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Australian Institute of Health and Welfare

Deaths and hospitalisations due to drowning, Australia 1999–00 to 2003–04

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Flinders University

AIHW INJURY RESEARCH AND STATISTICS SERIES № 39

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March 2008

Australian Institute of Health and Welfare
Canberra
Cat. no. INJCAT 109

This publication is part of the Australian Institute of Health and Welfare's Injury Research and Statistics Series. A complete list of the Institute's publications is available from the Institute's website <www.aihw.gov.au>. Electronic copies of publications in this series can be downloaded from the Research Centre for Injury Studies website <www.nisu.flinders.edu.au>

ISSN 1444-3791

ISBN 978 1 74024 757 3

Suggested citation

Australian Institute of Health and Welfare: Kreisfeld R & Henley G 2008. Deaths and hospitalisations due to drowning, Australia 1999–00 to 2003–04. Injury Research and Statistics Series Number 39. (Cat. no. INJCAT 109) Adelaide: AIHW.

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Published by the Australian Institute of Health and Welfare

Printed by Snap Printing

Proofreading & Layout by Stacey Avefua

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Executive summary

Total drownings

During the five-year period 1999–00 to 2003–04 an annual average of 370 people died in Australia as the result of drowning, and an annual average of 618 were hospitalised as a result of drowning.

Deaths

The highest age-specific rate was found in the 0–4 year age range. Males had consistently higher age-specific rates of drowning across all age groups than did females. The highest rates for males were in the age groups 0–4 and 85 years and over (4.8 and 5.3 per 100,000 population), respectively.

There was a statistically significant downward trend in drowning deaths over the reporting period. From a rate of 2.08 deaths per 100,000 population at the beginning of the period, deaths decreased by 4.6% per annum.

Age-adjusted rates of drowning were highest in the Northern Territory (4.3 deaths per 100,000 population) and lowest in South Australia (1.3 per 100,000).

Age-adjusted rates rose according to the remoteness of the deceased person's residence. The rate for the very remote zone was three times that for major cities.

Most drowning deaths occurred during the warmer months of the year.

The most commonly identified activities being undertaken at the time of the drowning were sports or leisure. Most drownings occurred at home. A significant proportion occurred in a sports or athletics area.

Hospitalisations

By far the highest age-specific rates of hospitalisation were found in the 0–4 year age group, where that rate was 18.0 separations per 100,000 population. The next highest rate was 3.0 per 100,000 among those aged 15–24 years.

As was the case for deaths, male rates of hospitalisation due to drowning were consistently higher than female rates across all age groups. The largest male to female rate ratio was 3.8 in the 25–29 year age group.

The Northern Territory had the highest age-adjusted rate of hospitalisation due to drowning (4.3 separations per 100,000 population).

Age –adjusted rates of hospitalisation rose with the remoteness of the person's residence. The rate for the very remote zone was close to 2.5 times as high as that for major cities.

Differences between average monthly frequencies of drowning-related hospitalisation were quite pronounced. January, the month with the highest number of hospitalisations, had 3.8 times the number of cases than did June, which had the lowest number.

Identifying cases with potential for severe or persisting consequences of drowning resulting in hospitalisation

The assignment of codes for a selected group of procedures or diagnoses to cases were used as indicators for potentially severe or persisting consequences of a drowning that lead to hospitalisation. For those who died in hospital, the proportion of cases where one or more of the potential indicators was present, was more than double that of those cases which survived to discharge, varying from 47.2% in 1999–2000 to 58.5% in 2003–04. For those who survived to discharge, the proportion of cases where one or more of the potential indicators was present was reasonably consistent over the entire period, varying from 18.7% in 2000–01 to 25.6% in 2002–03.

The length of stay in hospital following admission ranged from 1 day to 242 days. The mean length of stay was 3.7 days. The mean length of stay was highest in the older age groups, particularly among those aged 75 years and over.

The largest proportion of cases occurred while swimming.

Specific types of drowning

The highest proportion of drowning deaths occurred in natural bodies of water, accounting for an annual average proportion of 33%. The next most frequent categories were intentional self-harm (15%), swimming pool drownings (10%) and watercraft-related drownings (10%). The largest proportion of hospitalisations were due to drowning in swimming pools (29%), followed by drowning in natural bodies of water (27%) and watercraft-related drowning (10%).

Natural bodies of water

This section includes beaches, lakes, the open sea, rivers and streams. There was an annual average number of 122 deaths and 173 hospitalisations due to drowning in this category. The age-adjusted rates for this category of drowning were 0.6 deaths per 100,000 population and 0.9 separations per 100,000.

The highest age-specific rates of death for persons were found in the age ranges 75–79 years (1.0 deaths per 100,000 population) and for hospitalisations, in the 0–4 year age group (2.0 separations per 100,000 population). Male age-specific rates were consistently higher than female rates in all age groups for both deaths and hospitalisations.

Rates of both deaths and hospitalisations showed statistically significant downward trends.

Rates of drowning death rose according to the remoteness of the deceased person's residence. The rate for the very remote zone was 3.8 times that for major cities. Rates of hospitalisation due to drowning were fairly similar for the major cities and inner regional zones (0.7 and 0.8 separations per 100,000 population, respectively) and were also fairly similar for the outer regional and remote zones (1.0 and 1.1 per 100,000 respectively). The very remote area had the highest rate of 1.8 per 100,000. The rate for the very remote zone was 2.6 times that for major cities.

The majority of deaths and hospitalisations occurred during the warmer months of the year.

Across all ages, the length of stay in hospital following admission after a drowning incident ranged from 1 day to 134 days. The mean length of stay was 3.5 days.

Swimming pools

There was an annual average of 36 deaths and 182 hospitalisations due to drowning in swimming pools during the reporting period.

The highest age-specific rate of death was found in the 0–4 year age group (1.4 deaths per 100,000 population). Males had higher age-specific rates of hospitalisation than did females in almost all age groups. Males in the 0–4 year age group had the highest age-specific rate of hospitalisation (11.5 separations per 100,000 population). The comparative female rate was 7.7 per 100,000 population.

Statistically significant trends were not present for either deaths or hospitalisations.

Residents of the very remote zone had the highest rate of deaths and hospitalisations (0.35 deaths per 100,000 and 1.4 separations per 100,000).

Of the total of 36 swimming-pool related drowning deaths, 16 took place while the deceased was in the pool, and the remaining 20 after they had fallen into the pool. Ninety seven of the 182 persons who were admitted to hospital experienced a drowning episode while already in the swimming pool. Eighty five came close to drowning after they fell into the pool.

The length of stay in hospital ranged from 1 day to 242 days. The mean length of stay was 3.0 days.

A total of 46 cases of children aged between 0–9 years having drowned in a swimming pool during the period 2001–02 to 2003–04 were identified in the National Coroners Information System (NCIS) coronial data. Analysis showed that children are at their most vulnerable to drowning in a swimming pool during the first few years of life. The number of cases declined with age. By far the most important factor identified for young children was the lack of adequate supervision. Various aspects of pool fencing and gates were also commonly identified as contributing factors.

Fifty three cases of swimming pool drownings among persons aged 10 years and over were identified in NCIS data. In close to one-third of cases, the person who drowned had fallen into the pool. In around half of cases, mention was made of the presence of a significant morbidity(ies) such as ischaemic heart disease. Cleaning the pool was the activity being engaged in by several people when they fell into the pool and drowned. Among the contributing factors noted were such things as epilepsy, coronary artery disease, chronic airflow limitation, and the deceased falling into the pool, hitting their head and losing consciousness. The sudden onset of a medical event such as a heart attack occurred in numerous cases.

Bathtubs

There was an annual average of 20 drowning deaths and 47 hospitalisations due to drowning in bathtubs.

The age-adjusted rates of drowning and hospitalisation were 0.1 deaths per 100,000 population and 0.2 separations per 100,000 population. The highest rates of death and hospitalisation were found in the 0–4 year age group (0.5 person deaths per 100,000 population and 3.2 separations per 100,000).

No statistically significant trends over time were identified.

The inner regional zone had the highest rate of death due to drowning in a bathtub (0.12 deaths per 100,000 population) and the very remote zone had the highest rate of hospitalisation (0.44 separations per 100,000 population).

The length of stay in hospital for admissions related to drowning in a bathtub ranged from 1 day to 82 days. The mean length of stay was 2.6 days.

A search of NCIS coronial data found 15 cases of children in the 0–5 year age range who had drowned in a bathtub during the period 2001–02 to 2003–04. The majority of these were aged one year or under. Analysis of these cases showed the most important area for concern was inadequate or non-existent supervision which was identified in relation to all cases. A commonly mentioned practice was shared bathing with a sibling.

Thirty five cases of bathtub-related drowning were found in NCIS for people aged 6 years and over. The most commonly identified issue was epilepsy or some other form of seizure disorder. Other factors mentioned frequently in case documents were alcohol intoxication and the presence of significant morbidities such as Ischaemic Heart Disease.

Watercraft

There was an annual average of 37 drowning deaths and 65 hospitalisations due to watercraft-related drowning.

The age-adjusted rates of watercraft-related drowning and hospitalisation were 0.2 deaths per 100,000 population and 0.3 separations per 100,000 population.

Age-specific rates of death fluctuated considerably, but were highest overall between the ages of 30–64 years. The majority of deaths involved males.

With the exception of the 5–9 year age group, rates of hospitalisation were higher for males than females, often substantially so. Male rates were highest across a broad age band, from 15–69 years of age.

The inner regional and outer regional zones had the highest age-adjusted rates of death (0.31 and 0.34 deaths per 100,000 population respectively). Age-adjusted rates of hospitalisation rose according to the remoteness of the injured person's residence.

Fifty eight per cent of deaths and 22% of hospitalisations occurred as the result of incidents in which the vessel was damaged (e.g. overturning or sinking, a person jumping from a burning ship, etc.). The remaining 42% of deaths and 78% of hospitalisations occurred as the result of incidents in which the vessel did not sustain damage (e.g. fall from gangplank, ship or overboard, or being thrown or washed overboard).

Where the type of activity being undertaken was specified, the majority of watercraft-related drowning deaths occurred while the person was engaged in a leisure activity.

For those cases of hospitalisation where the body region was specified, the hip and lower limb were the most common site of injury (17%), followed by the head (16%), trunk (16%) and shoulder and upper limb (14%). Thirty seven per cent of injuries were not specified according to body region.

The length of stay in hospital ranged between 1 and 149 days. The average length of stay was 4.2 days.

Self-harm

There was an annual average of 56 drowning deaths and 39 hospitalisations due to intentional self-harm.

The age-adjusted rates of deaths and hospitalisations were 0.3 deaths per 100,000 population and 0.2 separations per 100,000 population.

Rates of death tended to rise with age from 15 years onward, especially for males. Males had higher age-specific rates of death in most age groups and similar rates to females in the remaining ones.

Age-specific rates of hospitalisation followed a different pattern to that for drowning deaths in that females had higher age-specific rates of hospitalisation in several age groups. The highest age-specific rate was for males aged 85 years and over (0.72 separations per 100,000 population).

There were no significant trends over time.

Death rates were the same for all remoteness zones (0.3 deaths per 100,000 population). Age-adjusted rates of hospitalisation were similar for major cities, inner regional and outer regional zones. Age-adjusted rates for the remote and very remote zones were 0.0.

There was considerable fluctuation of frequencies from month to month for both deaths and hospitalisations. The highest number of deaths occurred during December and January. Much less seasonality was evident than for most other types of cases.

The length of stay in hospital ranged from 1 day to 149 days. The mean length of stay was 8.0 days.

Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
ASGC	Australian Standard Geographical Classification
CI	Confidence Interval
ICD	International Classification of Diseases
ICD-10	International Classification of Diseases, 10th Revision
ICD-10-AM	International Classification of Diseases, 10th Revision Australian Modification
LOS	Length of stay
MCoD	Multiple Cause of Death
MLOS	Mean length of stay
NCIS	National Coroners Information System
NHMD	National Hospital Morbidity Database
NISU	AIHW National Injury Surveillance Unit
UCoD	Underlying Cause of Death
YPLL	Years of potential life lost

1 Introduction

1.1 Case selection criteria

Deaths

Deaths data used in this report are from the Australian Bureau of Statistics (ABS) mortality unit record data collection, 1997–2004.

A subset of total drowning deaths was created by selecting all cases that occurred during the financial year periods 1999–00 to 2003–04, where the ICD-10 code T75.1 *Drowning and nonfatal submersion* or any code(s) V90, V92, W65–W74, X71, X92, Y21 were present among the multiple causes of death codes.

Hospitalisations

This report uses data for hospital separations due to injury and poisoning that occurred in Australia during the period 1999–00 to 2003–04 to describe the occurrence of hospitalisations resulting from drowning in Australia.

National hospital separations data was provided by the Australian Institute of Health and Welfare (AIHW) National Hospital Morbidity Database (NHMD). A separation is defined as:

> A formal, or statistical process, by which an episode of care for an admitted patient ceases (Commonwealth Department of Health and Family Services and AIHW 1997).

Hospital separations reported here were coded according to the first three editions of ICD-10-AM (NCCH 2002).

Two groups of cases were excluded from case counts based on the hospital separations data:

1 Records in which the mode of admission was recorded as being by transfer from another acute-care hospital, on the grounds that such cases are likely to result in more than one separation record. It should be recognised that this method for avoiding multiple counting of cases is approximate. It should allow for cases involving transfer between or within hospitals. It cannot allow for readmissions which meet the project's selection criteria. Cases transferred from another hospital are included in estimates of patient days.

2 Deaths that occurred in hospital in order to avoid double counting, since these cases should also be included in the ABS deaths data. (A total of 191 such cases were excluded from the dataset.)

It should be noted that, in order to obtain an accurate figure for the total cost burden of hospitalised morbidity, the cases referred to in (1) and (2) above were not excluded for calculations of length of stay in hospital.

A subset of total hospitalised cases of drowning was created of all cases where the ICD-10 code T75.1 *Drowning and nonfatal submersion* or any code(s) V90, V92, W65–W74, X71, X92, Y21 appeared among available external cause codes.

Assignment of cases to categories of drowning

A small number of cases where T75.1 was recorded in the data record without any accompanying external cause code were identified. These comprised 5 hospitalisations due to drowning, but no deaths. These cases have not been included in the subset of Total drownings and submersions. Also excluded were 14 hospitalisations and 5 deaths that had been assigned a T75.1 code as well as an external cause code outside the inclusion codes specified for this report.

The data included in this report are expressed as annual average counts and rates over the five-year period 1999–00 to 2003–04. A reporting period of this duration was chosen because of the relatively small numbers of cases per year. Reporting data for a single year would produce many values based on small case numbers which are susceptible to chance variation and often cannot be reported because the case count for a table cell is less than 5. (This limit is to help ensure that patient confidentiality is preserved.)

Cases were assigned to major categories of drowning as shown in Table 1.1.

Table 1.1: Scheme for assigning cases to major categories of drowning

Major category of drowning	ICD-10 codes
Drowning in a natural body of water	W69, W70
Watercraft-related drowning	V90, V92
Other transport-related drowning	Any Chapter XX V-code excluding V90 and V92
Swimming pool drowning	W67, W68
Bathtub-related drowning	W65, W66
Drowning due to intentional self-harm	X60–X84
Drowning due to assault	X85–Y09

1.2 New definition of drowning

An interactive process that began in 1998 and included nine task forces comprising around 80 experts from a range of disciplines culminated, in 2002, in the adoption of an international, uniform definition of drowning:

> Drowning is the process of experiencing respiratory impairment from submersion/immersion in liquid (van Beeck et al. 2005).

It was further recommended that the term 'drowning' should be qualified by terms reflecting the outcome of cases: drowning mortality, drowning morbidity or drowning not resulting in morbidity.

Consensus was also reached on eliminating the use of terms such as wet, dry, active, passive, silent and secondary drowning.

To date, a range of terminology and definitions have been used (Szpilman 2002). As Üstün and Jakob observe, 'In scientific research, meaningful definitions are essential for comparability and reproducibility' (Üstün & Jakob 2005).

The WHO has accepted the proposed definition which will have an effect on two important classification systems: the International Classification of Diseases (ICD) and the International Classification of External Causes of Injury (ICECI) (Üstün & Jakob 2005). NISU will be watching these developments and responding to them in its analysis and reporting of drowning.

In the interim, the approach taken in this report is intended to be consistent with this new definition of drowning. Specifically, in order to describe differing outcomes of the same external cause of injury, NISU has reported deaths alongside hospitalisations. Emergency department data, which is available in some states, offers the potential for future exploration of some cases of drowning that do not result in death or significant mortality.

2 Total drownings

Mortality data: T75.1 or any code(s) V90, V92, W65–W74, X71, X92, Y21 among the multiple causes of death.

Morbidity data: Diagnosis code T75.1 or any code(s) V90, V92, W65–W74, X71, X92, Y21 among the external cause codes.

Table 2.1: Key indicators for total drownings, Australia 1999–00 to 2003–04

	Drowning (deaths)			Drowning (hospitalisations)		
Indicator	**Males**	**Females**	**Persons**	**Males**	**Females**	**Persons**
Annual average number of cases	277	94	370†	405	214	618†
Percentage of all drowning deaths/hospitalisations	100	100	100	100	100	100
Crude rate / 100,000 population	2.9	1.0	1.9	4.2	2.2	3.2
Adjusted rate (direct)	2.9	0.9	1.9	4.1	2.2	3.2
Rate ratio*	1.52	0.50	0	1.30	0.70	
mean YPLL <75y	36.1	33.8	35.6			

* Rate ratios are standardised rate for male or female / standardised rate for persons.

† Male plus Female does not sum exactly to Persons due to rounding of annual average case counts.

During the five-year period 1999–00 to 2003–04 there was an annual average of 370 deaths due to drowning, and an additional 618 cases per year in which a person was admitted to a hospital because of drowning. Deaths comprised 37% of total cases (i.e. drowning deaths plus hospitalisations due to drowning), 41% for males and 31% for females.

This chapter includes all cases of drowning deaths and hospitalisations, irrespective of intent or circumstances. The following two chapters cover, respectively, unintentional and intentional cases.

2.1 Age and sex

The highest age-specific rate for persons was in the 0–4 year age range. Drowning deaths account for a sizeable proportion of all deaths between the ages 1–4 years (1 year, 15%; 2 years, 18%; 3 years, 13%; 4 years, 13%).

Males had consistently higher age-specific rates of drowning death across all age groups than did females. The highest male to female rate ratios were found among young and middle aged persons and among those aged 80 years and over (Figure 2.1).

The highest rates for males were in the age groups 0–4 years and 85 years and over (4.8 and 5.3 per 100,000 population, respectively) (Figure 2.1).

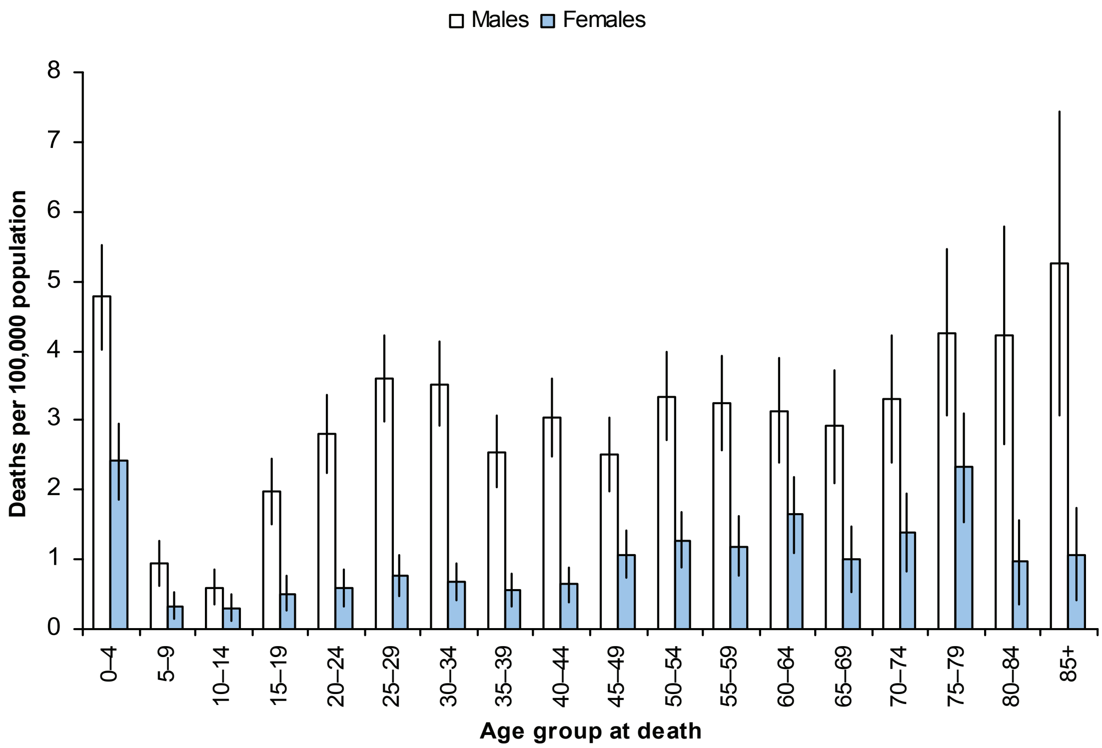

Figure 2.1: Deaths due to drowning by age and sex, persons, Australia 1999–00 to 2003–04

By far the highest age-specific rates of hospitalisation due to drowning were found in the 0–4 year age group, where the rate for persons was 18.0 separations per 100,000 population. The next highest age-specific rate was 3.0 per 100,000 population among those aged 15–24 years (Figure 2.2).

Male rates of hospitalisation due to drowning were consistently higher than female rates across all age groups. The largest male to female rate ratio was 3.8 in the 25–29 year age group (Figure 2.2).

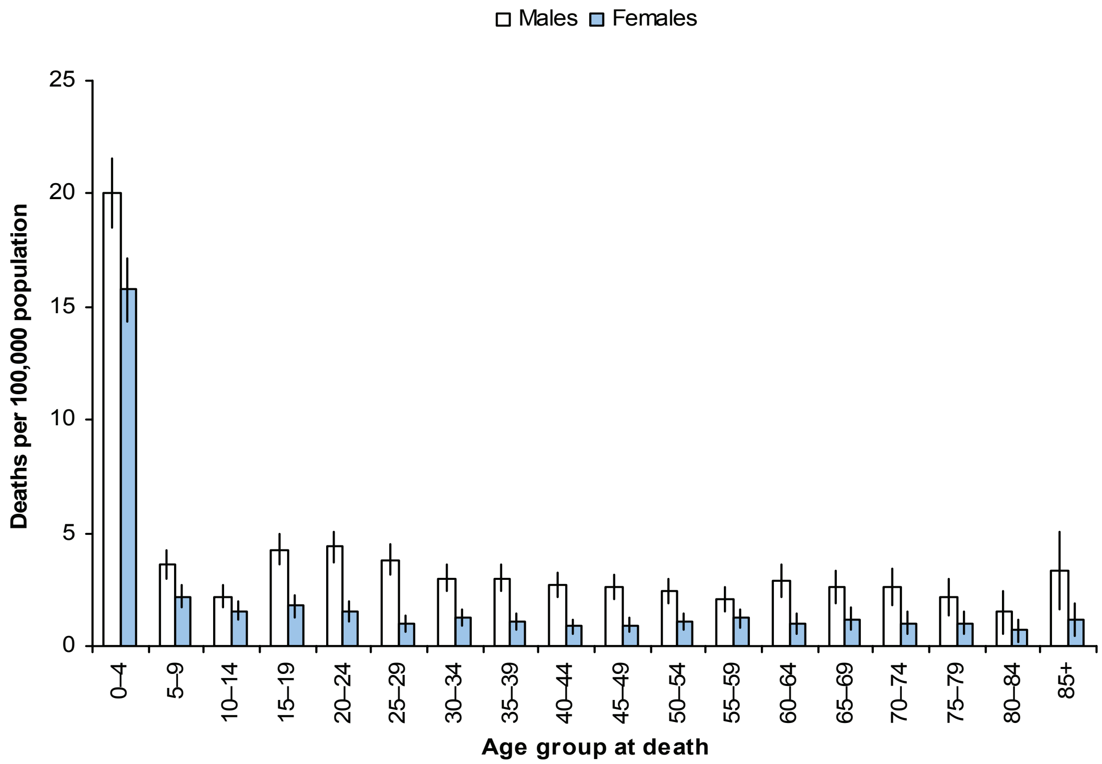

Figure 2.2: Hospitalisations due to drowning by age and sex, persons, Australia 1999–00 to 2003–04

2.2 Trends over time

Poisson regression modelling showed a downward trend in age-adjusted rates of drowning death between 1999–00 and 2003–04. The estimated age-adjusted rate at the beginning of the period was 2.08 deaths per 100,000 population (95% CI 1.92 to 2.24). According to the fitted model, the estimated annual age-adjusted rate of total drowning deaths decreased by an average of 4.6% per year during the 1999–00 to 2003–04 reporting period, a trend that was statistically significant (p=0.004) (Figure 2.3).
Over a longer term, a previous NISU report showed that the age-adjusted rate of drowning deaths in Australia fell by 48% overall during the 24-year period 1979–2002 (Kreisfeld et al. 2004), and that this continued a downward trend observed since at least 1920 (Bordeaux & Harrison 1998).

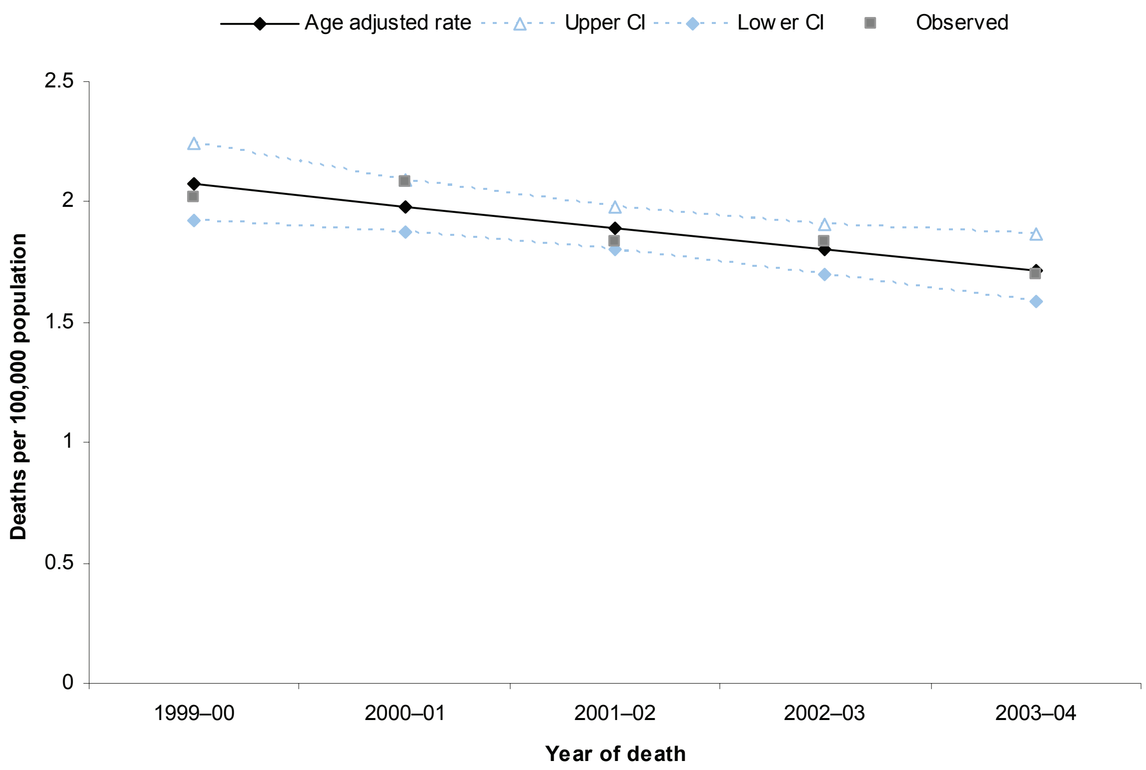

Figure 2.3: Deaths due to drowning, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Poisson regression modelling showed indications of a gradual downward trend in age-adjusted rates of hospitalisations due to drowning between 1999–00 and 2003–04, but this trend was not statistically significant (p=0.325) (Figure 2.4). The estimated age-adjusted rate at the beginning of the period was 3.26 deaths per 100,000 population (95% CI 3.06 to 3.46).

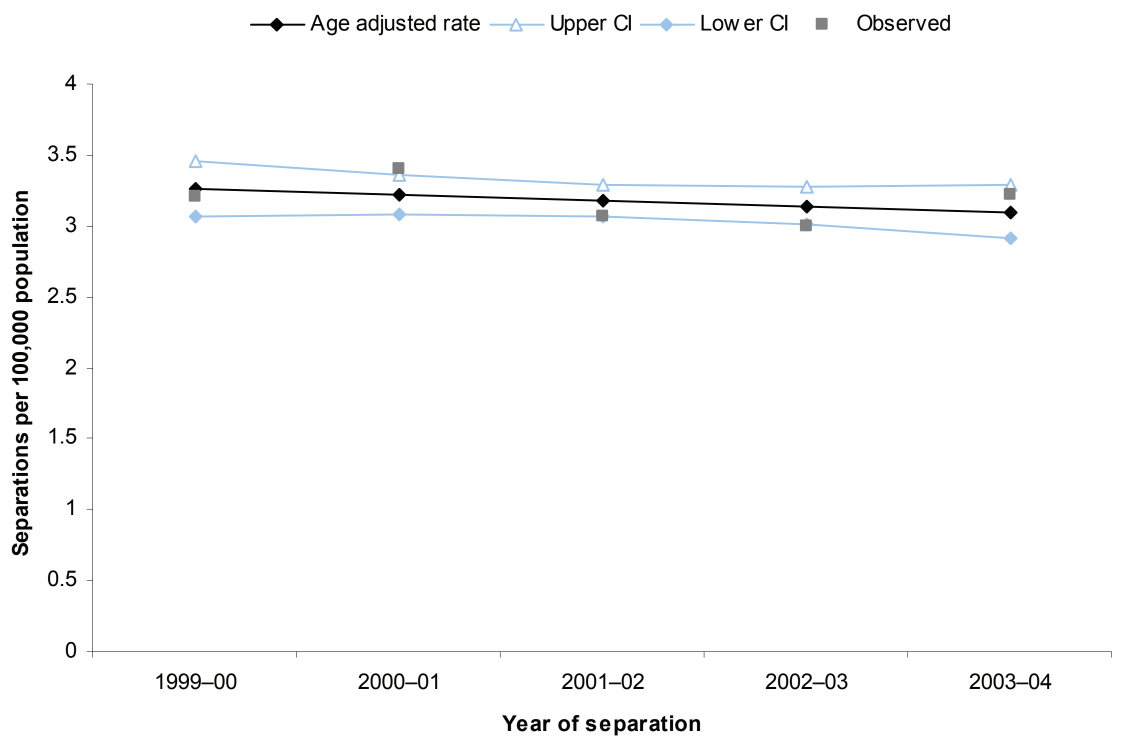

Figure 2.4: Hospitalisations due to drowning, persons, Australia 1999–00 to 2003–04, persons (age-standardised rates)

2.3 State or territory of residence

Age-adjusted rates of death by drowning were highest in the Northern Territory (4.3 deaths per 100,000 population) and lowest in South Australia (1.3 per 100,000). The rates for Victoria, Queensland, South Australia, Tasmania and the Northern Territory differed, to a statistically significant extent, to the all-Australia rate of 1.9 deaths per 100,000 population (Figure 2.5).

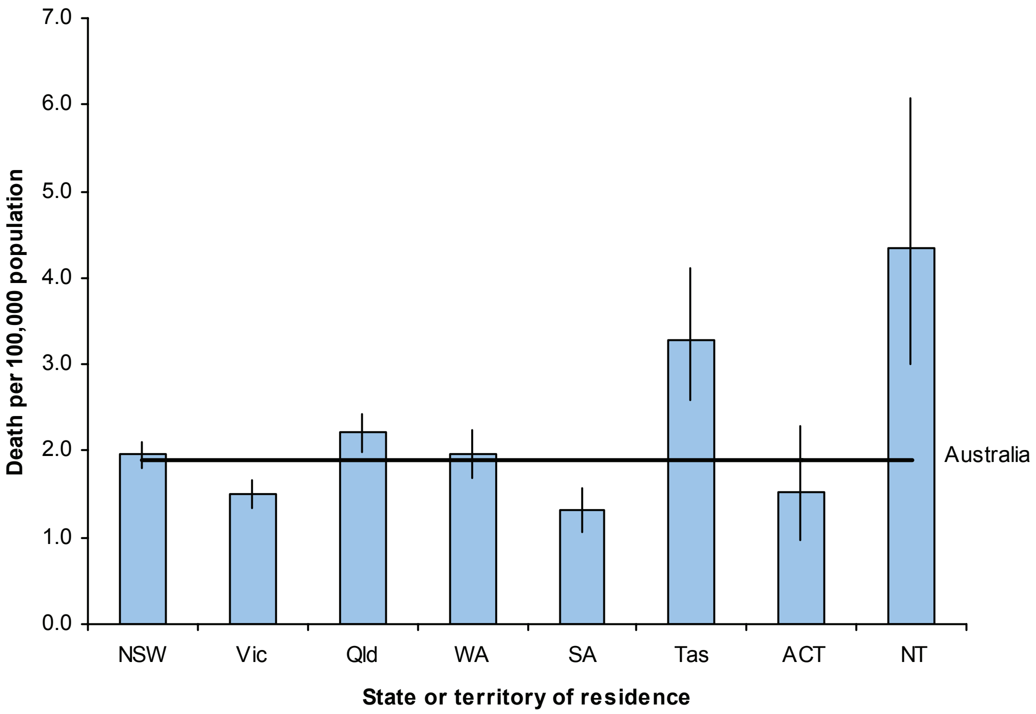

Figure 2.5: Deaths due to drowning by states and territory, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Table 2.2: Cases, age-adjusted rates and rate ratios* by state or territory for total drownings, persons, Australia 1999–00 to 2003–04

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Annual average number of cases	129.8	72.8	80.8	37.4	20.4	15.4	4.8	8.8
Adjusted rate (direct)	2.0	1.5	2.2	2.0	1.3	3.3	1.5	4.3
Rate ratio*	1.03	0.79	1.17	1.03	0.70	1.73	0.81	2.30

* Rate ratios are the standardised rate for a state or territory / standardised rate for Australia.

The Northern Territory had the highest age-adjusted rate of hospitalisation due to drowning (4.3 separations per 100,000 population), and Victoria had the lowest (1.6 per 100,000). Rates for Victoria, Queensland, Western Australia, and the Northern Territory were statistically different from the all-Australia rate of 3.0 separations per 100,000 population (Figure 2.6).

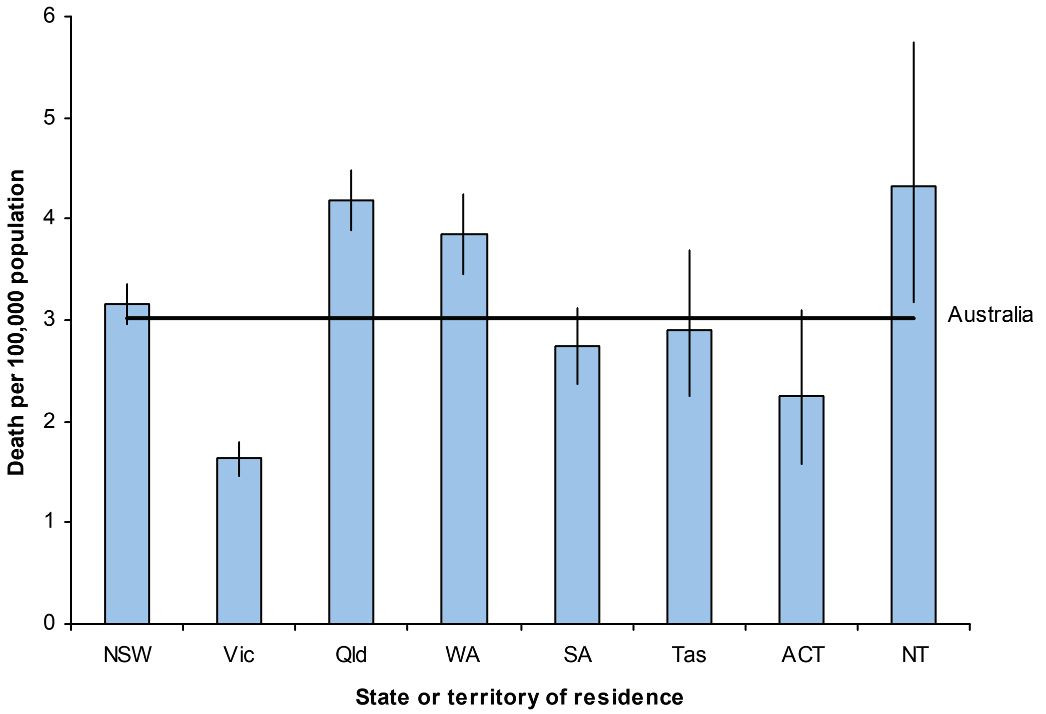

Figure 2.6: Hospitalisations due to drowning by state and territory, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Table 2.3: Cases, age-adjusted rates and rate ratios* by state or territory for total drownings, persons, Australia 1999–00 to 2003–04

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Annual average number of cases	207.6	77.8	155.8	73.8	40.2	13.6	7.4	10.2
Adjusted rate (direct)	3.2	1.6	4.2	3.9	2.7	2.9	2.2	4.3
Rate ratio*	1.05	0.54	1.39	1.28	0.91	0.96	0.74	1.43

* Rate ratios are the standardised rate for a state or territory / standardised rate for Australia.

2.4 Remoteness of residence

Age-adjusted rates of death by drowning rose according to the remoteness of the deceased person's residence. The rate for the very remote zone was three times that for major cities. The all-zones rate was 1.8 drowning deaths per 100,000 population (Figure 2.7).

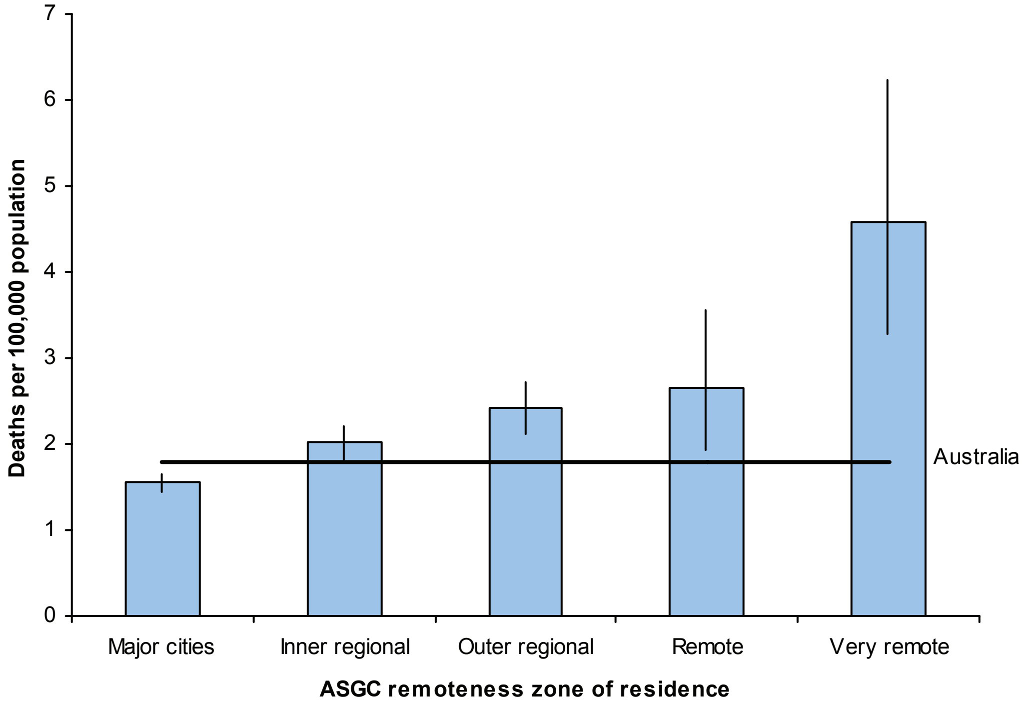

Figure 2.7: Deaths due to drowning by remoteness of residence, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Table 2.4: Cases, age-adjusted rates and rate ratios* by remoteness zone for total drownings, persons, Australia 1999–00 to 2003–04

	Major Cities	Inner Regional	Outer Regional	Remote	Very Remote
Annual average number of cases	200.7	81.7	48.9	8.9	8.7
Adjusted rate (direct)	1.5	2.0	2.4	2.7	4.6
Rate ratio*	0.87	1.13	1.36	1.49	2.56

* Rate ratios are the standardised rate for a remoteness zone / standardised rate for Australia.

As for deaths, age-adjusted rates of hospitalisation due to drowning rose with the remoteness of the patient's residence, although rates for the major cities and inner regional zones were quite similar. The rate for the very remote zone was close to 2.5 times as high as that for the major cities zone (Figure 2.8).

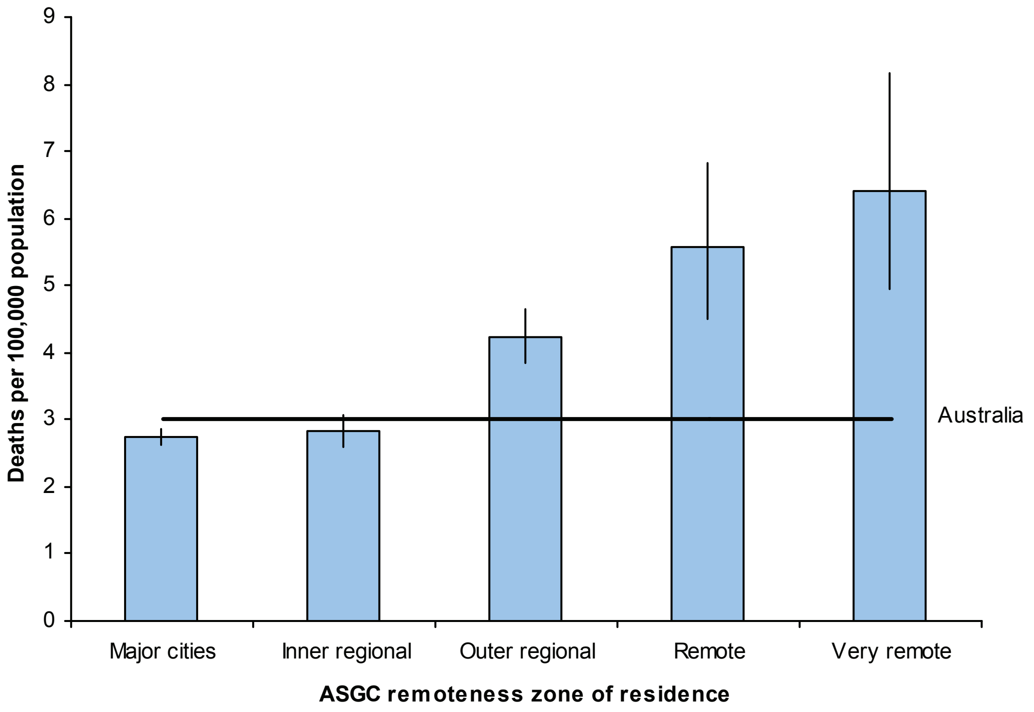

Figure 2.8: Hospitalisations due to drowning by remoteness of residence, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Table 2.5: Cases, age-adjusted rates and rate ratios* by remoteness of residence for total drownings, persons, Australia 1999–00 to 2003–04

	Major Cities	Inner Regional	Outer Regional	Remote	Very Remote
Cases	350.7	113.5	86.1	19.4	14.0
Adjusted rate (direct)	2.7	2.8	4.2	5.6	6.4
Rate ratio*	0.91	0.94	1.41	1.86	2.14

* Rate ratios are the standardised rate for a remoteness zone / standardised rate for Australia.

2.5 Associated factors

The average annual number of deaths where a code had been assigned to indicate the presence of an alcohol-related diagnosis was n=24. This equated to an annual average proportion of 6% of cases. Codes had been assigned to indicate the presence of pharmaceutical drugs in an average annual number of 18 deaths. This equated to 6% of cases.

The annual average number of deaths that had attracted a code indicating the presence of a mental illness was n=38 (10% of cases). The most commonly identified condition was depression, followed by schizophrenia.

2.6 Month of drowning

Not surprisingly, most deaths due to drowning occurred during the warmer months of the year when people are more likely to be engaging in water-related pursuits. The highest number of deaths occurred during January (n=221), and the lowest number during June (n=93) (Figure 2.9).

Differences between average monthly frequencies tended to be more pronounced for hospital separations than for deaths. January, the month with the highest number of drowning-related admissions to hospital (n=520) had 3.8 times the number of cases than did June, the month with the lowest number of admissions (n=138) (Figure 2.9).

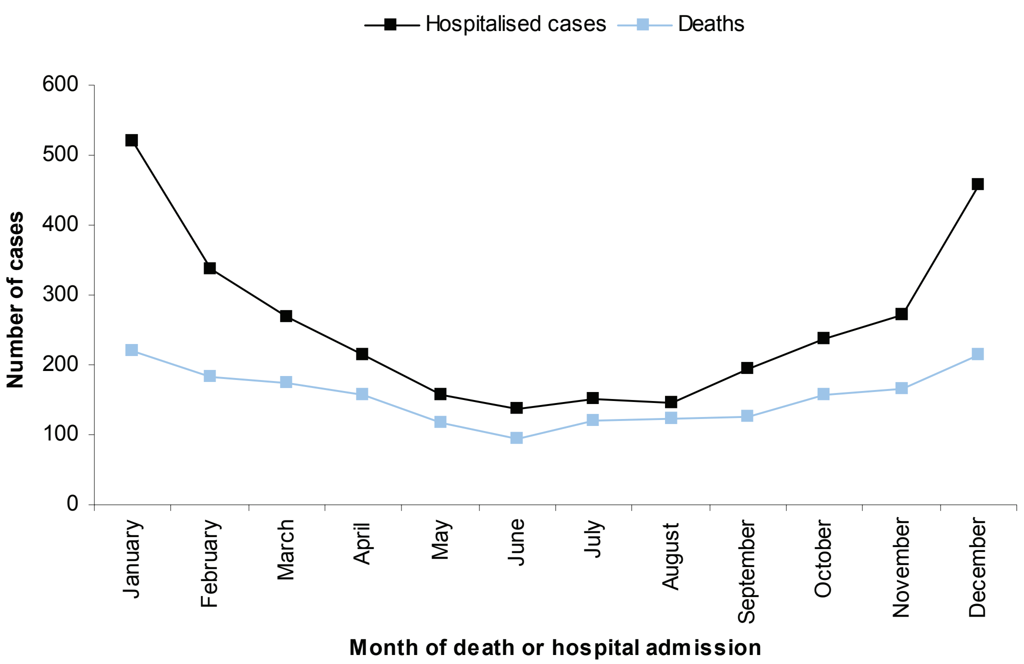

Figure 2.9: Drowning by month, persons, Australia 1999–00 to 2003–04

2.7 Length of stay in hospital

The length of stay in hospital following admission for a drowning leading to hospitalisation ranged from 1 day to 242 days. The mean length of stay was 3.7 days. The mean length of stay increased from young adulthood, and was particularly high among those aged 75 years and over (Table 2.6).

Table 2.6: Mean length of stay in days by age group for drowning-related hospitalisations, 1999–00 to 2003–04*

Age group in years	Mean length of stay in days
0-4	2.3
5-9	1.7
10-14	2.7
15-24	3.5
25-34	5.6
35-54	4.9
55-64	6.0
65-74	3.3
75+	7.2

* Includes patients who died in hospital.

2.8 Activity at time of injury

Table 2.7 below reports the activity being undertaken at time of injury for hospitalised cases of drowning for the two-year period 2002–03 to 2003–04. There was an annual average of 610 cases for the two-year period. In 307 (50.3%) of these cases activity was coded as 'other or unspecified activity' or 'activity not reported/not applicable'. These records have been excluded from the table.

The major proportion of cases occurred while swimming (33.5%). 'While resting, sleeping, eating or engaging in other vital activities' (these cases are most likely to have been bathtub-related drownings) accounted for 12.2% of cases and 'surfing, boogie boarding and wind surfing' accounted for 9.9%.

Table 2.7: Hospitalised drownings by type of activity engaged in at time of injury, persons, Australia 2002-03 to 2003–04, annual average counts

Activity	Annual average number of cases	Percentage
Swimming	102	33.5
Leisure activity, not elsewhere classified	51	16.7
Resting, sleeping, eating or engaging in other vital activities	37	12.2
Surfing, boogie boarding and wind surfing	30	9.9
Scuba diving and snorkelling	16	5.1
Fishing	12	4.0
Yachting, sailing and other boating	11	3.5
Working for income	9	2.8
Water skiing	7	2.3
Jet and surf skiing	6	2.0
Canoeing, kayaking and rafting	5	1.7
Other activities	20	6.4
Total	**303**	**100.0**

Note: Records where activity was coded as 'other or unspecified' or 'not reported/not applicable' were excluded from Table 2.7 (annual average n=307).

Table 2.8 below reports the activity being undertaken at time of injury for cases of drowning deaths that occurred during the three-year period 1999–00 to 2001–02 (the ABS ceased coding activity at the end of 2002). There was an annual average of 382 cases for the reporting period. In 241 (63%) of these cases activity was coded as 'other or unspecified activity' or was not coded. These records have been excluded from the table.

The major proportion of cases occurred 'While engaged in leisure activity' (56%). 26% of cases occurred 'While engaged in sports activity' and 12% 'While resting, sleeping, eating or engaging in other vital activities' (these cases are most likely to have been bathtub-related drownings) (Table 2.8).

Table 2.8: Drowning deaths by type of activity engaged in at time of injury, persons, Australia 1999–00 to 2001–02, annual average counts

Activity engaged in a time of injury	Annual average number of cases	Percentage
While engaged in leisure activity	78	55.4
While engaged in sports activity	36	25.5
While resting, sleeping, eating or engaging in other vital activities	17	11.8
While working for income	6	4.2
While engaged in other types of work	4	3.1
Total	**141**	**100.0**

Note: Records where activity was coded as 'other or unspecified' or 'not reported/not applicable' were excluded from Table 2.8 (annual average n=241).

2.9 Place of injury

Table 2.9 below reports the place of occurrence of hospitalised cases of drowning for the two-year period 2002–03 to 2003–04. The annual average number of cases for the reporting period was 610. For 63 (10.3%) of these, place of occurrence was coded as 'other or unspecified place of occurrence' or 'place not reported/not applicable'. These records have been excluded from the table.

Most cases of near drowning occurred at home (35.6%). The second most commonly coded location was a large area of water (e.g. a lake, ocean or sea) (24.6%).

Table 2.9: Hospitalised drownings by place of occurrence, Australia 2002–03 to 2003–04, annual average counts

Place of occurrence	Annual average number of cases	Percentage
Home	195	35.6
Large area of water	135	24.6
Beach	80	14.5
Stream of water	50	9.1
Swimming centre	44	8.0
Area of still water	20	3.6
Other locations	26	4.7
Total*	**547**	**100.0**

* Records where place of occurrence was coded as 'other or unspecified' or 'not reported/not applicable' were excluded from Table 2.9 (annual average n=63).

Table 2.10 below reports the place of occurrence of hospitalised cases of drowning for the period 1999–00 to 2001–02 (the ABS ceased coding place of occurrence after 2002). The annual average number of cases for the reporting period was 382. For 292 (76.4%) of these, place of occurrence was coded as 'other or unspecified place of occurrence' or place was not reported. These records have been excluded from the table.

Most cases of drowning occurred at home (77.9%).

Table 2.10: Drowning deaths by place of occurrence, Australia 1999–00 to 2001–02, annual average counts

Place of occurrence	Annual average number of cases	Percentage
Home	70	77.9
Farm	6	6.3
Sports and athletics area	4	4.1
School, other institution and public administrative area	3	3.3
Street and highway	3	3.0
Trade and service area	2	2.6
Residential institution	2	1.8
Industrial and construction area	1	1.1
Total	**90**	**100.0**

* Records where place of occurrence was coded as 'other or unspecified' or 'not reported/not applicable' were excluded from Table 2.10 (annual average n=346).

2.9 Severe or persisting consequences of drowning events in hospitalised patients

Serious consequences of drowning are of two main types: death and survival with persisting morbidity. Hypoxic brain damage is of particular concern. The hospital data collection used for this project does not provide direct information on the presence of persisting conditions. It does, however, provide information on diagnoses, some of which imply the presence or likelihood of persisting morbidity. It also provides information on procedures conducted during a period in hospital. Some of these, such as provision of ventilatory support, suggest that the drowning cases are serious, and more likely than other cases to result in persisting morbidity. This section of the report assesses cases in terms of the presence of a range of diagnosis and procedure codes that tend to suggest that cases were relatively severe.

2.9.1 Defining severe or persisting consequences of near-drowning event

A previous NISU report assessed the presence of persisting morbidities resulting from near drownings in Australia (Steenkamp 2002). The author defined persisting morbidity resulting from a near drowning as 'any loss or abnormality of psychological, physiological or anatomical structure of function that will persist over time and that follows a near drowning'. The report based the selection of cases with 'probable' persisting morbidity on nature of injury codes that implied persisting morbidity, as well as those diagnoses with a high likelihood of resulting in persisting morbidity. We have adopted a similar approach to that of Steenkamp in identifying cases with persisting morbidities. We have also attempted to identify cases sustaining severe injuries, by including patients who died in hospital. A measure of injury severity in this report is the ICD-based Injury Severity Score (ICISS). ICISS is an estimate of a patient surviving a given set of injuries. The lower the ICISS, the less likely the patient is to survive from their injuries. A detailed account on the development of ICISS and its usefulness as an injury severity measure can be found in the report '*Diagnosis-based injury severity scaling: A method using Australian and New Zealand hospital data coded to ICD-10-AM*' (Stephenson et al. 2003).

2.9.2 Identifying cases with potential for severe or persisting consequences of drowning

Hospitalised drowning cases which had been assigned at least one of the following procedures (Table 2.11) or diagnoses (Table 2.12) were identified as having potential for severe or persisting consequences.

Table 2.11: List of procedures used to identify cases with potential for severe or persisting consequences of drowning resulting in hospitalisation

Procedure	Description
90179, 92035, 92038, 92039, 92040, 92041, 92046, 92047	Airway management
13857, 13879, 13882	Continuous ventilatory support
56001, 56007	Computerised tomography of brain

Table 2.12: List of diagnoses used to identify cases with potential for severe or persisting consequences of drowning resulting in hospitalisation

Diagnosis	Description
G931	Anoxic brain damage, not elsewhere classified
R402	Coma, unspecified
S02.0	Fracture of vault of skull
S02.1	Fracture of base of skull
S06	Intracranial injury
S14.0, S14.1, S14.7	Injury of spinal cord at neck level
S24.0, S24.1, S24.7	Injury of spinal cord at thorax level
S34.0, S34.1, S34.7	Injury of lumbar spinal cord at abdomen, lower back and pelvis level
S12, S22, S32	Fracture of spine at neck, thoracic and lumbar levels
S48, S58, S68, S78, S88, S98	Traumatic amputation of shoulder and upper arm, forearm, wrist and hand, hip and thigh, lower leg, ankle and foot
S04, S44, S54, S64, S74, S84, S94	Injury of cranial nerves, nerves of shoulder and upper level, forearm level, wrist and hand level, hip and thigh level, lower leg level, ankle and foot level
S14.2–S14.6	Injury of nerves at neck level
S24.2–S24.6	Injury of nerves at thoracic level
S34.2–S34.6	Injury of nerves at abdomen, lower back and pelvis level
T05	Traumatic amputations involving multiple body regions
T06.0	Injuries of brain and cranial nerves with injuries of nerves and spinal cord at neck level
T06.1	Injuries of nerves and spinal cord involving other multiple body regions
T06.2	Injuries of nerves involving multiple body regions
T08	Fracture of spine, level unspecified
T09.3	Injury of spinal cord, level unspecified
T14.4	Injury of nerves of unspecified body region
T68	Hypothermia

2.9.3 Overview

Table 2.13 provides an overview of the presence of indicators of potentially severe or persisting consequences of drowning resulting in hospitalisation by whether or not the patient survived to discharge. For those who died in hospital, the proportion of cases where one or more of the potential indicators was present was more than double that of those cases which survived to discharge, varying from 47.2% (n=17) in 1999–2000 to 58.5% (n=24) in 2003–04. For those who survived to discharge, the proportion of cases where one or more of the potential indicators was present was reasonably consistent over the entire period, varying from 18.7% (n=123) in 2000–01 to 25.6% (n=150) in 2002–03.

Table 2.13: Hospitalised cases by presence of potential indicators of severe or persisting consequences of drowning resulting in hospitalisation by year by survival or non-survival to discharge, Australia, 1999–2000 to 2003–04

	Survived to discharge				Died in hospital			
Year	Not present	Present	Total	Per cent present	Not present	Present	Total	Per cent present
1999–00	481	137	618	22.2	19	17	36	47.2
2000–01	534	123	657	18.7	18	22	40	55.0
2001–02	456	141	597	23.6	15	21	36	58.3
2002–03	436	150	586	25.6	17	21	38	55.3
2003–04	494	139	633	22.0	17	24	41	58.5
Total	**2,401**	**690**	**3,091**	**22.3**	**86**	**105**	**191**	**55.0**

2.9.4 Occurrence of cases with potentially severe or persisting consequences of drowning

Table 2.14 lists the number of occurrences of potential indicators of severe or persisting consequences of drowning for hospitalised cases for the period from 1999–2000 to 2003–04. Of patients whose diagnosis codes indicate the presence of anoxic brain injury, 57.1% (n=36) died in hospital. For patients who had ventilatory support, 28.6% (n=72) died in hospital, while for patients who had airway management, 28.5% (n=43) died in hospital. Of all drowning patients who had at least one of the potential criteria, 13.2% (n=105) died in hospital, while for drowning patients with none of the indicators, only 3.5% (n=86) died in hospital. For patients who experienced at least one of the potential indicators associated with consequences of respiratory problems (i.e. anoxic brain injury, ventilatory support, airway management), 29.5% (n=102) died in hospital. This group includes 43.5% (n=346) of cases with any of the indicators, 97.1% (n=102) of all deaths in this group and 53.4% (n=102) of all deaths in hospital following drowning events.

Table 2.14: Occurrences of potential indicators of severe or persisting consequences of drowning for hospitalised cases, Australia, 1999–00 to 2003–04

	Hospitalisations			
Indicator	Count	Per cent	Died in hospital	Per cent died in hospital
Anoxic brain injury	63	1.9	36	57.1
Ventilatory support	252	7.7	72	28.6
Airway management	151	4.6	43	28.5
At least one of the above indicators	346	10.5	102	29.5
Computerised tomography	228	6.9	28	12.3
Hypothermia	190	5.8	9	4.7
Intracranial injury	158	4.8	7	4.4
Spinal cord injury	30	0.9	0	0.0
Spinal fracture	113	3.4	..	..
Skull fracture	22	0.7	..	..
Coma	14	0.4	..	..
Injury to nerves	5	0.2	0	0.0
At least one indicator	795	24.2	105	13.2
None of the indicators	2,487	75.8	86	3.5

.. For reasons of protecting confidentiality, cell counts of fewer than 5 cases have been suppressed.

2.9.5 Hospitalisations having anoxic brain injury, ventilatory support or airway management

Table 2.15 shows the proportion of cases dying in hospital as well as average length of stay of hospitalised cases by type of external cause by whether or not the patient had anoxic brain injury, ventilatory support or airway management. Of all patients in this group, 29.5% (n=102) died in hospital, with the average length of stay for these patients being 11.5 days. Of patients for which these potential indicators were absent, 3.0% (n=89) died in hospital with the average length of stay for these patients being only 2.7 days.

Table 2.15: Proportion of hospitalised cases dying in hospital and average length of stay (ALOS) by presence or absence of anoxic brain injury, ventilatory support and airway management by type of external cause, Australia, 1999–00 to 2003–04

	Presence of anoxic brain injury, ventilatory support or airway management							
	Present				Not present			
External cause	Count	Died in hospital	Per cent died in hospital	ALOS (Days)	Count	Died in hospital	Per cent died in hospital	ALOS (Days)
Unintentional drowning involving:								
Watercraft	12	4	33.3	20.9	293	0	0.0	3.9
Other transport	9	..	22.2	22.1	42	0	0.0	5.3
Bathtub	26	9	34.6	10.8	222	9	4.1	1.6
Swimming pool	107	35	32.7	14.7	872	35	4.0	1.5
Natural water	119	32	26.9	7.0	796	26	3.3	3.0
Other specified	16	6	37.5	9.9	109	5	4.6	2.2
Unspecified	28	9	32.1	10.8	309	5	1.6	2.7
Intentional self-harm	14	..	21.4	9.1	179	..	0.6	8.1
Assault	..	0	0.0	56.0	21	..	4.8	7.5
Undetermined intent	..	0	0.0	1.0	22	..	0.0	3.5
Other external cause	9	..	11.1	21.5	41	..	7.3	2.2
No external cause present	..	..	100.0	21.5	30	4	13.3	1.4
Total	**346**	**102**	**29.5**	**11.5**	**2,936**	**89**	**3.0**	**2.7**

.. For reasons of protecting confidentiality, cell counts of fewer than 5 cases have been suppressed.

2.9.6 Hospitalisations requiring ventilatory support

Tables 2.16 and 2.17 show hospitalised cases that required ventilatory support for the period from 1999–00 to 2003–04. Most of these cases (78.6%, n=198) showed the presence of at least one other potential indicator for severe or persisting consequences of drowning resulting in hospitalisation (Table 2.16). The combination of indicators which produced the highest fatality rate was ventilatory support in combination with anoxic brain injury where 80% (n=12) of patients died in hospital. This value should be treated with some caution due to the low case numbers. The mean ICISS was relatively stable for most combinations of indicators although the ICISS of 0.6516 for the combination of ventilatory support, computerised tomography and intracranial injury was much lower than for the other most common combinations. There was little correlation between the proportion who died in hospital and ICISS suggesting that the inclusion of information about the use of certain procedures when calculating the weights that underlie ICISS might improve the predictive capability of the method for drowning cases. Also, the diagnosis code for anoxic brain injury is not contained in Chapter XIX of the ICD-10-AM classification and, for this reason, was not included in the study that generated the Survival Rate Ratios (SRRs) used in this report. Since the SRR for this type of injury is likely to be relatively low, cases with anoxic brain injury are likely to have a higher value of ICISS than would be the case had an SRR for anoxic brain injury been included. There was reasonable consistency in the proportion of cases that died in hospital across age groups (Table 2.17). Proportions varied from 20.5% (n=8) for those aged 15–24 years to 34.4% (n=11) for those aged 25–34 years.

Table 2.16: Proportion of hospitalisations dying in hospital and mean ICISS for cases requiring ventilatory support, Australia, 1999–00 to 2003–04

	Hospitalisations			
Indicator(s)	**Count**	**Died in hospital**	**Per cent died in hospital**	**Mean ICISS**
Ventilatory support only	54	14	25.9	0.8961
Ventilatory support & computerised tomography	45	5	11.1	0.8914
Ventilatory support & airway management	39	12	30.8	0.9024
Anoxic brain injury & ventilatory support & computerised tomography	16	11	68.8	0.8827
Anoxic brain injury and ventilatory support	15	12	80.0	0.8809
Ventilatory support & computerised tomography & intracranial injury	12	..	8.3	0.6516
Ventilatory support & airway management & computerised tomography	8	..	37.5	0.8948
Ventilatory support—other combinations	63	14	22.2	0.7113
Total	**252**	**72**	**28.6**	**0.8366**

.. For reasons of protecting confidentiality, cell counts of fewer than 5 cases have been suppressed.

Table 2.17: Proportion dying in hospital for cases requiring ventilatory support, by age group, Australia, 1999–2000 to 2003–04

	Hospitalisations		
Age group	**Count**	**Died in hospital**	**Per cent died in hospital**
0-4	55	18	32.7
5-9	13	3	23.1
10-14	12	4	33.3
15-24	39	8	20.5
25-34	32	11	34.4
35-54	50	14	28.0
55-64	20	6	30.0
65-74	22	6	27.3
75+	9	2	22.2
Total	**252**	**72**	**28.6**

2.10 Types of drowning

The shaded categories of drowning in Table 2.18 are explored in the following sections of this report.

Summary information regarding those categories of drowning which are not explored in detail in the report are provided in sections 2.10.1, 2.10.2 and 2.10.3.

Table 2.18: Drownings by category of incident, annual average counts and proportions, persons, Australia 1999–00 to 2003–04

	Hospitalisations		Deaths	
Category of drowning	**Number**	**Per cent**	**Number**	**Per cent**
Unintentional drowning and immersion:				
Drownings in natural bodies of water	173	27.2	122	32.5
Swimming pool drownings	182	28.6	36	9.6
Bathtub drownings	47	7.4	20	5.3
Watercraft related drownings	65	10.2	37	9.9
Other transport related drownings	12	1.9	17	4.5
Intentional drowning and immersion:				
Intentional self-harm by drowning or immersion	39	6.1	56	14.9
Assault by drowning	6	0.9	4	1.1
Other:				
Drownings of undetermined intent	5	0.8	8	2.1
Other specified drownings	24	3.8	16	4.3
Unspecified drownings and immersions	65	10.2	53	14.1
T75.1 *Drowning and nonfatal submersion* without an external cause code	5	0.8	0	0.0
Records with T75.1 *Drowning and nonfatal submersion* and an external cause code that is not included in the above categories†	9	1.4	5	1.3
Total drownings*	**636**	**100.0**	**375**	**100.0**

* The total counts in this table exceed the counts reported at the beginning of this chapter (618 hospitalisations and 370 deaths) because some records were assigned more than one external cause code, thereby placing them in more than one defined category.

† The most commonly occurring external causes in this category were falls (38% of cases); confined to or trapped in a low-oxygen environment (16%); unintentional poisoning (9%); and sequelae of other accidents (9%).

2.10.1 Other transport-related drowning

Mortality data: T75.1 plus any code(s) in the range V00–V99 (excluding V90 or V92) among the multiple cause of death codes.

Morbidity data: Diagnosis code T75.1 plus any code(s) in the range V00–V99 (excluding V90 or V92) among the external cause codes.

Drowning deaths and hospitalisations due to drowning associated with land or air transport were comparatively rare events. During 1999–00 to 2003–04, 17 persons drowned in this way, and 12 were hospitalised (Table 2.19).

Table 2.19: Key indicators for accidental drownings related to other transport, Australia 1999–00 to 2003–04

	Drowning (deaths)			Drowning (hospitalisations)		
Indicator	Males	Females	Persons	Males	Females	Persons
Annual average number of cases	14	4	17†	9	3	12
Percentage of all drowning deaths/hospitalisations	5	4	5	2	1	2
Crude rate / 100,000 population	0.1	0.0	0.1	0.1	0.0	0.1
Adjusted rate (direct)	0.1	0.0	0.1	0.1	0.0	0.1
Rate ratio*	1.57	0.43		1.57	0.46	
mean YPLL <75y	36.3	33.8	35.8			

* Rate ratios are standardised rate for male or female / standardised rate for persons.

† Male plus Female does not sum exactly to Persons due to rounding of annual average case counts.

Note: Rates are mean annual rates / 100,000 population (Age adjusted by direct method to persons Australia 2001).

2.10.2 Assault by drowning

Mortality data: Any code(s) in the range X85–Y09 among the multiple causes of death codes.

Morbidity data: Any code(s) in the range X85–Y09 among the external cause codes.

Drowning due to assault accounts for a very small proportion of total drownings. During the period 1999–00 to 2003–04, there was an annual average of 4 drowning deaths and 6 admissions to hospital following a drowning due to assault (Table 2.20).

Table 2.20: Key indicators for drownings due to assault, Australia 1999–00 to 2003–04

	Drowning (deaths)			Drowning (hospitalisations)		
Indicator	Males	Females	Persons	Males	Females	Persons
Annual average number of cases	3	2	4†	3	3	6
Percentage of all drowning deaths/hosps	1	2	1	1	1	1
Crude rate / 100,000 population	0.0	0.0	0.0	0.0	0.0	0.0
Adjusted rate (direct)	0.0	0.0	0.0	0.0	0.0	0.0
Rate ratio*	1.29	0.77		0.91	1.09	
mean YPLL <75y	39.6	50.8	43.6			

* Rate ratios are standardised rate for male or female / standardised rate for persons.

† Male plus Female does not sum exactly to Persons due to rounding of annual average case counts.

Note: Rates are mean annual rates / 100,000 population (Age adjusted by direct method to persons Australia 2001).

2.10.3 Residual drownings and submersions

During the reporting period there was an annual average of 8 drowning deaths and 5 hospitalisations where intent could not be determined.

Over the same period there was an annual average of 5 cases of hospitalised drowning that had attracted an ICD-10 code of T75.1 *Drowning and nonfatal submersion* without an accompanying external cause code.

There were also an annual average of 9 cases of hospitalised drowning and 5 cases of drowning deaths which had been assigned the code T75.1 *Drowning and nonfatal submersion* together with a non-drowning related external cause code. The most common of these external causes were falls (38% of cases); confined to or trapped in a low-oxygen environment (16%); unintentional poisoning (9%); and sequelae of other accidents (9%).

2.11 Literature

In addition to the pain and suffering experienced, drowning imposes a hefty economic burden on the community.

Producing estimates of the economic costs of injury is a complex task and varied approaches are used. Such complexity notwithstanding, however, estimates produced in two Australian states provide an insight into the economic costs associated with this important cause of injury.

A 2003 report produced by the NSW Injury Risk Management Research Centre contains an incidence based estimate of the cost of drowning for the year 1998–99 for New South Wales. The estimate includes two basic components: the direct costs related to the use of health services (e.g. hospital treatment, ambulance transport, etc.) and the costs associated with lost output and lost quality of life. The resultant estimate was a lifetime cost of $71,811,912 for drownings that occurred in NSW during 1998–99 (Potter-Forbes 2003).

A 2004 report from Western Australia used a similar methodology to arrive at a lifetime cost estimate of $46.5 million for drownings and near drownings in WA during 2001–02. The average cost of a fatality is given as $1.598 million; a case with moderate or severe disability as $984,700; a fully recovered case admitted to hospital as $6,700; and a fully recovered case attending an emergency department without admission to hospital as $850. 98% of the estimated costs were the result of calculated losses of productivity and quality of life (Hendrie 2004).

Hospitalisation as a consequence of drowning can result in a range of sequelae, some extremely severe. For example, a retrospective review of 55 near drowning child victims admitted to an intensive care unit during a 5-year period found that 37 had survived. However, the profound neurological damage sustained by 5 of the survivors had resulted in a persistent vegetative state. (The mean age of the children in the study was 4.75 years.) (Biggart & Bohn 1990) Some other studies have mentioned outcomes such as severe spastic quadriplegia (Waugh et al. 1994); attention, memory and perceptual deficits as long-term sequelae of cerebral hypoxia (Cruikshank et al. 1988); and the pre-disposition, while in intensive care, to nosocomial infection and the sometimes fatal Acquired Respiratory Distress Syndrome (Sachdeva 1999).

Alcohol appears to play a part in a notable proportion of drowning deaths. Research undertaken by Driscoll et al., using Australian coronial data, found that in 19% of 137 cases where a blood alcohol level was available, alcohol appeared to have contributed to the drowning (Driscoll et al. 2003).

3 Unintentional drowning

Unintentional drowning accounted for an annual average of 479 cases of hospitalisation and 233 deaths. This chapter comprises reports on cases that occurred in four circumstances: in natural bodies of water, swimming pools, bathtubs, and watercraft. Between them, these four types of drowning made up 97% of all unintentional cases of drowning death and 93% of all unintentional cases of hospitalised drowning.

3.1 Drowning in a natural body of water

Mortality data: Any code(s) in the range W69–W70 among the multiple causes of death codes.

Morbidity data: Any code(s) in the range W69–W70 among the external cause codes.

This category, *Drowning in a natural body of water* includes a 'large area of water' (e.g. lake, ocean or sea); 'area of still water' (e.g. dam, pond, marsh or swamp); 'stream of water' (e.g. creek, canal, river or stream); or beach.

During the period 1999–00 to 2003–04 there was an annual average of 122 drowning deaths and 173 hospitalisations due to drowning in natural water. This represents around one-third of all drowning deaths and close to the same proportion of all hospitalised drownings (Table 3.1.1).

Table 3.1.1: Key indicators for accidental drownings natural bodies of water, Australia 1999–00 to 2003–04

	Drowning (deaths)			Drowning (hospitalisations)		
Indicator	Males	Females	Persons	Males	Females	Persons
Annual average number of cases	104	18	122	129	45	173†
Percentage of all drowning deaths/hosps	38	19	33	32	21	28
Crude rate / 100,000 population	1.1	0.2	0.6	1.3	0.5	0.9
Adjusted rate (direct)	1.1	0.2	0.6	1.3	0.5	0.9
Rate ratio*	1.72	0.29		1.49	0.52	
mean YPLL <75y	36.1	34.4	35.9			

* Rate ratios are standardised rate for male or female / standardised rate for persons.

† Male plus Female does not sum exactly to Persons due to rounding of annual average case counts.

Note: Rates are mean annual rates / 100,000 population (Age adjusted by direct method to persons Australia 2001).

3.1.1 Age and sex

The highest age-specific rates for persons were found in the age ranges 75–79 years (1.0 deaths per 100,000 population) and 25–34 years (0.9 deaths per 100,000) (Figure 3.1.1).

69% of drowning deaths and 61% of cases of hospitalised non-fatal drowning in natural bodies of water were in the age range 15–54 years.

Male age-specific rates of death by drowning were consistently higher than female rates in all age groups. The highest male to female rate ratio of 11.9 was found in the 50–54 year age group (Figure 3.1.1).

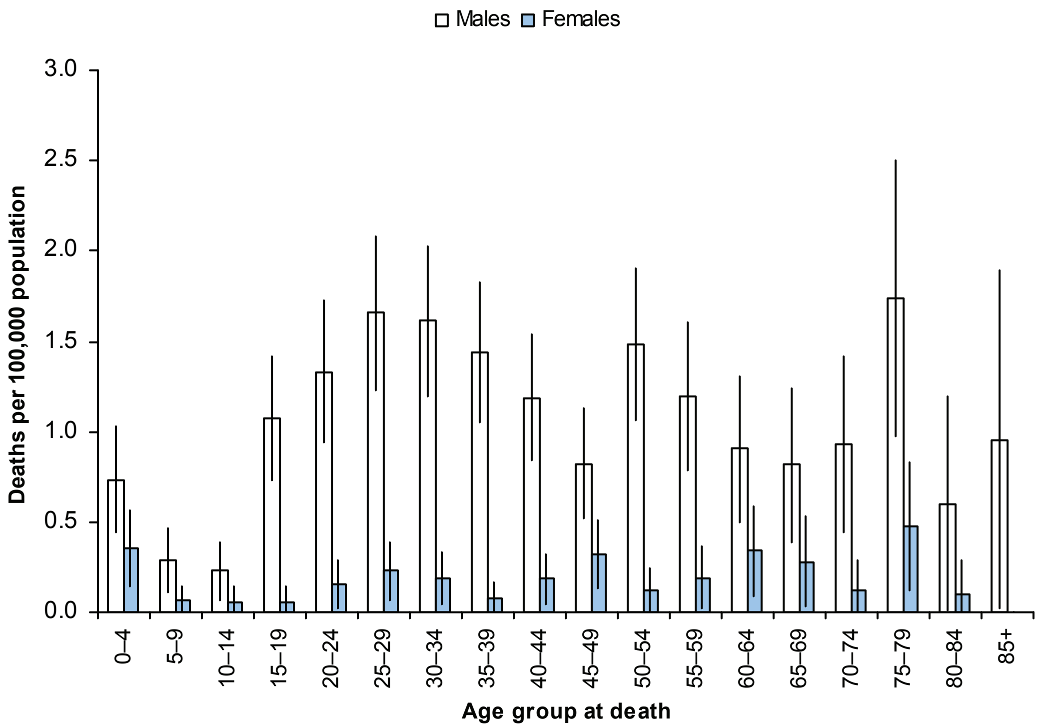

Figure 3.1.1: Deaths due to accidental drowning natural bodies of water by age and sex, persons, Australia 1999–00 to 2003–04

The highest age-specific rate of hospitalisation was found in the 0–4 year age group (2.0 separations per 100,000 population) (Figure 3.1.2).

As for deaths by drowning, male rates were consistently higher than female rates across all age groups. The highest male to female rate ratios were 10.9 in the 45–49 year age group and 7.8 in the 40–44 year age group (Figure 3.1.2).

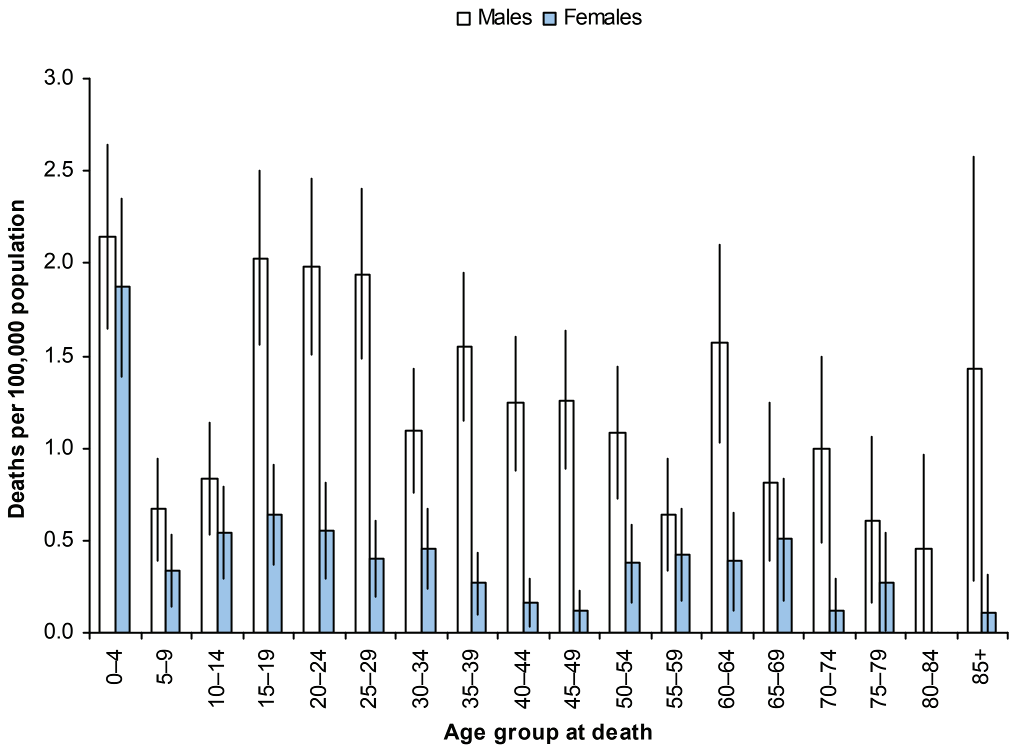

Figure 3.1.2: Hospitalisations due to accidental drowning natural bodies of water by age and sex, Australia 1999–00 to 2003–04

3.1.2 Trends over time

Poisson regression modelling showed a downward trend in age-adjusted rates of drowning in natural bodies of water between 1999–00 and 2003–04. The estimated age-adjusted rate at the beginning of the period was 0.78 deaths per 100,000 population (95% CI 0.68 to 0.88). According to the fitted model, the estimated annual age-adjusted rate of death decreased by an average of 10.7% per year during the 1999–00 to 2003–04 reporting period. This downward trend was statistically significant ($p<0.001$) (Figure 3.1.3).

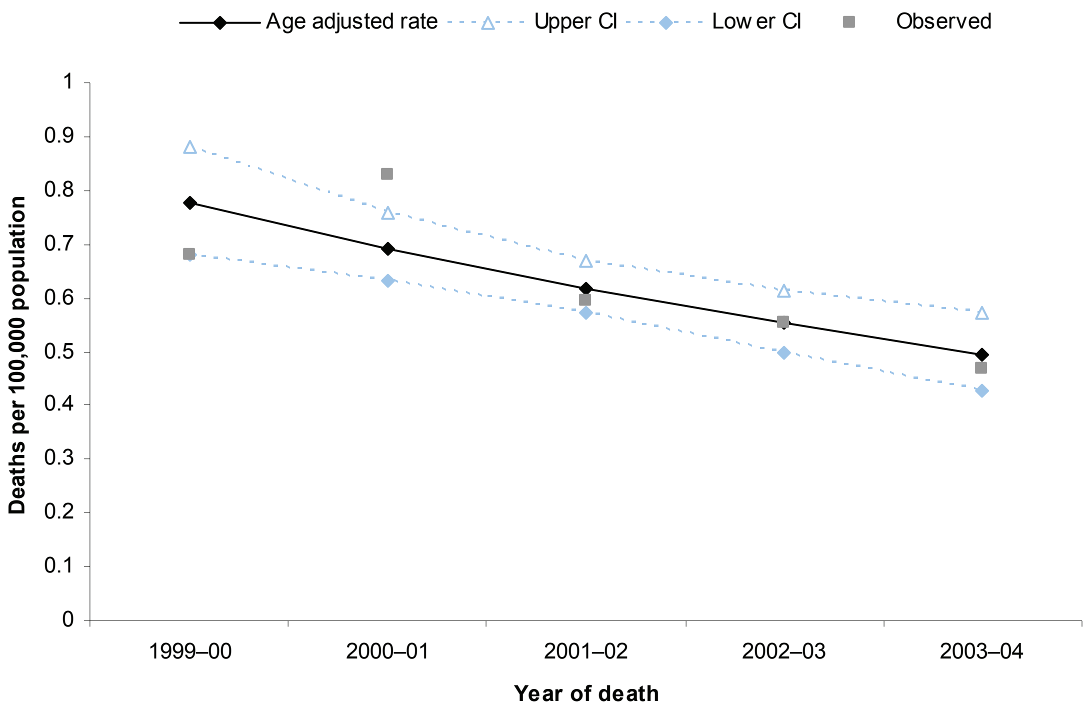

Figure 3.1.3: Deaths due to accidental drowning natural bodies of water, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Poisson regression modelling showed a downward trend in age-adjusted rates of hospitalisation due to drowning in natural bodies of water between 1999–00 and 2003–04. The estimated age-adjusted rate at the beginning of the period was 1.06 separations per 100,000 population (95% CI 0.95 to 1.18). According to the fitted model, the estimated annual age-adjusted rate of separations decreased by an average of 8.8% per year during the 1999–00 to 2003–04 reporting period, a trend that was statistically significant ($p<0.001$) (Figure 3.1.4).

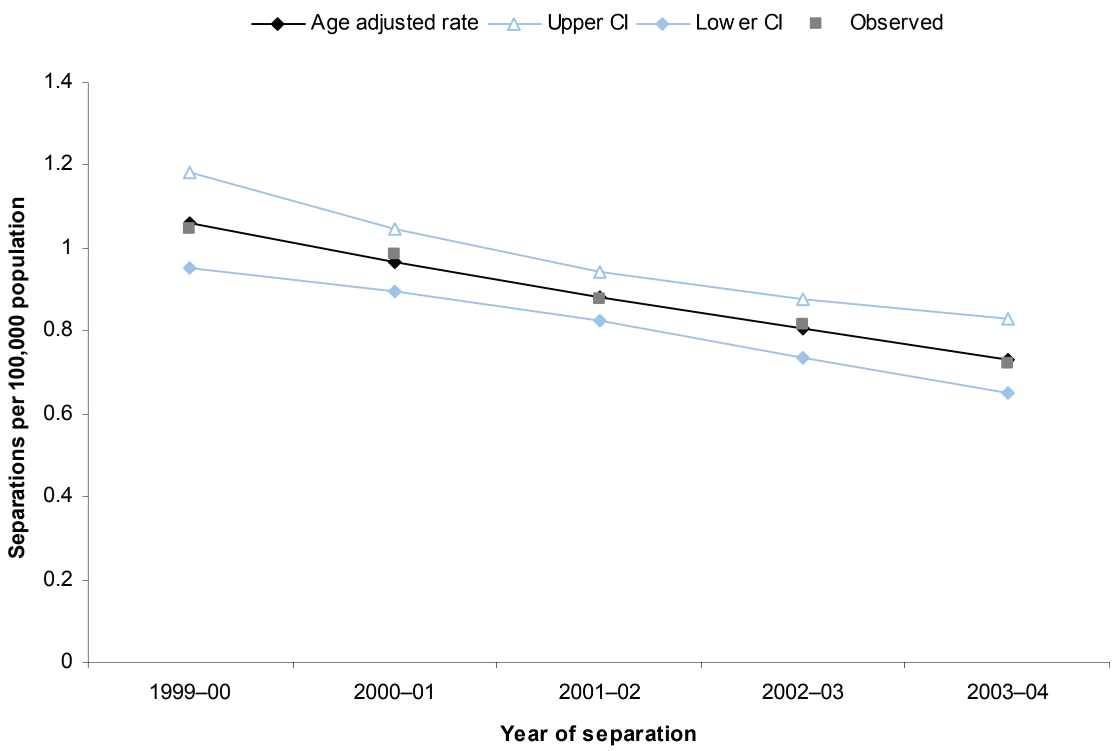

Figure 3.1.4: Hospitalisations due to accidental drowning natural bodies of water, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

3.1.3 Remoteness of residence

Rates of drowning death rose according to the remoteness of the deceased person's residence. The rate for the very remote zone was 3.8 times that for major cities. The all-zones rate was 0.6 deaths per 100,000 population) (Figure 3.1.5 and Table 3.1.2).

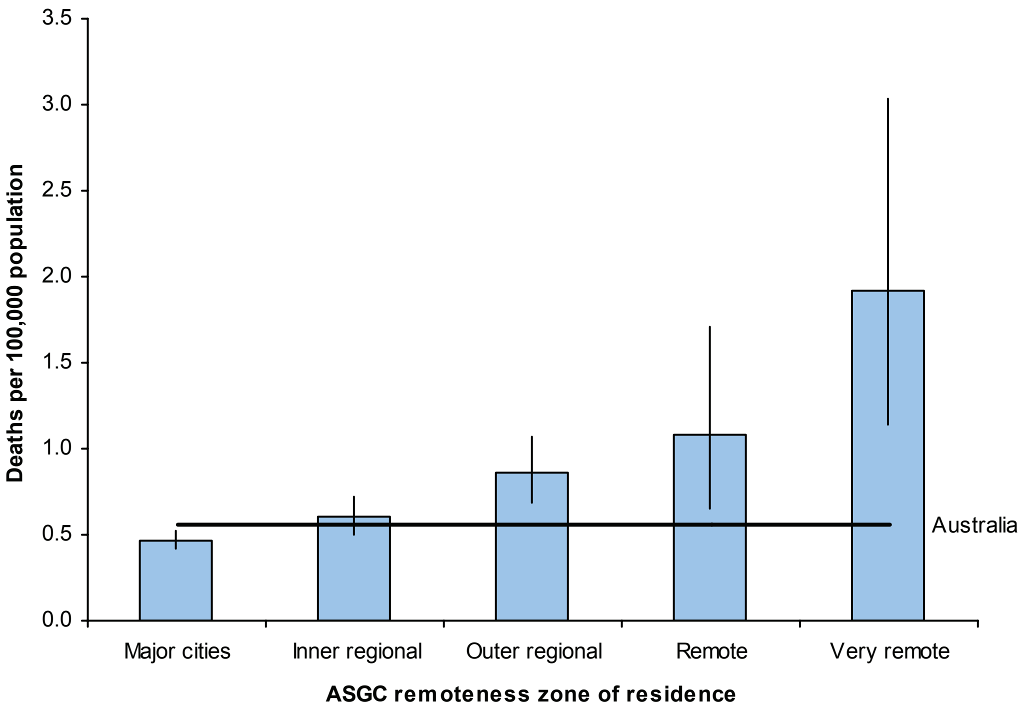

Figure 3.1.5: Deaths due to accidental drowning natural bodies of water by remoteness of residence, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Table 3.1.2: Cases, age-adjusted rates and rate ratios* by remoteness of residence for accidental drownings natural bodies of water, persons, Australia 1999–00 to 2003–04

	Major Cities	Inner Regional	Outer Regional	Remote	Very Remote
Annual average number of cases	61.2	24.3	16.8	3.7	3.7
Adjusted rate (direct)	0.5	0.6	0.9	1.1	1.9
Rate ratio*	0.83	1.08	1.54	1.93	3.42

* Rate ratios are the standardised rate for a remoteness zone / standardised rate for Australia.

Rates of hospitalisation due to drowning were fairly similar for the major cities and inner regional zones (0.7 and 0.8 separations per 100,000 population, respectively) and were also fairly similar for the outer regional and remote zones (1.1 and 1.8 per 100,000 respectively). The very remote area had the highest rate of 1.8 per 100,000. The rate for the very remote zone was 2.6 times that for major cities. The all-zones rate was 0.8 per 100,000 (Figure 3.1.6 and Table 3.1.3).

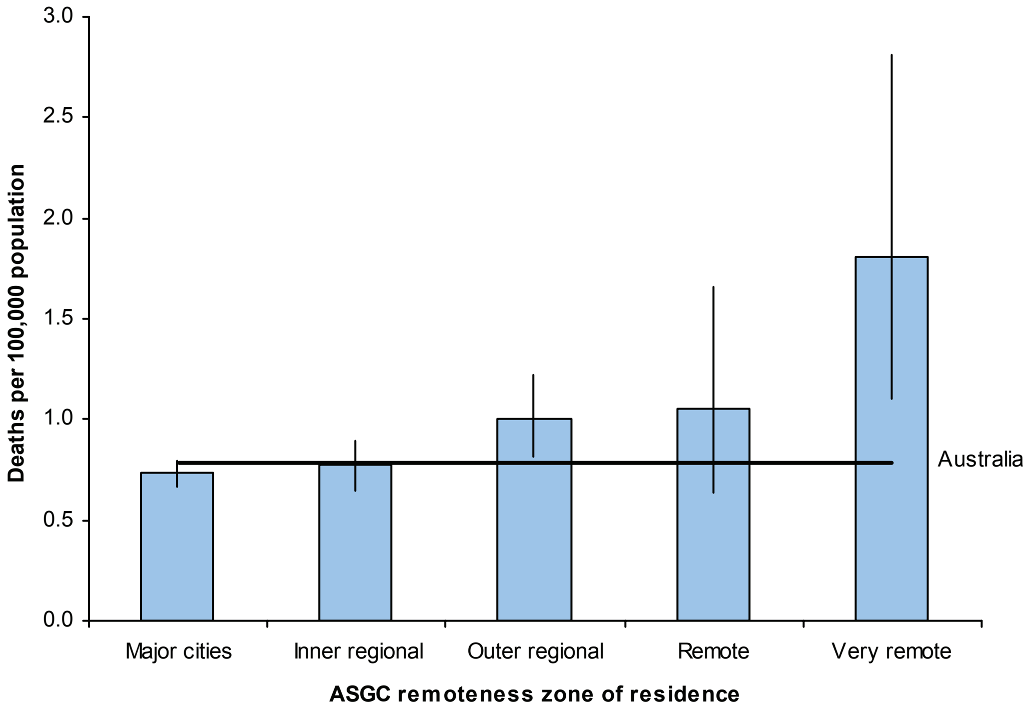

Figure 3.1.6: Hospitalisations due to accidental drowning natural bodies of water by remoteness of residence, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Table 3.1.3: Cases, age-adjusted rates and rate ratios* by remoteness of residence for drowning-related hospitalisations natural bodies of water, persons, Australia 1999–00 to 2003–04

	Major Cities	Inner Regional	Outer Regional	Remote	Very Remote
Annual average number of cases	95.2	30.8	19.9	3.7	4.0
Adjusted rate (direct)	0.7	0.8	1.0	1.1	1.8
Rate ratio*	0.93	0.98	1.27	1.34	2.30

* Rate ratios are the standardised rate for a remoteness zone / standardised rate for Australia.

3.1.4 Associated factors

The average annual number of cases where a code had been assigned to indicate that alcohol had contributed to the death was n=10. This equated to an annual average proportion of 8% of cases. (Information about interpreting information on alcohol is given in *Appendix 1: Data issues*.) Codes had been assigned to indicate the presence of pharmaceutical drugs in an average annual number of 3 deaths. This equated to an annual average proportion of 2% of cases.

The annual average number of cases that had attracted a code indicating that a mental illness had contributed to the death was n=4 (3% of cases).

3.1.5 Month of drowning

Deaths by drowning in natural bodies of water occurred most frequently during warmer months of the year. This is consistent with an escalation in water-related activities during those times. There were close to 3½ times as many deaths during January as there were during June (Figure 3.1.7).

As was the case for deaths, hospitalisations due to drowning occurred more often during the warmer months of the year. January had the highest frequency of cases (n=184) and July had the lowest (n=31) (Figure 3.1.7).

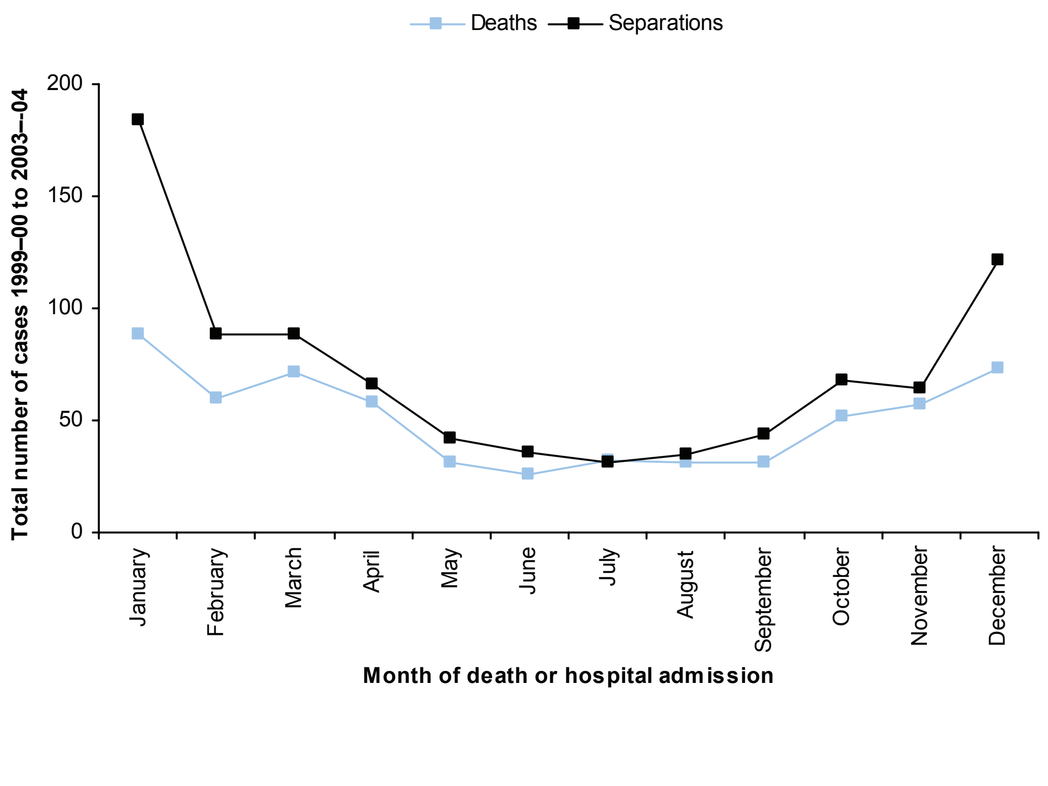

Figure 3.1.7: Drownings in natural bodies of water by month, persons, Australia 1999–00 to 2003–04

3.1.6 Length of stay in hospital

Across all ages, the length of stay in hospital following admission for a drowning incident ranged from 1 day to 134 days. The mean length of stay was 3.5 days. Mean length of stay in hospital tended to increase slightly with increasing age (Table 3.1.4).

Table 3.1.4: Mean length of stay after drowning in a body of natural water, by age group, 1999–00 to 2003–04*

Age group in years	Mean length of stay in days
0-4	2.2
5-9	2.2
10-14	2.2
15-24	3.2
25-34	4.9
35-54	3.1
55-64	5.1
65-74	5.1
75+	5.9

* Includes patients who died in hospital.

3.1.7 Literature

Available literature provides an insight into the locations and circumstances of drownings in natural bodies of water.

A study undertaken by the Royal Life Saving Society which used data collected from state and territory coronial offices, NCIS and media reports, found 259 cases of drowning for the one year period 2004–05. Of these, 64 occurred in a river, the ocean, or a harbour, bay or estuary; 63 cases occurred in a lake, dam or lagoon; and 44 took place at the beach. A more detailed breakdown showed that 28 drownings occurred in rivers, 29 in the ocean and 7 in a harbour, bay or estuary (The Royal Life Saving Society Australia 2005).

A 2005 study of usual water-related behaviour and near–drowning incidents in a cohort of young New Zealanders used face-to-face interviews from a structured questionnaire to elicit information from 1,037 21 year olds. Of this group, 141 reported having been involved in a near-drowning incident during the past 3 years. Altogether, there was a total of 169 such incidents. 60 (36%) of these incidents occurred while the person was swimming, 48 (28%) while surfing. The remainder occurred during a boating activity. The largest proportion (n=16, 27%) of the swimming-related incidents involved being caught in a rip or knocked over by waves while at the beach. Close to half of the surfing incidents (n=20, 42%) involved being held under or dragged out by the waves (Gulliver & Begg 2005).

ICD-10 is somewhat ambiguous in terms of what bodies of water are included in this category. Nevertheless, because dams present a serious drowning hazard for young children, literature on this topic is included here. A 2005 study which looked at Victorian coroners' records for the 13-year period 1989–01, found a total of 27 such drowning deaths. The majority of the children involved were aged between 1–3 years. The study identified five major contributing factors: the developmental stage of the child; a lack of adult supervision; the child playing outside of the home; the placement of the dam within 3,000 metres of where the child was playing; and the absence of effective barriers for keeping the child away from the dam (Bugeja & Franklin 2005).

The more than 4,000,000 tourists who visit Australia annually have shown themselves to be vulnerable to drowning. Research conducted by Mackie found that 88 tourists from 12 countries drowned while visiting Australia during the period 1992–97. He further reports that 61% of these drowned at surfing beaches or elsewhere in an ocean context, and 24% drowned while scuba diving or snorkelling (Mackie 1999).

3.2 Swimming pool drownings

Mortality data: Any code(s) in the range W67–W68 among the multiple causes of death codes.

Morbidity data: Any code(s) in the range W67–W68 among the external cause codes.

Over the period 1999–00 to 2003–04, an annual average of 36 persons died and 182 persons were hospitalised as the result of drowning in a swimming pool (Table 3.2.1).

Swimming pool cases accounted for 10% of drowning deaths, and for 29% of drowning hospitalisations. The high value of mean years of potential life lost before age 75 reflects the large proportion of toddlers among drowning deaths in swimming pools.

Table 3.2.1: Key indicators for accidental drowning involving swimming pools, Australia 1999–00 to 2003–04

	Drowning (deaths)			Drowning (hospitalisations)		
Indicator	**Males**	**Females**	**Persons**	**Males**	**Females**	**Persons**
Annual average number of cases	25	11	36	112	70	182
Percentage of all drowning deaths/hosps	9%	12%	10%	28%	33%	29%
Crude rate / 100,000 population	0.3	0.1	0.2	1.2	0.7	0.9
Adjusted rate (direct)	0.3	0.1	0.2	1.1	0.7	0.9
Rate ratio*	1.38	0.62		1.21	0.79	
mean YPLL <75y	55.0	46.1	52.2			

* Rate ratios are standardised rate for male or female / standardised rate for persons.

Note: Rates are mean annual rates / 100,000 population (Age-adjusted by direct method to persons Australia 2001).

3.2.1 Age and sex

The highest age-specific rates of death by drowning were found in the 0–4 year age group (1.4 deaths per 100,000 population). In this age group, the male rate was 2.0 deaths per 100,000 and the female rate was 0.8 deaths per 100,000 (Figure 3.2.1).

The largest differential between male and female rates of drowning death were found in the 80–84 year age group where the male to female ratio was 9.3.

Swimming pool drowning deaths were most frequent among 1 and 2 year olds (Table 3.2.2).

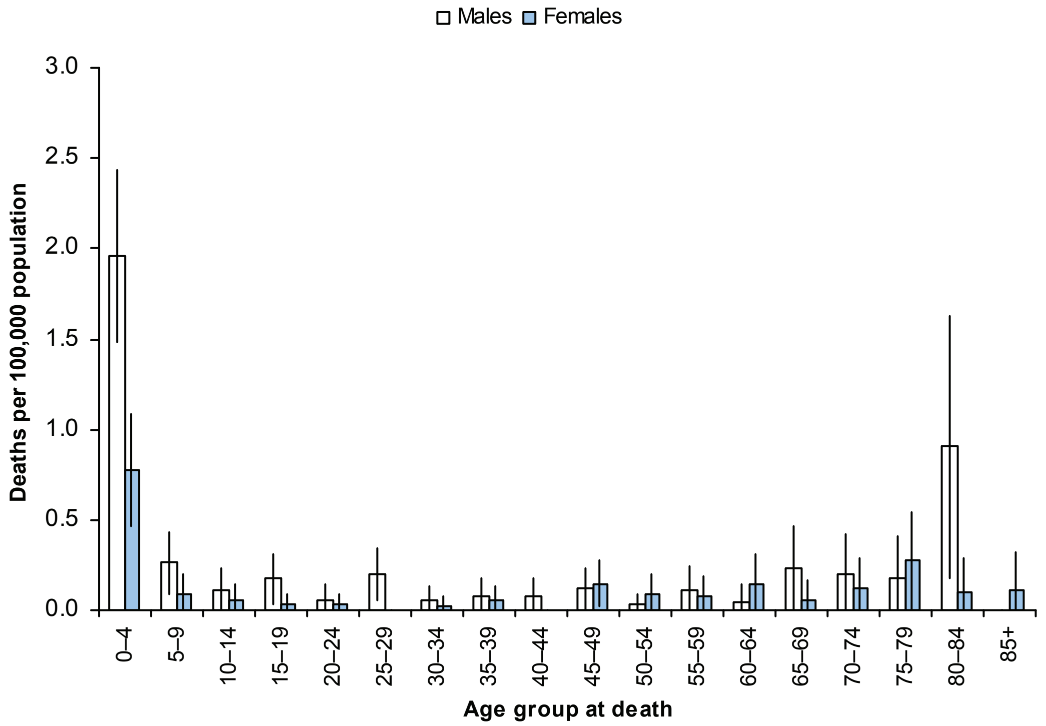

Figure 3.2.1: Deaths due to accidental drowning involving swimming pools by age and sex, Australia 1999–00 to 2003–04

Table 3.2.2: Category of death by age, 0–4 year olds, Australia 1999–00 to 2003–04

	Age at death (years)					
Category of death	**0**	**1**	**2**	**3**	**4**	**Total**
Swimming pool drowning deaths	3	29	29	15	12	88
Other drowning deaths	25	52	29	21	16	143
Deaths due to other external causes	147	100	79	65	63	454
Deaths due to natural causes	6,115	342	192	172	120	6,941
All causes	**6,290**	**524**	**331**	**276**	**215**	**7,626**

The highest age-specific rate of hospitalisation due to drowning was found among males in the 0–4 year age group (11.5 separations per 100,000 population). Females in this age group had a rate of 7.7 per 100,000 (Figure 3.2.2).

Males had higher age-specific rates of hospitalisation than females in almost all age groups.

In contrast to unintentional drowning in natural bodies of water, few cases involving swimming pools occurred after childhood.

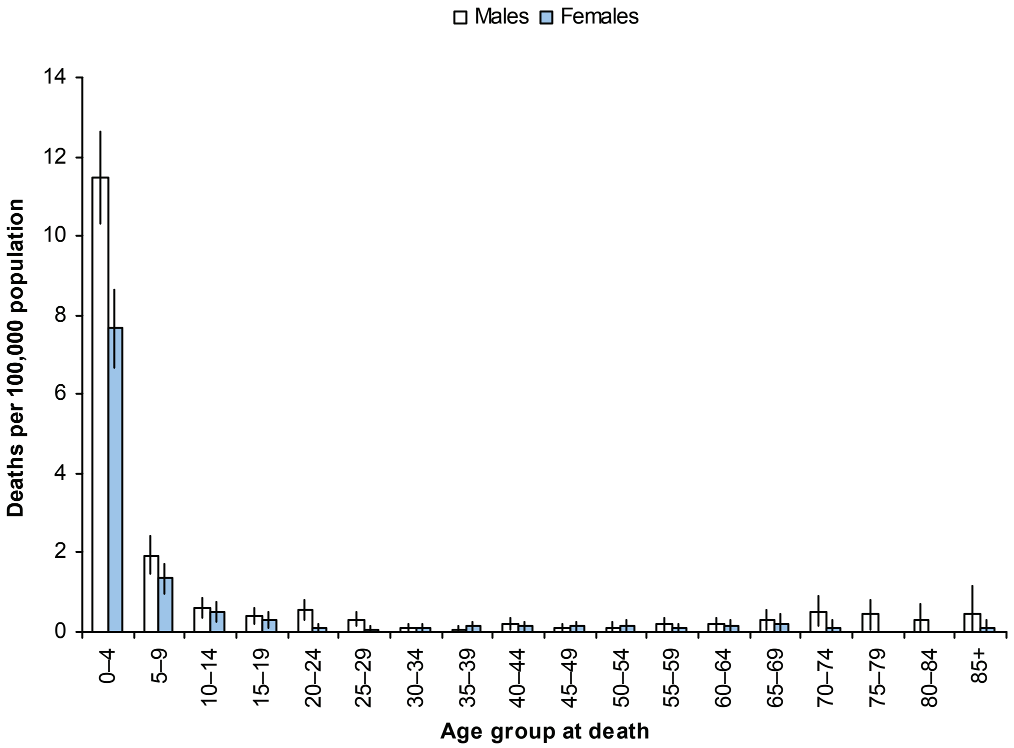

Figure 3.2.2: Hospitalisations due to drowning involving swimming pools by age and sex, Australia 1999–00 to 2003–04

3.2.2 Trends over time

Poisson regression modelling showed indications of a downward trend in age-adjusted rates of drowning in swimming pools across all ages between 1999–00 and 2003–04, but this was not statistically significant (p=0.632) (Figure 3.2.3). The estimated age-adjusted rate at the beginning of the period was 0.19 deaths per 100,000 population (95% CI 0.15 to 0.25). According to the fitted model, the estimated annual age-adjusted rate of swimming pool drownings decreased by and average of 2.5% per year during the 1999–00 to 2003–04 reporting period.

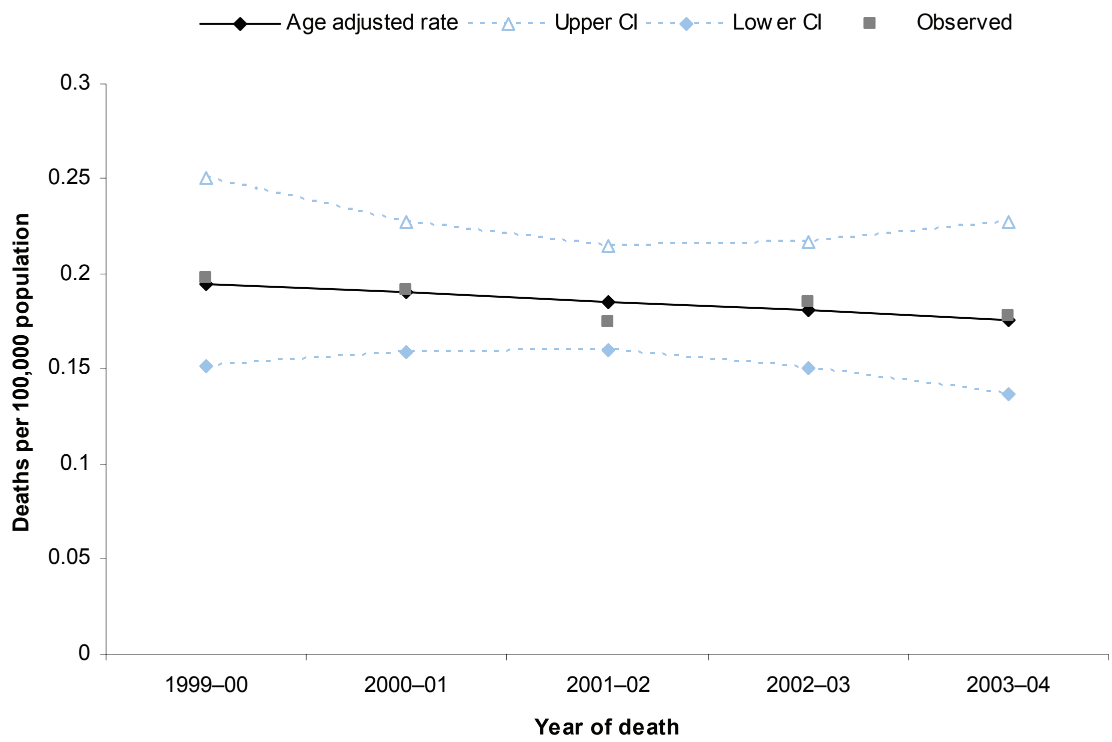

Figure 3.2.3: Deaths due to accidental drownings involving swimming pools, persons, all ages, Australia 1999–00 to 2003–04 (age-standardised rates)

For the 0–4 year age group, Poisson regression modelling showed indications of a small downward trend in age-adjusted rates of drowning in swimming pools between 1999–00 and 2003–04, but this was not statistically significant (p=0.903) (Figure 3.2.4). The estimated age-adjusted rate at the beginning of the period was 0.10 deaths per 100,000 population (95% CI 0.02 to 0.32). According to the fitted model, the estimated annual age-adjusted rate of swimming pool drownings decreased by an average of 3.5% per year during the 1999–00 to 2003–04 reporting period.

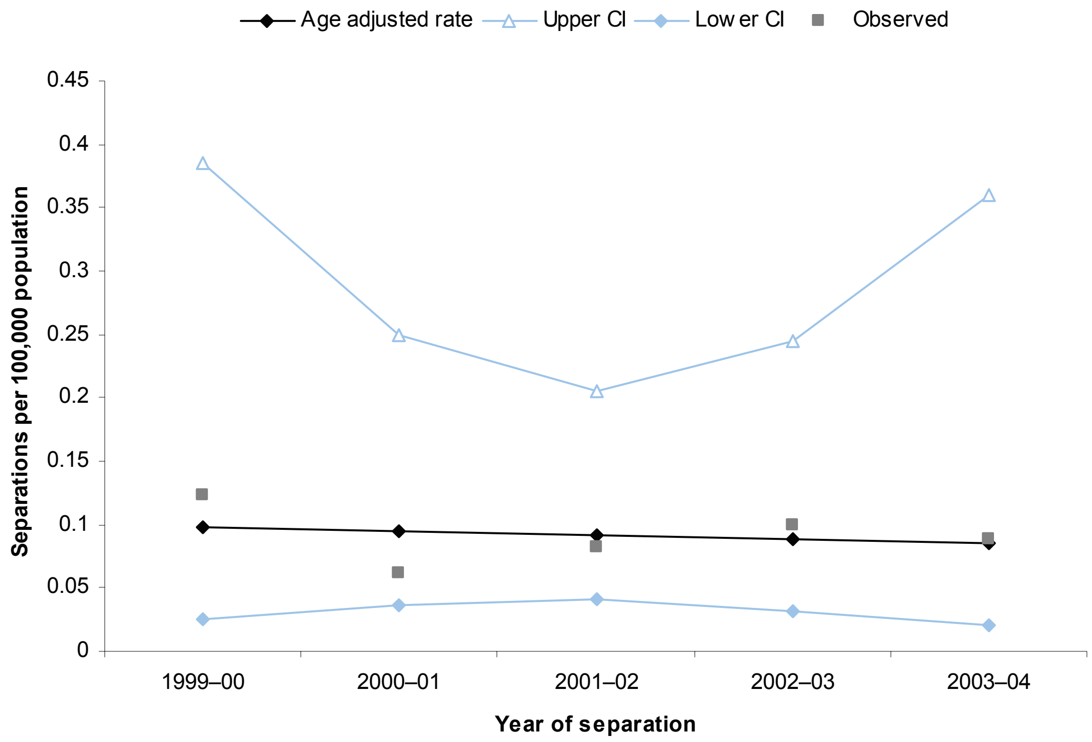

Figure 3.2.4: Deaths due to accidental drownings involving swimming pools, persons, 0–4 years, Australia 1999–00 to 2003–04 (age-standardised rates)

Negative binomial regression modelling showed an upward trend in age-adjusted rates of hospitalised drowning in swimming pools between 1999–00 and 2003–04, but this trend was not statistically significant (p=0.084) (Figure 3.2.5). The estimated age-adjusted rate at the beginning of the period was 0.83 separations per 100,000 population (95% CI 0.70 to 0.98). According to the fitted model, the estimated annual age-adjusted rate of swimming pool drownings increased by an average of 6.2% per year during the 1999–00 to 2003–04 reporting period.

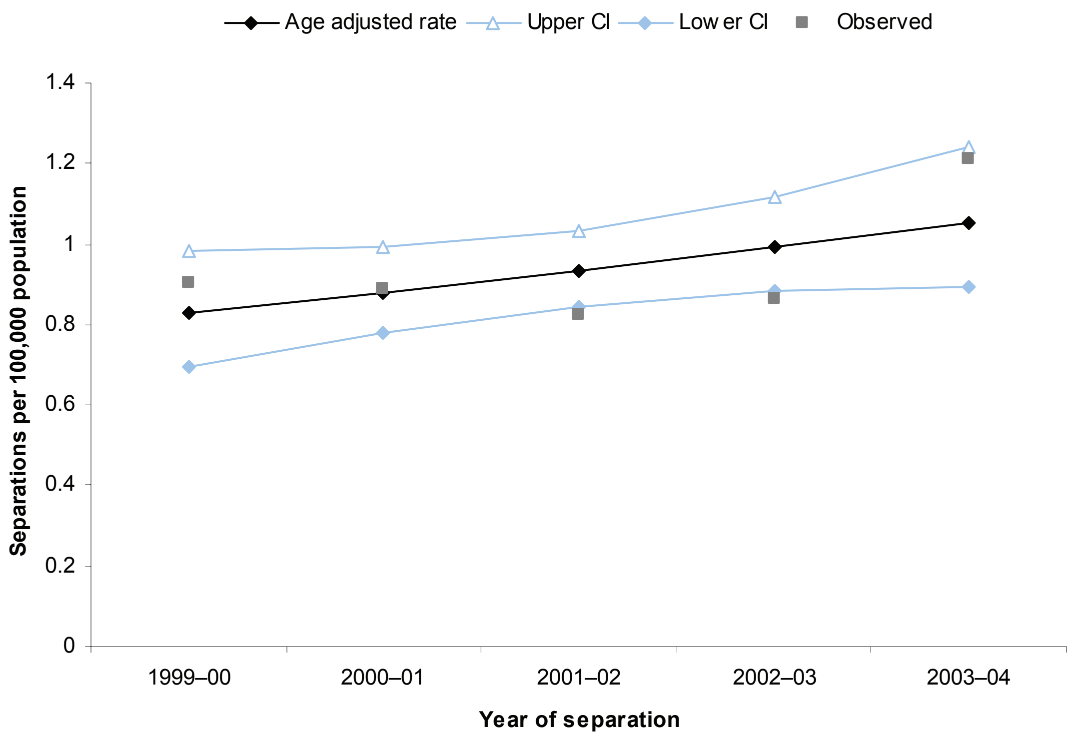

Figure 3.2.5: Hospitalisations due to drowning involving swimming pools, persons, all ages, Australia 1999–00 to 2003–04 (age-standardised rates)

Poisson regression modelling showed a slight upward trend in age-adjusted rates of hospitalised drowning in swimming pools between 1999–00 and 2003–04, but this trend was not statistically significant (p=0.849) (Figure 3.2.6). The estimated age-adjusted rate at the beginning of the period was 0.61 separations per 100,000 population (95% CI 0.35 to 1.04). According to the fitted model, the estimated annual age-adjusted rate of swimming pool drownings increased by an average of 2.1% per year during the 1999–00 to 2003–04 reporting period.

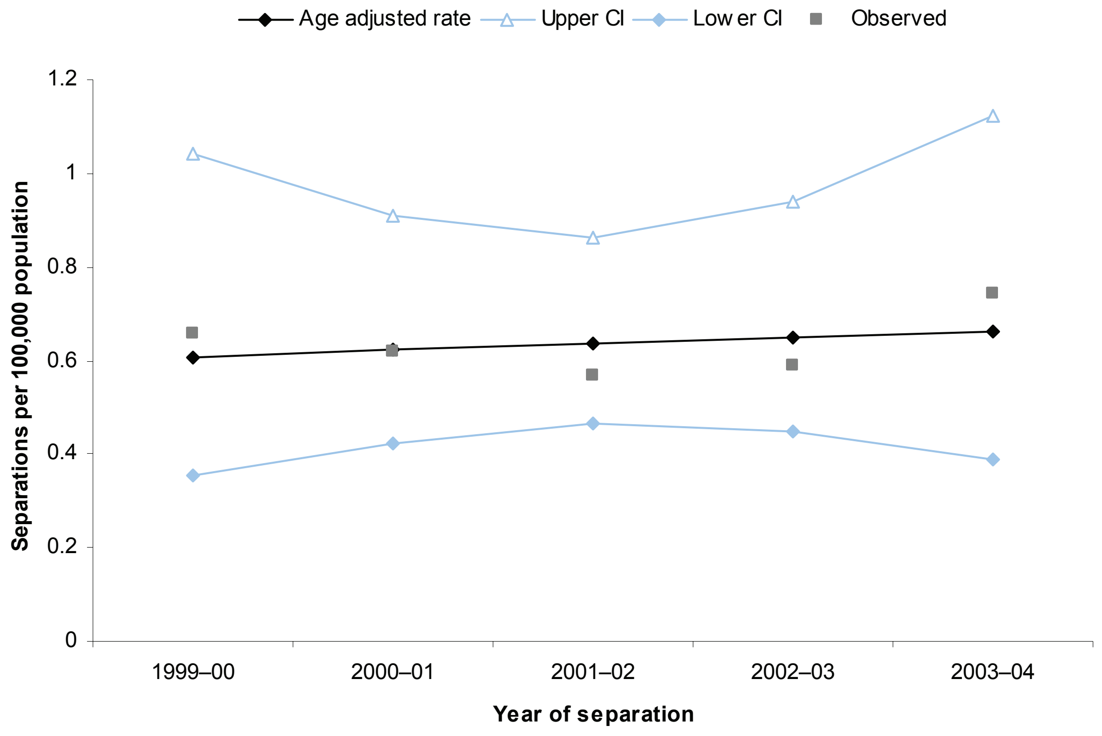

Figure 3.2.6: Hospitalisations due to drowning involving swimming pools, persons, 0–4 years, Australia 1999–00 to 2003–04 (age-standardised rates)

3.2.3 Remoteness of residence

The very remote zone had the highest rate of deaths by drowning (0.35 deaths per 100,000). None of the zones had rates that differed to a statistically significant extent from the all-zones rate of 0.18 (Figure 3.2.7 and Table 3.2.3).

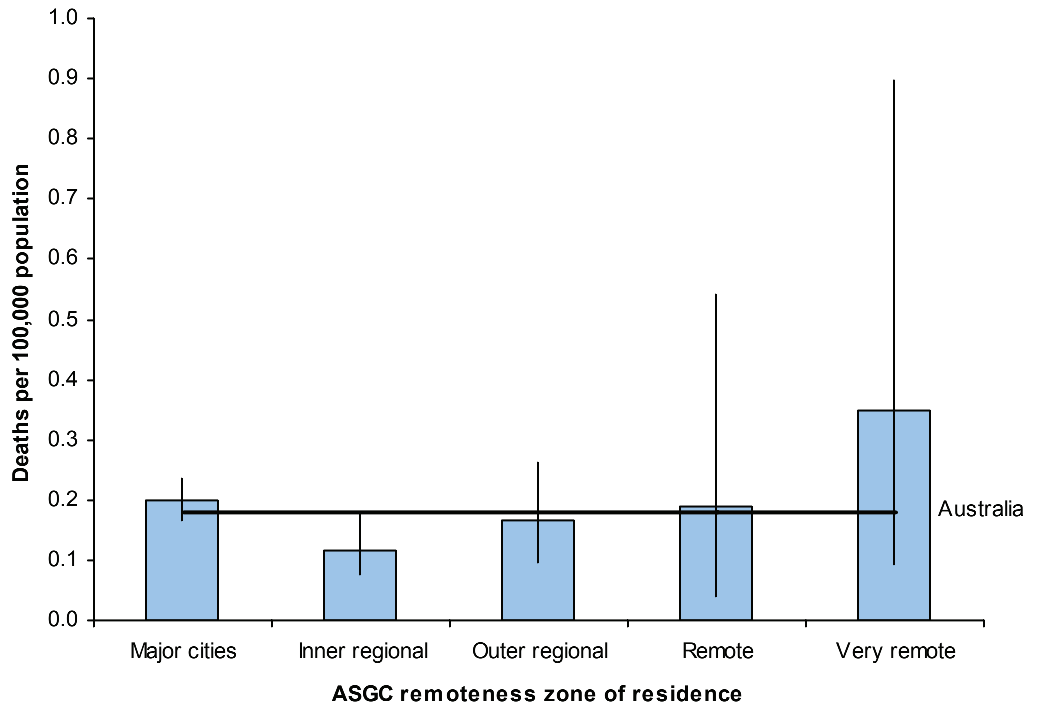

Figure 3.2.7: Deaths due to accidental drowning involving swimming pools by remoteness of residence, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Table 3.2.3: Cases, age-adjusted rates and rate ratios* by remoteness of residence for accidental drowning involving swimming pools, persons, Australia 1999–00 to 2003–04

	Major Cities	Inner Regional	Outer Regional	Remote	Very Remote
Annual average number of cases	25.3	4.8	3.4	0.6	0.8
Adjusted rate (direct)	0.2	0.1	0.2	0.2	0.3
Rate ratio*	1.11	0.65	0.91	1.05	1.93

* Rate ratios are the standardised rate for a remoteness zone / standardised rate for Australia.

As for deaths, the very remote zone had the highest rate of hospitalisations due to drowning in a swimming pool (1.4 separations per 100,000 population.) Only the inner regional zone had a rate that differed significantly from the all-Australia rate of 0.9 per 100,000 (Figure 3.2.8 and Table 3.2.4).

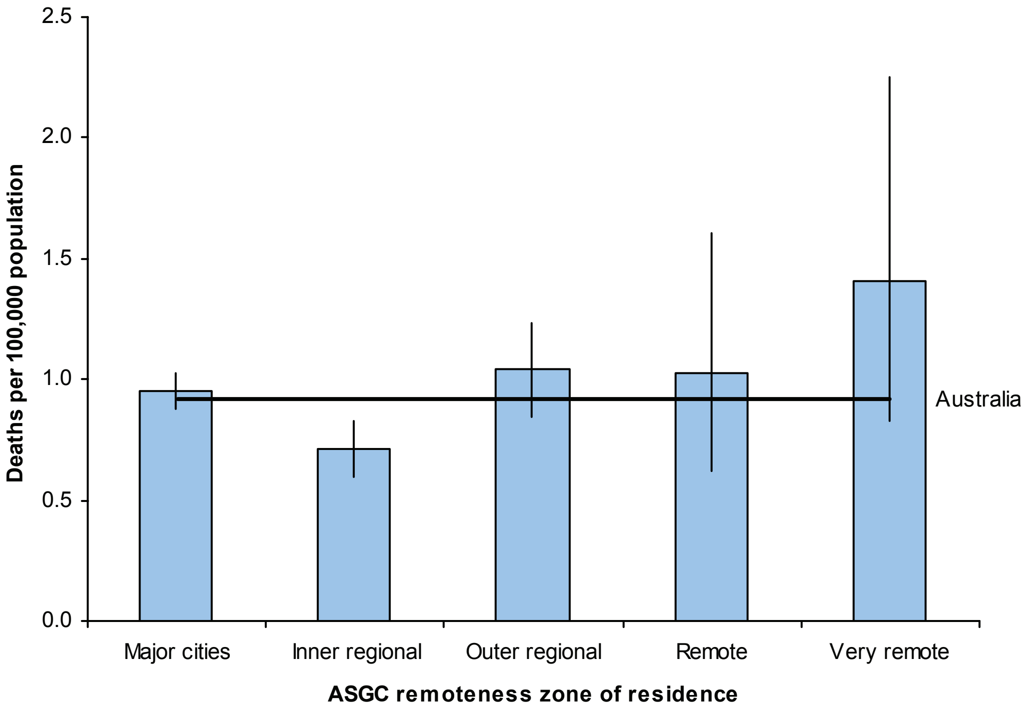

Figure 3.2.8: Hospitalisations due to accidental drowning involving swimming pools by remoteness of residence, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Table 3.2.4: Cases, age-adjusted rates and rate ratios* by remoteness of residence for drowning-related hospitalisations involving swimming pools, persons, Australia 1999–00 to 2003–04

	Major Cities	Inner Regional	Outer Regional	Remote	Very Remote
Annual average number of cases	118.9	28.7	22.1	3.9	3.5
Adjusted rate (direct)	1.0	0.7	1.0	1.0	1.4
Rate ratio*	1.04	0.77	1.14	1.12	1.54

* Rate ratios are the standardised rate for a remoteness zone / standardised rate for Australia.

3.2.4 Associated factors

Of the total of 36 swimming-pool related drowning deaths, 16 took place while the deceased was in the pool, and the remaining 20 after they had fallen into the pool.

97 of the 182 persons who were admitted to hospital experienced a drowning episode while already in the swimming pool. 85 came close to drowning after they fell into the pool.

3.2.5 Month of drowning

Patterns for drowning deaths and hospitalisations were broadly similar, being most frequent during the warmer months of the year and least frequent during the cooler months. However, seasonal variation was more marked for hospitalised cases than for deaths. The number of hospitalisations during December is noteworthy, perhaps reflecting the combination of school holidays and the approach of the Christmas season. The number of hospitalisations during December was 9 times the number that occurred in July. The number of drowning deaths during December, the month with the most cases, was 6.4 times that of May, the month with the least number of deaths (Figure 3.2.9).

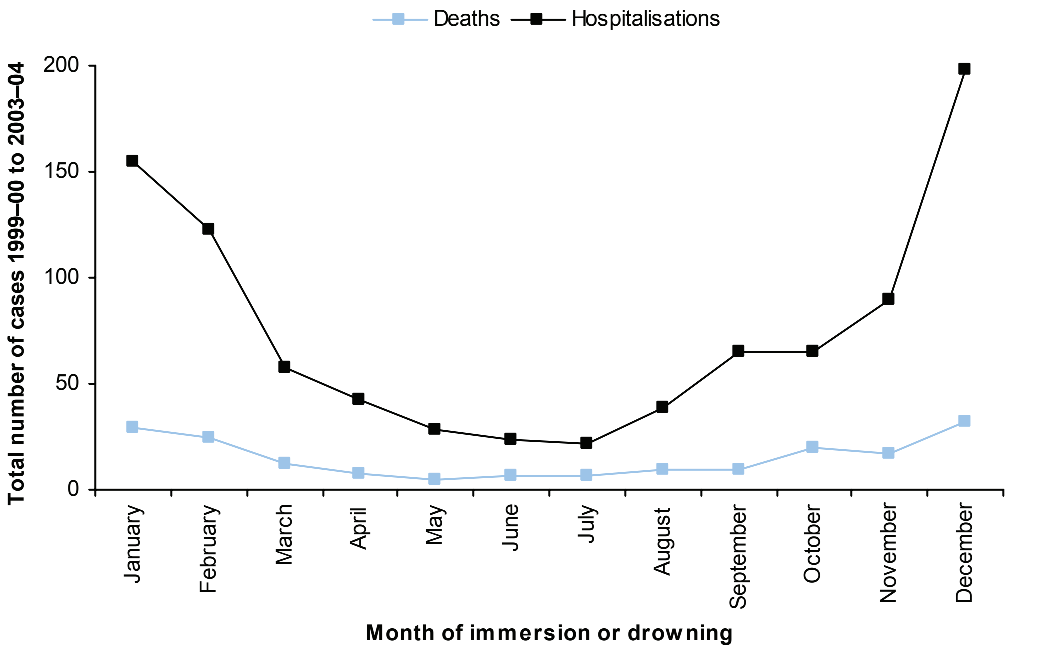

Figure 3.2.9: Drownings in swimming pools by month, persons, Australia 1999–00 to 2003–04

3.2.6 Length of stay in hospital

The length of stay in hospital following admission after a drowning incident ranged from 1 day to 242 days. The mean length of stay was 3.0 days. Mean length of stay increased from middle age onwards. The high value for the age group 25–34 is related to one case where the LOS was 242 days (Table 3.2.5).

Table 3.2.5: Mean length of stay in hospital by age group after drowning in a swimming pool, 1999–00 to 2003–04

Age group in years	Mean length of stay in days
0–4	2.2
5–9	1.7
10–14	3.1
15–24	2.5
25–34	14.8
35–54	7.5
55–64	5.8
65–74	7.9
75 plus	7.6

3.2.7 Coronial data

A search of the National Coronial Information System (NCIS) was conducted to identify cases of unintentional drowning in swimming pools that occurred over the period 2001–02 to 2003–04. Initially, two subsets of records were created. For both subsets, the basic selection criteria were cases that had been closed by the coroner, were unintentional, and had as their specified mechanism 'drowning'. Thereafter, the selection criteria for the first subset was the appearance of the text 'pool*'[1] or 'swim*'[1] in the police report. Selection criteria for the second subset were records where the coded object was a 'swimming pool'. The two subsets were then merged and duplicate records deleted. The final subset contained 99 records for further analysis.

In comparison to the 99 records identified in the NCIS, 104 records where a death had been coded as having occurred in a swimming pool (ICD-10 W67 or W68 and coroner certified) were identified in the ABS deaths data for the same period. While the difference is small for this injury type there is a need to understand the reasons why discrepancies occur and how they can be interpreted or taken account of in the course of investigating injurious events.

In recent years the ICD-10 codes assigned to death records by the ABS have been added to records in the NCIS on a case by case basis, although the additions have been quite extensive there are still records where an ABS-sourced ICD code has not been added. The presence of these ICD codes was used to compare the NCIS records referred to above with cases in the NCIS identified by the presence of an ABS added code of W67 *Drowning and submersion while in swimming-pool* or W68 *Drowning and submersion following fall into swimming-pool* anywhere in the death record. A search of the NCIS for records including these ICD codes identified 65 records overall, 63 of which were among the 99 previously identified records. Of the two cases not among the 99 swimming pool cases found in NCIS, one was a drowning case that, upon review of the documentation, was found to

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[1] An asterisk placed immediately after the search text denotes that this text can be accompanied by any ending (e.g. 'swim*' will return records with either the term 'swim' or 'swimming').

have occurred in a natural body of water, not a swimming pool. It is not understood why the other case had not appeared in the selected subset of 99 NCIS as it met all of the search criteria.

Of the 99 swimming pool cases found in NCIS, 36 did not have an ABS-sourced ICD code W67 or W68. Of unmatched records, 24 had not been assigned an ABS code and 12 had only ABS codes present outside the W67 or W68 inclusion criteria (see Table 3.2.6 for a summary).

Table 3.2.6: ABS-sourced ICD codes in a set of NCIS records of swimming pool drownings, 2001–02 to 2003–04

ABS-sourced ICD-10 code in NCIS record	Number
W67 or W68: Unintentional swimming pool drowning	63*
Other ICD-10 code	12
No ICD-10 code	24
Total	**99**

* Two other NCIS records for deaths in this period have ABS-sourced ICD-10 codes W67 or W68, but do not satisfy search criteria for unintentional drowning in swimming pool.

The 12 records within the NCIS identified as containing references to a 'swimming pool' as an object but that did not have an ABS code of W67 or W68 were examined more closely and the codes assigned to them are shown in Table 3.2.7. Ten of the records contained a T75.1 code of drowning and non-fatal immersion, 7 contained an unspecified drowning and submersion code (W74.0) and one did not contain any relevant drowning and submersion code.

Some additional observations about the 12 records can be made. All of these cases were deemed, by the coroner, to have been unintentional, yet two have been assigned codes indicating intentional self-harm. This is despite a requirement, under ICD-10 coding rules that, in order for a death to be coded as a suicide, 'documentation from a medical or legal authority (must) be available regarding both the self-inflicted nature and suicidal intent of the incident' (ABS 2007).

Through the process of comparing the ABS codes assigned to a record and the information contained in that record within the NCIS some insight has been gained as to why discrepancies can occur between counts of injury events between the two data sources.

In general, it is actually not surprising that some cases in which a drowning occurred in a swimming pool are not coded as such. The ABS recently released an information paper on the collection, coding and analysis of external causes of death data which outlines some of the constraints that the Agency faces in assembling deaths data. Among these is the time taken to close some cases of coroner-certified deaths. Coronial certification requires the collection of information from a variety of sources which can be a slow process. The ABS, on the other hand, endeavours to code all deaths within 12 months of their occurrence. This often requires codes to be assigned prior to a case having been closed, and before factors such as intent or mechanism having been established resulting in the allocation of less specific codes (ABS 2007). This is of particular relevance for drowning, where the vast majority of cases are referred to the coroner.

Table 3.2.7: Multiple causes of death codes assigned to cases present in the subset of NCIS swimming pool drownings but not in the subset of ABS swimming pool drownings, 2001–02 to 2003–04

Nature of underlying cause of death code	Number of cases
Unintentional drowning, but not specified as swimming pool	7
Diseases in which sudden loss of consciousness occurs	3
Other	2
Total	**12**

Analysis of NCIS swimming pool drowning records

The 99 selected NCIS cases were divided into two subsets: children aged 9 years and under, and those individuals aged 10 years and over. Creating a separate subset of young and very young children was done because there are special issues for this group. In particular, swimming skills are often absent or poorly developed in young children and the need for effective barriers and close supervision can be critical.

Quantitative analysis of NCIS data was not undertaken because the amount of information available about the circumstances surrounding each death varies from little or no information to detailed and informative descriptions.

0–9 year olds

A total of 46 cases of children aged between 0–9 years drowning in a swimming pool were identified in the NCIS data. Children were most vulnerable to drowning in a swimming pool during the first few years of life. The number of cases declined with age (Table 3.2.8).

Table 3.2.8: Age distribution of NCIS swimming pool drownings, 0–9 years, 2001–02 to 2003–04

Age	Number of cases
Less than 1 year	0
1 year	13
2 years	12
3 years	10
4 years	5
5 years	3
6 years	0
7 years	3
Total	**46**

Broadly, three main factors were identified in relation to the subset of drowning cases: access to the pool; sudden onset of an acute illness; supervision or distraction from the supervisory function; and issues surrounding medication.

Supervision was deemed to have been inadequate or non-existent in a majority of cases. In a number of cases, supervision of the child was taking place within the context of social interaction on the part of adults present. For example, a barbeque, or a conversation with a visitor was taking place at the time, distracting attention away from the carer's supervisory role. A small number of children drowned in a public swimming pool where supervision can be more difficult due to the number of people in attendance.

Various aspects relating to pool fencing and gates were also commonly identified as contributing factors. In over a quarter of cases there was either no fencing around the pool or the fencing was not adequate. The gate providing access to the pool was left unlatched or propped open in several cases, and was found to be faulty in a small number of cases. In a few cases the child had been able to gain access to the pool by getting under isolation fencing.

In a couple of cases the person who drowned suffered the onset of an acute medical event, and in two further cases, long-term morbid conditions may have contributed to the drowning.

10 years and over

53 cases of swimming pool drownings among persons aged 10 years and over were identified in NCIS data for the period 2001–02 to 2003–04 (Table 3.2.9).

Table 3.2.9: Age distribution of NCIS swimming pool drownings, 10 years and over, 2001–02 to 2003–04

Age group in years	Number of cases
10–14	5
15–24	8
25–34	7
35–44	6
45–54	9
55–64	3
65–74	5
75 plus	10
Total	**53**

In close to one-third of cases, the person who drowned had fallen into the pool. In some of these cases they hit their head and lost consciousness.

In around a quarter of cases, mention was made of the presence of a significant long-term morbidity(ies) such as ischaemic heart disease, dementia or an intellectual disability, a chronic airflow limitation, or a mobility disorder. In numerous cases the person drowned after experiencing the sudden onset of an acute medical event (e.g. epilepsy or heart attack). Other risk factors identified from the data were intoxication by alcohol or drugs, being unable to swim or having poorly developed swimming skills

Cleaning the pool was the activity being engaged in by several of the people when they fell into the pool and drowned.

A small number of people drowned subsequent to prolonged holding of their breath underwater.

3.2.8 Literature

The principal factors highlighted in the literature about swimming pool drownings are the effectiveness of fencing in the prevention of drowning, the type and state of fencing, compliance with fencing legislation and enforcement of compliance, and the supervision of children.

A 2000 study by Blum investigated reports of 33 drowning deaths among children between the ages and 1–4 years that had been reported to the Victorian state coroner. Over half of the pools in the study lacked any kind of fencing. Where pool fences were present, only three appeared to meet the Australian standards. Over half of the 33 children drowned in unfenced pools. None of the children had gained access to a pool where a fully functional gate and a fence that met the Australian standard were present. Of the children who did gain access to a fenced pool, the majority did so through gates that were faulty or inadequate in some way, or through gates that had been left propped open. 28 of the children were in the care of one or both parents at the time of the incident. In 15 cases, the person supervising the child had been distracted by a telephone call, social activity or other form of interruption (Blum & Shield 2000).

Bugeja, in a study of drownings of 0–5 year olds in Victoria in private pools, identified a combination of inadequate supervision and inadequate swimming pool barriers, particularly doors and gates, as the principal contributing factors to the deaths. Bugeja also notes that the enforcement of fencing legislation is hindered by incomplete records of properties containing swimming pools, causing difficulties for local councils in locating some pools and spas (Bugeja 2004b).

Bugeja also examined Victorian data on drownings at public swimming pools over the period July 1988 to June 2002. Her research identified two factors in particular: pre-existing illness (epilepsy and heart disease) and alcohol intoxication (Bugeja 2004a).

A review of research on the efficacy of swimming pool fencing published by the Cochrane collaboration in 2005 concluded that this type of intervention is effective in preventing drowning. The Cochrane review reports an odds ratio for risk of drowning or near drowning in a fenced pool, compared to an unfenced pool, of 0.27. Isolation fencing (where the entire pool is enclosed by a fence) has been found to be superior to perimeter fencing (where the pool is fenced on 3 sides only and the house provides the remaining barrier)—the odds ratio for the risk of drowning in a pool with isolation compared to one with three-sided fencing only is 0.17 (Thompson & Rivara 2000).

Focussing on the issue of swimming pool fencing, a 2003 Western Australian study by Stevenson et al. comprised 3 stages: a retrospective review of coroner's data; an audit of swimming pool inspections; and in-depth interviews with pool inspectors. The authors found that, over the period 1988–00, 50 children under the age of 5 drowned in private swimming pools in WA (a rate of 4.4 per 100,000 population). 68% of these deaths occurred in pools without 4-sided (isolation) fencing. The study found that there was almost double the risk of children drowning in a pool fenced on only 3 sides than in a pool with isolation fencing. The compliance of pool fencing with current legislation was approximately 400 per 1,000 swimming pools at first inspection. 52% of pools inspected after a drowning had occurred there, were found to be compliant with legislation. However, for those that complied, 43% of the drowning cases occurred when the child gained access to the pool through the house. This suggested that fencing was limited to 3 sides of the pool. In a further 43% of cases, the child had obtained access to the pool through a gate having been left propped open, and in 14% of cases inadequate supervision was explicitly identified as a contributing factor. Of the cases that had occurred in pools with isolation fencing, all were a result of either a pool gate being propped open or a faulty closing mechanism on the pool gate. An audit was conducted on a randomly selected subset of swimming pool inspection records. 45% of properties were found to be compliant at the first inspection. The most commonly reported reason for non-compliance was that the access gate was not self closing. Another 8% did not meet compliance as result of general problems with the gate. When the pool did not meet compliance, it took the owner on average 1 month to comply. At a second inspection conducted 4 years later, compliance with the legislation had increased to 57% (Stevenson et al. 2003).

Levels of enforcement and compliance with legislation vary across Australia. A New South Wales e-mail survey of all local councils was undertaken in mid-2002. The survey had a response rate of 69%. The final sample comprised 58% rural-based councils and 42% urban-based. 28% of councils reported that they undertook pool inspections. The most common junctures at which inspections occurred were upon installation of the pool (46%) or upon receipt of a complaint (19%). Only 7% of respondents reported that their council undertook routine inspections. 82% of respondents could give no estimate of the number of swimming pools in their area that did not comply with legislation. The barriers to enforcement that were identified by respondents included a lack of resources (86%); a lack of knowledge on the part of pool owners about the legislative requirements (46%); and an unwillingness by owners to comply with the Act (25%) (Mitchell & Haddrill 2004).

A telephone survey of a random sample of 35 metropolitan and rural council personnel with responsibility for inspection of domestic pools in Victoria was undertaken to gauge the level of enforcement of private pool safety regulations. 91% of respondents indicated that inspections were conducted in response to complaints, only 29% carried out routine random or systematic inspections. The main barriers to council enforcement were identified as a lack of resources, the cost to pool owners of erecting compliant barriers, relaxed community attitudes, and a lack of acceptance of fencing regulations on the part of pool owners. While 77% of councils conducted inspections in relation to the issue of new pool permits, a high proportion of these, as well as certificates of final inspection, were being provided by private surveyors, often under the aegis of pool building companies. Less than one-third of the councils that responded to the survey met the good practice criteria for local government enforcement of pool safety regulations (Paine & Cassell 2003).

3.3 Bathtub drownings

Mortality data: Any code(s) in the range W65–W66 among the multiple causes of death codes.

Morbidity data: Any code(s) in the range W65–W66 among the external cause codes.

During the period 1999–00 to 2003–04, an annual average of 20 persons died and 47 were admitted to hospital after a drowning incident in a bathtub (Table 3.3.1).

Unlike most other types of case analysed in this report, females outnumbered males for cases of drowning in bathtubs.

Table 3.3.1: Key indicators for accidental drownings involving bathtubs, Australia 1999–00 to 2003–04

	Drowning (deaths)			Drowning (hospitalisations)		
Indicator	**Males**	**Females**	**Persons**	**Males**	**Females**	**Persons**
Annual average number of cases	9	11	20	23	24	47
Percentage of all drowning deaths/hosps	3%	12%	5%	6%	11%	8%
Crude rate / 100,000 population	0.1	0.1	0.1	0.2	0.2	0.2
Adjusted rate (direct)	0.1	0.1	0.1	0.2	0.2	0.2
Rate ratio*	0.95	1.07		0.96	1.03	
mean YPLL <75y	46.3	37.1	41.4			

* Rate ratios are standardised rate for male or female / standardised rate for persons.

Note: Rates are mean annual rates / 100,000 population (Age adjusted by direct method to persons Australia 2001).

3.3.1 Age and sex

The highest rate of death by drowning in a bathtub was found in the 0–4 year and 75–79 year age group (0.5 person deaths per 100,000 population) (Figure 3.3.1).

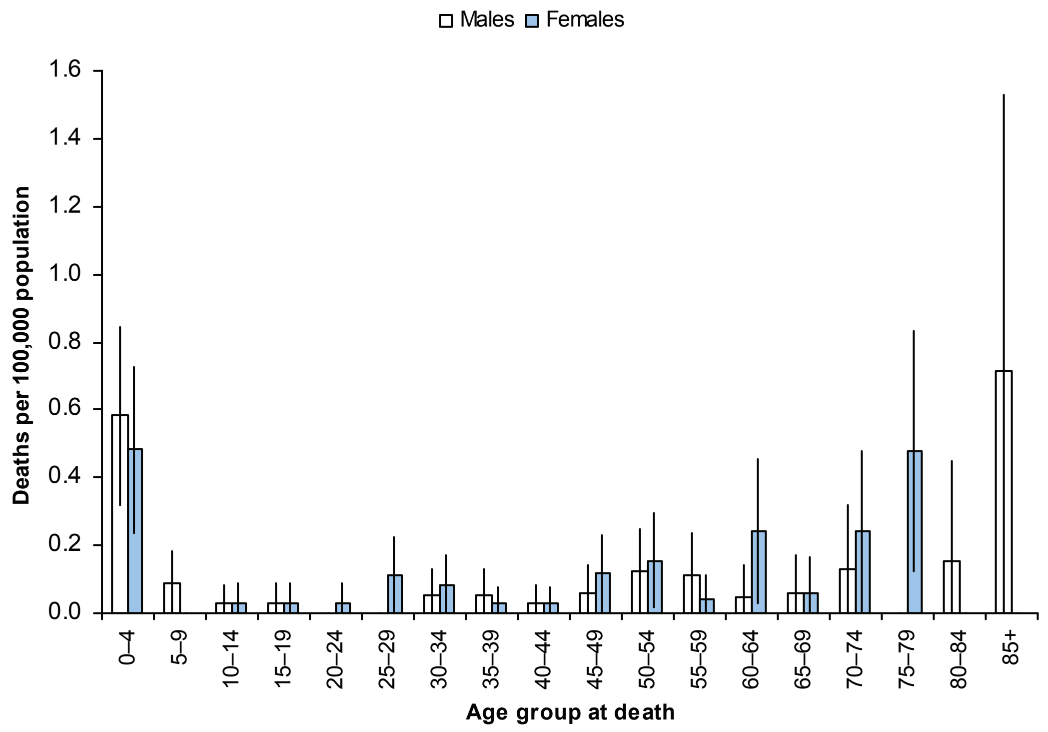

Figure 3.3.1: Deaths due to accidental drownings involving bathtubs by age and sex, Australia 1999–00 to 2003–04

As was the case for deaths, the rate of hospitalisation due to drowning in a bathtub was highest in the 0–4 year age group (3.2 separations per 100,000 population). Rates for males and females in this age group were similar. In almost all other age groups, case numbers were 3 or fewer (Figure 3.3.2). This pattern is similar to that for hospitalised drownings involving swimming pools.

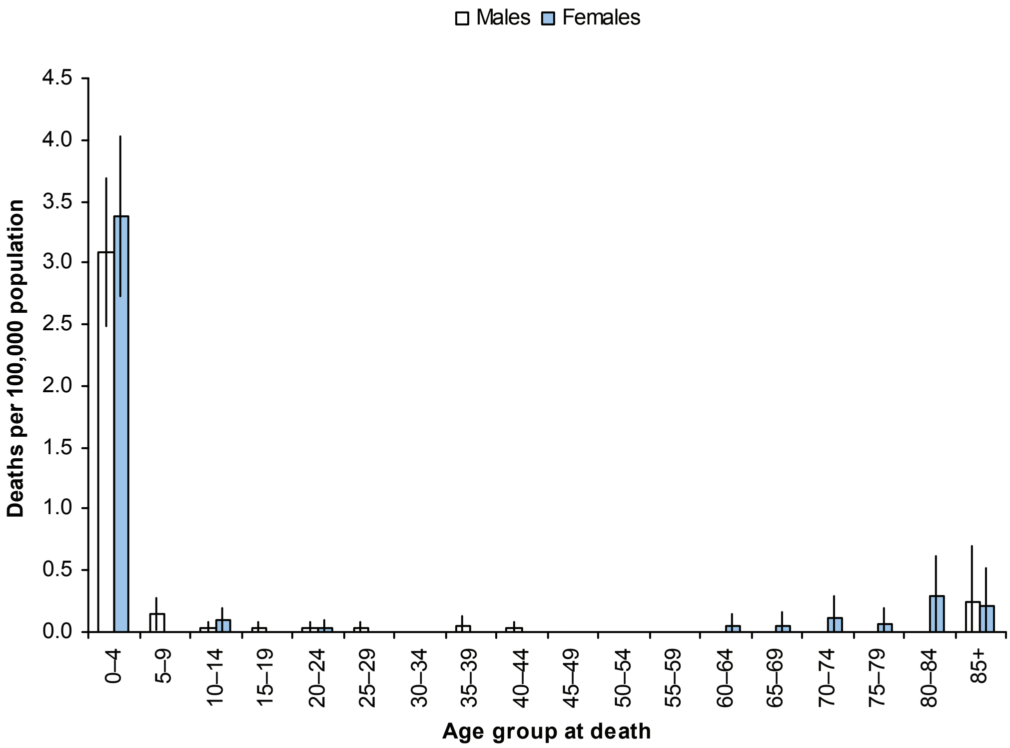

Figure 3.3.2: Hospitalisations due to drowning involving bathtubs by age and sex, Australia 1999–00 to 2003–04

3.3.2 Trends over time

Poisson regression modelling showed a downward trend in age-adjusted rates of bathtub-related drowning between 1999–00 and 2003–04. The estimated age-adjusted rate at the beginning of the period was 0.13 deaths per 100,000 population (95% CI 0.10 to 0.18). According to the fitted model, the estimated annual age-adjusted rate of bathtub drownings decreased by an average of 11.9% per year during the 1999–00 to 2003–04 reporting period. The trend was not statistically significant (p=0.074) (Figure 3.3.3).

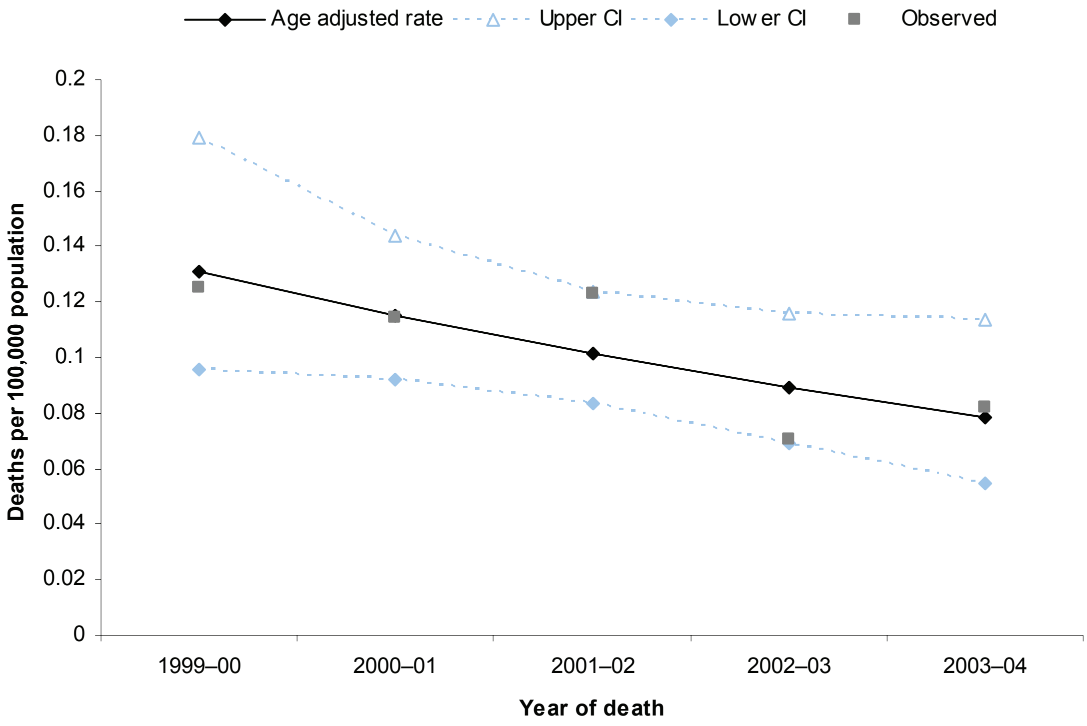

Figure 3.3.3: Deaths due to accidental drownings involving bathtubs, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Poisson regression modelling showed a downward trend in age-adjusted rates of hospitalisation due to bathtub-related drowning between 1999–00 and 2003–04. The estimated age-adjusted rate at the beginning of the period was 0.27 separations per 100,000 population (95% CI 0.22 to 0.34). According to the fitted model, the estimated annual age-adjusted rate of separations decreased by an average of 5.9% per year during the 1999–00 to 2003–04 reporting period. The downward trend was not statistically significant (p=0.190) (Figure 3.3.4).

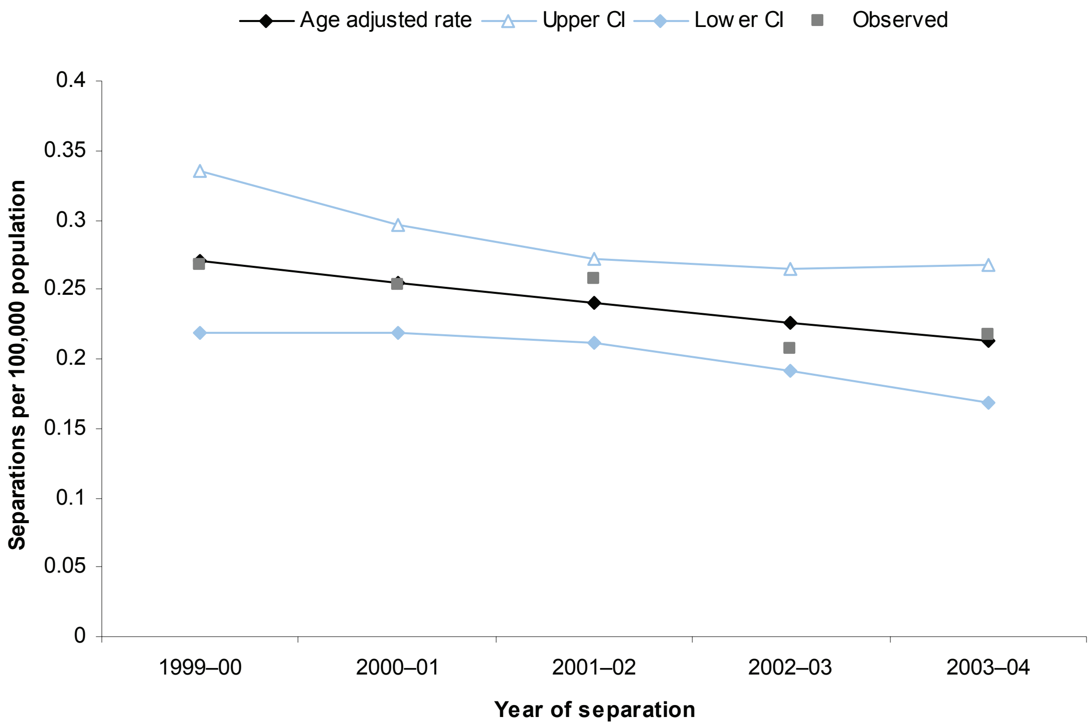

Figure 3.3.4: Hospitalisations due to drowning involving bathtubs, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

3.3.3 Remoteness of residence

Residents of the inner regional zone had the highest rate of death due to drowning in a bathtub (0.12 deaths per 100,000 population). The remote and very remote zones both had a rate of 0.0 (Figure 3.3.5 and Table 3.3.2).

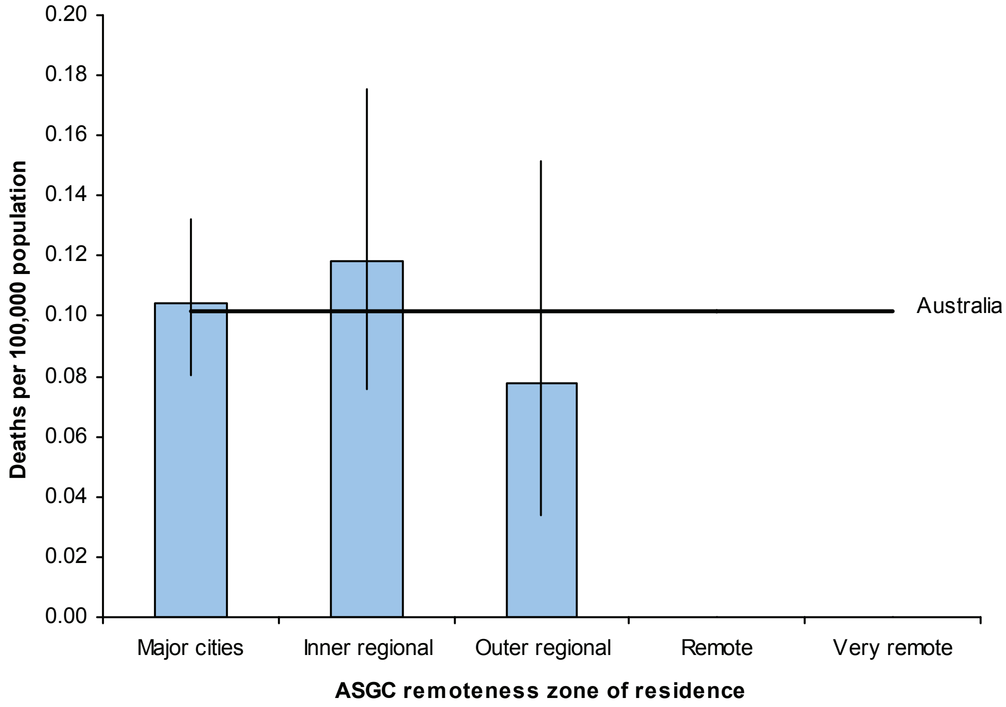

Figure 3.3.5: Deaths due to accidental drownings involving bathtubs by remoteness of residence, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Table 3.3.2: Cases, age-adjusted rates and rate ratios* by remoteness of residence for accidental drownings involving bathtubs, persons, Australia 1999–00 to 2003–04

	Major Cities	Inner Regional	Outer Regional	Remote	Very Remote
Annual average number of cases	13.3	4.8	1.6	0.0	0.0
Adjusted rate (direct)	0.1	0.1	0.1	0.0	0.0
Rate ratio*	1.02	1.16	0.76	0.00	0.00

* Rate ratios are the standardised rate for a remoteness zone / standardised rate for Australia.

The highest rate of hospitalisation following drowning in a bathtub was found among residents of the very remote zone (0.44 separations per 100,000 population). This was followed closely by the rate for the outer regional zone (0.40 per 100,000). Only residents of the outer regional zone had a rate that differed, at a statistically significant level, from the all-zones rate of 0.24 (Figure 3.3.6 and Table 3.3.3).

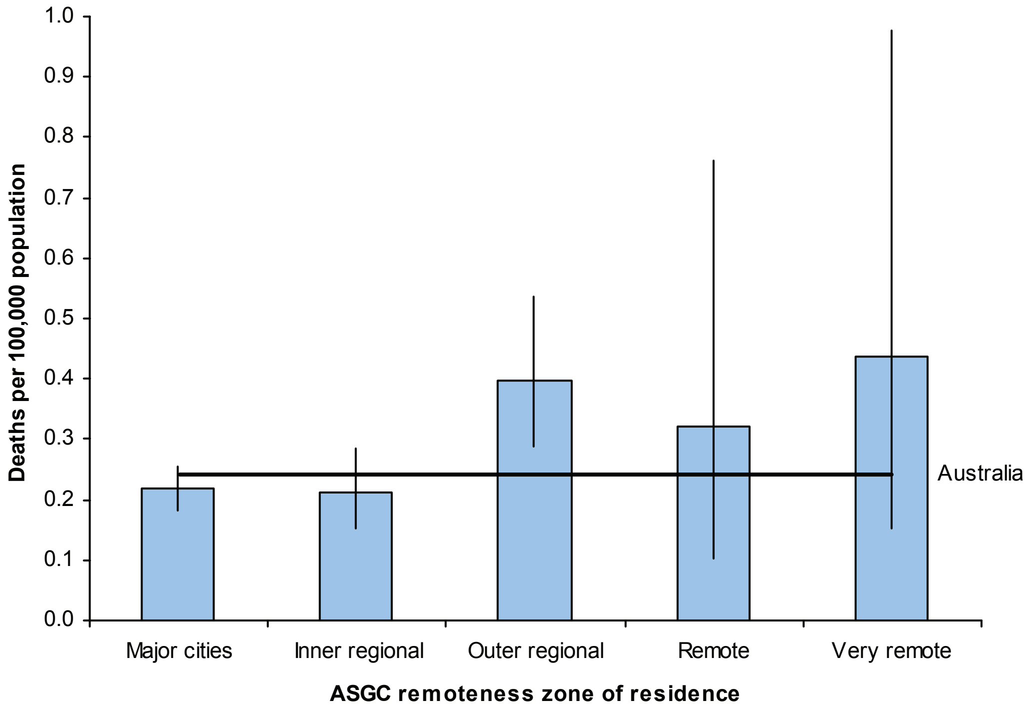

Figure 3.3.6: Hospitalisations due to drowning involving bathtubs by remoteness of residence, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Table 3.3.3: Cases, age-adjusted rates and rate ratios* by remoteness of residence for drowning-related hospitalisations involving bathtubs, persons, Australia 1999–00 to 2003–04

	Major Cities	Inner Regional	Outer Regional	Remote	Very Remote
Annual average number of cases	27.4	8.6	8.5	1.1	1.1
Adjusted rate (direct)	0.2	0.2	0.4	0.3	0.4
Rate ratio*	0.91	0.88	1.65	1.33	1.81

* Rate ratios are the standardised rate for a remoteness zone / standardised rate for Australia.

3.3.4 Associated factors

In around 15% of the deaths that occurred in a bathtub, the deceased had drowned after falling into the tub. In the remaining cases, the deceased was already in the bathtub when drowning occurred.

3.3.5 Length of stay in hospital

The length of stay in hospital for admissions related to drowning in a bathtub ranged from 1 day to 82 days. The mean length of stay was 2.6 days. There was no consistent pattern with respect to mean length of stay by age group, although the highest LOS was for those aged 75 years and over (Table 3.3.4).

Table 3.3.4: Mean length of stay in hospital by age group after drowning in a bathtub, 1999–00 to 2003–04*

Age group in years	Mean length of stay in days
0–4	2.5
5–9	1.0
10–14	2.2
15–24	1.8
25–34	2.0
35–54	3.3
55–64	1.0
65–74	4.0
75 plus	5.3

* Includes patients who died in hospital.

3.3.6 Coronial data

A search of the NCIS was conducted to identify cases of unintentional drowning in bathtubs over the period 2001–02 to 2003–04. The selection criteria used were cases that had been closed by the coroner, were unintentional, had as their specified mechanism 'drowning', and where the text 'bath' or 'bathtub' or 'bath tub' or 'tub' appeared in the police report. 54 records were identified. The documents for these were reviewed and 4 cases, where it was clear that the deceased did not drown in a bathtub, were excluded. This left 50 records for analysis.

The 50 selected cases were divided into two separate subsets: children between the ages of 0–5 years, and those where the death involved an individual aged 6 years and over. Creating a separate subset of very young children was done because there are special issues for this group, most notably the need for supervision while bathing.

0–5 year olds

The search of NCIS data found 15 cases of children in the 0–5 year age range. Twelve of these were aged one year or under (Table 3.3.5).

Table 3.3.5: Age distribution of cases of NCIS bathtub-related drownings, 0–5 year olds, 2001–02 to 2003–04

Age	Number of cases
0 years	6
1 year	6
2 years	0
3 years	2
4 years	0
5 years	1
Total	**15**

Analysis of these cases showed the most important area for concern was inadequate or non-existent supervision which was identified in relation to all cases. Children can drown very quickly. In a couple of instances the estimated period during which the child was left unattended was between 1 ½ and 2 minutes. It is also apparent that infants can drown in very shallow water. In a number of cases the depth of the water in the tub was below 15 cm. In one case the measured depth was only 8 cm.

In over one-third of cases the deceased child was placed in a bathtub with a sibling.

There were a few cases in which a baby bath seat was being used when the drowning occurred. In one instance the finding was that the infant had slipped down in the plastic seat and had drowned as a result. The coroner investigating one case concluded that 'the question of whether the sale of baby bath seats should be banned … should be considered nationally by the relevant regulatory agencies in the light of these findings… in any event, a strong public awareness campaign should be instituted warning of the dangers created by bathing infants in adult bathtubs, and that an infant should never be left unattended in a bathtub, and that the carer should always remain within arm's length when an infant is in a bathtub' (South Australian Coroner 2002).

There was one case in which the drowning was caused by an epileptic seizure, and in one case it was found that prescribed medication was below a sub-therapeutic level.

One child drowned after entering a bath that had been left filled with water.

In one case the drowning had occurred when the child was left in the care of an older (although young) sibling.

In a small number of cases a parent was identified as having been negligent in their role of carer (e.g. previous reports of neglect) (Table 3.3.6).

6 years and over

The age distribution of the 35 cases aged 6 years and over are shown in Table 3.3.6 below.

Table 3.3.6: Age distribution of cases of NCIS bathtub-related drownings, 6 years and over, 2001–02 to 2003–04

Age group in years	Number of cases
6–9	1
10–14	2
15–24	2
25–34	6
35–44	4
45–54	8
55–64	4
65–74	5
75 plus	3
Total	**35**

The most commonly identified issue was epilepsy or some other form of seizure disorder, which were mentioned in over one-third of cases. Other factors mentioned frequently in case documents were alcohol intoxication (over a quarter of cases) and the presence of significant morbidities such as Ischaemic Heart Disease. In some cases of alcohol intoxication, blood alcohol concentrations determined by toxicology were very high. Supervision could possibly have prevented several of these drownings (e.g. those of adults with intellectual disability. In a few of these cases the deceased had epilepsy; in one case the epilepsy was severe and was combined with cerebral palsy.

Other issues that appeared in case documents included falling asleep or losing consciousness while in the bath; drug toxicity; mobility disorders; and that the deceased had complained of feeling unwell prior to entering the bath.

In a couple of cases, the person had sustained scalds.

3.3.7 Literature

The literature identified in relation to bathtub-related drownings focused on children. The factors identified included the need for supervision, the use of bath seats, and the practice of shared bathing.

A study in Victoria researched 25 cases of drowning of young children in bathtubs from 1989–01. About 80% of the children were aged two years and under and, in more than 60% of the cases, the deceased child had been sharing the bath with another child. The absence of direct adult supervision was found to be the most significant contributing factor to the drowning. In 3 of the 25 cases, the child had been put into a bathtub seat or ring and had been left unattended. All of the children had been placed in the seat correctly, and the device was not defective in any way. The child had either slipped or crawled out of the device and drowned (Bugeja 2004).

A South Australian study points to a number of mechanisms by which a very young child may drown because a bath seat is being used. Byard & Donald suggest that such a device might tip over if an infant leans too far forward with the result of them being thrown face forward into the bath water; attempts to climb out of the bath seat can result in overbalancing; and the higher centre of gravity of infants and their lack of muscle control and coordination can place them at greater risk of falling. Additionally, a seat can tip over, trapping an infant underneath it, or the child can slide down in the seat and become trapped under its upper ring (Byard & Donald 2004).

A further study by Byard and colleagues has focused on the issue of shared bathing by young children. The researchers used autopsy information from South Australia (1963–99), Victoria (1991–99) and San Diego (1990–99). A total of 17 cases aged 2 years or younger had drowned while sharing the bath with another child. The age range of the children was 8–22 months (mean age 11.8 months). In all cases, the child that drowned was younger than the surviving child. The proportion of shared drowning cases varied from 22% to 58% of all identified drownings in the study (Byard et al. 2001).

A research study undertaken by Ross et al. used data supplied by doctors to the NSW Australian Paediatric Surveillance Unit during the period 1994–96 to investigate the issue of bathtub-related drownings among children under 5 years of age. These data were supplemented by additional case information received from reporting doctors through a postal questionnaire. 169 reported cases of near drowning were admitted to hospital over the reporting period. 26 (15%) of these cases had occurred in bathtubs. Of these, three were in the bath with another child, each of whom was also under 5. In 9 cases, the child was left unattended. 5 of those who were left unattended were reported to have had a fit of some kind (Ross et al. 2003).

3.4 Watercraft drownings

Mortality data: Any code(s) V90 or V92 among the multiple causes of death codes.

Morbidity data: Any code(s) V90 or V92 among the external cause codes.

During the period 1999–00 to 2003–04, watercraft were recorded on the ABS mortality data as being associated with mean annual numbers of 37 cases of drowning deaths and 65 cases of hospitalisation due to drowning (Table 3.4.1).

Table 3.4.1: Key indicators for accidental drownings involving watercraft, Australia 1999–00 to 2003–04

	Drowning (deaths)			Drowning (hospitalisations)		
Indicator	**Males**	**Females**	**Persons**	**Males**	**Females**	**Persons**
Annual average number of cases	34	3	37	49	15	65†
Percentage of all drowning deaths/hosps	12%	3%	10%	12%	7%	10%
Crude rate / 100,000 population	0.4	0.0	0.2	0.5	0.2	0.3
Adjusted rate (direct)	0.3	0.0	0.2	0.5	0.2	0.3
Rate ratio*	1.85	0.16		1.53	0.47	
mean YPLL <75y	30.2	34.3	30.5			

* Rate ratios are standardised rate for male or female / standardised rate for persons.

† Male plus Female does not sum exactly to Persons due to rounding of annual average case counts.

Note: Rates are mean annual rates / 100,000 population (Age adjusted by direct method to persons Australia 2001).

3.4.1 Age and sex

Age-specific rates, which fluctuated considerably, were highest overall between the ages of 30–64 years.

The majority of watercraft-related drowning deaths involved males. (There was a total of 3 female cases over the five-year period.)

Most cases involved adult males in the age range 20–74 years (Figure 3.4.1).

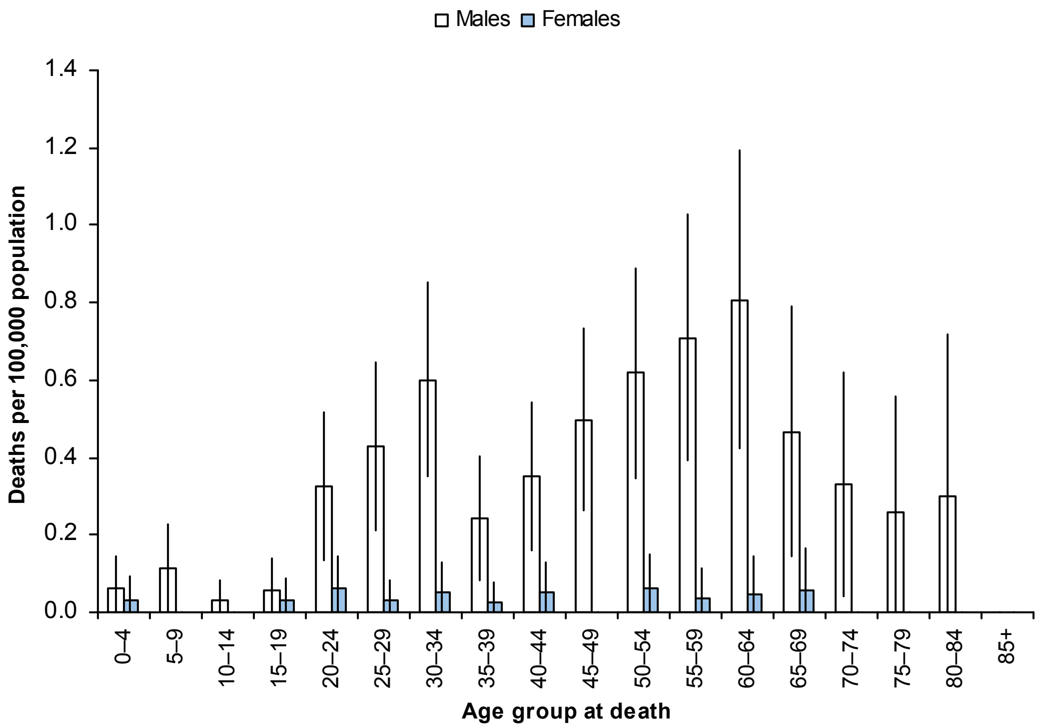

Figure 3.4.1: Deaths due to accidental drowning involving watercraft by age and sex, Australia 1999–00 to 2003–04

With the exception of the 5–9 year age group, rates of hospitalisation were higher for males than females, often substantially so. Male rates were highest across a broad age band, from 15–69 years of age (Figure 3.4.2).

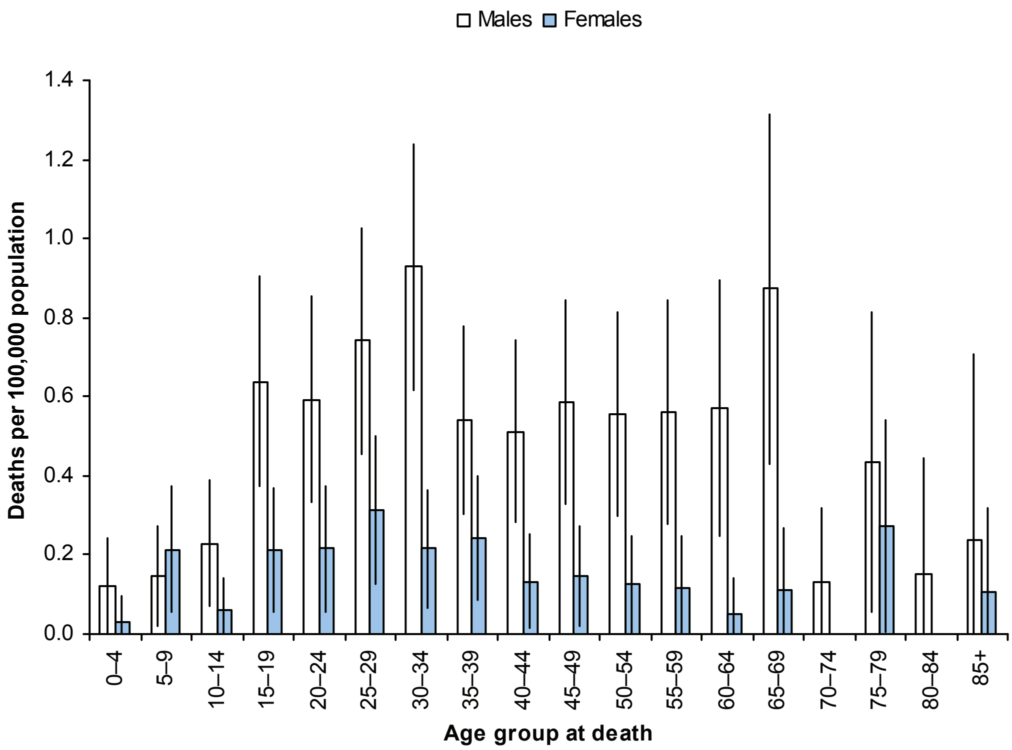

Figure 3.4.2: Hospitalisations due to accidental drowning involving watercraft by age and sex, Australia 1999–00 to 2003–04

3.4.2 Trends over time

Negative binomial regression modelling gave some indications of a downward trend in age-adjusted rates of death due to drowning associated with watercraft between 1999–00 and 2003–04. The downward trend was not statistically significant (p=0.357) (Figure 3.4.3). The estimated age-adjusted rate at the beginning of the period was 0.22 deaths per 100,000 population (95% CI 0.15 to 0.32). According to the fitted model, the estimated annual age-adjusted rate of death decreased by an average of 7.4% per year during the 1999–00 to 2003–04 reporting period.

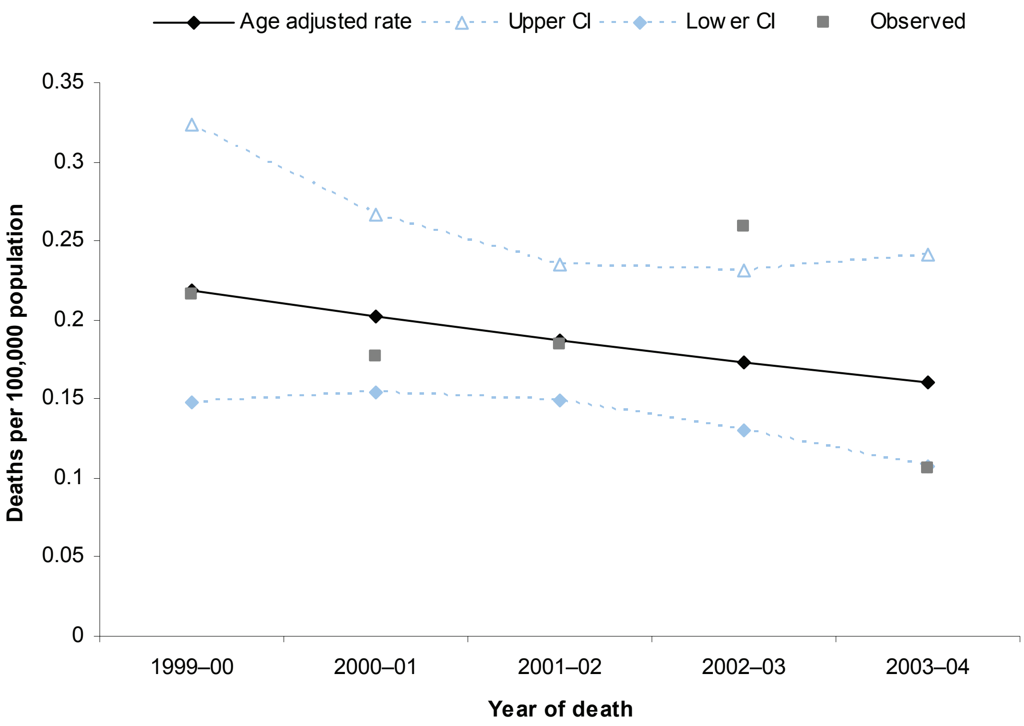

Figure 3.4.3: Deaths due to accidental drowning involving watercraft, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Poisson regression modelling showed a very slight and non-significant (p=0.972) trend in age-adjusted rates of hospitalisation due to drowning associated with watercraft between 1999–00 and 2003–04. The estimated age-adjusted rate at the beginning of the period was 0.33 deaths per 100,000 population (95% CI 0.28 to 0.40).

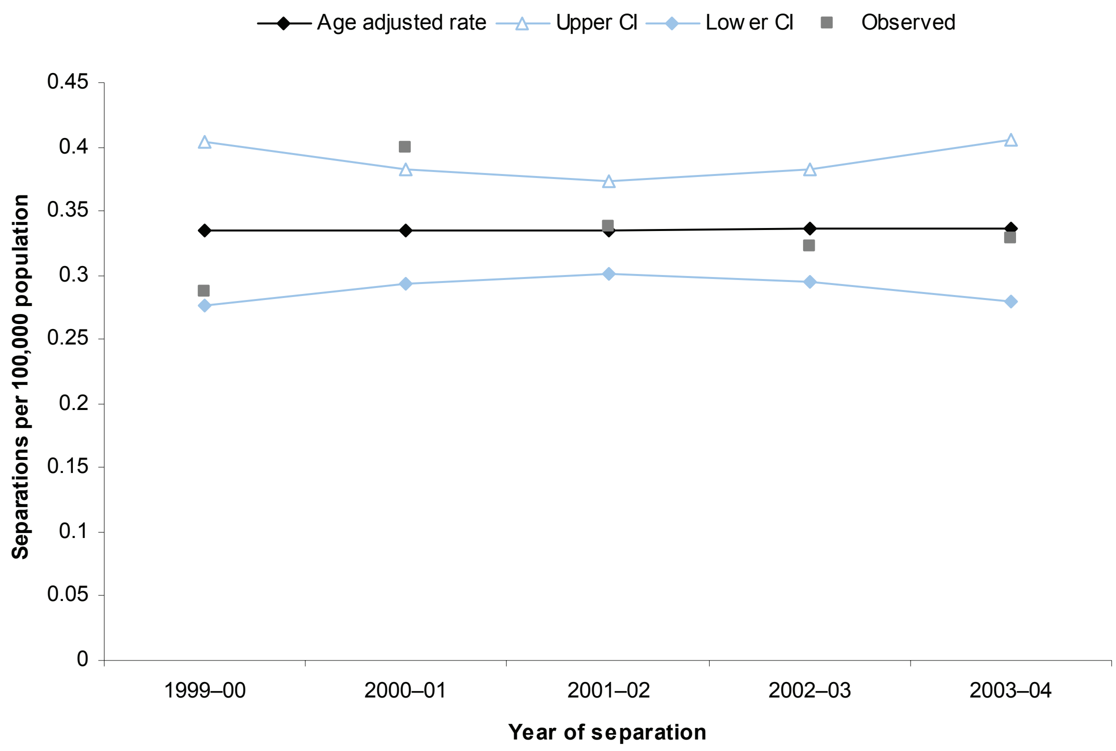

Figure 3.4.4: Hospitalisations due to accidental drowning involving watercraft, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

3.4.3 Remoteness of residence

Residents of the inner regional and outer regional zones had the highest age-adjusted rates of watercraft-related drowning deaths (0.31 and 0.34 deaths per 100,000 population respectively). The largest number of cases was among residents of major cities, although the rate for residents of this zone was the lowest (0.11 deaths per 100,000 per year), apart from the very remote zone (Figure 3.4.5 and Table 3.4.2).

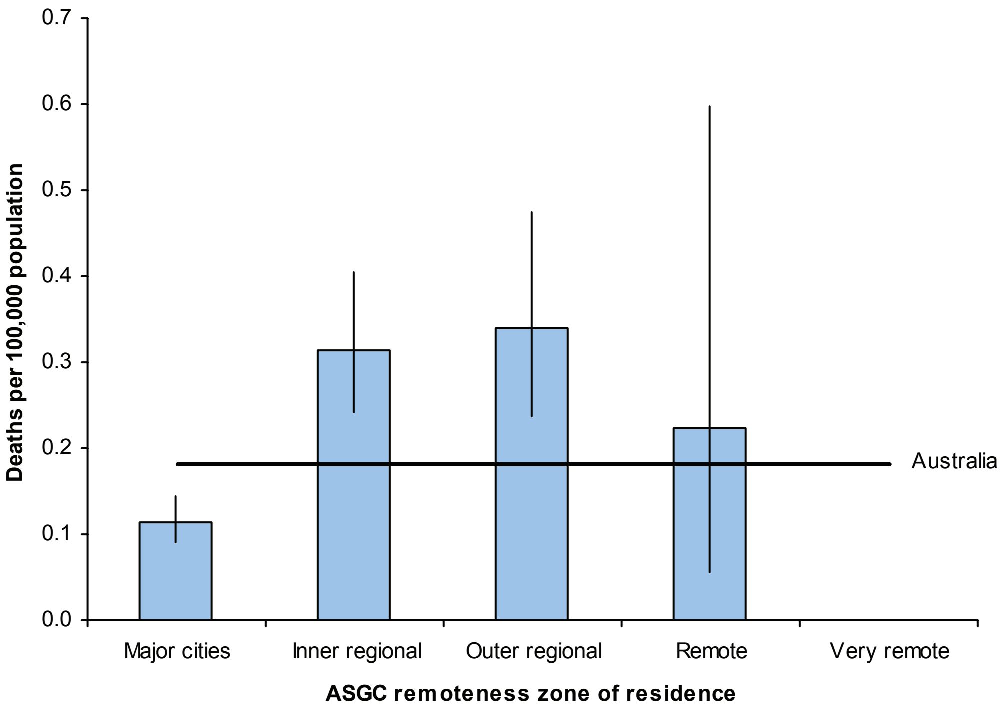

Figure 3.4.5: Deaths due to accidental drowning involving watercraft by remoteness of residence, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Table 3.4.2: Cases, age-adjusted rates and rate ratios* by remoteness of residence for accidental drownings involving watercraft, persons, Australia 1999–00 to 2003–04

	Major Cities	Inner Regional	Outer Regional	Remote	Very Remote
Annual average number of cases	15.0	12.5	7.0	0.7	0.4
Adjusted rate (direct)	0.1	0.3	0.3	0.2	0.0
Rate ratio*	0.63	1.73	1.87	1.23	0.00

* Rate ratios are the standardised rate for a remoteness zone / standardised rate for Australia.

In contrast, age-adjusted rates of hospitalisation due to watercraft-related drowning rose according to the remoteness of the injured person's residence (Figure 3.4.6 and Table 3.4.3).

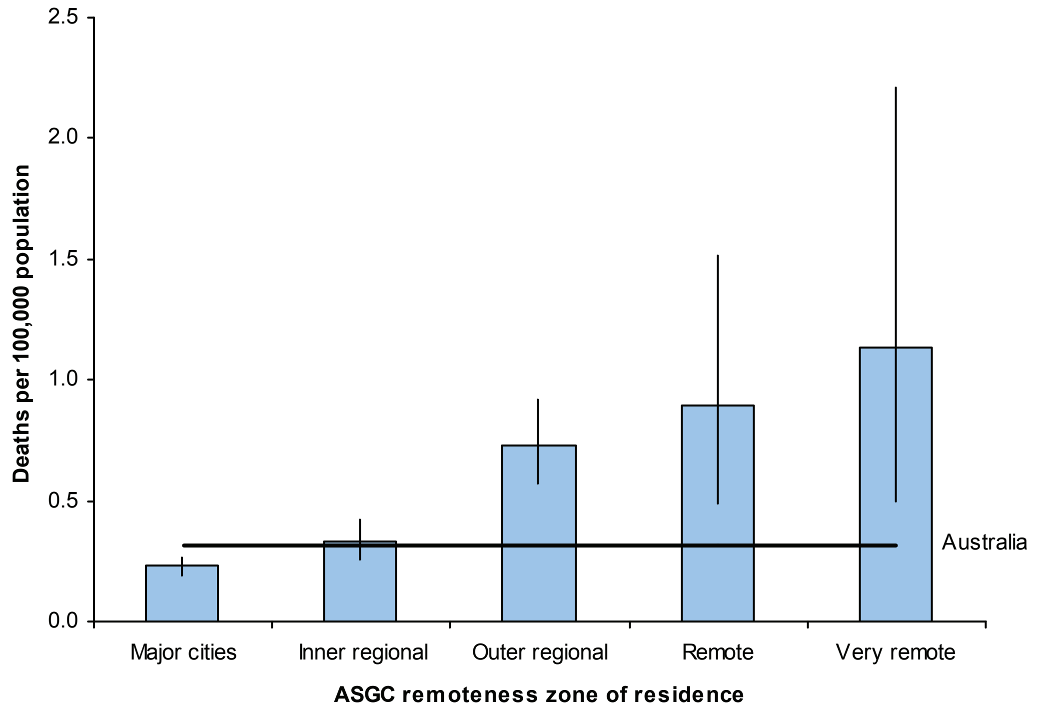

Figure 3.4.6: Hospitalisations due to drowning involving watercraft by remoteness of residence, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Table 3.4.3: Cases, age-adjusted rates and rate ratios* by remoteness of residence for drowning-related hospitalisations involving watercraft, persons, Australia 1999–00 to 2003–04

	Major Cities	Inner Regional	Outer Regional	Remote	Very Remote
Annual average number of cases	30.0	13.1	14.3	2.8	1.9
Adjusted rate (direct)	0.2	0.3	0.7	0.9	1.1
Rate ratio*	0.72	1.04	2.29	2.81	3.57

* Rate ratios are the standardised rate for a remoteness zone / standardised rate for Australia.

3.4.4 Associated factors

Few cases had received a code indicating that drugs or mental illness had been a factor in a drowning death.

22 (58%) of the total of 37 watercraft-related drownings and 14 (22%) of the total of 65 watercraft-related drowning hospitalisations occurred as the result of incidents in which the vessel was damaged (e.g. overturning or sinking, a person jumping from a burning ship, etc.).

The remaining 16 (42%) of the total of 37 watercraft-related drownings and 50 (78%) of the total of 65 hospitalisations occurred as the result of incidents in which the vessel did not sustain damage (e.g. fall from gangplank, ship or overboard, or being thrown or washed overboard).

Where the type of activity being undertaken was specified, the majority of watercraft-related drowning deaths occurred while the person was engaged in a leisure activity (annual average number of cases n=11, 29%). Activity was not specified in 18% of cases.

For those cases of hospitalisation where the body region was specified, the hip and lower limb were the most common site of injury (17%), followed by the head (16%), trunk (16%) and shoulder and upper limb (14%). 37% of injuries were not specified according to body region.

3.4.5 Length of stay in hospital

The length of stay in hospital following a watercraft-related drowning ranged between 1 and 149 days. The average length of stay was 4.2 days. The highest MLOS was found among those aged 75 years and over.

Table 3.4.4: Mean length of stay in hospital by age group after drowning involving watercraft, 1999–00 to 2003–04*

Age group in years	Mean length of stay in days
0–4	1.0
5–9	1.3
10–14	2.3
15–24	3.2
25–34	3.7
35–54	5.2
55–64	5.5
65–74	2.5
75+	8.0

* Includes patients who died in hospital.

3.4.6 Literature

Drownings related to watercraft fall into two categories: commercial use and recreational use. One issue highlighted in the literature that applies in both contexts is the use of personal floatation devices (PFDs). Other issues, referred to in the literature on commercial vessels, include the nature of cold weather clothing, inexperience on the part of commercial fishermen and changes in technology in the fishing industry. Alcohol has been identified as a major risk factor in some literature.

A report on commercial vessel fatalities from 1991–01 has identified the failure to use personal floatation devices (PFD) as a major contributing factor in drownings. 16 incidents resulting in 21 deaths were identified in Victorian Coroner's data. In 20 of these deaths the deceased was working for income. 14 (66%) of the deaths occurred on fishing vessels, 6 fatalities occurred on trading vessels, and the remaining death took place on a vessel used for surf rescues. 16 of the 21 deaths were due to drowning. In 13 of the 16 drowning deaths, a PFD was not worn. In one case, a PFD was worn but was subsequently shown to be faulty. In the remaining 2 cases, the wearing of a PFD was found to be 'not applicable to the incident' (Batchelor & Bugeja 2003).

47 traumatic deaths of commercial fishermen were identified in Australian coroners' files for 1982–84. The 47 fatalities occurred in 38 separate incidents. Two thirds of the deaths were due to drowning, or involved fishermen whose bodies were not recovered and were presumed dead. Rough or bad weather contributed to 25 of the deaths. Another contributing factor was vessels' lack of sea-worthiness. 25 subjects had not been wearing a PFD. Some of these were poor swimmers. 3 subjects were wearing PFDs for at least part of the time, but eventually drowned. No information about PFD use was available for the 5 cases where the body was not recovered. Of 6 cases where there would have been sufficient time for the subject to don a PFD, 3 did not have such a device available. The authors of this study observed that wearing PFDs of the design that is currently available could interfere with carrying out on-board tasks during bad weather and could, in fact, place the wearer at greater risk of injury. It was also observed that the clothing typically used by fishermen in bad weather contributed to 3 of the deaths by drowning, due to the poor buoyancy of such clothing. Two other contributing factors were found to be inexperience and changes in technology in the fishing industry. An example given of the latter was the use of global positioning equipment and autopilot which allow for greater activity at night, potentially increasing the risk of collision (Driscoll et al. 1994).

In Victoria, 30 deaths occurred involving recreational watercraft between 1999 and 2002. In most cases, these involved vessels under 6.5 metres in length. There was an over-representation of males. Cases were most frequent among males in the 20–29 year age group (20%) and those aged 40–49 years (23%). The most significant factor contributing to these deaths was the absence of PFD use. Where PFDs were available, many were of a type for emergency use only, and not suitable for constant wear. Such devices would not prevent drowning in some of the types of emergency that were observed in the study (e.g. capsize and man overboard events) (Bugeja 2003).

A review of 333 boating fatalities, associated with 270 incidents that occurred in Australia from 1992–98 identified a number of risk factors. The research utilised a range of sources including coroners' findings, witness statements, police, autopsy and search and rescue reports. 85% of the fatalities involved recreational vessels. It was found that close to half of the vessels had insufficient PFDs for the number of people aboard. Furthermore, of all of those who died, only 9% were wearing a PFD, and those that were wearing such a device had twice the likelihood of surviving. Alcohol was found to be a contributing factor; in 28% of deaths a BAC in excess of 0.05g/100ml was present. In 36% of cases, death followed the capsize of a vessel. Vessels that capsized were more likely to have been overloaded or improperly loaded, been located in dangerous wind or sea conditions, or were dinghies (O'Connor & O'Connor 2005).

A review of published research on the role played by alcohol in drowning during recreational aquatic activity found little good quality evidence regarding the contribution to the risk of drowning. The study's authors, Driscoll et al., highlight the problems in establishing causality when there is evidence of the presence of alcohol. They argue that the presence of alcohol can not be seen to be synonymous with alcohol having contributed to or caused the drowning to occur. The authors found only one paper, by Smith et al., that in their opinion provides sufficiently robust evidence of increases in risk due to alcohol consumption (Driscoll et al. 2004). Smith et al. conducted a population-based case control-study of drinking and recreational boating fatalities in Maryland and North Carolina, USA. The 221 cases were persons aged 18 years or over who had died during 1990–98. Control interviews were conducted with a probability sample of 3,943 boaters from both states during the period 1997–99. They concluded that alcohol consumption increases the relative risk of mortality even at low levels of BAC. The risk increases as BAC increases (Smith et al. 2001).

4 Intentional drowning

4.1 Self-harm by drowning

Mortality data: Any code T75.1 and any code(s) in the range X60–X84 among the multiple causes of death codes.

Morbidity data: Any code T75.1 and any code(s) in the range X60–X84 among the external cause codes.

Suicide and self-harm were responsible for an annual average of 56 drowning deaths and 39 hospitalisations due to drowning during the period 1999–00 to 2003–04 (Table 4.1.1).

Table 4.1.1: Key indicators for drownings due to intentional-self-harm, Australia 1999–00 to 2003–04

	Drowning (deaths)			Drowning (hospitalisations)		
Indicator	Males	Females	Persons	Males	Females	Persons
Annual average number of cases	33	22	56†	18	20	39†
Percentage of all drowning deaths/hosps	12%	24%	15%	4%	10%	6%
Crude rate / 100,000 population	0.3	0.2	0.3	0.2	0.2	0.2
Adjusted rate (direct)	0.4	0.2	0.3	0.2	0.2	0.2
Rate ratio*	1.27	0.78		0.97	1.04	
mean YPLL <75y	22.6	20.4	21.7			

* Rate ratios are standardised rate for male or female / standardised rate for persons.

† Male plus Female does not sum exactly to Persons due to rounding of annual average case counts.

Note: Rates are mean annual rates / 100,000 population (Age adjusted by direct method to persons Australia 2001).

4.1.1 Age and sex

Rates of death tended to rise with age, especially for males.

Males had higher age-specific rates in most age groups and similar rates to females in the remaining ones (Figure 4.1.1).

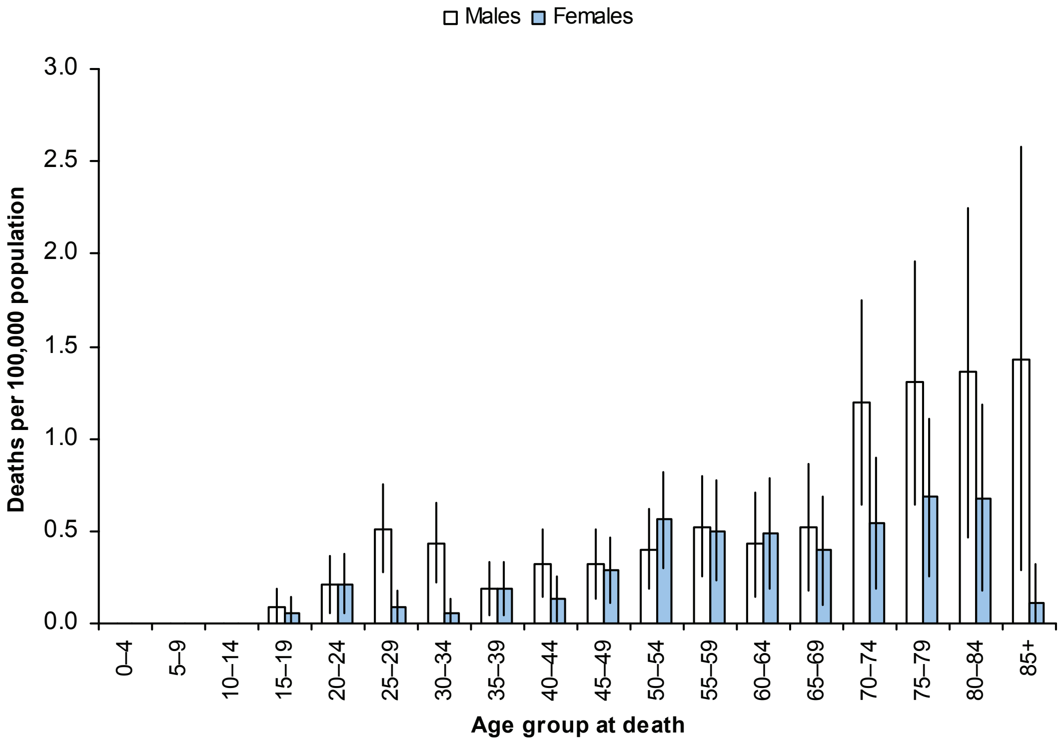

Figure 4.1.1: Deaths due to drowning as a result of intentional self-harm by age and sex, Australia 1999–00 to 2003–04

Age-specific rates of hospitalisation due to intentional self-harm by drowning followed a different pattern to that for drowning deaths in that females had higher age-specific rates of hospitalisation in several age groups, and no strong trend of rates with age was evident (Figure 4.1.2).

The highest rate was for males aged 85 plus years (0.72 separations per 100,000 population) (Figure 4.1.2).

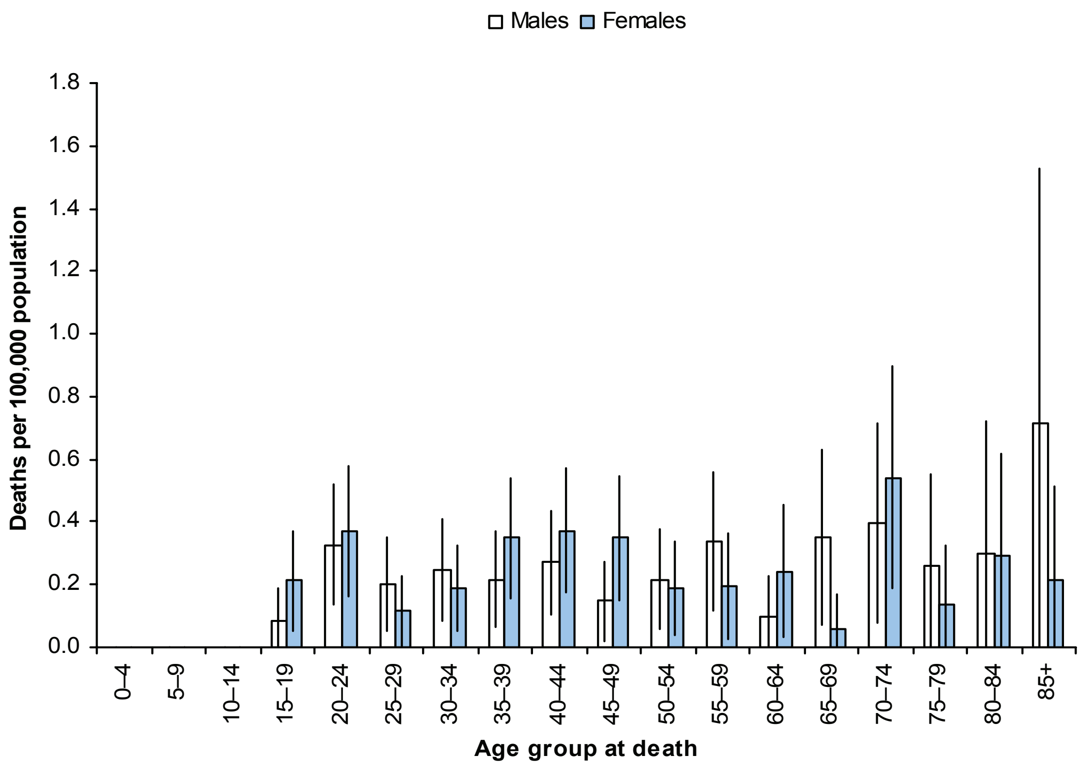

Figure 4.1.2: Hospitalisations due to drowning as a result of intentional self-harm by age and sex, Australia 1999–00 to 2003–04

4.1.2 Trends over time

Poisson regression modelling showed a tendency to an upward trend in age-adjusted rates of intentional self-harm due to drowning between 1999–00 and 2003–04, but the trend was not statistically significant (p=0.212) (Figure 4.1.3). The estimated age-adjusted rate at the beginning of the period was 0.25 deaths per 100,000 population (95% CI 0.21 to 0.31). According to the fitted model, the estimated annual age-adjusted rate of death increased by an average of 5.5% per year during the 1999–00 to 2003–04 reporting period.

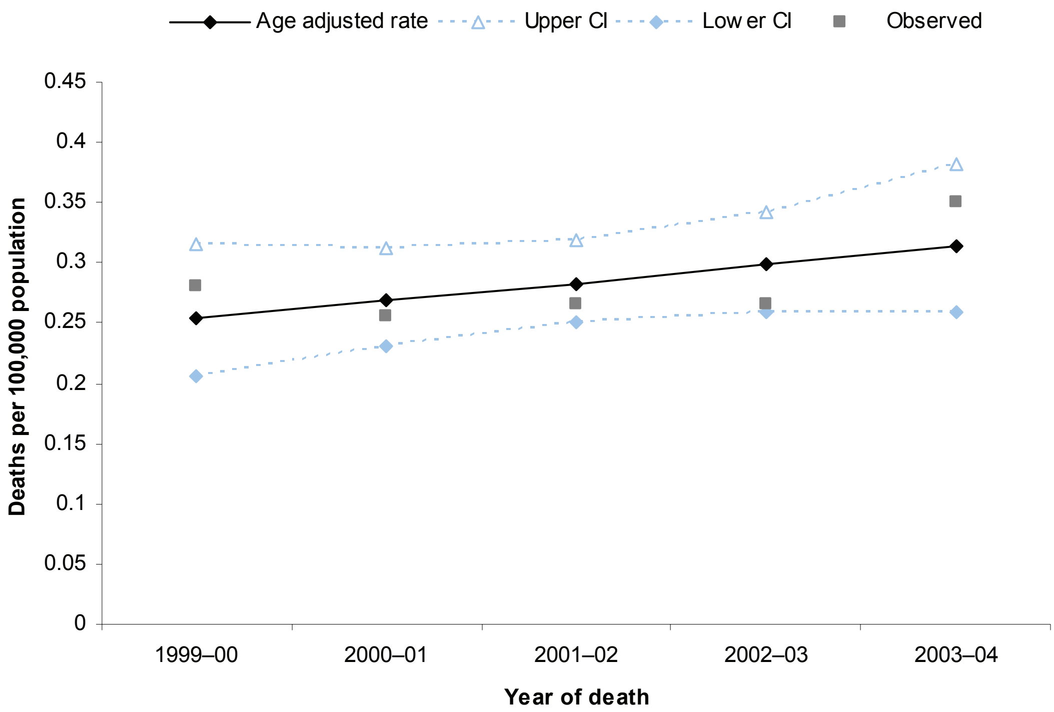

Figure 4.1.3: Deaths due to drowning as a result of intentional self-harm, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

Poisson regression modelling also showed a weak tendency towards an upward trend in age-adjusted rates of hospitalisation due to self-harm by drowning between 1999–00 and 2003–04. As for deaths, the trend was not statistically significant (p=0.530) (Figure 4.1.4). The estimated age-adjusted rate at the beginning of the period was 0.19 deaths per 100,000 population (95% CI 0.15 to 0.24).

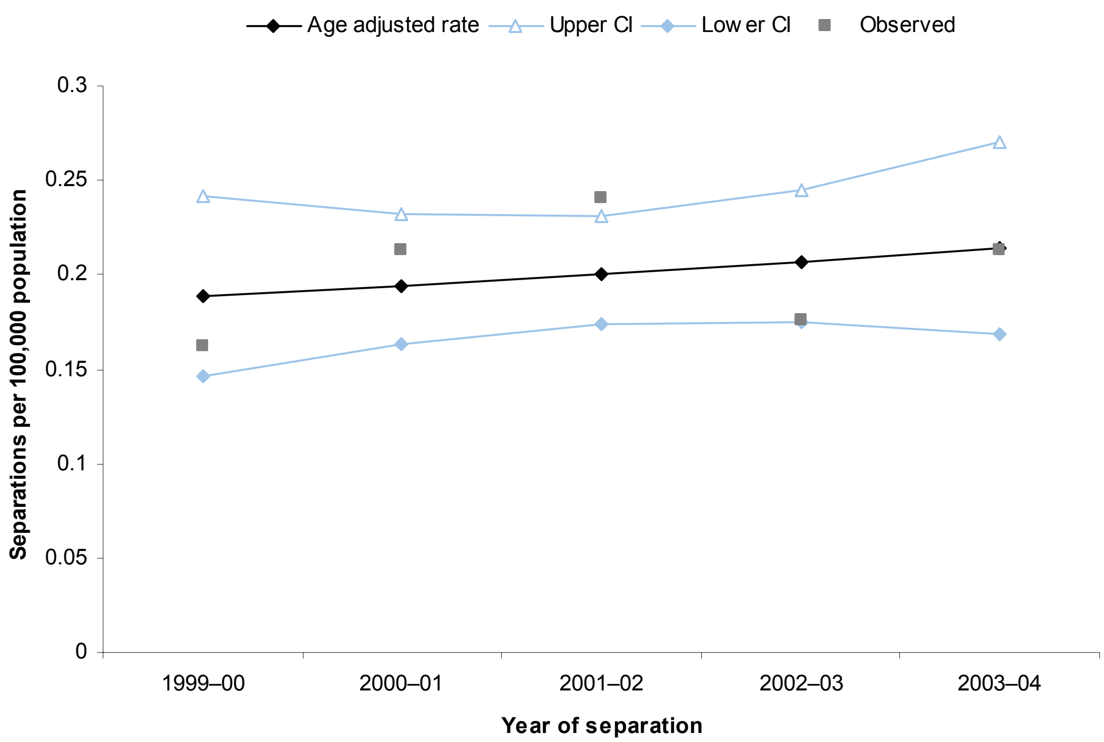

Figure 4.1.4: Hospitalisations due to drowning as a result of intentional self-harm, persons, Australia 1999–00 to 2003–04 (age-standardised rates)

4.1.3 Remoteness of residence

There were no differences between zones in terms of their age-adjusted rates of death by drowning. All had a rate of 0.3 deaths per 100,000 population (Table 4.1.2).

Table 4.1.2: Cases, age-adjusted rates and rate ratios* by remoteness of residence for drowning as a result of intentional self-harm, persons, Australia 1999–00 to 2003–04

	Major Cities	Inner Regional	Outer Regional	Remote	Very Remote
Annual average number of cases	36.0	11.6	5.6	0.8	0.6
Adjusted rate (direct)	0.3	0.3	0.3	0.3	0.3
Rate ratio*	0.99	0.99	0.97	1.00	1.10

* Rate ratios are the standardised rate for a remoteness zone / standardised rate for Australia.

Age-adjusted rates of hospitalisation were similar for major cities, inner regional and outer regional zones. Age-adjusted rates for the remote and very remote zones were 0.0 (Table 4.1.3).

Table 4.1.3: Cases, age-adjusted rates and rate ratios* by remoteness of residence for drowning as a result of intentional self-harm, persons, Australia 1999–00 to 2003–04

	Major Cities	Inner Regional	Outer Regional	Remote	Very Remote
Annual average number of cases	26.1	6.6	3.8	0.3	0.4
Adjusted rate (direct)	0.2	0.2	0.2	0.0	0.0
Rate ratio*	1.05	0.88	1.03	0.00	0.00

* Rate ratios are the standardised rate for a remoteness zone / standardised rate for Australia.

4.1.4 Associated factors

The average annual number of cases that had attracted a MCoD code indicating that alcohol had contributed to the death was n=3. This equated to 5% of cases. ICD-10 codes had been assigned as 'multiple cause' codes to indicate the presence of pharmaceutical drugs in an average annual number of 8 deaths. This equated to 14% of cases.

The annual average number of deaths that had attracted a code indicating that a mental illness had contributed to the death was n=9 (16% of cases). The most commonly identified condition was depression.

4.1.5 Drowning by month

There was considerable fluctuation of frequencies from month to month for both deaths and hospitalisations. Highest case numbers for deaths occurred during December and January (n=33 and n=29 respectively (Figure 4.1.5). Much less seasonality is evident here than for most other types of cases described in this report.

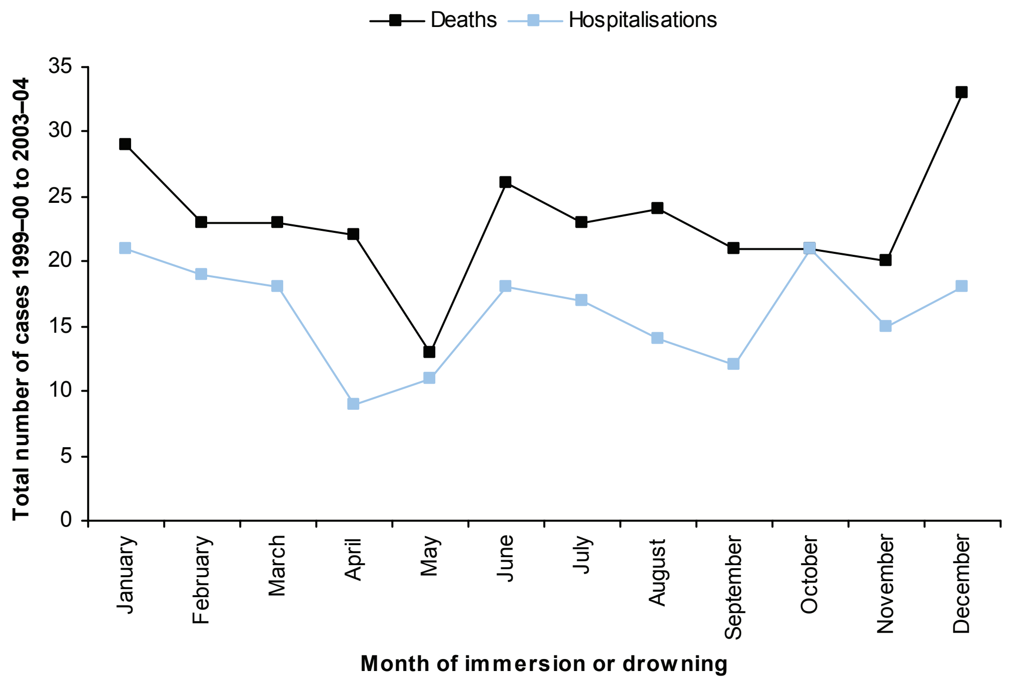

Figure 4.1.5: Drownings due to self-harm by month, persons, Australia 1999–00 to 2003–04

4.1.6 Length of stay in hospital

The length of stay in hospital following admission after a drowning incident ranged from 1 day to 149 days. The mean length of stay was 8.0 days. The highest MLOS was found in the 55–64 year age group (Table 4.1.4).

Table 4.1.4: Mean length of stay in hospital by age group after drowning through self-harm, 1999–00 to 2003–04

Age group in years	Mean length of stay in days
15-24	6.6
25-34	4.3
35-54	8.3
55-64	14.0
65-74	7.2
75+	9.5

4.1.7 Literature

Available literature provides an insight into the contexts within which people have chosen to attempt self-harm by drowning as well as the difficulties inherent in ascribing intent to this type of injury issue.

Examination of files of the Forensic Science Centre in Adelaide for the 20 year period 1981–00 found a total of 445 cases of suicides in persons aged 65 years and over. Of these, 66 (14.8%) were the result of drowning. 39 of the cases were male and 27 were female. The mean age was 73.3 years. The cases had occurred in a range of contexts including bodies of natural salt and freshwater, swimming pools and bathtubs. Over the study period, the male rate of suicide by drowning declined significantly, whereas the female rate remained constant (Byard et al. 2004). Byard et al. used the same data source to look at patterns of female suicide during the period 1986–00. Of a total of 609 cases of female suicide, 40 (7%) were due to drowning. The age range was 19–88 years and the mean age was 61 years. Such deaths were most frequent among older women (Byard et al. 2004).

A study by Cantor et al. (Cantor et al. 2001) compared data from the Queensland Suicide Register (QSR) with deaths data from the ABS for the five-year period 1990–95. The QSR classifies deaths in three ways: 'Beyond reasonable doubt' (BRD), 'Probable' or 'Possible' suicide. 2,728 deaths in the QSR were classified as either BRD or probable. This number was 4.7% greater than the number of suicide deaths found in the ABS data. Drownings were among three methods of suicide that were over-represented in the uncertain intent categories (probable and possible) of the QSR. Drowning deaths were over-represented in those aged 55 years and over, particularly for those deaths coded as possible and probable suicides. The research findings suggested that drowning was among the methods of suicide most likely to be classified to another category such as 'undetermined intent' in the ABS data. The authors noted that swimming, as the precursor to drowning is seen as a 'recreational activity'. When swimming results in a drowning there may be few situational clues, potentially leading to uncertainty regarding intent. Two case studies were used to illustrate this:

> "QSR possible suicide—drowning: A 68-year-old female pensioner was found floating in the ocean. She appeared in good spirits when last seen and left no indication regarding suicide. Investigations revealed that she had been suffering depression in recent weeks. Comment: Appearing in good spirits and drowning in the sea (as opposed to a dirty river) favour an accident. However, suffering depression raises the possibility of suicide."

“QSR probable suicide—drowning: a 71-year-old Asian man drowned in the canal behind his residence. His family told the police that he had been acting strangely for the past few days and had stated that someone was calling him from beyond and that he wished to speak to his dead brother across the water. The deceased was unable to swim. Comment: His relatives’ reports of strange behaviour and his grief for his brother suggest suicide. However, he could not swim and could have fall into the nearby canal accidentally. It is also possible his behaviour may have been a product of psychosis further complicating the determination of intent.”

5 Discussion

Although drownings are uncommon in comparison to some other types of injury events, they are nonetheless important in that they inflict a heavy burden on families and friends who experience the loss of a loved one; on the survivors who commonly live with the debilitating after-effects; and on the community through the significant costs it imposes.

Many drownings are preventable. For example, the analysis of coronial data in this report demonstrates that children can be protected by adequate supervision when placed in a bathtub, and by the use of isolation fencing with fully functioning self-closures on gates and a rigorous practice of ensuring that gates are not left open. The use of more widespread education campaigns about the need for supervision of small children and a greater level of enforcement of swimming pool legislation are just two of the interventions that could help to reduce drownings among children.

Many other creative potential interventions also remain to be explored and evaluated. A survey of inventions in the United States patent database undertaken by Gunatilaka and Ozanne-Smith identified several of these: Aimed at preventing drownings in public swimming pools, a system that employs video monitoring and image processing technology has the ability to pinpoint the exact location of swimmers in distress and alert lifeguards. A variety of PFDs use various devices to enable wearers to be easily located. Others have been designed to improve comfort and thus improve wearing rates. Another PFD design automatically turns the wearer to a face-up position, which has particular promise for drowning prevention in rough seas (Gunatilaka & Ozanne-Smith 2006).

This report has shown that the enumeration of drowning deaths resulting from specific mechanisms is not a precise practice. Specifically, the matching what is known about the circumstances of NCIS cases of swimming pool drowning to the ABS codes they have been assigned showed that a number of cases are not identified as swimming pool drownings in the ABS deaths data. This is likely to be the result of coding of cases by the ABS prior to their being closed by a coroner. The effect is that there is almost certainly undercounting of cases associated with specific mechanisms of drowning. In addition, attribution of intent is sometimes complex and, for a number of cases found in the NCIS data, intent has been described as 'unlikely to be known'. Accordingly, cases of intentional drowning in ABS mortality data can only be regarded as estimates.

Appendix 1 Data issues

Mortality data

Data sources

Deaths data are from the Australian Bureau of Statistics (ABS) mortality unit record data collection, 1997–04. Population data were obtained from the ABS.

Crude and age-specific rates were calculated using as population data the final estimate of the estimated resident population as at 31 December 2003, obtained from the AIHW.

Selection criteria

This report is intended to describe the population incidence of drownings in Australia that resulted in death. This section describes the criteria that were used to select records to achieve this purpose.

Period

This report is restricted to deaths that occurred in the period 1 July 1999 to 30 June 2004, and had been registered by 31 December 2004.

Cases

This report includes deaths that have the ICD-10 code T75.1 *Drowning and nonfatal submersion* or any external cause code(s) V90, V92, W65–W74, X71, X92, Y21 among the multiple causes of death codes.

Multiple causes of death

Until the end of 1996, the ABS coded only one cause for each death. This is the Underlying Cause (UCoD) which the Bureau defines as being 'the disease or injury which initiated the train of morbid events leading directly to death' (in keeping with WHO rules). The Underlying Cause is derived from information on the death certificate according to rules that form part of the *International Classification of Diseases*.

Beginning with deaths registered in 1997, other morbid conditions, diseases and injuries entered on the death certificate were also coded as ***Multiple Causes of Death (MCoDs)***. Up to 20 ***MCoDs*** may be recorded for each death, with one of the ***MCoDs*** being a duplicate of the ***UCoD*** for that death.

Where they are assigned, ***MCoD*** codes can provide additional information about deaths where the ***UCoD*** was an External Cause (injury or poisoning). ***MCoDs*** also make it possible to identify an additional subset of deaths, namely those where the ***UCoD*** was not an External Cause, but where one or more External Causes have been specified on the death certificate as having contributed to the death.

Ascertainment of cases: year of death

NISU receives mortality unit record data from the Australian Bureau of Statistics (ABS) in annual files, each containing records for all deaths ***registered*** in a particular calendar year, using information known to the ABS by a cut-off date, normally some time towards the end of the follow calendar year.

Some time always passes between the date on which a death occurs and the date on which it is registered. Hence, a file containing records for all deaths ***registered*** during a given period (e.g. calendar year 2002) will include the deaths that occurred in that period and had been registered by the end of the period, and will not include deaths that occurred in the period but were registered later.

Our investigations focused on deaths occurring during each 12 months to 30 June for recent years, and sought to gauge the proportion of drowning deaths that had been registered by 31 December of the same year. Over the period 1997–98 to 2002–03, 97.7% of drowning deaths were registered within 6 months of the financial year during which they occurred. Over the period, this proportion varied annually from 96.4% to 98.6%.

Years of potential life lost

This report has applied the method used by the ABS for calculating years of potential life lost (YPLL) with one change. The ABS estimated YPLL for ages 1–75 years, inclusive. We have calculated YPLL for ages 0–74 years, inclusive. The methodology is described in the following extract from the ABS publication *3303.0 Causes of Death Australia 1999,* with our amendments in italics.

> Estimates of YPLL were calculated for deaths of persons aged *0–74 years (i.e. <75 years)* years based on the assumption that deaths occurring at these ages are untimely. A number of variables are used in these calculations, as described below.
>
> YPLL is derived from:
>
> $YPLL = \sum_x (D_x (74 - A_x))$
>
> Where:
>
> A_x = adjusted age at death. As age at death is only available in completed years, the midpoint of the reported age was chosen (e.g. age at death 34 years was adjusted to 34.5).
>
> D_x = registered number of deaths at age x due to a particular cause of death.

Mean YPLL (<75 years) per case was calculated using as the denominator all deaths in the group of interest, irrespective of age at death.

Age adjustment

Most all-ages rates have been adjusted for age to allow comparison of injury risk free from the distortion introduced by one population having a different age distribution to another. Direct standardisation was employed, using the Australian population in 2001 as the standard (ABS 2007) (Table A2). Where crude rates or age-specific rates are reported, this is noted.

Confidence intervals

Nearly all deaths are believed to be included in the sources used for this report, so sampling errors do not apply to these data. However, the time periods used to group the cases (e.g. calendar years) are arbitrary. Use of another period (e.g. April to March) would result in different rates, especially where case numbers are small. The 95% confidence intervals of these rates are based on a Poisson assumption about the number of cases in a time period. Chance variation alone would be expected to lead to a rate outside the 95% confidence interval on 5% of occasions. Confidence intervals were calculated using the methods described by Anderson and Rosenberg (Anderson & Rosenberg 1998). Asymmetrical confidence intervals were calculated for case numbers up to 100. Symmetrical intervals, based on a normal approximation, were calculated where case numbers exceed 100.

Trend analysis

Age-adjusted annual incidence of drowning during 1999–00 to 2003–04 (inclusive) was estimated using a Poisson regression model. The predicted age-adjusted count of cases for a given year was divided by the Australian population for that year to give an incidence rate per million person years at risk. Goodness-of-fit statistics were used to test for over-dispersion. If over-dispersion was found, the Negative Binomial Distribution model was used instead of the Poisson regression model. To estimate age-specific trends, numbers of incident cases were modelled as a function of year with populations as an offset. The basic Poisson regression model was $\log(\text{rate}) = \beta o + \beta 1$ (year — 1999–00), so βo is the log of the baseline incidence rate in the first year (1999–00). The annual percentage change in incidence rate was obtained from the fitted model as $\exp(\beta 1)$-1. The level of $p \leq 0.05$ was taken to represent statistical significance.

Analyses were performed using Stata statistical software (Version 9).

Data quality

The reliability of information about cause of death depends on the reliability of ICD codes provided by the ABS. This depends largely on the adequacy of the information provided to the ABS through Registrars of Births, Deaths and Marriages, and originating from coroners and medical practitioners. Little published information is available on the quality of the data resulting from this process, particularly as it applies to injury deaths. Centralisation of mortality coding in the Brisbane office of the ABS since the mid 1990s has reduced the potential for variation due to local differences in coding practice. However, factors affecting information recording, provision, or coding could affect data in different ways for different jurisdictions, periods or population groups. Hence, apparent differences should be interpreted with caution.

The ABS has recently published an Information Paper on data quality in relation to external causes of death. This provides a detailed overview of the acquisition and coding of deaths data by the Bureau, as well as highlighting a range of issues surrounding the quality of these data (ABS 2007).

Associated factors

The appearance of ICD-10 codes for alcohol, drugs or mental illness among the MCoDs in ABS deaths data suggests that these were factors that, either directly or indirectly contributed to a death. Inclusion of equivalent ICD-10-AM codes in hospital separations records does not provide information about what role, if any, these may have played in the event that lead to hospitalisation. For this reason, information about the presence of alcohol, drugs or mental illness is not included in relation to hospital separations in this report. The selection criteria used were as follows: Alcohol, records where any MCoD was an ICD-10 code T51 or F10; drugs, records with a MCoD in the following ranges: T36–T50, F11–F16, F19; mental illness, any record where an MCoD was a code from ICD-10 Chapter V Mental and behavioural disorders.

Remoteness of residence

Remoteness zones in this report refer to the place of usual residence of the person who died or was admitted to hospital. The remoteness zones reported here are as specified in the ABS Australian Standard Geographical Classification (ASGC) (ABS 2001). Remoteness is defined in a manner based on the Accessibility/Remoteness Index of Australia (ARIA), which was developed for the Commonwealth Department of Heath and Aged Care by the National Key Centre for Social Applications of Geographic Information Systems (GISCA), Adelaide University. According to this method, remoteness is an index applicable to any point in Australia, based on road distance from urban centres of five sizes. The ABS has provided tables that specify the proportion of the population of each Statistical Local Area (SLA) in Australia whose place of residence is in each of five segments of the remoteness index. These segments are:

- Major Cities, with ARIA index value of 0 to 0.2
- Inner Regional, with ARIA index value of >0.2 and ≤2.4
- Outer Regional, with ARIA index value of >2.4 and ≤5.92
- Remote, with ARIA index value of >5.92 and ≤10.53
- Very Remote, with average ARIA index value of >10.53.

These tables were used to assign records to the five zones, on the basis of the SLA of usual residence of the person. Most SLAs lie entirely within one of the five zones. If this was so for all SLAs, then each record could simply be assigned to the zone in which its SLA lies. However, some SLAs include areas in two or more of the zones. Records with these SLAs were assigned to remoteness zones in proportion to the zone-specific distribution of the resident population of the SLA according to the 2001 census.

Following usual AIHW practice for deaths data, a proportion of each record was assigned to each remoteness zone represented in the SLA. The sum of the proportions for one of the zones is the overall estimate of cases in that zone. Note that the resulting value is not normally an integer. For purposes of this report, these values have been rounded to integers for tabulation. However, the unrounded values have been used to calculate other statistics, such as column percentages.

Hospitalisations data

Data sources

The data on hospital separations were provided by the Australian Institute of Health and Welfare (AIHW), from the National Hospital Morbidity Database (NHMD).

Crude and age-specific rates were calculated using as population data the final estimate of the estimated resident population as at 31 December 2003, obtained from the AIHW.

Selection criteria

This report is intended to describe the population incidence of drowning in Australia that resulted in admission to hospital. This section describes the criteria that were used to select records to achieve this purpose.

Period

This report is restricted to hospital separations that occurred in the period 1 July 1999 to 30 June 2004.

Cases

This report includes cases that have the ICD-10 code T75.1 *Drowning and nonfatal submersion* or any of the code(s) V90, V92, W65–W74, X71, X92, Y21 among the external cause codes.

Confidence intervals

Confidence intervals were calculated in the same way as for mortality data.

Age adjustment

Most all-ages rates have been adjusted for age to allow comparison of injury risk free from the distortion introduced by one population having a different age distribution to another. Direct standardisation was employed, using the Australian population in 2001 as the standard (ABS 2007) (Table A2). Where crude rates or age-specific rates are reported, this is noted.

Errors, inconsistencies and uncertainties

Due to rounding, the sum of the percentages in tables may not equal 100 per cent.

NHMD data are generally abstracted from records, entered and coded in hospitals, passed to state and territory health departments, then to the AIHW before being provided to NISU. Processing occurs at each of these steps. Errors and inconsistencies can arise due to the large number of people and processes involved in providing the data. Some variations occur in reporting and coding although Coding Standards, National Minimum Data Sets and other mechanisms have reduced this.

'Remoteness area classification of the patient's usual residence' was not missing for any records in 2003–04, and did not require substitution with the corresponding value for the remoteness area of the treating hospital as was done in the previous report in the series (Berry & Harrison 2006). The set of NHMD records with Principal Diagnosis codes in the range S00–T98 excluding transfers from another acute care hospital (n=416,808), contained few missing values for the variables used extensively in analysis: 'age' (n=0), 'sex' (n=3), and 'state of usual residence' (n=2,813), which is likely to include many non-residents of Australia.

Remoteness of residence

Refer to equivalent information in the mortality section together with the following note:

Following usual AIHW practice for hospitalisations data, each record in the set having a particular SLA code was assigned to one or other of the zones probabilistically, in proportion to the resident population of that SLA. The resulting values are integers.

Coronial data

Access to the National Coroners Information System was obtained from the Victorian Institute of Forensic Medicine (VIFM).

The NCIS data set commenced operation in July 2000 for all states and territories with the exception of Queensland, for which cases are included from January 2001.

For further information about the NCIS, see <www.ncis.org.au>

For further information on the use of the NCIS for injury surveillance, see the NISU report The National Coroners Information System as an information tool for injury surveillance (Driscoll et al. 2003).

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AIHW

This report presents national statistics on deaths and hospitalisations due to drowning for the five-year period 1999–00 to 2003–04.

Drowning occurs in a number of settings and contexts: in bodies of natural water, in swimming pools and bathtubs, in association with watercraft and as the result of intentional self-harm. Drownings resulting in death and hospitalisation are described in relation to these in terms of case numbers and rates, by age and sex, remoteness of usual residence, length of stay in hospital, and other characteristics.

This report will be relevant to anyone interested in gaining an insight into patterns of fatal and non-fatal drowning and the burden they impose on the Australian community.