

FACTS

about injuries



Drowning



World Health Organization

Injuries & Violence
Prevention

Non-Communicable
Diseases and
Mental Health

[www.who.int/
violence_injury_prevention/](http://www.who.int/violence_injury_prevention/)

In 2000, an estimated 409 272 people drowned, which makes drowning the second leading cause of unintentional injury death globally after road traffic injuries (1). This total includes only “accidental drowning and submersion”. The problem is even greater. These Global Burden of Disease (GBD) figures are an underestimate of all drowning deaths, since they exclude drowning due to cataclysms (floods), water and other transport accidents, assaults and suicide.

Also during 2000, injuries accounted for over 9% of total global mortality. Of these injury-related deaths, 8% were from unintentional drowning.* Of these unintentional drowning deaths, 97% occurred in low- and middle-income countries (2).

* Excludes cataclysms, water and other transport accidents, assaults and suicide.

Definition of drowning

“Drowning is the process of experiencing respiratory impairment from submersion/immersion in liquid. Drowning outcomes are classified as death, morbidity and no morbidity” (3).

Agreed terminology is essential to describe the problem and allow effective comparisons of drowning trends (4,5). For this reason, the definition of drowning – adopted by the 2002 World Congress on Drowning – should be widely used.

Magnitude of the problem

Table 1 shows the estimated number of deaths attributed to unintentional drowning*, by sex, in each WHO region for 2000 (1).

Table 1. Global drowning deaths by sex and WHO region (GBD 2000)

	World Total	AFR	AMR	EMR	EUR	SEAR	WPR
Males	281 717	67 654	20 181	20 712	30 322	55 258	87 600
Females	127 554	23 311	4 408	6 904	7 196	36 520	49 216
Total	409 272	90 965	24 589	27 616	37 518	91 778	136 816
Sex ratio (M:F)	2.2 : 1	2.9 : 1	4.6 : 1	3 : 1	4.2 : 1	1.5 : 1	1.8 : 1
%	100	22.3	6	6.8	9.1	22.4	33.4
Rate [†]	6.8	14.2	3	5.7	4.3	6	8.1

AFR = African Region; AMR = Americas Region; EMR = Eastern Mediterranean Region; EUR = European Region; SEAR = South-East Asian Region; WPR = Western Pacific Region

[†] Rate per 100 000 people.

- Data on non-fatal drowning morbidity in many specific low- and middle-income countries is not readily available, and therefore remains unreliable.
- One-third of all drowning occurs in the WPR, though the AFR has the highest rate (1).
- Overall, the male rate of drowning is more than twice that of females (1).
- The rate of drowning in the AFR is more than four times, and in the WPR, more than double, that of the AMR, the region with the lowest rate (1).
- Within some WHO regions, such as the EUR and the WPR, the rates between high- and low-income countries differ widely (6).

* Excludes cataclysms, water and other transport accidents, assaults and suicide.

Table 2 shows the burden of drowning deaths and hospitalizations in two high-income countries (7-11)[‡].

Table 2.
Injury markers for drowning in the United States and Australia for 2000

Marker	United States	Australia
Drowning deaths	3 458	322
Mortality rate*	1.25	1.7
Indigenous population mortality rate*	3.24	2.4
White mortality rate*	1.19	1.6
Rank leading cause of unintentional injury death (1981-1998)	5	4 [†]
Near-drowning	7 840	563
Morbidity rate*	2.85	3.2
Age-specific morbidity rate (0-4)*	26.50	24.1

* All rates per 100 000 people.

[†] Ranked 1-6 of leading cause of death due to unintentional injury (8,9,10).

- Drowning death rates in the AFR are more than eight times higher than those of the United States and Australia (7).
- Both the United States and Australia have higher drowning mortality rates among indigenous populations compared with white mortality rates.
- The rate of submersion resulting in hospitalization is approximately double the mortality rates from drowning in both countries (8,9).
- In Canada, a colder, high-income country, there are nearly two drowning deaths for each survivor of hospitalization (13).

Table 3 shows selected markers on the burden of drowning in two examples of low- and middle-income countries (7,12)[‡].

Table 3. *Injury markers for drowning in China and India for 2000*

Marker	China	India
Drowning deaths	129 000	86 000
Mortality rate*	10.2	8.5
% of global unintentional drowning mortality	26	17
Rank leading cause of unintentional injury death [†]	3	4
Disability Adjusted Life Years (DALYs)	3 567 000	2 445 000
% of total DALYs	24	17

* All rates per 100 000 people.

[†] Ranked 1-6 of leading cause of death due to unintentional injury (6,11).

[‡] Tables 2 and 3 show different markers and are not meant to be directly compared.

- Both China and India have particularly high drowning mortality rates and together contribute 43% of all drowning deaths worldwide (7).
- Together, China and India contribute 41% of the total DALYs attributed to drowning globally (12).

Risk factors

Major risk factors for drowning by all causes include:

Sex

- Males are more likely to die or be hospitalized due to drowning than females (1,14-16).
- Males in the AFR and WPR have the highest drowning-related mortality rates worldwide (2).
- Studies suggest males have higher drowning rates than females due to increased exposure to water and riskier behaviour, such as swimming alone, drinking alcohol before swimming alone, (15,17) and boating (4).

Age

- Among the various age groups, children under five years of age have the highest drowning mortality rates worldwide (2). Canada and New Zealand are exceptions, where adult males have the highest rates (13,18).
- Drowning is the leading cause of injury death to children aged 1-14 years in China (Table 4) (19,20).
- In Bangladesh, 20% of all deaths in children aged 1-4 years are due to drowning (21).
- Drowning was the second leading cause of unintentional injury death in children aged 1-14 in the United States in 2000 (18.1%) (8).
- Drowning is the leading cause of unintentional injury death in children aged 1-3 in every Australian state (22).
- Drowning in young children is often associated with a lapse in supervision.

Table 4. Child drowning deaths in China 2001

Ages	Urban rate*	% of child injury deaths	Rural rate*	% of child injury deaths
1-4	4.25	42.74	19.34	60.66
5-9	1.85	44.47	16.82	59.39
10-14	1.38	44.47	13.98	54.63

* All rates per 100 000 people.

Source: Ministry of Health, People's Republic of China (19).

Occupation

- The occupational mortality rate in Alaskan commercial fishermen is 116 per 100 000. Approximately 90% of these deaths are by drowning (23).
- Small-boat subsistence fishing in low-income countries is associated with many drowning deaths (24).

Floods*

- Large numbers of drowning deaths are associated with floods worldwide, including thousands of deaths in single countries, such as China (25).

Transportation*

- Vessels that may be unsafe or overcrowded (including refugee boats [26]), and poor weather conditions are associated with large, though unknown, numbers of drowning deaths every year (27).
- 90% of Canadian boating victims of drowning were not wearing a floatation device (13).

Alcohol

- Alcohol is a risk factor for drowning among adolescents and adults, though the proportion of drowning victims testing positive for blood alcohol concentration levels depends on the country reported (28).
- Alcohol may impair parental supervision of children near water.
- Alcohol or drug use was implicated in 14% of unintentional drowning fatalities in Australia in persons greater than 14 years, of whom 79% were male (29).

Epilepsy

- Children with epilepsy are at significantly greater risk of bath and pool drowning, compared to children without epilepsy (30).
- In Sweden, drowning was the cause of death in approximately 10% of people with a history of epilepsy (1975–1995) (31).
- In Canada, most epilepsy-associated drowning deaths occur to adults in bathtubs (13).

Socio-economic status

- Ethnic minority groups generally have higher drowning death rates, possibly due to differences in opportunities to learn to swim (32).
- In Bangladesh, children whose mothers have only primary education are at significantly greater risk of drowning compared with children whose mothers have secondary or higher education (16).

Access to water

- In Bangladesh, most young children who die from drowning are aged 12-23 months, with most fatalities occurring as a result of falling into ditches and ponds (21).

* Excluded from the global estimate of drowning deaths of 409 272 in 2000.

- For young children in the United States, the presence of a residential pool, particularly when inadequately fenced, is the greatest risk factor (4).
- In an Australian farm injury study, drowning accounted for over 58% of deaths in children aged less than five years, and 78% of those deaths were associated with access to farm dams and irrigation channels (33).
- In Mexico, children of parents with a water well at home are at significantly greater risk of drowning compared with children of parents with no well (34).
- Notably higher rates of drowning deaths in rural versus urban areas in some low- and middle-income countries are directly related to access to water (19,35).
- Infants left alone or with another child in an adult bathtub are at significant risk of drowning (13).
- Unfenced homes in proximity to bodies of water increase the risk of drowning (13).
- Tourists may be at unacceptably high risk of drowning (13,36).

Economic burden

- Cost data is not readily available for drowning.
- The highest mortality and morbidity worldwide is among the 0-15 age group; therefore, not surviving to reach the age of economic productivity has an even larger impact in regions where families rely on older children for income (2).
- In the United States, 45% of all drowning deaths in 2000 occurred among the most economically active segment of the population (15-44 years) (8).
- Annual total cost estimates for coastal drowning in the United States amounted to over US\$ 273 million in direct and indirect costs (1997) (37). This figure under-estimates the total drowning cost, since most drowning deaths in the United States are not coastal.
- Annual total cost of drowning injury in Australia was estimated at US\$ 85.5 million (1995-1996) (38).
- Canadian cost estimates for drowning were US\$ 173 million for deaths, excluding land transport related (1993). Land transport associated drowning, including snowmobiles, added another US\$ 49 million (13).
- In the Australian state of Victoria, drowning and near-drowning were found to have the highest average lifetime cost – US\$ 40 071 – of any injury type (39).

Prevention

The interventions which follow are based on research evidence (where available) and expert opinion.

Remove the hazard

- Drain unnecessary accumulations of water (e.g. baths, ponds, buckets, etc.).

Create barriers

- Build flood control embankments in flood-prone areas (40).
- Implement and enforce mandatory isolation fencing for swimming pools (41-46).
- Where possible, fence around rural fish ponds, construction ditches (where filled with rainwater) and other bodies of water around houses and in the community.
- Encourage fencing around rural homes in proximity to water (e.g. farmhouses).
- Encourage the use of grills over water wells (34).

Protect those at risk

- Promote “learn to swim” programs for primary school children, especially in low- and middle-income countries (47-49).
- Increase access to public swimming pools to promote learning to swim (50).
- Swimming and water-safety skills are associated with significant reductions in drowning fatalities (50).
- Increase awareness of the need to supervise children both in and outside the home, and establish parent groups or other childcare mechanisms in rural communities, especially around harvest times.
- Instruct children to avoid entering fast-flowing streams, and not to swim alone.
- Train lifeguards for regular deployment in supervised swimming locations (37).
- Harmonize internationally the flags and symbols used for beach safety (36).
- Educate and/or legislate against consuming alcohol while boating or around large bodies of water.
- Increase education in boat safety regulations as well as of the need for personal floatation devices when boating.
- All boats and larger vessels should be checked regularly for safety, including safety equipment, and never exceed the maximum passenger capacity for which they were designed.

Counter the damage

- Train the general community in resuscitation. Timely resuscitation initiated by layperson bystanders increases the survival prospects of paediatric drowning victims (51).

Role of public health:

- To describe the magnitude of the problem by collecting data on drowning deaths and morbidity.
- To identify vulnerable populations and address their needs.
- To undertake research to identify risk factors, protective factors and exposure measures.
- To identify the economic impact of drowning in order to provide a basis for cost-benefit analysis for safety improvements.

- To promote, facilitate and catalyze the implementation of drowning prevention measures and policies.
- To monitor and evaluate interventions.
- To advocate for more attention to drowning prevention.
- To strengthen emergency response services.

Limitations

- Drowning data is limited, especially from low- and middle-income countries, which may have the greatest burden.
- It is unknown how much of the difference in international and regional comparisons of drowning rates is due to differences in exposure.
- Distinctions between unintentional and intentional injuries may be unclear, as intentional drowning deaths (e.g. suicide, assaults) are not always reported or can be misclassified (35).
- GBD and specific country data (e.g. the United States and Australia) exclude drowning deaths due to water and other transport accidents, cataclysms and intentional injury from official statistics on drowning (52,53).
- Drowning research is largely confined to preventing deaths in recreational settings. In low- and middle-income countries, the majority of drowning fatalities are not associated with recreation or leisure but with everyday activities.
- Different prevention strategies are needed to address different exposures (35,54).

References

References are available on request.

Copies of this document are available from:

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