

Drownings and other water-related injuries in Canada

10 Years of Research

Module 1 *Overview*



Canadian
Red Cross

2006

*This report is dedicated to the 5,900 people
in Canada during 1991-2000
who died from a water-related injury,
and to the 3,526 who survived a
hospitalization for near drowning.*

*May these deaths not have been in vain —
let the information about risk factors guide
all with responsibility for water safety to act,
and to make the right decisions
to prevent all avoidable incidents,
saving thousands of lives and billions
of dollars during the next decade.*

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Drownings and Other Water-Related Injuries in Canada, 1991-2000
Module 1: Overview

For a pdf version of this module, please visit our website at www.redcross.ca

This Visual Surveillance Report was developed and written by Dr. Peter Barss, in collaboration with Rosemary Hong and Christy-Ann Moore of the Canadian Red Cross, and with the assistance of Cait Beattie of Résolutive Globale. Sophie Lapointe, research technician, carried out the data analysis.

Data collectors included volunteers and staff of the Canadian Red Cross and the Lifesaving Society. Data collection was made possible through the assistance and co-operation of provincial coroners, medical examiners, their statistical staff, and the National Association of Coroners. Financing of the work was done collaboratively by sharing resources and staff. Data collection mainly involved the Canadian Red Cross, the Lifesaving Society, and provincial coroners. Data coding, verification, and entry were supported by the Canadian Red Cross and the Lifesaving Society, and carried out by Isabelle Masson, Peter Barss, and Sophie Lapointe.

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wearalifejacket.com

A website supported by The Cook-Rees Memorial Fund For Water Search And Safety.

A central location of information on how to find and choose the best flotation device for various water-related activities, and to learn about recent advances in lifejacket design for individual comfort, style and protection.

Sport and safety organizations, policy makers and the media can also consult the website to share knowledge, research and drowning prevention campaigns to help inform the public about the need to wear a lifejacket in, on and around the water.

INTRODUCTION

This document presents risk factors and trends for drowning and other water-related injury deaths in Canada between 1991-2000. During this 10-year period, 5,900 individuals died and 3,526 survived a hospital admission for near drowning, some with permanent brain impairment. Each of these incidents was a tragedy for a family and our society, often with devastating long-term emotional and financial consequences. The cost to our society of water-related injuries is estimated to be about 500 million dollars per year.

In the early 1990's, the Canadian Red Cross set out to develop a sound research basis for its water safety programs. This research included identifying risk groups and risk factors for different water-related activities. Over time, the research developed into surveillance or monitoring of trends in various categories of injuries. This was the first population-based national injury surveillance system in Canada, and the first surveillance system for risk factors of water-related injury fatalities in the world.

Injury surveillance made possible an assessment of outcomes across Canada. Although reductions in water-related injury deaths cannot be conclusively attributed to new programs, it is definitely advantageous to verify positive or negative trends in detail to help evaluate and further improve prevention programs. Unfortunately, many new prevention programs for injuries and other health conditions are still introduced without an associated surveillance system to monitor outcomes such as deaths or hospitalizations.

Major trends during 1991-2000 were assessed in a 2003 summary entitled "What we have learned: 10 Years of Pertinent Facts About Drownings and Other Water-Related Injuries in Canada 1991-2000 (Canadian Red Cross, 2003, www.redcross.ca/cmslib/general/10drwn_english.pdf).

The present report, Module 1 in a series, is a more detailed overview of this 10-year period. It will be followed by other modules reporting in detail on specific subcategories of water-related fatalities, including incidents associated with ice and cold water, powered boating, unpowered boating, fishing, and aboriginal peoples.

Although the Red Cross published annual reports for data from 1991 to 1999, these did not include the analysis of long-term trends as in the present report and others to follow. Since the Red Cross developed and launched new national water safety programs and a new swimming and water-safety training manual during 1994-95, it was felt to be highly pertinent to assess trends in drowning and other water-related fatalities during the 1990's before and after introduction of the new research-based programs. As with earlier publications, this report relies upon fully labelled self-explanatory visual presentation of data with minimal text.

This research is based on modern principles of injury prevention, including careful assessment of personal, equipment, and environmental risk factors for different time phases of potential injury incidents, including pre-event, event, and post-event phases (Haddon's Matrix). Personal or host factors include variables such as age, sex, use of alcohol and other drugs, swimming ability, and ethnicity. Equipment factors include safety equipment such as flotation devices — which help to avoid injury during the event phase of the incident (i.e. immersion), and self-closing self-latching swimming pool gates — which work in the pre-event phase to help prevent an injury incident, i.e., a toddler falling into a pool, as well as other factors such as type of boat or vehicle. Environmental factors include body of water, wind, waves, light conditions, water temperature, season, and many others.

Data on survivors of hospitalization for near drowning are provided by the Canadian Institute for Health Information. Data for unintentional water-related injury deaths are collected each year from provincial and territorial coroners' offices across Canada, based on a 15-page questionnaire structured on risk factors for major categories of water-related activities by purpose. The main purposes of activity include recreation, daily life and subsistence, and occupation; major activities include boating, aquatic activities, falls into water during non-aquatic activities, bathing, and land and air transport.

Data are collected by dedicated volunteers affiliated with the Canadian Red Cross and the Lifesaving Society. Each province has a project manager who collaborates with the statistical or epidemiological staff of their provincial coroner's office to ensure that all unintentional water-related deaths are included. Intentional injuries such as suicide and homicide are excluded. Occasional deaths of unknown intent may be included in the database, but are identifiable by unknown activity and purpose. An effort is made to conform to World Health Organization injury classifications where feasible.

Data are verified, revised as necessary, and entered centrally by a small team of skilled professional public health injury researchers to ensure validity and consistency across the country. The same professionals verified the data during the entire 10-year period. *P* values and 95% confidence intervals for the percent decline (increase) in incidence rates in Table 2 are calculated using Poisson regression, with SAS 8.01 PROC GENMOD. Incidence rates for 1991-1995 were calculated using 1991 census data for population denominators, and rates for 1996-2000 using 1996 census data.

Many investigations by coroners or medical examiners take up to a year or longer to be finalized; data collection and analysis are also time-consuming. Hence the 1991 data were reported in 1993 and the 2000 data in 2003. Analysis of 10 years of data is more complex and will be completed in 2005-2006.

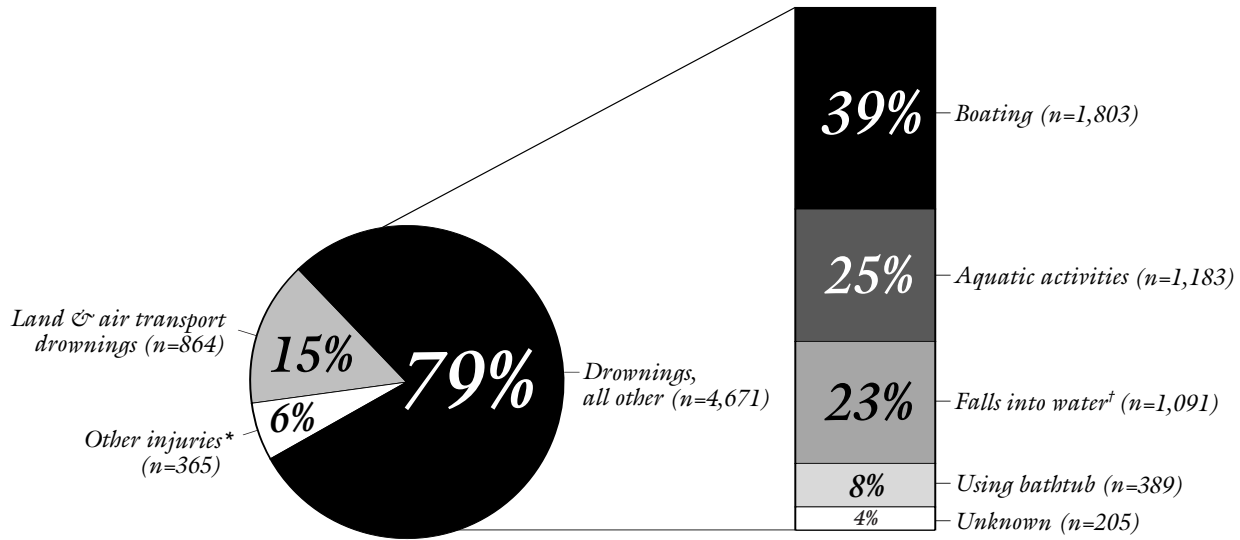
Further details about methodology can be obtained from earlier annual Red Cross reports issued during the 1990's.

DROWNINGS

During 1991-2000, there were 5,900 water-related injury fatalities in Canada. Drowning accounted for nearly 95% of these deaths; other injury fatalities are summarized in Table 1 (page 10). Land and air transport drownings are usually considered separately from other incidents. The largest single activity resulting in drowning in Canada is boating, followed by aquatic activities such as swimming, falls into water during non-aquatic activities such as playing near unprotected swimming pools, and bathing in a bathtub (Figure 1).

Figure 1

WATER-RELATED DEATHS BY TYPE OF INJURY & ACTIVITY, CANADA 1991-2000 (n=5,900)



* Includes all water-related injuries other than drownings

† Falls into water during non-aquatic activities such as walking or playing near water or on ice

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005



PERSONAL RISK FACTORS

AGE AND SEX During 1991-1995, toddlers (1-4-year-olds) and 15-24-year-old males had the highest drowning rates, followed by adult males 25 and older. During 1996-2000, the highest rates were among 15-24-year-old males, followed by toddlers and adult males 25 and older (Figure 2).

TRENDS

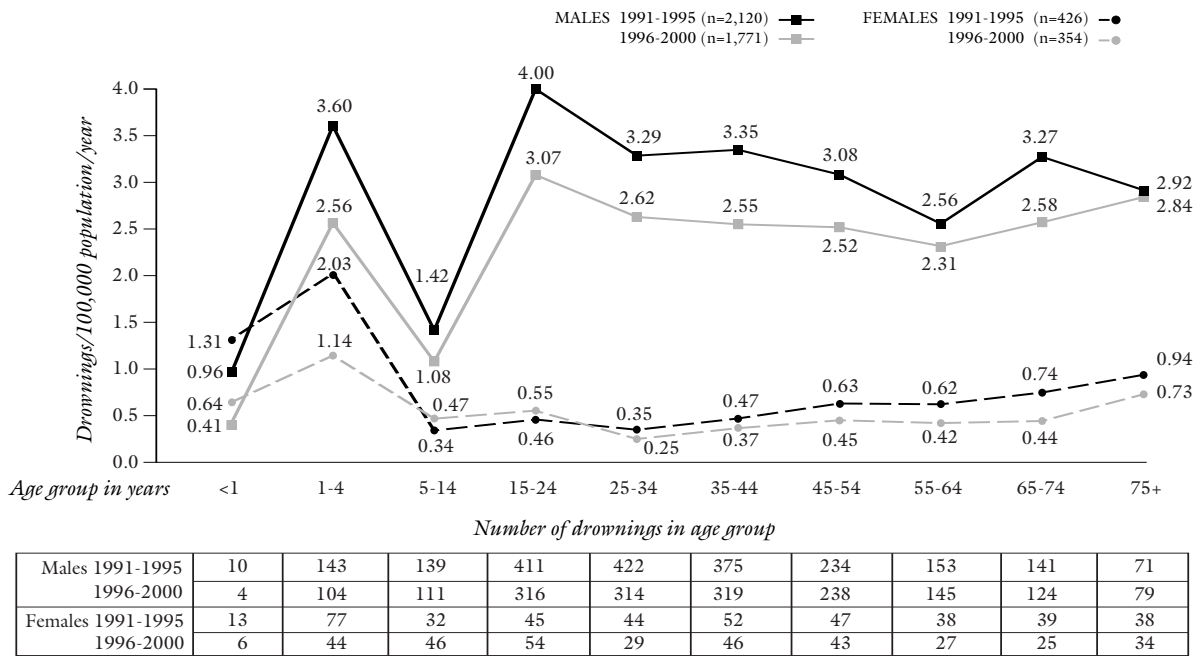
There was an improvement in drownings for all age groups with the exception of 5-24-year-old females during 1991-2000. The overall rate fell from 1.8 to 1.4 deaths per 100,000 population per year, an improvement of 22%, equivalent to 100 fewer deaths per year. The most striking improvement was seen for children under 5.

ALCOHOL For Canadians 15 years and older, alcohol was associated with 40% of drownings (Figure 3); however, since the presence of alcohol was unknown for another 25%, the true figure could be as high as 65%. Nearly 60% of the blood alcohol levels above the legal driving limit of 80 mg % were higher than 200 mg %; 18% were above 300 mg %.

DROWNINGS

Figure 2

RATE AND NUMBER OF DROWNINGS* BY AGE & SEX, CANADA 1991-2000
(n=4,671; 3,891 MALES, 780 FEMALES)^{†‡}



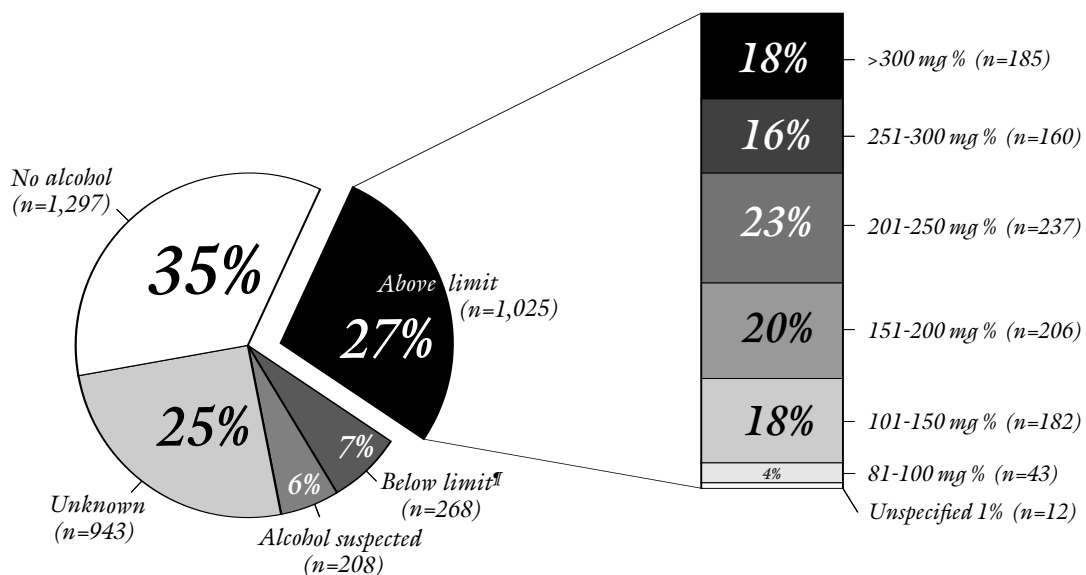
* Includes recreational, occupational & daily living drownings (E910, E830, E832); excludes land & air transport drownings

† Age unknown for 39 victims (males 21, 17; females 1, 0) ‡ Sex unknown for 9 victims, imputed male

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

Figure 3

BLOOD ALCOHOL LEVELS* FOR ALL DROWNINGS,† CANADA 1991-2000
(VICTIMS ≥15 YEARS OF AGE; n=3,942)^{‡§}



* Legal limit is 80 mg % † Includes recreational, occupational & daily living drownings (E910, E830, E832);

excludes land & air transport drownings ‡ This figure excludes 201 victims; decomposition rendered blood alcohol unreliable

§ Age unknown for 39 victims, presumed adult ¶ 159 at 1-49 mg %, 92 at 50-80 mg %, and 17 unspecified

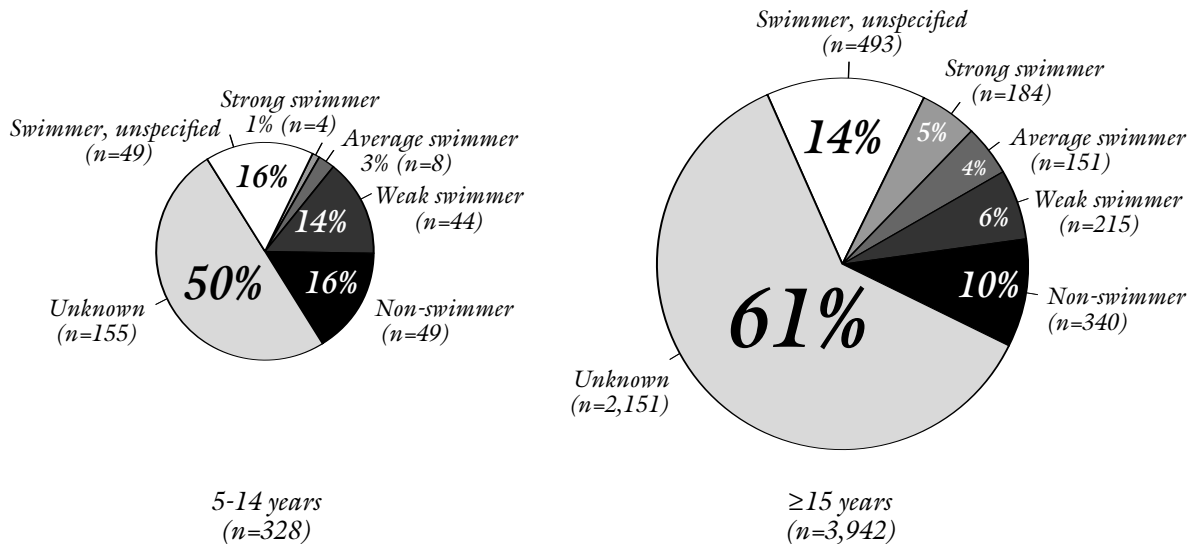
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

DROWNINGS

SWIMMING ABILITY Due to controversy about whether swimming ability is protective for young children, this risk factor was assessed only for children 5 years and older and for adults. Unfortunately, swimming ability was unspecified for more than half of victims 5 years and older. Where swimming ability was known, 60% of 5-14 year old victims were weak or non-swimmers (Figure 4). For victims 15 years and older with known swimming ability, 41% were weak or non-swimmers, while 13% were strong swimmers.

Figure 4

DROWNINGS* BY SWIMMING ABILITY BY AGE, CANADA 1991-2000 (VICTIMS ≥5 YEARS OF AGE; n=4,270)**



* Includes recreational, occupational & daily living drownings (E910, E830, E832);

excludes land & air transport drownings † Age unknown for 39 victims, presumed adult

‡ This figure excludes 427 cases where swimming ability was considered irrelevant (5-14 years 19, ≥15 years 408)

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005



ENVIRONMENTAL RISK FACTORS

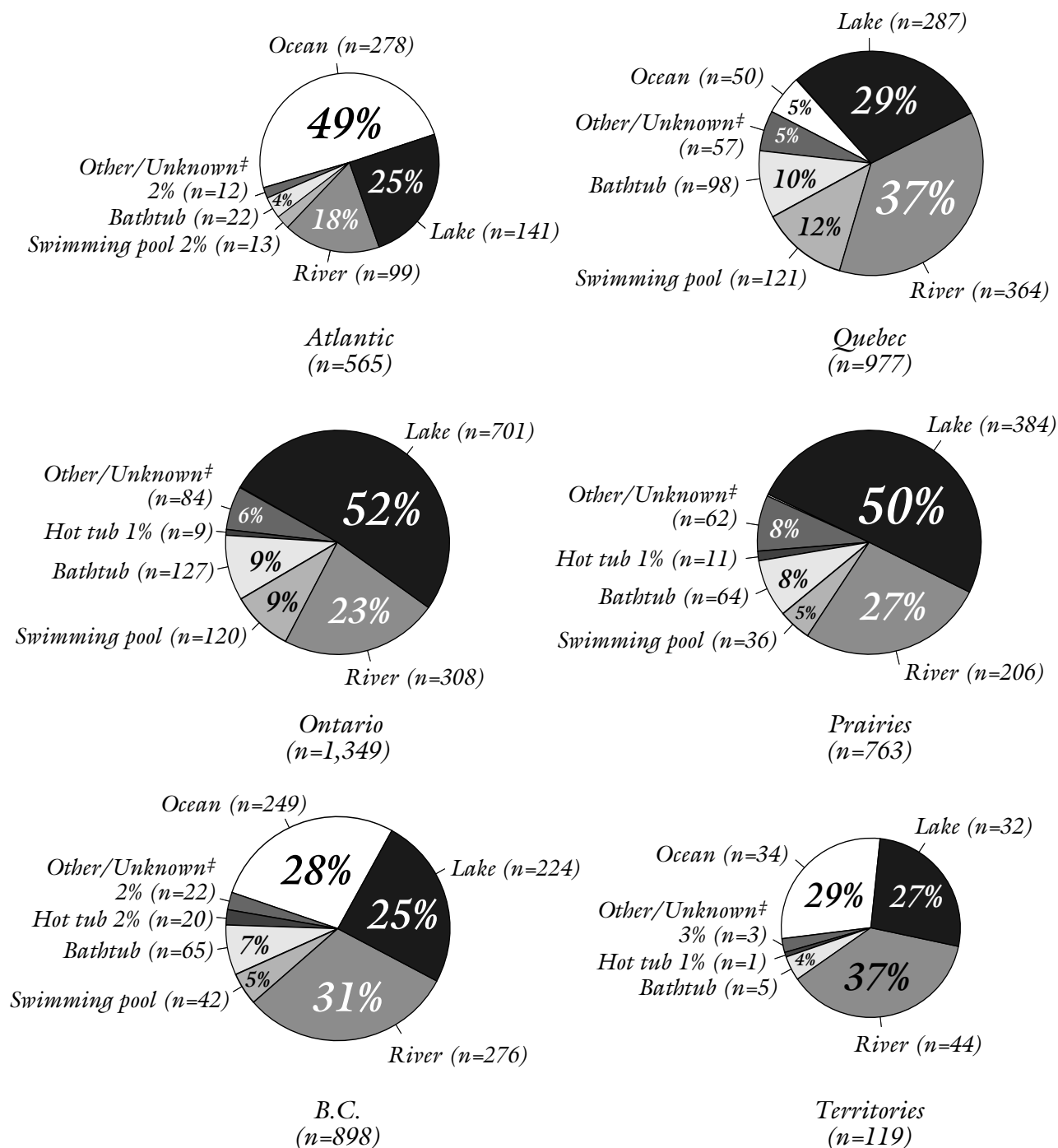
BODY OF WATER BY REGION In the flatter central parts of Canada, lakes were the most frequent bodies of water for drowning (Figure 5). In Quebec, British Columbia, and the northern territories rivers were most frequent, followed closely by lakes, while in the Atlantic region, the ocean predominated. Bathtub and swimming pool drownings were most common in Quebec and Ontario, followed by the Prairies and British Columbia.

ACCOMPANYING PERSONS The absence of adult supervision is a factor in most child drownings. However, increased supervision should not preclude implementation of equipment and environmental changes, since drownings and other injuries generally result from the interaction of multiple risk factors.

Almost all bathtub-drowning victims and nearly 80% of victims of falls into water were alone, or accompanied only by a minor (Figure 6). Presence of another adult was much more frequent in boating and aquatic drownings. In cases where the activity was unknown, the victim was usually alone; some of these may have been suicides, although not proven and classified as such.

DROWNINGS

Figure 5 DROWNINGS* BY REGION & TYPE OF BODY OF WATER,† CANADA 1991-2000 (n=4,671)

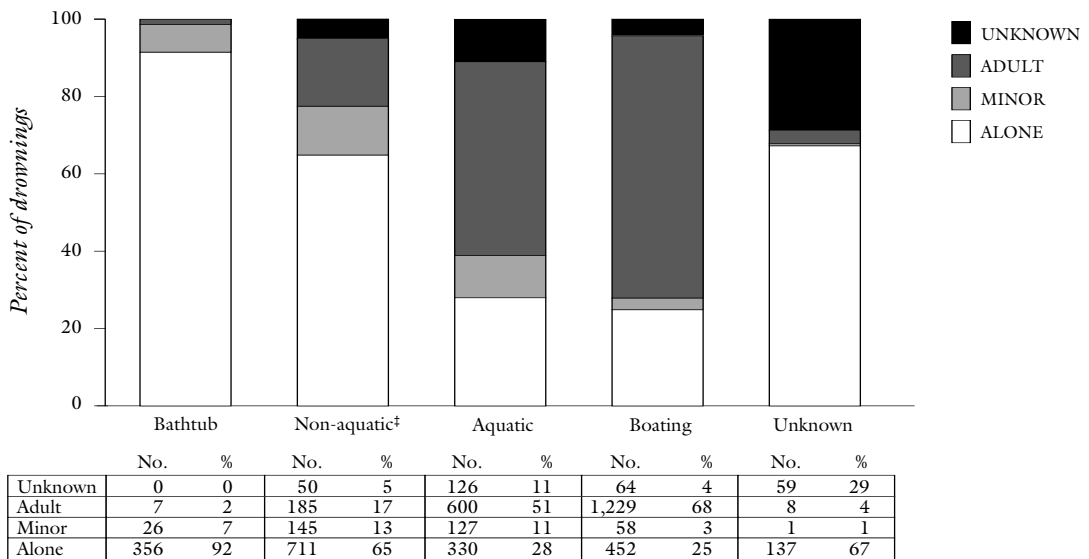


* Includes recreational, occupational & daily living drownings (E910, E830, E832); excludes land & air transport drownings
 † "Lake" includes pond & reservoir ‡ Including, for all of Canada, canal 38, ditch 31, dam 31, quarry 28, other 83 & unknown 29
 Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

DROWNINGS

Figure 6

DROWNINGS* BY ACCOMPANYING PERSONS† AND ACTIVITY, CANADA 1991-2000 (n=4,671)



* Includes recreational, occupational & daily living drownings (E910, E830, E832); excludes land & air transport drownings

† “Adult” indicates that victim was accompanied by adult(s); does not exclude presence of minor(s) (<18 years);

‡ “Minor” indicates presence of minor(s) only † Falls into water

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

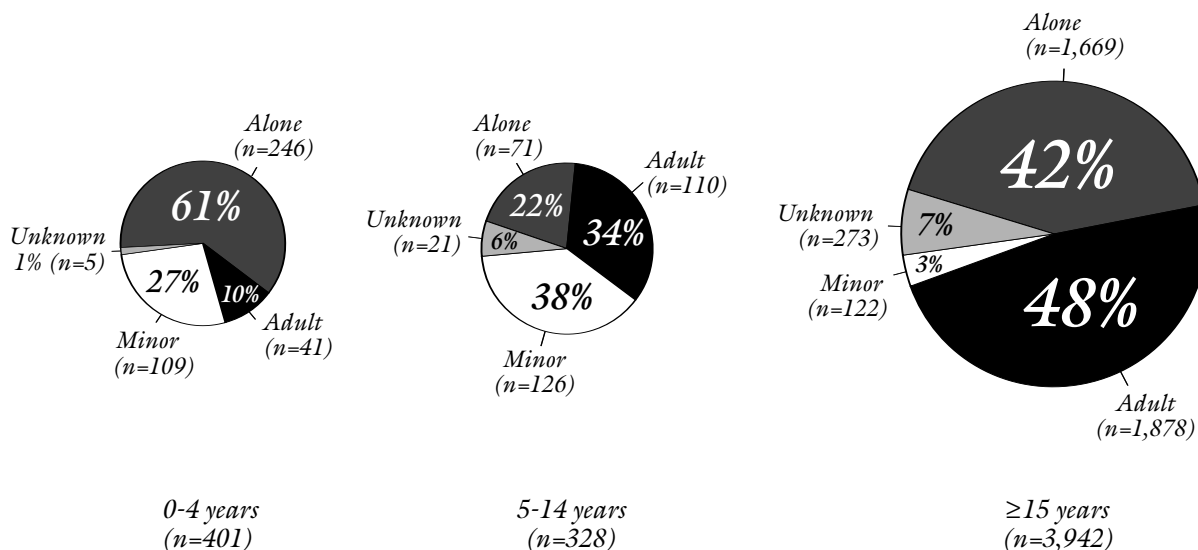
ACCOMPANYING PERSONS BY AGE The importance of adult supervision for infants and toddlers is evident, as only 10% of these victims drowned in the presence of an adult. It seems likely that supervision by another child was a frequent risk factor for infant and toddler drownings, since 27% of victims drowned only in the presence of a minor (Figure 7). Lack of adult supervision was also associated with most drownings of 5-14-year-olds.

RESCUE AND CPR Most infants and toddlers who drowned underwent acute rescue for a potentially survivable victim and received CPR. This was probably due to the fact that most incidents involving children under 5 tended to occur in and around the home, and were detected rapidly. Rescue and CPR decreased with age. For adults 25 years and older, acute rescue took place for only about 36% of victims, CPR for 20%.

DROWNINGS

Figure 7

DROWNINGS* BY AGE OF VICTIMS & ACCOMPANYING PERSONS,† CANADA 1991-2000 (n=4,671)‡



* Includes recreational, occupational & daily living drownings (E910, E830, E832); excludes land & air transport drownings

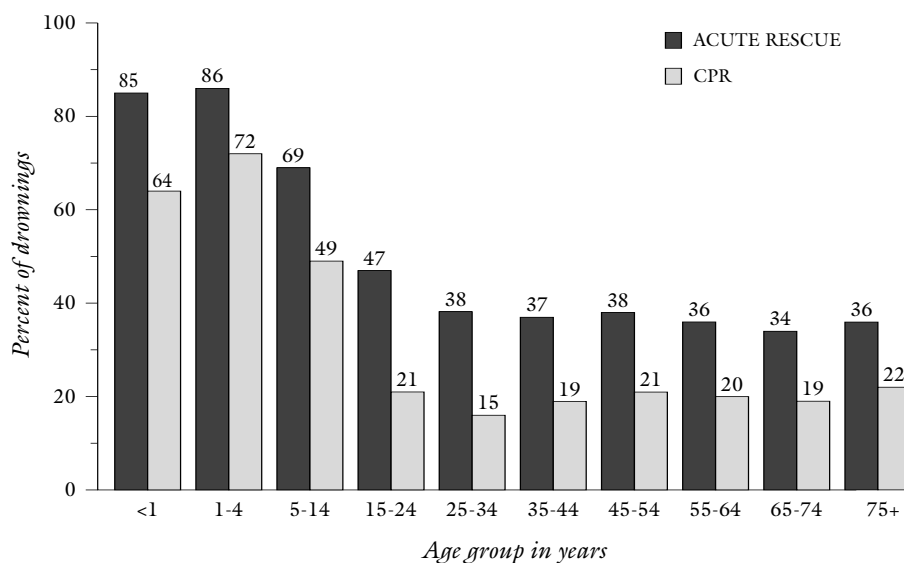
† “Adult” indicates that victim was accompanied by adult(s); does not exclude presence of minor(s) (<18 years);

‡ “Minor” indicates presence of minor(s) only † Age unknown for 39 victims, presumed adult

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

Figure 8

PERCENT OF DROWNINGS* WITH ACUTE RESCUE† & WITH RESUSCITATION BY CPR‡ BY AGE, CANADA 1991-2000 (n=4,671)§



* Includes recreational, occupational & daily living drownings (E910, E830, E832); excludes land & air transport drownings

† For a potentially survivable victim; excludes extended body searches ‡ Cardiopulmonary resuscitation

§ Age unknown for 39 victims, presumed adult; 12 with acute rescue only, and 1 with acute rescue and CPR

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

Non-Drowning Immersion Deaths

Boating was the activity most frequently associated with non-drowning immersion deaths, with a majority of these fatalities resulting from collisions and immersion hypothermia (Table 1). Scuba diving and diving head first into water were the most frequent aquatic activities. Most non-drowning snowmobile immersion deaths resulted from hypothermia. Deaths from falls into water from boats or land as well as deaths involving road vehicles and aircraft tended to result from head injury, with drowning as a secondary factor due to loss of consciousness.

Table 1 WATER-RELATED INJURY FATALITIES OTHER THAN DROWNINGS,* CANADA 1991-2000 (n=365)[†]

		N°	%
All activities other than land & air transport		297	81
Activity/incident	Type of injury[‡]		
Boating		149	50
Collision			
Boat with another boat	Head 22, multiple 14, spine 6; abdominal 1, major lacerations 3, unknown 1	34	
Boat with fixed object	Head 18, multiple 8, spine 3, hepatic rupture 1, blunt trauma 1, aortic transection 1, unknown 2	27	
Other collision	Head 4, multiple 4, spine 2, blunt trauma 1, major lacerations 1	9	
Other incidents			
Immersion in cold water	Hypothermia 51	51	
Fell out of boat	Head 9, multiple 1, cardiac failure 1, blunt trauma 1, spine 1, abdominal 1, unknown 3	15	
Propeller injury	Major lacerations 4, head 1, abdominal 1	6	
Other	Head 2, multiple 2, spine 2, major lacerations 3, chest 1, strangulation 1	7	
Aquatic		88	30
Diving	Head/spine 24, electrocution 1, unknown 6	31	
Scuba diving	Air embolism 35, nitrogen narcosis 3, head 1, multiple 1, asphyxia 1, unknown 3	43	
Swimming/playing in water	Hypothermia 3, head 2	5	
Jumping	Head 2, spine 2, chest 1, abdominal 1, aortic dissection 1	7	
Other	Major laceration 1, air embolism 1	2	
Using bathtub		5	2
Head 3, hypothermia 1, unknown 1			
Non-aquatic		55	19
Walking/playing near water/on ice	Head 15, multiple 7, spine 2, hypothermia 10	29	
Fishing/hunting	Hypothermia 4, head 1, spine 1, multiple 1	7	
Cycling	Head 1, spine 1, hypothermia 1	3	
Attempting rescue	Head 1, multiple 1	2	
Gardening	Head 2	2	
Other	Head 4, multiple 3, major lacerations 1, hypothermia 1, toxic gas poisoning 1	8	
Unknown	Hypothermia 2, head 1, multiple 1, unknown 1	4	
Land & air transport		68	19
Vehicle	Type of injury[‡]		
On-road vehicle	Head 11, multiple 10, chest 1, hypothermia 1, unknown 5	24	
Snowmobile	Hypothermia 14	14	
All terrain vehicle	Hypothermia 2, blunt trauma 3	5	
Other off-road vehicle	Chest 2, head 1, hypothermia 1, multiple 1	5	
Aircraft	Head 11, multiple 4, hypothermia 2, spine 1, unknown 5	20	
Total		365	100

* Primary cause of death was injury other than drowning, although drowning may have complicated another injury; in case of hypothermia, only hypothermia deaths reportedly uncomplicated by drowning are included here

[†] Values in light shaded areas refer to dark shaded totals above; values in unshaded areas refer to light shaded areas above

[‡] Victims may have sustained more than one type of injury

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

NEAR DROWNINGS

There were 3,526 survivors of hospitalization for near drowning in Canada for the 10-year period from April 1991 to March 2001. (The time period differs slightly, since hospitalizations are recorded by fiscal year, whereas deaths are recorded by calendar year.) The overall rates of near drowning are much higher among infants and toddlers than among older children and adults, and indeed 0-4-year-olds accounted for 31% of all survivors of hospitalizations for near drowning (Figure 9).

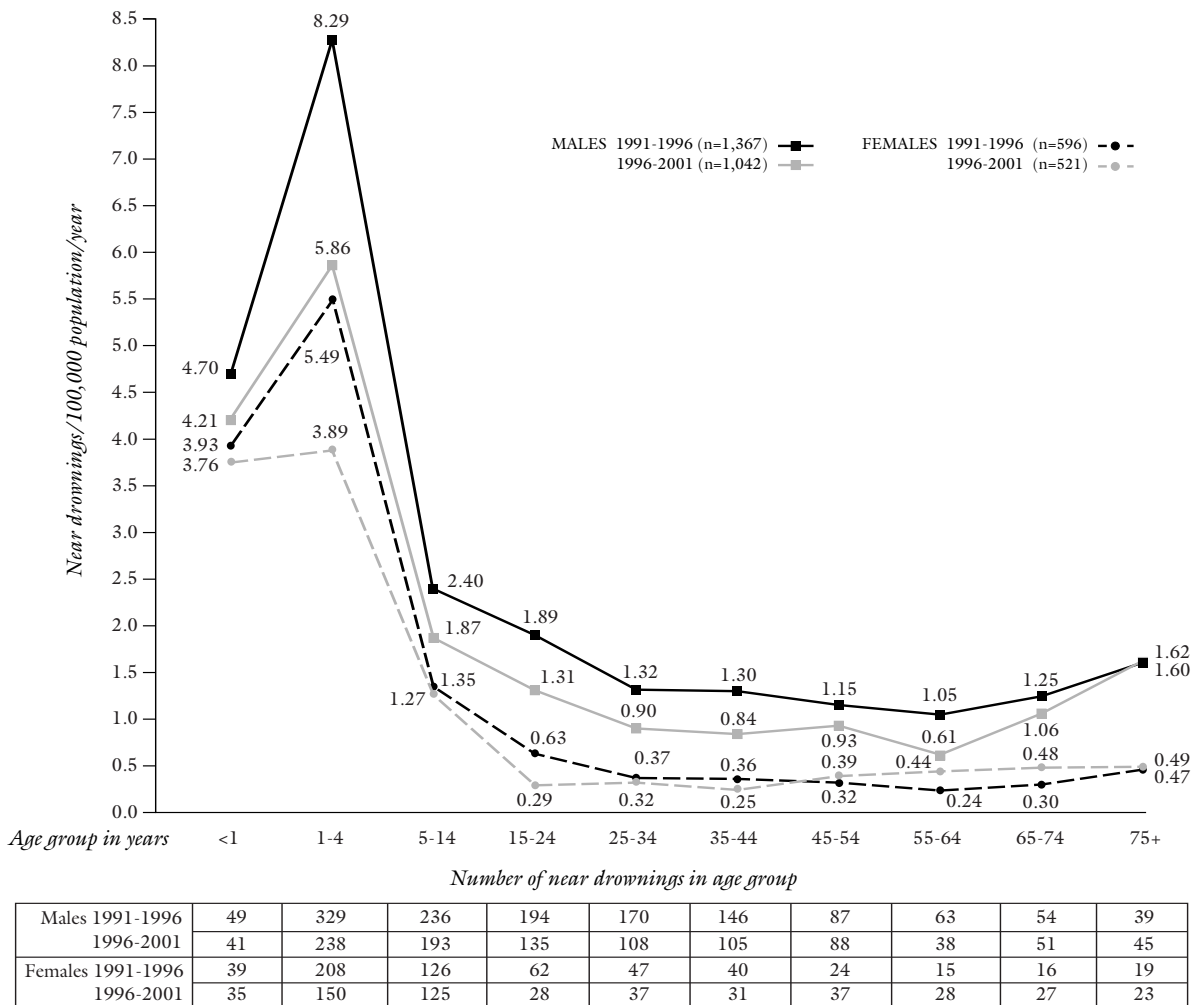


TRENDS

There was a 29% drop in near drowning rates for both male and female toddlers between 1991-1996 and 1996-2001. Comparing Figures 9 and 2, it is evident that for all ages combined, there was a ratio of about 0.75 survivors of hospitalization for near drowning for each drowning fatality. However, for infants there were about 4 survivors for each death and for toddlers about 2 survivors for each death.

Figure 9

RATE AND NUMBER OF HOSPITALIZATIONS FOR NEAR DROWNING* BY AGE & SEX, CANADA, 1991-2001† (n=3,526)



* Includes survivors but not in-hospital deaths, of which there were 451 (252, 199)

† This figure covers the 10-year period from April 1, 1991 to March 31, 2001 (data are by fiscal year)

Source: The Canadian Institute for Health Information (CIHI) & Statistics Canada, 2005

Boating drownings and other fatalities are discussed only briefly in this report. Because boating is the activity most frequently associated with drowning, there are two special modular reports dedicated to it. Module 3 offers an overview of boating and a more detailed look at powered boating; Module 4 deals with unpowered boating.

PURPOSE

Recreational boating accounted for 76% of boating incidents, occupational for 11%, daily living or subsistence activities for 10%, rescue for 2% and unknown for 1%.

ACTIVITY

Fishing, powerboating, and canoeing were the activities most often associated with recreational boating drowning (Figure 10). The most frequent daily living activity was boat travel, followed by subsistence fishing and hunting. Commercial fishing was the most frequent occupational activity.



PERSONAL RISK FACTORS

AGE AND SEX The vast majority of boating drowning victims were males 15 and older (Figure 10). Males accounted for 93% of all victims, and only 2% of male victims were less than 15 years old. For males and females combined, 97% of all victims were 15 and older.

TRENDS

There was a decrease in boating drownings in all age groups of males between 1991-1995 and 1996-2000 (Figure 11). The improvement was about 30% for males less than 45 years and 17% for those 45 and older.



EQUIPMENT FACTORS

The most common risk factor for recreational boating drowning during the entire 1990's was not wearing a flotation device. During 1991-1995 only 12% of victims were reported to be properly wearing a flotation device, and during 1996-2000, only 11%.

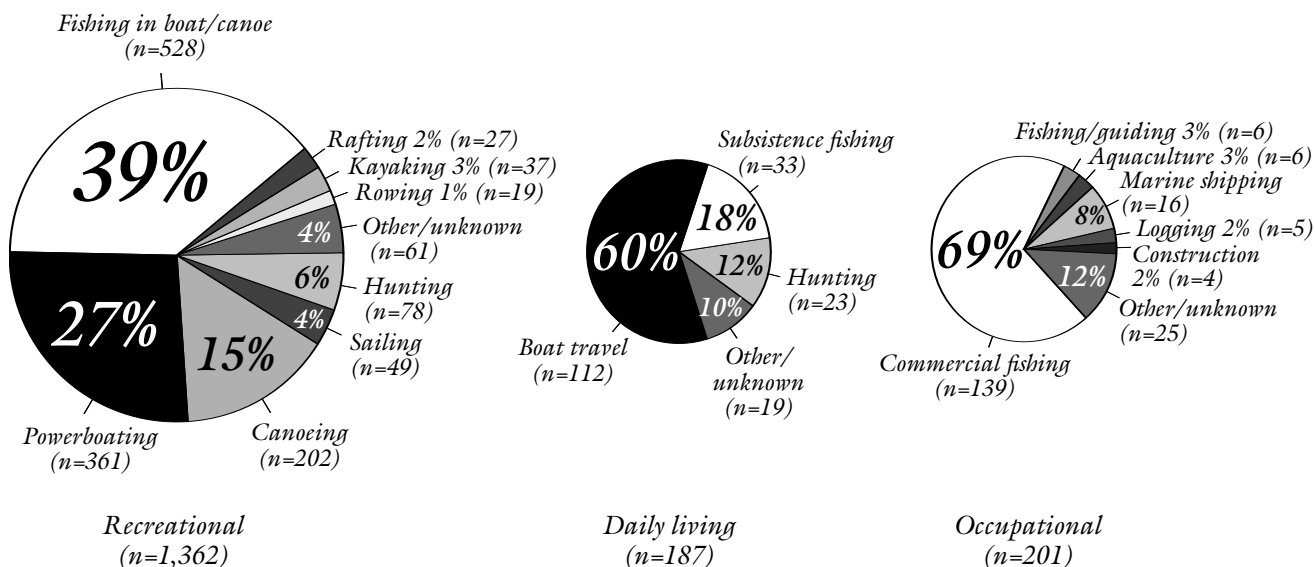
Non-drowning boating fatalities

Non-drowning boating fatalities resulted mainly from collisions and immersion hypothermia, as seen in Table 1 (page 10). Unlike for boating drownings, there was no improvement in non-drowning boating fatalities during 1991-2000, suggesting a need for innovative approaches to prevention.

Head injuries were reported in 63% of collisions and 60% of falls from boats. Loss of consciousness from head injury will generally result in drowning if immersion occurs. This raises the question of whether helmets and restraints such as safety belts should be used for some boating activities such as high-speed travel. Coroners did not report use of this type of safety equipment. Another cause of death was massive hemorrhage from propeller lacerations, which could be prevented by propeller guards. Again, coroners did not report on this safety equipment.

BOATING

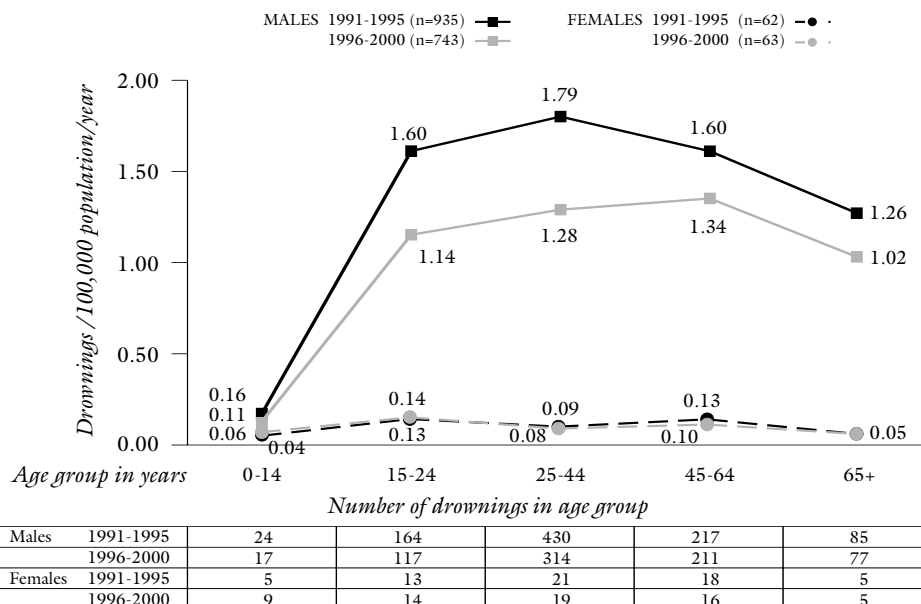
Figure 10 **BOATING DROWNINGS BY ACTIVITY & PURPOSE, CANADA 1991-2000 (n=1,803)***



* This figure excludes 28 victims who were attempting rescue, 4 other and 21 unknown

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

Figure 11 **RATE AND NUMBER OF BOATING DROWNINGS* BY AGE & SEX, CANADA 1991-2000 (n=1,803; 1,678 MALES, 125 FEMALES)†**



* Includes recreational, occupational, daily living & other boating drownings (E830 & E832)

† Age unknown for 22 victims (males 15, 6; sex unknown, imputed male 0,1)

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

PURPOSE

Recreational activities accounted for 92% of aquatic drownings, followed by rescue 4%, occupational 2%, daily living 1%, and other or unknown 2% (Annex 1a).

ACTIVITY

Most recreational aquatic drownings resulted from swimming, followed by playing or wading in water (Figure 12a). For certain activities, including scuba diving and diving into water, more deaths occurred from non-drowning injuries such as air embolism and head or spinal injuries than from drowning (Table 1, page 10). Hence scuba diving accounted for 6% of all aquatic deaths and diving for 5%.

TRENDS

There was a significant improvement in swimming and playing or wading drownings between 1991-1995 and 1996-2000 (Figure 12b). For swimming, most male age groups showed a reduction of about 25-30%, although in the highest risk group of 15-24-year-olds the decrease was only 14%. For other less frequent activities such as scuba diving, there was no improvement. For hot tubs, there was a 73% increase.

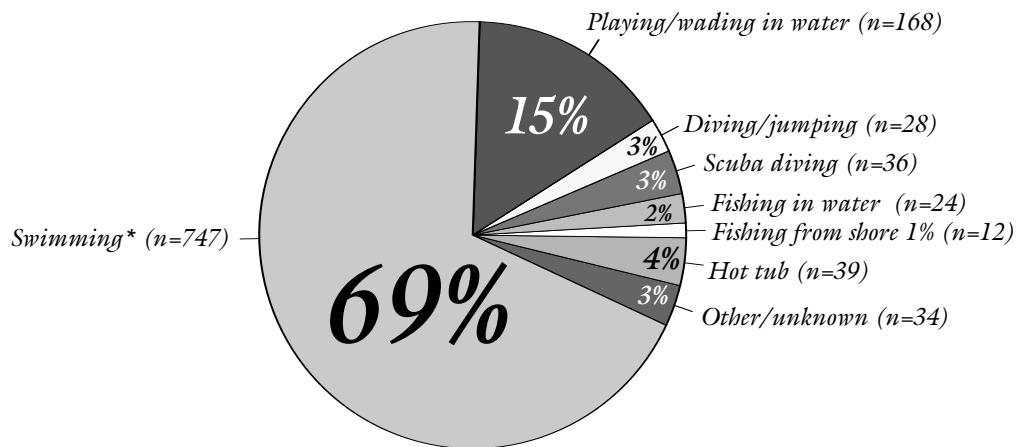


PERSONAL RISK FACTORS

AGE AND SEX Males accounted for 86% of swimming drowning victims. Most victims were between 5 and 44 years of age, with the highest rate in 15-24-year-olds (Figure 13).

Figure 12a

RECREATIONAL AQUATIC DROWNINGS BY ACTIVITY, CANADA 1991-2000 (N=1,088)

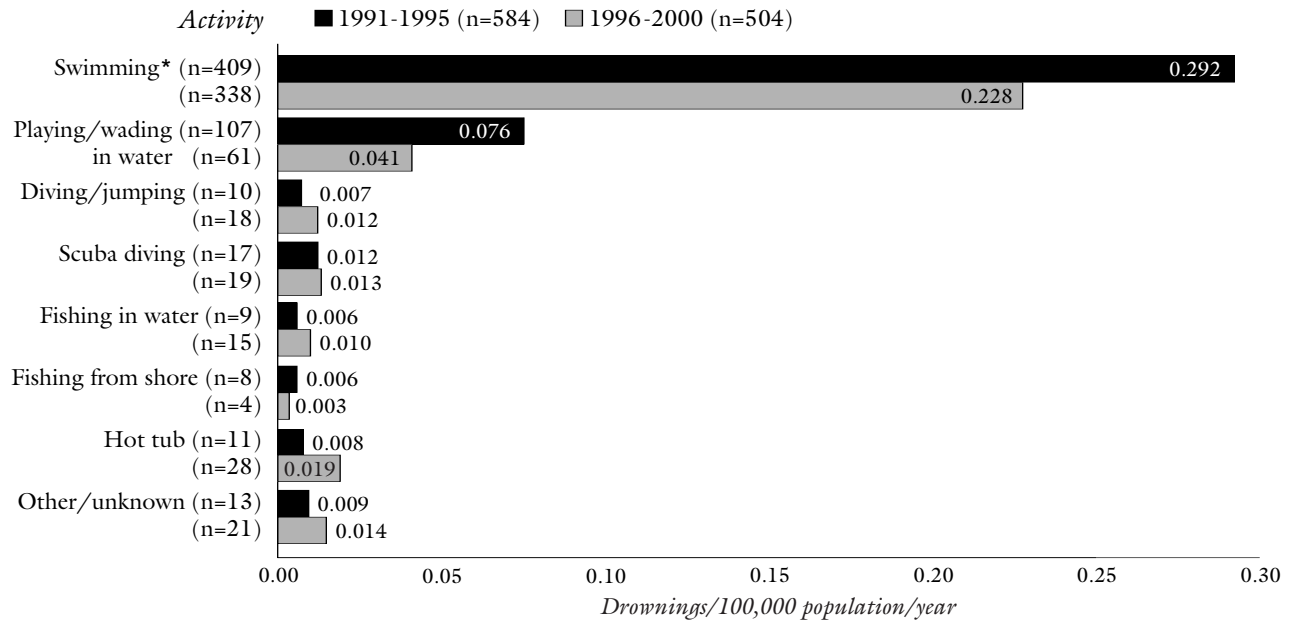


* This category includes victims ≥ 5 years

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

AQUATIC ACTIVITIES

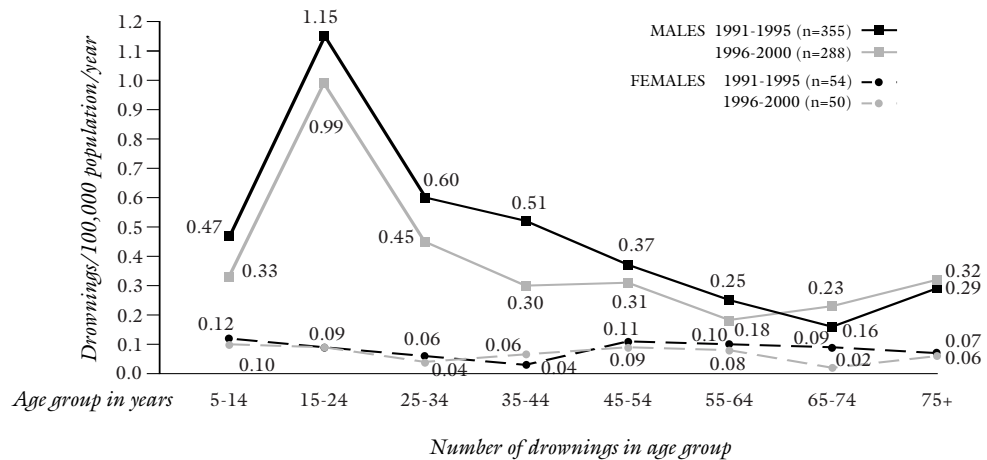
Figure 12b RATE OF RECREATIONAL AQUATIC DROWNINGS BY ACTIVITY, CANADA 1991-2000 (n=1,088)



* This category includes victims ≥ 5 years

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

Figure 13 RATE AND NUMBER OF RECREATIONAL SWIMMING DROWNINGS BY AGE & SEX, CANADA 1991-2000 (VICTIMS ≥ 5 YEARS OF AGE; n=747; 643 MALES, 104 FEMALES)



Males 1991-1995	46	118	77	57	28	15	7	7
1996-2000	34	102	54	38	29	11	11	9
Females 1991-1995	11	9	8	4	8	6	5	3
1996-2000	10	9	5	8	9	5	1	3

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

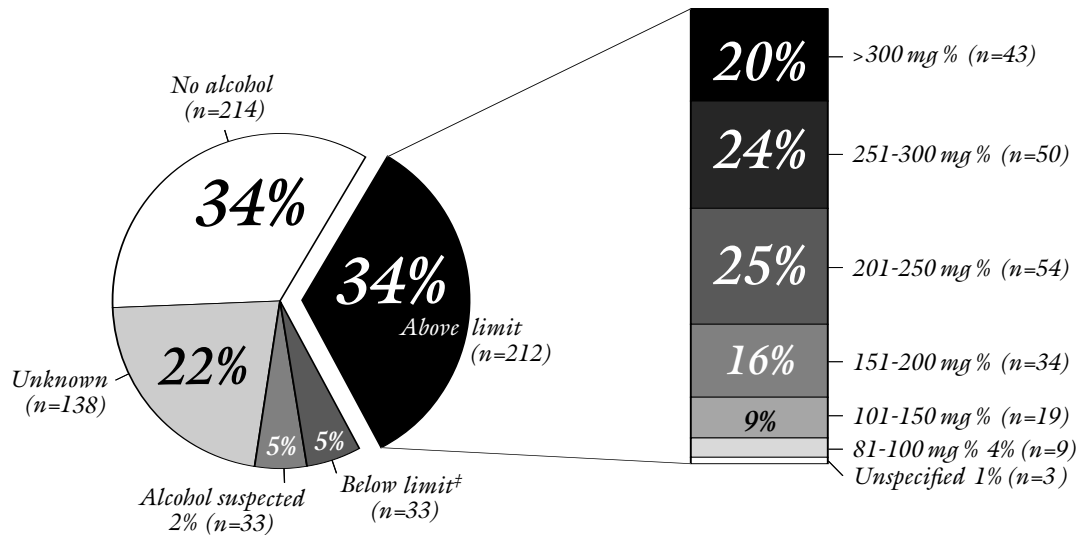
AQUATIC ACTIVITIES



ALCOHOL Alcohol was associated with at least 44% of swimming drownings of victims 15 and older, and in most of these incidents the blood alcohol level was very high, well above the legal limit for driving a car or operating a boat (Figure 14). Alcohol was much more frequent in older swimming victims than 15-24-year-olds (Figure 15).

Figure 14

BLOOD ALCOHOL LEVELS* FOR RECREATIONAL SWIMMING DROWNINGS, CANADA 1991-2000 (VICTIMS ≥ 15 YEARS OF AGE; n=646)[†]

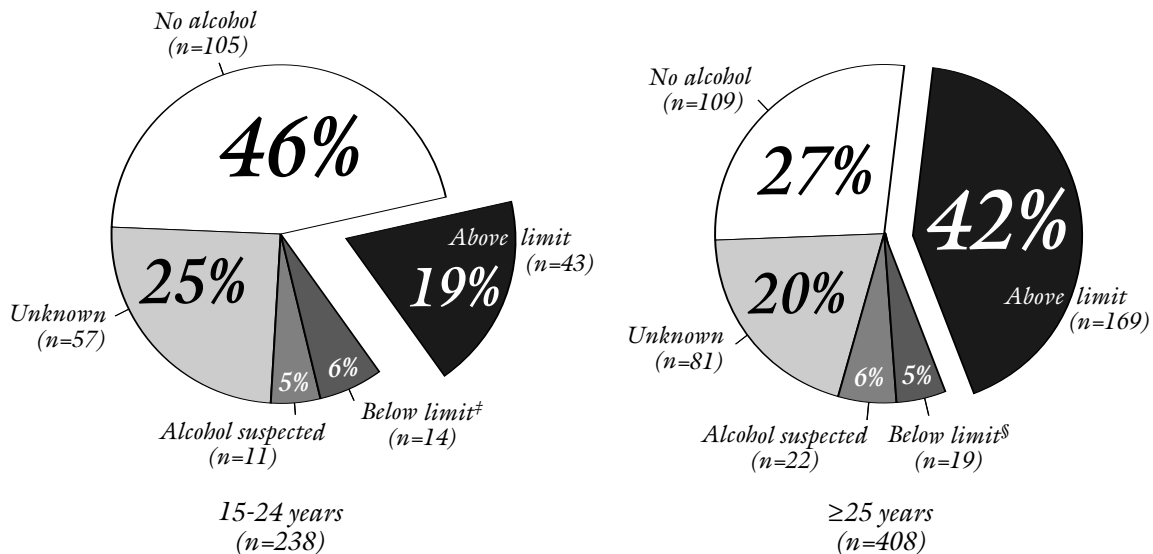


* Legal limit is 80 mg % † This figure excludes 16 victims; decomposition rendered blood alcohol unreliable
‡ 22 at 1-49 mg %, 10 at 50-80 mg %, & 1 unspecified

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

Figure 15

BLOOD ALCOHOL LEVELS* FOR RECREATIONAL SWIMMING DROWNINGS BY AGE, CANADA 1991-2000 (VICTIMS ≥ 15 YEARS OF AGE; n=646)[†]



* Legal limit is 80 mg % † This figure excludes 16 victims (8 15-24 years; 8 ≥ 25 years); decomposition rendered blood alcohol unreliable
‡ 11 at 1-49 mg %, 3 at 50-80 mg % § 11 at 1-49 mg %, 7 at 50-80 mg %, and 1 unspecified

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005



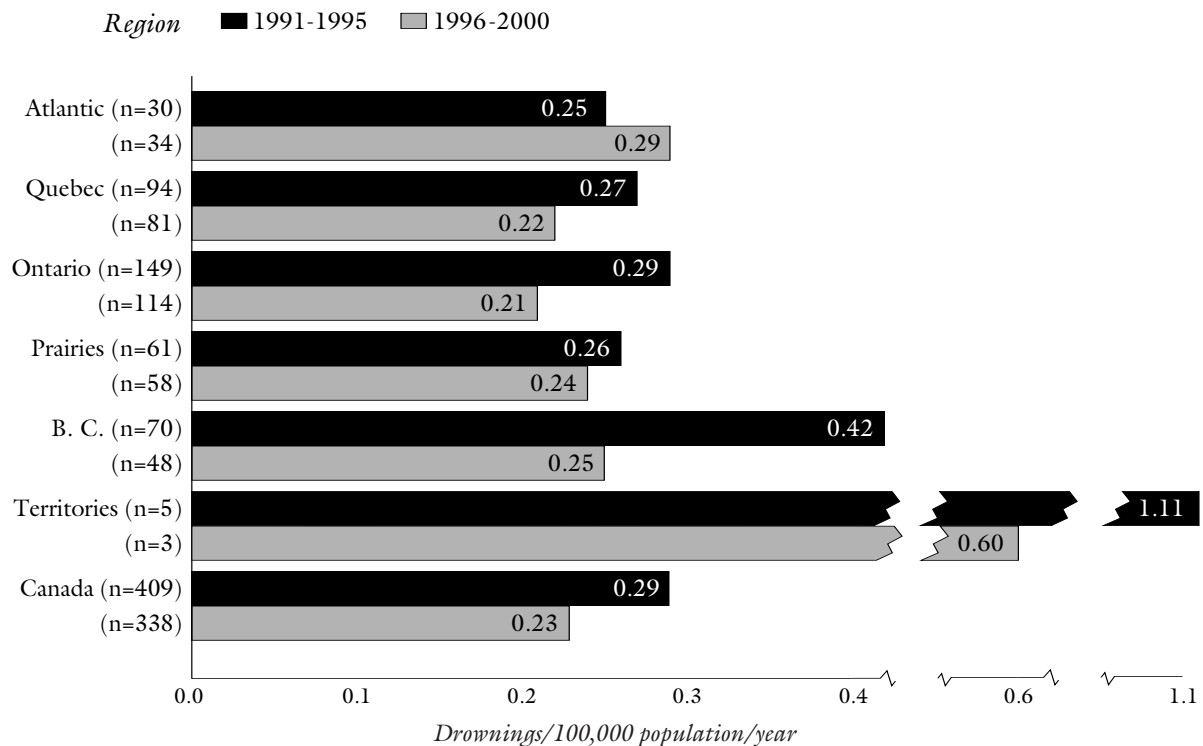
ENVIRONMENTAL FACTORS

TRENDS BY REGION In the first half of the 1990's, swimming drowning rates were similar across Canada, with the exception of a higher rate in British Columbia (Figure 16). There was a 21% decrease in the swimming drowning rate in Canada between 1991-1995 and 1996-2000. The largest regional decrease, 40%, occurred in British Columbia. The Atlantic and Prairie regions experienced no significant improvement. Hence for the second half of the 1990's, rates were relatively similar across the entire country.

BODY OF WATER BY REGION Lakes, rivers, and swimming pools were the most frequent bodies of water for swimming drownings in Canada, with the exception of the Atlantic region where the ocean was more frequent than pools (Figure 17). The pattern varied by region. Flatter regions showed lakes as the leading site. Rivers were more frequent in mountainous regions with fast flowing rivers, including Quebec, British Columbia, and the northern territories. Swimming pools were a relatively frequent site across the country.

Figure 16

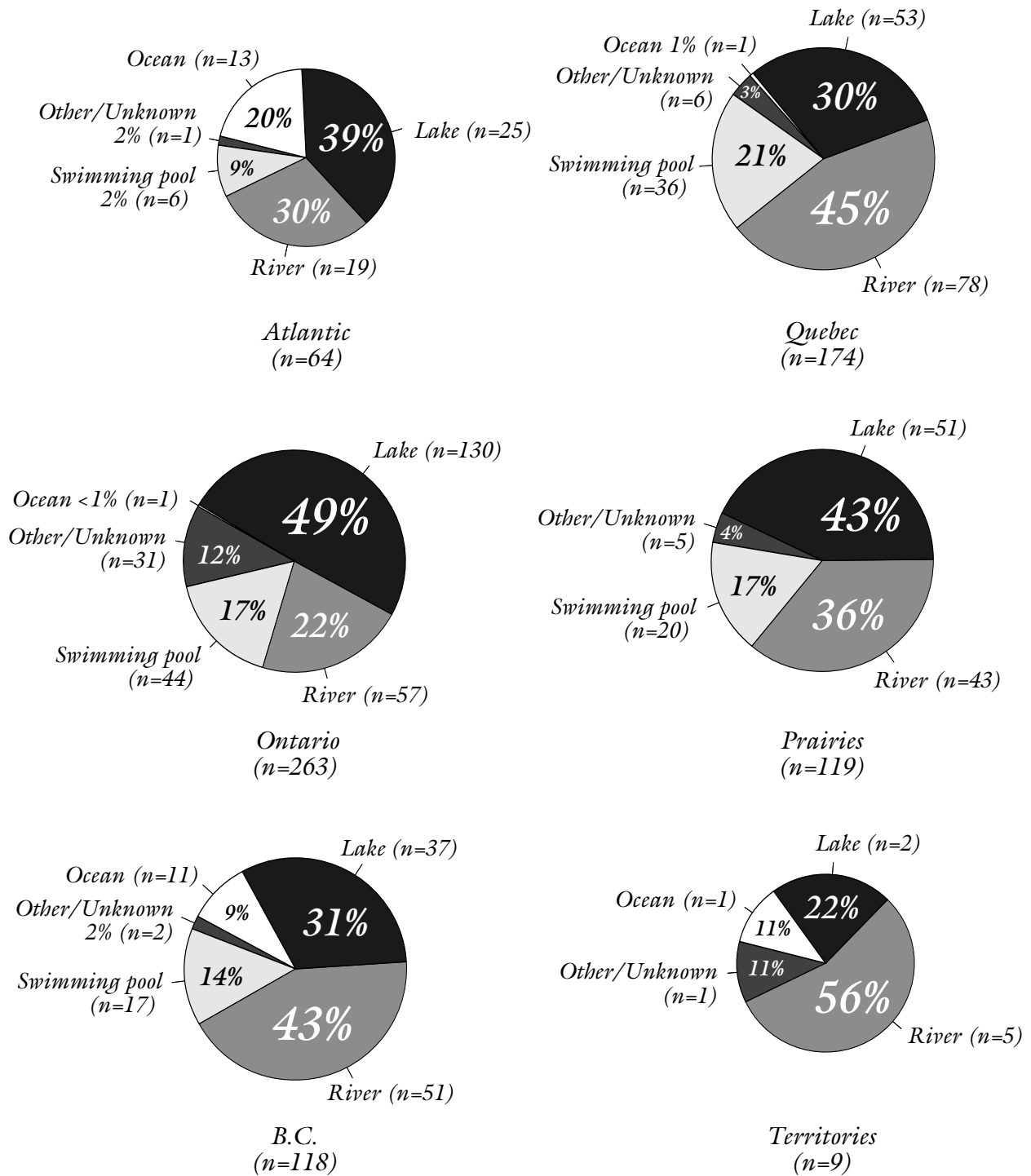
RATE OF RECREATIONAL SWIMMING DROWNINGS BY REGION, CANADA 1991-2000 (n=747)



Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

AQUATIC ACTIVITIES

Figure 17 RECREATIONAL SWIMMING DROWNINGS BY REGION & TYPE OF BODY OF WATER,* CANADA 1991-2000 (n=747)



*"Lake" includes pond & reservoir

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

NON-AQUATIC ACTIVITIES



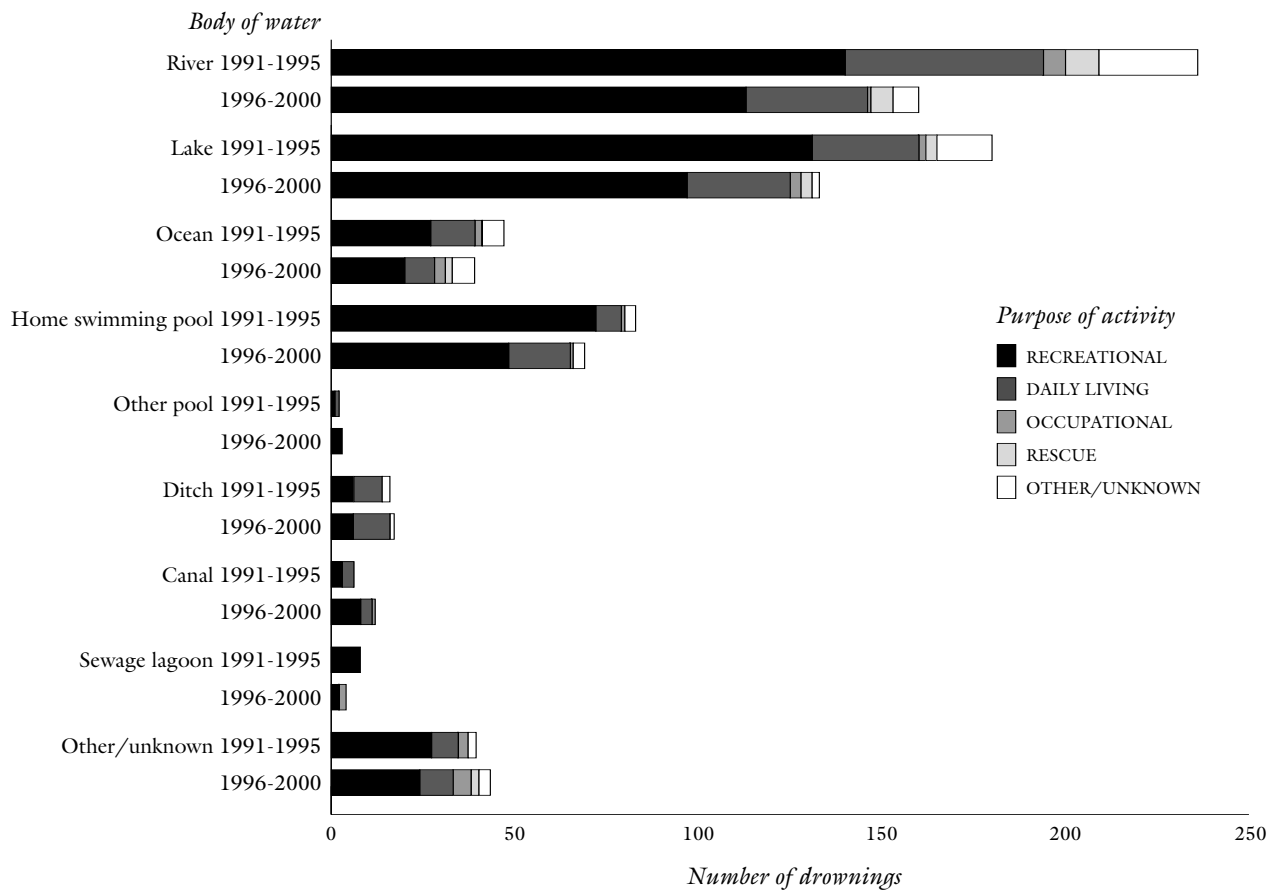
The most frequent bodies of water for drownings from falls into water were rivers, lakes, and home swimming pools (Figure 18). Most of the victims of falls into home pools were 1-4 year old toddlers; pool drowning is described in the next section.

TRENDS

There were significant reductions in the number of incidents in rivers and lakes between 1991-1995 and 1996-2000 (Figure 18).

Figure 18

DROWNINGS FROM FALLS INTO WATER DURING NON-AQUATIC ACTIVITIES BY PURPOSE OF ACTIVITY* & TYPE OF BODY OF WATER,† CANADA 1991-2000 (n=1,091)



* Recreation includes adult leisure activities and children's play; daily living includes activities such as non-recreational travel by foot
† "Lake" includes pond & reservoir

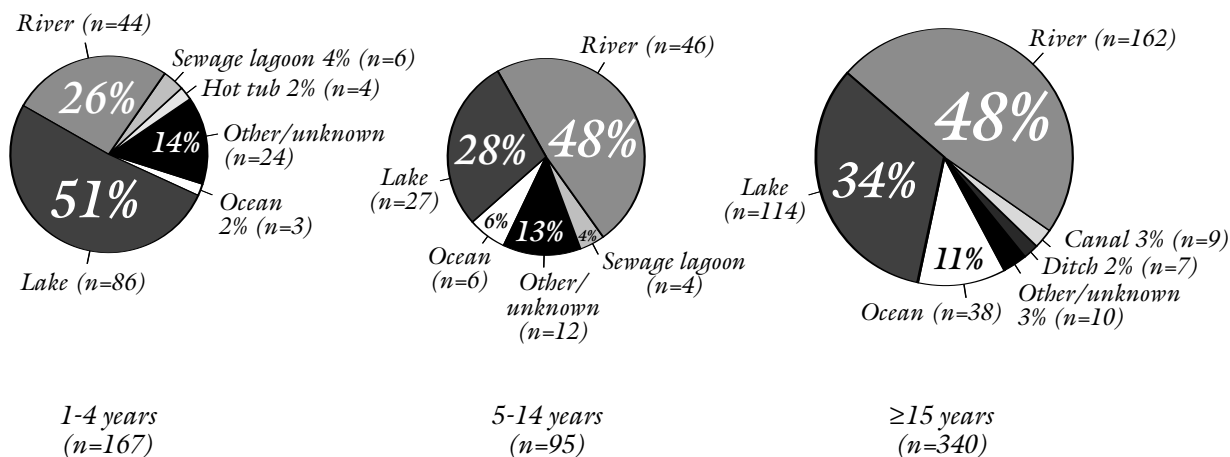
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

NON-AQUATIC ACTIVITIES

Considering non-pool incidents by age, lakes accounted for about half of drownings from falls into water for toddlers, and rivers for about half of these drownings for victims 5 and older (Figure 19). Current was probably a major contributing factor for river drownings.

Figure 19

DROWNINGS FROM FALLS INTO WATER OTHER THAN SWIMMING POOLS DURING NON-AQUATIC RECREATIONAL ACTIVITIES BY AGE* & TYPE OF BODY OF WATER,† CANADA 1991-2000 (n=606)



* There were 4 infant (<1 year) deaths from falls into water

† "Lake" includes pond & reservoir

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

There are several hazardous environments and vulnerable groups for drowning in Canada. In the built environment, the home is a key location for avoidable drownings of two vulnerable groups. The two main drowning hazards in homes are swimming pools and bathtubs. The two main vulnerable groups for home drowning are infants and toddlers 0-4 years old and persons with epilepsy 15 years and older.

Another vulnerable group for drowning is aboriginal peoples, discussed in detail in Module 6. Drownings of aboriginals — both children and adults — tend to take place in the natural environment rather than in the built environment.



Swimming Pool Drownings

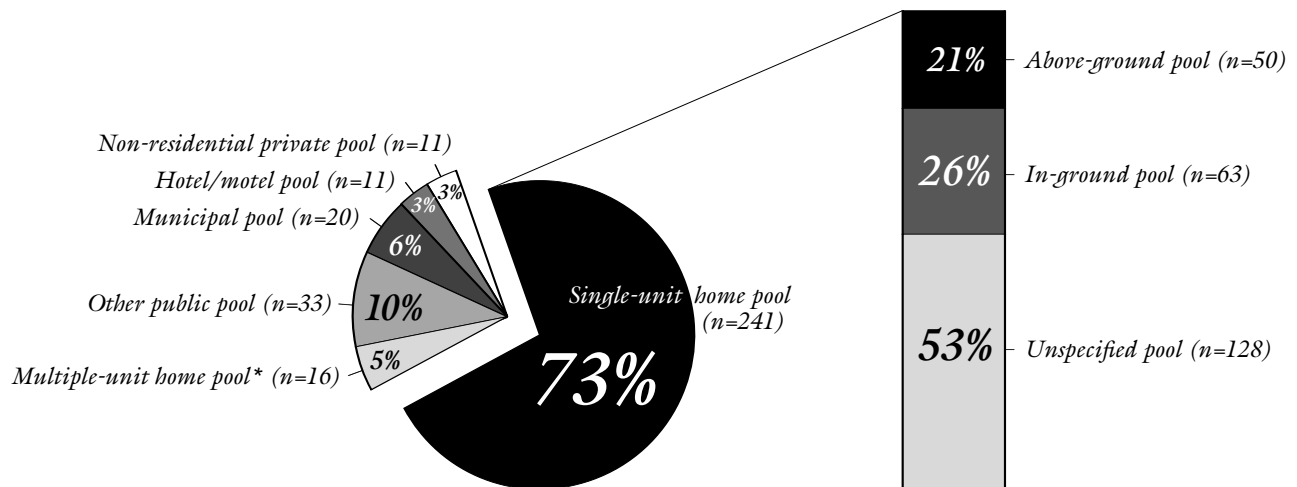
Most swimming pool drownings occurred in single-unit home pools (Figure 20). Of these, 50% involved 1-4 year old toddlers (Figure 21), nearly all in pools with inadequate safety gates. In only 5% (n=6/121) of these toddler pool drownings was the pool reported to be equipped with an automatic self-closing and self-latching gate. In 26% (n=32), the gate was either self-closing or self-latching, in 19% (n=23) of unknown type, in 15% (n=18) no gate was present, and in 35% (n=42), there was no information in the coroner or police files about the gate.

TRENDS

Between 1991-1995 and 1996-2000 there was a decrease in home pool drownings of 71% for female toddlers and 30% for male toddlers (Figure 21). There was no improvement for those 5 and older, for whom risk factors included limited swimming ability, alcohol, epilepsy, and other medical conditions.

Figure 20

SWIMMING POOL DROWNINGS BY TYPE OF POOL, CANADA 1991-2000 (n=332)

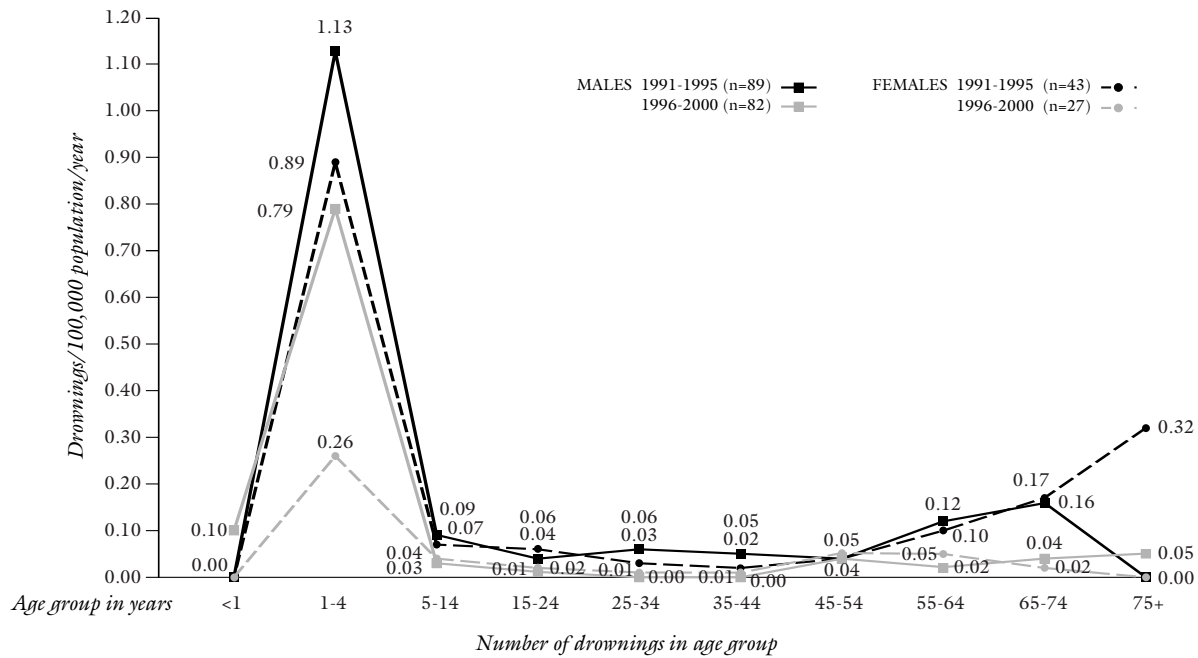


* Pool at an apartment building

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

Figure 21

RATE AND NUMBER OF SINGLE-UNIT HOME POOL DROWNINGS BY AGE & SEX, CANADA 1991-2000 (n=241)*



	Number of drownings in age group									
Males 1991-1995	0	45	9	4	8	6	3	7	7	0
1996-2000	0	36	7	6	3	3	4	6	8	9
Females 1991-1995	1	30	3	1	0	0	3	1	2	2
1996-2000	0	10	4	2	1	1	5	3	1	0

* Sex unknown for 2 victims, imputed male (2,0)

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

Infant and Toddler Drownings



Nearly all drownings of infants less than 1 year old occurred in adult-size home bathtubs during momentary inattention by a parent or supervision by another child. The most frequent location for drownings of 1-4-year-old toddlers was home swimming pools, followed by lakes, rivers, and for 1-2-year-olds, bathtubs (Figure 22).



ETHNICITY

Aboriginal toddlers had high drowning rates, and were more likely to drown in natural bodies of water such as lakes and rivers, due to proximity of homes to such hazards. Refer to Module 6 for more information on aboriginal drownings.



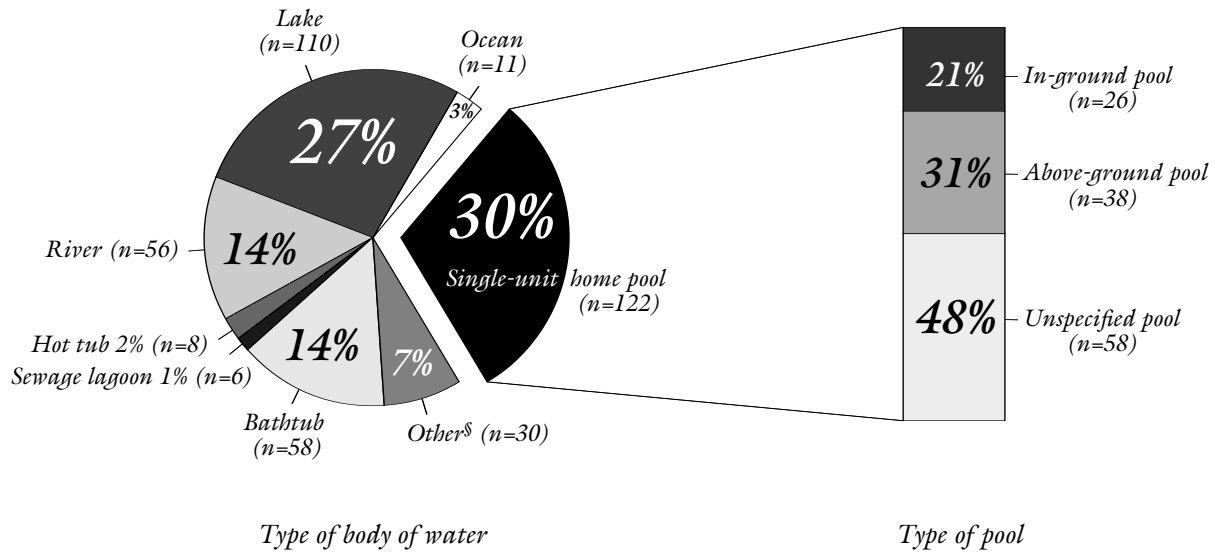
TODDLER POOL DROWNINGS

The most frequent type of home pool for toddler drownings was above-ground. These are inexpensive and often joined to the living area of the home by a patio-terrace, which makes them dangerously accessible to toddlers. Quebec, with approximately 24% of Canada's population, accounted for 47% of toddler pool drownings.

TRENDS

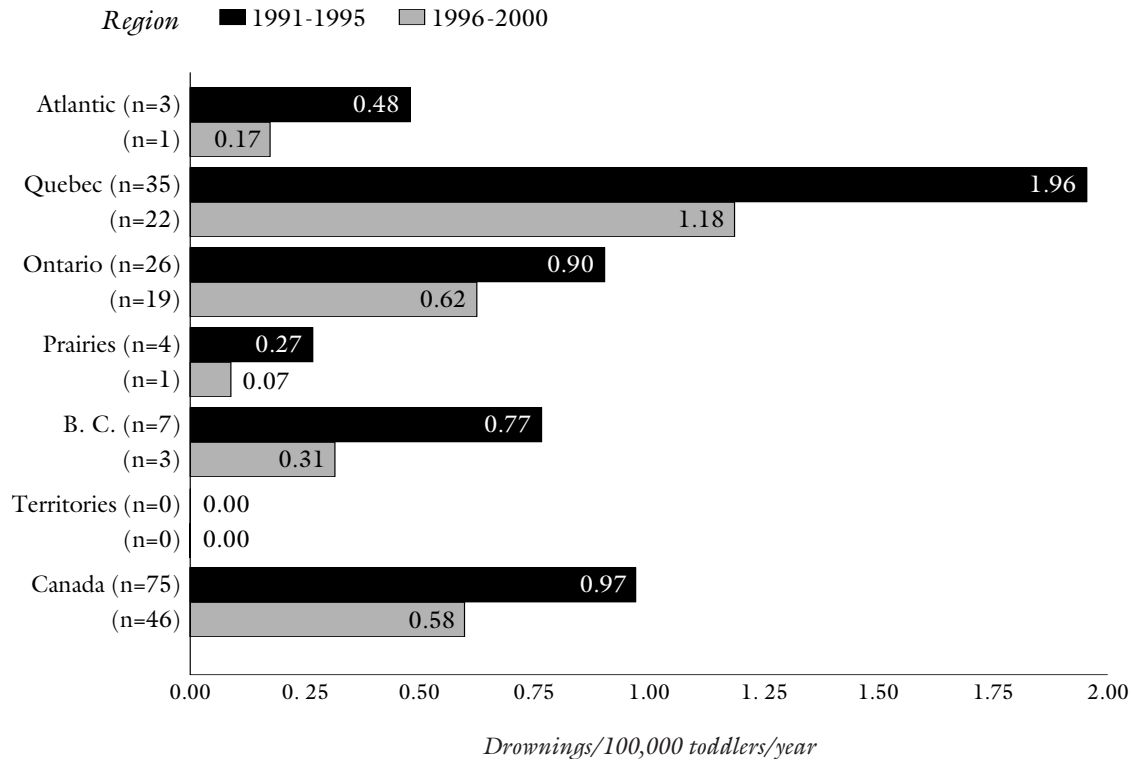
There was a 40% decrease in home pool toddler drownings between 1991-1995 and 1996-2000, with improvements in all regions, including Quebec (Figure 23).

Figure 22 INFANT AND TODDLER* DROWNINGS† BY TYPE OF BODY OF WATER,‡ CANADA 1991-2000 (n=401)



* Infants are <1 year old; toddlers are 1-4 years old † Excludes land & air transport drownings ‡ “Lake” includes pond & reservoir § Including pail 4, multiple-unit home pool 3, cistern 3, ditch 3, pit 3, toilet 2, water trough 2, rut 2, sump hole 2, & 1 each of non-residential private pool, canal, septic tank, duck pond, lumber conditioning plant, & garbage can
 Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

Figure 23 RATE AND NUMBER OF SINGLE-UNIT HOME SWIMMING POOL TODDLER* DROWNINGS BY REGION, CANADA 1991-2000 (n=121)



* Toddlers are 1-4 years old
 Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005



Bathtub Drownings

PERSONAL RISK FACTORS

AGE AND SEX Infants and toddlers 0-4 years old accounted for 15% of all bathtub drowning victims, and 5-14-year-olds for only 4% (Figure 22, Annexes 1a, 3). Bathing was one water-related activity where the rate of female drownings exceeded that of males, with 58% of victims being female (Figure 24). Although in the first half of the 1990's rates were especially high among female toddlers, these rates fell dramatically during 1996-2000.

ALCOHOL There was a large difference in blood alcohol levels between victims with and without epilepsy. For persons without epilepsy, alcohol was present or suspected in 30% of those 15 years and older, and above the legal limit of 80 mg % for driving a car in 24% of cases. For those above the limit, 88% had levels higher than 150 mg %, with many of them much higher. Levels were considerably lower for persons with epilepsy. Only 6% of victims 15 and older had any alcohol detectable in the blood, and of these, only half, 3% of all persons 15 and older with epilepsy, had levels above the limit.

HEALTH CONDITIONS Among victims 15 years of age and older, there were several health conditions that tended to affect the level of consciousness and predispose an individual bathing alone to drowning in a bathtub (Figure 25). Epilepsy was the most frequent, followed by other neurological conditions, mental illness, alcoholism, and cardiac illness.

For all ages, 28% of bathtub drownings occurred in people with epilepsy. By age group, for 0-4 year olds, 8% of bathtub drownings occurred in children with epilepsy, for 5-14 year olds, 58%, for 15-54 year olds, 58%, and for 55 years and older, 8%. Hence, except for the two extremes of age where other factors were predominant, epilepsy accounted for the majority, nearly 60%, of bathtub drownings.

SUPERVISION Of the 25 infants less than 1 year old without epilepsy who drowned in bathtubs, only 12% (n=3) were with an adult, while 56% (n=14) were with a minor child less than 15 years old and 32% (n=8) were alone. Of 32 toddlers 1-4 years old without epilepsy, only 3% (n=1) was with an adult, 31% (n=10) were with a minor child, and 66% (n=21) were alone. Of 6 children 5-14 years old without epilepsy who drowned in bathtubs, 100% were alone. There were no infants with epilepsy who drowned in bathtubs. Of the 2 cases of toddlers with epilepsy who drowned in bathtubs, both were alone, while for 8 children 5-14 years old with epilepsy who drowned in a bathtub, 12% (n=1) were with an adult and 88% (n=7) alone.

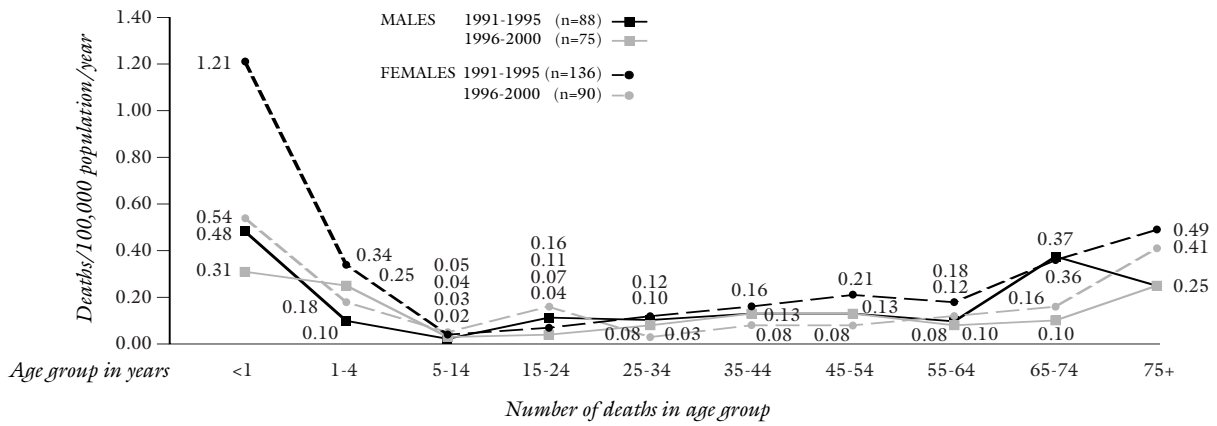
IMPLICATIONS FOR PREVENTION From the above, it is clear that about 60% of bathtub drownings among 5-54-year-olds were people with epilepsy, with alcohol rarely a factor. For this group, the major means of prevention is use of a shower rather than bathing alone immersed in a tub. For other victims 15-54 years old, most incidents involved high levels of alcohol and/or other drugs, suggesting the need to increase awareness in the general public of the hazards of bathing after consuming alcohol and/or other drugs. For 0-4 year olds, constant adult supervision of toddlers and use of infant bathtubs for bathing infants would be the major implications of the data. For bathers 55 and older, the risk of drowning is affected by a mix of personal risk factors including alcohol and chronic health conditions associated with advancing age, poor diet, lack of exercise, and smoking.

TRENDS

There was a 26% improvement in the overall number of bathtub drownings between 1991-95 and 1996-2000 (Annex 1c). The greatest improvement in bathtub drowning rates were seen among 0-4-year-old and 25-74-year-old females (Figure 24), with a 52% drop in the number of bathtub drownings for both of these groups. On the other hand, although the numbers are small, there were increases of 150% among 1-4-year-old males and 129% among 15-24-year-old females.

Figure 24

RATE AND NUMBER OF BATHTUB DROWNINGS BY AGE & SEX, CANADA 1991-2000 (n=389; 163 MALES, 226 FEMALES)*



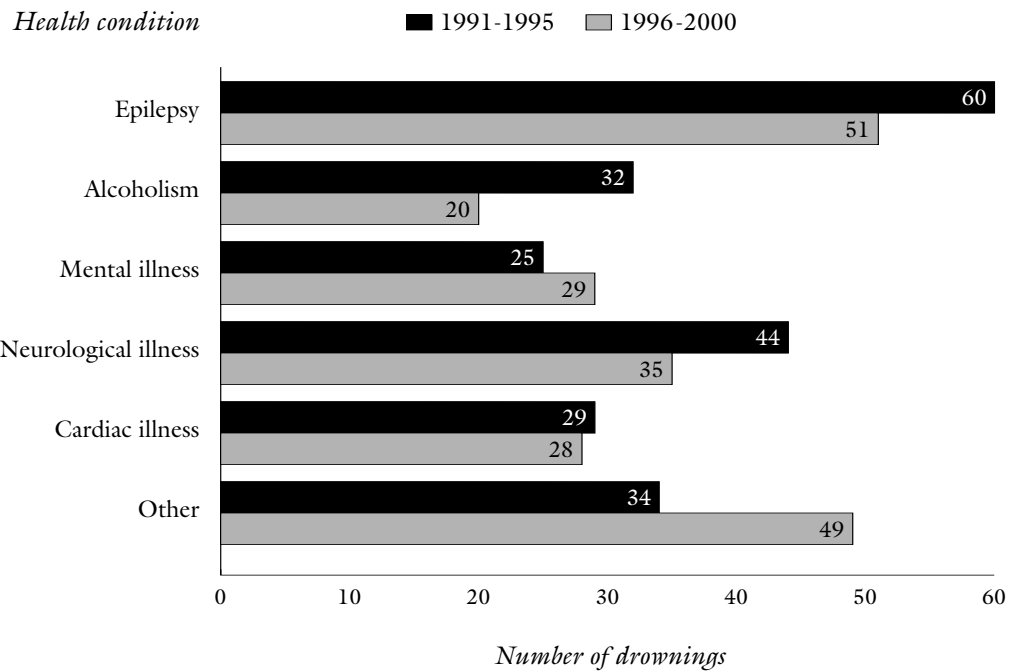
		Number of deaths in age group									
		<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+
MALES	1991-1995	5	4	2	11	13	15	10	6	16	6
	1996-2000	3	10	3	4	10	16	12	5	5	7
FEMALES	1991-1995	12	13	4	7	15	18	16	11	19	20
	1996-2000	5	7	5	16	3	10	8	8	9	19

* Sex unknown for 1 victim ≥75 years old, imputed female (1,0)

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

Figure 25

HEALTH CONDITIONS* OF VICTIMS OF BATHTUB DROWNINGS, CANADA 1991-2000 (VICTIMS ≥15 YEARS OF AGE; n=316)



* Includes conditions with possible effect on consciousness, alertness, or balance; victims may suffer from more than one condition

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005



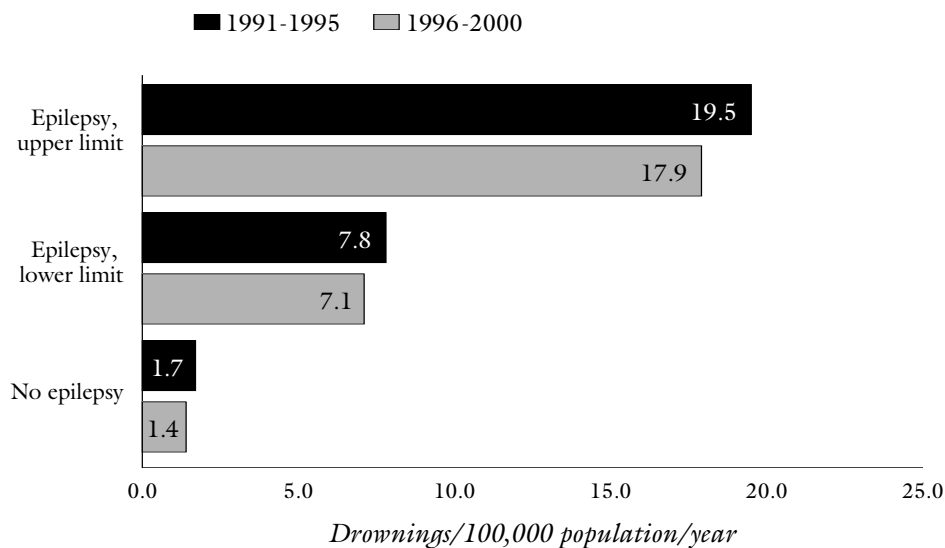
Persons with Epilepsy

Epilepsy predisposes the individual to seizures and sudden loss of consciousness. This is a risk factor for drowning and other injuries. The precise prevalence of epilepsy in the population is not known, so a range of possibilities was used to estimate the rate of drowning among people with epilepsy compared with other Canadians (Figure 26). The drowning rate for persons with epilepsy was estimated to be between 4.5 and 11.5 times higher than for people without epilepsy.

ACTIVITY & AGE Persons between 15 and 54 years of age accounted for 81% of drownings of people with epilepsy (Figure 27). More than half of people with epilepsy who drowned did so in a bathtub, and 83% of these victims were between 15 and 54 years of age (Figure 28). Nevertheless, the highest risk groups for drowning by age for persons with epilepsy are quite different overall than for bathtub drownings. For all bathtub drownings, the very young and the very old are most vulnerable, while for epilepsy, it is mainly the working age population at risk (Compare Figures 24 and 27). Thus most persons with epilepsy who drowned were economically productive adults. Their deaths were not only tragic but also economically costly for families and communities.

Figure 26

ESTIMATED RATE* OF DROWNINGS† FOR PERSONS WITH & WITHOUT EPILEPSY, CANADA 1991-2000 (n=4,671; 228 WITH EPILEPSY, 4,443 WITHOUT EPILEPSY)



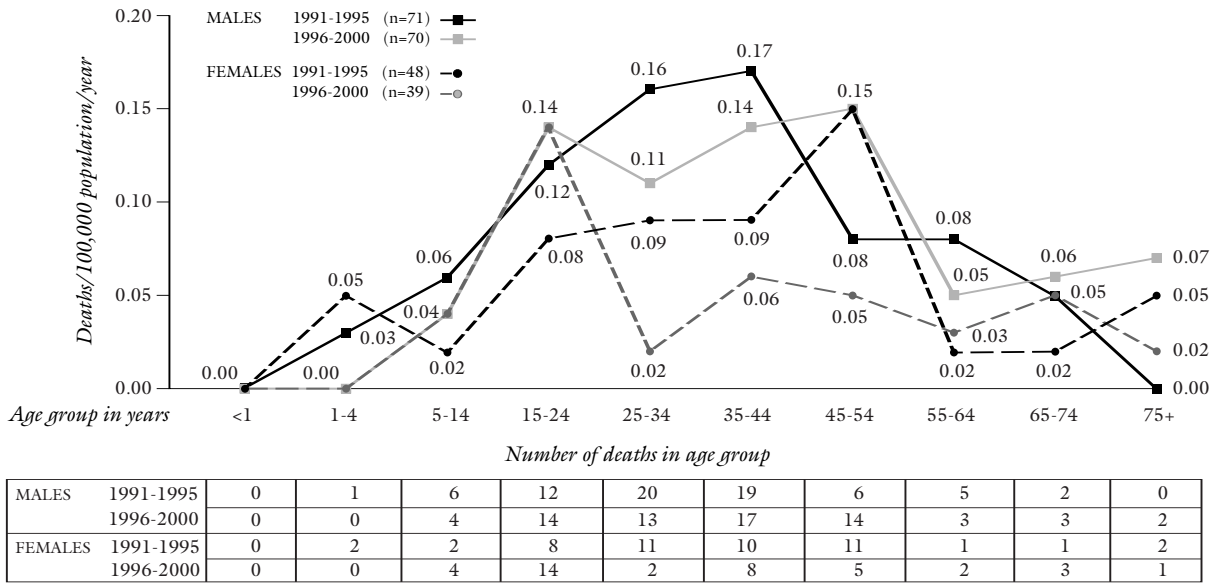
* Lower limit is based on a prevalence estimate for epilepsy of 400/100,000 population and upper limit on a prevalence of 1,000/100,000 population (prevalence estimates from Shorvon, *Lancet* 1990;336:93-96)

† Includes recreational & daily living drownings (E910, E830, E832); excludes land & air transport drownings

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

Figure 27

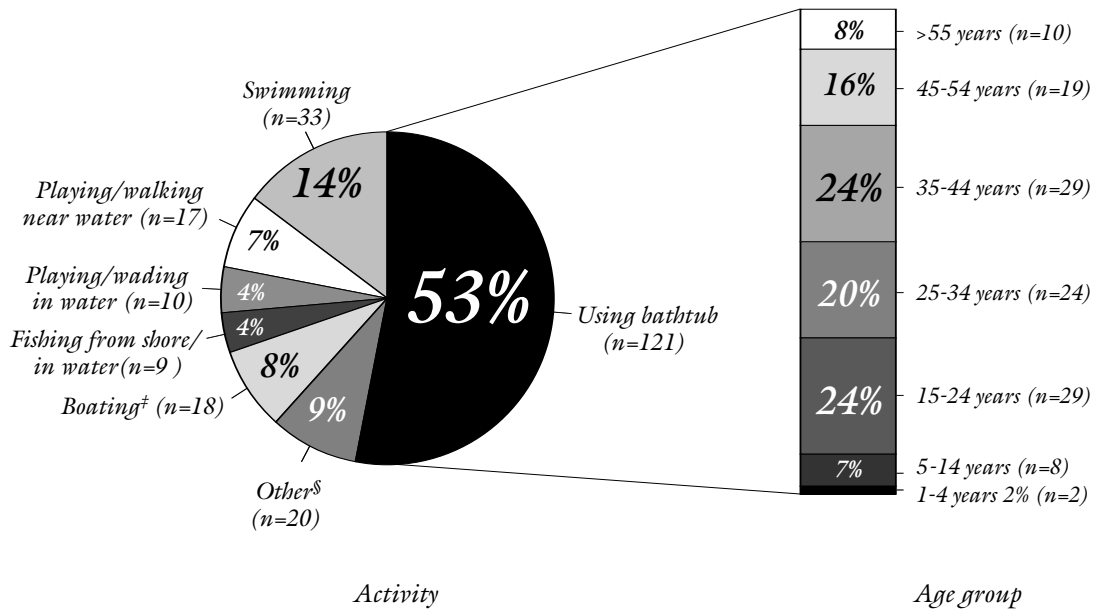
RATE AND NUMBER OF DROWNINGS OF PERSONS WITH EPILEPSY BY AGE & SEX, CANADA 1991-2000 (n=228; 141 MALES, 87 FEMALES)



Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

Figure 28

DROWNINGS* OF PERSONS WITH EPILEPSY BY ACTIVITY, CANADA 1991-2000 (n=228)†



* Includes recreational, occupational & daily living drownings (E910, E830, E832); excludes land & air transport drownings
 † At least 182 drownings occurred during seizures; seizure was not reported for the other 46 ‡ Includes fishing from boat
 § Including hunting 3, 2 each of using hot tub, cleaning pool, gardening, 1 each of partying, sitting on float, sitting on bridge, moving lawn, cleaning caribou, & unknown 6

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

Snowmobile immersion deaths are discussed only briefly here; they are described in greater detail in Module 2. There were 232 snowmobile drownings reported in Canada during 1991-2000; hypothermia would have been a factor in many of these deaths. There were another 14 snowmobile immersion deaths; these victims died of hypothermia without drowning. (We do not report on other causes of death, such as crashes.) Most incidents occurred in the dark, at high speed. The snowmobiler may have encountered an open hole in the ice — or in Newfoundland, the open sea — but was unable to stop quickly enough.



PERSONAL RISK FACTORS

AGE AND SEX Males 15-74 years old were the main risk group for snowmobile drowning (Figure 29). Many victims were aboriginals, who often use snowmobiles for daily travel and subsistence activities.

ALCOHOL Alcohol was associated with at least 60% of snowmobile drownings, and probably more (Figure 30). In many of these cases, the level of blood alcohol was very high, well above the legal limit for driving a car of 80 mg %.



ENVIRONMENTAL RISK FACTORS

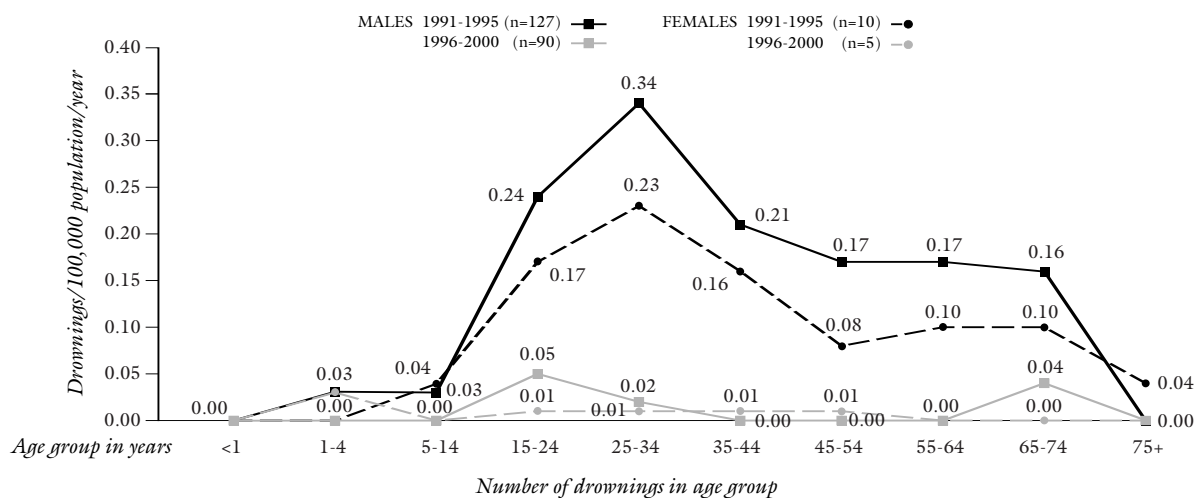
REGION The highest rates of snowmobile drowning were seen in the northern territories and the Atlantic provinces, followed by Ontario, Quebec and the Prairies (Figure 31). Less than 1% of snowmobile drownings occurred in British Columbia.

TRENDS

Although Quebec showed a small increase in the number of snowmobile drownings between 1991-1995 and 1996-2000, most other regions showed a significant decrease. If we include hypothermia deaths, which increased over the same period, the overall reduction in snowmobile immersion deaths in Canada was 24%.

Figure 29

RATE AND NUMBER OF SNOWMOBILE DROWNINGS BY AGE & SEX, CANADA 1991-2000 (n=232)†**



	<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+
Males 1991-1995	0	1	3	25	44	23	13	10	7	0
1996-2000	0	0	4	18	28	20	8	6	5	1
Females 1991-1995	0	0	0	5	3	0	0	0	2	0
1996-2000	0	1	0	1	1	1	1	0	0	0

* Included recreational 168 (93, 75), daily living 53 (37, 16), occupational 7 (4, 3), attempting rescue 2 (1, 1), & unknown 2 (2, 0)

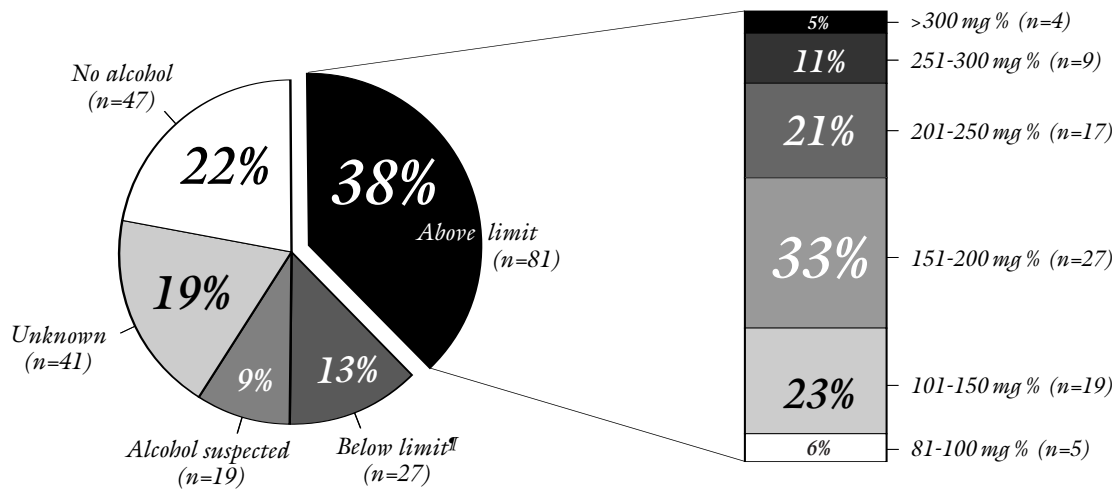
† There were 14 additional snowmobile immersion deaths from hypothermia without drowning (3, 11) ‡ Age unknown for 1 male victim (1, 0)

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

SNOWMOBILING

Figure 30

BLOOD ALCOHOL LEVELS* FOR SNOWMOBILE DROWNINGS, CANADA 1991-2000 (VICTIMS ≥15 YEARS OF AGE; n=223)†

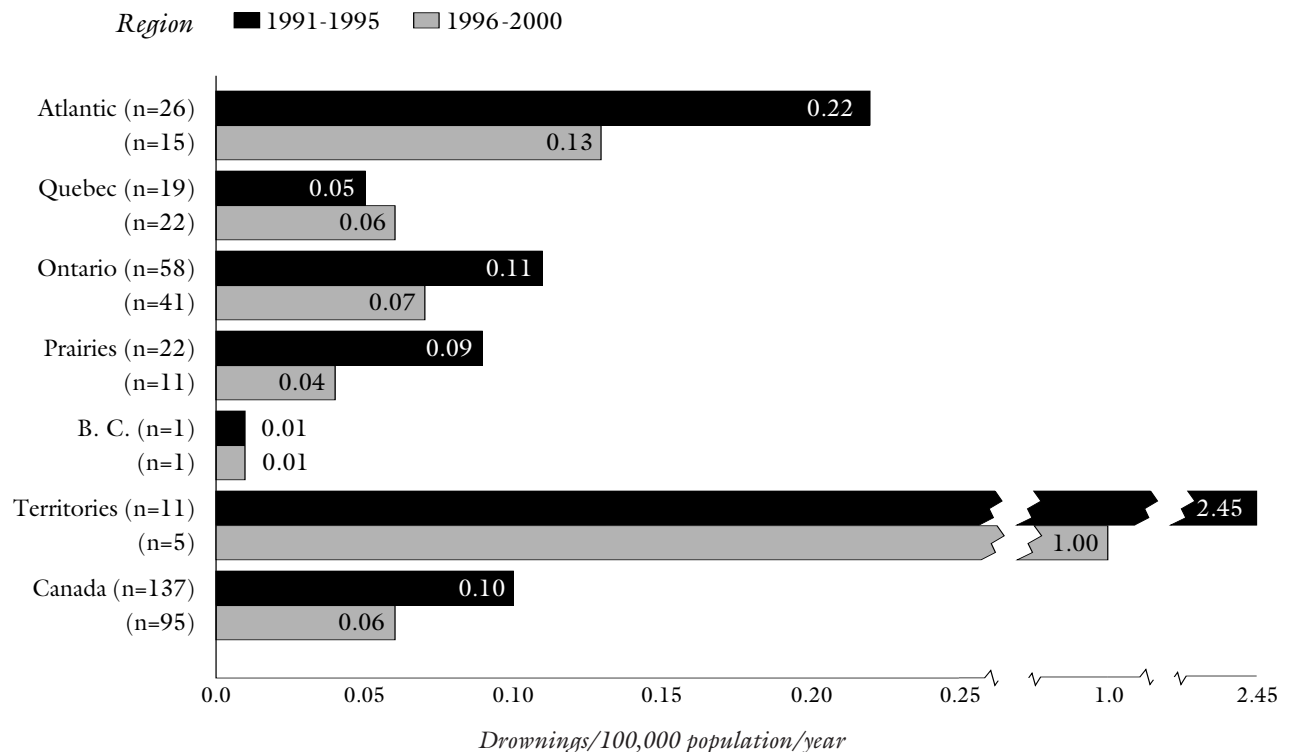


* Legal limit is 80 mg % † This figure excludes 8 victims; decomposition rendered blood alcohol unreliable
 ‡ 14 at 1-49 mg %, 12 at 50-80 mg %, & 1 unspecified

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

Figure 31

RATE AND NUMBER OF SNOWMOBILE DROWNINGS BY REGION, CANADA 1991-2000 (n=232)



Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005



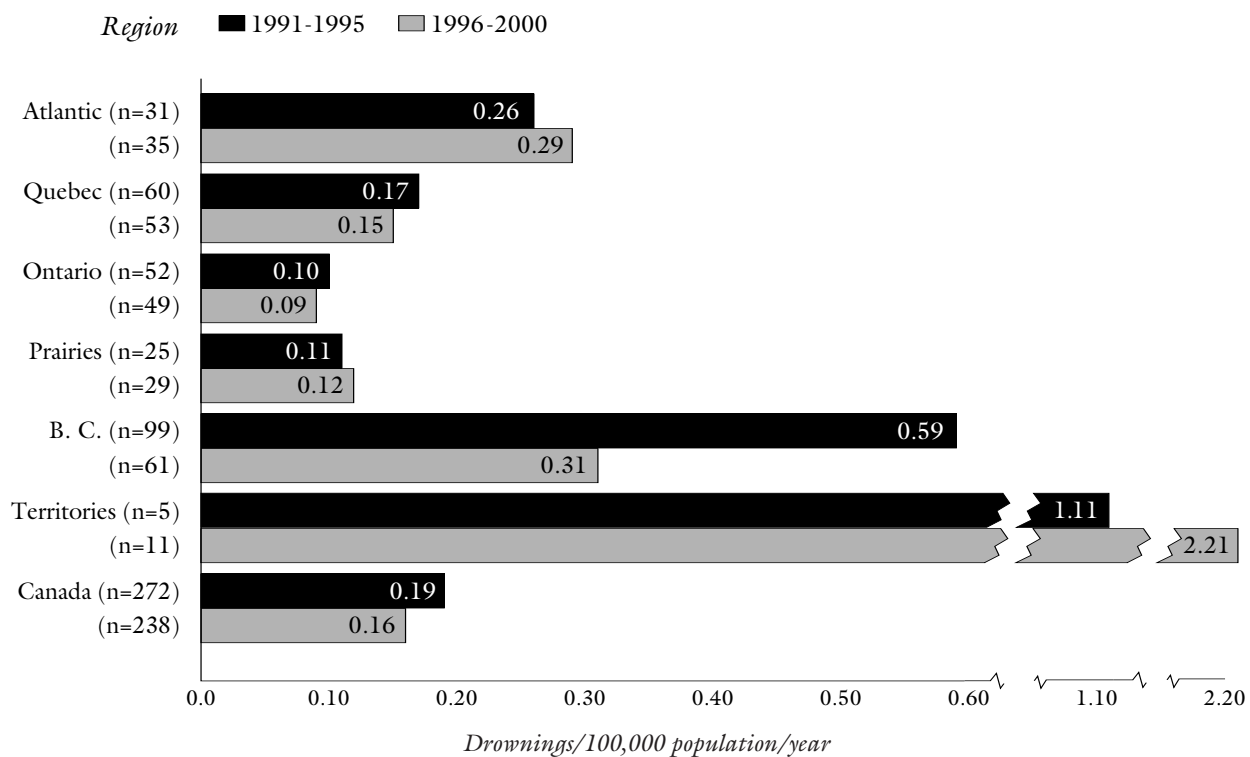
Drowning in on-road vehicles such as cars and trucks occurred mainly when vehicles went off the road into water. In Quebec and British Columbia, which have more rivers, a proportion of such incidents occurred when a vehicle went off a bridge. Inadequate or absent barriers to contain a skidding vehicle was a factor in some incidents.

TRENDS



British Columbia, with a reduction of 48%, was the only region that experienced a significant improvement in road traffic drownings between 1991-1995 and 1996-2000. In contrast, the northern territories saw an increase (Figure 32).

Figure 32 **RATE AND NUMBER OF ROAD TRAFFIC DROWNINGS BY REGION, CANADA 1991-2000 (n=510)**



Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

As well as analyzing activities and risk factors associated with drowning and other water-related injuries in Canada during 1991-2000, we also looked at trends between 1991-1995 and 1996-2000.

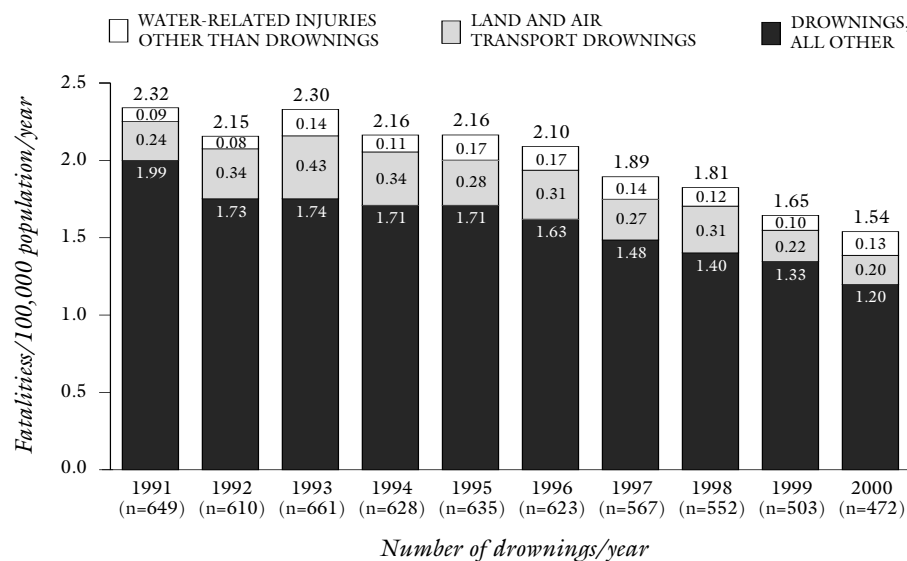
Overall, the rate of water-related fatalities in Canada decreased by 19% between the two 5-year periods (refer to Table 2, page 33, for an overview of numbers, rates and trends for the categories listed below).

DROWNINGS

There was a 20% decrease in the rate of land and aircraft drowning; for all other drownings there was a decrease of 21%. If we compare only the first and the last years of the decade, the reduction was even more dramatic at 40% (Figure 33).

Figure 33

RATE AND NUMBER OF DROWNINGS AND OTHER WATER-RELATED FATALITIES, CANADA 1991-2000 (n=5,900)



	Number of drownings/year									
Water-related injuries other than drownings	24	23	40	31	50	49	41	35	32	40
Land & air transport drownings	68	96	122	100	83	91	81	94	66	63
Drownings, all other	557	491	499	497	502	483	445	423	405	369

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

BOATING

There was a 24% decrease in the rate of boating drowning in Canada, with a particularly significant decrease in daily living boating drownings.

AQUATIC ACTIVITIES

Since many people engage in swimming and wading, these categories of drowning claim the largest number of victims; hence decreases of 22% for swimming and 46% for wading are encouraging. The improvements were mainly evident in British Columbia and Ontario. No improvement was seen in the Atlantic or Prairie regions.

Although the number of deaths is much smaller, there was a 138% increase in the rate of drowning in hot tubs during the period, and increases or no improvement in the rates of drowning during diving/jumping, fishing by wading, and scuba diving.

NON-AQUATIC ACTIVITIES

There was a 27% decrease in the rate of drowning during non-aquatic activities, generally caused by falls into water. The most frequent body of water for these incidents continues to be rivers, where current is a frequent risk factor, followed by lakes and home swimming pools. Infants under one year old are at minimal risk for such incidents. For toddlers 1-4 years old, incidents tended to occur in home pools, followed by lakes and rivers. Rivers accounted for nearly 50% of incidents among adults and children 5 years and older.

SWIMMING POOLS

Home pools are the most frequent location for swimming pool drownings. The main victims in home pools are 1-4-year-old toddlers. Nearly all of these incidents resulted from falls into pools. There was a 40% decrease in the rate of swimming pool drowning of toddlers in Canada; this improvement appears to have resulted from research-based training and publicity. There were large differences between provinces and regions.

BATHTUBS

There was a 26% decrease in the rate of bathtub drowning. Among infants less than one year old, the decrease was 50%.

INFANTS & TODDLERS

There was a 54% decrease in the rate of infant and 25% of toddler drownings in Canada. Since infants drowned most frequently in bathtubs and toddlers in home pools, the improvement reflects a decrease in drowning in these sites.

PERSONS WITH EPILEPSY

There was no significant change in the rate of drowning of persons with epilepsy.

SNOWMOBILING

Although there was a 34% decrease in the rate of snowmobile drowning in Canada, there was a 246% increase in the rate of snowmobile hypothermia deaths. The overall decrease in the snowmobile immersion death rate was 28%.

NON-DROWNINGS

No improvement was seen for non-drowning fatalities — in fact there was an increase of 11%. Non-drowning incidents included boating collisions (24%), boating hypothermia (17%), scuba incidents, mainly air embolism (14%), diving into water (10%), and snowmobile immersion hypothermia (4%).

NEAR DROWNINGS

The overall trend in rates of hospitalization for near drowning where the victim survived was a decrease of 25%. Infants and toddlers accounted for 31% of survivors of hospitalization. There was a 29% drop in the rate of hospitalization for near drowning among toddlers and 8% among infants.

Table 2

TRENDS IN WATER-RELATED INJURY RATES*: DROWNINGS, NON-DROWNING FATALITIES AND NEAR DROWNINGS, CANADA 1991-2000 (n=9,426)

WATER-RELATED INJURIES	1991-1995		1996-2000		RATE REDUCTION† (INCREASE) (%)	95% CI‡ (%)	p-value§
	#	RATE	#	RATE			
DROWNINGS (excluding land & air transport)	2,546	1.82	2,125	1.43	21	17-26	<0.0001
Recreational	1,732	1.24	1,456	0.98	21	15-26	<0.0001
Daily living	470	0.34	334	0.23	33	22-41	<0.0001
Occupational	139	0.10	115	0.08	22	(2)-38	0.0770
Infants	23	1.13	10	0.53	54	1-88	0.0456
Toddlers	220	2.84	168	2.12	25	9-39	0.0043
Boating	997	0.71	806	0.54	24	17-31	<0.0001
Recreational	728	0.52	634	0.43	18	8-26	0.0005
Daily living	125	0.09	62	0.04	53	40-67	<0.0001
Occupational	114	0.08	87	0.06	28	1-43	0.0433
Aquatic activities	614	0.44	569	0.38	12	3-33	0.0118
Recreational	584	0.42	504	0.34	18	9-28	0.0005
Swimming	409	0.29	338	0.23	22	8-31	0.0016
Playing/wading in water	107	0.08	61	0.04	46	32-63	<0.0001
Bathtub	224	0.16	165	0.11	30	16-44	0.0003
Non-aquatic activities	617	0.44	474	0.32	27	18-35	<0.0001
LAND & AIR TRANSPORT DROWNINGS	469	0.33	395	0.27	20	6-28	0.0033
Snowmobile	137	0.10	95	0.06	34	22-54	<0.0001
TOTAL DROWNINGS	3,015	2.15	2,520	1.70	21	17-25	<0.0001
OTHER WATER-RELATED FATALITIES	168	0.12	197	0.13	(11)	(33)-12	0.4450
Snowmobile (hypothermia)	3	0.00	11	0.01	(246)	(1,141)-3	0.0570
TOTAL FATALITIES	3,183	2.27	2,717	1.83	19	15-23	<0.0001
NEAR DROWNINGS¶ (all ages)	1,963	1.40	1,563	1.05	25	20-30	<0.0001
Infants	88	4.33	76	3.99	8	(25)-32	0.6015
Toddlers	537	6.92	388	4.90	29	19-38	<0.0001

* Victims per 100,000 population per year † Rate reductions were calculated from unrounded rates

‡ Confidence interval; we can be 95% certain that the decrease (increase) is within this interval

§ Probability that this decrease (increase) occurred by chance alone (e.g. for a p-value of <0.0001, probability is less than 1 in 10,000)

¶ Includes survivors of hospitalization for near drowning

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

COMMON ACTIVITIES AND RISK FACTORS

The research shows that the activities most often leading to drowning during 1991-2000 were boating, swimming or wading, walking or playing near water, snowmobile and car travel, and bathing in a bathtub.

Being male was the most frequent risk factor for all activities except bathing in a bathtub. Failure to wear a flotation device was a major risk factor for boating. Alcohol consumption and river current were frequent risk factors for swimming and wading, falls into water, boating, and snowmobiling. Darkness and high speed were also important risk factors for snowmobiling. The absence of an automatic self-closing and self-latching gate was a risk factor for nearly all home pool drownings involving small children. Bathing in an adult-sized bathtub was a common risk factor for infants as well as for adults with epilepsy.

Please refer to Methods, page 3, for information on methodology used in analyzing results.

TRENDS

The trends in rates for most categories of drowning, especially among children, were quite encouraging during the 1990's (Table 2). The improvement in child drowning occurred shortly after the introduction of new research-based Red Cross water safety training and swimming programs and manual in the mid-1990's. This new material reached most communities across Canada. The Canadian Coast Guard also began using Red Cross research and surveillance reports as a guide to educational programs for boating, along with other government and private organizations.

For the first time in Canada, and indeed in the world, detailed information about the incidence and risk factors for water-related injury deaths was available for the entire country. While the results are promising, to achieve a target closer to vision zero for water-related deaths, other measures such as legislation and enforcement will be required, and these are discussed below. Ongoing annual surveillance continues, and will be essential to help assess the success of new programmes and other interventions.

HOW TO PREVENT WATER-RELATED INJURIES

PERCEPTION OF RISK

A key issue in prevention is the individual's and family's perception of risk for different activities. **The actual risk of water-related injury and death per exposure to water tends to be much higher than the public perception.** Thus while the risk of death or severe injury from a motor vehicle crash is quite low per trip, nearly all drivers and passengers in Canada now wear seatbelts and avoid alcohol. On the other hand, people often load their boats with alcohol and forget to bring or wear their flotation devices, drink before swimming and diving, swim or wade in strong current, install home swimming pools without an automatic safety gate, dive into home pools, and so forth. **The lesson for those who train and educate the public is that a first priority must be to discuss risk perception.** Only then can misperceptions be corrected so that each individual has a realistic appreciation of the risk of injury for different activities. At that point, the discussion can move on to strategies for reducing risk to a sensible and reasonable level in order to avoid injury.

BOAT SMART!

It is worth noting that only 12% of boaters who drowned during 1991-1995 were wearing a flotation device, and only 11% during 1996-2000. This is a major opportunity for prevention by good legislation and enforcement, and of course individual safety practices. Wearing rates for flotation devices in boats lag far behind those for seatbelts in cars. It is best to focus on adult male or family wearing, rather than child wearing, since 97% of boating drowning victims are males 15 and older, with high rates in all age groups.

Taking time in advance to choose and purchase an appropriate flotation device for the activity that is planned helps to ensure that the device is cool and comfortable and will be worn. For a comprehensive examination of boating, see Modules 3 and 4.

MAKE YOUR ENVIRONMENT CHILD-SAFE AND SUPERVISE CHILDREN

Since it is difficult to constantly monitor small children in the home, home pools should be protected on all sides by a fence at least one metre high. The fence should include vertical bars with no horizontal bars or chain mesh that children can use to climb. The key element is a gate fitted with tension-adjustable self-closing hinges and a latch that is at the top of the gate. The home should never open into a pool area; otherwise, children can wander out of the house into the pool and drown.

Families who choose to spend holidays at cottages adjacent to water should be prepared to provide constant adult supervision for their 1-4-year-old toddlers if access to the water is unrestricted. A safer and more practical alternative is to rent a cottage at a suitable distance from the water such that trips to the water are a planned family event with constant supervision. Otherwise there is always a risk of toddlers wandering off and falling into water when parents are busy with various household activities such as cooking.

BATHE SAFELY

Little infant tubs offer support for children less than a year old. When bathing infants or toddlers, an adult should remain with the child at all times — children should never be relied upon to supervise other children in the bath. The adult should never leave to answer the phone or for other momentary distractions: this is when drownings happen.

Since 53% of persons with epilepsy drowned in bathtubs, persons with epilepsy and the physicians who care for them need to understand the high risk of bathing alone, and the importance of taking showers in preference to baths.

The general public needs to be better educated about the hazards of bathing after consuming alcohol or drugs.

SWIM AND DIVE SAFELY

Many swimmers drown in river current. Young swimmers in particular need to be trained about the hazards of current and how to escape from current using the power of the river or ocean rather than fighting it. Appropriate use of angle while swimming gently upstream against current can sweep the swimmer to the side of the river, similar to use of a ferry angle in a canoe or kayak.

Alcohol was involved in about half of swimming drownings. Surprisingly, high blood alcohol levels were more than twice as frequent among swimmers 25 and older as among those 15-24 years old. Hence older adult males should be especially targeted for training in the hazards of alcohol and swimming. The best safety practice is to avoid alcohol when swimming or diving, since even small amounts can increase the risk of injury.

Diving headfirst into water should be avoided unless the individual is properly trained and certain that the water is sufficiently deep. For swimming pools, the depth of water needed to dive safely is a function of the height and weight of the diver, the length of the deep end of the pool, and the length of the diving board and its distance above the water. Many, and perhaps most, in-ground home pools, even those fitted with diving boards, are unsafe for diving, particularly for adult males. The deep end is often too short and the diver can strike his head on the slope of the pool leading up toward the shallow end. Injury to the cervical spine, which is a relatively fragile structure, can be fatal or cause permanent paralysis of all four limbs. All swimmers should be aware of this danger. The best safety practice is to avoid diving in home pools; all water safety training should emphasize safe feet-first entry into the water.

Swimming training should always include not only how to swim but also how to stay safe in the water, and how to self-rescue and survive if trouble occurs. Family safety and enjoyment will be enhanced if everyone knows how to swim and stay safe in, on and around the water before children are ready to start school. Swimming and water safety training should be based on sound research.

DON'T UNDERESTIMATE CURRENT

Current was a factor in most river drownings as well as in some ocean drownings. A swimmer or wader who underestimates the power of current can be swept away in an instant. A canoeist who broadsides a boulder in current can be trapped between the canoe and the rock in a matter of seconds. (The French term for what can ensue, “cravat” or necktie, is a vivid portrayal of how tons of water can collapse and wrap a canoe around a river rock.) A canoeist or kayaker who is unaware of the danger of a “strainer” or fallen tree across the stream can be suddenly caught in the branches and swept underwater by the current. Other hazards relating to current that are seldom understood without specific training include the risk to swimmers and boaters from circulating hydraulic currents at the base of even a small dam, and the hazard of foot entrapment when trying to wade across a fast flowing river. Swimmers and boaters should be trained to avoid approaching anywhere close to even small dams, including areas above and below.

Research-based water safety education and swimming instruction on how to deal with current for all children in Canada at school entry, with a later reinforcement for youth and young adults, represent another important opportunity for prevention. In our country, covered with innumerable rivers and streams, every Canadian should be able to safely manoeuvre in current, when the need arises.

STAY SAFE ON ICE

Snowmobilers and others who walk or play on ice should exercise extreme caution on rivers and avoid outflows of lakes and reservoirs, since ice with current under it poses the greatest risk. Travel over ice at night or in other conditions of reduced visibility is best avoided since holes or weak areas are difficult to see and rescue is much more difficult. Many snowmobiles travel at speeds that are far too high for safe travel on ice, and alertness is often impaired by alcohol or fatigue. The tendency to increase rather than decrease speed on an open body of ice must be counteracted by effective training. Clothing that provides hypothermia protection and flotation is a must, along with attached and accessible ice picks to crawl out onto the ice in the event of an immersion.

SPECIAL OPPORTUNITIES FOR LARGE GAINS IN PREVENTION

Immediate attention to **five risk factors** could eliminate many drownings and other water-related injury deaths in Canada, saving the lives of hundreds of active Canadians every year.

1 – Safety Equipment for Event Phase of Boating Incidents

Legislation and enforcement to ensure wearing of an appropriate flotation device by all boaters, especially adult males, *could eliminate up to 90% of all boating drownings and up to 35% of all drownings in Canada, saving up to 160 lives per year.* Such legislation would need to be reinforced by appropriate training and education of decision makers, boaters, coast guard, and police. For the law to be a success, boaters would need to be well informed about the choice of a quality comfortable PFD appropriate for their chosen activity. They would also need to be trained to have a more precise perception about the risk of boating as compared with land activities, and the absolute need for water safety.

2. Safety Equipment for Pre-Event Phase of Swimming Pool Incidents

It should not be legal for pool vendors to sell a dangerous product without including the appropriate safety equipment. Legislation could be introduced to ensure that every pool sold in Canada be equipped with an automatic self-closing and self-latching gate, and that existing pool owners be required to install such a gate. Insurance companies could be encouraged to conduct pool safety inspections when insuring homes with pools. Such measures could eliminate nearly all pool drownings of toddlers, *prevent about 10% of all drownings in Canada, and could save about 50 lives of 1-4-year-old children per year.* Developing and legislating pool safety standards could also prevent many diving injuries.

3. Alcohol, a Personal Risk Factor for Pre-Event, Event, and Post-Event Phases of All Water-Related Injury Incidents

Legislation and enforcement together with training and education to limit alcohol consumption in, on, or around the water *could prevent about 30% of all drownings in Canada and save about 150 lives per year.* Such measures would also avert up to 25 deaths per year from other water-related injuries such as boating collisions.

4. Safety Equipment for Event Phase of Snowmobile Incidents

Snowmobilers who travel over water should be encouraged to wear a flotation-hypothermia suit with attached ice-picks. Manufacturers should be lobbied to fit snowmobiles with a luminous flotation device with attached ice picks that would automatically pop out into water and be visible in the dark to help a snowmobiler escape from the hole in the ice even if the machine sinks. If these measures worked, we could expect to *save about 20 snowmobilers lives per year, about 4% of all drownings.*

5. River Current, an Environmental Risk Factor for Pre-Event, Event, and Post-event Phases of Aquatic, Non-aquatic, and Boating Incidents

Effective evidence-based training in how to manage all hazards of current during swimming, wading, boating, and unexpected falls into water could pay large dividends in *averting about 30% of drownings per year, saving 130 lives.* Training needs to include practice in how to safely manoeuvre in current and how to use the power of current for self-rescue. Education should include the theory of current and the types of scenarios to be expected.

Thus it is within the capacity of our elected leaders and our population to eliminate about 85% of drownings and other water-related injury deaths and save over 400 million dollars per year by implementing appropriate regulations, enforcement and education to target five key risk factors. These risk factors must be addressed by governments, and by the organizations with the power to inform, to lobby, and to negotiate in order to persuade decision-makers to act.

SUMMARY OF NUMBERS AND PERCENTS* FOR WATER-RELATED INJURY FATALITIES, CANADA 1991-2000 (n=5,900)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	1991-2000	Average															
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	%	No.															
	%	%	%	%	%	%	%	%	%	%	%	%															
DROWNING (E910, E830, E832) (excludes land & air transport)	557	86	491	80	499	75	497	79	502	79	483	78	445	78	405	81	405	77	423	77	405	81	405	78	4,671	467	79
Boating	209	38	214	44	191	38	186	37	197	39	185	38	176	40	171	40	145	36	129	35	129	35	1,803	180	39		
Recreational	165	79	145	68	143	75	122	66	153	78	156	84	138	78	120	70	122	84	98	76	98	76	1,362	136	76		
Daily living	17	8	45	21	19	10	29	16	15	8	10	5	11	6	21	12	11	8	9	7	187	19	10				
Occupational	23	11	15	7	22	12	32	17	22	11	14	8	23	13	26	15	9	6	15	12	201	20	11				
Rescue	0	0	2	1	6	3	1	1	5	3	1	1	2	1	2	2	3	2	6	5	28	3	2				
Other/unknown	4	2	7	3	1	1	2	1	2	1	4	2	2	1	2	1	0	0	1	1	25	2	1				
Aquatic activities	146	26	110	22	114	23	109	22	135	27	131	27	103	23	118	28	113	28	104	28	104	28	1,183	118	25		
Recreational	142	97	105	95	108	95	101	93	128	95	120	92	90	87	106	91	96	85	92	88	92	88	1,088	109	92		
♦ Swimming	100	79	79	5	74	7	75	3	81	75	75	7	60	72	72	7	70	70	61	61	61	61	747	75			
- Home swimming pool	5	7	5	1	7	7	3	6	1	10	4	7	5	10	10	4	9	9	6	6	6	6	54	5			
- Other swimming pool	7	7	7	7	7	7	6	6	7	7	4	7	9	4	4	7	9	9	6	6	6	6	69	7			
- Other body of water	88	67	67	67	60	66	66	66	70	70	62	46	46	58	58	44	59	59	48	48	48	48	624	62			
♦ Playing/wading in water	29	18	18	18	20	20	12	12	26	26	12	13	13	18	18	18	8	8	9	9	9	9	165	16			
♦ Other	12	8	8	8	14	14	14	14	21	21	33	17	17	15	15	22	18	18	22	22	22	22	174	17			
♦ Unknown	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2	0			
Daily living	1	1	0	0	2	2	1	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	6	1			
Occupational	2	1	2	2	2	2	3	3	2	1	5	4	1	1	1	1	3	3	1	1	1	1	22	2			
Rescue	1	1	1	1	1	1	3	3	5	4	5	4	6	6	6	6	12	12	8	8	8	8	49	5			
Other	0	0	0	0	1	1	1	1	0	0	0	0	3	3	2	2	1	1	2	2	2	2	10	1			
Unknown	0	0	0	0	0	0	1	1	0	0	0	0	2	2	3	3	0	0	1	1	1	1	8	1			
Using bathtub	50	9	36	7	48	10	45	9	45	9	41	8	34	8	27	6	25	6	38	10	38	10	389	39	8		
Non-aquatic activities (falls into water)	133	24	115	23	132	26	126	25	111	22	107	22	104	23	91	22	94	23	78	21	78	21	1,091	109	23		
Recreational	96	72	87	76	88	67	84	67	60	54	53	50	78	75	61	67	66	70	58	74	58	74	731	73			
♦ Swimming pool	13	13	16	16	22	22	14	14	8	8	12	12	10	10	11	11	11	11	8	8	8	8	125	13			
♦ Other body of water	83	83	71	15	66	70	70	70	52	52	41	41	68	50	50	50	55	55	50	50	50	50	606	61			
Daily living	18	14	17	15	32	24	28	22	26	23	39	36	14	13	23	23	20	21	13	17	13	17	228	23			
♦ Walking near water or on ice	11	12	12	12	27	27	16	16	18	18	28	28	9	16	16	16	9	9	8	8	8	8	154	15			
♦ Other	3	3	3	3	4	4	12	12	8	8	11	11	5	4	4	4	11	11	5	5	5	5	66	7			
♦ Unknown	4	4	2	2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	8	1			
Occupational	5	4	1	1	5	4	3	2	0	0	3	3	3	3	3	3	4	4	3	4	3	4	30	3			
Rescue	0	0	1	1	2	2	4	3	5	5	5	5	3	3	4	4	1	1	0	0	0	0	25	2			
Other	4	3	0	0	1	1	1	1	0	0	2	2	3	3	0	0	0	0	0	0	0	0	11	1			
Unknown	10	8	9	8	4	3	6	6	20	18	5	5	3	3	2	2	3	3	4	5	4	5	66	7			
Unknown activities	19	3	16	3	14	3	31	6	14	3	19	4	28	6	16	4	28	7	20	5	20	5	205	20	4		
LAND & AIR TRANSPORT DROWNING	68	10	96	16	122	18	100	16	83	13	91	15	81	14	94	17	66	13	63	13	63	13	864	86	15		
On-road motor vehicle (on-/off-road incident)	37	54	46	48	73	60	72	72	44	53	49	54	52	64	52	55	45	68	40	63	40	63	510	51			
Snowmobile	24	35	40	42	31	25	14	14	28	34	24	26	16	20	28	30	17	26	10	16	10	16	232	23			
All-terrain vehicle	0	0	4	4	2	2	3	3	5	6	3	3	2	2	7	7	0	0	5	8	5	8	31	3			
Other off-road vehicle	3	4	4	4	7	6	6	6	2	2	6	7	3	4	5	5	2	2	5	8	5	8	43	4			
Aircraft	4	6	2	2	6	5	5	5	4	5	9	10	8	10	2	2	2	3	3	3	3	3	45	4			
Unknown	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0			
NON-DROWNING FATALITIES†	24	4	23	4	40	6	31	5	50	8	49	8	41	7	35	6	32	6	40	8	40	8	365	36	6		
TOTAL	649	11	610	10	661	11	628	11	635	11	623	11	567	10	552	9	503	9	472	8	472	8	5,900	590	100		

* Values in light shaded areas refer to darker shaded totals above; values in unshaded areas refer to shaded totals above; bottom row percents are proportion of 10-year total at right † For details, see Annex Ib; primary cause of death was injury other than drowning, although drowning may have complicated another injury; in case of hypothermia, only hypothermia deaths reportedly uncomplicated by drowning are included here; for all years, 1991-2000, 47 deaths were occupational, including 21 boating fatalities

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

SUMMARY OF NUMBER AND PERCENTS* FOR NON-DROWNING INJURY FATALITIES BY ACTIVITY, CANADA 1991-2000 (n=365)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	1991-2000	Average											
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	%	No.											
	%	%	%	%	%	%	%	%	%	%	%	%											
NON-DROWNING FATALITIES†																							
Boating	11	46	11	48	18	45	13	42	15	30	20	41	16	39	15	43	12	38	18	45	149	15	41
Aquatic activities	7	29	10	43	9	22	8	26	11	22	11	22	9	22	8	23	8	25	8	20	89	9	24
Scuba diving, air embolism	1	3	3	4	5	7	2	2	2	2	2	2	2	2	2	2	2	5	3	3	35	4	4
Scuba diving, other	0	1	2	2	0	1	2	2	0	1	1	0	1	1	0	0	0	0	1	1	8	1	1
Diving into water, head/spinal injury	5	1	1	2	5	2	2	2	2	5	2	2	3	2	2	2	2	2	0	0	23	2	2
Diving into water, other/unsp. injury	0	3	0	0	1	1	0	0	1	1	1	1	1	1	0	0	1	1	1	1	8	1	1
Jumping into water	0	1	0	0	0	0	0	0	0	0	0	0	2	2	2	2	0	0	2	2	7	1	1
Other	1	1	3	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	1	1	8	1	1
Non-aquatic activities (falls into water)	4	17	1	4	4	10	7	23	10	20	8	16	4	10	8	23	3	9	3	8	52	5	15
Land & air transport	2	8	1	4	5	12	3	10	14	28	7	14	12	29	4	11	9	28	11	28	68	7	19
On-road vehicle, on-/off-road incident	0	1	1	3	4	4	3	3	4	4	4	4	4	4	2	2	1	1	4	4	24	2	2
Snowmobile	2	0	0	0	1	2	0	0	1	2	2	1	1	1	1	1	5	5	2	2	14	1	1
All-terrain vehicle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	3	3	5	1	1
Other off-road vehicle	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	2	2	5	0	0
Aircraft	0	0	0	0	9	0	0	0	9	9	0	0	7	7	0	0	2	2	0	0	20	2	2
Other/unknown activities	0	0	0	0	0	0	0	0	0	0	3	6	0	0	0	0	0	0	0	0	7	1	2
TOTAL	24	7	23	6	40	11	31	8	50	14	49	13	41	11	35	10	32	9	40	11	365	36	100

* Values in unshaded areas refer to shaded totals above; bottom row percents are proportion of 10-year total at right

† Primary cause of death was injury other than drownings, although drowning may have complicated another injury in case of hypothermia, only hypothermia deaths reportedly uncomplicated by drowning are included here; for all years, 1991-2000, 47 deaths were occupational, including 21 boating fatalities
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

SUMMARY OF NUMBERS AND PERCENTS* FOR WATER-RELATED INJURY FATALITIES DURING BOATING
AND OTHER MAJOR ACTIVITIES, CANADA 1991-2000 (n=5,900)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	1991-2000	Average											
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	%	No.											
	%	%	%	%	%	%	%	%	%	%	%	%											
DROWNING (E910, E830, E832) (excludes land & air transport)	557	86	491	80	499	75	497	79	502	79	483	78	445	78	423	77	405	81	369	78	4,671	467	79
Boating	209	37	214	44	191	38	186	37	197	39	185	38	176	40	171	41	145	36	129	35	1,803	180	39
Recreational	165	79	145	68	143	75	122	66	153	78	156	84	138	78	120	70	122	84	98	76	1,362	136	76
Powerboat	84	51	97	67	91	64	64	52	88	58	75	48	80	58	70	58	76	62	56	57	781	78	57
♦ Small open powerboat [†] (≤5.5m)	65	77	71	73	53	58	45	70	64	73	45	60	53	66	34	49	41	54	40	71	511	51	65
♦ Large powerboat (>5.5m)	5	6	13	13	16	18	6	9	4	5	4	5	9	11	8	11	15	20	3	5	83	8	11
♦ Personal watercraft	1	1	4	4	4	4	0	0	2	2	1	1	3	4	4	6	2	3	6	11	27	3	3
♦ Powerboat, size unspecified	13	15	9	18	20	13	20	13	18	20	25	33	15	19	24	34	18	24	7	12	160	16	20
Unpowered boat	66	40	44	30	41	29	50	41	55	36	74	47	50	36	45	38	37	30	39	40	501	50	37
♦ Canoe	40	61	33	75	21	51	37	74	39	71	37	50	27	54	25	56	16	43	24	62	299	30	60
♦ Kayak	6	9	4	9	5	12	3	6	1	2	4	5	3	6	4	9	2	5	5	13	37	4	7
♦ Rowboat	7	11	0	0	6	15	3	6	9	16	10	14	8	16	5	11	4	11	6	15	58	6	12
♦ Inflatable	3	5	2	5	2	5	4	8	2	4	6	8	7	14	3	7	5	14	0	0	34	3	7
♦ Sailboat/sailboard	10	15	4	9	6	15	1	2	2	4	12	16	3	6	13	10	27	0	0	0	54	5	11
♦ Other	0	0	1	2	1	2	4	2	4	5	7	2	4	2	4	4	0	4	0	4	10	2	4
♦ Other/unknown boat	15	9	4	3	11	8	8	7	10	7	7	4	8	6	5	4	9	7	3	3	80	8	6
Daily living	17	8	45	21	19	10	29	16	15	8	10	5	11	6	21	12	11	8	9	7	187	19	10
♦ Small open powerboat [†] (≤5.5m)	6	35	24	53	3	16	10	34	7	47	4	40	8	73	4	19	3	27	2	22	71	7	39
♦ Large powerboat (>5.5m)	8	47	4	9	3	16	8	28	0	1	10	0	0	0	0	0	0	0	0	0	31	3	17
♦ Powerboat, size unspecified	0	0	6	13	5	26	3	10	1	7	3	30	0	0	3	14	0	0	0	0	21	2	11
♦ Canoe	2	12	6	13	6	32	1	3	5	33	0	0	2	18	5	24	5	45	2	22	34	3	18
♦ Other unpowered	1	6	2	4	1	5	2	7	1	7	1	10	1	9	1	5	1	9	0	0	11	1	6
♦ Other/unknown boat	0	0	3	7	1	5	5	17	1	7	1	10	0	0	1	5	2	18	5	56	19	2	10
Occupational	23	11	15	7	22	12	32	17	22	11	14	8	23	13	26	15	9	6	15	12	201	20	11
♦ Small open powerboat [†] (≤5.5m)	7	30	7	47	2	9	5	16	4	18	4	29	6	26	4	15	1	11	3	20	43	4	21
♦ Large powerboat (>5.5m)	12	52	4	27	12	55	23	72	16	73	7	50	12	52	18	69	6	67	11	73	121	12	60
♦ Powerboat, size unspecified	0	0	0	0	3	14	1	3	0	0	3	21	3	13	2	8	2	22	1	7	15	2	7
♦ Unpowered boat	1	4	2	13	1	5	2	6	1	5	0	0	2	9	1	4	0	0	0	0	10	1	5
♦ Other/unknown boat	3	13	2	13	4	18	1	3	1	5	0	0	0	0	1	4	0	0	0	0	12	1	6
Rescue	0	0	2	1	6	3	1	1	5	3	1	1	2	1	2	2	3	2	6	5	28	3	2
Other/unknown	4	2	7	3	1	1	2	1	2	1	4	2	2	1	2	1	0	0	1	1	25	2	1
Aquatic activities	146	26	110	22	114	23	109	22	135	27	131	27	103	23	118	28	113	28	104	28	1,183	118	25
Using bathtub	50	9	36	7	48	10	45	9	45	9	41	8	34	8	27	6	25	6	38	10	389	39	8
Non-aquatic activities (falls into water)	133	24	115	23	132	26	126	25	111	22	107	22	104	23	91	22	94	23	78	21	1,091	109	23
Unknown activities	19	3	16	3	14	3	31	6	14	3	19	4	28	6	16	4	28	7	20	5	205	20	4
LAND & AIR TRANSPORT DROWNING [§]	68	10	96	16	122	18	100	16	83	13	91	15	81	14	94	17	66	13	63	13	864	86	15
NON-DROWNING FATALITIES [§]	24	4	23	4	40	6	31	5	50	8	49	8	41	7	35	6	32	6	40	8	365	36	6
Boating	11	50	11	48	18	45	13	42	15	30	20	41	16	39	15	43	12	38	18	45	149	15	41
All other causes	13	50	12	52	22	55	18	58	35	70	29	59	25	61	20	57	20	63	22	55	216	22	59
TOTAL	649	11	610	10	661	11	628	11	635	11	623	11	567	10	552	9	503	9	472	8	5,900	590	100

* Values in light shaded areas refer to darker shaded totals above; values in unshaded areas refer to shaded totals above; bottom row percents are proportion of 10-year total at right
† Includes open outboard motor-boats & other open powered boats such as inflatable; excludes personal watercraft. ‡ The true number of small powerboat drownings in 1998 was probably higher than 34, since the number of unspecified powerboat drownings in Quebec increased from 0 in 1997 to 12 in 1998. § Primary cause of death was injury other than drowning, although drowning may have complicated another injury in case of hypothermia, only hypothermia deaths reportedly unaccompanied by drowning are included here; for all years, 1991-2000, 47 deaths were occupational, including 21 boating fatalities
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

SUMMARY OF NUMBERS AND PERCENTS* FOR WATER-RELATED INJURY FATALITIES BY PROVINCE AND TERRITORY, CANADA 1991-2000 (n=5,900)

	NFLD	NS	PEI	NB	QC	ONT	MAN	SASK	ALTA	BC	NUNAVUT	NWT	YUKON	CANADA
	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %
DROWNING (E910, E830, E832) (excludes land & air transport)	178 69	211 81	31 84	145 81	977 81	1,349 82	261 85	194 80	308 85	898 73	2 25	89 75	28 70	4,671 79
Boating	114 64	115 55	20 65	57 39	308 32	502 37	91 35	78 40	81 26	357 41	0 0	61 69	19 68	1,803 39
Recreational	61 54	67 58	11 55	38 67	260 84	433 86	62 68	55 71	74 91	267 75	0 0	20 33	14 74	1,362 76
Daily living	6 5	6 5	0 0	2 4	27 9	42 8	19 21	13 17	3 4	29 8	0 0	36 59	4 21	187 10
Occupational	43 38	36 31	7 35	14 25	13 4	13 3	9 10	6 8	3 4	54 15	0 0	2 3	1 5	201 11
Rescue	0 0	0 0	1 5	1 2	3 1	10 2	1 1	2 3	1 1	6 2	0 0	3 5	0 0	28 2
Other/unknown	4 4	6 5	1 5	2 4	5 2	4 1	0 0	2 3	0 0	1 0	0 0	0 0	0 0	25 1
Aquatic activities	21 12	44 21	3 10	45 31	281 29	364 27	72 28	41 21	87 28	209 24	1 50	12 13	3 11	1,183 25
Recreational	19 90	36 82	3 100	39 87	257 91	340 93	64 89	41 100	84 97	192 92	0 0	10 83	3 100	1,088 92
Swimming	13	27	2	22	175	263	41	25	53	118	0	6	2	747
- Home swimming pool	0	3	0	1	21	18	0	0	6	5	0	0	0	54
- Other swimming pool	1	0	0	1	15	26	4	6	4	12	0	0	0	69
- Other body of water	12	24	0	20	139	219	37	19	43	101	0	6	2	624
Playing/wading in water	2	3	1	9	46	44	14	11	13	18	0	4	1	165
Other/Unknown	4	6	0	8	36	33	9	5	18	56	0	0	1	176
Daily living	0 0	0 0	0 0	2 4	1 0	1 0	3 3	0 0	0 0	0 0	0 0	0 0	0 0	1 6
Occupational	1 5	1 2	0 0	3 7	9 3	3 1	0 0	0 0	0 0	4 2	1 100	0 0	0 0	22 2
Rescue	1 5	6 14	0 0	0 0	10 4	15 4	6 6	0 0	3 3	8 4	0 0	2 17	0 0	49 4
Other/unknown	0 0	1 2	0 0	1 2	4 1	5 1	2 3	0 0	0 0	5 2	0 0	0 0	0 0	18 2
Using bathtrub	3 2	10 5	2 6	8 6	101 10	129 10	12 5	16 8	37 12	66 8	0 0	5 6	0 0	389 8
Non-aquatic activities (falls into water)	34 19	36 17	3 10	31 21	242 25	314 23	75 29	46 24	80 26	215 24	0 0	10 11	5 18	1,091 23
Recreational	23 68	29 81	1 33	24 77	181 75	209 67	55 73	34 74	47 59	118 55	0 0	7 70	3 60	731 67
Swimming pool	0	2	0	5	52	45	5	0	2	14	0	0	0	125
Other body of water	23	27	1	19	129	164	50	34	45	104	0	7	3	606
Daily living	6 18	5 14	0 0	4 13	42 17	72 23	8 11	17 17	19 24	61 28	0 0	2 20	1 20	228 21
Walking near water or on ice	5	4	0	4	28	48	6	4	13	39	0	2	1	155
Other/unknown	1	1	0	0	14	24	2	4	6	22	0	0	0	73
Occupational	0 0	1 3	1 33	2 6	6 2	5 2	3 4	0 0	6 6	3 3	0 0	1 10	0 0	30 3
Rescue	1 3	0 0	0 0	0 0	5 2	5 2	2 3	1 2	2 3	9 4	0 0	0 0	0 0	25 2
Other	0 0	0 0	0 0	0 0	0 0	4 1	0 0	1 2	2 3	4 2	0 0	0 0	0 0	11 1
Unknown	4 12	1 3	1 33	1 3	8 3	19 6	7 9	2 4	5 6	17 8	0 0	0 0	1 20	66 6
Unknown activities	6 3	6 3	3 10	4 3	45 5	40 3	11 4	13 7	23 7	51 6	1 50	1 1	4 4	205 4
LAND & AIR TRANSPORT DROWNING	59 23	36 14	5 14	22 12	182 15	232 14	35 11	38 16	35 10	186 16	2 25	22 19	10 25	864 15
On-road motor vehicle, on-/off-road incident	15 25	32 89	3 60	16 73	113 62	101 44	15 43	18 47	21 60	160 86	0 0	8 36	8 80	510 59
Snowmobile, on-/off-road incident	36 61	2 6	1 20	2 9	41 23	99 43	19 54	13 34	4 11	2 1	2 100	14 64	0 0	232 27
All-terrain vehicle	5 8	1 3	0 0	1 5	8 4	7 3	1 3	1 3	4 11	3 2	0 0	0 0	0 0	31 4
Other off-road vehicle	1 2	1 3	0 0	1 5	7 4	11 5	0 0	6 16	9 26	7 4	0 0	0 0	0 0	43 5
Aircraft	1 2	0 0	1 20	0 0	13 7	14 6	0 0	0 0	0 0	14 8	0 0	0 0	2 20	45 5
Unknown	1 7	0 0	0 0	2 13	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	3 0
NON-DROWNING FATALITIES*	20 8	13 5	1 3	11 6	54 4	72 4	11 4	12 5	20 6	140 12	4 50	5 4	2 5	365 6
Boating	8 40	3 23	0 0	4 36	27 51	39 54	1 9	5 42	7 35	50 36	4 100	0 0	1 50	149 41
Scuba diving; air embolism	0 0	5 38	0 0	0 0	2 4	7 10	0 0	0 0	0 0	20 14	0 0	1 20	0 0	35 10
Scuba diving; other injury	1 5	0 0	0 0	0 0	4 8	0 0	0 0	0 0	0 0	3 2	0 0	0 0	0 0	8 2
Diving into water; head/spinal injuries	1 5	0 0	0 0	2 18	2 4	6 8	2 18	1 8	0 0	8 6	0 0	0 0	1 50	23 6
Diving into water; other/unspecified	0 0	0 0	0 0	0 0	4 8	1 1	0 0	0 0	0 0	3 2	0 0	0 0	0 0	8 2
Jumping into water	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	7 5	0 0	0 0	0 0	7 2
Other aquatic activity	0 0	1 8	0 0	0 0	0 0	0 0	0 0	1 8	3 15	3 2	0 0	0 0	0 0	8 2
Falls into water	4 20	2 15	0 0	2 18	6 11	8 11	1 9	4 33	6 30	17 12	0 0	2 40	0 0	52 14
Snowmobile, hypothermia†	4 20	0 0	1 100	1 9	2 4	1 1	3 27	0 0	0 0	1 1	0 0	1 20	0 0	14 4
On-road vehicle, on-/off-road incident	0 0	2 15	0 0	2 18	1 2	2 3	0 0	0 0	2 10	16 11	0 0	0 0	0 0	24 7
Off-road vehicle	0 0	0 0	0 0	0 0	1 4	1 1	0 0	0 0	0 0	0 0	0 0	0 0	0 0	4 1
ATV	0 0	0 0	0 0	0 0	1 2	2 3	1 9	1 8	0 0	0 0	0 0	1 20	0 0	4 1
Aircraft	2 10	0 0	0 0	0 0	3 6	2 3	3 27	0 0	0 0	10 7	0 0	0 0	0 0	20 5
Other	0 0	0 0	0 0	0 0	1 4	3 4	0 0	0 0	1 5	2 1	0 0	0 0	0 0	7 2
TOTAL	257 4	260 4	37 1	178 3	1,213 21	1,653 28	307 5	244 4	363 6	1,224 21	8 0	116 2	40 1	5,900 100

* Values in light shaded areas refer to darker shaded totals above; values in unshaded areas refer to shaded totals above; bottom row percent are proportion of national total at right † Primary cause of death was injury other than drowning, although drowning may have complicated another injury; in case of hypothermia, only hypothermia deaths reportedly uncomplicated by drowning are included here ‡ Snowmobile crashes are not included here
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

**PROPORTION* OF ALL DROWNINGS† BY TYPE AND PURPOSE OF ACTIVITY,
BY AGE AND SEX, CANADA 1991-2000 (n=5,535)**

BOTH SEXES														
TYPE OF ACTIVITY	Total		0-14		15-24		25-44		45-64		65+		Unknown	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Recreational	3,186	58	627	81	642	63	1,042	54	578	51	286	44	11	28
Boating	1,362	43	40	6	252	39	566	54	356	62	140	49	8	73
Aquatic	1,088	34	203	32	309	48	354	34	152	26	69	24	1	9
♦ Swimming	747		101		238		251		111		46		0	
♦ Playing/wading	165		88		30		32		9		6		0	
♦ Other	176		14		41		71		32		17		1	
Falls into water	731	23	382	61	81	13	120	12	69	12	77	27	2	18
Unknown	5	0	2	0	0	0	2	0	1	0	0	0	0	0
Non recreational‡	1,485	27	102	13	184	18	559	29	347	31	265	41	28	70
Boating	441	30	15	15	56	30	218	39	106	31	32	12	14	50
Aquatic	95	6	8	8	23	13	46	8	14	4	3	1	1	4
Using bathtub	389	26	73	72	38	21	100	18	76	22	102	38	0	0
Falls into water	360	24	4	4	41	22	111	20	105	30	97	37	2	7
Unknown	200	13	2	2	26	14	84	15	46	13	31	12	11	39
Land & air transport	864	16	45	6	188	19	327	17	208	18	95	15	1	3
TOTAL	5,535	100	774	14	1,014	18	1,928	35	1,133	20	646	12	40	1
MALE														
TYPE OF ACTIVITY	Total		0-14		15-24		25-44		45-64		65+		Unknown	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Recreational	2,763	60	464	86	585	66	955	56	501	54	247	51	11	28
Boating§	1,265	46	31	7	230	39	534	56	329	66	133	54	8	73
Aquatic	929	34	155	33	285	49	319	33	117	23	52	21	1	9
♦ Swimming	643		80		220		226		83		34		0	
♦ Playing/wading	129		63		25		30		6		5		0	
♦ Other	157		12		40		63		28		13		1	
Fall into water	565	20	277	60	70	12	100	10	54	11	62	25	2	18
Unknown	4	0	1	0	0	0	2	0	1	0	0	0	0	0
Non recreational‡	1,128	25	47	9	142	16	475	28	269	29	168	34	27	69
Boating	413	37	10	21	51	36	210	44	99	37	29	17	14	52
Aquatic	79	7	6	13	16	11	42	9	12	4	2	1	1	4
Using bathtub	164	15	27	57	15	11	54	11	33	12	35	21	0	0
Falls into water	307	27	3	6	38	27	99	21	86	32	79	47	2	7
Unknown	165	15	1	2	22	15	70	15	39	14	23	14	10	37
Land & air transport	691	15	29	5	155	18	270	16	163	17	73	15	1	3
TOTAL	4,582	100	540	12	882	19	1,700	37	933	20	488	11	39	1
FEMALE														
TYPE OF ACTIVITY	Total		0-14		15-24		25-44		45-64		65+		Unknown	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Recreational	423	44	163	70	57	43	87	38	77	39	39	25	0	0
Boating	97	23	9	6	22	39	32	37	27	35	7	18	0	0
Aquatic	159	38	48	29	24	42	35	40	35	45	17	44	0	0
♦ Swimming	104		21		18		25		28		12		0	
♦ Playing/wading	36		25		5		2		3		1		0	
♦ Other	19		2		1		8		4		4		0	
Falls into water	166	39	105	64	11	19	20	23	15	19	15	38	0	0
Unknown	1	0	1	1	0	0	0	0	0	0	0	0	0	0
Non recreational‡	357	37	55	24	42	32	84	37	78	39	97	61	1	100
Boating	28	8	5	9	5	12	8	10	7	9	3	3	0	0
Aquatic	16	4	2	4	7	17	4	5	2	3	1	1	0	0
Using bathtub	225	63	46	84	23	55	46	55	43	55	67	69	0	0
Falls into water	53	15	1	2	3	7	12	14	19	24	18	19	0	0
Unknown	35	10	1	2	4	10	14	17	7	9	8	8	1	100
Land & air transport	173	18	16	7	33	25	57	25	45	23	22	14	0	0
TOTAL	953	100	234	25	132	14	228	24	200	21	158	17	1	0

* Values in unshaded areas refer to shaded totals above; bottom row percents are proportion of 10-year total at left

† Codes are E910, E830, E832 (WHO 1977) ‡ Non recreational drownings include occupational, daily living, rescue, other & unknown incidents

§ Includes 9 victims of unknown sex, imputed male

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2005

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