

4 Mortality differences by geographic region

A number of Australian studies have examined the relationship between geographic region and mortality (Mathers 1994a, 1994b, 1995, 1996; Strong et al. 1998a; Glover et al. 1999; AIHW 2002, 2003; ABS 2002). The findings of these works generally indicate that death rates are lowest in capital cities and major metropolitan regions, and highest in rural and remote areas.

Summarising the relationship between geographic region and mortality beyond this overall finding, however, is difficult. Much of the extant research has used different geographic classifications, or a differently sized area-based unit of analysis, and the nature and extent of mortality inequalities by geographic region seem to be contingent on the cause of death, the age group examined, and sex.

The assessment of geographic mortality inequalities is further complicated by the variable concentration of Indigenous peoples in rural and remote areas. Specifically: to what extent are higher death rates in non-metropolitan regions of Australia due to the higher mortality experience of the Indigenous populations who reside in these areas? Previous research suggests that Indigenous mortality contributes moderately to higher death rates among people in rural regions, and substantially in remote and very remote areas (Coory 2003; Glover et al. 1999; AIHW 2002).

In this chapter we examine the mortality profile of different geographic regions for the period 1998–2000, for males and females aged 0–14, 15–24, 25–64 and 65 years or more. The analysis is based on the remoteness characteristics of Statistical Local Areas (SLAs). In most cases, SLAs correspond to council boundaries defined by Local Government Areas, and, in aggregate, SLAs cover the whole of Australia without gaps or overlaps (ABS 2001).

The geographic remoteness of each SLA was ascertained using the Accessibility/Remoteness Index of Australia (ARIA) (Department of Health and Aged Care 2001). Released in 1999, ARIA is an alternative measure to the Rural, Remote and Metropolitan Area (RRMA) classification, which was limited as an indicator of people's access to services by its use of straight-line distance measurements between places, which did not capture the reality of road travel (Bamford et al. 1999; Hays et al. 1998). ARIA, by contrast, was developed using Geographic Information Systems network analysis to calculate actual distance travelled by road from 11,340 populated localities to four categories of ABS-defined urban centres: Category A = >250,000 persons; B = 48,000–249,999; C = 18,000–47,999; D = 5,000–17,999 persons. ARIA is based on the minimum distance that people have to travel to reach an urban centre containing basic services (e.g. health, education, and retail). The ARIA methodology produces a continuous variable that ranges from 0 (areas of highest accessibility) to 12 (areas of highest remoteness). Using an interpolation process, ARIA remoteness values can be assigned to all places and points in Australia. ARIA scores for each SLA are calculated by taking the average remoteness value for each 1-km grid-segment forming the SLA. The developers of ARIA have produced a categorical measure that allows SLAs with similar degrees of access and remoteness to services to be grouped together as follows:

1. Highly Accessible SLAs – areas with relatively unrestricted access to a wide range of goods and services and opportunities for social interaction.
2. Accessible SLAs – areas with some restrictions in accessibility to some goods, services and opportunities for social interaction.
3. Moderately Accessible SLAs – areas with significantly restricted accessibility to goods, services and opportunities for social interaction.

4. Remote SLAs – areas with very restricted accessibility to goods, services and opportunities for social interaction.
5. Very Remote SLAs – areas with very little accessibility to goods, services and opportunities for social interaction.

Due to the relatively small populations and number of deaths within areas classified as Remote or Very Remote, these two categories were combined.

As part of this chapter, we also investigate whether the higher death rates of Indigenous peoples contribute to geographic differences in mortality. Examining the mortality status of Indigenous Australians is complicated by variations in the extent to which Indigenous persons are included in national data collections, and the accuracy with which they are identified in administrative datasets. At present, it is considered that only Queensland, South Australia, Western Australia, and the Northern Territory reliably report Indigenous status on death certificates (ABS & AIHW 2001, 2003). As such, only these states and territories are included in the Indigenous mortality analysis undertaken in this report.

4.1 Persons aged 0–14 years

In 1998–2000, life expectancy at birth for males born in Highly Accessible areas of Australia was approximately 77.3 years, whereas life expectancy for males born in Remote/Very Remote areas was 73.1 years (Table 4.1.1). The corresponding figures for females were 82.7 and 79.6 years respectively.

Table 4.1.1: Life expectancy by ARIA category and sex, children born 1998–2000

ARIA category	Boys	Girls
Highly accessible	77.3	82.7
Accessible	75.8	81.8
Moderately accessible	75.8	82.0
Remote/very remote	73.1	79.6
All persons	76.8	82.4

Source: ABS mortality data.

Infants aged less than 1 year

Children aged less than 1 year from Remote/Very Remote areas experienced significantly higher all-cause mortality in 1998–2000 than their counterparts from Highly Accessible areas (Table 4.1.2).

For male infants, all-cause death rates were 80% higher in Remote/Very Remote areas (429 more male deaths per 100,000), and for females, 154% higher (661 more female deaths per 100,000). Death rates among infants were also significantly higher in Remote/Very Remote areas for certain conditions originating in the perinatal period, and for congenital malformations, deformations and chromosomal abnormalities (females only).

Table 4.1.2: Age-standardised mortality rates and rate ratios, children aged less than 1 year by ARIA category and sex, 1998–2000

Cause of death and ICD-10 codes	Boys		Girls	
	Rate ^(a)	Rate ratio	Rate ^(a)	Rate ratio
<i>All causes</i>				
Highly accessible	539.0	1.00	430.0	1.00
Accessible	703.3	1.30***	518.8	1.21**
Moderately accessible	773.2	1.43***	491.4	1.14
Remote/very remote	967.8	1.80***	1,090.7	2.54***
<i>Certain conditions originating in the perinatal period (P00–P96)</i>				
Highly accessible	257.0	1.00	202.9	1.00
Accessible	317.0	1.23*	246.6	1.22
Moderately accessible	346.4	1.35*	213.4	1.05
Remote/very remote	412.6	1.61***	445.8	2.20***
<i>Congenital malformations, deformations and chromosomal abnormalities (Q00–Q99)</i>				
Highly accessible	146.3	1.00	123.1	1.00
Accessible	171.9	1.17	130.3	1.06
Moderately accessible	179.4	1.23	135.8	1.10
Remote/very remote	210.1	1.44	294.6	2.39***

(a) Deaths per 100,000 persons.

Source: ABS mortality data.

*p<0.05, **p<0.01, ***p<0.001

In 1998–2000, approximately 174 male deaths, and 130 female deaths, could have been avoided if infants in Accessible, Moderately Accessible, and Remote/Very Remote areas experienced the same mortality rate as male and female infants in Highly Accessible areas (Table 4.1.3).

Table 4.1.3: Excess mortality by ARIA category and sex, children aged less than 1 year, 1998–2000

Cause of death and ICD-10 codes	Boys		Girls	
	Number ^(a)	Per cent ^(b)	Number ^(a)	Per cent ^(b)
All causes	174	6.3	130	6.3
Certain conditions originating in the perinatal period (P00–P96)	60	5.7	46	5.8
Congenital malformations, deformations and chromosomal abnormalities (Q00–Q99)	23	3.6	26	5.0
Accidents and injury (V01–Y98)	33	10.6	19	9.6

(a) Total number of deaths that would have been avoided if all ARIA categories experienced the same mortality rate as highly accessible areas.

(b) Percentage of deaths that would have been avoided if all ARIA categories had the same mortality rate as highly accessible areas.

Source: ABS mortality data.

Children aged 0-14 years

Boys and girls aged 0-14 who lived in Remote/Very Remote areas experienced the greatest number of potential years of life lost, and the highest mortality rates for all causes, for potentially avoidable deaths, and for accidents and injury (Figure 4.1.1; Table 4.1.4).

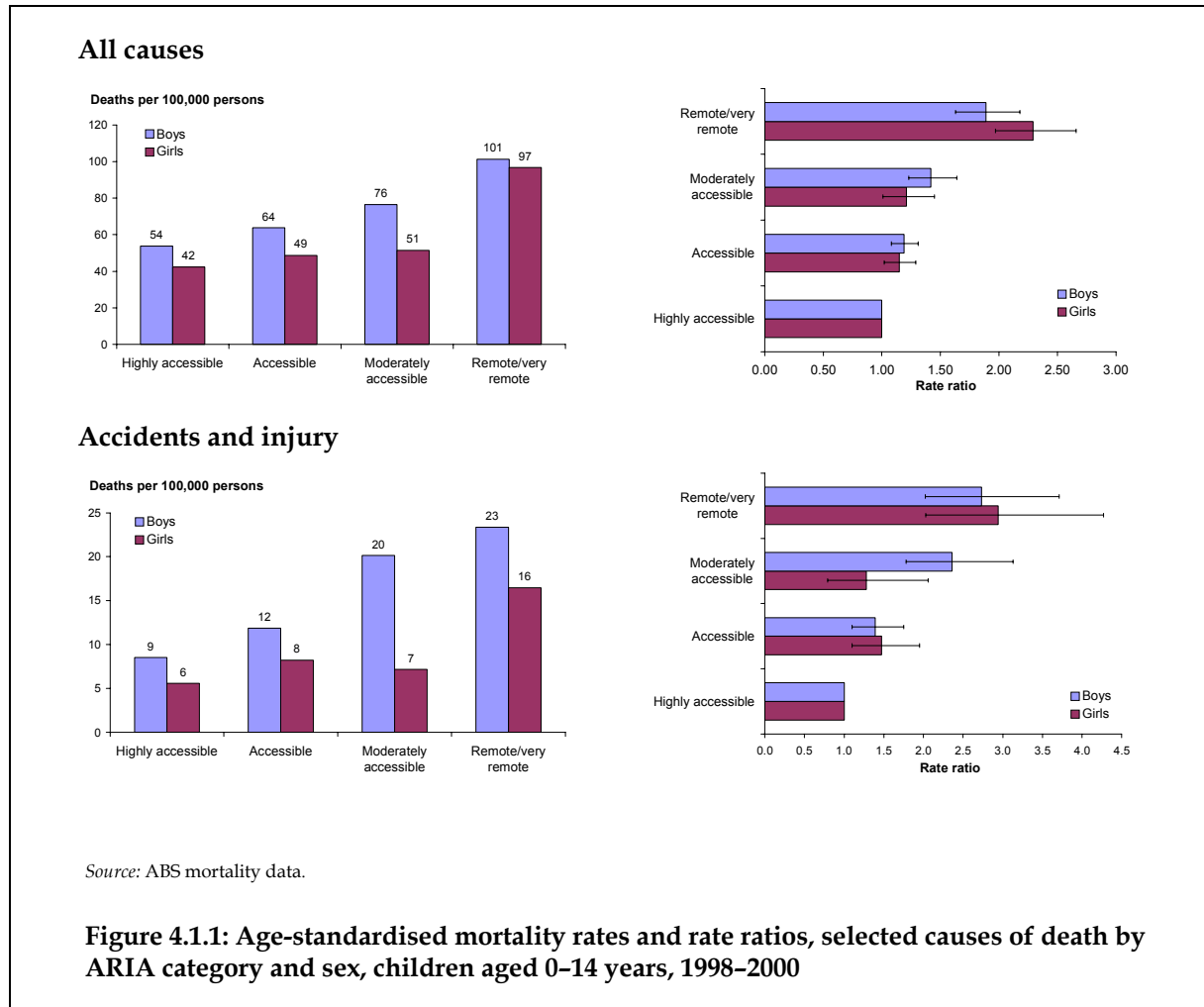


Table 4.1.4: Age-standardised mortality rates and rate ratios, children aged 0–14 years by ARIA category and sex, 1998–2000

Cause of death and ICD-10 codes	Boys		Girls	
	Rate ^(a)	Rate ratio	Rate ^(a)	Rate ratio
<i>All causes</i>				
Highly accessible	53.7	1.00	42.4	1.00
Accessible	63.8	1.19***	48.7	1.15*
Moderately accessible	76.4	1.42***	51.4	1.21*
Remote/very remote	101.3	1.89***	96.8	2.29***
<i>PYLL^(b)</i>				
Highly accessible	37.7	1.00	29.7	1.00
Accessible	43.1	1.14**	33.0	1.11
Moderately accessible	52.4	1.39***	35.5	1.20
Remote/very remote	72.9	1.93***	70.9	2.39***
<i>Potentially avoidable deaths</i>				
Highly accessible	26.1	1.00	20.2	1.00
Accessible	36.6	1.40***	23.4	1.16
Moderately accessible	41.5	1.59***	27.6	1.37*
Remote/very remote	51.2	1.96***	50.8	2.52***
<i>Accidents and injury (V01–Y98)</i>				
Highly accessible	8.5	1.00	5.6	1.00
Accessible	11.9	1.39**	8.2	1.47**
Moderately accessible	20.1	2.36***	7.2	1.28
Remote/very remote	23.4	2.73***	16.5	2.94***

(a) Deaths per 100,000 persons.

(b) PYLL per 1,000 persons.

Source: ABS mortality data.

*p<0.05, **p<0.01, ***p<0.001

In 1998–2000, if all geographic regions in Australia experienced the same mortality rate as Highly Accessible regions, approximately 399 deaths among 0–14 year olds could have been avoided, which represented 6.7% of all deaths in this age group (Table 4.1.5).

Table 4.1.5: Excess mortality by ARIA category and sex, children aged 0–14 years, 1998–2000

Cause of death and ICD-10 codes	Boys		Girls	
	Number ^(a)	Per cent ^(b)	Number ^(a)	Per cent ^(b)
All causes	227	6.7	172	6.7
Accidents and injury (V01–Y98)	85	14.4	43	11.9

(a) Total number of deaths that would have been avoided if all ARIA categories experienced the same mortality rate as highly accessible areas.

(b) Percentage of deaths that would have been avoided if all ARIA categories had the same mortality rate as highly accessible areas.

Source: ABS mortality data.

Indigenous deaths among 0–14 year olds, and their impact on geographic mortality inequalities

In 1998–2000, babies born to Indigenous mothers were more than twice as likely to die during the perinatal period than babies born to non-Indigenous mothers (Table 4.1.6). Foetal deaths (stillbirths) were around 48% higher amongst babies born to Indigenous mothers, while neonatal deaths (death of an infant within 28 days of birth) were around 61% higher.

Table 4.1.6: Perinatal mortality by mother’s Indigenous status, 1998–2000

Indigenous status	Foetal deaths		Neonatal deaths ^(a)		Perinatal deaths ^(b)	
	Number	Rate ^(c)	Number	Rate ^(d)	Number	Rate ^(c)
Babies of Indigenous mothers	337	12.8	193	7.4	530	20.1
Babies of non-Indigenous mothers	5,004	6.7	2,171	2.9	7,175	9.6

(a) Based on live births only. May exclude neonatal deaths within 28 days of birth for babies transferred or readmitted to hospital and those dying at home, for selected states and territories.

(b) Perinatal deaths include fetal deaths and neonatal deaths.

(c) Deaths per 1,000 total births.

(d) Deaths per 1,000 live births.

Source: ABS & AIHW 2003.

In Queensland, South Australia, Western Australia, and the Northern Territory in 1999–2000, Indigenous infants and children comprised a relatively small proportion of all children aged 0–14 years. As Table 4.1.7 shows, however, deaths among Indigenous infants and children accounted for a disproportionately high number of all deaths among young people in the population.

Table 4.1.7: Deaths identified as Indigenous,^(a) persons aged 0–14 years, 1999–2001 (per cent)

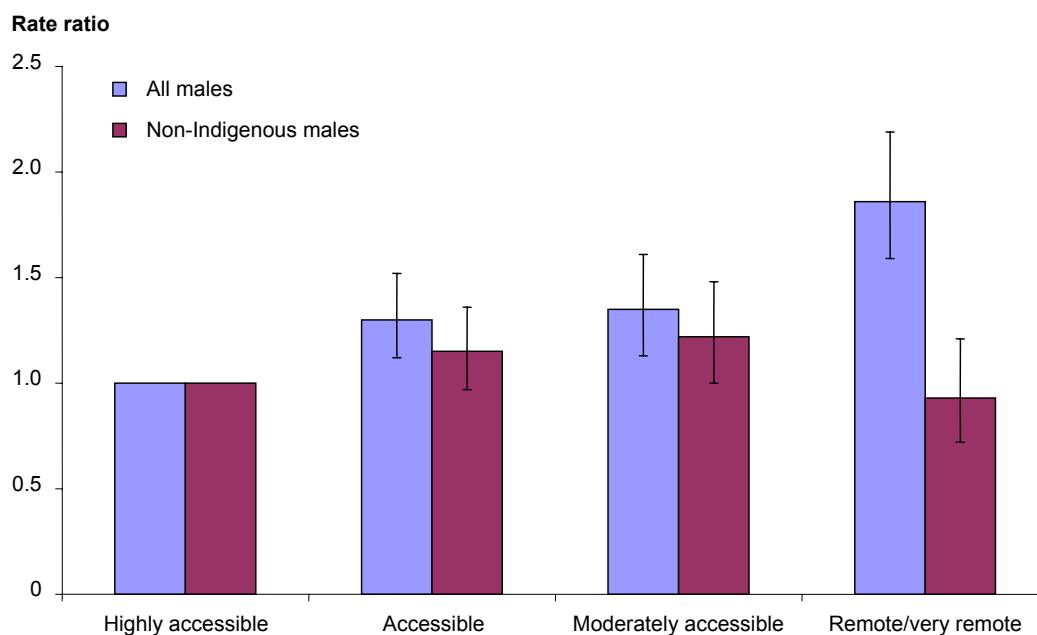
Age group	Indigenous deaths as a proportion of all deaths	Indigenous population as a proportion of total population
Less than 1	19.1	7.4
1–4	16.6	7.1
5–14	14.5	6.4

(a) Data are for Queensland, South Australia, Western Australia and the Northern Territory.

Source: ABS & AIHW 2003.

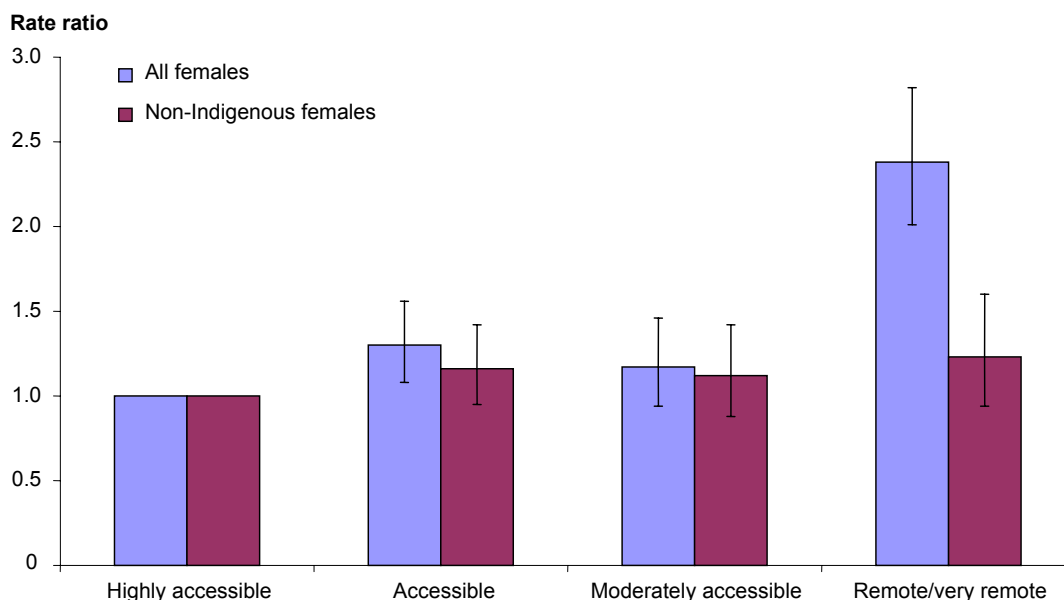
Figures 4.1.2 and 4.1.3 compare all-cause mortality rates across the ARIA categories for males and females aged 0–14 years, using death data for all persons, and then based on data that excluded Indigenous deaths.

Compared with Highly Accessible areas, mortality rates among all boys were 30% higher in Accessible areas, 35% higher in Moderately Accessible areas, and 86% higher in Remote/Very Remote areas (Figure 4.1.2). When Indigenous deaths were removed from the analysis, the corresponding differences across the ARIA categories were 15%, 22% and 7% (with this latter difference indicating a lower all-cause mortality rate in Remote/Very Remote regions compared with Highly Accessible areas). A similar patterning is found for girls (Figure 4.1.3). Prior to the removal of Indigenous deaths, all-cause mortality rates were 30% higher in Accessible areas, 17% higher in Moderately Accessible areas, and 138% higher in Remote/Very Remote areas. These differences reduced to 16%, 12% and 23% respectively when the analysis was based on deaths among only non-Indigenous girls.



Note: Data are for Queensland, South Australia, Western Australia and the Northern Territory.

Figure 4.1.2: All-cause age-standardised mortality rate ratios by ARIA category, total male population and male non-Indigenous population aged 0–14 years, 1998–2000



Note: Data are for Queensland, South Australia, Western Australia and the Northern Territory.

Figure 4.1.3: All-cause age-standardised mortality rate ratios by ARIA category, total female population and female non-Indigenous population aged 0–14 years, 1998–2000

4.2 Persons aged 15–24 years

In 1998–2000, males aged 15 years living in Remote/Very Remote areas, had a life expectancy of 59.2 years: this was approximately 3.7 years less than males of the same age from Highly Accessible areas (Table 4.2.1). The corresponding difference in life expectancy between Remote/Very Remote and Highly Accessible areas for 15 year old females was 2.5 years.

Table 4.2.1: Life expectancy, persons at 15 years by ARIA category and sex, 1998–2000

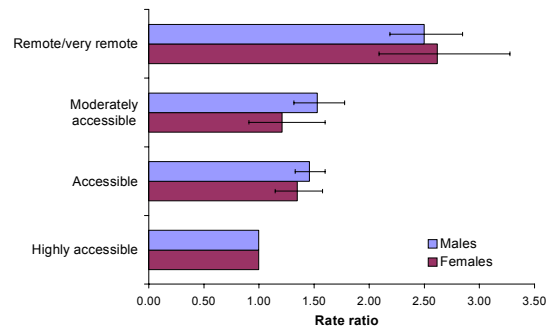
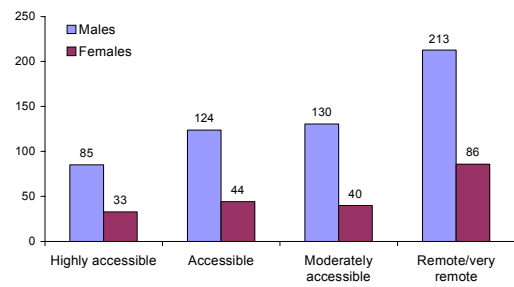
ARIA category	Males	Females
Highly accessible	62.9	68.2
Accessible	61.6	67.4
Moderately accessible	61.7	67.6
Remote/very remote	59.2	65.7
Total persons	62.5	68.0

Source: ABS mortality data.

Persons aged 15–24 from Remote/Very Remote areas experienced significantly higher mortality rates for all causes of death, and for a range of specific causes including accidents and injuries, and suicide (males only) (Figure 4.2.1; Table 4.2.2).

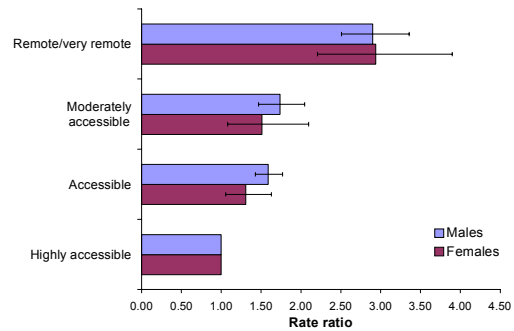
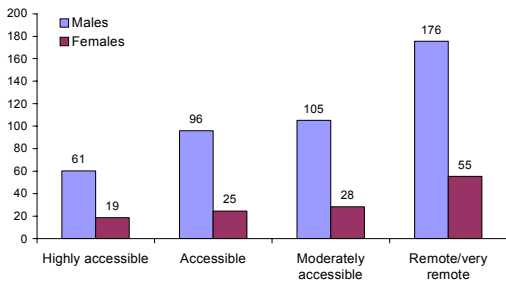
All causes

Deaths per 100,000 persons



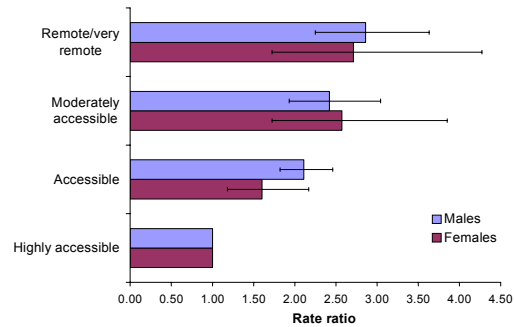
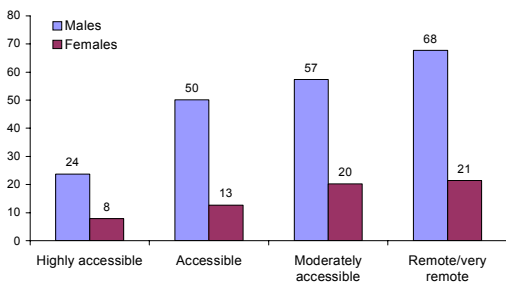
Accidents and injury

Deaths per 100,000 persons



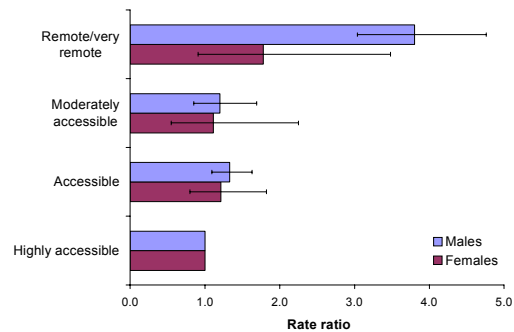
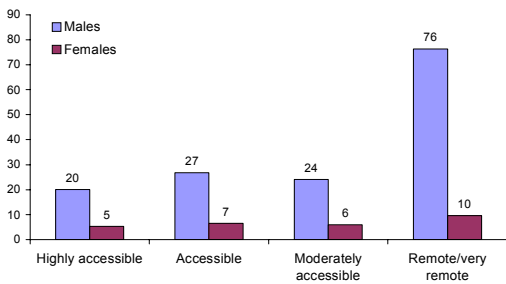
Transport accidents

Deaths per 100,000 persons



Suicide

Deaths per 100,000 persons



Source: ABS mortality data.

Figure 4.2.1: Age-standardised mortality rates and rate ratios, selected causes of death by ARIA category, persons aged 15–24 years, 1998–2000

Table 4.2.2: Age-standardised mortality rates and rate ratios, persons aged 15–24 years by ARIA category and sex, 1998–2000

Cause of death and ICD-10 codes	Males		Females	
	Rate ^(a)	Rate ratio	Rate ^(a)	Rate ratio
<i>All causes</i>				
Highly accessible	85.1	1.00	32.9	1.00
Accessible	123.9	1.46***	44.4	1.35***
Moderately accessible	130.5	1.53***	39.9	1.21
Remote/very remote	212.5	2.50***	86.1	2.62***
<i>PYLL^(b)</i>				
Highly accessible	46.8	1.00	18.2	1.00
Accessible	67.3	1.44***	24.3	1.33***
Moderately accessible	70.8	1.51***	22.6	1.24
Remote/very remote	117.8	2.51***	47.6	2.62***
<i>Potentially avoidable deaths</i>				
Highly accessible	51.6	1.00	18.2	1.00
Accessible	73.9	1.43***	25.9	1.42***
Moderately accessible	85.3	1.65***	26.9	1.48*
Remote/very remote	145.2	2.81***	44.8	2.46***
<i>Accidents and injury (V01–Y98)</i>				
Highly accessible	60.5	1.00	18.9	1.00
Accessible	96.1	1.59***	24.8	1.31*
Moderately accessible	105.2	1.74***	28.4	1.51*
Remote/very remote	175.6	2.90***	55.4	2.94***
<i>Transport accidents (V01–V99)</i>				
Highly accessible	23.7	1.00	7.9	1.00
Accessible	50.1	2.11***	12.6	1.60**
Moderately accessible	57.3	2.42***	20.3	2.57***
Remote/very remote	67.7	2.86***	21.4	2.71***
<i>Suicide (X60–X84)</i>				
Highly accessible	20.1	1.00	5.4	1.00
Accessible	26.8	1.33**	6.6	1.21
Moderately accessible	24.1	1.20	6.0	1.11
Remote/very remote	76.3	3.80***	9.7	1.78

(a) Deaths per 100,000 persons.

(b) PYLL per 1,000 persons.

Source: ABS mortality data.

*p<0.05, **p<0.01, ***p<0.001

Around 477 deaths among 15–24 year olds (males n=373, females n=104) could have been avoided in 1998–2000 if the mortality rate in Accessible, Moderately Accessible, and Remote/Very Remote areas was the same as in Highly Accessible areas (Table 4.2.3).

Table 4.2.3: Excess mortality, selected causes of death by ARIA category and sex, persons aged 15–24 years, 1998–2000

Cause of death and ICD-10 codes	Males		Females	
	Number ^(a)	Per cent ^(b)	Number ^(a)	Per cent ^(b)
All causes	373	9.6	104	7.4
Accidents and injury (V01–Y98)	342	12.1	71	8.7
Transport accidents (V01–V99)	207	17.5	47	13.1
Suicide (X60–X84)	97	10.5	10	4.4

(a) Total number of deaths that would have been avoided if all ARIA categories had the same mortality rate as highly accessible areas.

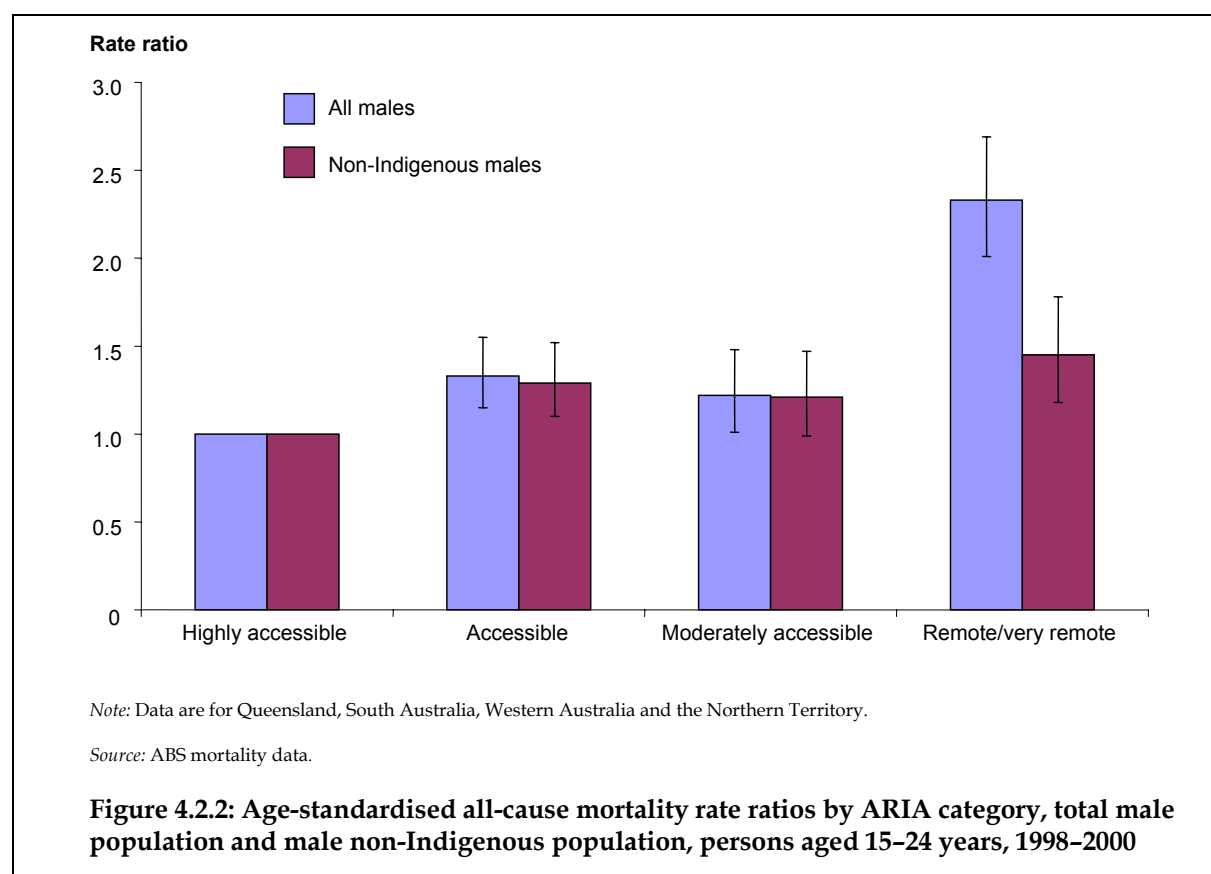
(b) Percentage of deaths that would have been avoided if all ARIA categories had the same mortality rate as highly accessible areas.

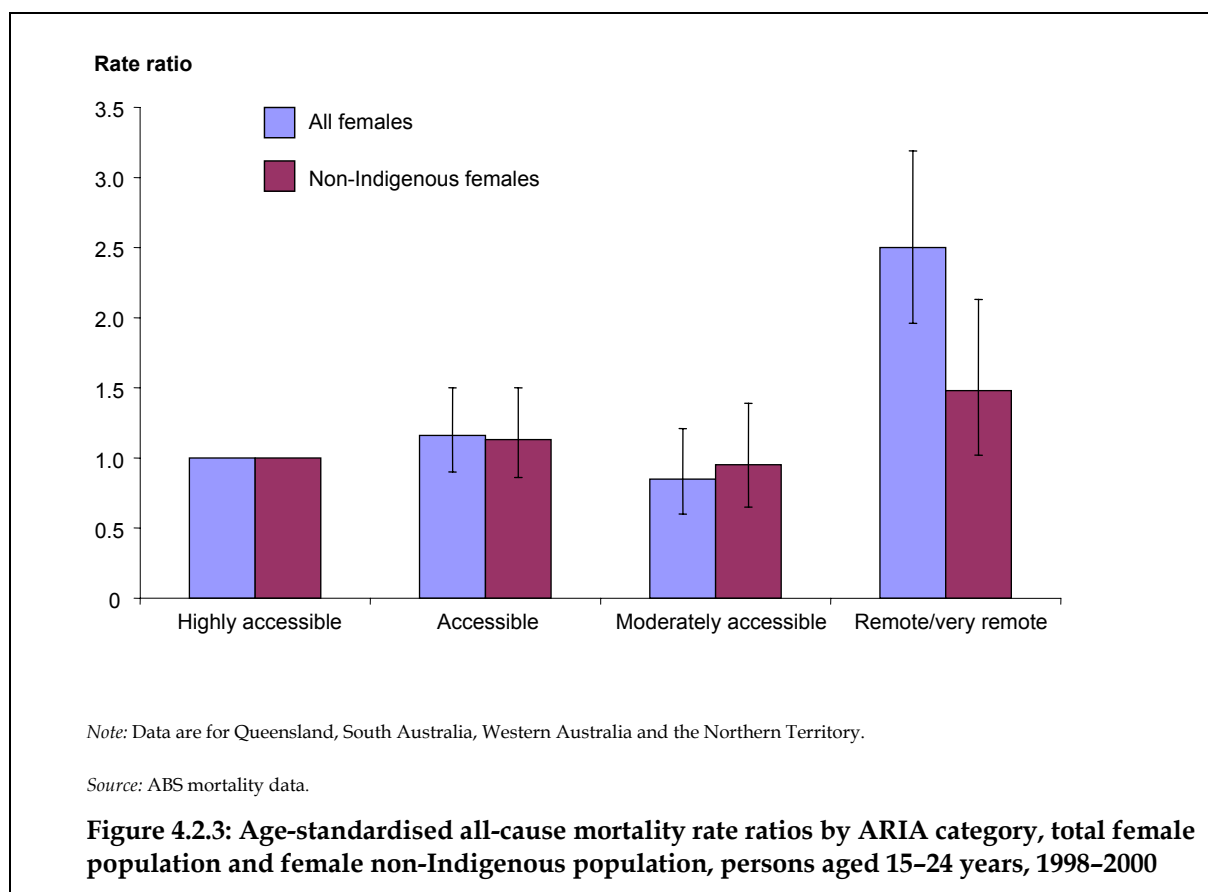
Source: ABS mortality data.

Indigenous deaths among 15–24 year olds, and their impact on geographic mortality inequalities

In 1997–1999, Indigenous Australians aged 15–24 years represented about 4.7% of the Queensland, South Australian, Western Australian and Northern Territory populations: among this age group; however, Indigenous persons accounted for around 12.4% of all deaths (ABS & AIHW 2001).

Figure 4.2.2 compares death rates across the ARIA categories for males aged 15–24 using data that first includes and then excludes Indigenous deaths. Death rates for all males were 133% higher in Remote/Very Remote areas than in Highly Accessible areas: this difference reduces to 45% when based on deaths among non-Indigenous males. A similar pattern was observed among females: death rates were 150% higher in Remote/Very Remote areas when based on all deaths, reducing to 48% when deaths among Indigenous females were excluded (Figure 4.2.3).





4.3 Persons aged 25–64 years

In 1998–2000, males aged 25 years and resident in Remote/Very Remote areas had a life expectancy of 50.4 years: this was 3 years less than 25 year old males from Highly Accessible areas (Table 4.3.1). The corresponding difference in life expectancy among 25 year old females from Remote/Very Remote and Highly Accessible areas was 2.1 years.

Table 4.3.1: Life expectancy by ARIA category and sex, persons aged 25 years, 1998–2000

ARIA category	Males	Females
Highly accessible	53.4	58.4
Accessible	52.3	57.7
Moderately accessible	52.4	57.9
Remote/very remote	50.4	56.3
Total population	53.1	58.2

Source: ABS mortality data.

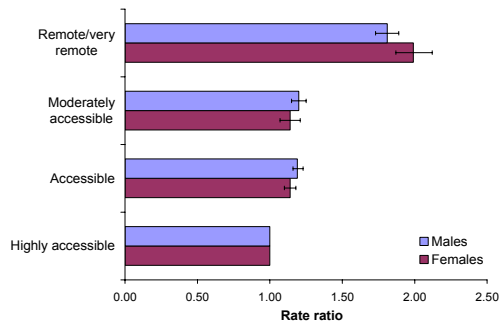
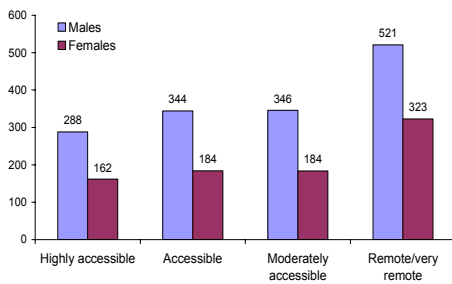
Persons aged 25–64 who resided in Remote/Very Remote areas in 1998–2000 experienced a significantly higher mortality rate for all causes, and for many specific causes (Figure 4.3.1; Table 4.3.2). For males and females, all-cause death rates were 81% and 99% higher respectively among those living in Remote/Very Remote areas compared with those from Highly Accessible areas.

For specific causes, death rates for males and females aged 25–64 from Remote/Very Remote areas were significantly higher for:

- all cancers: 21% higher for males (20 more deaths per 100,000), 17% higher for females (14 more deaths per 100,000);
- lung cancer: 63% higher for males (14 more deaths per 100,000), 43% higher for females (5 more deaths per 100,000);
- diseases of the circulatory system: 111% higher for males (77 more deaths per 100,000), 193% higher for females (50 more deaths per 100,000);
- diseases of the respiratory system: 231% higher for males (22 more deaths per 100,000), 245% higher for females (19 more deaths per 100,000); and
- accidents and injury: 100% higher for males (63 more deaths per 100,000), 83% higher for females (16 more deaths per 100,000).

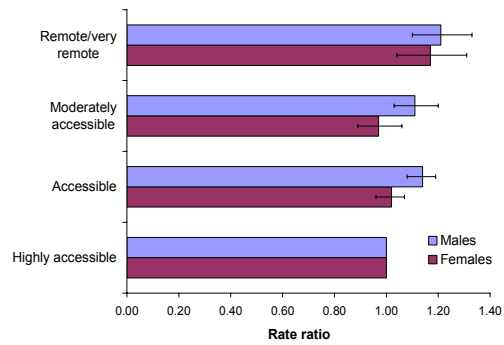
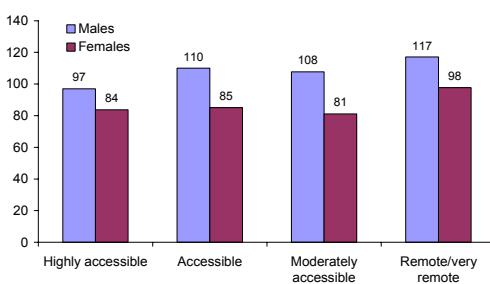
All causes

Deaths per 100,000 persons



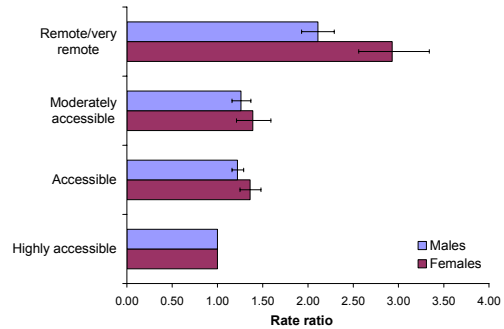
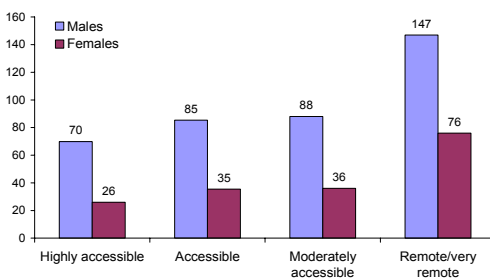
Cancers

Deaths per 100,000 persons



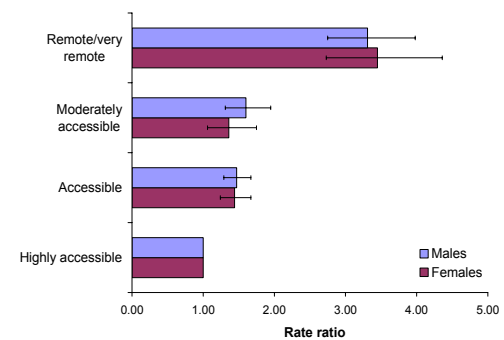
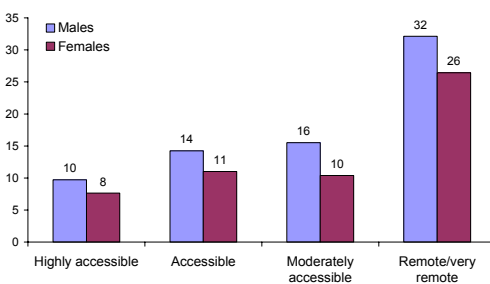
Diseases of the circulatory system

Deaths per 100,000 persons



Respiratory diseases

Deaths per 100,000 persons



Source: ABS mortality data.

Figure 4.3.1: Age-standardised mortality rates and rate ratios, selected causes of death by ARIA category, persons aged 25–64 years, 1998–2000

Table 4.3.2: Age-standardised mortality rates and rate ratios by ARIA category and sex, persons aged 25–64 years, 1998–2000

Cause of death and ICD-10 codes	Males		Females	
	Rate ^(a)	Rate ratio	Rate ^(a)	Rate ratio
<i>All causes</i>				
Highly accessible	288.1	1.00	161.9	1.00
Accessible	344.1	1.19***	184.0	1.14***
Moderately accessible	346.1	1.20***	183.8	1.14***
Remote/very remote	520.7	1.81***	322.9	1.99***
<i>PYLL^(b)</i>				
Highly accessible	71.2	1.00	38.6	1.00
Accessible	88.9	1.25***	45.7	1.18***
Moderately accessible	87.5	1.23***	46.4	1.20***
Remote/very remote	133.2	1.87***	74.0	1.92***
<i>Potentially avoidable deaths</i>				
Highly accessible	186.1	1.00	101.0	1.00
Accessible	220.4	1.18***	114.2	1.13***
Moderately accessible	232.5	1.25***	118.1	1.17***
Remote/very remote	348.8	1.87***	205.2	2.03***
<i>Cancers (C00–C97)</i>				
Highly accessible	97.0	1.00	83.8	1.00
Accessible	110.1	1.14***	85.1	1.02
Moderately accessible	107.7	1.11**	81.1	0.97
Remote/very remote	117.1	1.21***	97.7	1.17**
<i>Cancer of the digestive organs (C15–C26)</i>				
Highly accessible	30.5	1.00	17.8	1.00
Accessible	31.5	1.03	18.2	1.02
Moderately accessible	31.8	1.04	17.6	0.99
Remote/very remote	35.1	1.15	21.8	1.22
<i>Colon cancer (C18)</i>				
Highly accessible	9.4	1.00	7.0	1.00
Accessible	10.3	1.10	8.3	1.18
Moderately accessible	8.9	0.95	5.3	0.77
Remote/very remote	9.1	0.97	6.4	0.92
<i>Melanoma of skin (C43)</i>				
Highly accessible	4.7	1.00	2.8	1.00
Accessible	5.6	1.19	3.1	1.13
Moderately accessible	5.2	1.12	3.0	1.08
Remote/very remote	4.2	0.90	2.9	1.07
<i>Lung cancer (C33, C34)</i>				
Highly accessible	21.7	1.00	11.6	1.00
Accessible	27.0	1.24***	10.8	0.94
Moderately accessible	27.4	1.26**	9.5	0.82
Remote/very remote	35.4	1.63***	16.5	1.43*
<i>Breast cancer (C50)</i>				
Highly accessible	—	—	22.4	1.00
Accessible	—	—	23.7	1.06
Moderately accessible	—	—	19.3	0.86
Remote/very remote	—	—	23.2	1.04

(continued)

Table 4.3.2 (continued): Age-standardised mortality rates and rate ratios by ARIA category and sex, persons aged 25–64 years, 1998–2000

Cause of death and ICD-10 codes	Males		Females	
	Rate ^(a)	Rate ratio	Rate ^(a)	Rate ratio
<i>Cancer of the female genital organs (C51–C58)</i>				
Highly accessible	—	—	4.5	1.00
Accessible	—	—	8.5	1.00
Moderately accessible	—	—	11.1	1.32*
Remote/very remote	—	—	9.8	1.16
<i>Brain cancer (C71)</i>				
Highly accessible	5.8	1.00	3.6	1.00
Accessible	6.5	1.13	3.5	0.97
Moderately accessible	7.5	1.30	3.9	1.08
Remote/very remote	3.5	0.61	4.1	1.14
<i>Cancer of the lymphoid, haematopoietic and related tissue (C81–C96)</i>				
Highly accessible	6.6	1.00	4.7	1.00
Accessible	7.6	1.15	5.0	1.07
Moderately accessible	5.6	0.84	4.3	0.90
Remote/very remote	6.0	0.91	6.1	1.28
<i>Mental and behavioural disorders due to psychoactive substance use (F10–F19)</i>				
Highly accessible	8.9	1.00	2.3	1.00
Accessible	7.3	0.82*	1.7	0.74
Moderately accessible	3.9	0.44***	0.5	0.23*
Remote/very remote	11.1	1.24	4.5	1.91*
<i>Diseases of the circulatory system (I00–I99)</i>				
Highly accessible	69.8	1.00	26.0	1.00
Accessible	85.4	1.22***	35.4	1.36***
Moderately accessible	88.0	1.26***	36.1	1.39***
Remote/very remote	147.0	2.11***	76.0	2.93***
<i>Ischaemic heart disease (I20–I25)</i>				
Highly accessible	48.4	1.00	12.1	1.00
Accessible	57.6	1.19***	17.1	1.41***
Moderately accessible	61.2	1.26***	18.2	1.50***
Remote/very remote	100.1	2.07***	36.6	3.02***
<i>Acute myocardial infarction (I21)</i>				
Highly accessible	23.1	1.00	6.3	1.00
Accessible	33.7	1.46***	10.7	1.68***
Moderately accessible	37.8	1.64***	10.5	1.66***
Remote/very remote	53.2	2.31***	17.8	2.80***
<i>Stroke (I60–I69)</i>				
Highly accessible	9.2	1.00	6.6	1.00
Accessible	6.5	0.70***	8.4	1.26**
Moderately accessible	9.7	1.05	8.1	1.23
Remote/very remote	18.4	1.99***	15.5	2.34***
<i>Diseases of the respiratory system (J00–J99)</i>				
Highly accessible	9.7	1.00	7.7	1.00
Accessible	14.2	1.47***	11.0	1.44***
Moderately accessible	15.5	1.60***	10.4	1.36*
Remote/very remote	32.1	3.31***	26.4	3.45***

(continued)

Table 4.3.2 (continued): Age-standardised mortality rates and rate ratios by ARIA category and sex, persons aged 25–64 years, 1998–2000

Cause of death and ICD-10 codes	Males		Females	
	Rate ^(a)	Rate ratio	Rate ^(a)	Rate ratio
<i>Chronic lower respiratory disease (J40–J47)</i>				
Highly accessible	6.4	1.00	5.6	1.00
Accessible	10.3	1.61***	8.1	1.45***
Moderately accessible	1.5	1.81***	8.3	1.48**
Remote/very remote	22.5	3.53***	18.1	3.25***
<i>Diseases of the digestive system (K00–K93)</i>				
Highly accessible	11.7	1.00	5.1	1.00
Accessible	14.8	1.27***	7.4	1.45***
Moderately accessible	13.8	1.18	6.6	1.29
Remote/very remote	23.7	2.03***	14.9	2.91***
<i>Diseases of the liver (K70–K77)</i>				
Highly accessible	8.6	1.00	3.0	1.00
Accessible	11.3	1.32***	4.0	1.32*
Moderately accessible	10.9	1.28*	5.1	1.69**
Remote/very remote	17.7	2.07***	10.1	3.35***
<i>Accidents and injury (V01–Y98)</i>				
Highly accessible	62.6	1.00	18.8	1.00
Accessible	81.6	1.30***	20.6	1.10
Moderately accessible	84.7	1.35***	26.2	1.39***
Remote/very remote	125.4	2.00***	34.4	1.83***
<i>Transport accidents (V01–V99)</i>				
Highly accessible	12.7	1.00	4.1	1.00
Accessible	23.0	1.81***	7.1	1.74***
Moderately accessible	25.8	2.03***	10.6	2.61***
Remote/very remote	38.1	3.01***	11.3	2.76***
<i>Suicide (X60–X84)</i>				
Highly accessible	27.6	1.00	7.4	1.00
Accessible	33.8	1.22***	6.5	0.88
Moderately accessible	33.2	1.20*	7.0	0.95
Remote/very remote	38.2	1.38***	6.8	0.92

(a) Deaths per 100,000 persons.

(b) PYLL per 1,000 persons.

Source: ABS mortality data.

*p<0.05, **p<0.01, ***p<0.001

In 1998–2000, an estimated 2,411 male deaths and 1,048 female deaths could have been avoided among persons aged 25–64 years if all geographic areas of Australia had experienced the same all-cause mortality rate as that exhibited by Highly Accessible areas (Table 4.3.3). Substantial numbers of deaths could also have been avoided for cancers (n=465), diseases of the circulatory system (n=1,134) and accidents and injury (n=869).

Table 4.3.3: Excess mortality by ARIA category, persons aged 25–64 years, 1998–2000

Cause of death and ICD-10 codes	Males		Females	
	Number ^(a)	Per cent ^(b)	Number ^(a)	Per cent ^(b)
All causes	2,411	5.2	1,048	4.1
Cancers (C00–C97)	417	2.7	48	0.4
Lung cancer (C33, C34)	195	5.2	–13	–0.7
Diseases of the circulatory system (I00–I99)	746	6.5	388	9.0
Stroke (I60–I69)	–10	–0.7	65	6.1
Diseases of the digestive system (K00–K93)	129	6.6	83	9.5
Accidents and injury (V01–Y98)	733	7.4	136	4.6

(a) Total number of deaths that would have been avoided if all ARIA categories had the same mortality rate as highly accessible areas.

(b) Percentage of deaths that would have been avoided if all ARIA categories had the same mortality rate as highly accessible areas.

Source: ABS mortality data.

Indigenous deaths among 25–64 year olds, and their impact on geographic mortality inequalities

In 1997–1999, Indigenous Australians aged 25–64 years represented less than 4% of the Queensland, South Australian, Western Australian and Northern Territory populations; however, they accounted for approximately 14% of all deaths among this age group (ABS & AIHW 2001) (Table 4.3.4).

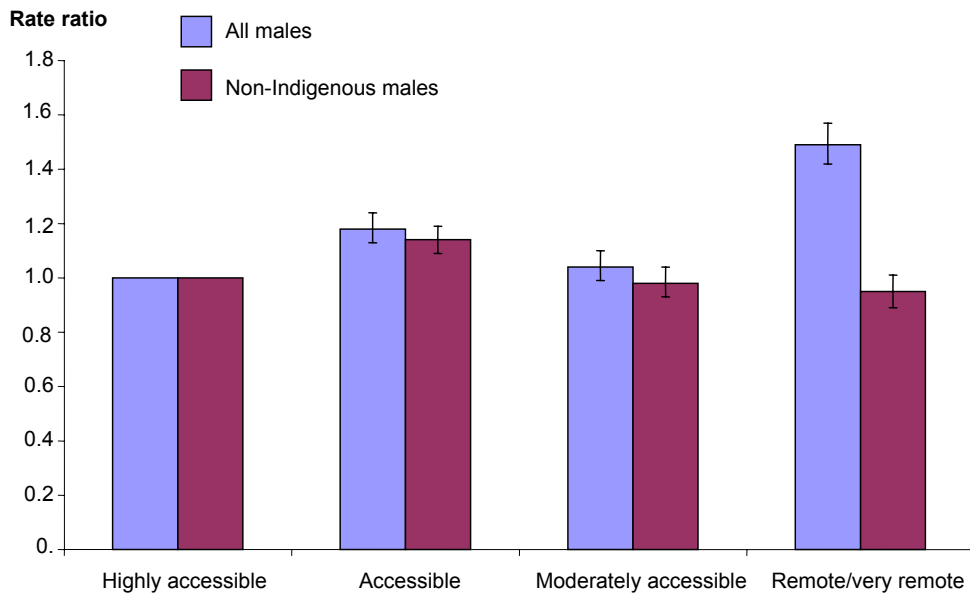
Table 4.3.4: Deaths identified as Indigenous,^(a) persons aged 25–64 years, 1997–1999 (per cent)

Age group	Indigenous deaths as a proportion of all deaths	Indigenous population as a proportion of total population
25–34	13.7	3.8
35–44	13.9	2.6
45–54	9.0	1.8
55–64	5.3	1.5

(a) Data are for Queensland, South Australia, Western Australia and the Northern Territory.

Source: ABS & AIHW 2001.

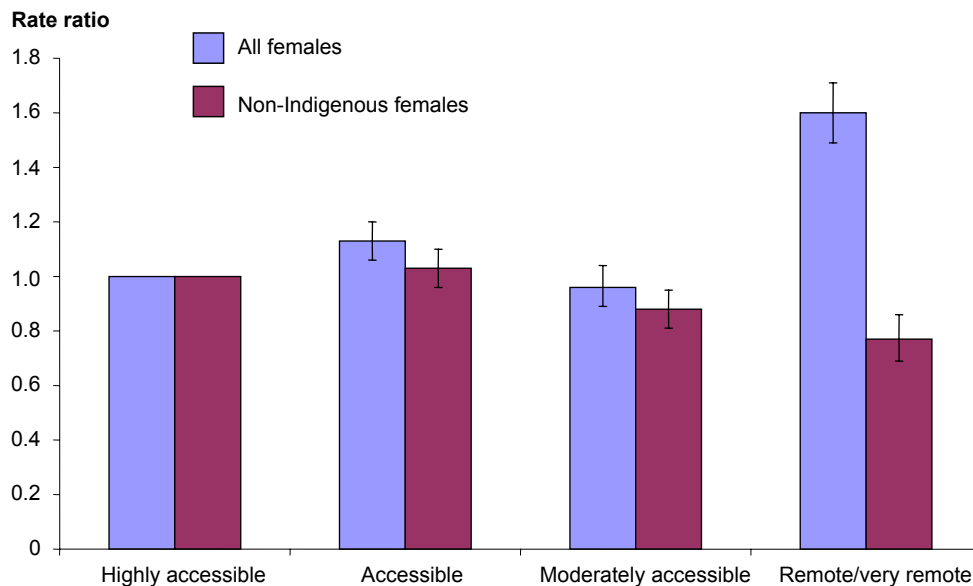
Figure 4.3.2 compares death rates across the ARIA categories for males aged 25–64 using data that first includes and then excludes Indigenous deaths. The total death rate for all males was 49% higher in Remote/Very Remote areas than in Highly Accessible areas: this difference was only 5% when based on deaths among non-Indigenous males. Indeed, as the figure shows, the all-cause death rate was actually lower in Remote/Very Remote areas than in Highly Accessible areas when calculated using non-Indigenous deaths. A similar pattern was observed among females: death rates were 60% higher in Remote/Very Remote areas when based on all deaths; but when deaths among Indigenous females were excluded, rates were 23% lower in Remote/Very Remote areas than in Highly Accessible areas (Figure 4.3.3).



Note: Data are for Queensland, South Australia, Western Australia and the Northern Territory.

Source: ABS mortality data.

Figure 4.3.2: Age-standardised all-cause mortality rates ratios by ARIA category, total male population and male non-Indigenous population aged 25-64 years, 1998-2000



Note: Data are for Queensland, South Australia, Western Australia and the Northern Territory.

Source: ABS mortality data.

Figure 4.3.3: Age-standardised all-cause mortality rate ratios by ARIA category, total female population and female non-Indigenous population aged 25-64 years, 1998-2000

4.4 Persons aged 65 years and over

In this report, deaths among those aged 65 years and over are expressed as rates per 1,000 persons, which is consistent with the earlier (benchmark) work of Mathers (1994b).

In 1998–2000, there was little difference in life expectancy across the ARIA categories for persons aged 65 years (Table 4.4.1). This contrasts with the younger age groups, where as much as 4 years separated the life expectancy of those from Highly Accessible and Remote/Very Remote areas.

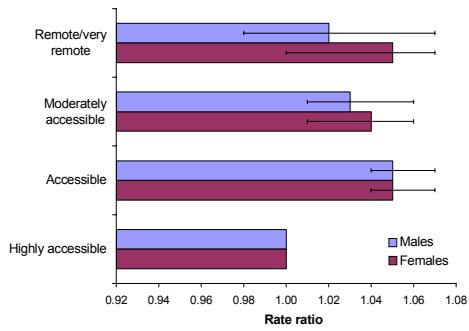
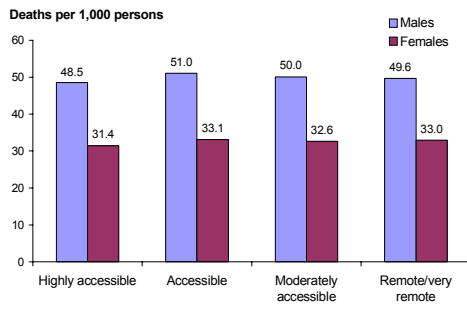
Table 4.4.1: Life expectancy, persons aged 65 years and over by ARIA category and sex, 1998–2000

ARIA category	Males	Females
Highly accessible	17.20	20.90
Accessible	16.76	20.47
Moderately accessible	16.88	20.64
Remote/very remote	17.03	21.05
Total population	17.10	20.82

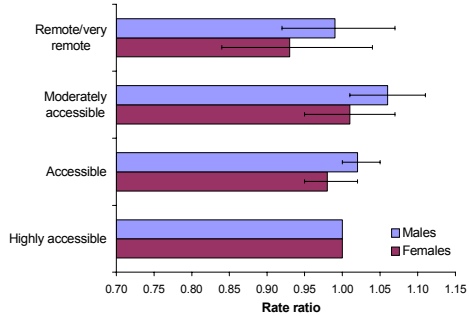
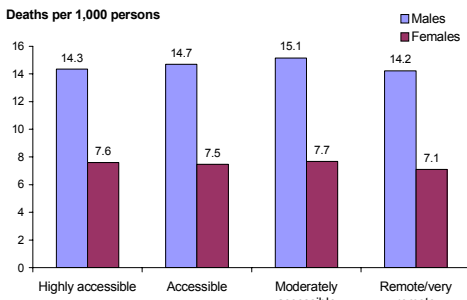
Source: ABS mortality data.

Among persons aged 65 years and older, all-cause and specific-cause mortality rates showed a mixed patterning across the ARIA categories (Figure 4.4.1; Table 4.4.2). The first thing to note about these data is that seemingly very small differences in death rates between the Highly Accessible and other categories were sometimes (statistically) significantly different. Second, for many conditions, it was the Remote/Very Remote category that had the lowest mortality rate. Third, and related, there was no clear evidence of a mortality gradient across the ARIA categories associated with the degree of remoteness. This contrasts with that found among the younger age groups where, more often than not, death rates increased in magnitude in a linear step-wise manner from Highly Accessible to Remote/Very Remote areas.

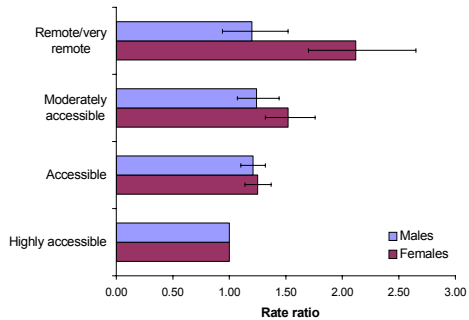
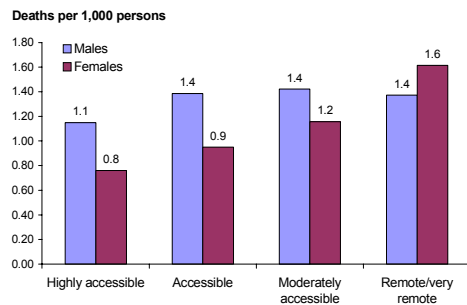
All causes



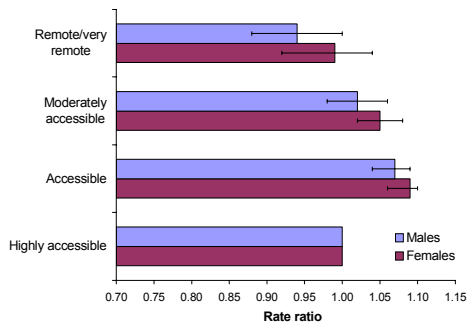
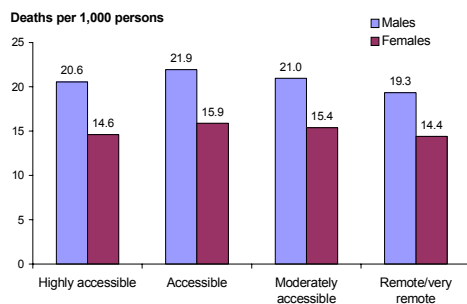
Cancers



Diabetes



Diseases of the circulatory system



Source: ABS mortality data.

Figure 4.4.1: Age-standardised mortality rates and rate ratios, selected causes of death by ARIA category and sex, persons aged 65 years and over, 1998-2000

Table 4.4.2: Age-standardised mortality rates and rate ratios by ARIA category and sex, persons aged 65 years and over, 1998–2000

Cause of death and ICD-10 codes	Males		Females	
	Rate ^(a)	Rate ratio	Rate ^(a)	Rate ratio
<i>All causes</i>				
Highly accessible	48.48	1.00	31.43	1.00
Accessible	51.01	1.05***	33.09	1.05***
Moderately accessible	50.03	1.03*	32.62	1.04**
Remote/very remote	49.65	1.02	32.96	1.05*
<i>Cancers (C00–C97)</i>				
Highly accessible	14.34	1.00	7.60	1.00
Accessible	14.70	1.02	7.47	0.98
Moderately accessible	15.15	1.06*	7.69	1.01
Remote/very remote	14.21	0.99	7.11	0.93
<i>Cancer of the digestive organs (C15–C26)</i>				
Highly accessible	3.89	1.00	2.35	1.00
Accessible	3.95	1.02	2.37	1.01
Moderately accessible	3.91	1.01	2.43	1.03
Remote/very remote	4.07	1.05	2.01	0.86
<i>Colon cancer (C18)</i>				
Highly accessible	1.25	1.00	0.85	1.00
Accessible	1.28	1.03	0.97	1.14**
Moderately accessible	1.17	0.94	0.98	1.15
Remote/very remote	1.07	0.85	0.68	0.79
<i>Cancer of the pancreas (C25)</i>				
Highly accessible	0.59	1.00	0.49	1.00
Accessible	0.60	1.01	0.45	0.92
Moderately accessible	0.62	1.04	0.42	0.85
Remote/very remote	0.56	0.95	0.37	0.75
<i>Lung cancer (C33, C34)</i>				
Highly accessible	3.37	1.00	1.18	1.00
Accessible	3.41	1.01	1.11	0.95
Moderately accessible	3.64	1.08	1.11	0.95
Remote/very remote	3.59	1.07	1.22	1.03
<i>Breast cancer (C50)</i>				
Highly accessible	—	—	0.95	1.00
Accessible	—	—	0.97	1.02
Moderately accessible	—	—	0.87	0.91
Remote/very remote	—	—	0.87	0.92
<i>Cancer of the male genital organs (C60–C63)</i>				
Highly accessible	2.34	1.00	—	—
Accessible	2.68	1.14***	—	—
Moderately accessible	2.78	1.19**	—	—
Remote/very remote	2.35	1.00	—	—
<i>Prostate cancer (C61)</i>				
Highly accessible	2.33	1.00	—	—
Accessible	2.67	1.15***	—	—
Moderately accessible	2.75	1.18**	—	—
Remote/very remote	2.31	0.99	—	—

(continued)

Table 4.4.2 (continued): Age-standardised mortality rates and rate ratios by ARIA category and sex, persons aged 65 years and over, 1998–2000

Cause of death and ICD-10 codes	Males		Females	
	Rate ^(a)	Rate ratio	Rate ^(a)	Rate ratio
<i>Cancer of the lymphoid, haematopoietic and related tissue (C81–C96)</i>				
Highly accessible	1.36	1.00	0.85	1.00
Accessible	1.27	0.93	0.80	0.95
Moderately accessible	1.24	0.91	0.83	0.98
Remote/very remote	0.87	0.64**	0.54	0.64*
<i>Endocrine, nutritional and metabolic diseases (E00–E90)</i>				
Highly accessible	1.48	1.00	1.06	1.00
Accessible	1.71	1.16***	1.22	1.15***
Moderately accessible	1.68	1.14	1.51	1.43***
Remote/very remote	1.65	1.12	1.99	1.89***
<i>Diabetes mellitus (E10–E14)</i>				
Highly accessible	1.15	1.00	0.76	1.00
Accessible	1.38	1.21***	0.95	1.25***
Moderately accessible	1.42	1.24**	1.16	1.52***
Remote/very remote	1.37	1.20	1.61	2.12***
<i>Diseases of the nervous system (G00–G99)</i>				
Highly accessible	1.38	1.00	1.08	1.00
Accessible	1.28	0.93	1.14	1.05
Moderately accessible	1.17	0.85*	0.89	0.82*
Remote/very remote	0.85	0.62**	0.91	0.85
<i>Alzheimer's disease (G30)</i>				
Highly accessible	0.49	1.00	0.57	1.00
Accessible	0.46	0.94	0.67	1.18**
Moderately accessible	0.34	0.70*	0.37	0.66***
Remote/very remote	0.28	0.56*	0.53	0.93
<i>Diseases of the circulatory system (I00–I99)</i>				
Highly accessible	20.56	1.00	14.60	1.00
Accessible	21.94	1.07***	15.88	1.09***
Moderately accessible	20.95	1.02	15.40	1.05**
Remote/very remote	19.35	0.94	14.40	0.99
<i>Ischaemic heart disease (I20–I25)</i>				
Highly accessible	11.95	1.00	7.20	1.00
Accessible	12.58	1.05***	7.72	1.07**
Moderately accessible	11.91	1.00	7.57	1.05
Remote/very remote	10.86	0.91*	6.86	0.95
<i>Acute myocardial infarction (I21)</i>				
Highly accessible	6.65	1.00	4.12	1.00
Accessible	7.07	1.06**	4.40	1.07**
Moderately accessible	6.72	1.01	4.05	0.98
Remote/very remote	5.99	0.90	3.79	0.92
<i>Pulmonary heart disease of pulmonary circulation and other forms of heart disease (I26–I52)</i>				
Highly accessible	2.39	1.00	1.97	1.00
Accessible	2.82	1.18***	2.49	1.26***
Moderately accessible	2.63	1.10	2.25	1.14**
Remote/very remote	2.56	1.07	2.40	1.22*

(continued)

Table 4.4.2 (continued): Age-standardised mortality rates and rate ratios by ARIA category and sex, persons aged 65 years and over, 1998–2000

Cause of death and ICD-10 codes	Males		Females	
	Rate ^(a)	Rate ratio	Rate ^(a)	Rate ratio
<i>Heart failure (I50)</i>				
Highly accessible	0.97	1.00	0.88	1.00
Accessible	1.23	1.27***	1.17	1.33***
Moderately accessible	1.18	1.22*	1.15	1.31***
Remote/very remote	1.17	1.21	1.16	1.32*
<i>Stroke (I60–I69)</i>				
Highly accessible	4.47	1.00	4.11	1.00
Accessible	4.45	0.99	4.17	1.02
Moderately accessible	4.49	1.00	3.95	0.96
Remote/very remote	4.42	0.99	3.74	0.91
<i>Diseases of arteries, arterioles and capillaries (I70–I79)</i>				
Highly accessible	1.23	1.00	0.73	1.00
Accessible	1.48	1.20***	0.87	1.18***
Moderately accessible	1.36	1.10	0.84	1.15
Remote/very remote	1.10	0.89	0.67	0.92
<i>Diseases of the respiratory system (J00–99)</i>				
Highly accessible	4.81	1.00	2.55	1.00
Accessible	5.37	1.12***	2.58	1.01
Moderately accessible	5.03	1.05	2.31	0.91
Remote/very remote	6.33	1.31***	3.35	1.32***
<i>Influenza and pneumonia (J10–J18)</i>				
Highly accessible	0.90	1.00	0.69	1.00
Accessible	0.87	0.96	0.70	1.01
Moderately accessible	0.92	1.01	0.54	0.79*
Remote/very remote	1.20	1.33*	1.10	1.60
<i>Chronic lower respiratory disease (J40–J47)</i>				
Highly accessible	3.05	1.00	1.43	1.00
Accessible	3.75	1.23***	1.54	1.08
Moderately accessible	3.52	1.15**	1.40	0.98
Remote/very remote	4.34	1.42***	1.85	1.29*
<i>Diseases of the digestive system (K00–K93)</i>				
Highly accessible	1.37	1.00	1.06	1.00
Accessible	1.46	1.07	1.12	1.05
Moderately accessible	1.62	1.18*	1.28	1.21**
Remote/very remote	1.64	1.20	1.16	1.09
<i>Diseases of the genitourinary system (N00–N99)</i>				
Highly accessible	1.17	1.00	0.85	1.00
Accessible	1.10	0.94	0.82	0.97
Moderately accessible	0.99	0.85	0.87	1.02
Remote/very remote	1.56	1.34*	1.41	1.67***
<i>Renal failure (N17–N19)</i>				
Highly accessible	0.80	1.00	0.51	1.00
Accessible	0.79	0.99	0.52	1.03
Moderately accessible	0.67	0.84	0.48	0.96
Remote/very remote	1.03	1.29	0.87	1.73***

(continued)

Table 4.4.2 (continued): Age-standardised mortality rates and rate ratios by ARIA category and sex, persons aged 65 years and over, 1998–2000

Cause of death and ICD-10 codes	Males		Females	
	Rate ^(a)	Rate ratio	Rate ^(a)	Rate ratio
<i>Accidents and injury (V01–Y98)</i>				
Highly accessible	1.12	1.00	0.67	1.00
Accessible	1.23	1.10	0.69	1.03
Moderately accessible	1.21	1.08	0.89	1.32***
Remote/very remote	1.57	1.14**	0.73	1.08
<i>Falls (W00–W19)</i>				
Highly accessible	0.17	1.00	0.11	1.00
Accessible	0.16	0.93	0.13	1.19
Moderately accessible	0.11	0.63	0.13	1.17
Remote/very remote	0.15	0.84	0.11	1.00

(a) Deaths per 1,000 persons.

Source: ABS mortality data.

*p<0.05, **p<0.01, ***p<0.001

Persons aged 65–74 and 75 years and over

Table 4.4.3 examines male and female mortality rates across the ARIA categories for a range of conditions for those aged 65–74 and 75 years and older. This table highlights some of the limitations of the foregoing data (in Table 4.4.2), which pertained to persons aged 65 years and over: examining deaths over such a wide age-range, especially given that most people now live well beyond 65, obscures some important patterns. Among the 65–74 year olds, we see a similar association between ARIA and mortality that was found for the younger age groups, namely, that mortality rates followed a graded pattern across the ARIA categories with the highest rates being observed in Remote/Very Remote areas. This is not evident among those aged 75 years and older: deaths among this group follow no obvious graded pattern (with the exception of diabetes among females) and it is those from Remote/Very Remote areas who experienced the lowest death rates.

Table 4.4.3: Age-standardised mortality rates and rate ratios by ARIA category, persons aged 65–74 years and 75 years and over, 1998–2000

Cause of death and ICD-10 codes	Males				Females			
	65–74 years		75 years & older		65–74 years		75 years & older	
	Rate ^(a)	Rate ratio	Rate ^(a)	Rate ratio	Rate ^(a)	Rate ratio	Rate ^(a)	Rate ratio
<i>All causes</i>								
Highly accessible	24.12	1.00	85.94	1.00	13.11	1.00	59.62	1.00
Accessible	26.11	1.08***	89.30	1.04***	13.96	1.06***	62.51	1.05***
Moderately accessible	27.73	1.15***	84.32	0.98	14.38	1.10**	60.82	1.02
Remote/very remote	32.38	1.34***	76.21	0.89***	18.81	1.43***	54.73	0.92**
<i>Cancers (C00–C97)</i>								
Highly accessible	9.84	1.00	21.27	1.00	5.47	1.00	10.89	1.00
Accessible	10.17	1.03	21.67	1.02	5.50	1.01	10.51	0.97
Moderately accessible	11.45	1.16***	20.84	0.98	5.54	1.01	11.01	1.01
Remote/very remote	11.55	1.17**	18.31	0.86**	6.14	1.12	8.59	0.79***
<i>Diabetes mellitus (E10–E14)</i>								
Highly accessible	0.66	1.00	1.90	1.00	0.40	1.00	1.31	1.00
Accessible	0.71	1.08	2.41	1.27***	0.46	1.13	1.71	1.30***
Moderately accessible	0.74	1.11	2.48	1.31**	0.54	1.33	2.11	1.61***
Remote/very remote	1.02	1.54*	1.92	1.01	1.19	2.94***	2.27	1.73***
<i>Disease of the circulatory system (I00–I99)</i>								
Highly accessible	8.51	1.00	39.09	1.00	4.14	1.00	30.69	1.00
Accessible	9.50	1.12***	41.08	1.05***	4.66	1.13***	33.14	1.08***
Moderately accessible	9.84	1.16***	38.05	0.97	4.60	1.11*	32.00	1.04*
Remote/very remote	10.92	1.28***	32.31	0.83***	6.17	1.49***	27.06	0.88***
<i>Accidents and injury (V01–Y98)</i>								
Highly accessible	0.60	1.00	1.91	1.00	0.30	1.00	1.25	1.00
Accessible	0.74	1.24**	1.98	1.04	0.26	0.86	1.37	1.09
Moderately accessible	0.69	1.16	2.00	1.05	0.48	1.62**	1.51	1.21*
Remote/very remote	1.30	2.17***	1.99	1.04	0.41	1.37	1.22	0.97

(a) Deaths per 1,000 persons.
Source: ABS mortality data.
*p<0.05, **p<0.01, ***p<0.001

Indigenous deaths among older persons, and their impact on geographic mortality inequalities

In 1999–2001, Indigenous Australians aged 65–74 and 75 years and older represented approximately 1% and 0.5% respectively of the total population of Queensland, South Australia, Western Australia and the Northern Territory (ABS & AIHW 2003). During this period, however, they accounted for a disproportionately higher number of deaths than would be expected given their representation in the population of these states and territories (Table 4.4.4).

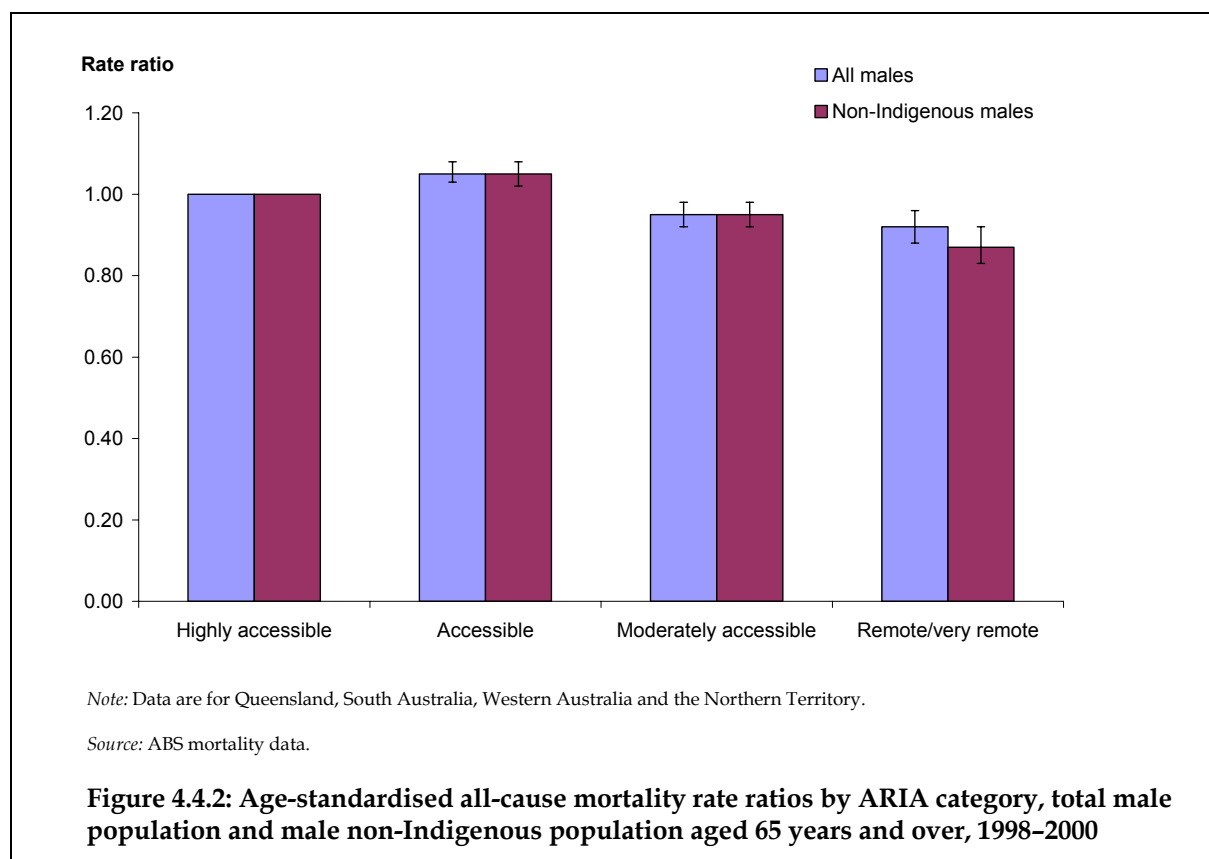
Table 4.4.4: Deaths identified as Indigenous,^(a) persons aged 65 years and over, 1999–2001 (per cent)

Age group	Indigenous deaths as a proportion of all deaths	Indigenous population as a proportion of total population
65–74	2.6	1.0
75 years and older	0.8	0.5

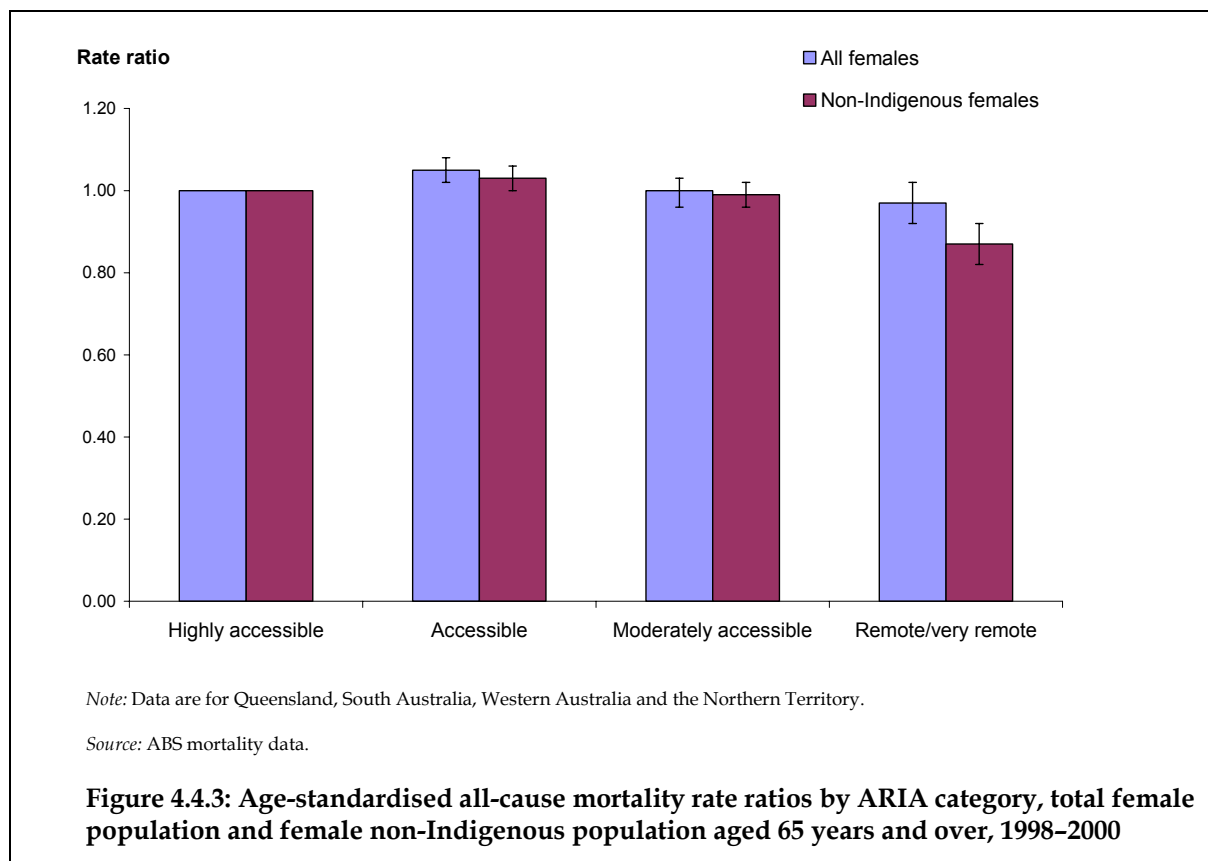
(a) Data are for Queensland, South Australia, Western Australia and the Northern Territory.

Source: ABS & AIHW 2003.

Figures 4.4.2 and 4.4.3 present the all-cause mortality profiles for the ARIA categories for males and females aged 65 years and over, using data that first included and then excluded Indigenous persons. Among males, mortality rates in 1998–2000 were 8% lower in Remote/Very Remote areas than in Highly Accessible areas when based on all deaths, and 13% lower when deaths among Indigenous males were excluded (Figure 4.4.2). Mortality rates for the other ARIA categories were the same irrespective of whether they were calculated using deaths among all males or only non-Indigenous males.



For females, the all-cause mortality rate in Accessible areas was 5% higher than that found in Highly Accessible areas when based on all female deaths, and 3% higher with Indigenous deaths excluded (Figure 4.4.3). The corresponding difference for the Moderately Accessible category was 1%. In Remote/Very Remote areas, all-cause mortality was 3% lower than that observed in Highly Accessible areas when calculated using deaths among all females aged 65 years or more, and 13% lower with Indigenous deaths excluded.



4.5 Summary and discussion

This chapter has examined mortality inequalities by geographic region for males and females at different lifecourse stages, for the period 1998–2000. In general, the overall mortality pattern indicated that geographic remoteness and rates of death were positively related. For all causes of death, and for most specific causes, death rates tended to be lowest in Highly Accessible areas and highest in Remote/Very Remote areas. Importantly, mortality inequalities between geographic areas did not reduce simply to differences between the least and most remote areas; rather, death rates often followed a graded pattern, increasing in a step-wise manner across the ARIA categories (i.e. as remoteness increased). Life expectancy at birth, and at age 15 and 25, were also related to geographic remoteness, with predicted longevity being greatest in Highly Accessible areas and lowest in Remote/Very Remote areas. Further, analyses showed that geographic differences in mortality made a substantial contribution to the total mortality burden in the population. If it were possible to reduce death rates among the ARIA categories to a level equivalent to that of Highly Accessible areas, large savings in premature mortality would result: during 1998–2000 this was estimated at 304 deaths among infants (aged less than 1 year); 399 deaths among persons aged 0–14; 477 deaths among adolescents and young adults (15–24 years); and 3,459 deaths among working-aged adults (25–64 years). It should be noted that many of the geographic mortality inequalities presented in this chapter were probably actually larger than that reported due to the need to combine the Remote and Very Remote categories. The mortality estimate for the Remote/Very Remote category was in effect an average of the two separate categories, which served to attenuate the true difference in mortality inequalities across the ARIA categories.

The findings of this chapter are similar to that found in a number of earlier Australian studies (Mathers 1994a, 1994b, 1995, 1996; Strong et al. 1998a; Glover et al. 1999; AIHW 2002; ABS 2002),

although the only other known study to report mortality inequalities using the ARIA classification was that conducted by Glover et al. (1999). This work showed that during the period 1992–1995, death rates among infants and those aged 15–64 were usually lowest in Highly Accessible areas, intermediate (but often increasing) across the Accessible, Moderately Accessible and Remote categories, and highest in Very Remote areas.

Among older persons, mortality rates by geographic region followed a somewhat more complicated pattern than was evident for the younger age groups. For males and females aged 65 years and over, there were few significant differences in rates of mortality across the ARIA categories, and where differences did exist, they were not necessarily between the Highly Accessible and Remote/Very Remote areas: very often, the differences were between the Highly Accessible, Accessible, and Moderately Accessible areas. On further examination it became evident that the use of a broad age grouping such as '65 or more' obscured a number of important underlying patterns. Specifically, among those aged 65–74, death rates followed a pattern across the ARIA categories that was consistent with those reported for younger people: namely, graded rates of death that increased in magnitude from Highly Accessible to Remote/Very Remote areas. Among males and females aged 75 years and older, however, we witnessed a flattening of the gradient (for most but not all conditions examined), with death rates often being highest in the Accessible and Moderately Accessible areas and lowest in the Remote/Very Remote areas. There are a number of possible reasons for this, and each probably makes a contribution to the flattening and reversal of the mortality gradient among this elderly group. First, this mortality patterning may be due to 'selective survival': at younger ages, males and females from Remote/Very Remote areas experience substantially higher levels of premature mortality, resulting in a disproportionate attrition of persons from these areas, leaving behind the most resilient (and presumably healthy) of their cohort, who as a result, manifest a mortality profile in old age that is similar to (and sometimes better than) their counterparts from Highly Accessible areas. Second, elderly persons from rural and remote areas who experience severe chronic illness late in life may relocate to urban areas for treatment and/or to be close to essential health services, or to spend their remaining time with family. This then becomes their place of residence, and hence place of death as recorded on the death information form.

Previous Australian studies investigating the relationship between geographic area and mortality have discussed the possibility that the higher death rates in non-metropolitan regions, especially Remote and Very Remote areas, was due to the combined effects of the disproportionate concentration of Indigenous peoples in these areas, and their much poorer mortality experience (Coory 2003; Glover et al. 1999; AIHW 2002). We examined this issue and, overall, our results confirmed that deaths among Indigenous persons contributed substantially to geographic differences in all-cause mortality, with the greatest impact on mortality rates being observed in Remote/Very Remote areas. This pattern was evident for males and females in all age groups, although it was much less marked among those aged 65 years or more. Thus the findings of this report suggest that a large part of the 'health disadvantage' of people living in rural and remote areas is due to the higher death rates of Indigenous persons. Importantly, it needs to be emphasised that this study used mortality as its sole indicator of health status, and while mortality is a valid, reliable, and objective measure, it is nevertheless a somewhat limited marker of health's many other dimensions. Thus when health is conceptualised more broadly – to encompass such things as morbidity, hospitalisation rates, risk factor behaviour, and health service provision and utilisation – it appears that the health of people living in rural and remote regions of Australia is worse than those living in metropolitan regions (Wilkinson & Blue 2002).

