/prostate_report.pdf).

Baade P, Fritschi L, Aitken J. *Geographical differentials in cancer incidence and survival in Queensland: 1996-2002*. Viertel Centre for Research in Cancer Control, Queensland Cancer Fund, October 2005. (www.cancerqld.org.au/downloads/Geographical_differentials_report/).

Appendix B – Methods

Cancer classifications

Throughout this report the definitions of cancer type (Table B1) are the same as those currently used by the Queensland Cancer Registry, as shown in their annual report.[63] These definitions are based on the World Health Organization's International Classification of Diseases for Oncology, 3rd edition (ICD-O3).[64]

Table B1: Cancer ICD-O3 codes

Type of cancer	ICD-O3 code
All invasive cancers	C00-C80 (excluding C44 (M805-M811))
Oesophageal cancer	C15
Stomach cancer	C16
Colorectal cancer	C18-C20 and C218
Pancreatic cancer	C25
Lung cancer	C33-C34
Melanoma	C44 and M872-M879
Breast cancer	C50
Cervical cancer	C53
Uterine cancer	C54
Ovarian cancer	C56
Prostate cancer	C61
Kidney cancer	C64-C66 and C68
Bladder cancer	C67
Brain cancer	C70-C72
Thyroid cancer	C73
Non-Hodgkin lymphoma	M959, M967-M971
Leukaemia	M980-M994
Myeloma	M973

Data sources

Australian Bureau of Statistics (ABS)

Population data were obtained from the Australian Bureau of Statistics.[14,15] These data include estimated population counts by age group, sex, year and SLA of residence. Population data were primarily used in this report as the denominator for calculating rates and for age-standardisation.

De-identified unit record mortality data for all causes of death for Queensland residents were also obtained from the Australian Bureau of Statistics.[16] These data were used to calculate expected population mortality estimates for the relative survival models. Since some Queensland residents die interstate, permission was obtained from the Registrar of Births, Deaths and Marriages in every State and Territory in Australia to access these data.

Queensland Cancer Registry (QCR)

De-identified data on all cancers diagnosed among people living in Queensland during 1996 to 2007 were obtained from the QCR. Ethical approval to conduct this study was obtained from the Central Office Human Research Ethics Committee of Queensland Health (HREC/09/QHC/25). Approval to extract the data was obtained from the Chief Executive Officer – Centre for Health Care Improvement, Queensland Health, under delegation by the Director-General, Queensland Health.

The QCR is a population-based cancer registry that maintains a record of all cases of cancer diagnosed in Queensland since 1982, with data currently available to the end of 2007.[63] Cancer Council Queensland has managed the processing operations of the QCR on behalf of Queensland Health since October 2000.

Details of all cancers diagnosed in Queensland are legally required to be included in the QCR under the Public Health Act 2005. Notifications of patients with cancer are received from all public and private hospitals and nursing homes throughout the State. Queensland pathology laboratories are also required to provide copies of pathology reports for cancer specimens. Information regarding the deaths of people diagnosed with cancer is provided to the QCR by the Registrar of Births, Deaths and Marriages.

Further details about the QCR can be found in their annual report.[63]

Bayesian methods

Background

Bayesian methods make inferences from data using probability models. Rather than basing the analysis entirely on the observed data, Bayesian models utilise probability distributions for the variables included in the model. These distributions are called 'prior' distributions, and are generated using previous (or 'prior') knowledge about the variables in question, or the characteristics they are expected to have.

All probability distributions have parameters controlling their shape, such as the *mean* and *variance*. Unfortunately, when specifying the 'prior' distribution, there is often little or no information to guide what these distributions should look like.[13] Rather than give these parameters specific values, they can instead be given a distribution of values (called 'hyperprior' distributions) to reflect this uncertainty. This results in different levels, or hierarchies, of distributions governing the behaviour of the variables in the models. These are known as Bayesian hierarchical models.

In a spatial model, the underlying assumption is that neighbouring regions are more likely to share similar features than regions that are further apart. Hence the parameters of a region could be better estimated by using the data in that region, as well as incorporating information obtained from the neighbouring regions. These two sources of information are weighted by the populations in the regions, so that areas which have small populations will be subjected to greater neighbourhood 'smoothing' than areas with larger populations. A recommended way of modelling spatial variation is to include two random effects components – one which smooths the estimates towards their neighbours (spatial heterogeneity), and one which smooths the estimates towards the overall State average (uncorrelated heterogeneity).[21]

Development of the neighbourhood adjacency matrix

For this report, SLAs were defined as neighbours if they shared a common physical boundary, known as "Queen" adjacencies. This neighbourhood matrix was then manually adjusted to ensure all regions had at least one neighbour, even if the region was an island. In particular, most of the islands in far North Queensland were grouped together. Details of the neighbour groupings used for this report are available from the authors on request.

Models

The Bayesian models were run using WinBUGS[65] interfaced with Stata[66] (using the wb commands written by John Thompson, University of Leicester[67]). A burn-in period of 100,000 and 250,000 iterations was used initially for the incidence and survival models, respectively, with a subsequent 100,000 iterations run. Since the posterior distribution was simulated using Markov Chain Monte Carlo (MCMC) methods with Gibbs sampling, the value of each iteration depends on the previous one. To decrease autocorrelation every 10th iteration was kept, resulting in 10,000 iterations used to calculate the final estimates.

Convergence of the Bayesian models for each combination of cancer type and sex was assessed using visual examination of autocorrelation, trace and density plots,[68] as well as Geweke[69] diagnostics.

Incidence

Data were aggregated by sex and 5-year age groups (0-4, 5-9…, 80-84, 85+) and standardised against the Queensland population to calculate the indirectly standardised incidence ratio (SIR) for each SLA. These 'crude' SIR components (observed and expected cases) were then used in the Bayesian model. The Besag, York and Mollié (BYM) model was used, as this is the standard model used in disease mapping.[22]

The BYM model separates area-specific random effects into 2 components: one which takes into account the effects that vary in a structured manner (spatial or correlated heterogeneity), and one which models the effects that vary in an unstructured way between areas (uncorrelated heterogeneity).[70]

The model is:

$$y_i \sim \text{Poisson}(e_i\theta_i)$$

$$\log(\theta_i) = \alpha + u_i + v_i$$

where α is the overall level of relative risk, u_i are the correlated (spatial) heterogeneity and v_i are the unstructured random effects.[70] A normal distribution was assumed for the unstructured random effects, $(v_i \sim N(0, \tau_v^2))$ while the spatial component (u_i) was modelled with the intrinsic Gaussian conditional autoregressive (CAR) prior.

This model can be very sensitive to the choice of hyperprior distributions for the parameters controlling the variability of the area-specific random effect components (τ_u and τ_v), so sensitivity analyses were performed comparing Deviance Information Criterion (DIC) values, residuals, shrinkage and quantile-quantile plots. Results from these sensitivity analyses indicated an appropriate choice for hyperprior distributions were:

$$\tau_u \sim \text{Gamma}(0.1, 0.1)$$

$$\tau_v \sim \text{Gamma}(0.001, 0.001)$$

The median smoothed relative risk or modelled SIR (i.e. exponential($\alpha + u_i + v_i$)) for each SLA was classified into categories and mapped.

Survival

The number of expected deaths and person-time at risk for each SLA, gender, broad age group (0-49,50-69,70-89 years) and follow-up time (in one year intervals up to 5 years) were calculated using the strs command in Stata.[66] The relative survival model described by Dickman et al was used,[23] with additional random effects included.[24]

Input data required for this relative survival Bayesian model were the observed number of deaths, expected number of deaths (calculated from general population mortality data and representing deaths due to causes other than the cancer of interest) and person-time at risk for each SLA, gender, broad age group and follow-up time interval.

The model was specified as a generalised linear model with the number of deaths as the outcome d_{kji}, a Poisson distribution, link function log $(\mu_{kji} - d^*_{kji})$ and offset $\log(y_{kji})$. Excess hazard rates were assumed to be constant within each follow-up time.[23] Data were stratified by *k* broad age groups, *j* follow-up intervals and *i* SLAs.

$$d_{kji} \sim \text{Poisson}(\mu_{kji})$$

$$\log(\mu_{kji} - d^*_{kji}) = \log(y_{kji}) + \alpha_j + \text{x}\beta_k + u_i + v_i$$

where y_{kji} is person-time at risk in the *k*th age group, the *j*th follow up interval and the *i*th SLA, d^*_{kji} is the expected number of deaths due to causes other than the cancer of interest, α_j is the intercept (which varied by follow-up year), β_k is the coefficient of the predictor variable vector x (representing the broad age groups), v_i are the unstructured random effects between areas (which has a normal distribution: $v_i \sim N(0, \tau_v^2)$ and u_i are the spatial components modelled with the intrinsic Gaussian CAR prior. The model was run separately for males and females.

Sensitivity analyses for the hyperprior distributions on τ_u and τ_v were conducted, and the distributions chosen were:

$$\tau_u \sim \text{Gamma}(0.1, 0.01)$$

$$\tau_v \sim \text{Gamma}(0.1, 0.01)$$

The median smoothed relative excess risk or RER (i.e. exponential($u_i + v_i$)) was classified into categories and mapped.

Measures

Credible intervals

All estimates are calculated with some degree of imprecision. When using Bayesian methods, the level of precision is typically reported in terms of a credible interval, which specifies a range of values in which the true point estimate is expected to lie with a given level of probability. Although credible intervals of 70% to 80% are considered to provide adequate coverage,[71] for the purposes of this report it was decided to use more conservative 95% credible intervals, similar to other published research examining spatial variation in cancer outcomes.[24]

Geographic location risks

Cancers with significant overall variation had estimates of the risk calculated by broad rurality and socioeconomic categories compared against the Queensland average. First the smoothed 'observed' value for each SLA were calculated, and summed across the categories. These were divided by the sum of the expected values for each category to produce an SIR or RER. These observed and expected values were calculated for all 10,000 iterations output from the Bayesian modelling (every 10th iteration from 100,000 iterations), and the 95% credible intervals were calculated as the 2.5 and 97.5 percentiles.

An additional adjustment was made to the expected values to ensure that the sum of the expected values across Queensland equalled the total Queensland count (accounting for rounding of the modelled estimates).

Indirect standardisation

Refer to 'Standardised Incidence Ratio' below, which is calculated by indirect standardisation.

Number of preventable deaths

For cancers that had strong or moderate evidence of geographic variation, the number of deaths which could have been prevented if survival matched the Queensland average was calculated for the four rurality groups using the following formula:

Number of preventable deaths $= \text{dprev}_r = \text{dmod}_r - \text{dexp}_r$

Where $\mathbf{dmod}_r$ is the number of modelled deaths in the r[th] rurality group, and $\mathbf{dexp}_r$ is the number of expected deaths in that group.

The number of modelled deaths was calculated from the relative survival model for the i[th] SLA, k[th] age group and j[th] follow-up interval using the formula $\left(y_{kji} \times \exp\left(\alpha_j + x\beta_k + u_i + v_i\right)\right) + d^*_{kji}$. This value was calculated at each of the 10,000 MCMC iterations. Refer to "Survival" on page 83 for an explanation of each term in this formula.

The estimated number of modelled deaths μ_{kji} was obtained as the median of the 10,000 values. These were summed over age group and follow-up interval to provide the number of modelled deaths for each SLA.

Number of modelled deaths (by SLA) $= \mathbf{dmod}_i = \sum_{k,j} \mu_{kji}$

The expected number of deaths for each SLA was calculated by dividing the number of modelled deaths by the RER for that SLA.

Number of expected deaths (by SLA)

$$= \mathbf{dexp}_i = \frac{\mu_i}{\exp(u_i + v_i)} = \frac{\mu_i}{\mathrm{RER}}$$

The SLA-specific values of expected and modelled number of deaths were then summed across the (r = 1,..,4) rurality categories.

$$\mathbf{dmod}_r = \sum_{i \in R} \mathbf{dmod}_i$$

$$\mathbf{dexp}_r = \sum_{i \in R} \mathbf{dexp}_i$$

Person-time at risk

Person-time at risk measures the amount of time a cancer patient contributes to the analysis. It is calculated by taking the time between diagnosis and the date of death or 31st December 2007 (whichever is earlier, for those who are prevalent cases at some time between 1st January 1998 and the end of 2007).

Relative excess risk (RER)

The RER is also known as an excess hazard ratio, and represents whether the 'smoothed' estimate of excess mortality within five years of diagnosis in a particular SLA is higher or lower than the Queensland average. The RER is calculated in this report by taking the exponential of the sum of the spatial and unstructured random components from the relative survival model then multiplying by 100 (see page 83 for details on the relative survival model). A value of 100 represents the average mortality within five years of diagnosis for Queensland, so an RER value above 100 indicates a higher risk of dying within five years after diagnosis (and poorer survival) than the State, whereas an RER below 100 indicates a lower risk of dying (better survival) than Queensland as a whole.

Relative survival

Relative survival compares the survival of people who have a particular disease or condition against the expected survival of a comparable group from the general population, taking into account age, sex and year of diagnosis. The relative survival estimate can be interpreted as the percentage of cancer patients alive *x* years after diagnosis in the hypothetical situation where the cancer in question is the only possible cause of death.[72] Since this method requires information on whether the patient has died, and not the specific cause of death, relative survival is the preferred method for reporting cancer survival when using data from population-based cancer registries.[23]

Relative survival can be calculated using either period or cohort methods.[73] The period method was used as it is recognised as providing more up-to-date survival estimates.[73] Under the period method, the group of cancer patients included in the survival calculations are selected based on whether they are living with a diagnosis of cancer in the "at risk" period, which for this report is 1998-2007. In contrast, the cohort method is defined by the time of diagnosis. We included all patients diagnosed up to 31 December 2007.

Patients who were still alive at 31 December 2007 were considered censored. Persons with unknown age or aged 90 years and over at time of diagnosis have been excluded from the calculation of survival estimates. These cases represent 2% of all people diagnosed with cancer in Queensland during the study period. Other patients excluded were those whose cancer diagnosis was based on death certificate or autopsy only, or those with a survival time of zero days or less (1.2% of all cases).

Observed survival was calculated using a life table (or actuarial) method. Population expected survival was based on the Ederer II method[72] and calculated from Queensland all-cause mortality data.[16] Mortality

data were averaged over 1997-2002 and 2003-2007 to minimise the effects of year to year variation. The observed mortality, expected population mortality and person-time at risk were then input to the Bayesian relative survival model.

Rurality

Rurality was defined according to the SLA where the person was living at diagnosis. Categories of rurality in Queensland used throughout this report were defined using the ARIA+ (Accessibility/Remoteness Index for Australia plus) classification.[18]

The ARIA+ classification is an enhancement of the original ARIA classification, and defines remoteness on the basis of five categories: major city, inner regional, outer regional, remote and very remote (Figure D2). For the purposes of this report we have combined remote and very remote as the 'Remote' category. Full details of the differences between the ARIA+, ARIA and other geographic remoteness classifications have been described elsewhere.[74]

Socioeconomic status (SES)

Like rurality, socioeconomic status was defined according to the SLA where the person was living at diagnosis. Using the Socioeconomic Indexes for Areas (SEIFA) Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD) compiled by the Australian Bureau of Statistics,[19] SLAs in Queensland were ranked from the most disadvantaged to the most advantaged and then divided into quintiles (see Figure D3). The quintiles were labelled as follows: most advantaged, advantaged, middle SES, disadvantaged and most disadvantaged.

The IRSAD was based on a variety of data items available at the SLA level, such as the percentages of: people with high income; people who were unemployed; households paying cheap rental; households with no car; and households with broadband internet connection. Further details of the SEIFA indexes are reported elsewhere.[75]

Standardised Incidence Ratio (SIR)

The SIR allows for comparisons to be made between the incidence of cancer in a specific SLA and Queensland as a whole, adjusting for any differences in the population age-structures.

The crude SIR is calculated as:

$$\text{SIR} = \frac{\text{Observed number of cases}}{\text{Expected number of cases}} \times 100$$

where the expected number of cases

$$= \frac{\text{Queensland number of cases}}{\text{Queensland population}} \times 100$$

The expected number of cases were initially calculated separately for the age groups (0-4,5-9,10-14,...,80-84,85+), then summed over all age groups.

The smoothed SIR is calculated from the BYM model as the exponential of the sum of the overall level of relative risk, the spatial random components and the unstructured random components, multiplied by 100 (see page 82 for details on the incidence model).

A crude or smoothed SIR value of 100 represents the average incidence rate across Queensland. Therefore an SIR above 100 indicates higher incidence than the State average, whereas an SIR below 100 indicates a lower incidence compared to the Queensland average.

Statistical Local Area (SLA)

SLAs are part of the Australian Standard Geographic Classification (ASGC) used by the Australian Bureau of Statistics.[17] They correspond either to Local Government Areas (LGAs) or suburbs in larger LGAs (e.g. Brisbane City). In 2006 there were 478 SLAs in Queensland.[17]

Statistical local areas were mapped to the 2006 ASGC boundaries. For incidence and survival data (at the individual level), the suburb and postcode information were used to define the appropriate SLA classification. This classification was completed prior to extracting the data from the Queensland Cancer Registry. For the mortality data (used to calculate the expected mortality for relative survival), no information was available regarding suburb and postcode at death. Therefore an approximate SLA concordance developed by the ABS was used to map the SLA codes to the 2006 ASGC classification.

Cancer records that had missing or undefined SLAs (0.8% of all records between 1996 and 2007) were excluded from the analysis.

Tango's Maximised Excess Events Test (Tango's MEET)

Even though most maps show some evidence of geographic variation in outcomes, it is important to determine how likely it is that this variation reflects real differences, or merely random variation (or chance). Tango's Maximised Excess Events Test (Tango's MEET) is a test for overall clustering, which provides a measure of the significance of the variation.[20] There are multiple tests available (e.g. Besag-Newell's R, Moran's I, Oden's Ipop etc.), but Tango's MEET has been shown to perform well across a variety of datasets.[76]

Small p-values indicate there is variation throughout the State. Results were considered to have strong overall spatial variation if Tango's MEET was less than 0.01, and moderate overall spatial variation if Tango's MEET was between 0.05 and 0.01. Values between 0.05 and 0.10 were considered to provide only weak evidence for geographical variation, and those above 0.10 no evidence.

S+ code for Tango's MEET is available from: www.niph.go.jp/soshiki/gijutsu/download/index.html.

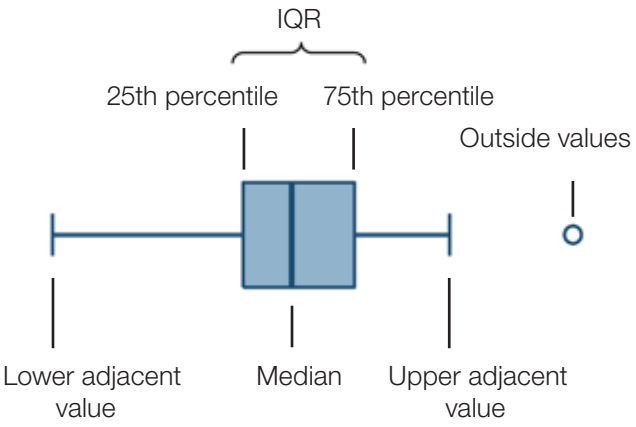
Statistical and spatial software

Bayesian analysis was undertaken in WinBUGS v1.4 (© 1996-2003 Imperial College and MRC, UK). Additional data analysis was performed using Stata software v11.0 (© 1984-2009 StataCorp, Texas) and R (v2.9.2; © 2009 The R Foundation for Statistical Computing). Neighbourhood matrices were generated using GeoDa v0.9.5-i (© 1998-2004 Luc Anselin and The Regents of the University of Illinois). Maps were generated using MapInfo Professional software v10.0 (© 2009 Pitney Bowes Software Inc.).

Map colours were based on those recommended by ColorBrewer (colorbrewer2.org) which were suitable for printing and classed as 'Colour-blind friendly'.

Distribution plot components

The distribution plots include the following specific components within each category of socioeconomic status or rurality:



25th percentile: The value below which 25% of all SLA-specific estimates fall.

Median: The middle value when all the SLA-specific estimates are arranged in ascending order.

75th percentile: The value above which 25% of all SLA-specific estimates fall.

IQR: The Interquartile range (IQR) is the 75th percentile value minus the 25th percentile value.

Lower adjacent value: The smallest estimate that is greater than or equal to the 25th percentile - 1.5 x IQR.

Upper adjacent value: The largest estimate that is less than or equal to the 75th percentile + 1.5 x IQR.

Outside values: These are any values greater than the upper adjacent value, or less than the lower adjacent value. These estimates can be considered outliers.

Appendix C – Incidence and survival rates

Table C1: Incidence by sex, Queensland, 1998-2007

	Males			Females		
Type of cancer	Count[a]	Rate[b,c]	Lifetime risk (1 in n)[d]	Count[a]	Rate[b,c]	Lifetime risk (1 in n)[d]
All invasive cancers	10,505	610.4	2	8,247	426.6	3
Oesophageal cancer	146	8.6	85	64	3.2	210
Stomach cancer	219	13.2	54	107	5.4	138
Colorectal cancer	1,341	78.1	10	1,087	55.8	13
Pancreatic cancer	194	11.5	62	171	8.6	84
Lung cancer	1,115	65.7	11	568	29.5	25
Melanoma	1,379	77.8	11	1,011	52.8	19
Breast cancer – females only	-	-	-	2,242	116.8	8
Cervical cancer	-	-	-	164	8.6	124
Uterine cancer	-	-	-	311	16.2	50
Ovarian cancer	-	-	-	212	11.0	75
Prostate cancer	2,522	147.2	5	-	-	-
Kidney cancer	312	17.9	43	188	9.7	77
Bladder cancer	503	30.5	23	157	8.0	87
Brain cancer	150	8.3	109	107	5.6	156
Thyroid cancer	77	4.2	227	222	11.7	97
Non-Hodgkin lymphoma	355	20.4	38	289	14.9	52
Leukaemia	308	17.9	45	209	10.8	76
Myeloma	119	7.1	102	91	4.7	152

a. Count is the average number diagnosed per year.
b. Rate is the average age-standardised rate per 100,000 population per year.
c. Rates are directly age-standardised to the Australian standard population (2001).
d. Lifetime risk is the risk of being diagnosed with the specific cancer by age 80.

Table C2: Five-year relative survival by sex, Queensland, 1998-2007

Type of cancer	Males [95% conf. int.][a]	Females [95% conf. int.][a]
All invasive cancers	62.9 [62.6,63.3]	68.9 [68.5,69.2]
Oesophageal cancer	18.3 [16.1,20.6]	20.1 [16.7,23.9]
Stomach cancer	25.9 [23.8,28.1]	28.4 [25.5,31.5]
Colorectal cancer	63.8 [62.7,64.9]	65.5 [64.4,66.7]
Pancreatic cancer	5.3 [4.3,6.5]	6.3 [5.2,7.7]
Lung cancer	11.5 [10.9,12.2]	15.1 [14.1,16.2]
Melanoma	92.6 [91.8,93.3]	95.5 [94.8,96.1]
Breast cancer – females only	-	87.9 [87.3,88.5]
Cervical cancer	-	75.4 [73.1,77.5]
Uterine cancer	-	82.2 [80.4,83.9]
Ovarian cancer	-	45.9 [43.5,48.3]
Prostate cancer	85.2 [84.4,86.0]	-
Kidney cancer	66.3 [64.1,68.4]	62.5 [59.8,65.1]
Bladder cancer	76.0 [74.3,77.7]	71.9 [68.9,74.6]
Brain cancer	22.8 [20.6,25.0]	23.6 [21.1,26.3]
Thyroid cancer	92.1 [88.9,94.7]	97.6 [96.5,98.6]
Non-Hodgkin lymphoma	64.4 [62.3,66.4]	66.1 [63.9,68.2]
Leukaemia	56.8 [54.7,58.9]	59.4 [56.9,61.8]
Myeloma	41.8 [38.3,45.3]	44.4 [40.5,48.4]

a. Conf. int. = confidence interval. The true value is likely to be within this range.

Notes: Relative survival calculated using the period method for persons aged 0-89 years at diagnosis. Data are for 'at risk' cases in the period 1998 - 2007.

Appendix D – Additional maps

Figure D1: Major Cities

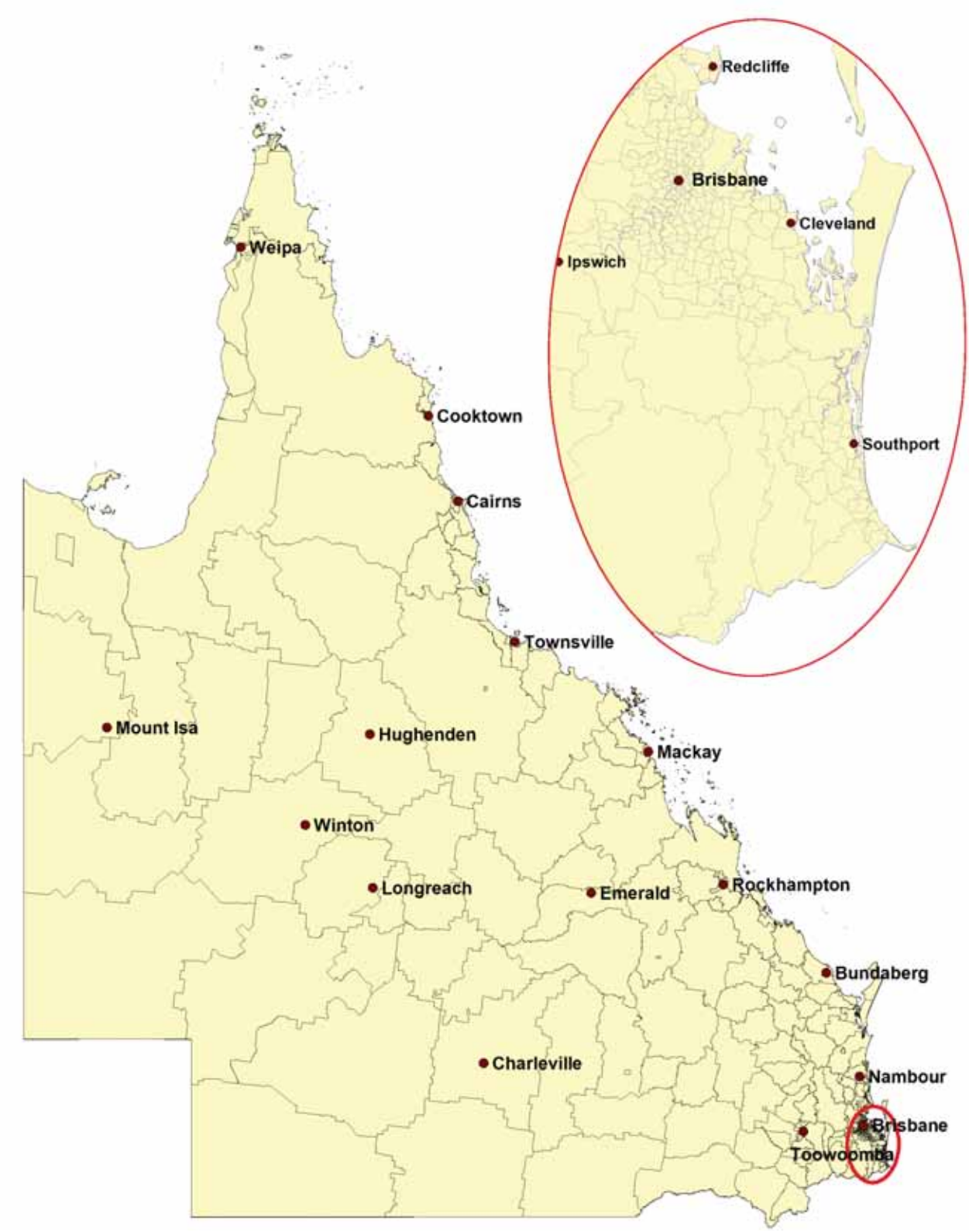


Figure D2: Rurality (ARIA+)

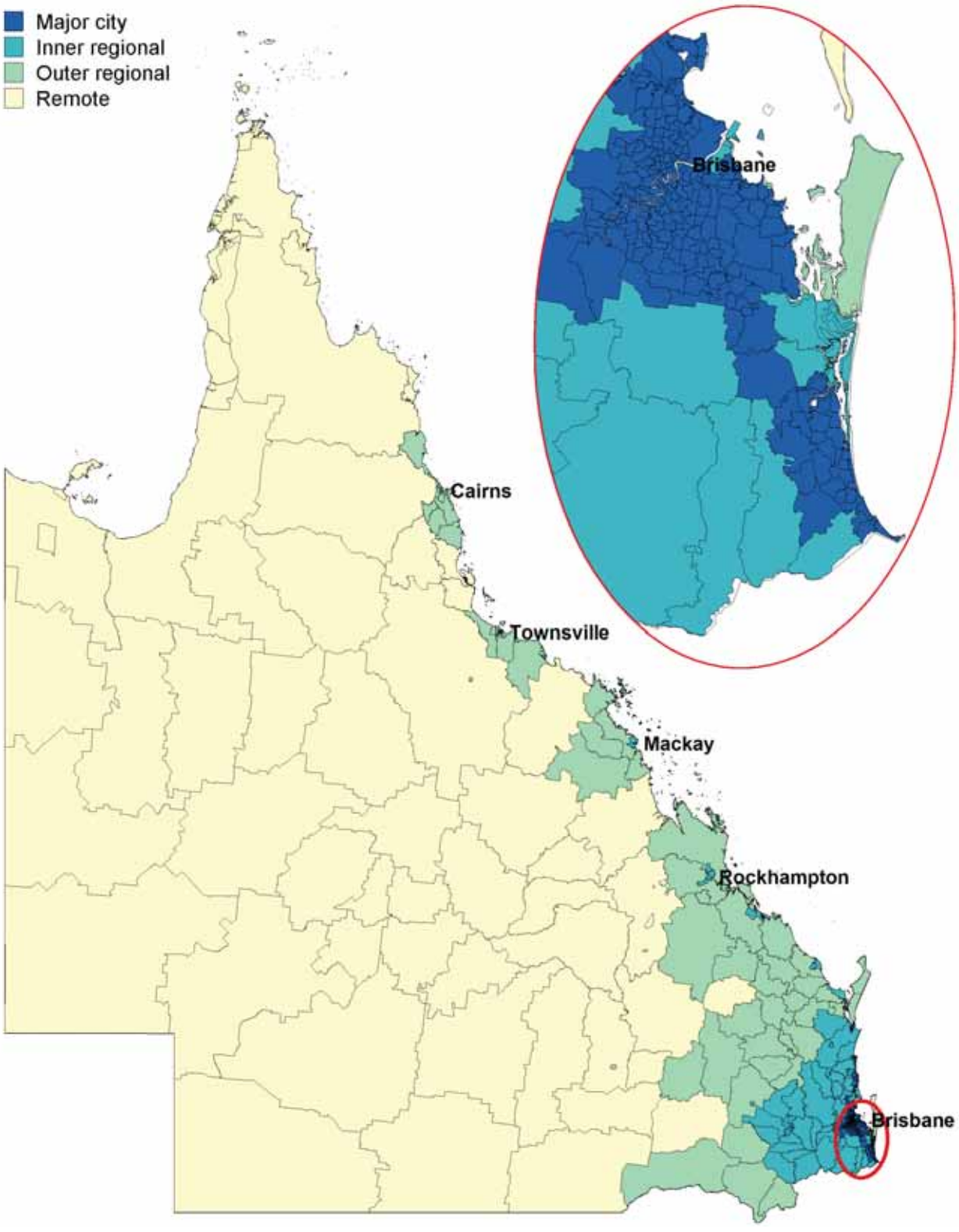
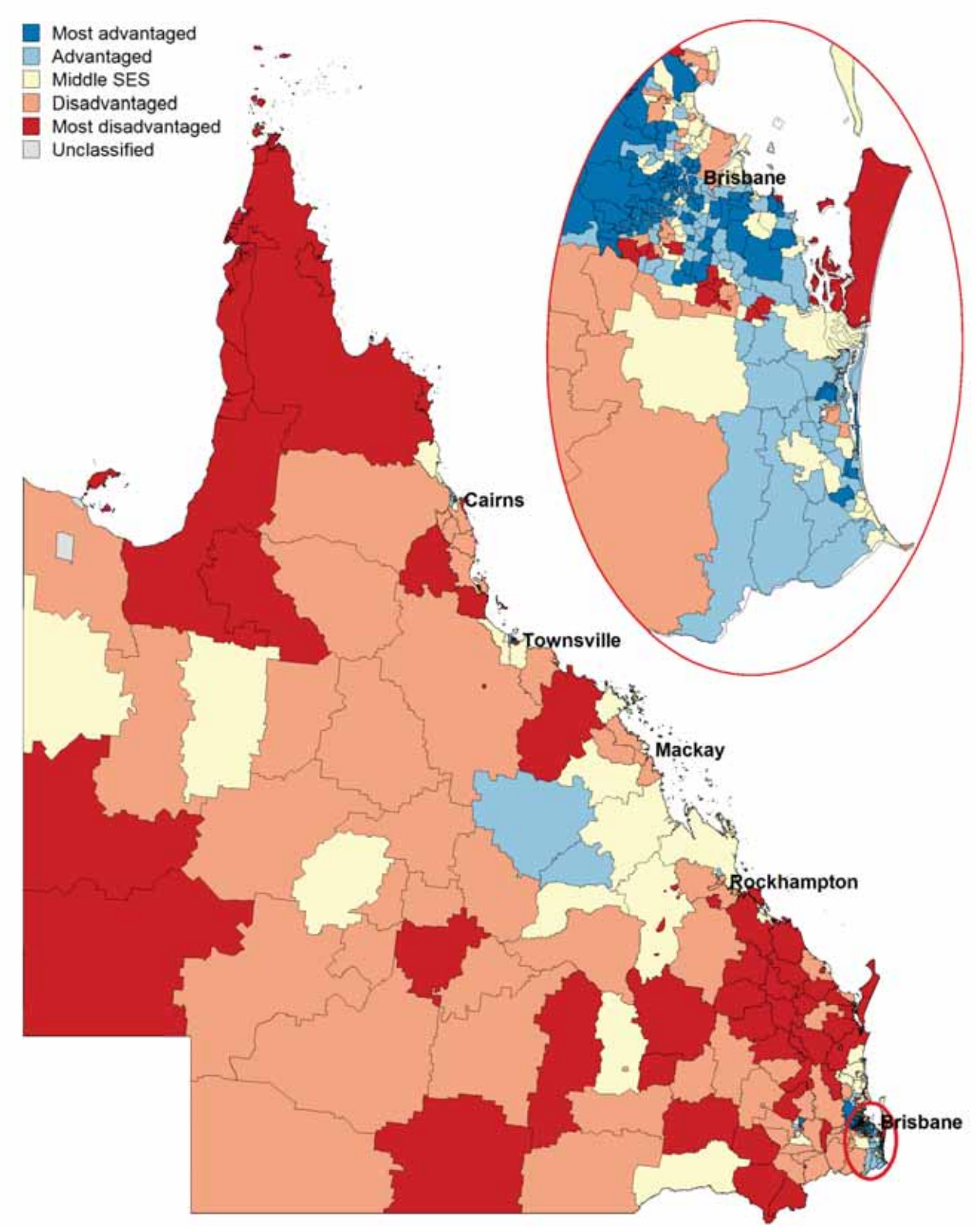


Figure D3: Socioeconomic status (SEIFA - IRSAD)



Appendix E – Geographic location risks

Table E1: Geographic location risks by rurality

		Smoothed SIR		Smoothed RER	
Cancer site	**Rurality**	**Males [95% CI]**	**Females [95% CI]**	**Males [95% CI]**	**Females [95% CI]**
All invasive cancers	Major city	100.4 [99.6,101.2]	102.0 [101.1,103.0]	95.5 [93.5,97.5]	96.4 [94.4,98.5]
	Inner regional	102.0 [100.8,103.3]	99.8 [98.4,101.3]	98.2 [95.4,101.1]	100.1 [97.1,103.4]
	Outer regional	98.5 [97.1,100.0]	94.5 [92.8,96.1]	111.5 [108.4,114.9]	111.2 [107.8,114.8]
	Remote	91.6 [89.1,94.2]	92.4 [89.5,95.5]	130.6 [125.3,136.2]	119.8 [114.5,125.6]
Oesophagus	Major city	95.2 [89.1,101.7]	-	-	-
	Inner regional	96.7 [88.7,104.9]	-	-	-
	Outer regional	115.3 [104.6,126.8]	-	-	-
	Remote	117.3 [102.4,133.8]	-	-	-
Stomach	Major city	-	-	94.9 [89.7,99.9]	-
	Inner regional	-	-	106.5 [98.9,114.9]	-
	Outer regional	-	-	109.2 [101.2,118.1]	-
	Remote	-	-	112.6 [99.8,128.5]	-
Colorectal	Major city	-	-	94.2 [91.1,97.5]	96.1 [92.4,100.2]
	Inner regional	-	-	103.3 [98.0,108.7]	102.8 [97.1,108.7]
	Outer regional	-	-	113.1 [107.6,119.1]	110.4 [103.9,117.4]
	Remote	-	-	116.9 [108.7,126.0]	112.0 [103.0,122.7]
Lung	Major city	96.7 [94.3,99.1]	104.9 [101.5,108.4]	95.1 [92.8,97.5]	95.6 [92.1,99.1]
	Inner regional	100.0 [96.3,103.8]	87.7 [83.1,92.3]	100.9 [97.0,104.8]	103.3 [97.7,109.3]
	Outer regional	105.9 [101.4,110.4]	98.5 [92.7,104.6]	111.3 [107.4,115.5]	112.2 [106.6,118.6]
	Remote	118.0 [110.1,126.8]	101.0 [91.5,111.6]	116.9 [111.0,123.4]	118.4 [109.3,129.3]
Melanoma	Major city	101.6 [99.3,103.8]	98.5 [96.0,100.9]	-	-
	Inner regional	102.8 [99.4,106.3]	108.1 [104.1,112.1]	-	-
	Outer regional	98.1 [94.3,102.0]	98.2 [94.0,102.6]	-	-
	Remote	77.5 [72.0,83.4]	88.5 [81.9,95.4]	-	-
Breast – females only	Major city	-	104.3 [102.6,106.1]	-	95.2 [90.4,99.8]
	Inner regional	-	98.9 [96.3,101.5]	-	104.8 [97.5,112.6]
	Outer regional	-	89.7 [86.9,92.6]	-	111.6 [103.9,120.2]
	Remote	-	85.5 [80.9,90.4]	-	114.1 [103.0,127.5]
Cervix	Major city	-	99.1 [93.2,105.2]	-	-
	Inner regional	-	92.6 [84.6,100.9]	-	-
	Outer regional	-	108.1 [98.0,119.0]	-	-
	Remote	-	115.0 [100.4,132.2]	-	-

Cancer site	Rurality	Smoothed SIR		Smoothed RER	
		Males [95% CI]	Females [95% CI]	Males [95% CI]	Females [95% CI]
Uterus	Major city	-	98.0 [93.7,102.5]	-	-
	Inner regional	-	103.8 [97.7,110.2]	-	-
	Outer regional	-	101.4 [94.2,109.1]	-	-
	Remote	-	102.6 [91.9,114.3]	-	-
Prostate	Major city	99.1 [97.4,100.7]	-	96.4 [91.7,101.0]	-
	Inner regional	106.3 [103.7,109.0]	-	100.5 [93.5,108.0]	-
	Outer regional	98.6 [95.7,101.6]	-	108.1 [100.3,116.2]	-
	Remote	86.1 [81.5,90.9]	-	117.7 [106.0,132.3]	-
Kidney	Major city	105.9 [101.3,110.6]	-	-	-
	Inner regional	97.4 [91.5,103.5]	-	-	-
	Outer regional	88.3 [81.9,95.3]	-	-	-
	Remote	85.1 [75.7,95.0]	-	-	-
Bladder	Major city	104.1 [100.6,107.9]	-	-	-
	Inner regional	98.7 [93.8,103.9]	-	-	-
	Outer regional	92.8 [87.3,98.7]	-	-	-
	Remote	81.9 [73.7,90.5]	-	-	-
Thyroid	Major city	-	103.9 [98.6,109.4]	-	-
	Inner regional	-	99.1 [91.8,106.7]	-	-
	Outer regional	-	89.7 [81.7,98.1]	-	-
	Remote	-	90.2 [78.7,103.1]	-	-
Non-Hodgkin lymphoma	Major city	101.8 [97.7,106.2]	105.0 [100.3,109.7]	95.4 [88.9,101.2]	93.5 [86.9,100.4]
	Inner regional	106.2 [100.4,112.7]	97.1 [91.2,103.3]	101.1 [92.4,110.3]	104.8 [94.5,116.1]
	Outer regional	90.3 [84.0,96.7]	88.3 [81.6,95.5]	112.6 [103.0,124.5]	122.2 [108.8,137.9]
	Remote	84.2 [75.3,94.1]	86.9 [77.5,97.3]	121.5 [106.1,142.9]	126.0 [108.6,148.7]
Leukaemia	Major city	99.9 [95.4,104.5]	101.3 [96.1,106.7]	94.7 [88.9,101.0]	-
	Inner regional	103.0 [96.9,109.6]	98.6 [91.4,106.2]	107.0 [97.3,118.5]	-
	Outer regional	98.8 [91.7,106.1]	98.4 [90.0,107.2]	109.8 [100.2,121.0]	-
	Remote	92.3 [82.4,102.6]	94.6 [82.8,107.2]	103.0 [89.2,117.3]	-

Note: Values are in comparison to the Queensland average, and are only shown for cancers which had a Tango's MEET p-value of <0.05.

Table E2: Geographic location risks by socioeconomic status

Cancer site	Socioeconomic	Smoothed SIR		Smoothed RER	
		Males [95% CI]	Females [95% CI]	Males [95% CI]	Females [95% CI]
All invasive cancers	Most advantaged	100.5 [98.9,102.1]	102.7 [101.0,104.4]	89.6 [86.9,92.4]	89.7 [86.8,92.5]
	Advantaged	98.1 [96.8,99.3]	100.6 [99.2,102.0]	94.5 [92.0,97.0]	96.4 [93.9,98.9]
	Middle SES	100.8 [99.6,101.9]	99.5 [98.3,100.8]	99.8 [97.3,102.3]	101.2 [98.7,103.8]
	Disadvantaged	99.5 [98.3,100.7]	97.8 [96.5,99.2]	104.6 [101.9,107.3]	105.2 [102.4,108.0]
	Most disadvantaged	101.9 [100.3,103.5]	100.9 [99.1,102.7]	111.8 [108.6,115.3]	107.2 [103.9,110.7]
Oesophagus	Most advantaged	91.7 [83.6,99.9]	-	-	-
	Advantaged	97.7 [91.0,105.0]	-	-	-
	Middle SES	102.7 [96.4,110.0]	-	-	-
	Disadvantaged	100.8 [93.7,108.1]	-	-	-
	Most disadvantaged	104.4 [96.0,113.9]	-	-	-
Stomach	Most advantaged	-	-	94.4 [87.5,101.0]	-
	Advantaged	-	-	93.5 [86.9,99.1]	-
	Middle SES	-	-	100.4 [95.1,105.9]	-
	Disadvantaged	-	-	104.8 [98.9,111.5]	-
	Most disadvantaged	-	-	107.2 [99.9,116.4]	-
Colorectal	Most advantaged	-	-	94.1 [89.9,98.3]	94.9 [90.0,99.8]
	Advantaged	-	-	94.6 [90.8,98.2]	96.2 [91.9,100.5]
	Middle SES	-	-	100.5 [96.9,104.2]	100.3 [96.3,104.5]
	Disadvantaged	-	-	105.4 [101.3,109.9]	104.0 [99.7,109.1]
	Most disadvantaged	-	-	104.8 [99.9,110.2]	105.5 [99.8,111.9]
Lung	Most advantaged	86.5 [82.4,90.6]	95.5 [90.2,101.0]	95.4 [92.0,98.8]	93.2 [88.2,97.8]
	Advantaged	89.8 [86.4,93.1]	100.2 [95.7,104.6]	96.4 [93.5,99.3]	96.5 [92.5,100.7]
	Middle SES	101.9 [98.7,105.3]	103.7 [99.5,108.0]	99.7 [96.9,102.5]	99.2 [95.2,103.2]
	Disadvantaged	105.5 [102.0,109.1]	98.7 [94.4,103.1]	103.1 [100.1,106.2]	105.2 [100.9,110.0]
	Most disadvantaged	114.8 [110.0,119.9]	99.3 [93.7,105.3]	103.1 [99.6,106.6]	105.5 [100.6,111.2]
Melanoma	Most advantaged	104.1 [100.3,108.1]	96.1 [92.4,100.1]	-	-
	Advantaged	101.6 [98.6,104.8]	98.4 [95.2,101.7]	-	-
	Middle SES	105.1 [102.2,108.1]	104.1 [100.9,107.3]	-	-
	Disadvantaged	94.0 [91.1,97.0]	98.3 [95.0,101.7]	-	-
	Most disadvantaged	93.2 [89.4,97.1]	102.0 [97.9,106.5]	-	-
Breast – females only	Most advantaged	-	109.5 [106.5,112.6]	-	89.4 [82.5,95.6]
	Advantaged	-	102.5 [100.1,104.9]	-	96.8 [91.4,102.0]
	Middle SES	-	99.0 [96.8,101.3]	-	103.5 [98.3,109.4]
	Disadvantaged	-	95.8 [93.5,98.2]	-	104.3 [98.6,110.6]
	Most disadvantaged	-	94.4 [91.3,97.4]	-	104.9 [97.9,112.6]
Cervix	Most advantaged	-	100.2 [92.2,108.7]	-	-
	Advantaged	-	98.6 [92.1,105.1]	-	-
	Middle SES	-	99.0 [92.9,105.6]	-	-
	Disadvantaged	-	101.5 [94.5,109.1]	-	-
	Most disadvantaged	-	101.7 [93.7,110.6]	-	-

Cancer site	Socioeconomic	Smoothed SIR		Smoothed RER	
		Males [95% CI]	Females [95% CI]	Males [95% CI]	Females [95% CI]
Uterus	Most advantaged	-	101.7 [95.4,108.2]	-	-
	Advantaged	-	95.1 [90.3,100.1]	-	-
	Middle SES	-	96.8 [92.1,101.6]	-	-
	Disadvantaged	-	103.4 [98.0,108.9]	-	-
	Most disadvantaged	-	106.8 [100.3,113.9]	-	-
Prostate	Most advantaged	105.4 [102.3,108.5]	-	96.6 [90.5,102.7]	-
	Advantaged	95.7 [93.4,98.1]	-	98.4 [92.7,103.7]	-
	Middle SES	99.8 [97.5,102.0]	-	99.7 [94.4,105.1]	-
	Disadvantaged	102.8 [100.5,105.2]	-	99.9 [94.1,105.7]	-
	Most disadvantaged	96.9 [93.9,99.9]	-	107.0 [99.8,115.1]	-
Kidney	Most advantaged	104.4 [97.9,111.0]	-	-	-
	Advantaged	102.4 [97.1,107.9]	-	-	-
	Middle SES	100.3 [95.2,105.4]	-	-	-
	Disadvantaged	96.9 [91.6,102.3]	-	-	-
	Most disadvantaged	96.7 [90.5,103.4]	-	-	-
Bladder	Most advantaged	100.0 [94.5,105.6]	-	-	-
	Advantaged	100.9 [96.3,105.6]	-	-	-
	Middle SES	101.3 [97.1,105.7]	-	-	-
	Disadvantaged	98.6 [94.3,103.3]	-	-	-
	Most disadvantaged	98.5 [93.1,104.3]	-	-	-
Thyroid	Most advantaged	-	111.4 [103.8,119.6]	-	-
	Advantaged	-	101.4 [95.7,107.4]	-	-
	Middle SES	-	92.6 [87.3,98.0]	-	-
	Disadvantaged	-	97.4 [91.4,104.0]	-	-
	Most disadvantaged	-	103.0 [95.3,111.4]	-	-
Non-Hodgkin lymphoma	Most advantaged	102.6 [96.5,109.3]	107.9 [101.5,114.8]	95.1 [87.1,102.4]	91.4 [82.9,99.9]
	Advantaged	100.9 [95.7,106.2]	102.4 [97.4,107.8]	95.7 [88.7,102.1]	92.7 [85.2,100.4]
	Middle SES	99.7 [95.0,104.7]	99.2 [94.3,104.1]	99.9 [93.6,106.3]	101.0 [94.2,108.2]
	Disadvantaged	95.9 [90.8,101.0]	95.5 [90.4,100.7]	107.3 [100.2,116.8]	110.4 [102.4,121.7]
	Most disadvantaged	103.5 [96.9,110.5]	96.9 [90.7,103.5]	100.5 [91.9,109.6]	106.3 [96.0,118.0]
Leukaemia	Most advantaged	104.9 [98.4,111.8]	105.0 [97.8,112.8]	91.3 [83.1,99.5]	-
	Advantaged	98.6 [93.5,103.8]	101.0 [95.3,107.2]	94.9 [88.7,101.6]	-
	Middle SES	97.8 [93.0,102.7]	97.4 [92.0,102.9]	101.1 [95.0,108.5]	-
	Disadvantaged	98.6 [93.3,104.0]	99.8 [93.8,106.2]	105.0 [97.7,114.1]	-
	Most disadvantaged	104.0 [97.5,111.1]	98.1 [90.9,105.7]	107.5 [98.2,118.8]	-

Note: Values are in comparison to the Queensland average, and are only shown for cancers which had a Tango's MEET p-value of <0.05.

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