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Persisting morbidity among hospitalisations for near drowning, Australia 1997–98

Malinda Steenkamp

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Executive Summary

'Drowning and near drowning' is one of the four priority topics for 2001–2003 in the National Injury Prevention Plan. In 1999, around 420 Australians died because of drowning and it is estimated that as many people 'near-drown' as drown.

The main aim for this report was to quantify persisting morbidity resulting from near drowning, but all hospitalised near drownings for the financial year 1997–98 are also described. This report includes a brief discussion about other possible sources of data on persisting morbidity resulting from near drownings.

Hospitalised near drownings

- A total of 831 near drowning separations were identified among hospital separations for 1997–98. Some injuries result in more than one hospital separation. If transfers to other acute hospitals and statistical type discharges are excluded, the estimated incident number of near drowning cases is 721 for 1997–98.
- Males made up two-thirds (66.5%) of the 831 separations.
- Age-specific rates were by far the highest for the 0–4 year age group. Also, 238 near drownings (28.6% of 831) were to children aged 1–3 years.
- ICD-9 External Cause codes 'traditionally' seen as signifying near drownings (i.e. those coded to E910) accounted for about 86% (n=713) of the near drowning separations. Boating-related incidents formed 7.6% of the 831 hospitalised near drownings, while other unintentional and intentional incidents together accounted for 6.6%.
- Mechanisms of near drowning differed by age group. For children aged 1–3 years old, about 61% of the near drownings involved a swimming pool, whereas such immersions made up much smaller proportions for persons aged 15 years or more.
- Immersions in the bath made up a more than half of the 27 near drownings in children aged less than 1 year.
- Of the 390 separations for which detailed information on 'Place of occurrence' was available, 60.5% occurred at *Home* and 30.0% at *Places of recreation or sport*.
- *Effects of drowning and non-fatal submersion* was the Principal Diagnosis for 70% of separations. Fractures of the neck and trunk accounted for about 4% of separations and head injury for around 3% of the principal diagnoses.

- The 831 separations accounted for 2,938 bed days. For around 25% of the separations, discharge occurred on the same day as the day of admission. About 25% of admitted patients had a stay of three days or more.
- Close to 78% of the separations were discharged to their usual residence after admission.
- There were 58 deaths among the 831 near drownings. Of these, 68.9% were male. Six were less than 1 year of age and 24 were aged 1–3 years. More than half of the patients (n=30) died on the same day that they were admitted.

Probable persisting morbidity among near drowning cases

- A total of 41 separations were identified as probable cases with persisting morbidity. Some separations were counted twice and 35 individual patients could be identified.
- These 35 individual cases with persisting morbidity made up about 5% of the 721 estimated incident cases.
- Males made up 74.3% of the cases.
- All 35 cases were younger than 65 years, with about 60% of the cases aged between 10 and 39 years. This profile is very different from the one for all near drowning separations.
- Age seemed to be related to the mechanism of the injury. For example, in boys younger than 10 years, swimming pool-related events were a prominent feature, whereas boating-related immersion were more of a feature for males aged 20–24 years and 40–64 years.
- A total of 235 diagnoses were recorded for the 35 cases with probable persisting morbidity, i.e. an average of 6.7 per separation. There was a total of 200 additional diagnoses recorded, i.e. an average of 5.7 per separation.
- Thirty-three of the 35 cases with persisting morbidity had either a traumatic brain injury (TBI) or a spinal cord injury (SCI). One other case had both a TBI and a SCI.
- Of the 23 TBI cases, 10 were aged younger than 15 years and 8 were aged 20–39 years. Seven of the ten SCI cases were younger than 40 years.
- For 6 of the 10 SCI cases, the E-code was E910.2 (*Accidental submersion while engaged in other sport or recreational activity without diving equipment*). Fourteen of the TBI cases were due to accidental submersion (E910). Of these, 5 involved a swimming pool (E910.5 and E910.6).
- A total of 90 procedures were recorded for the 35 cases with persisting morbidity, i.e. an average of 2.6 procedures per separation. The procedures indicated the more serious nature of the injuries for cases with persisting morbidity.
- More than 50% of the separations were transferred to another acute hospital.

- The 35 cases resulted in a total of 1,191 bed days, i.e. an average length of stay (ALOS) of 34.0 days. This length of stay (LOS) is an underestimate of the true LOS for the identified cases. This is because a large proportion of cases were transferred to other acute facilities and days spent in rehabilitation centres were not known and could not be included.
- SCI accounted for about 29% of the identified cases with persisting morbidity, but made up more than 54% of the total LOS for such separations. These cases also accounted for the longest ALOS, i.e. 64.4 days.

Other data sources

There is no national trauma registry in Australia that can provide routine data on persisting morbidity resulting from near drownings. Queensland and South Australia have a state trauma registry, Victoria is establishing such a registry and other jurisdictions have trauma registries at major trauma centres. However, many of these registries do not include near drowning in their inclusion criteria. Of the registries that do include near drowning, none include any outcome measures other than those contained in national hospital separations data. None of the registries have any follow up of patients.

The national Australian Spinal Cord Injury Register (ASCIR) includes immersions cases that had a spinal cord injury and which were admitted to a spinal unit. The ASCIR includes some data on functional ability at discharge as measured by the Functional Independence Measure.

Acknowledgments

Thank you to Yvonne Helps who assisted in obtaining information on the trauma registries.

I also thank the helpful persons who provided information on these registries.

Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
AIS	Abbreviated Injury Score
ALOS	Average LOS
ASCIR	Australian Spinal Cord Injury Register
DHAC	Department of Health and Aged Care
E-code	External cause code
ICD-9-CM	9th Revision of the International Classification of Diseases, Clinic Modification
ICD-10-AM	10th Revision of the International Classification of Diseases, Australian Modification
ISS	Injury Severity Scale
LOS	Length of stay
NHMD	National Hospital Morbidity Database
NHPA	National Health Priority Area
NISU	National Injury Surveillance Unit
NOI code	Nature of Injury code
RCIS	Research Centre for Injury Studies
SCI	Spinal Cord Injury
TBI	Traumatic Brain Injury

1 Introduction

'Drowning and near drowning' is one of the four priority topics for 2001–2003 in the National Injury Prevention Plan (Department of Health and Aged Care 2001). In 1999, 427 Australians died because of drowning (NISU Unpublished data 2001) and it is estimated that nearly as many people 'near-drown' as drown (Nixon, Pearn et al. 1995).

Drowning is the best known serious consequence of immersion events and a number of Australian reports and articles on the epidemiology of drowning have been published (NSW Injury Risk Management Research Centre 2000);(Nixon, Pearn et al. 1986) (Mackie 1999).

Serious consequences other than death sometimes occur after immersion events. For example, it is estimated that 2–8% of submersions where there is loss of consciousness or altered breathing result in permanent brain damage (Nixon, Pearn et al. 1995). Australian literature on the epidemiology of near drowning is, however, scarce, as is Australian information on the long-term effects of serious near drownings.

There is a need to describe the national profile of near drowning and to quantify serious outcomes other than deaths following immersion events. This report describes hospital separations related to near drownings for the year 1997–98, but also focuses on hospitalised immersions that were likely to result in persisting morbidity.

Hospital separations data pose specific challenges in regard to near drowning. This is because near drowning does not result in large numbers of hospital separations annually and identification of these events among hospital data is not straightforward. Quantifying persisting morbidity is also a challenge because hospital separations data do not include outcome measures, other than 'Mode of separation'.

For purposes of this report, near drowning was defined as 'an immersion event where the person survived and was admitted to a hospital bed'. An immersion event was defined as a hospital separation where there was a relevant ICD-9-CM diagnosis of 994.1 (*Effects of drowning and non-fatal submersion*) and/or any of the external cause codes listed in Table 2.1 in a relevant field. The terms 'immersion event' and 'immersion' were used interchangeably with 'near drowning'.

The main aim of this report was to quantify persisting morbidity resulting from near drownings, but all immersion events for the financial year 1997–98 are also described. This report also briefly outlines other possible sources of routine data on persisting morbidity resulting from near drownings. The report is structured as follows:

- In Chapter 2, the identification of near drownings among hospital separations for 1997–98 is presented and the profile of the identified separations is described.
- Chapter 3 discusses persisting morbidity among near drowning cases, i.e. how they were identified and the profile of these cases.
- Chapter 4 discusses data issues regarding hospital separations data, including how the transition to ICD-10-AM might affect data relating to near drowning.
- Chapter 5 reports on other possible sources of data on persisting morbidity.
- Chapter 6 is the Discussion and is followed by the Appendices, which contains tables of data relating to Chapter 2.

2 Hospitalised near drownings

2.1 Data source

The aim of this Chapter was to present the analysis of near drownings among hospital separations for the financial year 1997–98.

A 'separation' is the event that occurs at the conclusion of an episode of in-patient care in a hospital. Most often, patients go to their usual residence, but some separations are to other health care facilities, and some occur because patients have died.

The data presented here are from the AIHW National Hospital Morbidity Database (NHMD). The data were coded to the second Australian edition of the Clinical Modification of the International Classification of Diseases, 9th Version (ICD-9-CM).

It should be noted that some injuries result in more than one hospital separation, because of transfers between hospitals, because the treatment of some cases requires re-admission, and for some less important reasons. The NHMD contains a record for each separation and not for each individual patient. Hence, estimates of the incidence of injury resulting in hospitalisation that include all separations by injury cases will be overestimates.

The 1997–98 data year was used in order to eliminate possible complications related to the transition to Australian Modification of the 10th Revision of the ICD-10 (ICD-10-AM) for more recent years (see Section 4.6).

2.2 Identifying hospitalisations due to near drownings

In order to identify all possible near drownings among hospitalisations, the following separations were selected:

- Separations that had an ICD-9-CM diagnosis 994.1 *Effects of drowning and non-fatal submersion* in any of the 26 diagnosis fields; and/or
- Separations that had any of the External Cause codes (E-codes) listed in Table 2.1 in any of the 21 E-code fields or in the diagnosis fields.

Table 2.1: ICD-9-CM External cause codes and description related to immersion events

E-code	Description
E830.0	Accident to watercraft causing submersion: occupant of small boat, unpowered
E830.1	Accident to watercraft causing submersion: occupant of small boat, powered
E830.2	Accident to watercraft causing submersion: occupant of other boat—crew
E830.3	Accident to watercraft causing submersion: occupant of other boat—other than crew
E830.4	Accident to watercraft causing submersion: water skier
E830.5	Accident to watercraft causing submersion: swimmer
E830.6	Accident to watercraft causing submersion: dockers, stevedores
E830.8	Accident to watercraft causing submersion: other specified person
E830.9	Accident to watercraft causing submersion: unspecified person
E832.0	Other accidental submersion or drowning in water transport accident: occupant of small boat, unpowered
E832.1	Other accidental submersion or drowning in water transport accident: occupant of small boat, powered
E832.2	Other accidental submersion or drowning in water transport accident: occupant of other boat—crew
E832.3	Other accidental submersion or drowning in water transport accident: occupant of other boat—other than crew
E832.4	Other accidental submersion or drowning in water transport accident: water skier
E832.5	Other accidental submersion or drowning in water transport accident: swimmer
E832.6	Other accidental submersion or drowning in water transport accident: dockers, stevedores
E832.8	Other accidental submersion or drowning in water transport accident: other specified person
E832.9	Other accidental submersion or drowning in water transport accident: unspecified person
E910.0	Accidental drowning and submersion: while water-skiing
E910.1	Accidental drowning and submersion: while engaged in other sport or recreational activity with diving equipment
E910.2	Accidental drowning and submersion: while engaged in other sport or recreational activity without diving equipment
E910.3	Accidental drowning and submersion: while swimming or diving for purposes other than recreation or sport
E910.4	Accidental drowning and submersion: in bathtub
E910.5[(a)]	Accidental drowning and submersion: while swimming in swimming pool
E910.6[(a)]	Accidental drowning and submersion: following fall into swimming pool
E910.7[(a)]	Accidental drowning and submersion: following fall into natural water
E910.8	Accidental drowning and submersion: other
E910.9	Accidental drowning and submersion: unspecified
E954	Suicide and self-inflicted injury by submersion [drowning]
E964	Assault by submersion [drowning]
E984	Submersion [drowning], undetermined whether accidentally or purposely inflicted

(a) These E-codes were additions to the 2nd Australian edition of ICD-9-CM that was used from 1 July 1996–97. These E-codes are not available for data years prior to 1996–97.

2.3 Profile

2.3.1 Age and sex

Using the selection criteria above, a total of 831 hospitalised near drownings were identified among hospital separations for 1997–98 (Table 2.2). As stated, these are not incident cases as readmissions, transfers between facilities, etc. are also included in the database.

Table 2.2: Key indicators for hospitalised immersions; Australia 1997–98

Indicator	Males	Females	Persons
Number of separations	553	278	831
Per cent of all injury and poisoning separations	0.4%	0.2%	0.3%
Age-specific separations rate per 100,000 population	6.0	3.0	4.5
Age-standardised separations rate per 100,000 population	6.1	3.1	4.6

The overall male to female rate ratio was 1.9 (as based on age-standardised rates). This varied by age group, e.g. the male to female rate ratio for children less than 5 years was 1.3, whereas the rate ratio for persons aged 60 years or more was about 4 (see Table A8.1).

Hospitalisation rates due to near drownings were generally higher for males than for females (Figure 2.1). For both males and females, age-specific rates were highest for the 0–4 year age group. For males, age-specific rates for near drowning showed a second smaller peak in the 20–24 year age group, whereafter age-specific rates declined to below the rates for children aged 5–14 years (Figure 2.1).

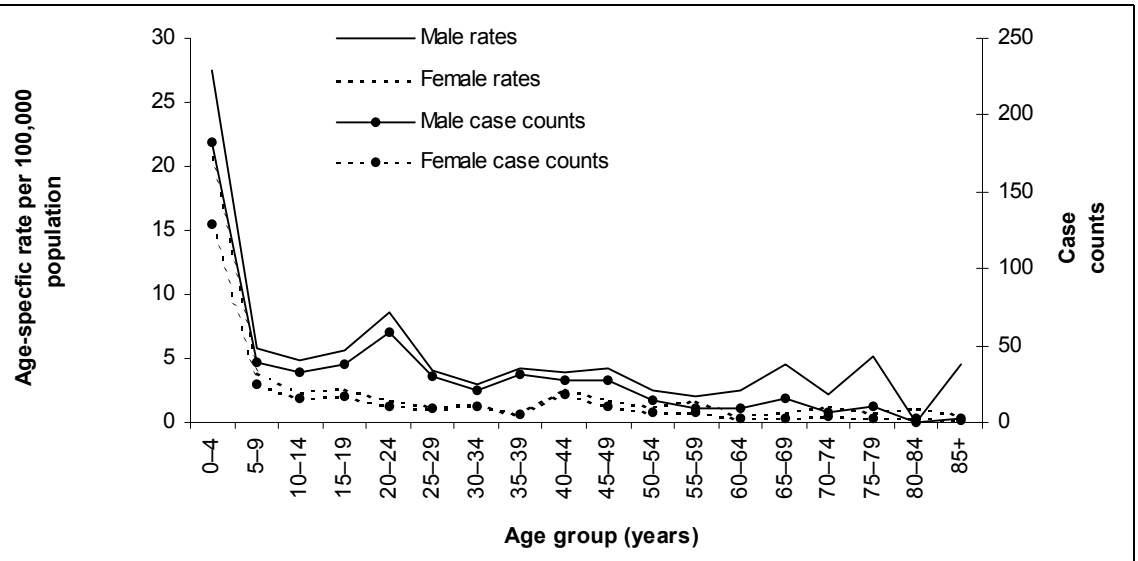

Figure 2.1: Age-specific rates for hospitalised immersions; Australia 1997–98

2.3.2 Circumstances of near drowning

Mechanism

The term 'mechanism' is used here to refer to the external causes that resulted in near drowning as described by ICD-9-CM E-codes. Table 2.3 lists the mechanisms involved in near drownings among hospitalised separations. This list includes E-codes other than those used to select near drowning separations—this is because some of the separations with a diagnosis code 994.1 (*Effects of drowning and non-fatal submersion*) had E-codes other than those listed in Table 2.1.

Table 2.3 shows the following:

- E-codes 'traditionally' seen as signifying near drownings (i.e. those coded to E910) accounted for about 86% (n=713) of near drowning separations. Of these, one-third (n=236) involved a swimming pool, i.e. separations were coded to E910.5 or E910.6.
- About one in five near drowning separations (n=219), occurred while the person was involved in other sport or recreational activity without diving equipment.
- Immersion events in bathtubs made up about 8% of the total 831 near drowning separations.
- Twenty near drowning separations (2.4%) involved diving equipment (E910.1).

- Boating-related immersions (i.e. separations coded to E830.0–E830.0, E832.0–E832.9 or E838.1) accounted for a small proportion of separations, i.e. 7.6% (n=63). If immersion separations due to water-skiing (11 separations were coded to E910.0) were added, the proportion increased to about 9%.
- Self-inflicted immersions made up less than 4% of all the near drowning separations. Assault by immersion was recorded for only two near drowning separations and the intent was undetermined for four separations.

Table 2.3: External causes of hospitalised immersions; Australia 1997–98

Description	E-code	Counts	Per cent
Accidental submersions (E910.0–E910.9)			
While engaged in other sport or recreational activity without diving equipment	E910.2	219	26.4%
While swimming in swimming pool	E910.5	121	14.6%
Following fall into swimming pool	E910.6	115	13.8%
Following fall into natural water	E910.7	81	9.7%
In bathtub	E910.4	67	8.1%
Other accidental drowning and submersion	E910.8	62	7.5%
While engaged in other sport or recreational activity with diving equipment	E910.1	20	2.4%
While water-skiing	E910.0	11	1.3%
Unspecified accidental drowning and submersion	E910.9	11	1.3%
While swimming or diving for purposes other than recreation or sport	E910.3	6	0.7%
Subtotal		*713*	*85.8%*
Boating-related immersions (E830.0–E830.9 and E832.0–E832.9)			
Other accidental submersion in water transport accident: occupant of small boat, unpowered	E832.0	14	1.7%
Other accidental submersion in water transport accident: occupant of small boat, powered	E832.1	9	1.1%
Other accidental submersion in water transport accident: unspecified person	E832.9	8	1.0%
Other accidental submersion in water transport accident: water skier	E832.4	6	0.7%
Other accidental submersion in water transport accident: occupant of other boat—crew	E832.2	5	0.6%
Accident to watercraft causing submersion: occupant of small boat, powered	E830.1	3	0.4%
Accident to watercraft causing submersion: occupant of other boat—crew	E830.2	3	0.4%
Accident to watercraft causing submersion: unspecified person	E830.9	3	0.4%
Accident to watercraft causing submersion: occupant of small boat, unpowered	E830.0	2	0.2%
Accident to watercraft causing submersion: occupant of other boat—other than crew	E830.3	2	0.2%
Other accidental submersion in water transport accident: occupant of other boat other than crew	E832.3	2	0.2%
Other accidental submersion in water transport accident: swimmer	E832.5	2	0.2%
Other accidental submersion in water transport accident: other specified person	E832.8	2	0.2%
Accident to watercraft causing submersion: water skier	E830.4	1	0.1%
Other and unspecified water transport accident: occupant of small boat, powered	E838.1	1	0.1%
Subtotal		*63*	*7.6%*
Other unintentional events			
Fall into hole or other opening in surface	E883.0	7	0.8%
Fall on or from stairs or steps	E880	2	0.2%
Other falls	E882 + E884.9	2	0.2%
Exposure to weather conditions not elsewhere classifiable	E904.3	1	0.1%
Exposure to floods	E908.2	1	0.1%
Striking against or struck accidentally by objects or persons in running water	E917.2	1	0.1%
Accident cause by mining and earth drilling machinery	E919.1	1	0.1%
Accident caused by electric current: other	E925.8	1	0.1%
Overexertion and strenuous movements	E927.0	1	0.1%
Surgical operation with transplant of whole organ	E878.0	1	0.1%
Subtotal		*18*	*2.2%*
Intentional and undetermined events			
Self-inflicted injury by poisoning with pharmaceuticals	E950	3	0.3%
Self-inflicted injury by submersion	E954	26	3.1%
Self-inflicted injury by other means	E953.8 + E958.3	2	0.2%
Assault by submersion	E964	2	0.2%
Submersion, undetermined whether accidentally or purposely inflicted	E984	3	0.4%
Falling from high place, undetermined whether accidentally or purposefully inflicted	E987.1	1	0.1%
Subtotal		*37*	*4.5%*
Total		**831**	**100.0%**

The mechanisms of near drowning were related to age,[1] and to a lesser degree, to sex (Figures 2.2 and 2.3):

- Overall, the highest numbers of hospitalised near drownings were recorded for 1–3 year olds. This was true for both males with 139 out of a total of 553 separations (25.1%) and for females with 99 out of a total of 278 separations (35.6%).
- For males aged 1–3 years old, 79 of the 139 near drownings (57.8%) involved a swimming pool (E910.5 and E910.6). For females in the same age group, 66 of the 99 separations (62.6%) were coded to E910.5 and E910.6.
- Near drownings in swimming pools also accounted for notable proportions in the 4–9 and 10–14 year age ranges. For males aged 10–14 years about 42% of immersions among males aged 4–9 years (n=23) were coded to E910.5 and E910.6 and the proportion for females in the same age group was 45.7% (n=16). In the 10–14 year age groups the proportion for males was 27.3% (n=9) and for females it was 66.7% (n=10). Near drownings in swimming pools made up much smaller proportions in ages 15 years or more (i.e. mostly less than 10%), as well as for children aged less than 1 year (i.e. around 15% for both males and females).
- Immersions in the bath (E910.4) made up a more than 55% of the 27 near drownings in children aged less than 1 year (n=15). Close to 7% of the immersions in males aged 1–3 years (n=9) occurred in the bath, while in females aged 1–3 years, 10 separations (10.1%) were coded to E910.4. Seven males aged 4–9 years (12.7%) also had near drownings in the bath, while only one female in this age group (2.9%) had such an event. Three males aged between 25 and 64 years had an immersion event in the bath (E910.4). Another three males aged 65 years or more had a similar near drowning. Three adult females had a near drowning coded to E910.4. Only one of them was aged between 65 and 74 years.
- Other accidental near drownings (E910.0–.3, E910.7–.9) made up large proportions of separations in males and females, especially from ages 4 years and more. More detail about these mechanisms is limited by the nature of the E-codes, but it can be distinguished that 7 male and 4 female near drownings occurred during water skiing (E910.0) and that 12 male and 8 female separations occurred while the persons were using diving equipment (E910.1). These 31 separations were all to persons who were older than 15 years. Fifty-six male and 25 female separations were coded to E910.7 (*Fall into natural body of water*). Of the male separations, 37 (66.1%) were to males older than 15 years and of the females, 17 (68.0%) were aged 15 years or older.

[1] The age groupings presented in this report are not equal, but rather reflect life stages that have been found to be relevant to drowning and near drowning.

- Boating-related immersions (E830.0–.9, E832.0–.9 and E838.1) accounted for 17.3% of near drownings among males in the age group 20–24 years (n=10), 18.3% for those aged 25–39 years (n=15) and 22.1% for men in the 40–64 years group (n=19). For females, boating-related immersions did not feature much.
- There were relatively few intentional or undetermined separations (n=37). For males there were 3 separations in the 20–24 year old group, 3 in the 25–39 year age category, 6 in the 40–64 year age group and 4 were aged 65+ years. For females, 1 separation was to a female aged 20–24 years, 3 to females aged 20–39 years and 14 to females aged 40–64 years, and 2 females were aged 65+ years.

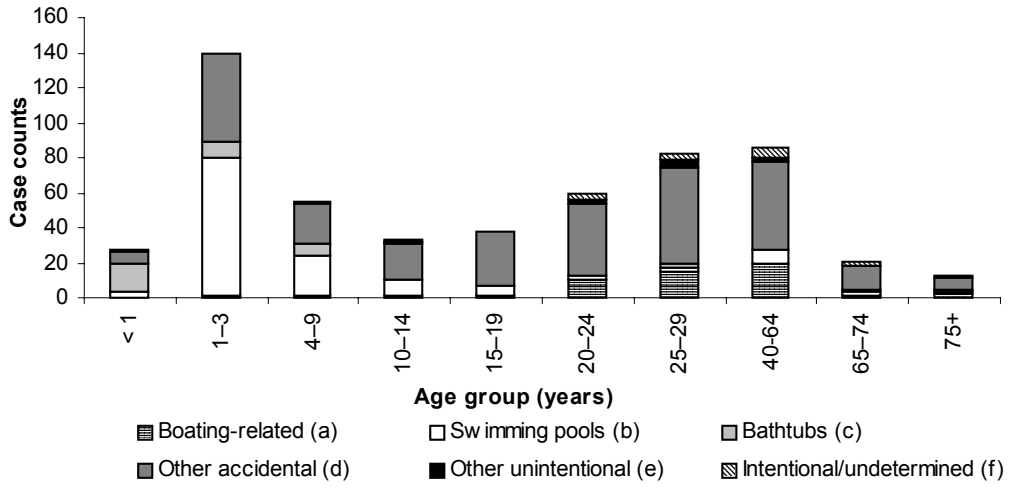

Figure 2.2: Main mechanism groups by age group for male hospitalised immersions; Australia 1997–98

(a) Separations coded to E830.0–E830.0, E832.0–E832.9 or E838.1
(b) Separations coded to E910.5 and E910.6
(c) Separations coded to E910.4
(d) Separations coded to E910.0–.3, E910.7–.9
(e) Separations coded to E880, E882, E883, E884.9, E904.3, E908.2, E917.2, E917.2, E919.1, E919.1, E925.8, E927.0, and E878.0
(f) Separations coded to E950, E953.8, E954, E958.3, E964, E984, and E987.1

Figure 2.3: Main mechanism groups by age group for female hospitalised immersions; Australia 1997–98

(a) Separations coded to E830.0–E830.0, E832.0–E832.9 or E838.1
(b) Separations coded to E910.5 and E910.6
(c) Separations coded to E910.4
(d) Separations coded to E910.0–.3, E910.7–.9
(e) Separations coded to E880, E882, E883, E884.9, E904.3, E908.2, E917.2, E917.2, E919.1, E919.1, E925.8, E927.0, and E878.0
(f) Separations coded to E950, E953.8, E954, E958.3, E964, E984, and E987.1

Place of occurrence

In the second Australian edition of ICD-9-CM it is specified that the 'Place of occurrence' (i.e. where the injury event occurred) should be used with E-codes E850–E869 and E880–E928.

These ranges exclude boating-related E-codes. However, some information on Place was provided for 53 out of the 63 boating-related separations. Of the 53 separations, 36 separations were coded to *Other specified place* and 6 separations to *Unspecified place*. Of the 11 remaining separations, 7 occurred in *Places of recreation or sport* and 2 at *Home*.[2]

Table 2.4 shows the remaining 714 separations (information was missing for 64 separations):

- More than one-third of separations were coded to *Other specified place* and about 10.4% to *Unspecified place*.
- Of the 390 separations where more detailed information was available, 60.5% occurred at *Home* and 117 (30.0%) at *Places of recreation or sport*. Eleven separations occurred on a farm (1.5%).

[2] Home includes premises around home.

Table 2.4: Place of occurrence for hospitalised immersions with E-codes in the ranges E850–E869 and E880–E928; Australia 1997–98

Place of occurrence	No. of separations	Per cent of 714	Per cent of 390
Home	236	33.1%	60.5%
Place of recreation or sport	117	16.4%	30.0%
Public building	12	1.7%	3.1%
Farm	11	1.5%	2.8%
Residential institution	9	1.3%	2.3%
Industrial place	3	0.4%	0.8%
Street/highway	2	0.3%	0.5%
Subtotal	*390*	*54.7%*	*100%*
Other specified place	250	35.0%	..
Place not specified	74	10.4%	..
Total	**714**[a]	**100%**	**..**

(a) Place of occurrence was missing for 64 separations. Total also excludes boating-related separations.

About 53% (n=126) of the 236 near drownings related to swimming pools (E910.5 and E910.6) had *Home* as place of occurrence. A further 18.6% (n=44) of such near drownings occurred at *Places of recreation or sport*.

2.3.3 Diagnoses

The NHMD allows for one principal diagnosis to be recorded, as well as up to 25 additional diagnoses.

Principal diagnosis

Groups of the principal diagnoses recorded for near drownings are presented in Table 2.5, together with more specific nature of injury (NOI) codes for some groups.

- Just less than 600 separations were coded to *Other and unspecified effects of external causes.* Of these, 582 had 994.1 (*Effects of drowning and non-fatal submersion*) as principal diagnosis.
- Diagnoses that fell outside the ICD-9-CM Injury and Poisoning chapter were the second most common group of principal diagnoses. Of these, 3 separations had 348.1 (*Anoxic brain damage*) as principal diagnosis.
- *Fractures of the neck and trunk*, which includes fractures with accompanying spinal cord injury (SCI), accounted for 35 separations (4.2%). Of these, 6 had a definite SCI. Another 5 separations had an injury to the nerves and spinal cord, of which 3 had a definite SCI.
- Head injury-related diagnoses, i.e. *Intracranial injury* (n= 18) and *Fractures of the skull* (n=9) made up 3.3% of all the principal diagnoses recorded.
- Fractures of the upper (n=10) and lower (n=14) limbs accounted for 2.9% of the recorded principal diagnoses.

Table 2.5: Groups of principal diagnoses (including some specific principal diagnoses) recorded for hospitalised immersions; Australia 1997–98

Group of diagnoses	Nature of injury code	No. of separations	Per cent of 831
Other and unspecified effects of external causes	990–995	599	72.1%
Effects of drowning and non-fatal submersion	*994.1*	*582*	*70.0%*
Hypothermia	*991.6*	*11*	*1.3%*
Not poisoning/injury	001–799, V01–V82	84	10.1%
Pneumonitis due to inhalation of other solids and liquids	*507.8*	*5*	*0.6%*
Major depressive disorder—unspecified	*296.20*	*4*	*0.5%*
Pneumonitis due to inhalation of food or vomitus	*507.0*	*4*	*0.5%*
Anoxic brain damage	*348.1*	*3*	*0.4%*
Unspecified neurotic disorder	*300.9*	*3*	*0.4%*
Syncope and collapse	*780.2*	*3*	*0.4%*
Fracture of neck and trunk	805–809	35	4.2%
Closed fracture of dorsal vertebra	*805.2*	*5*	*0.6%*
Closed fracture of lumbar vertebra	*805.4*	*4*	*0.5%*
Closed fracture of seventh cervical vertebra	*805.07*	*3*	*0.4%*
Intracranial injury	850–854	18	2.2%
Concussion with brief loss of consciousness	*850.1*	*10*	*1.2%*
Concussion, unspecified	*850.9*	*5*	*0.6%*
Fracture of lower limb	820–829	14	1.7%
Closed fracture of shaft of tibia	*823.20*	*3*	*0.4%*
Closed bimalleolar fracture of ankle	*824.4*	*3*	*0.4%*
Sprains and strains	840–848	12	1.4%
Sprain and strain of neck	*847.0*	*6*	*0.7%*
Fracture of upper limb	810–819	10	1.2%
Certain traumatic complications and unspecified injuries	958–959	10	1.2%
Fracture of skull	800–804	9	1.1%
Dislocation	830–839	8	1.0%
Open wound of head, neck or trunk	870–879	7	0.8%
Injury to nerves and spinal cord	950–957	5	0.6%
Poisoning by drugs, medicinal or biological substances	960–979	4	0.5%
Open wound to lower limb	890–897	4	0.5%
Open wound to upper limb	880–887	3	0.4%
Contusion with intact skin	920–924	3	0.4%
Internal injury of chest, abdomen or pelvis	860–869	2	0.2%
Injury to blood vessels	900–904	2	0.2%
Superficial injury	910–919	1	0.1%
Complication of surgical and medical care	996–999	1	0.1%
Total		**831**	**100%**

Additional diagnoses

There was a total of 1,231 additional diagnoses recorded, i.e. an average of 1.5 per separation.

- A number of the separations seemed to have some form of existing impairment, e.g. intellectual disability, cerebral palsy, or conduct disorders.

- Forty-five separations (5%) had some form of 'epilepsy' (NOI code 345.0–.9 or 780.32) as an additional diagnosis. Of these, 9 were aged between 0–4 years, 13 between 5–14 years, and 8 between 15–19 years. It was sometimes difficult to determine whether the epilepsy was present before the near drowning.
- For 29 separations (3%), a drug-related diagnosis was recorded, i.e. the patient had one of the following ICD-9-CM NOI codes: 291 (*Alcoholic psychosis*); 292 (*Drug psychosis*); or 305 (*Non-dependent drug use disorder*). Twenty-two of these separations were male and 15 were aged 35–64 years.
- Of the 67 near drownings that occurred in a bath (E910.4), 31 were to children under 1 year of age, 19 were aged 1–3 years, and 8 were aged 4–9 years. Of the 50 children under 4 years, 20.0% had one (or more) diagnosis related to 'fever' and/or an 'infection' of some sort, e.g. *Febrile convulsions* (780.31) or *Unspecified otitis media* (328.9). It is difficult to know with certainty, but it appeared as if these symptoms may have been present before the immersion occurred. Of the 8 bathtub immersions among children aged 4–9 years, 2 separations had an indication of 'fever' or 'infection'. Five separations in this age group had some indication of 'epilepsy'. Two of these had an additional code related to infantile cerebral palsy (343).

2.3.4 Procedures

The NHMD allows for up to four procedures to be coded. This includes a principal procedure and three additional ones.

Of the 831 near drowning separations, 550 separations (66%) did not have any principal procedure recorded. The remaining 281 separations had an average of 2.2 procedures recorded. These are shown in Table 2.6.

Table 2.6: Top ten 'Principal procedures' among hospitalised immersions; Australia 1997–98

Principal procedure	Code	No. of separations	Per cent
Insertion of endotracheal tube	96.04	26	9.3%
Computerised axial tomography of head	87.03	24	8.5%
Other computerised axial tomography	88.38	20	7.1%
Continuous positive airway pressure (CPAP)	93.90	15	5.3%
Injection of antibiotic	99.21	14	5.0%
Social work assessment	94.70	13	4.6%
Continuous mechanical ventilation for greater than 24 and less than 96 consecutive hours	96.71	13	4.6%
Suture of skin and subcutaneous tissue of other sites	86.59	12	4.3%
Continuous mechanical ventilation for 96 consecutive hours or more	96.72	12	4.3%
Other physical therapy musculoskeletal manipulation	93.20	10	3.6%
Rest of principal procedures		122	43%
All principal procedures	**Total**	**281**	**100%**

2.3.5 Outcome

The NHMD does not contain any outcome measure, other than 'Mode of separation'. Length of stay (LOS) gives some indication of severity, which can be helpful in assessing outcome, but there is no precise relationship between LOS and severity.

Separation mode

The majority of separations (77.9%) ended with patients being discharged to their usual residence after admission (Table 2.7). A notable proportion was transferred to another acute hospital (12.5%) and 58 patients died (7.0%)—this is much higher than for injury in general.

Table 2.7: Mode of separation for hospitalised immersion; Australia 1997–98

Mode of separation	Frequency	Per cent
Other separation—i.e. discharge to usual residence	647	77.9%
Transfer to another acute hospital	104	12.5%
Died	58	7.0%
Discharge at own risk	8	1.0%
Statistical discharge—change of type	5	0.6%
Transfer to a psychiatric facility	4	0.5%
Transfer to a nursing home	2	0.2%
Transfer to another other health care facility	2	0.2%
Statistical discharge—leave	1	0.1%
Total	**831**	**100%**

Some injuries result in more than one hospital separation, because of transfers between hospitals, because the treatment of some cases requires re-admission, and for some less important reasons. The NHMD contains a record for each separation. Hence, estimates of the incidence of injury resulting in hospitalisation that include all separations by injury cases will be overestimates. One method to attempt correcting this is using the Mode of Separation data item. If transfers to other acute hospitals and statistical type discharges are excluded, the estimated incident number of immersion cases is 721 for 1997–98.

Length of stay

Calculation of LOS due to injury events is not straightforward and a number of factors have the effect that the data understate long-term stay and overstate short stay. The first episode of care for an incident case will start with admission to a hospital bed. A particular case may be transferred to another hospital and each hospital only records the number of days the particular patient spent in their facility. To determine the total number of bed days for a particular case, the LOS needs to be added across hospitals. Also, some cases may be readmitted for further episodes of care related to a particular injury. This LOS should also be added in order to calculate the total LOS for particular incident cases. Currently, there is no case linkage across hospitals nationally and it is also not possible to identify readmitted cases on a national scale.[3] Therefore, total LOS cannot be determined for individual patients. A way to address this is unknown at this stage.

The data below represents an aggregated estimate of LOS as the LOS for all separations having a relevant diagnosis code and E-code are added. This includes separations of incident cases, readmissions and transfers.

The 831 near drowning separations had an ALOS of 3.6 days. For 25.3% (n=210) of these separations, discharge occurred on the same day of admission. About 25% (n=158) of admitted patients had a stay 3 days or more (Table 2.8).

Table 2.8: Length of stay for hospitalised immersions; Australia 1997–98

Length of stay	No. of separations	Per cent
1 day	568	68.4%
2 days	105	12.6%
3-4 days	67	8.1%
5-7 days	40	4.8%
8-14 days	22	2.6%
15-21 days	10	1.2%
22-28 days	6	0.7%
36-48 days	5	0.6%
More than 6 weeks	8	1.0%
Total	**831**	**100%**

[3] There are some areas such as WA where data linkage is possible.

When calculating LOS it is necessary to take into account that some admitted separations are discharged on the same day (Table 2.9).

Table 2.9: Mode of separation, total length of stay (LOS) and average length of stay (ALOS) for hospitalised immersions where same days cases were included and where they were excluded; Australia 1997–98

Mode of separation	All separations, including same day cases				No. of same day cases	Separations, excluding same day cases		
	Number	Total LOS	% of 2,982	ALOS		Total LOS	% of 2,772	ALOS
Transfer to other acute facility	104	238	8.0%	2.3	80	158	5.7%	6.6
Transfer to a nursing home	2	72	2.4%	36.0	1	71	2.6%	..
Transfer to a psychiatric facility	4	77	2.6%	19.3	..	77	2.8%	19.3
Transfer to another health care facility	2	3	0.1%	1.5	..	3	0.1%	1.5
Statistical discharge—type change	5	183	6.1%	36.6	..	183	6.6%	36.6
Discharge at own risk	8	13	0.4%	1.6	..	13	0.5%	1.6
Statistical discharge—leave	1	1	0.0%	..	..	1	0.0%	..
Died	58	193	6.5%	3.3	30	163	5.9%	5.8
Other discharge—mostly to usual residence	647	2,202	73.8%	3.4	99	2,103	75.9%	3.8
Total	**831**	**2,982**	**100%**	**3.5**	**210**	**2,772**	**100%**	**4.5**

Of the 210 patients who had a same day flag, 80 separations (38.1%) were transferred to another acute care facility, 99 (42.8%) were discharged to their usual residence, and 30 (14.2%) died (Table 2.9).

Of the 58 deaths, 40 (68.9%) were male. Six of those that died were less than 1 year of age and 24 (41.4%) were aged 1–3 years. More than half of the patients (n=30) had a same day flag. Another 12 separations had a stay of 1 day. Fifty of the deaths had 994.1 *Effects of drowning and submersion* as principal diagnosis.

3 Persisting morbidity among hospitalised near drownings

This Chapter aimed:

- To define persisting morbidity for purposes of this report;
- To identify cases with 'probable' persisting morbidity from hospital separations for Australia for 1997–98; and
- To present the profile of identified cases with probable persisting morbidity.

3.1 Defining persisting morbidity

For purposes of this report, persisting morbidity resulting from near drownings was defined in terms of impairment (in the context of a health condition), i.e 'any loss or abnormality of psychological, physiological or anatomical structure or function' (Wen and Fortune 1999) that will persist over time and that follows a near drowning.

National hospital separations data do not include outcome measures other than mode of separation and it was not possible to identify impairment directly from the national data set. NHMD variables that do provide some clues about the outcome of injury events are diagnoses recorded, Mode of separation, LOS, and, to some degree, procedures performed.

In ICD-9-CM there are a number of diagnoses codes that, by the nature of the injury they describe, imply persisting morbidity. Examples are 806.01 (*Fracture of vertebral column at C1–C4 level with complete lesion of cord*) or 897.2 (*Unilateral amputation of leg at or above knee (complete/partial) without mention of a complication*). For some other diagnoses, the probability of persisting morbidity is high (e.g. 348.1 *Anoxic brain damage* or 780.1 *Coma*). However, the outcomes of such cases vary according to factors such as hemodynamic status on arrival at emergency departments and neurologic status thereafter (Habib, Tecklenburg et al. 1996). Hospital separations data do not provide information on these factors.

For this report, it was decided to base 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. In addition, it was assumed that LOS, together with Mode of separation, diagnoses recorded (i.e. diagnoses other than those already mentioned), and procedures could act as a guide to identifying other possible cases with persisting morbidity.

The focus of this report was therefore on persisting morbidity. Cases with impairment for a limited period of time were not considered. For example, a person who sustained a fracture during an immersion, who were admitted but discharged after a few days would obviously have been impaired for a few weeks. It is highly likely that this patient would recover fully. Such cases were not included in the selection of cases reported on in this section. Also, cases with minor/mild brain injury (e.g. concussion) that might have a long-term effect, but which could not be identified at the point of separation was also excluded. As stated in Section 2.3.3, a number of people appeared to have had some type of persisting morbidity before the near drowning. Such cases were also not considered for inclusion in Section 3.3.

3.2 Identifying 'probable' persisting morbidity cases

The process of identifying cases relevant for this section was not straightforward and involved six steps as outlined. The outcome of the selection process is shown in Table 3.2.

Step 1: Reviewing ICD-9-CM diagnoses

The ICD-9-CM was reviewed to identify those diagnoses that implied persisting morbidity or that had a high likelihood of persisting morbidity. These are listed in Table 3.1.

Table 3.1: Diagnoses with a high likelihood of persisting morbidity

Code	Description
348.1	Anoxic brain damage
780.01	Coma
780.03	Persistent vegetative state
800.1–.4, .6–.9	Fracture of vault of skull, with some mention of intracranial injury
801.1–.4, .6–.9	Fracture of base of skull, with some mention of intracranial injury
803.1–.4, .6–.9	Other and unqualified skull fractures, with some mention of intracranial injury
804.1–.4, .6–.9	Multiple fractures involving skull or face with other bones, with some mention of intracranial injury
806.0–806.9	Fracture of the vertebral column with SCI
850.4	Concussion with prolonged loss of consciousness, without return to pre-existing conscious level
851.0–.9	Cerebral laceration and contusion
852.0–.9	Subarachnoid, subdural and extradural haemorrhage, following injury
854.0–854.1	Intracranial injury of other and unspecified nature
871.0–.6	Open wound of eyeball
885.0–.1	Traumatic amputation of thumb (complete or partial)
886.7–.1	Traumatic amputation of arm and hand (complete or partial)
896.0–.3	Traumatic amputation of foot (complete or partial)
897.0–.7	Traumatic amputation of leg(s) (complete or partial)
950.0–.9	Injury to optic nerve and pathways
951.0–.9	Injury to other cranial nerves
952.0–.9	SCI without evidence of spinal bone injury
953.0–.9	Injury to nerve roots and spinal plexus
954.0–.9	Injury to other nerve(s) of trunk, excluding shoulder and pelvic girdles
955.0–.9	Injury to peripheral nerve(s) of shoulder girdle and upper limb
956.0–.9	Injury to peripheral nerve(s) of pelvic girdle and lower limb
957.0–.9	Injury to other and unspecified nerves

Step 2: Exclusion of deaths and low severity cases

Frequencies for 'Separation mode' were reviewed and the following cases were excluded:

- all deaths (42 of the deaths had a LOS of 1 day (of these 30 had a same day flag) and only 3 deaths had a LOS of more than 14 days); and
- all cases that had a stay of two days or less and that were discharged to their usual residence. (The choice of two days or less was arbitrary and these cases were excluded because it was thought unlikely that they would have any persisting morbidity.)

Step 3: Selecting cases with probable persisting morbidity

Of the 258 remaining separations, those with any diagnosis listed in Table 3.1 were selected.

Step 4: Review of remaining cases

The remaining cases were reviewed individually in terms of LOS, diagnoses recorded, procedures performed and mode of separation to identify all possible cases with persisting morbidity.

Step 5: Rechecking all near drownings

The original total of 831 cases were checked for cases that may have included a similar profile than the probable persisting morbidity cases to ensure that all possible cases were included.

Step 6: Allowing for multiple counting of separations

Hospital separations include those that were transferred from one hospital to another acute facility, as well as cases that were readmitted. Therefore, separations do not reflect incident cases. In selecting cases with persistent morbidity it was possible to identify 12 cases counted twice (6 individual patients) as these cases had the same date of birth and other relevant variables were similar. The data for these cases were combined and the results reported in Section 3.2 therefore reflect individual cases and not separations.

Table 3.2: Outcome of selection process for persisting morbidity cases

STEP 1:		**ICD-9-CM reviewed and relevant diagnoses were identified**
STEP 2:		**831 separations had some mention of an immersion event**
Excluded:	515	'Low' severity cases, i.e. cases with a LOS < 3 days which were discharged to usual residence
	58	Deaths
STEPS 3 and 4:		**258 separations had a 'high' severity, i.e. LOS was 3 days or more**
Included:	41	Cases with relevant diagnosis as listed in Table 3.1
Excluded:	146	Cases that did not meet the criteria
	39	Transfers to acute hospital, no other information
	16	Transfers to acute hospitals, but low severity cases
	7	Transfers to other acute hospitals, lack of facilities, no other information
	6	Transfers to other acute facility—unknown whether for immersion event, but persistent morbidity not likely from immersion event or due to another pre-existing condition
	3	Transfers to acute hospital because of lack of facilities, but low severity cases
STEP 5:		**No relevant cases were identified in Step 5.**
RESULT:		41 separations with probable persisting morbidity
STEP 6:		**Allowances were made for the 6 double counted cases.**
RESULT:		35 individual cases with probable persisting morbidity

Although care was taken to select all probable cases with persisting morbidity, some cases may have been missed. For many cases where the patient was transferred to another acute facility, no additional diagnoses were provided and no conclusion could be made as to the outcome of these cases.

3.3 Profile

Please note:
This Section deals with individual cases, whereas Chapter 2 deals with separations.

3.3.1 Age and sex

A total of 35 individual cases with probable persisting morbidity were identified. This was 4.9% of the 721 estimated incident cases (Table 3.3). Males made up 74.3% of the cases.

Table 3.3: Key indicators for hospitalised immersion cases with probable persisting morbidity; Australia 1997–98

Indicator	Males	Females	Persons
Number of **patients** with probable persisting morbidity	26	9	35
Per cent of 721 estimated incidence cases	5.4%	3.8%	4.9%
Crude rate per 100,000 population	0.3	0.1	0.2

Nearly 70% of the male cases were older than 19 years (Figure 3.1). This is very different from the profile for all immersion separations as shown in Figure 2.1.

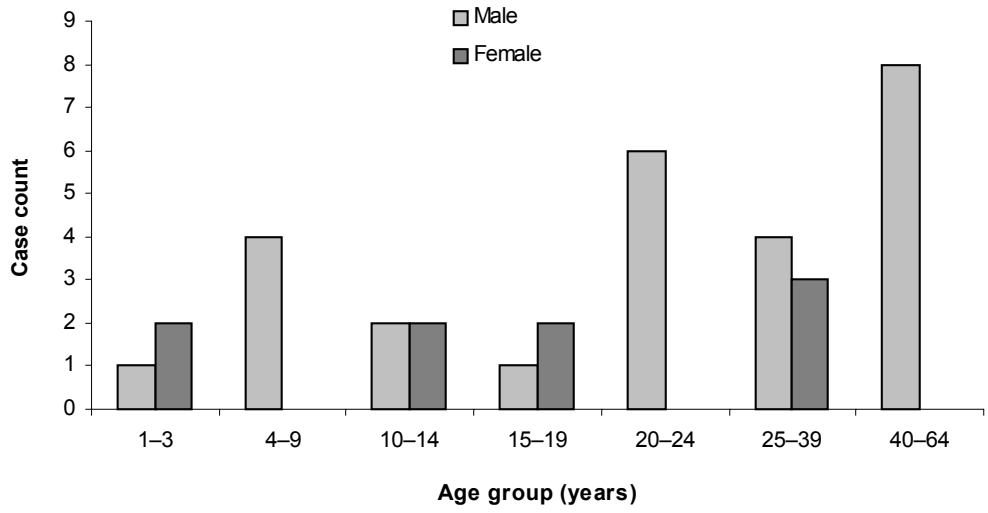

Figure 3.1: Case counts for hospitalised immersions with probable persisting morbidity, by age group and sex; Australia 1997–98

3.3.2 Circumstances of near drowning

Mechanism

The majority of cases with persisting morbidity were coded to E910 (*Accidental submersion*) (Table 3.4). Of these, eight cases were coded to E910.2 (*Accidental submersion while engaged in other sport or recreational activity without diving equipment*). Five cases involved a swimming pool (E910.5 and E910.6) and three occurred in a bathtub (E910.4).

Table 3.4: External causes of hospitalised immersions with probable persisting morbidity; Australia 1997–98

Description	E-code	Males	Females
Accidental submersion			
While engaged in other sport or recreational activity with diving equipment	E910.1	1	0
While engaged in other sport or recreational activity without diving equipment	E910.2	7	1
In bathtub	E910.4	1	2
While swimming in swimming pool	E910.5	0	1
Following fall into swimming pool	E910.6	3	1
Following fall into natural water	E910.7	2	3
Other accidental drowning and submersion	E910.8	1	0
Subtotal		*15*	*8*
Boating-related immersions			
Other accidental submersion in water transport accident: occupant of small boat, powered	E832.1	3	0
Other accidental submersion in water transport accident: water skier	E832.4	1	0
Other accidental submersion in water transport accident: swimmer	E832.5	1	0
Subtotal		*5*	*0*
Other unintentional events			
Fall from or out of building or other structure	E882	1	0
Fall into hole/other opening in surface: —diving/jumping into water (swimming pool)	E883.0	2	0
Other falls from one level to another	E884.9	0	1
Accident caused by electric current: other	E925.8	1	0
Subtotal		*4*	*1*
Intentional and undetermined events			
Self-inflicted injury by poisoning tranquillisers and other psychotropic agents	E950.3	1	0
Self-inflicted injury by submersion	E954	1	0
Subtotal		*2*	*0*
Total number of cases		**26**	**9**

For male cases with persisting morbidity, age seemed to be related to the mechanism of the injury (Figure 3.2). For example, in boys younger than 10 years, swimming pool-related events were a prominent feature, whereas boating-related immersion were more of a feature for males aged 20–24 years and 40–64 years.

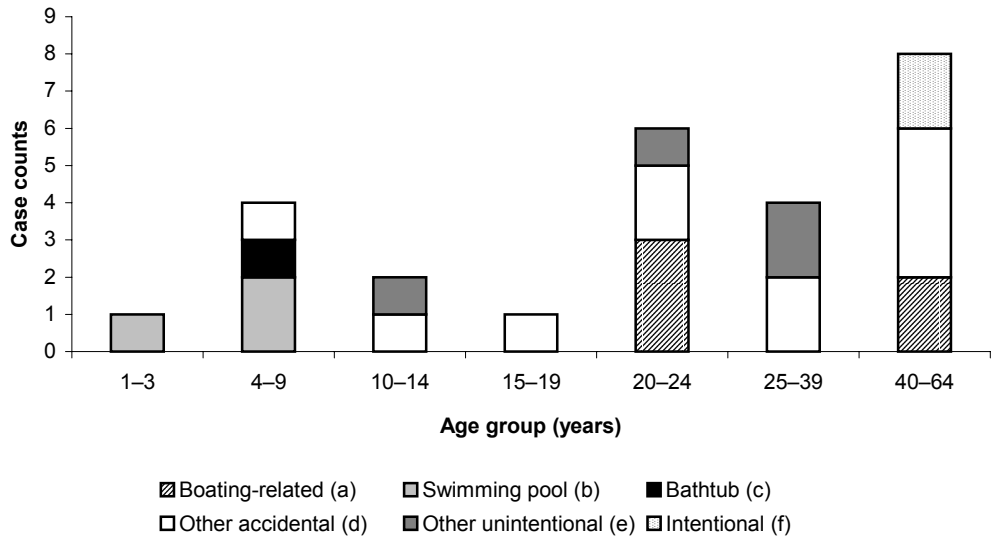

Figure 3.2: Main mechanism groups by male age group for hospitalised immersion cases with probable persisting morbidity; Australia 1997–98

(a) Separations coded to E830.0–E830.0, E832.0–E832.9 or E838.1
(b) Separations coded to E910.5 and E910.6
(c) Separations coded to E910.4
(d) Separations coded to E910.0–.3, E910.7–.9
(e) Separations coded to E880, E882, E883, E884.9, E904.3, E908.2, E917.2, E917.2, E919.1, E919.1, E925.8, E927.0, and E878.0
(f) Separations coded to E950, E953.8, E954, E958.3, E964, E984, and E987.1

A similar figure for females are not shown because small numbers complicates interpretation of data.

Place

Of the cases where Place of injury occurrence information was available, the data were not useful for about half of them. That is, the data were coded to *Other specified place*.

Table 3.5: Place of occurrence among hospitalised immersion cases with probable persisting morbidity; Australia 1997–98

Place of occurrence	Case counts
Home	5
Place of recreation or sport	5
Public building	1
Residential institution	1
Other specified place	11
Place not specified	3
Total	**26**

(b) There were missing values for 9 cases.

3.3.3 Diagnoses

A total of 235 diagnoses were recorded for the 35 cases with probable persisting morbidity, i.e. an average of 6.7 per separation.

Table 3.6 shows the following in regard to the Principal Diagnoses:

- About one-third of the cases had 994.1 (*Effects of drowning and non-fatal submersion*) as the Principal Diagnosis.
- Nine cases had a spinal cord injury as the Principal Diagnosis.
- For 6 cases a head injury was the Principal Diagnoses.

Table 3.6: Principal diagnoses for hospitalised immersions with probable persisting morbidity ; Australia 1997–98

Principal diagnosis	ICD-9-AM Code	Case counts
Effects of drowning and non-fatal submersion	994.1	11
Intracranial injury of other and unspecified nature, without mention of open intracranial wound—unspecified state of consciousness	854.00	2
Electrocution and non-fatal effects of electric current	994.8	1
Spinal cord injury without evidence of spinal bone injury—unspecified site of spinal cord	952.9	1
Spinal cord injury without evidence of spinal bone injury—C5–C7 level with unspecified spinal cord injury	952.05	1
Spinal cord injury without evidence of spinal bone injury—C1–C4 level with unspecified spinal cord injury	952.00	1
Other and unspecified intracranial haemorrhage following injury, without mention of open intracranial wound - unspecified state of consciousness	853.00	1
Open fracture of shaft of clavicle	810.12	1
Closed dorsal fracture at T1–T6 level with anterior cord syndrome	806.22	1
Closed cervical fracture at C5–C7 level with other specified spinal cord injury	806.09	1
Closed cervical fracture at C5–C7 level with complete lesion of cord	806.06	1
Closed cervical fracture at C5–C7 level with unspecified spinal cord injury	806.05	1
Closed cervical fracture at C1–C4 level with anterior cord syndrome	806.02	1
Closed cervical fracture at C1–C4 level with complete lesion of cord	806.01	1
Multiple closed fractures without mention of intracranial injury with LOC of unspecified duration	804.06	1
Closed fracture of base of skull with intracranial injury of other and unspecified nature - with prolonged [> 24 hours] LOC and return to pre-existing conscious level	801.14	1
Open fracture of vault of skull with other and unspecified intracranial haemorrhage with LOC of unspecified duration	800.86	1
Unspecified intestinatal obstruction	560.9	1
Pneumonitis due to inhalation of other solids and liquids	507.8	1
Generalised convulsive epilepsy	345.10	1
Conduct disorder, childhood onset	312.81	1
Major depressive disorder—unspecified	296.20	1
Other specified rehabilitation procedure	V57.89	1
Care involving other physical therapy	V57.1	1
Total		**35**

There was a total of 200 additional diagnoses recorded, i.e. an average of 5.7 per separation.

These additional diagnoses were considered together with the principal diagnoses in order to identify broad types of injury:

- Traumatic brain injury (TBI), i.e. the patient had one or more diagnoses signifying a major head injury (e.g. 348.1 *Anoxic brain damage*) or;
- Spinal Cord Injury (SCI), i.e. there were one or more diagnoses that implied definite SCI.
- Other, i.e. the patient did not seem to have a TBI or SCI.

A total of 33 (94.2%) had either a TBI or a SCI (Table 3.7). Another one case had both TBI and SCI. This case had 780.09 (*Other alteration of consciousness*) as the head injury diagnosis. The remaining case did not have a NOI code that indicated head trauma, but there was the potential for acquired brain injury. The patient had, *inter alia*, an intracranial abscess (324.0) and meningitis (599.0).

Table 3.7: Broad type of injury (as based on all available diagnoses) for hospitalised immersions with probable persisting morbidity by age group; Australia 1997–98

Age group (in years)	Type of injury			
	TBI	SCI	TBI + SCI	Other
1–3 years	3			
4–9 years	4			
10–14 years	3	1		
15–19 years		2		1
20–24 years	5	1		
25–39 years	3	3	1	
40–64 years	5	3		
Total	**23**	**10**	**1**	**1**

Of the TBI cases, 11 had diagnoses that might indicate relatively mild head injury, e.g. 780.09 (*Other alteration of consciousness*) or 850.1 (*Concussion with brief loss of consciousness*). It was assumed that these diagnoses indicated less severe injuries. Also, the cases did not have any other diagnoses that indicated more serious injury. However, for 12 cases the head injury seemed to be of a more serious nature.

All 35 cases were younger than 65 years (Table 3.7):

- Of the 23 TBI cases, 10 were aged younger than 15 years and 8 were between 20 and 39 years.
- Seven of the SCI cases were younger than 40 years.
- The 1 case with both SCI and TBI was a female aged 32 years.

For 6 of the 9 SCI cases, the E-code was E910.2 (*Accidental submersion while engaged in other sport or recreational activity without diving equipment*). *Fall into hole or other opening in surface* (E883.0) accounted for 2 cases and 1 case was due to *Other accidental submersion in water transport accident as a water skier* (E832.4).

Fourteen of the 23 TBI cases were due to accidental submersion (E910). Of these, 5 involved a swimming pool (E910.5 and E910.6).

3.3.4 Procedures

A total of 90 procedures were recorded for the 35 cases with persisting morbidity, i.e. an average of 2.6 procedures per case. Nine cases did not have any procedure recorded. If these are excluded, the average number of procedure per case was 3.4. The principal procedures are listed in Table 3.8. These procedures give an indication of the more serious nature of the injuries for cases with persisting morbidity.

Table 3.8: Principal procedures for hospitalised immersions with probable persisting morbidity, Australia 1997–98

Principal procedure and Description	Frequency	Per cent
No principal procedures recorded	9	22.0
87.03 Computerised axial tomography of head	3	8.6
96.04 Insertion of endotracheal tube	4	11.4
96.72 Continuous mechanical ventilation for 96 consecutive hours or more	1	2.9
88.38 Other computerised axial tomography	3	8.6
31.1 Temporary tracheostomy	2	5.7
02.04 Bone graft to skull	1	2.9
02.94 Insertion or replacement of skull tongs or halo traction device	1	2.9
34.04 Insertion of intercostal catheter for drainage	1	2.9
38.91 Arterial catheterisation	1	2.9
57.32 Other cystoscopy	1	2.9
79.39 Open reduction of fracture to other specified bone with internal fixation	1	2.9
86.59 Suture of skin an subcutaneous tissue of other sites	1	2.9
88.93 Magnetic resonance imaging of spinal canal	1	2.9
93.20 Other physical therapy musculoskeletal manipulation	1	2.9
93.22 Ambulation and gait training	1	2.9
94.70 Social work assessment	1	2.9
96.07 Insertion of other (naso-)gastric tube	1	2.9
96.70 Continuous mechanical ventilation of unspecified duration	1	2.9
Total	**35**	**100**

3.3.5 Length of stay

The 35 cases resulted in a total of 1,191 bed days, i.e. an ALOS of 34.0 days. All 12 cases with a LOS of 1 day refer, to cases where there was a transfer to an acute hospital (Table 3.9).

Table 3.9: Length of stay for hospitalised immersions with probable persisting morbidity; Australia 1997–98

Length of stay	Separations	Per cent
1 day [(a)]	12	34.3
3–4 days	6	17.1
5–7 days	3	8.6
8–14 days	3	8.6
15–21 days	2	5.7
22–28 days	1	2.9
36–48 days	1	2.9
More than 6 weeks	7	20.0
Total	**35**	**100%**

(a) These were cases that were transferred to other acute facilities.

SCI accounted for about 29% of the identified cases with persisting morbidity, but made up more than 54% of the total LOS for such separations (Table 3.10). These cases also accounted for the longest ALOS, i.e. 64.4 days.

Table 3.10: Counts, total and average length of stay by broad injury type for hospitalised immersions with probable persisting morbidity; Australia 1997–98

Broad type of injury	Case count	Per cent	Total LOS	Per cent	ALOS
TBI	23	65.7%	354	29.7%	15.4
SCI	10	28.6%	644	54.1%	64.4
SCI and TBI	1	2.9%	192	16.1%	..
No SCI or TBI	1	2.9%	1	0.1%	..
Total	**35**	100%	**1,191**	100%	**29.0**

The LOS shown in Tables 3.9 and 3.10 are underestimates of the true LOS for the identified cases. This is because a large proportion of cases were transferred to other acute facilities and the total LOS could not be determined for these cases, except for 6 cases where double counting could be allowed for. Also, time spent in rehabilitation centres were unknown and could not be included.

3.3.6 Separation mode

More than 50% of the separations were transferred to another acute hospital (Table 3.11). The nature of the selection process excluded deaths.

Table 3.11: Mode of separation for hospitalised immersions with probable persisting morbidity; Australia 1997–98

Mode of separation	Frequency	Percent
Trans to other acute hospital	18	51.4%
Trans to nursing home	1	2.9%
Trans to psychiatric facility	1	2.9%
Statistical discharge type change	3	8.6%
Other discharge to usual residence	12	34.3%
Total	**35**	**100%**

4 Data issues

4.1 Data sources

The data on hospital separations and population data were provided by the AIHW.

4.2 Selection criteria

The selection criteria were discussed in Sections 2.1 and 3.2.

Cases with E993.3 were investigated, but were not included as these cases mostly seemed to result from medical or surgical procedures. Also, one case that was included in the near drowning selection was excluded. This case had a diagnosis code of 994.1, but the E-code was E913.2 (*Accidental mechanical suffocation due to lack of air in closed place*). The diagnosis code for asphyxiation and strangulation is 994.7 and it was taken that the original 994.1 code in the database was a mistake.

4.3 Hospitalised cases vs other cases

Only some injuries from near drownings result in admission to a hospital. Hence, cases which rapidly result in death are not included. Also, cases that resulted in a visit to a general practitioner or to an emergency department, but did not get admitted to a hospital, are excluded, as is the still larger group of cases that do not result in a visit to a medical service at all. In general, cases admitted to a hospital are more serious, or require observation because they might be serious, or require particular forms of treatment.

4.4 Errors, inconsistencies and uncertainty in the data

The data used for this report were abstracted from medical records in hundreds of hospitals and coded and entered by a large number of people, operating in distinct State and Territory hospital systems and further processed by the AIHW and NISU. Consequently, and despite the existence of a well defined National Minimum Data Set for hospital in-patient data, variations occur in the data, between places and over time. The following data issues are relevant to this project:

- The quality of External Cause and Place coding in Australian hospital in-patient collections remains uncertain. They have been the subject of few published studies, and they are not necessary for deriving Diagnosis Related Groups and other key outputs of the data source.
- Not all hospital separations are new incident cases, i.e. hospitalisations include repeat admissions and transfers between acute hospitals.
- Changes in hospital admission policies may have influenced age-standardised rates reported, as might changes to coding or reporting of data.
- According to ICD-9-CM (second Australian edition), a *Place* code was required for cases given an external cause code in the ranges E850–E869 and E880–E928 (i.e. accidental injuries other than transport accidents, and excluding medical misadventures). In practice, a *Place* code was commonly provided for cases with a wider range of external cause codes. This practice was consistent with the guide for use of this item given in the National Health Data Dictionary (NHDD) (p 185): 'A place of occurrence code must accompany each related external cause code' (Australian Institute of Health and Welfare 1998). In particular, 'transport accidents' were commonly allocated a place code, usually *Street or Highway*. (This changed with the introduction of ICD-10-AM.)

4.5 Calculation of rates

Rates were calculated using final population estimates as at 31 December of the relevant years. Some rates have been adjusted for age to overcome the effect of differences in the proportions of people of different ages (and different injury risks) in the populations that are compared. Direct standardisation was employed, taking the Australian population in 1991 as the standard. Changes in age composition are small within narrow age bands (e.g. 15–19 years) and adjustment has not been applied to 5-year age groups.

4.6 Transition from ICD-9-CM to ICD-10-AM

Hospital separations data are usually reported according to financial year. Up to the end of June 1998, hospital data were coded according to the second version of the Australian modification of ICD-9 (ICD-9-CM) (Table 4.1).

A first version of the Australian modification of ICD-10 (i.e. ICD-10-AM) was introduced at various stages in the different States and Territories. From 1 July 1998, New South Wales, Victoria, Northern Territory and the Australian Capital Territory coded data according to ICD-10-AM (Table 4.1). The other four jurisdictions started coding data according to ICD-10-AM from 1 June 1999 (Table 4.1).

Table 4.1. Use of ICD in national hospital morbidity data; Australia

ICD-9-CM US version	ICD-9-CM First Australian edition	ICD-9-CM Second Australian edition	ICD-10-AM First edition	ICD-10-AM First Edition	ICD-10-AM Second Edition
1993 – 1/07/95 National	1/07/95 – 30/06/96 National	1/07/96 – 30/06/98/ National	1/07/98 – 30/06/99 NSW, VIC, NT, ACT	1/07/99 – 30/06/00 National	1/07/00 to current National
		1/07/98 – 30/06/99 QLD, WA, SA, TAS			

An important element in producing useful injury statistics is the representation of trends in the rates of injury. Unfortunately, each time a new ICD revision has been implemented in the past, it has produced some level of discontinuity in the ability to produce such analyses (Australian Institute of Health and Welfare Draft).

There are uncertainties as to how the transition to ICD-10-AM will influence time series for injury, including data on near drownings.

The AIHW has done some analyses in regard to dual coded hospital separations data (i.e. data coded to both ICD-9-CM and ICD-10-AM), but the number of cases available for injury was quite small. That is, less than 700 dual coded separations related to injury were compared and numbers on near drowning were much too small for an assessment of likely discontinuity (Australian Institute of Health and Welfare *Draft*).

NISU has investigated the impact of the transition from ICD-9 to ICD-10 for mortality deaths by analysing dual coded data for the years 1997 and 1998 (NISU Unpublished data 2001). They found that the comparability ratio[4] for drownings (i.e. cases coded to E910) was 1.02—a CR of 1.00 indicates no real difference between coding outcomes under the two versions of ICD. This seems to indicate that the transition to ICD-10 did not have a large impact for a large number of drowning deaths (i.e. those coded to E910).

In order to investigate the impact on near drownings among hospital separations data, trends for these data were plotted in Figure 4.1.

Interpretation of trends are not straightforward. Small numbers of separations are involved and the number of data points is also small. Figure 4.1 shows that the case counts and age-standardised rates show a decrease for 1999–00. More data years are needed to interpret this pattern. That is, it is uncertain whether the decreases are due to the fact that 1999–00 is the first year where all jurisdictions coded to ICD-10-AM or whether it signifies a decrease in the number of separations. It does, however, appear as if the transition to ICD-10-AM did not have any major effects on time trends for drownings.

[4] A comparability ratio for a specific cause of injury is calculated by dividing the number of cases arrived at by coding to ICD-10 by the number arrived at through coding to ICD-9.

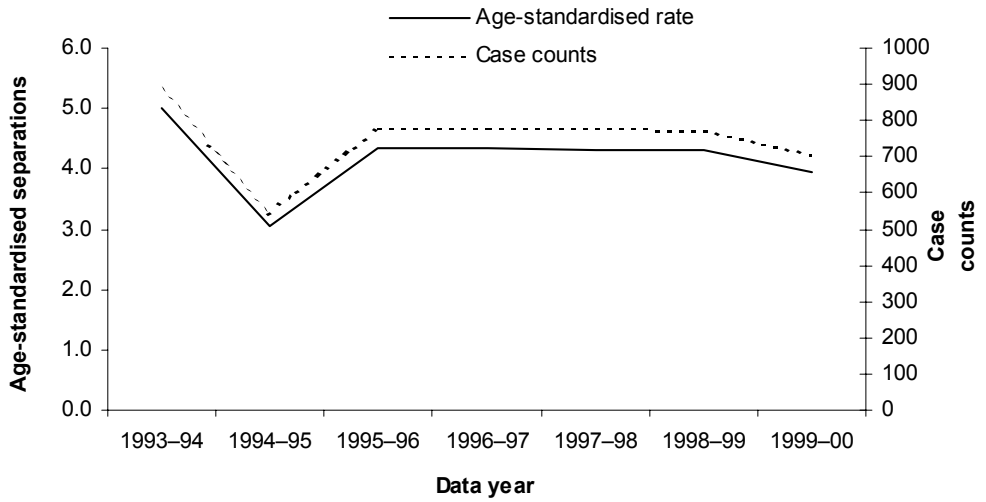

Figure 4.1: Trends in hospitalised immersions, Australia 1993–94 to 1999–00

Codes used for 1993/94–1997–98: ICD-9-CM codes E910, E830, E832, E954, E964 and E984

Codes used for 1998/98–1999–00: ICD-10-AM codes W65–W74, V90, V92, X71, X92, and Y21 (1998–99 data for SA, WA, Tasmania and NT were mapped to ICD-10-AM, see Table 4.1)

5 Other sources of information

In addition to hospital separations data, other sources of information may provide useful insight into persisting morbidity resulting from immersion events. Inquiries into other data sources with routine reporting of cases were therefore made in order to determine whether these could be used to quantify persisting morbidity or whether they could supplement the hospital morbidity collection.

5.1 Methods

Possible data sources that routinely collected information and that would allow identification of persisting morbidity were identified by contacting the relevant health departments in the various jurisdictions. The snowball technique was used to identify relevant contact persons. Where appropriate, the identified people were interviewed according to a proforma with relevant questions as listed in Table 5.1.

Table 5.1: Questions asked of identified contact people

Do you include drowning/near drowning cases in your data source?
What is your definition of near drowning/immersion event?
Are some cases excluded, e.g. low severity cases, cases related to boating/bathtub, etc?
Can you provide me with a list of data items in your data source? (Please fax or e-mail).
Does your data source include measures of severity? If yes, please describe.
Does your data source include outcome measures? If yes, please describe.
Do you have any specific items that relates to persisting morbidity?
Persisting morbidity resulting from immersion events is defined in terms of impairment, i.e. 'any loss or abnormality of psychological, physiological or anatomical structure or function' that will persist over time and that follows an immersion event.
Do you have any plans to include (other) severity or outcome measures in your data source in the future?
Do you know of any other possibly relevant routine data sources on near drownings?

The following data sources were investigated:

- Trauma registries in SA, Queensland, NSW, WA, and Victoria. (There are no trauma registries in Tasmania or the NT).
- The Australian Spinal Cord Injury Register.

5.2 Results

5.2.1 Trauma registries

'A trauma registry is a database comprising routinely collected clinical and process information from all patients considered to be sufficiently severely injured to be worthy of ongoing review' (Neale, Kassulke et al. 1998).

NSW

In NSW there is no State wide registry, but four hospitals each have a trauma registry. At the time of writing, there were discussions between stakeholders as to the establishment of a State wide trauma registry.

One of the registries is at Westmead Hospital. This trauma registry did not include drownings before January 2001. From January 2001, all near drowning cases that presented to the emergency department (ED) or that were admitted, were included in the registry. Currently there is no follow-up of cases—this is done by rehabilitation teams. The registry does not have outcome measures other than diagnoses and separation mode.

Another registry is operating at Royal North Shore Hospital, but near drownings are not recorded in this registry.

The Royal Alexandra Hospital for Children supports a trauma registry which includes near drowning. Severity is measured by means of ISS scores, with a score of more than 15 being severe. It should be noted that this scoring system was designed for adult injury, rather than for paediatric application. Outcome measures include data on procedures and treatment.

Liverpool Hospital also has a trauma registry, but they do not include near drowning.

The John Hunter Hospital in Newcastle also has a trauma registry. This hospital includes near drownings. The following information is collected: trauma management in the pre-hospital phase, socio-demographic and identifying variables, cause and place of injury, data relevant to admission, disposal from ED, injury outcome, diagnosis and ISS. The registry does not include any measures on functional status at the time of discharge and there is no follow-up of patients after discharge as lack of resources does not allow for this.

Victoria

In this jurisdiction there is the Victorian State Outcomes Register. This register records only 'major' trauma, which excludes near drowning unless another injury is also present, for example, spinal cord injury damage.

Queensland

The Queensland Trauma Registry operates at four Level 6 hospitals and ten Level 5 hospitals throughout the State. For data collection purposes, a distinction is made between minor and major trauma cases. Major trauma refer to admissions where the injury case had an ISS ≥ 16, were admitted to intensive care or died during admission. Near drownings are included in the major trauma data collection if the patient met the relevant inclusion criteria. Minor trauma is classified as being an injury, but not meeting major trauma criteria.

For the minor data collection, the following information is collected: socio-demographic and identifying variables, cause and place of injury, data relevant to admission, disposal from ED, injury outcome, diagnosis (as coded to the Abbreviated Injury Score (AIS)), and ISS. The major data collection includes additional information and covers trauma management from the pre-hospital phase through to discharge from hospital. This includes data on complications and operations, as well as performance indicators in regard to the trauma registry. The registry does not include any measures on functional status at the time of discharge and there is no follow-up of patients after discharge, as lack of resources does not allow for this.

Western Australia

Four hospitals in this State have trauma registries, but none include near drowning in their trauma registry as they do not consider such cases to be trauma cases.

South Australia

Three major SA trauma centres (Royal Adelaide Hospital (RAH), Flinders Medical Centre and the Women's and Children's Hospital) each have a trauma registry. The Injury Surveillance and Control Unit collate these data in a central database. The inclusion criteria for all three centres exclude near drownings. However, those patients who experienced an immersion event are included in the registries if they meet any of the other inclusion criteria, such as having an ISS≥9 (for RAH the ISS limit is $\underline{>}$16).

The trauma registry includes information on the socio-demographic data, data about the circumstances of the injury event; pre-hospital (including the revised trauma score (RTS), the Glasgow Coma Score (GCS) or the paediatric trauma score); data about the resuscitation and transport; as well as certain information on the outcome of the injury. This includes: destination from the emergency department (ED), occupied bed days, destination on discharge, diagnostic radiology, operative procedures, whether the patient sustained a cervical spinal injury or not, the AIS together with ISS (New ISS is used), ICD nature of injury codes (these will include, for example, anoxic brain damage), co-morbid medical conditions, and complications directly related to the injury (these refer to, for example, an infection of an injury wound). There is no follow up of

patients after discharge and the registry does not include any measures on functional status at the time of discharge.

ACT

There is a trauma registry in this jurisdiction, but near drownings are not routinely collected because the sources do not have the collection capacity. If resources allowed, such cases would be included.

5.2.2 The Australian Spinal Cord Injury Register

The Australian Spinal Cord Injury Register (ASCIR) is a cooperative arrangement of the 6 Australian spinal units and the AIHW National Injury Surveillance Unit. At the time of writing, the Register was in its seventh year of operation and had about 10,000 registered incident cases. Of these, about 4,000 originated from a data collection that operated from 1986–1991.

The ASCIR collects data on incident cases from traumatic and non-traumatic causes, as well as on readmissions to the spinal units. Coverage of the adult population by the ASCIR was assessed to be complete (O'Connor 2000).[5]

The case definition employed for registration of traumatic SCI cases reads: '… a case of spinal cord injury is defined as the occurrence of an acute, traumatic lesion of neural elements in the spinal canal (spinal cord and cauda equina) resulting in temporary or permanent sensory deficit, motor deficit, or bladder/bowel dysfunction' (Thurman, Kraus et al. 1995). Obviously the cases in the ASCIR will only reflect spinal cord injury cases that resulted from an immersion event. The data source does not include near drownings that did not result in a spinal cord injury.

Data are coded using the National Data Standards for Injury Surveillance, Level 2 and the ASCIR currently includes:

- identifying information of the patient;
- socio-demographic items, e.g. sex, employment status;
- acute admission data, including reason for admission, spinal diagnoses on acute admission, additional diagnoses, and ASIA impairment scale measure on admission, complications of care;
- data on the injury event that resulted in the admission, e.g. External Cause, Place;
- clinical management information, such as complications and procedures; and

[5] Coverage is incomplete for paediatric cases. Investigations show that the ASCIR covers about half of all paediatric cases that occur annually. However, the case numbers involved are small—about 5 cases per year nationally—and overall trends are not affected substantially.

- discharge data, such as ASIA impartment scale at discharge, mode of separation, principal SCI diagnosis, discharge date, functional assessment at discharge as measured by the Functional Independence Measure.

6 Summary

Hospitalised near drownings

A total of 831 near drowning cases were identified among hospital separations for 1997–98. These are not incident cases. The selection criteria were set to identify every possible near drowning. The identified separations would include those that were transferred from one hospital to another acute facility, cases that were readmitted, as well as statistical type discharges. It was estimated that there were about 721 incident cases for 1997–98, which yielded a crude incidence rate of about 4 per 100,000 population for this year.

For the 831 near drowning cases included in this report, 1 in 14 died. This was quite different from injury and poisoning in general where 1 in about 113 cases die annually (NISU Unpublished data 2002).

The 0–5 years age group is one of the key demographic groups identified in the National Water Safety Plan (Australian Water Safety Council 1998). There is good reason for this. *Death* rates due to drowning are highest for children aged 0–4 years, i.e. the death rate for boys was about 5 per 100,000 for the period 1992–1998 and around 3 per 100,000 for girls during the same period (NSW Injury Risk Management Research Centre 2000). For near drownings, age-specific rates, both males and females, are highest for the 0–4 year age group, i.e. 27.2 per 100,000 for boys and 20.3 for girls. These rates are higher than the comparable drowning rates. Within the 0–4 year age group, the highest numbers of hospitalised near drownings were recorded for 1–3 year olds.

For males, age-specific rates for near drowning also showed a (smaller) peak in the 20–24 year age group (the rate for this age group is 8.0 per 100,000). Thereafter age-specific rates declined and tended to be below the rate for children aged 5–14 years (the rate for children aged 0–14 years are about 5 per 100,000). This pattern is different from the profile seen for death rates—rates for drowning deaths are lowest for the 5–14 year age group (i.e. at around 1 per 100,000), whereafter the rates increase somewhat (to about 2.5 per 100,000) and more or less remain equal for the various age groups (NSW Injury Risk Management Research Centre 2000).

For females, the profile of age-specific rates for deaths and hospitalisations due to near drownings are similar, i.e. the rates are high in the 0–4 year age group, but low for the other age groups. Near drowning rates for 5-year age groups other than the 0–4 year age group were slightly higher (generally between 1.5 and 5.0 per 100,000) than those for drowning deaths (usually less than 1 per 100,000) (NSW Injury Risk Management Research Centre 2000).

Mechanisms of near drownings differed by age group. This most likely reflects changes in exposure. For example, boating related immersions were more

common in the male 20–39 and 40–59 year age groups that in the female groups of the same ages or than the other age groups. Also, many of the near drownings in children under 15 years occurred in swimming pools, whereas water activities in other bodies of water made up large proportions for the older age groups.

More than 91% (n=126) of the 236 near drownings related to swimming pools were to children aged 0–4 years old. It is well known that pool fencing significantly reduces the risk of drowning in young children and that isolation fencing is superior to perimeter fencing (Thompson and Rivara 2002). Therefore, that intervention initiatives such adequate pool fencing which aims specifically at the 0–4 year age group should, at the very least, continue but at best such initiatives should be expanded. Enforcement of legislation regarding pool fencing through pool inspection is especially important. Supervision of these children is also essential (Cass, Ross et al. 1996) (Coffman 1991).

Some 1,231 additional diagnoses were recorded for the near drownings in 1997–98. These were useful to identify a number of things:

- More than 5% of the near drownings had an association with epilepsy.
- Twenty per cent of the 50 bathtub immersions to children under 4 years had an indication that there was a fever present prior to the immersion event.
- A number of patients had pre-existing morbidities, e.g. cerebral palsy, intellectual disability, etc.

These factors have implications for prevention of near drownings. For example, parents or carers should be made aware of the danger of an immersion event occurring when a child is being treated for a fever by placing the child in a lukewarm bath.

The 831 separations resulted in 2,938 bed days. For just more than 25% of the separations, discharge occurred on the same day as the day of admission. It seemed as if many of the admissions (especially among children) were for observation purposes only. About 25% of admitted patients had a stay of 3 days or more, indicating more severe injuries.

Using the nature of injury code 994.1 in the selection criteria was useful, because it picked up otherwise 'hidden' near drowning cases. This approach may be useful for deaths data for which multicause data are available (i.e. in addition to the drowning flag). It has been reported that a number of drowning deaths are missed when only selecting on External Cause codes (Smith and Langley 1998).

It is important to include cases coded to external causes other than only those coded to the ICD-9 External Cause code traditionally seen as signifying near drownings (i.e. those coded to E910). In this report, cases coded to E910 accounted for about 86% (n=713) of the immersion cases, i.e. some 14% of cases would not have been included if the selection criteria only specified E910.

It is well known that alcohol plays a role in near drownings (Cairns, Koelmeyer et al. 1984; Copeland 1984; Smith, Keyl et al. 2001). Although additional diagnoses allowed identification of possible alcohol involvement for some cases, the information in hospital separations data were inadequate. That is, the reliability of assigning alcohol-related diagnoses codes is unknown and the exact role alcohol played in the event cannot be determined.

Persisting morbidity among near drowning cases

For purposes of this report, persisting morbidity resulting from immersion events was defined in terms of impairment, i.e 'any loss or abnormality of psychological, physiological or anatomical structure or function' (Wen and Fortune 1999) that will persist over time and that follows an immersion event. However, national hospital separations data do not include outcome measures other than 'Mode of separation'.

In this report a number of NHMD variables were used to gain some insight into persisting morbidity. These were diagnoses recorded, Mode of separation, LOS, and, to some degree, procedures performed. In regard to the diagnosis codes, it was assumed that some diagnoses imply definite persisting morbidity and for a number of others the probability of persisting morbidity was high. The validity of these assumptions is not known.

The diagnoses used to identify probable persisting morbidity (as listed in Table 3.1) provided a practical way of selecting cases. These codes could be used in future, provided that the limitations of doing so are recognised. Reviewing cases individually is very time-consuming and does not add many cases.

The term 'probable persisting morbidity' was used in this report because of the uncertainties around the actual outcomes of the identified cases.

A total of 35 individual cases with probable persisting morbidity were identified. These made up about 5% of the 721 estimated incident cases. This is similar to other literature on this topic (Nixon, Pearn et al. 1995).

All 35 near drownings with persisting morbidity were to persons aged younger than 65 years and more than 60% were aged 10–39 years. This implies a large burden of injury with many years lost due to disability.

The profile for persisting morbidity cases due to near drownings was different from the pattern for all immersions. For example, in contrast to the profile for all near drownings, nearly 70% of the male cases were older than 19 years. Also, near drownings in swimming pools were less prominent in immersion cases with probable persisting morbidity.

For male cases with persisting morbidity, age seemed to be related to the mechanism of the injury. For example, in boys younger than 10 years, swimming pool-related events were a prominent feature, whereas boating-related immersion were more of a feature for males aged 20-24 years and 40-64 years. Small numbers complicated interpretation of data for females.

Of the cases where 'Place of injury occurrence' information was available, the data were not useful for about half of them. That is, the data were coded to *Other specified place*.

A total of 235 diagnoses were recorded for the 35 cases with probable persisting morbidity, i.e. an average of 6.7 per separation. About one-third of the cases had 994.1 (*Effects of drowning and non-fatal submersion*) as the Principal Diagnosis. There was a total of 200 additional diagnoses recorded, i.e. an average of 5.7 per separation.

About 94.2% of near drowning cases with persisting morbidity had either a TBI or a SCI. Another case had both a TBI and a SCI.

Of the TBI cases, 11 had diagnoses that might indicate relatively mild head injury, but for the other 12 cases the head injury seemed to be of a more serious nature.

A total of 90 procedures were recorded for the 35 cases with persisting morbidity, i.e. an average of 2.6 procedures per case. These procedures gave an indication of the more serious nature of the injuries for cases with persisting morbidity.

The 35 cases resulted in a total of 1,191 bed days, i.e. an ALOS of 34.0 days. SCI accounted for about 29% of the identified cases with persisting morbidity, but made up more than 54% of the total LOS for such separations. These cases also accounted for the longest ALOS, i.e. 64.4 days.

More than 50% of the separations were transferred to another acute hospital. The nature of the selection process excluded deaths.

The LOS underestimates the true LOS for the identified cases. This is because a large proportion of cases were transferred to other acute facilities and the total LOS could not be determined for these cases, except for six cases where double counting could be allowed for. Also, time spent in rehabilitation centres was unknown and could not be included.

Other data sources

There is no national trauma registry. Queensland has a State Trauma Registry and the other States have trauma registries at major trauma centres. Many of the existing trauma registries do not include near drowning in their inclusion criteria, as near drowning is not seen to be 'trauma' cases, i.e. those cases that are the consequence of kinetic and penetrating energy.

Of the registries that do include near drowning, none include any outcome measures other than information as to whether the patient survived or not, where the patient was discharged to, whether the patient had any operations or procedures, and what the diagnoses were. That is, the data are similar to those contained in national hospital separations data. None of the registries have any follow up of patients—lack of resources prohibits this.

The ASCIR includes immersions cases that had a spinal cord injury and which were admitted to a spinal unit. The ASCIR include data on mode of separation, principal SCI diagnosis, discharge date, functional assessment at discharge as measured by the Functional Independence Measure. This source is useful to identify SCI cases where the patient survived and was admitted to a spinal unit.

7 References

Australian Institute of Health and Welfare (Draft). Hospital morbidity data and population health statistics: Impact of the transition from ICD-9-CM to ICD-10-AM. Canberra, Australian Institute of Health and Welfare.

Australian Water Safety Council (1998). National Water Safety Plan. Drummoyne, Australian Water Safety Council.

Australian Institute of Health and Welfare (1998). National Health Data Dictionary. Version 7. Canberra, Australian Institute of Health & Welfare.

Australian Institute of Health and Welfare (Draft). Hospital morbidity data and population health statistics: Impact of the transition from ICD-9-CM to ICD-10-AM. Canberra, Australian Institute of Health and Welfare.

Australian Water Safety Council (1998). National Water Safety Plan. Drummoyne, Australian Water Safety Council.

Cairns, F. J., T. D. Koelmeyer, et al. (1984). "Deaths from drowning." New Zealand Medical Journal **97**(749): 65-7.

Cass, D. T., F. Ross, et al. (1996). "Childhood drowning in New South Wales 1990-1995: a population-based study." Medical Journal of Australia **165**(11-12): 610-2.

Coffman, S. P. (1991). "Parent education for drowning prevention." Journal of Pediatric Health Care **5**(3): 141-6.

Copeland, A. R. (1984). "Deaths during recreational activity." Forensic Science International **25**(2): 117-22.

Department of Health and Aged Care (2001). National Injury Prevention Action Plan: Priorities for 2001-2003. Implementation Plan. Canberra, Department of Health and Aged Care**:** 36.

Habib, D. M., F. W. Tecklenburg, et al. (1996). "Prediction of childhood drowning and near-drowning morbidity and mortality." Pediatric Emergency Care **12**(4): 255-258.

Mackie, I. J. (1999). "Patterns of drowning in Australia, 1992-1997." Medical Journal of Australia **171**(11-12): 587-590.

Neale, R., D. Kassulke, et al. (1998). Queensland Trauma Registry 1998 Report, University of Queensland.

Nixon, J., J. Pearn, et al. (1995). Review of countermeasures to reduce drowning, near-drowning and spinal injuries from diving into shallow water. Canberra, Commonwealth Department of Human Services and Health.

Nixon, J., J. Pearn, et al. (1986). "Fifteen years of child drowning--a 1967-1981 analysis of all fatal cases from the Brisbane Drowning Study and an 11 year study of consecutive near-drowning cases." Accident Analysis & Prevention **18**(3): 199-203.

NSW Injury Risk Management Research Centre (2000). Analysis of drowning in Australia and pilot analysis of near-drowning in New South Wales. Sydney, Australian Water Safety Council and the University of New South Wales,**:** 75.

O'Connor, P. (2000). "Development and utilisation of the Australian Spinal Cord Injury Register." Spinal Cord **38**: 597-603.

Smith, G., P. Keyl, et al. (2001). "Drinking and recreational boating fatalities. A population-based case-control study." Jama **286**(23): 2974-2980.

Smith, G. S. and J. D. Langley (1998). "Drowning surveillance: how well do E codes identify submersion fatalities." Injury Prevention **4**(2): 135-9.

Thompson, D. C. and F. P. Rivara (2002). Pool fencing for preventing drowning in children, Cochrane Database of Systematic Reviews**:** 1.

Thurman, D., J. Kraus, et al. (1995). Standards for surveillance of neurotrauma. Geneva, World Health Organisation**:** 41.

Wen, X. and N. Fortune (1999). Physical disability - how many are affected? how is it defined? Canberra, AIHW.

Wen, X. and N. Fortune (1999). Physical disability - how many are affected? how is it defined? Canberra, AIHW.

8 Appendices

Table A8.1: Case counts, age-specific rates and male to female ratio for hospital separations due to immersion for males, females and persons; Australia 1997–98

Age group (years)	Males		Females		Persons		Male:Female rate ratio
	Case count	Age-specific rate	Case count	Age-specific rate	Case count	Age-specific rate	
1–4	180	27.2	127	20.2	307	23.8	1.3
5–9	39	5.8	25	3.9	64	4.9	1.5
10–14	33	4.9	15	2.3	48	3.7	2.1
15–19	37	5.5	17	2.7	54	4.1	2.1
20–24	55	8.0	13	1.9	68	5.0	4.1
25–29	32	4.4	10	1.4	42	2.9	3.2
30–34	20	2.8	10	1.4	30	2.1	2.0
35–39	31	4.2	5	0.7	36	2.4	6.2
40–44	24	3.5	19	2.7	43	3.1	1.3
45–49	29	4.4	11	1.7	40	3.1	2.6
50–54	13	2.3	7	1.3	20	1.8	1.8
55–59	9	2.0	6	1.4	15	1.7	1.5
60–64	9	2.5	3	0.8	12	1.6	3.0
65–69	16	4.8	4	1.1	20	2.9	4.2
70–74	6	2.1	4	1.2	10	1.6	1.7
75–79	11	5.6	2	0.8	13	2.8	7.4
80–84	1	0.9	3	1.7	4	1.4	0.5
85+	3	4.5	1	0.7	4	1.8	6.9
Total	**548**	**5.9**	**282**	**3**	**830**	**4.5**	**2.0**

Table A8.2: Case counts and proportions for E910.0–E910.9 for males age group; Australia 1997–98

Description	E-code	Case count	Per cent	Case count	Per cent	Case count	Per cent	Case count	Per cent	Case count	Per cent	Case count	Per cent
Male		**0–14 years**		**15–19 years**		**20–39 years**		**40–59 years**		**60+ years**		**All ages**	
While water-skiing	E910.0	0	0.0%	3	8.1%	3	2.9%	1	1.9%	0	0.0%	7	1.5%
While engaged in other sport or recreational activity with diving equipment	E910.1	0	0.0%	2	5.4%	5	4.9%	4	7.5%	1	3.0%	12	2.5%
While engaged in other sport or recreational activity without diving equipment	E910.2	49	19.8%	13	35.1%	60	58.3%	29	54.7%	13	39.4%	164	34.7%
While swimming or diving for purposes other than recreation or sport	E910.3	1	0.4%	1	2.7%	3	2.9%	1	1.9%	0	0.0%	6	1.3%
In bathtub	E910.4	31	12.6%	0	0.0%	2	1.9%	1	1.9%	3	9.1%	37	7.8%
While swimming in swimming pool	E910.5	49	19.8%	5	13.5%	5	4.9%	3	5.7%	3	9.1%	66	14.0%
Following fall into swimming pool	E910.6	66	26.7%	1	2.7%	0	0.0%	1	1.9%	4	12.1%	72	15.2%
Following fall into natural water	E910.7	19	7.7%	8	21.6%	20	19.4%	6	11.3%	3	9.1%	56	11.8%
Other accidental drowning and submersion	E910.8	30	12.1%	3	8.1%	4	3.9%	6	11.3%	3	9.1%	46	9.7%
Unspecified accidental drowning and submersion	E910.9	2	0.8%	1	2.7%	1	1.0%	1	1.9%	2	6.1%	7	1.5%
Subtotal for males		**247**	**100.0%**	**37**	**100.0%**	**103**	**100.0%**	**53**	**100.0%**	**33**	**100.0%**	**473**	**100.0%**

Table A8.3 Case counts and proportions for E910.0–E910.9 for females by age group; Australia 1997–98

Description	E-code	Case count	Per cent	Case count	Per cent	Case count	Per cent	Case count	Per cent	Case count	Per cent	Case count	Per cent
Females		**0–14 years**		**15–19 years**		**20–39 years**		**40–59 years**		**60+ years**		**All ages**	
While water-skiing	E910.0	0	0.0%	3	18.8%	1	3.7%	0	0.0%	0	0.0%	4	1.7%
While engaged in other sport or recreational activity with diving equipment	E910.1	0	0.0%	0	0.0%	6	22.2%	2	8.0%	0	0.0%	8	3.3%
While engaged in other sport or recreational activity without diving equipment	E910.2	23	14.2%	6	37.5%	11	40.7%	12	48.0%	3	30.0%	55	22.9%
While swimming or diving for purposes other than recreation or sport	E910.3	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
In bathtub	E910.4	27	16.7%	0	0.0%	1	3.7%	1	4.0%	1	10.0%	30	12.5%
While swimming in swimming pool	E910.5	49	30.2%	1	6.3%	2	7.4%	2	8.0%	1	10.0%	55	22.9%
Following fall into swimming pool	E910.6	42	25.9%	0	0.0%	0	0.0%	1	4.0%	0	0.0%	43	17.9%
Following fall into natural water	E910.7	8	4.9%	4	25.0%	5	18.5%	5	20.0%	3	30.0%	25	10.4%
Other accidental drowning and submersion	E910.8	11	6.8%	2	12.5%	1	3.7%	2	8.0%	0	0.0%	16	6.7%
Unspecified accidental drowning and submersion	E910.9	2	1.2%	0	0.0%	0	0.0%	0	0.0%	2	20.0%	4	1.7%
Subtotal for females		**162**	**100.0%**	**16**	**100.0%**	**27**	**100.0%**	**25**	**100.0%**	**10**	**100.0%**	**240**	**100.0%**

Table A8.4: Case counts and proportions for E910.0–E910.9 for persons age group; Australia 1997–98

Description	E-code	Case count	Per cent	Case count	Per cent	Case count	Per cent	Case count	Per cent	Case count	Per cent	Case count	Per cent
Persons		**0–14 years**		**15–19 years**		**20–39 years**		**40–59 years**		**60+ years**		**All ages**	
While water-skiing	E910.0	0	0.0%	6	11.3%	4	3.1%	1	1.3%	0	0.0%	11	1.5%
While engaged in other sport or recreational activity with diving equipment	E910.1	0	0.0%	2	3.8%	11	8.5%	6	7.7%	1	2.3%	20	2.8%
While engaged in other sport or recreational activity without diving equipment	E910.2	72	17.6%	19	35.8%	71	54.6%	41	52.6%	16	37.2%	219	30.7%
While swimming or diving for purposes other than recreation or sport	E910.3	1	0.2%	1	1.9%	3	2.3%	1	1.3%	0	0.0%	6	0.8%
In bathtub	E910.4	58	14.2%	0	0.0%	3	2.3%	2	2.6%	4	9.3%	67	9.4%
While swimming in swimming pool	E910.5	98	24.0%	6	11.3%	7	5.4%	5	6.4%	4	9.3%	121	17.0%
Following fall into swimming pool	E910.6	108	26.4%	1	1.9%	0	0.0%	2	2.6%	4	9.3%	115	16.1%
Following fall into natural water	E910.7	27	6.6%	12	22.6%	25	19.2%	11	14.1%	6	14.0%	81	11.4%
Other accidental drowning and submersion	E910.8	41	10.0%	5	9.4%	5	3.8%	8	10.3%	3	7.0%	62	8.7%
Unspecified accidental drowning and submersion	E910.9	4	1.0%	1	1.9%	1	0.8%	1	1.3%	4	9.3%	11	1.5%
Total for persons		**409**	**100.0%**	**53**	**100.0%**	**130**	**100.0%**	**78**	**100.0%**	**43**	**100.0%**	**713**	**100.0%**

Table A8.5: Principal diagnosis for all immersion cases; Australia 1997–98

Principal diagnosis	Code	Frequency	Per cent
Effects of drowning and non-fatal submersion	994.1	582	70.0
Hypothermia	991.6	11	1.3
Concussion with brief loss of consciousness	850.1	10	1.2
Other and unspecified injury to face and neck	959.0	7	0.8
Sprain and strain of neck	847.0	6	0.7
Pneumonitis due to inhalation of other solids and liquids	507.8	5	0.6
Closed fracture of dorsal vertebra	805.2	5	0.6
Concussion, unspecified	850.9	5	0.6
Major depressive disorder—unspecified	296.20	4	0.5
Pneumonitis due to inhalation of food or vomitus	507.0	4	0.5
Closed fracture of lumbar vertebra	805.4	4	0.5
Open wound of forehead, without mention of complication	873.42	4	0.5
Unspecified neurotic disorder	300.9	3	0.4
Anoxic brain damage	348.1	3	0.4
Syncope and collapse	780.2	3	0.4
Closed fracture of seventh cervical vertebra	805.07	3	0.4
Other closed fractures of distal end of radius (alone)	813.42	3	0.4
Closed fracture of shaft of tibia	823.20	3	0.4
Closed bimalleolar fracture of ankle	824.4	3	0.4
Closed dislocation of shoulder - unspecified	831.00	3	0.4
Closed anterior dislocation of humerus	831.01	3	0.4
Caisson disease	993.3	3	0.4
Unspecified alcohol use disorder	305.00	2	0.2
Brief depressive reaction	309.0	2	0.2
Generalised convulsive epilepsy	345.10	2	0.2
Cardiac arrest	427.5	2	0.2
Laryngeal spasm	478.75	2	0.2
Acute oedema of lung, unspecified	518.4	2	0.2
Febrile convulsions	780.31	2	0.2
Fit	780.32	2	0.2
Closed fracture of first cervical vertebra	805.01	2	0.2
Closed fracture of second cervical vertebra	805.02	2	0.2
Closed fracture of sixth cervical vertebra	805.06	2	0.2
Closed fracture of three ribs	807.03	2	0.2
Closed fracture of four ribs	807.04	2	0.2
Closed fracture of medial malleolus of ankle	824.0	2	0.2
Closed fracture of lateral malleolus of ankle	824.2	2	0.2
Intracranial injury of other and unspecified nature, without mention of open intracranial wound—unspecified state of consciousness	854.00	2	0.2
Open wound of knee, leg (except thigh) and ankle, without mention of complication	891.0	2	0.2
Injury to internal carotid artery	900.03	2	0.2
Poisoning by benzodiazepine-based tranquillisers	969.4	2	0.2
Viral disease	049.9	1	0.1
Unspecified organic brain syndrome	294.9	1	0.1

continued

Table A8.5 (continued): Principal diagnosis for all immersion cases; Australia 1997–98

Principal diagnosis	Code	Frequency	Per cent
Major depressive disorder—severe	296.23	1	0.1
Major depressive disorder, recurrent episode—unspecified	296.30	1	0.1
Major depressive disorder, recurrent episode—severe	296.33	1	0.1
Neurotic depression	300.4	1	0.1
Borderline personality	301.83	1	0.1
Unspecified acute alcoholic intoxication	303.00	1	0.1
Cont other and unspecified alcohol dependence	303.91	1	0.1
Adjustment reaction with mixed emotional features	309.28	1	0.1
Conduct disorder, childhood onset	312.81	1	0.1
ADD with hyperactivity	314.01	1	0.1
Epilepsy unspecified	345.90	1	0.1
Cerebrospinal fluid otorrhoea	388.61	1	0.1
MI—unspecified site, initial episode of care	410.91	1	0.1
Intermedia coronary syndrome	411.1	1	0.1
Atrial fibrillation	427.31	1	0.1
Sinoatrial node dysfunction	428.1	1	0.1
Subarachnoid haemorrhage	430.	1	0.1
Unspecified transient cerebral ischaemia	435.9	1	0.1
Other venous embolism/thrombosis	453.8	1	0.1
Acute pharyngitis	462.	1	0.1
Pneumonia, organism unspecified	486.	1	0.1
Extrinsic asthma without mention of status asthmaticus	493.00	1	0.1
Pulmonary congestion and hypostasis	514	1	0.1
Pulmonary collapse	518.0	1	0.1
Pulmonary insufficiency following trauma and surgery	518.5	1	0.1
Unspecified intestinal obstruction	560.9	1	0.1
Acute renal failure	584.9	1	0.1
Cellulitis of leg, except foot	682.6	1	0.1
Cellulitis of foot, except toes	682.7	1	0.1
Recurrent dislocation of ankle and foot	718.37	1	0.1
Cervicalgia	723.1	1	0.1
Unspecified backache	724.5	1	0.1
Other disorder of synovium, tendon and bursa	728.89	1	0.1
Path fracture of other spec site	733.19	1	0.1
Down's syndrome	758.0	1	0.1
Other symptoms involving respiratory system and chest	786.9	1	0.1
Abdominal pain, unspecified site	789.00	1	0.1
Non-specified low blood pressure reading	796.3	1	0.1
Open fracture of vault of skull with cerebral laceration and contusion with LOC of unspecified duration	800.66	1	0.1
Open fracture of vault of skull with other and unspecified intracranial haemorrhage with LOC of unspecified duration	800.86	1	0.1
Closed fracture base of skull without mention of intracranial injury	801.00	1	0.1
Closed fracture of base of skull with intracranial injury of other and unspecified nature - with prolonged [. 24 hours] LOC and return to pre-existing conscious level	801.14	1	0.1

continued

Table A8.5 (continued): Principal diagnosis for all immersion cases; Australia 1997/98

Principal diagnosis	Code	Frequency	Per cent
Closed fracture of nasal bones	802.0	1	0.1
Open fracture of nasal bones	802.1	1	0.1
Multiple closed fractures without mention of intracranial injury with LOC of unspecified duration	804.06	1	0.1
Closed fracture of other or unspecified body of mandible	802.28	1	0.1
Closed fracture of orbital floor (blow-out)	802.6	1	0.1
Closed fracture of third cervical vertebra	805.03	1	0.1
Closed fracture of fourth cervical vertebra	805.04	1	0.1
Closed fracture of fifth cervical vertebra	805.05	1	0.1
Closed fracture of multiple cervical vertebrae	805.08	1	0.1
Closed cervical fracture at C1–C4 level with complete lesion of cord	806.01	1	0.1
Closed cervical fracture at C1–C4 level with anterior cord syndrome	806.02	1	0.1
Closed cervical fracture at C5–C7 level with unspecified spinal cord injury	806.05	1	0.1
Closed cervical fracture at C5–C7 level with complete lesion of cord	806.06	1	0.1
Closed cervical fracture at C5–C7 level with other specified spinal cord injury	806.09	1	0.1
Closed dorsal fracture at T1–T6 level with anterior cord syndrome	806.22	1	0.1
Closed fracture of two ribs	807.02	1	0.1
Closed fracture of pubis	808.2	1	0.1
Closed fracture of unspecified site of pelvis	808.8	1	0.1
Open fracture of shaft of clavicle	810.12	1	0.1
Closed fracture of acromial end of clavicle	811.03	1	0.1
Closed fracture of surgical neck of humerus	812.01	1	0.1
Closed supracondylar fracture of humerus	812.41	1	0.1
Closed fracture of other and unspecified fractures of proximal end of ulna (alone)	813.04	1	0.1
Colles' fracture of radius and ulna	813.41	1	0.1
Closed fracture of distal end of radius alone	813.43	1	0.1
Closed fracture of midcervical section of neck of femur	820.02	1	0.1
Closed fracture of unspecified trochanteric section of neck of femur	820.20	1	0.1
Closed fracture of upper end of tibia	823.00	1	0.1
Closed fracture of unspecified part of fibula	823.82	1	0.1
Tear of medial cartilage or meniscus of knee - current	836.0	1	0.1
Closed dislocation of thoracic vertebra	839.21	1	0.1
Sprain and strain of rotator cuff	840.4	1	0.1
Sprain and strain of unspecified site of hip and thigh	843.9	1	0.1
Sprain and strain of medial collateral ligament of knee	844.1	1	0.1
Sprain and strain of cruciate ligament of knee	844.2	1	0.1
Sprain and strain of lumbar part of back	847.2	1	0.1
Sprain and strain of unspecified site of back	847.9	1	0.1
Other and unspecified intracranial haemorrhage following injury, without mention of open intracranial wound—unspecified state of consciousness	853.00	1	0.1
Pneumothorax without mention of open wound into thorax	860.0	1	0.1
Contusion of lung, without mention of open wound into thorax	861.21	1	0.1
Open wound of face, without mention of complication—unspecified site	873.40	1	0.1
Open wound of cheek, without mention of complication	873.41	1	0.1
Complicated wound of lip	873.53	1	0.1
Open wound of elbow, without mention of complication	881.01	1	0.1

continued

Table A8.5 (continued): Principal diagnosis for all immersion cases; Australia 1997–98

Principal diagnosis	Code	Frequency	Per cent
Open wound of hand, except fingers, with tendon involvement	882.2	1	0.1
Open wound of finger(s), without mention of complication	883.0	1	0.1
Open wound of hip and thigh, without mention of complication	890.0	1	0.1
Open wound of foot, except toe(s) alone, without mention of complication	892.0	1	0.1
Abrasion or friction burn of shoulder and upper arm, without mention of infection	912.0	1	0.1
Contusion of face, scalp, and neck, except eye(s)	920	1	0.1
Unspecified contusion of eye	921.9	1	0.1
Contusion of abdominal wall	922.2	1	0.1
Spinal cord injury without evidence of spinal bone injury—C1–C4 level with unspecified spinal cord injury	952.00	1	0.1
Spinal cord injury without evidence of spinal bone injury—C5–C7 level with unspecified spinal cord injury	952.05	1	0.1
Spinal cord injury without evidence of spinal bone injury—unspecified site of spinal cord	952.9	1	0.1
Injury to sciatic nerve	956.0	1	0.1
Injury to superficial nerves of head and neck	957.0	1	0.1
Traumatic shock	958.4	1	0.1
Traumatic subcutaneous emphysema	958.7	1	0.1
Other and unspecified injury to trunk	959.1	1	0.1
Poisoning by aromatic analgesics, nec	965.4	1	0.1
Poisoning by other and unspecified anticonvulsants	966.3	1	0.1
Effects of barotrauma, sinus	993.1	1	0.1
Exhaustion due to excessive exertion	994.5	1	0.1
Electrocution and non-fatal effects of electric current	994.8	1	0.1
Complications peculiar to transplanted heart	996.83	1	0.1
Care involving other physical therapy	V57.1	2	0.2
Other specified rehabilitation procedure	V57.89	1	0.1
Observation following other accident	V71.4	1	0.1
Observation for other specified suspected condition	V71.8	1	0.1
Observation for unspecified suspected condition	V71.9	1	0.1
Total		**831**	**100.0**

Table A8.6: 'Principal procedures' among hospitalised immersion cases; Australia 1997–98

Principal procedure	Code	No. of separations	Per cent
Insertion of endotracheal tube	96.04	26	9.3%
Computerised axial tomography of head	87.03	24	8.5%
Other computerised axial tomography	88.38	20	7.1%
Continuous positive airway pressure (CPAP)	93.90	15	5.3%
Injection of antibiotic	99.21	14	5.0%
Social work assessment	94.70	13	4.6%
Continuous mechanical ventilation for greater than 24 and less than 96 consecutive hours	96.71	13	4.6%
Suture of skin and subcutaneous tissue of other sites	86.59	12	4.3%
Continuous mechanical ventilation for 96 consecutive hours or more	96.72	12	4.3%
Other physical therapy musculoskeletal manipulation	93.20	10	3.6%
Other diagnostic physical therapy procedure	93.09	9	3.2%
Open reduction of fracture with internal fixation	79.36	8	2.8%
Other oxygen enrichment	93.96	6	2.1%
Cardiopulmonary resuscitation, not otherwise specified	99.60	5	1.8%
Temporary tracheostomy	31.1	4	1.4%
Arterial catheterisation	38.91	4	1.4%
Venous catheterisation, not elsewhere specified	38.93	4	1.4%
Closed reduction of dislocation of shoulder	79.71	4	1.4%
Breathing exercise	93.18	3	1.1%
Ambulation and gait training	93.22	3	1.1%
Application of neck support	93.52	3	1.1%
Insertion of other (naso-)gastric tube	96.07	3	1.1%
Thoracentesis	34.91	2	0.7%
Closed reduction of fracture without internal fixation	79.02	2	0.7%
Computerised axial tomography of abdomen	88.01	2	0.7%
Magnetic resonance imaging of spinal canal	88.93	2	0.7%
Other rehabilitation therapy	93.80	2	0.7%
Respiratory medication administered by nebuliser	93.94	2	0.7%
Hyperbaric oxygenation	93.95	2	0.7%
Social work—crisis intervention	94.72	2	0.7%
Other supportive counselling	94.77	2	0.7%
Continuous mechanical ventilation of unspecified duration	96.70	2	0.7%
Injection of infusion of other therapeutic or prophylactic substance	99.29	2	0.7%
Other excision or destruction of lesion or tissue of brain	01.59	1	0.4%
Bone graft to skull	02.04	1	0.4%
Insertion or replacement of skill tongs or halo traction device	02.94	1	0.4%
Spinal tap	03.31	1	0.4%
Linear repair of laceration of eyelid or eyebrow	08.81	1	0.4%
Closed reduction of nasal fracture	21.71	1	0.4%
Suture of laceration of nose	21.81	1	0.4%
Other septoplasty	21.88	1	0.4%
Drainage of face and floor of mouth	27.0	1	0.4%
Insertion of intercostal catheter for drainage	34.04	1	0.4%
Biopsy of heart	37.25	1	0.4%
Other cystoscopy	57.32	1	0.4%

continued

Table A8.6 (continued): 'Principal procedures' among hospitalised immersion cases; Australia 1997–98

Principal procedure	Code	No. of separations	Per cent
Closed reduction of fracture with internal fixation	79.11	1	0.4%
Closed reduction of radius and ulna fracture without internal fixation	79.12	1	0.4%
Closed reduction of carpals and metacarpals fractures without internal fixation	79.15	1	0.4%
Open reduction of femur fracture with internal fixation	79.35	1	0.4%
Open reduction of fracture to other specified bone with internal fixation	79.39	1	0.4%
Arthroscopy	80.26	1	0.4%
Excision of semilunar cartilage of knee	80.6	1	0.4%
Tarsometatarsal fusion	81.15	1	0.4%
Other suture of other tendon of hand	82.45	1	0.4%
Rotator cuff repair	83.63	1	0.4%
Excisional debridement of wound, infection, or burn	86.22	1	0.4%
Routine chest x-ray, so described	87.44	1	0.4%
Skeletal x-ray of wrist and hand	88.23	1	0.4%
Skeletal series	88.31	1	0.4%
Arteriography of cerebral arteries	88.41	1	0.4%
Arteriography of pulmonary arteries	88.43	1	0.4%
Diagnostic ultrasound of heart	88.72	1	0.4%
Electrographic monitoring	89.54	1	0.4%
Measurement of systemic arterial blood gases	89.65	1	0.4%
Bone scan	92.14	1	0.4%
Pulmonary scan	92.15	1	0.4%
Nutritional assessment	92.91	1	0.4%
Provision of therapeutic diet	92.94	1	0.4%
Other specified nutritional intervention	92.98	1	0.4%
Other psychiatric interview and evaluation	94.19	1	0.4%
Other electroshock therapy	94.27	1	0.4%
Drug detoxification	94.65	1	0.4%
Insertion of nasopharyngeal airway	96.01	1	0.4%
Insertion of oropharyngeal airway	96.02	1	0.4%
Other intubation if respiratory tract	96.05	1	0.4%
Injection or infusion of electrolytes	99.18	1	0.4%
Injection of anticoagulant	99.19	1	0.4%
All principal procedures	**Total**	**281**	**100**

INJURY RESEARCH & STATISTICS

This is a statistical report on persisting morbidity among hospitalisations due to near drowning in Australia for 1997–98. The main aim was to quantify persisting morbidity resulting from immersion events, but all near drownings for this year are also described. Other possible sources of routine data on persisting morbidity related to near drowning are briefly outlined.

The report is useful for insight into identifying near drowning and persisting morbidity among national data sources.

The report will be relevant to those interested in data on drowning and near drowning, as well as to community practitioners, health planners and administrators, academic researchers and the public.