Introduction

Death rates in Australia are on the decline overall, but there is considerable variation in the magnitude of the decline among the various causes of death (AIHW 2004b, p. 49). This report, the seventh in a series that describes the health status of Australians living in regional and remote areas, builds on a previous report of the Australian Institute of Health and Welfare (AIHW): *Rural, Regional and Remote Health – A Study on Mortality* (AIHW 2003), to examine inter-regional differences in the rate and direction of changes in death rates for each of a number of causes.

The report looks at changes in death rates between 1992 and 2003, comparing the changes that have occurred in each of the Australian Standard Geographical Classification (ASGC) Remoteness areas (see page 6) for each of a range of causes (see Table 1 on page 5), for both males and females. This extends the time series and provides coverage of more specific causes of death than the broad categories presented in the earlier report.

Mortality is only one aspect of the health of a population, but death rates are important indicators of health. Mortality also has the advantage of being easily defined and regularly and reliably collected.

Nevertheless, there are some caveats in its use as an indicator of health. Mortality data:

- may not be accurate for Indigenous people in any region, and are less reliable in some geographical areas than in others. This is because the propensity for Indigenous people to identify as such varies over time and across areas. Identification is considered to be most reliable, overall, in the Northern Territory, South Australia, Western Australia and Queensland, but, in every State and Territory, is likely to be poorer in Major Cities than in the other regions
- does not take into account the possible migration of the 'frail aged' to less remote areas. Frequently, death rates for elderly non-Indigenous people in remote areas appear to be lower than for their counterparts in Major Cities, whereas the reverse may be the case for younger age groups. It is thought that elderly people in poor health may move to less remote areas where they can regularly access health services, leaving behind healthier individuals
- may mask underlying health conditions. For example, deaths where diabetes was the underlying condition have been identified in this report, but this still understates the burden of this disease, because diabetes is a contributing factor for other deaths
- allows for demographic differences between different populations, but not other differences, such as socioeconomic differences, environmental factors or different levels of access to, and quality of, health services
- does not provide direct information about how well people 'feel', their levels of fitness, the prevalence of risk factors such as smoking or the frequency of interventions such as visits to health practitioners.

Another major study in the series, *Rural, Regional and Remote health – Indicators of Health,* has provided a wealth of additional information about the health of populations in Major Cities, Inner and Outer Regional areas, and Remote and Very Remote areas.

The results presented in this and previous reports need to be interpreted in the context of various data quality issues and the statistical methods applied, both of which are described below.

Statistical methods

Because the age and sex profile of the population varies both across geographical regions and over time, age standardisation for males and females has been used in this report to compare death rates across time and between areas.

Age standardisation has been used in this study because:

- the risk of death is usually age-related
- the age structure of the populations in each Remoteness Area is different (and substantially so between remote and other areas)
- the age structure of a population changes with time.

Without age standardisation, comparison of calculated crude rates may simply reflect the different age and sex structures of populations rather than any change in the underlying likelihoods of death over time in each area.

Indirect age-standardised death rates (Standardised Mortality Ratios—SMRs) for each year from 1992 to 2003 were calculated for each of the ASGC Remoteness areas, for both males and females and for each of the causes of death examined. For each cause, these rates have been presented as a graph to provide an easily understood representation of the changes (and year-to-year variability) in the rate of death in each area from year to year.

The slopes of trend lines for describing the change in death rates over time were calculated using weighted least squares. Confidence intervals for the slope were calculated using the standard error of the slope.

The slope in each case is the equivalent of the reduction in the SMR, which has been multiplied by 100 to assist in description and interpretation. For example, if the trend line for the SMR in an area decreased from 166 to 100 between 1992 and 2003, then the decrease would have been 6.0 points per year. Similarly, if the decrease was from 266 to 200, then the average yearly decrease would have been, again, 6.0 points per year. In these two cases the average annual decrease is 6.0 points and the two trend lines would be parallel. Proportionally, the decrease is greater from 166 than it is from 266.

The absolute, rather than relative, size of changes in each area is likely to be more useful in making inter-regional comparisons. For this reason, the change in the death rate in each area has been expressed as the number of points by which the SMR changes each year on average, rather than the percentage change.

The relative contributions of each of the broad causes of death to the overall change in the death rate were calculated using linear regression of the number of 'excess' deaths attributed to each cause, over time, using the method described in Armitage & Berry (1987, pp. 143–150).

Indirect age standardisation

Rates for males and females in each of the years 1992–2003 have been indirectly age standardised to the Major Cities rates in the aggregated three-year period 2001–2003.

Indirect age standardisation, rather than direct age standardisation, has been used to compare the rate of death in each area with that in Major Cities in the period 2001–2003. Indirect rather than direct standardisation has been used to avoid instability due to small numbers of deaths in some of the areas, especially when examining causes of death that are not particularly common.

In general terms, the relative (indirect age-standardised) rates of death in the different areas were calculated by comparing the number of deaths that actually occurred with the number that would have been expected if Major Cities age-specific rates for the period 2001–2003 had applied in each area and in each year. 'Excess' deaths have been expressed as the difference between the number of deaths observed and the number expected (Armitage & Berry 1987, pp. 403–405).

Described in a stepwise manner, the indirect age-standardised method involves the following steps:

- calculation of age- and sex-specific rates for the standard population (for this study, the Major Cities population in 2001–2003)
- calculation of the number of deaths expected to occur if the standard age- and sex-specific rates applied to the population in each area in each year
- comparison of the total number of deaths observed in the population of each area in each year to the number expected (that is, the ratio of observed to expected deaths).

Because the ratio of the observed to expected deaths is exactly the same as the ratio of the indirect age-standardised rates in each area to that in Major Cities, the difference between the mortality in one area and that in Major Cities can be expressed either as:

- one rate is 'so many times as high as another'; or
- there are 'so many times more deaths than expected'.

For example, if 1,500 deaths were observed in an area, and 1,000 were expected, then there were 1.5 times as many deaths as expected, expressed in this report as an SMR of 150. In other words, the adjusted rate of death in the area was 1.5 times that in Major Cities, or, alternatively, death rates were 50% higher than in Major Cities in 2001–2003, or there were 1.5 times as many deaths as expected.

Reporting for Indigenous and non-Indigenous people

A substantial proportion of the higher death rates in regional, and especially remote, areas is a reflection of the relatively large proportion of the population who are Indigenous in those areas. Approximately 1%, 2%, 5%, 13% and 44%, respectively, of the populations of Major Cities, Inner Regional, Outer Regional, Remote and Very Remote areas are Indigenous (AIHW 2005).

On average, Indigenous people experience substantially higher death rates than other Australians, for a number of underlying reasons (ABS & AIHW 2003), and this, coupled with their greater representation in regional and remote areas, can explain a substantial proportion of the higher rate of death outside Major Cities. As a result of the importance of Indigenous health issues, both in its own right and also as a major explanatory variable in accounting for elevated rates outside Major Cities, it would be preferable to describe Indigenous and non-Indigenous mortality separately in each area over time.

Unfortunately, the quality of the data prevents this analysis.

Not only is it likely that identification of Indigenous people in the mortality data collection improves with remoteness (AIHW 2003) but people have become more likely to identify as Indigenous over time (ABS & AIHW 2003). Consequently, any increase in death rates for Indigenous people over time could reflect a greater propensity to identify as Aboriginal or Torres Strait Islander in the mortality data collection, and higher Indigenous death rates outside Major Cities could merely reflect a greater likelihood to identify as such in regional and especially remote areas.

Issues pertaining to cause of death coding

Recording of cause of death in the mortality data collection has evolved over the years.

Before 1999, the 9th Revision of the International Classification of Diseases (ICD-9) was used to code the underlying cause of death. The 10th Revision (ICD-10) was introduced in 1999.

In addition to the change from ICD-9 to ICD-10, there has been a change from manual to automatic coding. In 1997, cause of death, which had been manually coded using ICD-9, started to be automatically coded using ICD-9.

In 1999, automatic ICD-10 coding replaced automatic ICD-9 coding. Mortality data for 1997 and 1998 was then back-coded automatically using ICD-10, resulting in a single break after 1996.

Both these changes (ICD-9 to ICD-10, and manual to automatic) complicate comparisons of death rates over time.

A comparability factor was calculated from a number of deaths in 1997 and 1998 which were coded in both manual ICD-9 and automatic ICD-10. This comparability factor is used to estimate the number of deaths ascribed to each cause before 1997, had automatic ICD-10 coding been used in that period. This adjustment is believed to make time trend analysis more valid for this period.

The ICD-9 and ICD-10 codes and the comparability factors used in this report are listed in Table 1.

The number of deaths due to 'other causes' within each chapter and other causes overall were calculated by subtraction, and so a comparability factor was not calculated.

Table 1: ICD-9 and ICD-10 chapter and cause codes, and comparability factors

Chapter and cause	ICD-9	ICD-10	Comparability factor
Neoplasms	140–239	C00–D48	1.00
Lung cancer	162	C33, C34	0.97
Colorectal cancer	153, 154	C18–C21	0.98
Breast cancer	174, 175	C50	0.98
Cervical cancer	180	C53	0.98
Prostate cancer	185	C61	0.98
Melanoma	172	C43	0.98
'Other' neoplasms	140–239 (excluding above)	C00–D48 (excluding above)	n.a.
Circulatory diseases	390–459	I00–I99	1.00
Coronary heart disease	410–414	I20–I25	1.01
Cerebrovascular disease	430–438	I60–I69	0.97
'Other' circulatory disease	390–459 (excluding above)	I00–I99 (excluding above)	n.a.
Respiratory diseases	460–519	J00–J99	0.91
Pneumonia and influenza	480–487, 514	J10–J18	0.84
Asthma	493	J45–J46	0.75
Chronic obstructive pulmonary disease	491, 492, 496	J41, J42, J43, J44	0.93
'Other' respiratory disease	460–519 (excluding above)	J00–J99 (excluding above)	n.a.
Injury and poisoning	E800–E999	V01–Y98	1.06
Motor vehicle traffic accidents (MVTA)	E810–E819	V02–V04 (.1–.9), V09.2, V12–V14 (.3–.9)	0.95
		V19 (.4–.6), V20–V28 (.3–.9), V29 (.4–.9)	
		V30–V39 (.4–.9), V40–V49 (.4–.9), V50–V59 (.4–.9), V60–V69 (.4–.9)	
		V70–V79 (.4–.9), V80(.3–.5), V81.1, V82.1, V83–V86 (.0–.3), V87 (.0–.8), V89.2	
All other land transport accidents	E800–E829, excluding codes in MVA above	V01.0–V89.9, excluding codes in MVA above	n.a.
Suicide	E950–E959	X60–X84	0.97
Interpersonal violence	E960–E978	X85–Y09	1.02
'Other' injury/poisoning	E800–E999 (excluding those above)	V00–Y98 (excluding those above)	n.a.
Other causes	All codes excluding those above	All codes excluding those above	n.a.
Diabetes	250	E10–E14	0.99
Renal failure	584–586	N17–N19	1.05
'Other' other causes n.e.d.	All other codes	All other codes	n.a.

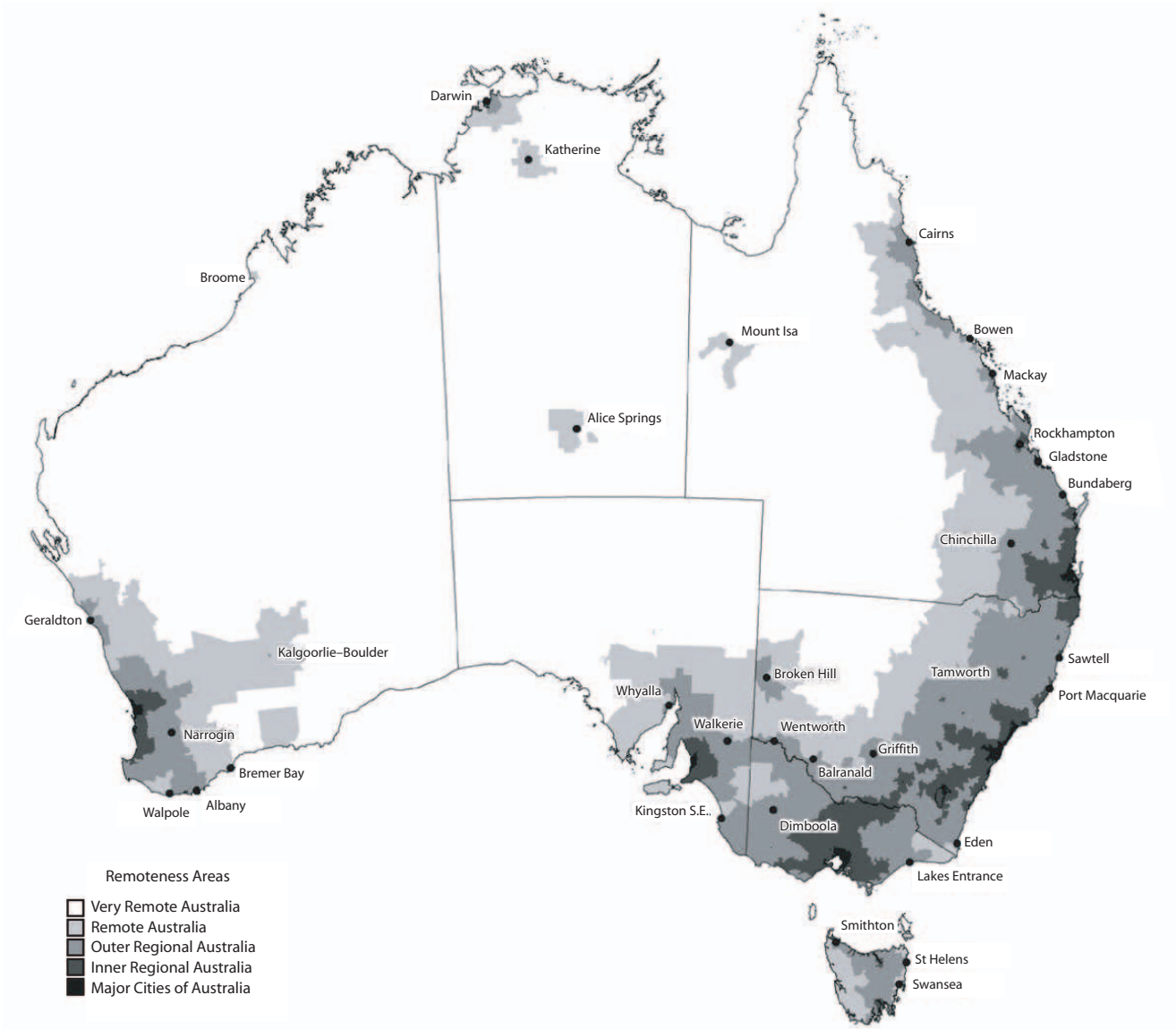
Geographic classification

The Australian Bureau of Statistics (ABS) ASGC Remoteness classification (see Figure 1) was selected in preference to the Accessibility/Remoteness Index of Australia (ARIA) and Rural, Remote and Metropolitan Areas (RRMA) classifications as the geographic basis for reporting for a range of reasons outlined in an earlier report in this series *Rural, Regional and Remote Health: A Guide to Remoteness Classifications* (AIHW 2004a).

The ASGC Remoteness classification was developed by the ABS and was based on ARIA+, which was developed earlier by the National Key Centre for the Social Applications of Geographic Information Systems (GISCA) (ABS 2001).

In figures and tables throughout this report, Major Cities, Inner Regional, Outer Regional, Remote and Very Remote categories have been abbreviated as MC, IR, OR, R and VR.

For more information on the various remoteness classifications please refer to the AIHW publication *Rural, Regional and Remote Health: A Guide to Remoteness Classifications* (AIHW 2004a).



Source: ABS.

Figure 1: ASGC Remoteness areas of Australia

Notes on data presentation

1. Percentages or numbers in tables may not add to 100 or other totals due to rounding.
2. Standardisation has been indirect, using Major Cities rates in 2001–2003 for males and females as the standard. SMRs have been multiplied by 100 to assist in the description and interpretation of the results.
3. In this report, names of specific areas defined by the ASGC have been capitalised (for example, Inner Regional, Remote, Very Remote). Where reference has been made to generic 'regional' or 'remote' areas (respectively, Inner plus Outer Regional areas, Remote plus Very Remote areas), the terms have been left un-capitalised (for example, regional, remote).
4. 'Excess' deaths are calculated by subtracting the expected number of deaths from the number observed. Expected deaths are the number of deaths expected annually if death rates found in Major Cities are applied to the populations living in each of the other areas. 'Excess' deaths provide an indication of the extra burden of mortality in each area.
5. Where there were fewer deaths than expected (in comparison with the Major Cities 'experience'), this report states either (for example) 5 fewer deaths than expected annually, or –5 'excess' deaths annually: both expressions mean the same thing.
6. All statements about rates in this report are based on the ratio of observed to expected deaths. If there are twice as many deaths as expected, then the rate of death can be assumed to be twice that of the Major Cities comparison population.
7. Confidence intervals were calculated at the 95% level and used to identify statistically significant rate changes. Where changes in death rate are statistically significantly different from one another, they are referred to in the text as 'significantly different'; if changes in death rate are not statistically significantly different they are not said to be significantly different.
8. In some situations, differences that just fail to be statistically significant at the 95% level (but the context suggests that real differences exist) have been described as 'apparent' rather than 'significant' differences; alternatively, the difference is stated as being statistically significant at 'a lower level of confidence'.
9. Statistically significant figures are indicated in tables in bold type and with an asterisk.
10. To improve readability, where reference is made to 'Major Cities, Inner Regional, Outer Regional, Remote and Very Remote areas', the term 'the five areas' has been used. Where there is reference to 'Inner Regional, Outer Regional, Remote and Very Remote areas', the term 'the four areas outside Major Cities' has been used.

Summary

Overview

This report describes changes in death rates, for a number of causes, in Major Cities, Inner Regional, Outer Regional, Remote and Very Remote areas, between 1992 and 2003.

Overall, death rates for males and females in Major Cities declined by 4 points p.a. for males and 3 points p.a. for females. The rate of decline in regional and Remote areas was similar (although slightly lower for males in Inner Regional areas). The rate of decline in Very Remote areas (5 points p.a.) was greater than that in Major Cities.

Both the pace and the direction of change in death rates differed between causes.

There are several causes of death identified as being the main contributors to higher death rates in regional and remote areas (AIHW 2003).

The most numerically important four of these causes (in terms of raising regional and remote death rates) are coronary heart disease, 'other' circulatory diseases, chronic obstructive pulmonary disease and motor vehicle traffic accidents. For both sexes, there has been a decrease over time in the rate of death due to these causes (although for women, there has been essentially no change in chronic obstructive pulmonary disease death rates over the period).

For diabetes and suicide, there have not been consistent or substantial decreases, and in a number of areas, there have been increases in the rate of death from these causes.

For the other causes ('other' injuries, and for lung, colorectal and prostate cancers), there have also been decreases in death rates over time. However, for women there was little change in the rate of death from 'other injuries' and there was an increase in the rate of lung cancer death.

Regional differences in the rate of decline for the most influential causes of death

Coronary heart disease: the decline was similar for males in all areas (8 points p.a.), except for Very Remote areas (13 points p.a.), where the decline was significantly faster. For females, the declines were about 7 points p.a. in all areas.

Other circulatory diseases: the declines in most areas were not significantly different from those in Major Cities (6 and 5 points p.a., respectively, for males and females). The rate of decline for females in regional areas was slightly lower (4 points p.a.).

Chronic Obstructive Pulmonary Disease (COPD): rates of decline were about 6 points p.a. for males in all areas. Rates for females in Major Cities declined by about 1 point p.a. The declines for females in regional and remote areas were not significantly different from zero.

Motor Vehicle Traffic Accidents (MVTA): rates of decline for males and females in Major Cities were about 3 and 8 points p.a., respectively. Rates of decline in regional and remote areas were not significantly different from those in Major Cities.

Diabetes: for males in Major Cities there was little change in the rate of death from diabetes while for females in Major Cities there was a decline of about 2 points p.a. Rates in regional

areas increased for males by about 1 point p.a. while rates for females declined by about 1 point p.a. In remote areas, changes were not significant.

Suicide: Suicide death rates for males and females in Major Cities declined, respectively, by a significant and non-significant 1 point p.a. In regional areas, death rates for males remained similar or decreased slightly, while for females from Inner Regional areas rates increased by about 2 points p.a. Rates in Remote areas for both males and females were non-significantly higher, and in Very Remote areas increased by a significant 10 points p.a. for males and a non-significant 7 points p.a. for females.

Other injuries: For males in Major Cities, death rates declined by about 2 points p.a. There were similar declines in Inner Regional and Very Remote areas, and faster declines in Outer Regional (5 points p.a.) and remote (8 points p.a.) areas. For females in all areas, there was no significant change in the death rate.

Colorectal cancer: For males and females in Major Cities, death rates declined by about 3 points and 2.5 points p.a., respectively. Declines in the other areas were not significantly different from these.

Prostate cancer: Death rates for males in Major Cities declined by about 3 points p.a. Declines were similar to these in the other areas.

Lung cancer: In Major Cities, death rates declined for males by about 3 points p.a. and increased for females by about 1 point p.a. In the other areas, rates for males declined at rates that were not significantly different from that in Major Cities. For females in regional areas, rates increased at about the same rate as, or at a slightly greater rate than, those in Major Cities, while in remote areas there was no significant change in the rate of death.

The following section describes these in more detail.

Detailed specific causes summary

Neoplasms

Neoplasm (mainly cancer) death rates in Major Cities declined by about 2.2 points p.a. for males and 1.2 points p.a. for females. Rates of decline in regional areas were lower than in Major Cities (1.5 points p.a. and 0.7 points p.a. for males and females respectively). Rates of decline in remote areas were not significantly different from those in Major Cities.

Lung cancer death rates in Major Cities declined for males by about 3 points p.a. Rates of decline for males in regional and remote areas were similar to, or not significantly different from, the decline in Major Cities.

Lung cancer death rates in Major Cities increased for females by about 1 point p.a. Rates for females from regional areas appeared to increase by about 2 points p.a. There was no clear change in lung cancer rates of death for females in remote areas.

Colorectal cancer death rates in Major Cities declined by about 3 points p.a. for males and 2.5 points p.a. for females. Rates of decline in regional and remote areas were similar to these.

Breast cancer death rates in Major Cities declined for females by about 2.5 points p.a., with rates of decline in regional and remote areas not significantly different from this.

Cervical cancer death rates in Major Cities declined for females by about 7.5 points p.a. Rates of decline in regional and Remote areas were not significantly different from this. The rate of decline in Very Remote areas (about 40 points p.a.) was significantly greater than in Major Cities.

Prostate cancer death rates in Major Cities declined for males by about 3 points p.a., with rates of decline in regional and remote areas not significantly different from this.

Melanoma death rates in Major Cities appeared to decrease slightly, but not significantly. For males, rates in Inner Regional areas appeared to increase by about 2 points p.a., while in Outer Regional and remote areas the increases were not statistically significant. Rate changes were not statistically significant for females in regional areas, while overall rates in remote areas declined by about 8 points p.a.

In Major Cities, death rates for 'other' neoplasms declined by about 1.5 points p.a. for males and 1.0 points p.a. for females. Rates of decline in Inner Regional areas were lower than in Major Cities (0.7 points p.a. and 0.3 points p.a. for males and females respectively). In the other areas, the declines for both sexes were not significantly different from those in Major Cities, with clear decreases for both sexes in Outer Regional areas and for males in remote areas, but with less clear decreases for females in Very Remote areas.

Diseases of the circulatory system

Circulatory disease death rates declined in Major Cities by about 7 points p.a. for males and 6 points p.a. for females. Declines in regional and remote areas were similar to those in Major Cities, except for males in Very Remote areas where the rate of decline (10 points p.a.) was significantly greater than for males in Major Cities.

Death rates due to cerebrovascular disease declined in Major Cities by about 5 points p.a. for males and 4 points p.a. for females. Declines in regional and remote areas were similar to those in Major Cities, except for males in Very Remote areas where the rate of decline (10 points p.a.) was significantly greater than for males in Major Cities.

Death rates due to coronary heart disease declined in Major Cities by about 8 points p.a. for males and 7 points p.a. for females. Declines in regional and remote areas were similar to those in Major Cities, except for males in Very Remote areas where the rate of decline (13 points p.a.) was significantly greater than for males in Major Cities.

Death rates due to 'other' circulatory diseases declined in Major Cities by about 6 points p.a. for males and 5 points p.a. for females. Rates of decline for males in regional and remote areas were similar to those in Major Cities. For females, the rate of decline in regional areas (4 points) was lower than in Major Cities, while death rates for females in remote areas declined at rates indistinguishable from those in Major Cities and regional areas.

Diseases of the respiratory system

Respiratory disease death rates declined in Major Cities by about 2 points p.a. for males and increased by about 1 point p.a. for females.

Respiratory diseases death rates for males declined by about 3 points p.a. in regional and Remote areas. In Very Remote areas they declined by about 13 points p.a.

Respiratory disease death rates for females increased in Inner Regional areas by about 1 point p.a., while they changed little in Outer Regional areas, declined by about 2 points p.a. in Remote areas and by about 11 points p.a. in Very Remote areas.

Pneumonia and influenza death rates increased in Major Cities by about 3 points p.a. for males and by about 4 points p.a. for females. Rates in Inner Regional areas increased similarly, while rates in Outer Regional areas did not appear to change much. In Remote areas rates appeared to decrease by about 2 points p.a., and in Very Remote areas by about 19 points p.a.

Death rates due to asthma declined in Major Cities by about 12 points p.a. for males and 10 points p.a. for females. Rates for regional males appeared to decline faster (about 16 points p.a.) than in Major Cities. Rates of decline for regional females were not significantly different from those in Major Cities. Rates in remote areas also declined; for males, at a rate faster than in Major Cities; for females, at a rate indistinguishable from that in Major Cities.

Death rates due to chronic obstructive pulmonary disease declined in Major Cities by about 6 points p.a. for males and 1 point p.a. for females. Rates of decline for males in regional and remote areas were similar to those in Major Cities. For females in regional and remote areas, there was no significant change in the rate of death between 1992 and 2003.

Death rates due to 'other' respiratory diseases increased in Major Cities by about 3 points p.a. for both males and females. In regional areas, rates increased by about 2 points p.a., except for males in Outer Regional areas where they increased by about 1 point p.a. In remote areas, rates did not increase; they either remained similar or appeared to decrease. Specifically, the apparent decreases for males in Very Remote areas and for females in Remote areas were significantly different from the increases experienced by their counterparts in Major Cities.

Injury and poisoning

Death rates due to injury and poisoning declined in Major Cities by about 2 points p.a. for males and 1 point p.a. for females. Declines in regional and remote areas were similar to (or not significantly different from) those in Major Cities, except in Outer Regional areas where rates for males declined by about 4 points p.a. (significantly faster than in Major Cities).

Death rates due to suicide in Major Cities declined by about 1 point p.a. for males and appeared to decline by about 1 point p.a. for females. In regional areas, the death rate for males appeared to decline slightly, and at a rate that was not significantly different from the decline in Major Cities. In Inner Regional areas, rates at which females died as a result of suicide increased by about 2 points p.a. between 1992 and 2003; in Outer Regional areas there was no apparent change in the female suicide death rate. In Remote areas, there was a non-significant increase in the suicide death rate for both sexes, while in Very Remote areas there was a 10 points p.a. increase in the suicide death rate for males, and an apparent 7 points p.a. increase for females.

Death rates due to interpersonal violence declined in Major Cities by about 3 points p.a. for males and 5 points p.a. for females. For males in regional and remote areas, there was no significant change in the rate of death due to interpersonal violence except in Outer Regional areas, where death rates declined by about 6 points p.a. For females in regional areas, death rates appeared to decline at about the same rate as in Major Cities, while for those in remote areas, death rates declined substantially by about 28 points p.a. over the period 1992–2003.

Death rates due to motor vehicle traffic accidents declined in Major Cities by about 3 points p.a. for males and 8 points p.a. for females. Declines in regional areas were similar to those in Major Cities, while in remote areas rates appeared to decline at a rate not significantly different from those in Major Cities and regional areas.

Because of data constraints, trends for other land transport accidents were calculated for the period 1997–2003 (rather than for 1992–2003). Over this period, death rates in Major Cities declined by about 10 points p.a. for both males and females. Similar declines also appear to have occurred in regional areas. In remote areas, rates for males increased by about 60 points p.a., while for females the rate change was not significantly different from zero (or from the changes evident in Major Cities).

Death rates due to 'other' injuries and poisoning declined in Major Cities by about 2 points p.a. for males and remained essentially unchanged for females. Rates for males in Inner Regional areas declined at about the same rate as in Major Cities, but declined faster in Outer Regional and remote areas (at 5 points and 8 points p.a. respectively). Rates for females in regional and remote areas appeared to decrease overall, but the changes in the individual areas tended to be relatively small and not significantly different from zero.

Other causes

Death rates due to other causes declined in Major Cities by about 2 points p.a. for males and by less than 1 point p.a. for females. Declines for males in regional areas were about 1 point p.a. (less than in Major Cities), while for females from regional areas rates of decline were not significantly different from those in Major Cities. In remote areas, rates of decline tended not to be significantly different from those in Major Cities.

Death rates in Major Cities due to diabetes changed little for males and declined by about 2 points p.a. for females. In regional areas, rates for males increased by about 1 point p.a., while for females they declined by about 1 point p.a. In remote areas, rates did not appear to change during the period.

Death rates in Major Cities due to renal failure increased by about 1 point p.a. for both males and females. There do not appear to have been substantial changes in rates of death due to renal failure in regional or remote areas.

Death rates in Major Cities due to all other causes not elsewhere described declined by about 2.5 points p.a. for males and did not appear to change substantially for females. Rates for males from regional areas declined by about 1 point p.a., while those for females from regional areas declined at less than 1 point p.a. In remote areas, rates did not appear to change during the period.

Overall mortality trends

Reporting here is for all deaths in the period 1992–2003.

For perspective, Table 2 describes the number of deaths in each area in 2003.

Table 2: Number of deaths in 2003

	MC	IR	OR	R	VR	Total
Males	41,892	16,289	8,153	1,046	638	68,018
Females	41,343	14,797	6,572	718	392	63,822

Note: 452 records were missing details of geographic location and have been lost from the analysis.

Between 1992 and 2003, death rates in Major Cities declined significantly by 4 points p.a. for males and 3 points p.a. for females (Table 3, Figure 2 and Figure 3). Rates for males in Inner and Outer Regional areas also declined, respectively, at about 3 points p.a. and at about 4 points p.a. (respectively slower than, and similar to, rates of decline in Major Cities). Rates for females in regional areas declined at about the same rate as those in Major Cities (about 3 points p.a.).

Rates in Remote and Very Remote areas also declined: in the former at about the same rate as in Major Cities, and in the latter at a faster rate (5 points p.a.) than in Major Cities (Table 3).

Interpretation of overall mortality trends

Figure 2 shows a decline in the overall death rates in all areas for both sexes; but are death rates in each of the areas converging with, diverging from, or running parallel to, those in Major Cities?

Table 3: Annual change in SMRs, 'all causes', 1992–2003

	Males					Females				
	MC	IR	OR	R	VR	MC	IR	OR	R	VR
Average annual change	–3.7	***–3.3**	–3.6	–4.0	***–5.4**	–2.6	–2.4	–2.5	–2.3	***–5.0**

Note: Changes are based on the slope of the curve, calculated using the weighted least squares method. Changes that are significantly different from those in Major Cities are bold and marked with an asterisk. Positive changes signify an increase in mortality; negative changes signify a decrease in mortality.

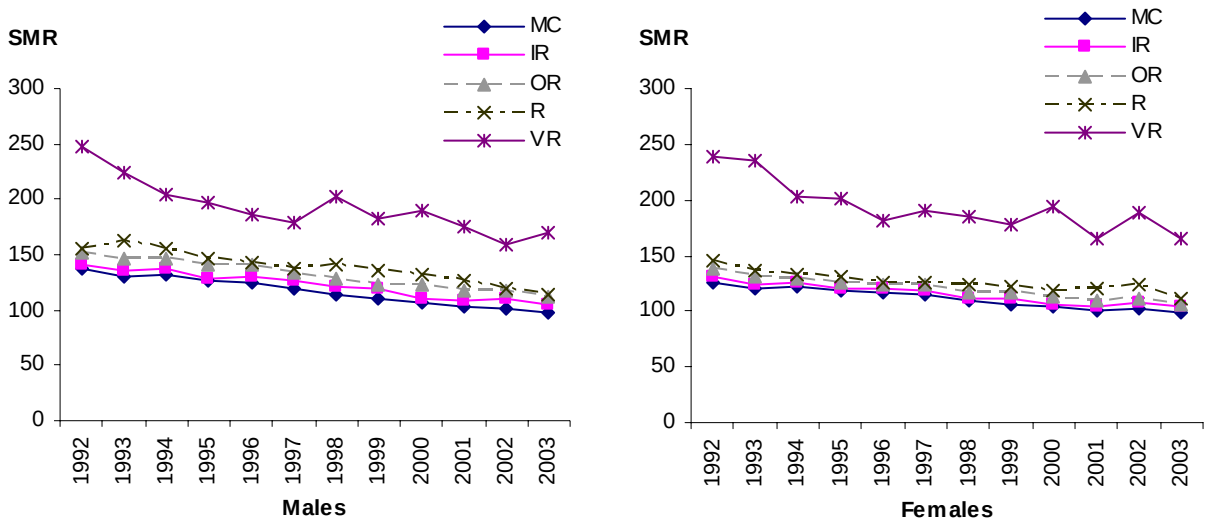
Figure 3 and Table 3 indicate that the SMR for male residents of Major Cities, Inner Regional and Very Remote areas declined by 3.7, 3.3 and 5.4 points on average each year, between 1992 and 2003. In other words, the SMR for males in each of these areas declined, respectively, by about 40, 37 and 60 points over the entire period (assuming a linear trend line).

The trend line estimates the 1992 SMR for males in Major Cities, Inner Regional and Very Remote areas as, respectively, about 140, 144 and 230 (i.e. death rates were about 1.4, 1.44 and 2.3 times those in Major Cities in 2003).

From the trend line, between 1992 and 2003:

- the SMR declined for males most quickly in Very Remote areas, from about 230 to about 170. This is an absolute decline of 60 points, which is 60% of the standard (Major Cities 2001–2003) death rate. This equates to an approximate 26% decline in the death rate (100×(60/230)).
- the SMR declined for males in Major Cities areas, from about 140 to about 100. This is an absolute decline of 40 points, which is 40% of the standard (Major Cities 2001–2003) death rate. This equates to an approximate 29% decline in the death rate (100×(40/140)).
- the SMR declined more slowly for males in Inner Regional areas, from about 144 to about 107. This is an absolute decline of 37 points, which is 37% of the standard (Major Cities 2001–2003) death rate. This equates to an approximate 26% decline in the death rate (100×(37/144)).

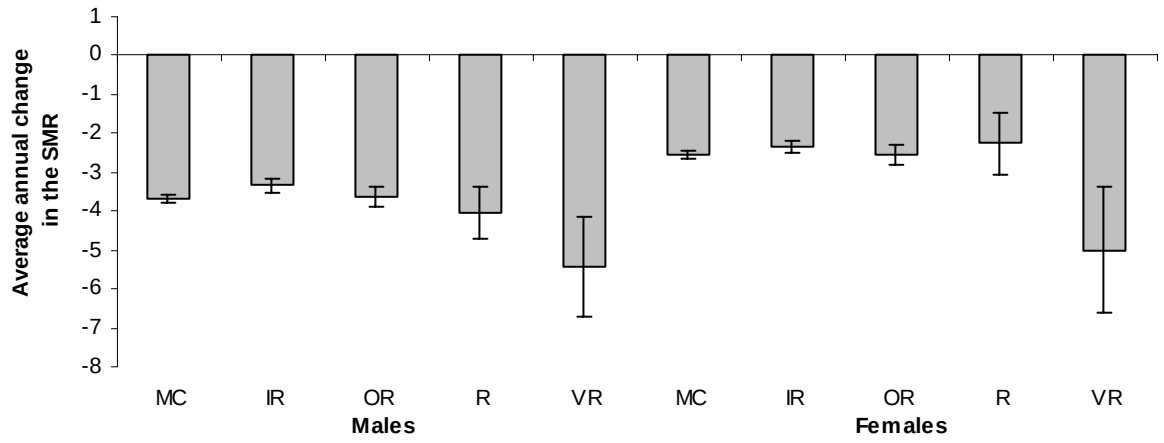
For males, the high death rate in Very Remote areas is dropping more rapidly (at 5.4 points per year) than is the death rate in Major Cities (3.7 points per year); in other words, the death rates in these two areas are slowly converging. Conversely, the slightly elevated death rate in Inner Regional areas is dropping at a slightly slower rate (3.3 points per year) than is the death rate in Major Cities (3.7 points per year); in other words, the death rates in these two areas are very slowly diverging



Note: SMRs calculated using Major Cities rates in the period 2001–2003 as the standard, and expressed as multiples of 100.

Source: AIHW National Mortality Database.

Figure 2: Overall trend in SMRs, 'all causes', males and females, 1992–2003



Notes

1. SMRs calculated using Major Cities rates in the period 2001–2003 as the standard, and expressed as multiples of 100.
2. Error bars indicate 95% confidence intervals. These indicate the amount of uncertainty about the precision of the calculated annual change.

Source: AIHW National Mortality Database.

Figure 3: Annual change in the ratio of observed to expected deaths, 'all causes', 1992–2003

Contribution of major cause groups to the overall decline in mortality

Table 4 and Figure 4 describe the contribution of each broad cause of death to the overall decline in mortality for each Remoteness area between 1992 and 2003.

Declines in the rates of death due to circulatory diseases accounted for most (between 72% and 81%) of the decline in Major Cities and regional areas, although their relative importance was less in remote areas (contributing 66% and 61% of the decline in Remote and Very Remote areas respectively).

Declines in rates of death due to neoplasms made the next largest contribution to the overall decline (contributing between about 15% and 20% to the decline) although this contribution was lower (11%) in both Inner and Outer Regional areas.

Respiratory diseases, injury and 'other causes' made smaller contributions (between 1% and 6% each), except in remote areas where some of these causes made substantial contributions to the overall decline. Specifically, declines in rates of death due to respiratory diseases contributed 7% and 22%, respectively, to the overall decline in Remote and Very Remote areas. Declines in injury mortality contributed 9% to the overall decline in Remote areas (but only 1% in Very Remote areas).

Table 4: Percentage of the decrease in the total number of 'excess' deaths that resulted from changes in mortality of each broad cause, 1992–2003

Broad cause of death	MC	IR	OR	R	VR
Circulatory disease	72	81	76	66	61
Neoplasms	17	11	11	21	16
Respiratory disease	1	3	4	7	22
Injury	4	2	6	9	1
Other causes	6	3	2	–4	0

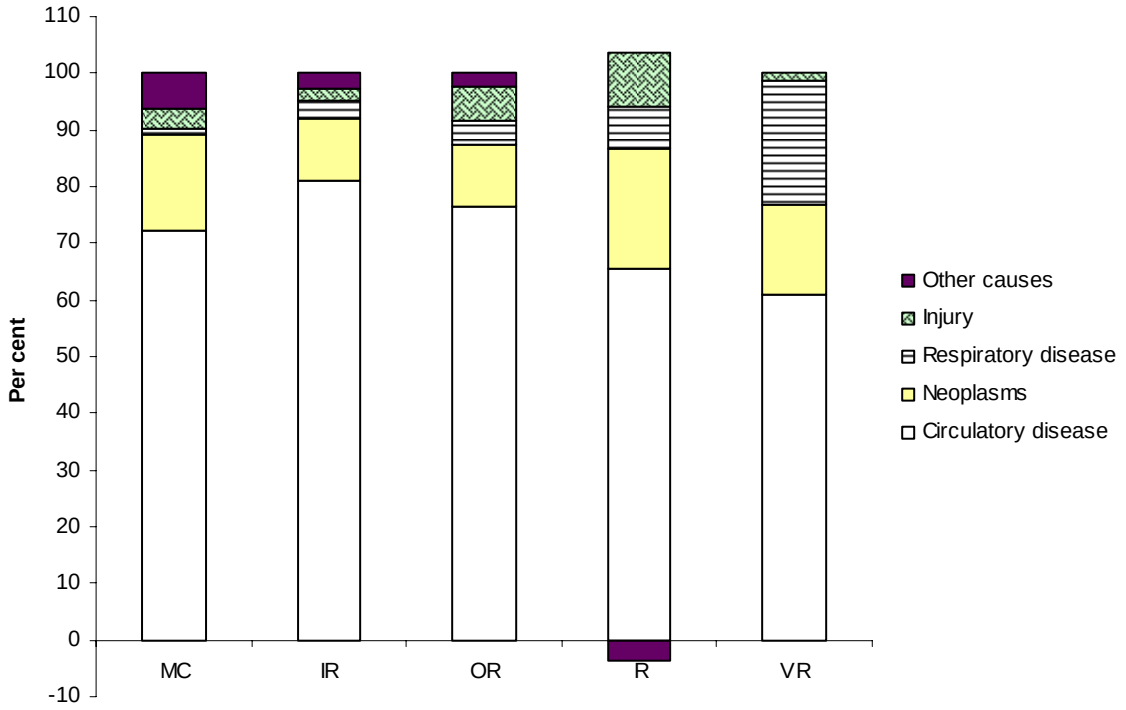
Note: 'Excess' deaths calculated using Major Cities rates in the period 2001–2003 as the standard. The percentage of the decrease attributable to each broad cause was allocated by linear regression of the numbers of 'excess' deaths in each year. Negative numbers indicate increases in the number of excess deaths over time due to that cause.

Source: AIHW National Mortality Database.

The contribution of each broad cause to the overall decline in mortality in each remoteness area was last reported in *Rural, Regional and Remote Health: A Study on Mortality* (AIHW 2003) for the period 1992 to 1999. There are broad similarities between the results reported for that (1992–1999) period and the declines reported for this (1992–2003) period. These similarities relate particularly to the substantial contribution to declines in the overall death rate of changes in rates of death due to circulatory diseases and neoplasms.

Where there have been differences, they have occurred because of changes between 1999 and 2003 in the pace or direction of earlier trends. For example:

- declines in rates of death due to respiratory diseases contributed proportionally less in Major Cities and regional areas in this more recent analysis
- injury death rates appeared to decline in this analysis, making some contribution to the decline in overall death rates, whereas in the previous analysis they had appeared to contribute little to the overall decline.



Note: 'Excess' deaths calculated using Major Cities rates in the period 2001–2003 as the standard. The percentage of the decrease attributable to each broad cause was allocated by linear regression of the numbers of 'excess' deaths in each year.

Source: AIHW National Mortality Database.

Figure 4: Percentage of the decrease in the total number of 'excess' deaths that result from changes in mortality due to each broad cause, 1992–2003

The contribution of 'other' causes in the earlier (1992–1999) period was small in most areas, but substantial in Very Remote areas. In this more recent analysis, the contribution of 'other' causes was comparatively larger in Major Cities and regional areas, and negligible in remote areas.

Another way of illustrating the contribution of each major cause to the overall decline in mortality is by plotting the change in the annual number of 'excess' deaths, for males and females in each area (see figures 5–9).

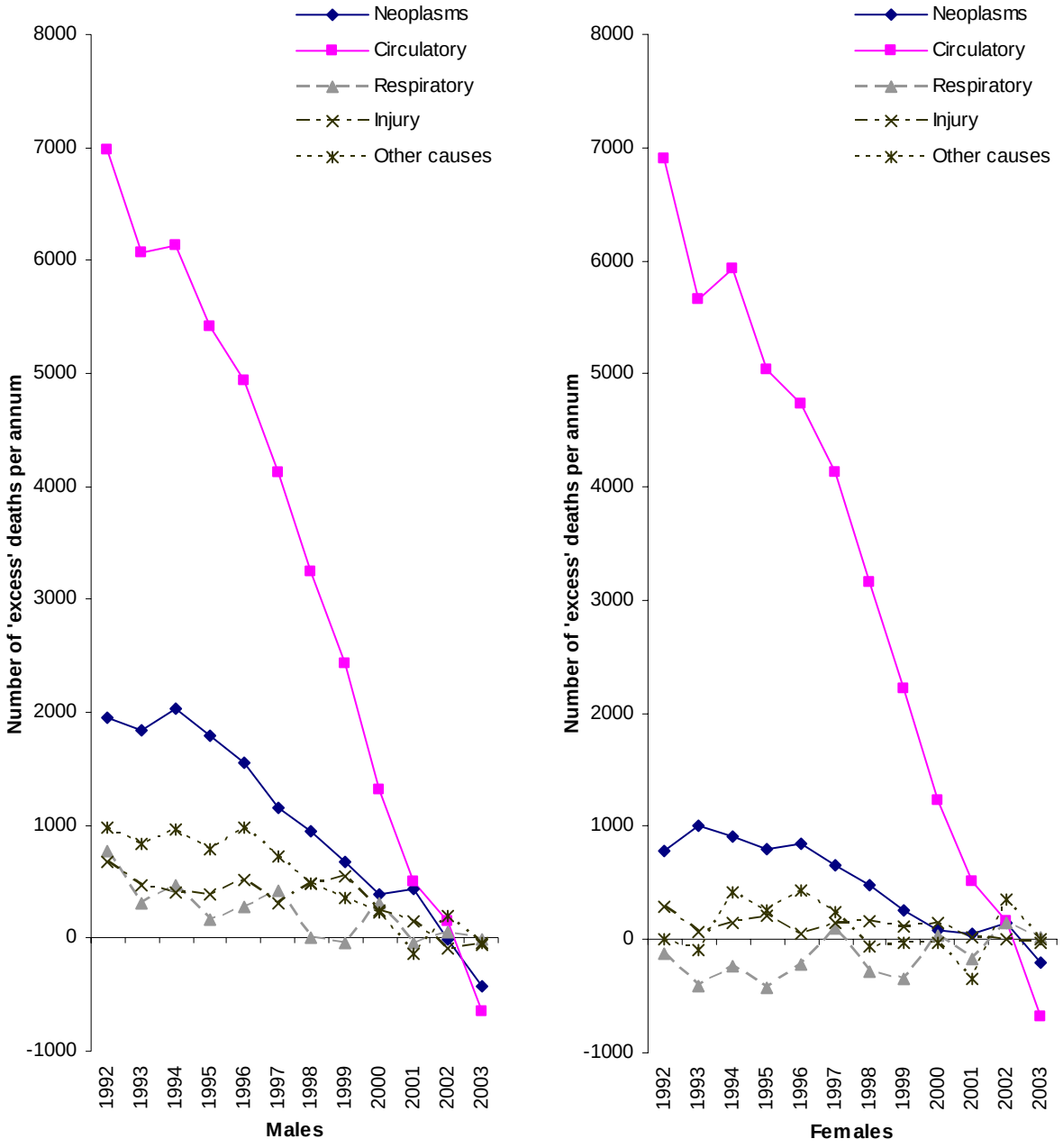
The number of 'excess' deaths is calculated as the number of deaths that occurred in each year, in excess of the number expected if Major Cities age- and sex-specific death rates for the period 2001–2003 applied to the populations in each area in each year. Conversely, if 'excess' deaths were eliminated, death rates in regional and remote areas would be identical to those in Major Cities.

Some of the interesting tendencies that can be identified from these figures include:

- the clear and substantial importance of declines in circulatory disease deaths, and to a lesser extent neoplasm deaths, to the decline in overall mortality
- the tendency for declines in respiratory disease mortality for males not to be reflected in any declines for females, for whom rates remained similar or even increased.

With the rapid decline of circulatory diseases as the main reason for higher death rates in regional and remote areas, and the less rapid decline in the rates of death due to the other causes, the latter have become relatively more important as contributors to the higher death

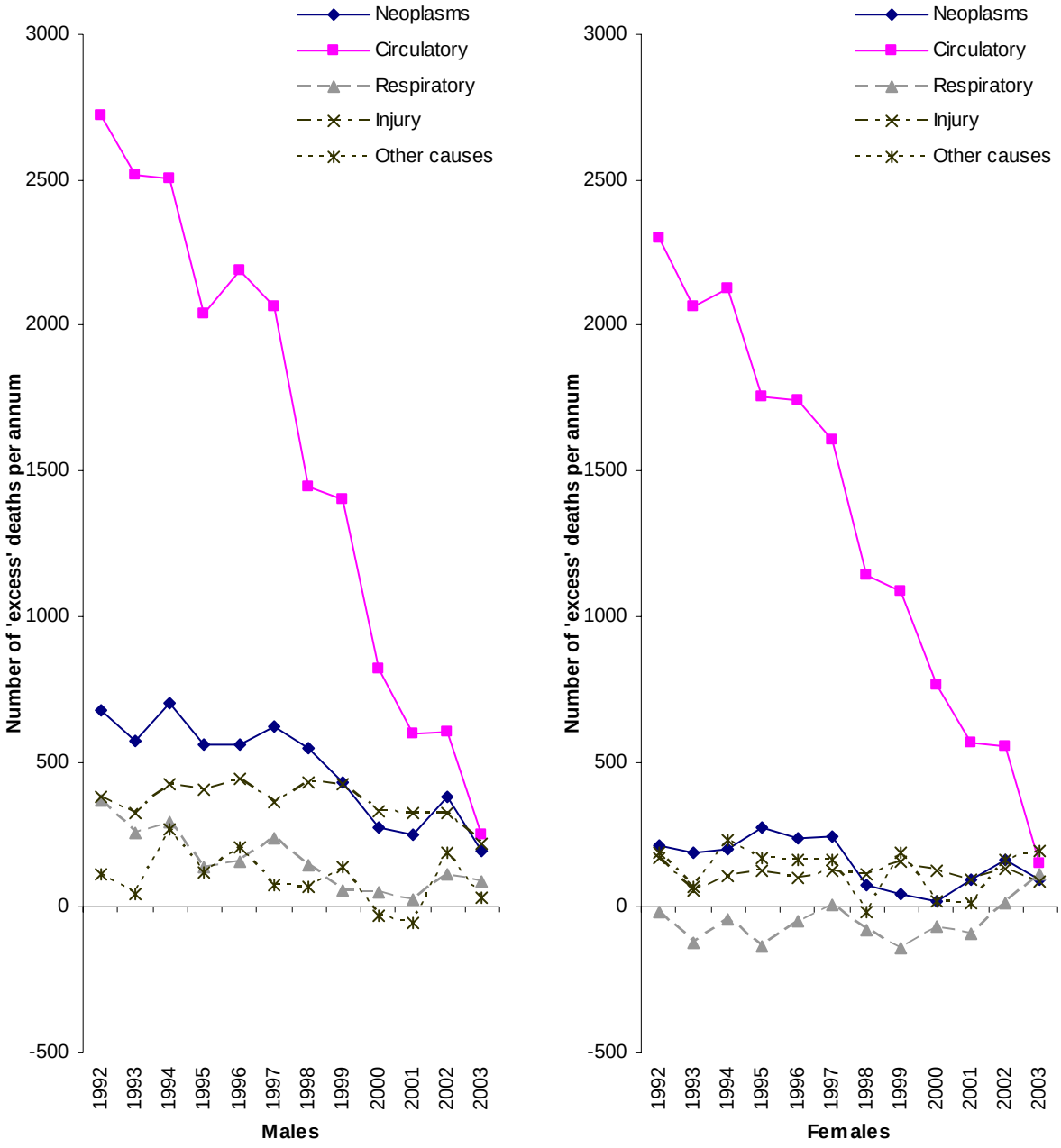
rates in these areas. For example, in these areas, injury has become one of the most important causes of 'excess' death for males, particularly in Very Remote areas; along with 'other' causes, injury is the principal cause of the higher death rates in such areas. In less remote areas, for example in Inner and Outer Regional areas, injury, neoplasms and circulatory diseases appeared, in 2003, to be roughly equally important as contributors to the higher death rates of males.



Note: 'Excess' deaths calculated using Major Cities rates in the period 2001–2003 as the standard.

Source: AIHW National Mortality Database.

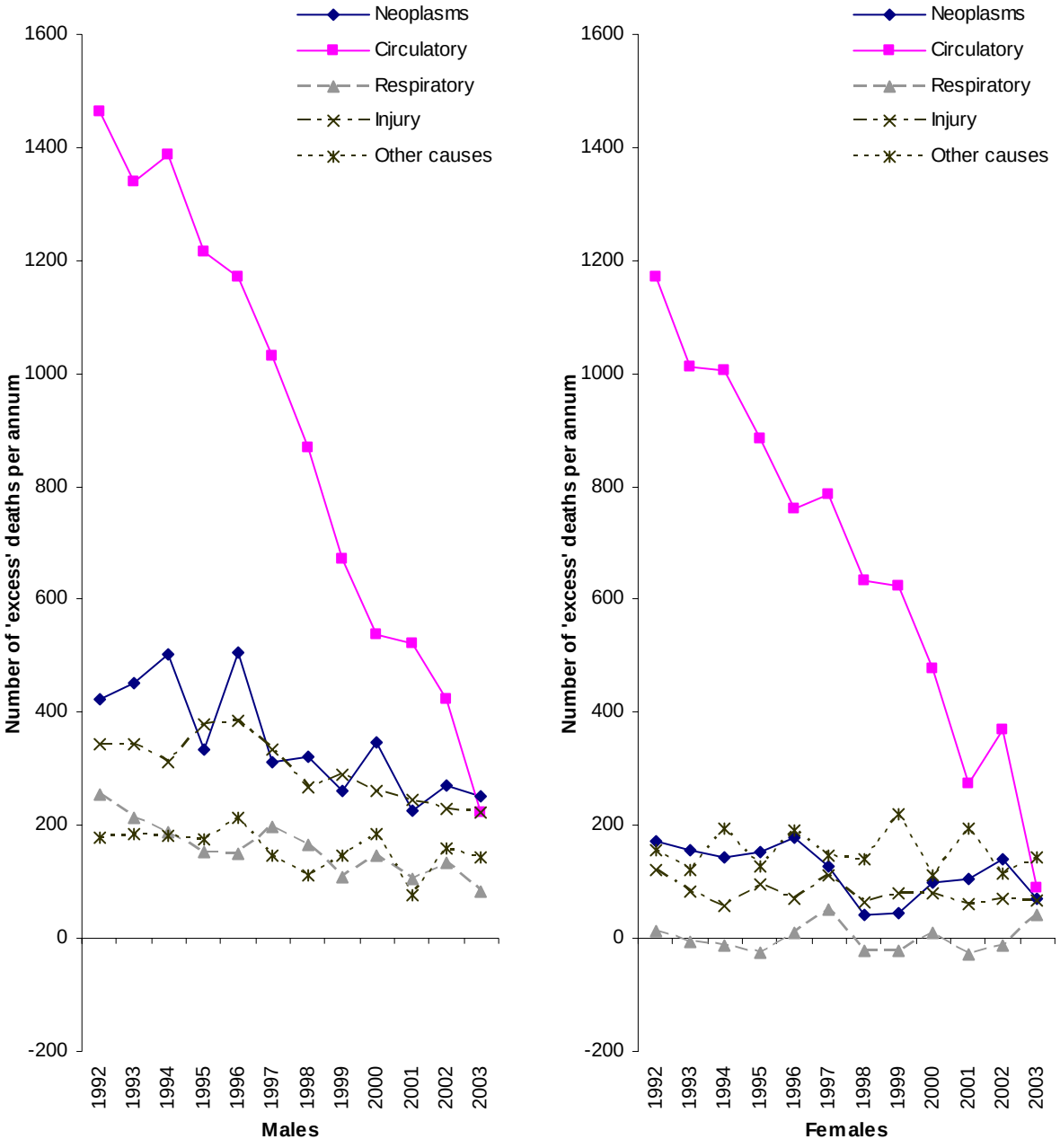
Figure 5: The contribution of each broad cause of death to the overall decline in mortality in Major Cities, as expressed by the annual number of 'excess' deaths attributable to each cause, in each year, 1992–2003



Note: 'Excess' deaths calculated using Major Cities rates in the period 2001–2003 as the standard.

Source: AIHW National Mortality Database.

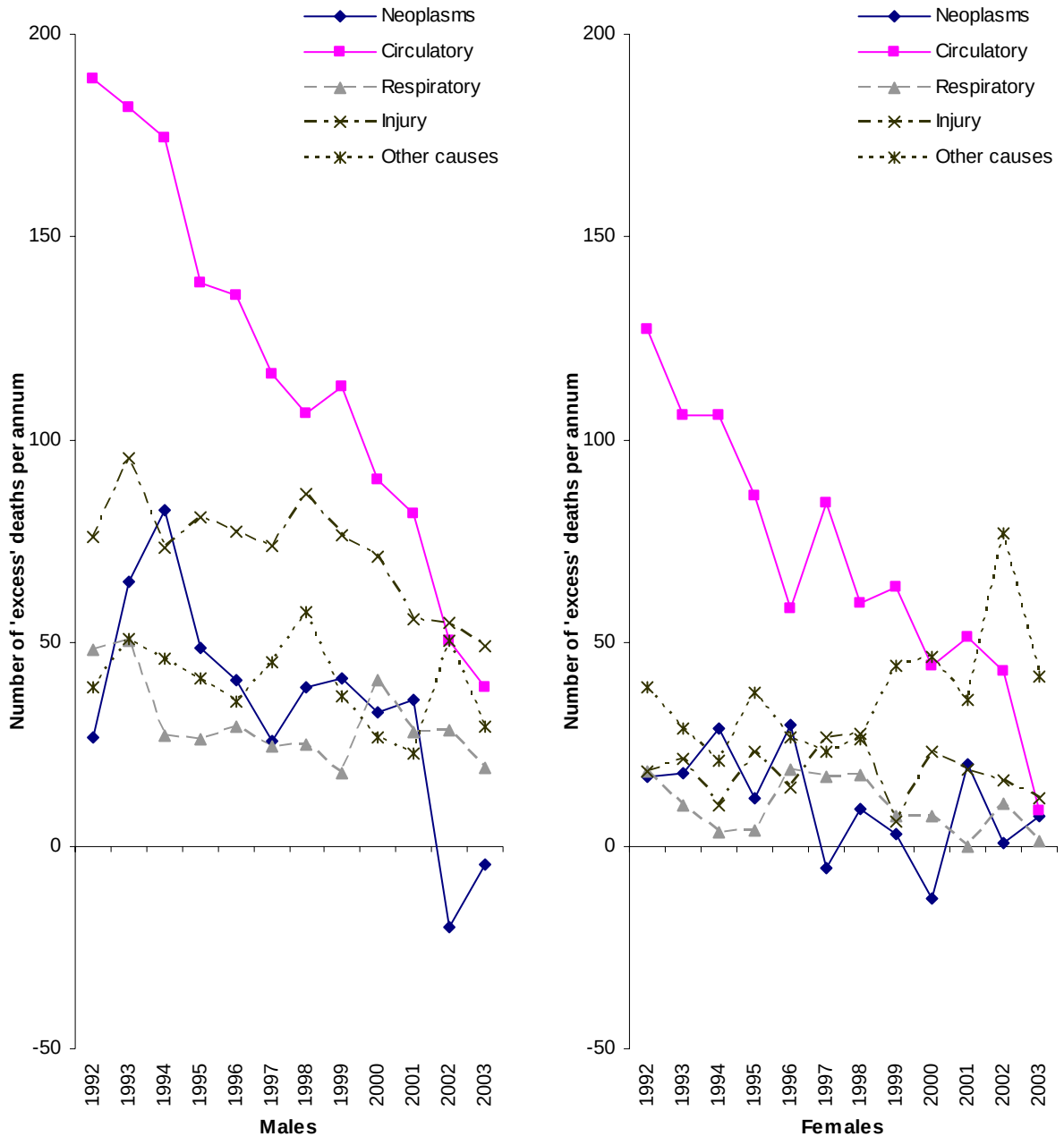
Figure 6: The contribution of each broad cause of death to the overall decline in mortality in Inner Regional areas, as expressed by the annual number of 'excess' deaths attributable to each cause, in each year, 1992–2003



Note: 'Excess' deaths calculated using Major Cities rates in the period 2001–2003 as the standard.

Source: AIHW National Mortality Database.

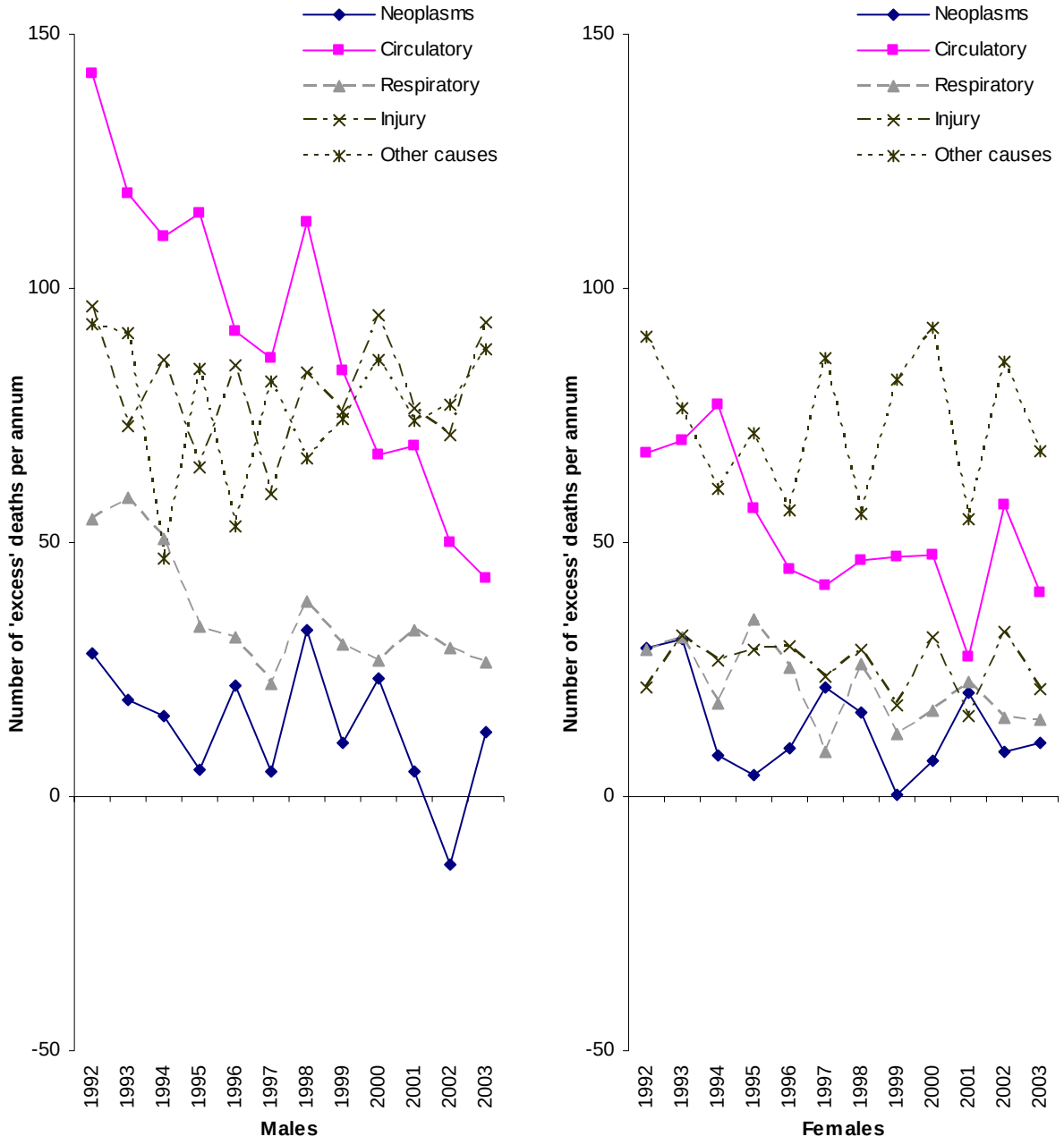
Figure 7: The contribution of each broad cause of death to the overall decline in mortality in Outer Regional areas, as expressed by the annual number of 'excess' deaths attributable to each cause, in each year, 1992–2003



Note: 'Excess' deaths calculated using Major Cities rates in the period 2001–2003 as the standard.

Source: AIHW National Mortality Database.

Figure 8: The contribution of each broad cause of death to the overall decline in mortality in Remote areas, as expressed by the annual number of 'excess' deaths attributable to each cause, in each year, 1992–2003



Note: 'Excess' deaths calculated using Major Cities rates in the period 2001–2003 as the standard.

Source: AIHW National Mortality Database.

Figure 9: The contribution of each broad cause of death to the overall decline in mortality in Very Remote areas, as expressed by the annual number of 'excess' deaths attributable to each cause, in each year, 1992–2003