

Advance Data



From Vital and Health Statistics of the CENTERS FOR DISEASE CONTROL AND PREVENTION/National Center for Health Statistics

International Comparative Analysis of Injury Mortality Findings From the ICE on Injury Statistics

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Abstract

Objective—This report investigates international differences in injury mortality rates among 11 of the countries participating in the International Collaborative Effort on Injury Statistics.

Methods—The cause, intent, and age-specific injury mortality rates are calculated and presented from Australia, Canada, Denmark, England & Wales, France, Israel, New Zealand, The Netherlands, Norway, Scotland, and the United States. Data are presented by cause (or mechanism) and intent (or manner of death) according to the matrix framework for presenting injury mortality statistics published in August 1997. The benefits of this matrix approach to investigating injury mortality are explained with numerous examples.

Results—Injury death rates are higher in France and Denmark and lower in England & Wales, Israel, and The Netherlands than elsewhere. New Zealand, the United States, and Norway had similar average annual injury death rates of 56–57 per 100,000 population. As an example of the benefit of presenting data in the matrix framework, the total poisoning death rate in Denmark for all categories of intent (13 per 100,000) is about twice the rate in the United States. Unintentional poisoning death rates, however, are similar in the United States and Denmark (about 4 per 100,000) and are higher than elsewhere. However, the suicide poisoning death rate in Denmark is 3 times the rate in the United States.

Conclusion—Using these results, the ICE on Injury will be investigating death registration practices in each of the countries to better understand international variation in injury mortality due to reporting or registration procedures.

Keywords: international comparisons • injury mortality • vital statistics

Highlights

- Average annual injury death rates were lower in England & Wales, Israel, and The Netherlands, and higher in France and Denmark. The highest rate in France with 75 injury deaths per 100,000 population, was more than twice the lowest rate in England & Wales, with a rate of 31 per 100,000. New Zealand, United States, and Norway had similar injury death rates of 56–57 per 100,000.
- Motor vehicle traffic crashes, firearms, poisoning, falls, suffocations, and drownings account for about 60 percent of injury deaths in the 11 comparison countries.
- The rates of death from motor vehicle traffic-related injuries ranged from a low of 6 per 100,000 in England & Wales to a high of 21 per 100,000 in New Zealand. New Zealand had the highest rate of deaths in which the

Acknowledgments

Data were provided by the following ICE participants for their respective countries: James Harrison, Australia; Susan Mackenzie, Canada; Birthe Frimodt-Møller, Denmark; Cleo Rooney, England & Wales; Eric Jouglu and Gerard Pavillon, France; Pnina Zadka, Israel; John Langley, New Zealand; Johan Lund, Norway; Jack Arrundale, Scotland; and Saakje Mulder, The Netherlands. For institutional affiliations and e-mail addresses of ICE participants, see: <http://www.cdc.gov/nchswww/about/otheract/ice/who2.htm>. The National Center for Health Statistics sponsors the ICE on Injury Statistics. The National Institute of Child Health and Human Development of the National Institutes of Health provides additional funding. This report was edited by Thelma W. Sanders and typeset by Annette F. Holman of the Publications Branch, Division of Data Services.



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
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victim was riding a motorcycle as either the driver or passenger.

- The death rate from firearm injuries in the United States at 14 per 100,000 was more than twice the rate in any of the 10 comparison countries.
- In France the death rate due to suffocation at 14 per 100,000 was nearly twice the rates in the comparison countries.
- Poisoning and fall mortality were nearly twice as high in Denmark as in the comparison countries at 13 and 26 per 100,000.
- Motor vehicle traffic-related injuries are the leading cause of injury death among children 1–14 years in all 11 countries, accounting for about 40 percent of injury mortality at ages 1–14 years, from a low of 27 percent in Norway to 53 percent in Israel.
- Motor vehicle traffic-related death rates among children are lowest in England & Wales, Norway, and The Netherlands at 2–3 per 100,000 and highest in New Zealand at 7 per 100,000.
- At ages 15–24 years the rate of motor vehicle traffic-related injuries is highest in New Zealand at 49 deaths per 100,000 persons, about 1.7 times the rates in the countries with the next highest rates, United States (29 per 100,000) and France (28 per 100,000).
- In four of the comparison countries, in the United States, Norway, Israel, and France, firearms are the second leading cause of injury death at ages 15–24 years. In the United States, however, the rate of deaths from firearm injuries at 27 per 100,000 was similar to the rate of deaths from motor vehicle traffic injuries whereas, in the other three countries, the rate of deaths from motor vehicle traffic injuries is between 2 and 6 times higher than the rate of deaths from firearm injuries. In all the countries except the United States, the firearm deaths were primarily (51–93 percent) suicides. In the United States the majority of the firearm-related deaths were homicides (62 percent).
- At 65 years of age and over, falls are the leading specified cause of injury death in all countries except Australia, France, and Israel. In the

United States, the rate is similar to that for motor vehicle traffic injuries.

- For all ages poisoning death rates are lowest in Israel and The Netherlands at 1–2 per 100,000 and are highest in Denmark at 13 per 100,000. Unintentional poisoning death rates are higher in the United States and in Denmark than elsewhere. In all the countries except the United States, the rate of suicidal poisoning exceeds rates of poisoning that were unintentional and where the intent could not be determined. The rate of poisonings of undetermined intent is highest in Denmark, England & Wales, and Scotland.
- Unintentional injury death rates are highest in France and Denmark at 46 and 48 per 100,000 and lowest in England & Wales, Israel, and The Netherlands at 19–22 per 100,000.
- Suicide rates are highest in Denmark and France at 18 and 21 per 100,000 and lowest in Israel and England & Wales at 7 per 100,000.
- The homicide rate in the United States, 9 per 100,000, is 4–9 times the rates in the comparison countries. Two-thirds of homicides in the United States are committed with firearms.

Introduction

The first meeting of the International Collaborative Effort (ICE) on Injury Statistics was convened in 1994 to foster improvements in the quality and international comparability of injury data. The long-term goal of these efforts is to provide the data needed to better understand the causes of injury and the most effective means of prevention. This ICE is one of several international activities sponsored by the National Center for Health Statistics, Centers for Disease Control and Prevention (1).

This report provides the first international comparative analysis of injury mortality data according to a new internationally accepted, standard framework designed for presenting injury statistics (2). The data for this research were provided by the ICE collaborators through their respective national vital statistics offices.

Traditionally, international statistics are displayed using the Basic Tabulation List provided by the World Health Organization (WHO) in the *World Health Statistics Annual* (3). [Figure 1](#) presents data categorized according to this tabulation list for the fictitious “country X.” The principle problem with the list is that it does not present the causes (i.e., mechanisms) of deaths for suicides, homicides, or for injury deaths in which the intent could not be determined. Cause-specific statistics are only presented for unintentional injury. For prevention, knowledge of both the cause and the intent (i.e., manner) for all injury deaths is important.

At the 1996 meeting of the ICE on Injury Statistics, participants agreed to adopt the framework or “matrix” for displaying injury data simultaneously by cause (i.e., mechanism) and intent (i.e., manner) ([table 1](#)). Presenting injury mortality data solely by either the intent (i.e., unintentional, suicide, or homicide) or the mechanism (for example, motor vehicle, falls, and firearms) masks the critical information on the other factor. The framework was initially developed by the members of the Injury Control and Emergency Health Services section within the American Public Health Association (2).

The matrix overcomes the limitations of the WHO presentation of injury mortality statistics by allowing for easy access to cause and intent for all injury deaths. Summary statistics for cause and intent of injury deaths are also readily accessible using the marginal numbers.

This report presents injury death rates for 11 countries (i.e., Australia, Canada, Denmark, England & Wales, France, Israel, The Netherlands, New Zealand, Norway, Scotland, and the United States) using the matrix framework for reporting the data.

Methods

The ICE collaborators from the following 11 countries provided data on the injury deaths, population and in some instances, the calculated death rates, from their national vital statistics offices: Australia, Canada, Denmark, England & Wales, France, Israel, The

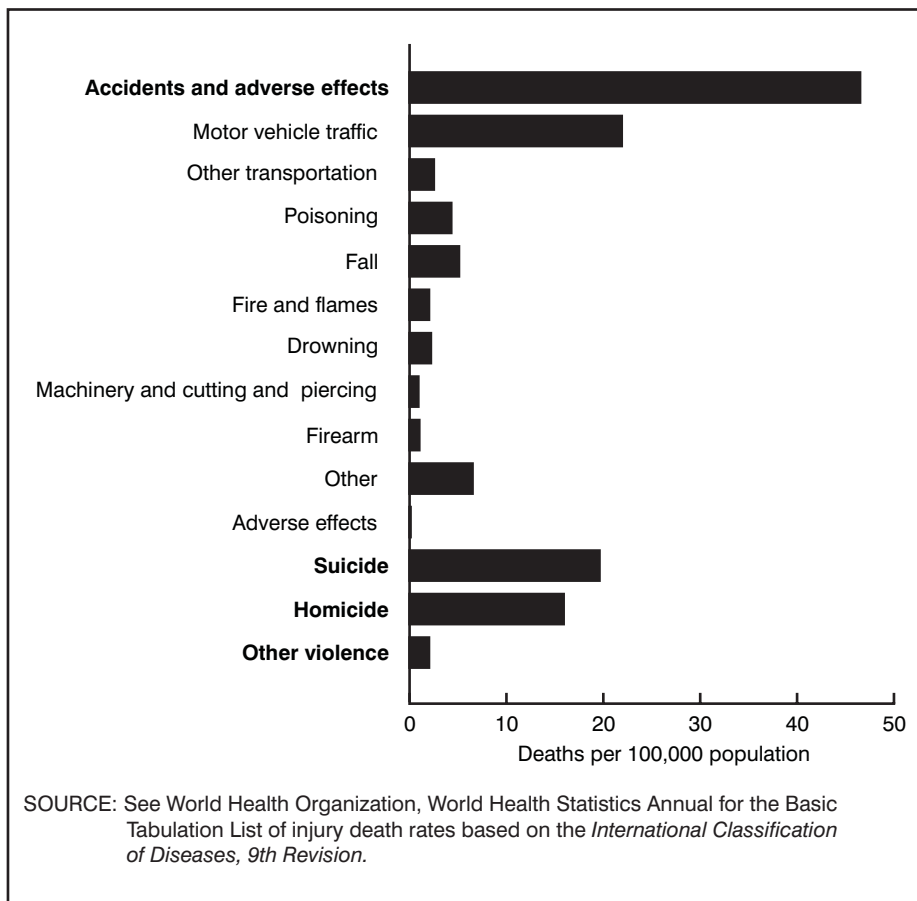


Figure 1. Injury death rates according to the “Basic Tabulation List” of the ICD-9 by intent and mechanism of injury: “Country X”

Netherlands, New Zealand, Norway, Scotland, and the United States. Data for England & Wales are analyzed as one unit and will be referred to as “England & Wales.” Country representatives were asked to provide the data categorized according to the *International Classification of Diseases* (ICD) external cause code (E-code) groupings recommended by the matrix for reporting injury mortality (2,4). The matrix for the E-code groupings for ICD-9 is shown in table 1. The rationale for adopting the groupings and more detail on the injuries included in each category is presented elsewhere (2).

All the countries with the exception of Denmark classified injury deaths according to the Ninth Revision of the ICD (4). Denmark coded deaths according to the Tenth Revision (5). Danish collaborators adapted the matrix for the more recent version of the ICD. For most causes of injury, mapping between the versions did not appear to

cause much difficulty. However, in the matrix for ICD-9, code E887 (i.e., “fracture, cause unspecified”) was included in the group of injuries with unspecified causes, even though it is listed within the range of E-codes for unintentional falls. In ICD-10 there is no comparable code for fractures with unspecified cause; rather there is a code for “unspecified fall” (code W19). In the adaptation developed by the researchers from Denmark, “unspecified fractures” were made comparable to “unspecified falls” and were therefore categorized with the falls (6). Thus, the death rate from falls is likely to be higher in Denmark relative to the other countries who coded using ICD-9.

Average annual injury death rates are shown as deaths per 100,000 population. The National Center for Health Statistics (NCHS) calculated the rates using the frequencies of deaths and population data provided by the country representatives for the majority of countries. However, rates generated by

the collaborating country were used if provided. Age-specific data were obtained for five age groups (1–14 years, 15–24 years, 25–44 years, 45–64 years, and 65 years and over) from all the countries except Denmark. Country collaborators were asked to verify their data.

Death rates for all ages are shown as crude rather than as age adjusted in this report. Because the population age distributions of the countries did not differ significantly (with the exception of Israel that has a younger population), the age-adjusted rates are similar to the crude rates. Death rates were not calculated for causes based on fewer than 20 deaths. For the average annual unintentional motor vehicle traffic-related death rates according to the person injured (figure 8), the number of deaths assigned to unspecified persons was distributed (in each country except France and Israel) according to the known distributions of motor vehicle occupants and motorcyclists (2). In France and Israel the proportions of all motor vehicle deaths in which the person injured was unspecified were too high, 88 percent and 75 percent, respectively, to justify distributing them.

Standard errors of the death rates were calculated as (7):

$$(1/\sqrt{D}) \cdot R$$

where D = number of deaths

where R = death rate per 100,000

Differences highlighted in the text are statistically significant at the 0.05 level; lack of mention, however, does not necessarily mean that differences were not significant. Unless otherwise indicated, all percents are calculated based on the number of deaths rather than on death rates. Numbers are available on request to the authors.

In this report the term “cause” is used to describe the mechanism that produces the energy that results in the fatal injury. The term “cause” (as in “cause of death”) is more appropriately used when dealing with natural causes of death such as in cancer or heart disease. For injury, however, motor

Table 1. Matrix for external cause of injury mortality data

Mechanism or cause	Manner or intent				
	Unintentional	Suicide	Homicide	Undetermined	Other
Cut/pierce	E920.0–.9	E956	E966	E986	E974
Drowning/submersion	E830.0–.9, 832.0–.9, 910.0–.9	E954	E964	E984	...
Fall	E880.0–886.9, 888	E957.0–.9	E968.1	E987.0–.9	...
Fire/hot object or substance ¹	E890.0–899, 924.0–.9	E958.1,.2,.7	E961, 968.0, .3	E988.1,.2,.7	...
Fire/flame	E890.0–899	E958.1	E968.0	E988.1	...
Hot object/scald	E924.0–.9	E958.2,.7	E961, 968.3	E988.2,.7	...
Firearm	E922.0–.9	E955.0–.4	E965.0–.4	E985.0–.4	E970
Machinery	E919.0–.9	...	...	...	...
Motor vehicle traffic	E810–819 (.0–.9)	E958.5	...	E988.5	...
Occupant	E810–819 (.0,.1)	...	...	...	...
Motorcyclist	E810–819 (.2,.3)	...	...	...	...
Pedal cyclist	E810–819 (.6)	...	...	...	...
Pedestrian	E810–819 (.7)	...	...	...	...
Unspecified	E810–819 (.9)	...	...	...	...
Pedal cyclist, other.	E800–807 (.3), E820–825 (.6), E826 (1,.9), 827–829 (.1)	...	...	...	...
Pedestrian, other.	E800–807 (.2), 820–825 (.7), E826–829 (.0)	...	...	...	...
Transport, other.	E800–807 (.0–.1,.8–.9), E820–825 (.0–.5,.8–.9), E826 (.2–.8), 827–829, (.2–.9) E831.0–.9, 833.0–845.9	E958.6	...	E988.6	...
Natural/environmental factors	E900.0–909, 928.0–.2	E958.3	...	E988.3	...
Bites and stings	E905.0–.6,.9, 906.0–.4, .9	...	...	...	...
Overexertion	E927	...	...	...	...
Poisoning	E850.0–869.9	E950.0–952.9	E962.0–.9	E980.0–982.9	E972
Struck by, against	E916–917.9	...	E960.0, 968.2	...	E973, 975
Suffocation	E911–913.9	E953.0–.9	E963	E983.0–.9	...
Other specified and classifiable	E846–848, 914–915, 918, E921.0–.9, 923.0–.9, E925.0–926.9, 929.0–.5	E955.5,.9, 958.0,.4	E960.1, 965.5–.9, E967.0–.9, 968.4	E985.5, 988.0,.4	E971, 978 E990–994, 996, E997.0–.2
Other specified, NEC ²	E928.8, 929.8	E958.8, 959	E968.8, 969	E988.8, 989	E995, 997.8, 977, E998–999
Unspecified	E887, 928.9, 929.9	E958.9	E968.9	E988.9	E976, 997.9
All injury ³	E800–869, 880–929	E950–959	E960–969	E980–989	E970–978 E990–999

... Category not applicable.

¹In the text this category name is simplified to "fire/burn."

²Not elsewhere classifiable.

³Excludes deaths caused by adverse events (E-codes E870–E879 and E930–E949).

vehicles or firearms are not the "causes" of death, rather they are the objects involved in producing energy that results in injury. Similarly, falling is not the cause of the death, but rather the mechanism or the way the injury was sustained. While recognizing these differences, the term "cause" is used interchangeably with "mechanism."

The number of years of data provided by each country varied due to the country's population size and years of vital statistics data available. Data collaborators were asked to provide the most recent years of data available with sufficient numbers of years to ensure stable estimates of death rates within age groups, causes, and intent. The most recent data available in the countries

ranged between 1993–95 with countries providing between 1 and 10 years of data (figure 2). New Zealand and Scotland each provided 10 years of data, 1984–93 and 1986–95, respectively. Norway provided 5 years (1990–94). France (1992–94), Israel (1993–95), Australia (1993–95), and England & Wales (1993–95) provided 3 years. Canada and Denmark provided 2 years,

1994–95. The United States and The Netherlands provided 1 year (1995).

The 11 countries can be categorized into four ranges by population size: smaller populations with about 3–5 million people in New Zealand, Norway, Scotland, Denmark, and Israel; smaller midrange populations with about 15–30 million people in The Netherlands, Australia, and Canada; larger midrange with about 52–58 million in England & Wales and France; and the largest population with 263 million in the United States (figure 2).

Results

All injury death rates

Among the 11 comparison countries, average annual injury death rates were lower in England & Wales, Israel and The Netherlands and higher in France and Denmark (figure 3). The highest average annual death rate in France with 75 injury deaths per 100,000 population, was more than twice the lowest rate in England & Wales, with a rate of 31 per 100,000. New Zealand, United States, and Norway had similar injury death rates of 56–57 per 100,000.

By mechanism (figure 4)—Six mechanisms of injury—motor vehicle traffic-related incidents, firearms, poisonings, falls, suffocations, and drownings—account for about 60 percent of injury mortality in the comparison countries.

The average annual rates of death from motor vehicle traffic-related injuries ranged from a low of 6 per 100,000 in England & Wales to a high of 21 per 100,000 in New Zealand. In France the death rate due to suffocation at 14 per 100,000 was 2–4 times the rates in the comparison countries. Poisoning and fall death rates in Denmark at 13 and 26 per 100,000, respectively, were nearly twice as high as in the comparison countries. (It is possible that some of the high rates shown for Denmark are due to the different classification structure of the ICD-10 and the adaptation of the matrix for ICD-10.) The death rate from firearm injuries in the United States at 14 per 100,000 was more than twice the rate in the comparison countries.

The cause of death was not specified for 25–29 percent of the injury deaths in France, Israel, The Netherlands, and Norway. For the remaining seven comparison countries,

the percent of deaths recorded without a known cause ranged from the lows of 1–5 percent in Denmark, New Zealand, and the United States to a high of 16 percent in England & Wales.

Age- and cause-specific injury death rates

For persons 1–14 years and 15–24 years, injury death rates are high relative to other causes of death (3), and for persons 65 years of age and over, cause-specific injury death rates are high relative to the injury death rates at other ages.

For persons 1–14 years (figure 5)—Average annual injury death rates are highest for children ages 1–14 years in New Zealand and the United States with rates of 17 and 13 per 100,000 children, respectively. England & Wales and The Netherlands had the lowest rates of 5–6 injury deaths per 100,000 children.

Motor vehicle traffic-related injuries are the leading mechanism of injury death among children 1–14 years in all 11 countries. Overall motor vehicle traffic-related incidents account for about 40 percent of injury mortality at these ages, ranging from a low of 27 percent in Norway to a high of 53 percent in Israel. The motor vehicle traffic-related death rates among children are lowest in England & Wales, Norway, The Netherlands, and Australia at 2–3 per 100,000 and highest in New Zealand at 7 per 100,000. Nearly all the motor vehicle traffic-related deaths at these ages in the countries are coded as unintentional.

Drowning accounts for an average of 15 percent of injury deaths among the 1–14 year olds, ranging from 7–8 percent in England & Wales and Scotland to 19–21 percent in Norway, The Netherlands, and Australia. In the following countries drowning is either the second or third leading mechanism of injury death in this age group: New Zealand, Australia, the United States, France, Canada, The Netherlands, and Israel. In Norway the drowning rate is similar to the motor vehicle traffic death rate. New Zealand has the highest rate of drowning at 3 drownings per 100,000 children. In all the countries except

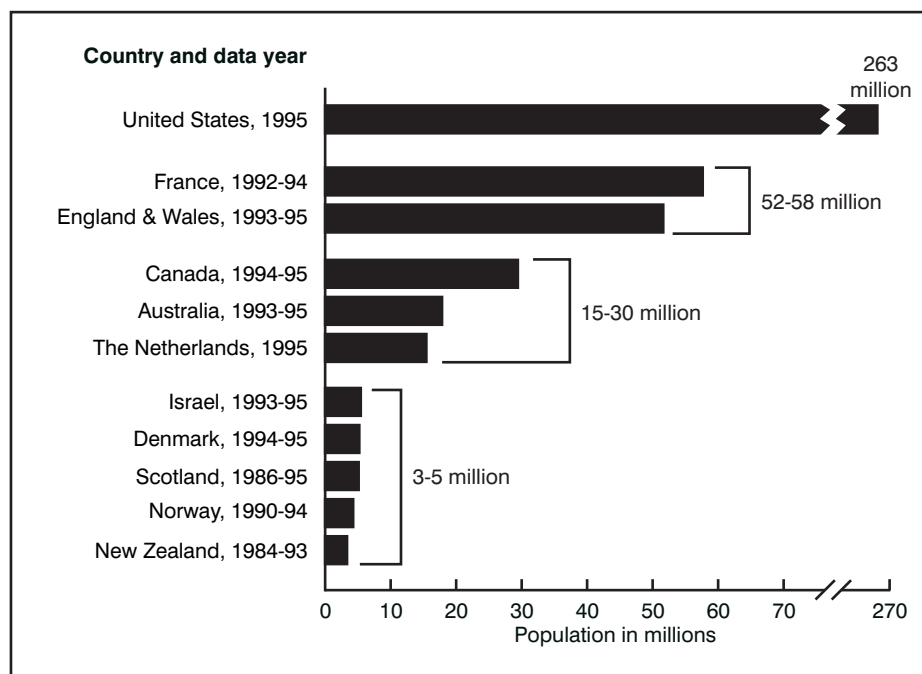


Figure 2. Average annual populations and data years used in analyses: Injury ICE countries

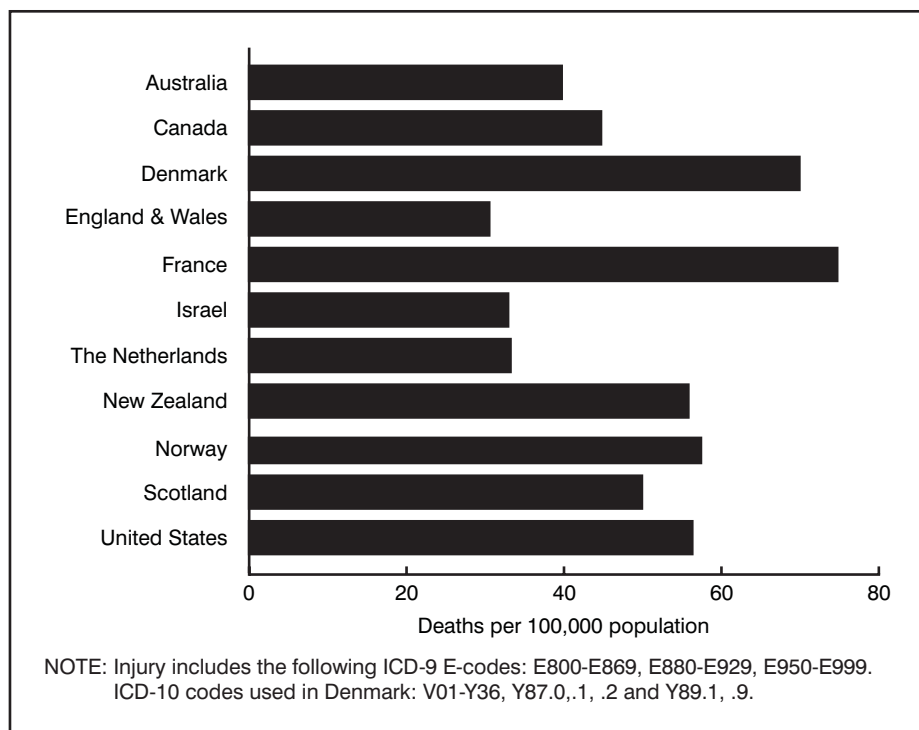


Figure 3. Average annual injury death rates: Injury ICE countries, selected recent years

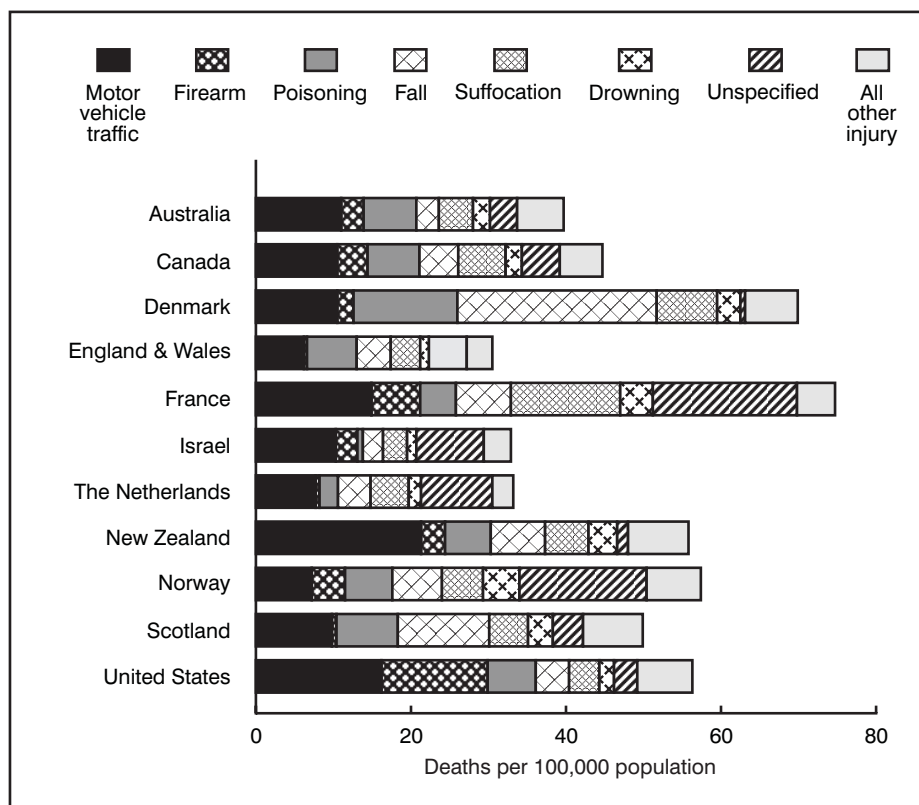


Figure 4. Average annual injury death rates by mechanism: Injury ICE countries, selected recent years

France, nearly all the drownings are recorded as unintentional. In contrast, in France, 45 percent of the drownings are coded as undetermined intent.

Fires and burns and suffocations are also among the leading mechanisms of deaths in this age group, each accounting for an average of 8–11

percent of the injury deaths. Fire and burn death rates are higher in the United States and Scotland than in the other countries.

New Zealand and the United States have high rates of injuries that are not included among these four causes of death. At 0.8 deaths per 100,000, New Zealand has a higher rate of pedestrian fatalities that do not occur on public roads (i.e., nontraffic-related injuries) relative to the comparison countries; it is twice the rate in the United States and Australia, the countries with the next highest rates. The United States has a substantially higher firearm injury death rate at 2 deaths per 100,000 children, 4 times the rates in New Zealand, Canada, and France—the countries with the next highest rates. More than one-half of firearm injury deaths among children 1–14 years in the United States are classified as homicides.

For persons 15–24 years (figure 6)—Among teenagers and young adults 15–24 years, average annual injury death rates are highest in New Zealand (86 per 100,000) and the United States (73 per 100,000) and lowest in The Netherlands (24 per 100,000). Motor vehicle traffic-related injuries are the leading mechanism of injury deaths in this age group for each country. The rate of these injuries is highest in New Zealand at 49 deaths per 100,000 persons ages 15–24 years, about 1.7 times the rates in the countries with the next highest rates, the United States (29 per 100,000) and France (28 per 100,000). The countries with low motor vehicle traffic-related death rates are England & Wales, The Netherlands, Norway, and Israel (12–15 per 100,000).

In four of the comparison countries, the United States, Norway, Israel, and France, firearms are the second leading mechanism of injury death in this age group. In the United States, however, the firearm injury death rate, 27 per 100,000, was 4–6 times the rates in the three countries. Also in the United States, the death rate from firearm injuries was similar to the death rate from motor vehicle traffic-related injuries whereas, in the other three countries the death rates from motor vehicle traffic-related injuries are between 2 and 6 times higher than the

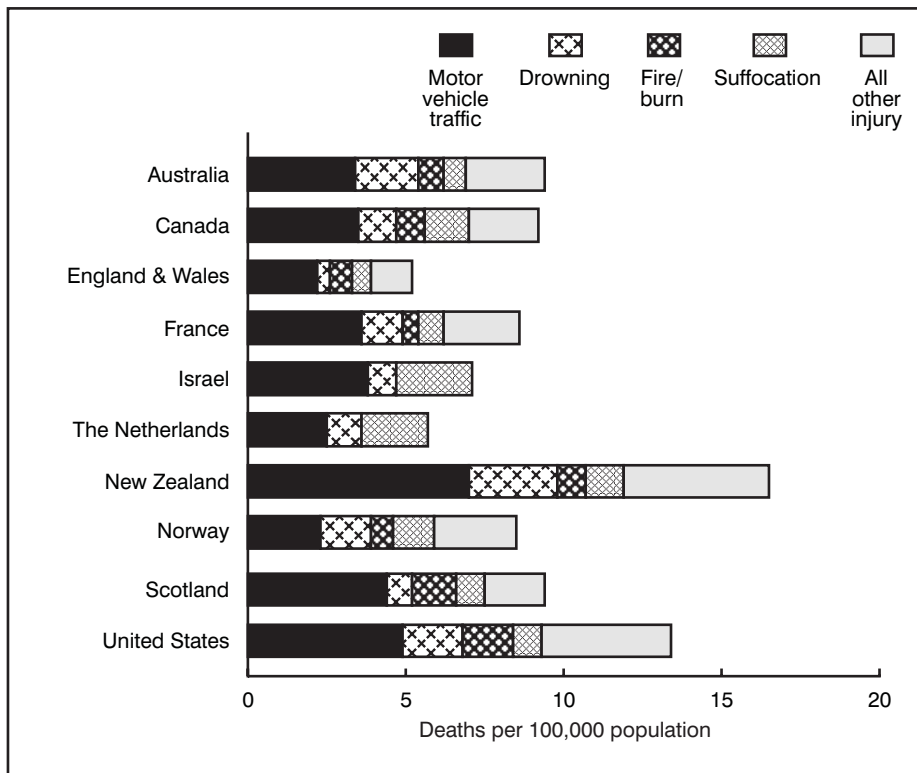


Figure 5. Average annual injury death rates by mechanism among children 1-14 years of age: Injury ICE countries, selected recent years

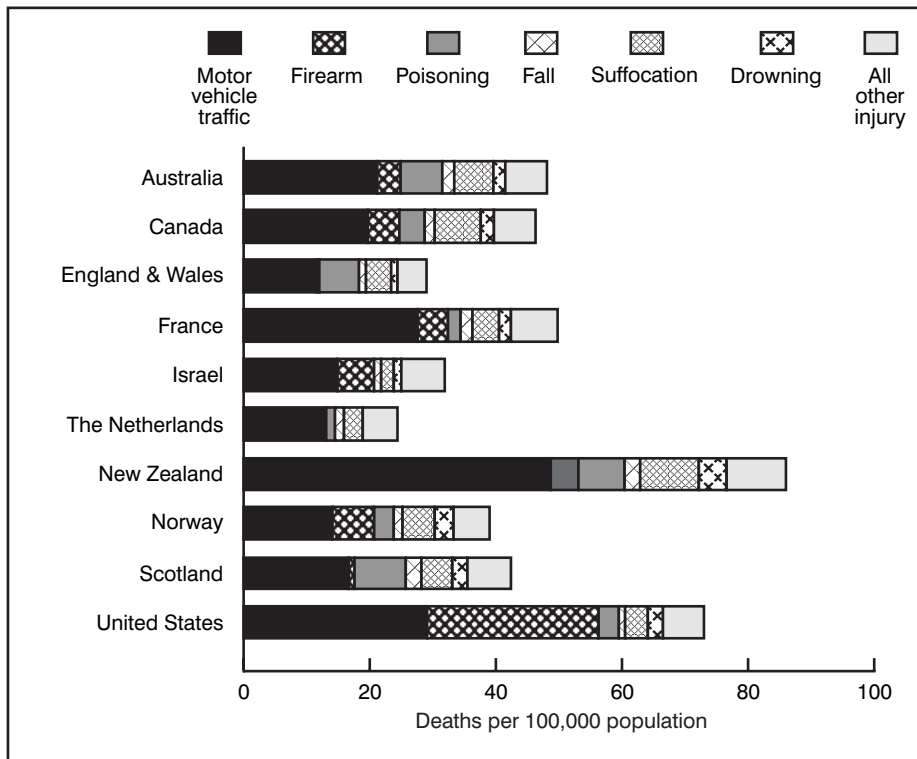


Figure 6. Average annual injury death rates by mechanism among persons 15-24 years of age: Injury ICE countries, selected recent years

death rates from firearm injuries. In all the countries except the United States and The Netherlands, the firearm deaths were primarily (51-93 percent) suicides. In the United States the majority of the firearm related deaths were homicides (62 percent). In The Netherlands only 11 firearm deaths were recorded at this age and 10 were coded as homicides.

In Scotland, Australia, and England & Wales poisoning is the second leading mechanism of injury death at this age. With the exceptions of the United States, England & Wales, and Israel more than one-half of poisoning deaths at this age are coded suicides ranging from 53 percent in Scotland to 75-79 percent in Norway and New Zealand. In the United States and in England & Wales, 35-40 percent of the poisonings were coded as suicides. In Israel only five poisoning deaths were recorded. In three countries relatively high proportions of poisoning deaths are coded as undetermined intent, 18 percent in England & Wales, 21 percent in France, and 26 percent in Scotland compared with less than 10 percent in most of the other countries. In England & Wales, these differences in coding are likely due in part to the legal requirements for determining the manner of death (8).

In France the firearm death rate (5 per 100,000) is similar to the suffocation rate (4 per 100,000). In Australia the poisoning death rate (7 per 100,000) is similar to the suffocation rate (6 per 100,000). New Zealand and Canada have relatively high rates of suffocation in this age group with rates of 9 and 7 per 100,000, respectively. Over 90 percent of these are coded as suicides.

For persons 65 years and over (figure 7)—For persons 65 years of age and over, injury death rates are highest in France at 224 per 100,000, nearly 30 percent higher than in Norway at 175 per 100,000 with the second highest injury death rate in this age group. England & Wales and Australia have the lowest rates at 72 and 82 injury deaths per 100,000 persons aged 65 years and over.

In seven countries the cause of injury was not recorded for between 29 and 56 percent of the deaths for persons

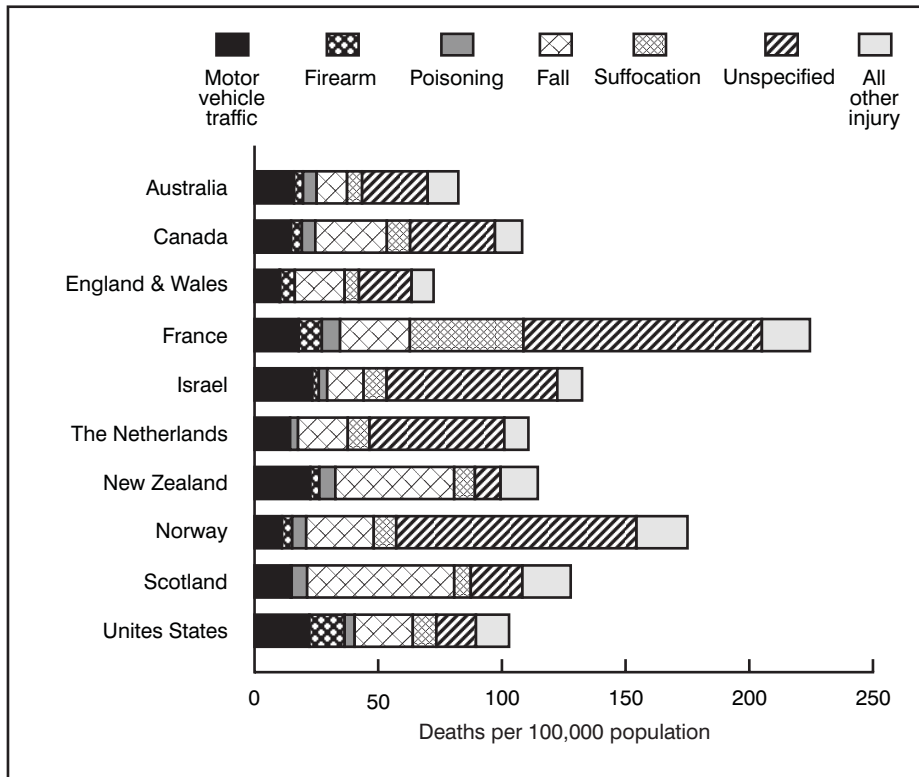


Figure 7. Average annual injury death rates by mechanism among persons 65 years of age and over: Injury ICE countries, selected recent years

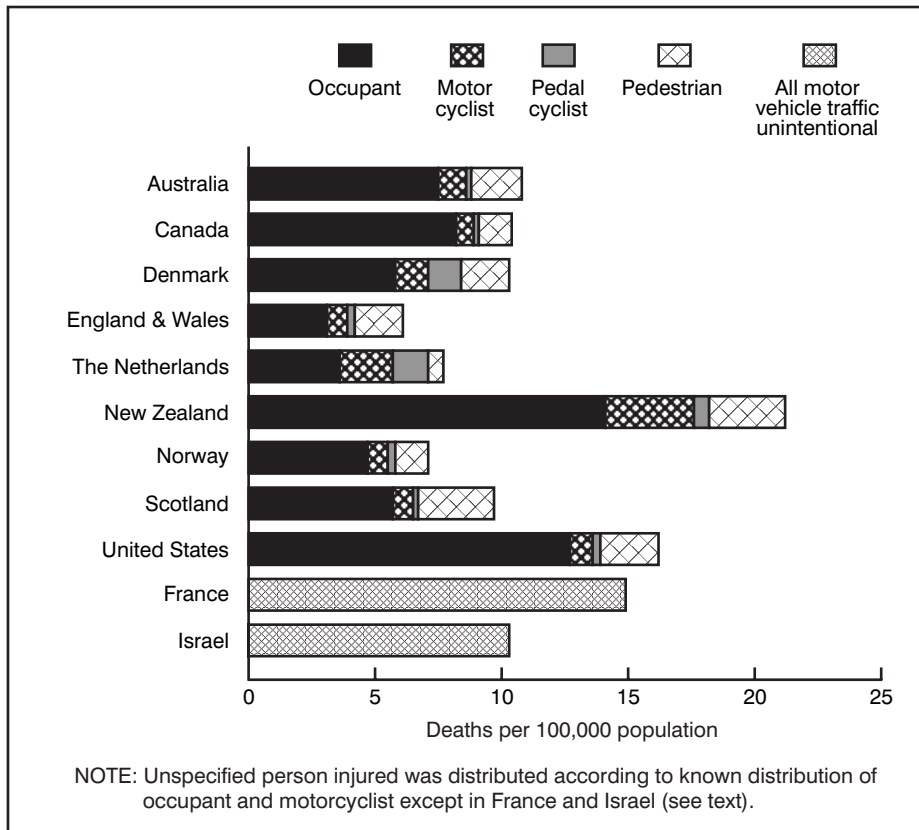
65 years of age and over and, therefore, the rates of death by unspecified causes were higher than any of the rates by the cause-specific categories. On the other hand, in New Zealand, the United States, and Scotland the cause was not specified for only 9–16 percent of injury deaths.

Falls are the leading specified mechanism of injury death in all countries except Australia, Israel, and France. In the United States the rate for fall deaths is similar to that for motor vehicle traffic injuries. More than 85 percent of deaths due to falls in all the countries except Israel are classified as unintentional. In Israel 59 percent of fall deaths are classified as unintentional and 36 percent as suicides.

The leading specified mechanism of injury death among those aged 65 years and over in Israel and Australia is motor vehicle traffic-related injuries. Suffocation is the leading mechanism of death in France at 46 per 100,000; this rate is between 5 and 8 times the rates in the comparison countries. Sixty-three percent of the suffocations in France are unintentional and 35 percent are suicidal.

Cause-specific injury death rates

Motor vehicle traffic-related death rates according to person injured (figure 8)—Motor vehicle traffic-related injuries were either the first or second specified leading mechanism of injury death in all the countries except Denmark. Virtually all motor vehicle traffic-related deaths were coded as unintentional. New Zealand, the country with the highest motor vehicle traffic death rate, 21 deaths per 100,000 population, also had the highest rate of deaths in which the victim was riding a motorcycle (3.5 per 100,000). The Netherlands, which had a relatively low motor vehicle traffic-related death rate, had a relatively high death rate for pedal cyclists and the second highest for motorcyclists. In France and Israel the person injured was not specified for the vast majority of motor vehicle traffic-related deaths (88 and 75 percent, respectively). In Israel data on all pedal cycle deaths have not generally been included on either the death certificates



NOTE: Unspecified person injured was distributed according to known distribution of occupant and motorcyclist except in France and Israel (see text).

Figure 8. Average annual unintentional motor vehicle traffic-related death rates according to person injured: Injury ICE countries, selected recent years

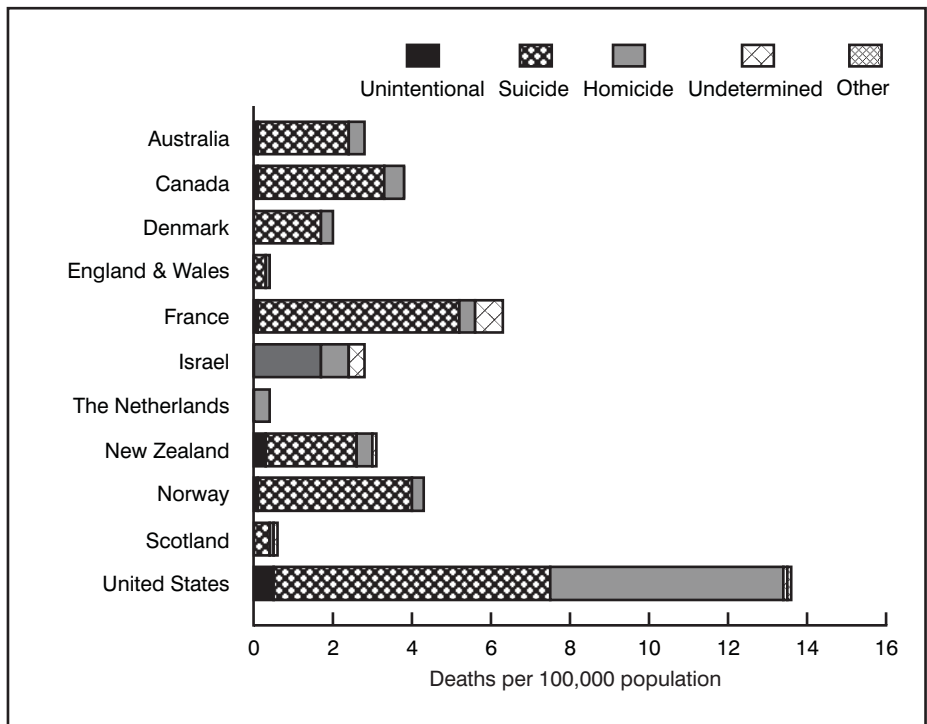


Figure 9. Average annual firearm injury death rates by intent: Injury ICE countries, selected recent years

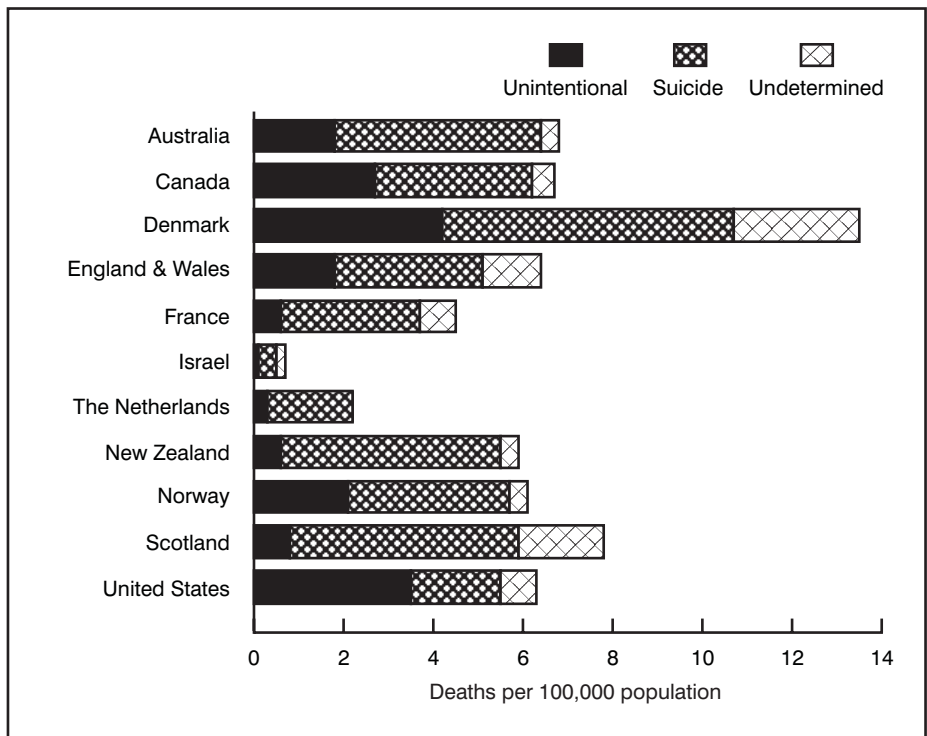


Figure 10. Average annual poisoning death rates by intent: Injury ICE countries, selected recent years

or on police reports of transportation-related fatalities. Improvements are being made for data year 1998 (9).

Firearm death rates by intent (figure 9)—The average annual firearm death rate in the United States at 14 deaths per 100,000 is about 20–30 times

the rates in Scotland, The Netherlands, and England & Wales, and 2–7 times the rates in the other countries. The Netherlands, England & Wales, and Scotland have notably low death rates by firearms with less than 1 death per 100,000 people. For all the countries, except the United States and The Netherlands, 60–90 percent of firearm deaths are coded as suicides. In the United States, the majority of firearm deaths are suicides (51 percent); however, about 43 percent are homicides. The firearm homicide rate at 6 per 100,000 in the United States is 8 times the next highest rate. The firearm suicide rate in the United States was 1.4 times the rate in France, the country with the highest overall suicide rate. New Zealand with a low overall rate of deaths by firearms, had a high proportion of firearm deaths coded as unintentional.

Poisoning death rates by intent (figure 10)—Average annual poisoning death rates are lowest in Israel and The Netherlands at 1–2 per 100,000 and are highest in Denmark at 13 per 100,000. In New Zealand, Norway, the United States, England & Wales, Canada, and Australia poisoning death rates were similar, at 6–7 deaths per 100,000. Unintentional poisoning death rates are higher in Denmark and in the United States than elsewhere. In all the countries except the United States, the rates of poisonings that were suicides exceed rates of poisonings that were unintended and rates of poisonings where the intent could not be determined. With the exception of the United States, poisoning by suicide accounts for more than one-half of all poisoning deaths. In the United States unintentional poisonings account for 56 percent of all poisoning deaths. The rates of poisoning deaths of undetermined intent are highest in Denmark, England & Wales, and Scotland.

Among persons aged 25–44 years, the age group with highest rates of poisonings, the death rates are similarly high in England & Wales, Canada, Australia, United States, and Scotland at 10–12 per 100,000. Rates are lowest in Israel and The Netherlands.

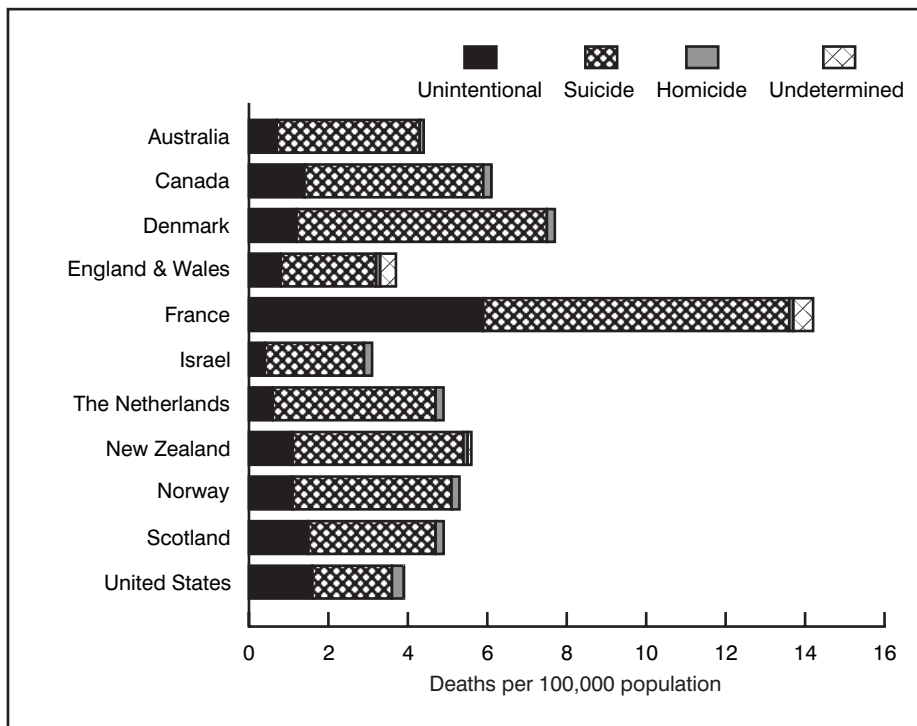


Figure 11. Average annual suffocation rates by intent: Injury ICE countries, selected recent years

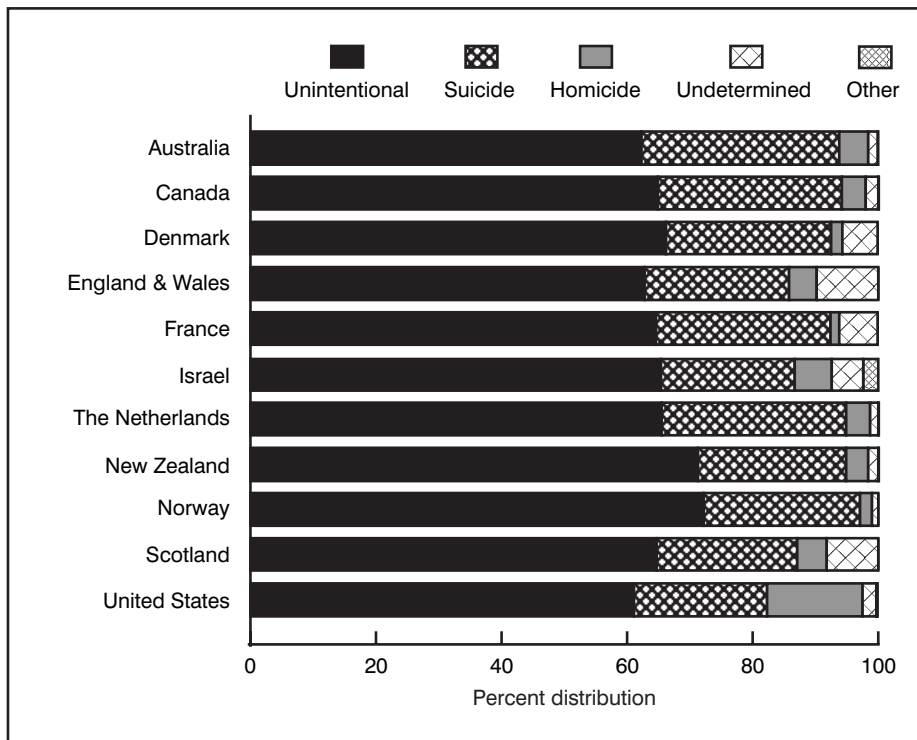


Figure 12. Percent distribution of injury deaths by intent: Injury ICE countries, selected recent years

Suffocation rates by intent (figure 11)—The average annual suffocation rate in France, 14 per 100,000, is 2–5 times the rates in the comparison countries. With the exception of France, the rates of

suffocation ranged between 3 and 8 per 100,000. Suicides (i.e., hanging) account for about 60–80 percent of the suffocations in the comparison countries except in the United States and France where it account for about 50 percent of

the suffocations. In each country the rate was higher for suicidal suffocation than for unintentional suffocation (i.e., choking on food or other objects that obstruct the airway). The rate of unintentional suffocation in France was more than 3 times those in the comparison countries at 6 per 100,000 compared with less than 1 to 2 per 100,000.

Injury by intent and mechanism

By intent (figure 12)—Unintentional injury accounts for 61–72 percent, suicide for 21–31 percent, and homicide for 1–6 percent of the injury deaths in all the countries, except in the United States where homicide accounts for 15 percent of the deaths. For 6 of the 11 countries, the intent could not be determined for 1–2 percent of the injury deaths. In the remaining five countries (Israel, Denmark, France, Scotland, and England & Wales) the intent could not be determined for between 5 and 10 percent of the injuries. Of the 11 comparison countries, Israel is the only 1 of the comparison countries in which the category “other” accounts for more than 0.2 percent of all injury deaths and there it accounts for 2 percent.

Unintentional injury by mechanism (figure 13)—Among the comparison countries, unintentional injury death rates are highest in France and Denmark and lowest in England & Wales, Israel, and The Netherlands. With the exceptions of Denmark and Scotland, motor vehicle traffic-related injuries are the leading mechanism of unintentional death. In Denmark falls are the leading mechanism of unintentional injury death and it has the highest fall death rate. At 25 unintentional fall deaths per 100,000 persons in Denmark, the fall death rate is more than twice as high as the next highest rate in Scotland of 11 per 100,000 persons. Unintentional poisoning death rates are highest in the United States and Denmark; unintentional suffocation rates are highest in France. In Norway, France, The Netherlands, and Israel a mechanism is not specified for about one-third of the unintentional deaths; between 84–96 percent of these deaths

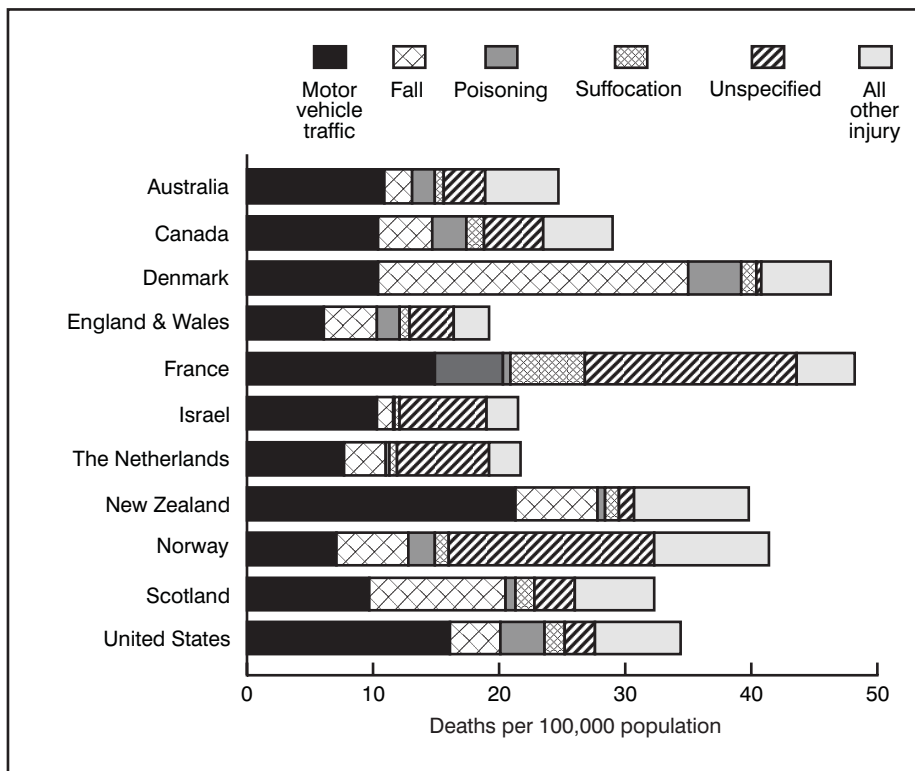


Figure 13. Average annual unintentional injury death rates by mechanism: Injury ICE countries, selected recent years

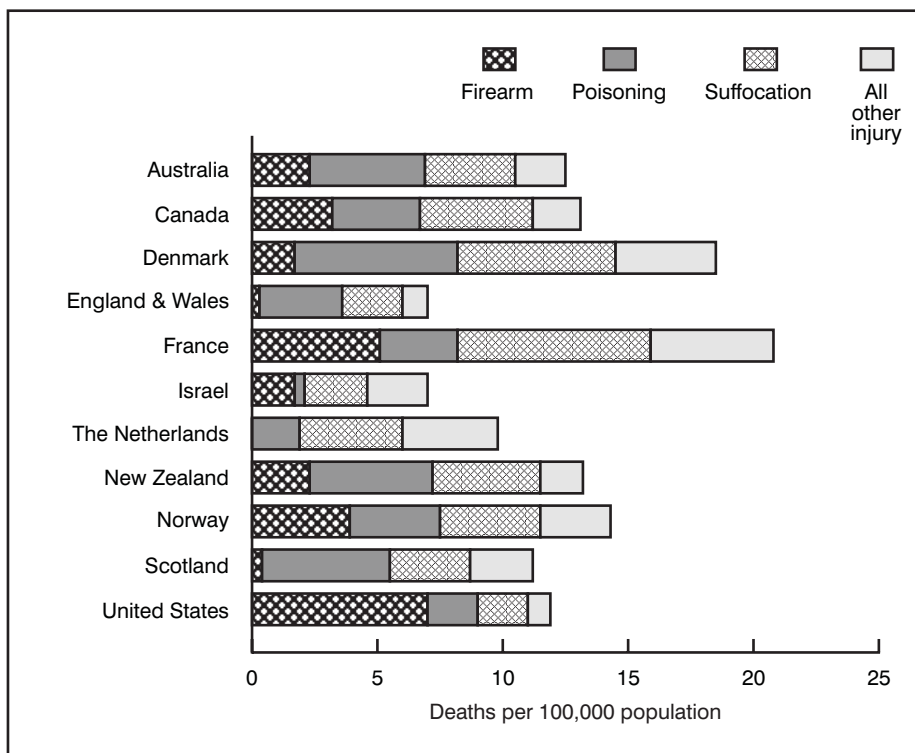


Figure 14. Average annual suicide rates by mechanism: Injury ICE countries, selected recent years

without a specified mechanism are among persons aged 65 years and over.

Suicide by mechanism (figure 14)—Suicide rates are highest in Denmark

and France at 18 and 21 per 100,000, respectively. The suicide rates are lowest in Israel and England & Wales at 7 per 100,000. The rates in the remaining

countries range between 10 and 14 per 100,000. The leading mechanism of deaths coded as suicides varies by country. In the United States firearms are the leading mechanism of suicide accounting for nearly 60 percent of all the deaths. Poisoning is the leading mechanism of suicide in England & Wales, Scotland, New Zealand, and Australia accounting for between 37–47 percent of the suicides. Suffocation is the leading mechanism of suicide in The Netherlands, France, Israel, and Canada accounting for between 34–42 percent of the deaths. In Norway firearms, poisoning, and suffocation account for similar proportions (25–28 percent) of suicides.

Homicide by mechanism (figure 15)—The homicide rate in the United States, 9 homicides per 100,000, is 4–9 times the rates in the comparison countries with 1–2 homicides per 100,000 population. Knives (i.e., cutting and piercing instruments) and firearms are the mechanisms in the majority of homicides in all the countries except for England & Wales and Scotland. The “all other” category includes fatal assaults by striking, by suffocation, and by undetermined causes. Two-thirds of homicides in the United States are committed with firearms, far higher than elsewhere. In France, Canada, The Netherlands, Israel, and Norway the firearm homicide rates are either similar to or slightly higher than the rate for knives. In Scotland, with a homicide rate of 2 per 100,000, the death rate for knives is 9 times the rate for firearms.

Undetermined intent injury death rates by mechanism (figure 16)—Undetermined intent injury death rates are highest in France, Scotland, Denmark, and England & Wales and is lowest in The Netherlands. Poisoning in Scotland and Denmark and drowning and firearms in France are the mechanisms for these injuries in which the intent could not be determined. Poisonings, firearms, and drownings account for between 60 and 80 percent of the deaths where the intent could not be determined in all the countries except Israel and The Netherlands, where they account for 40–50 percent of the deaths.

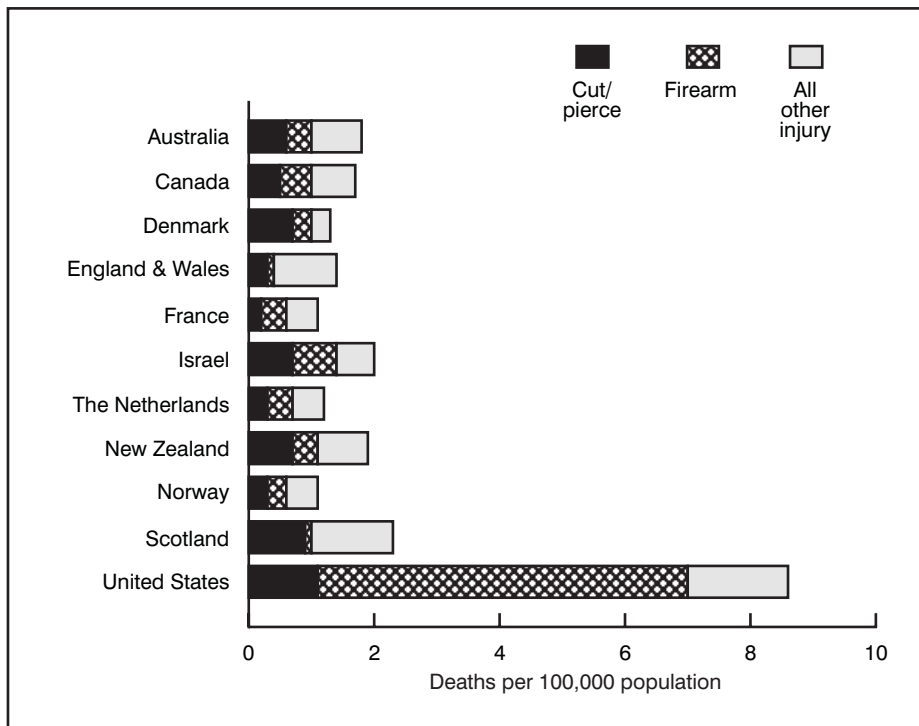


Figure 15. Average annual homicide rates by mechanism: Injury ICE countries, selected recent years

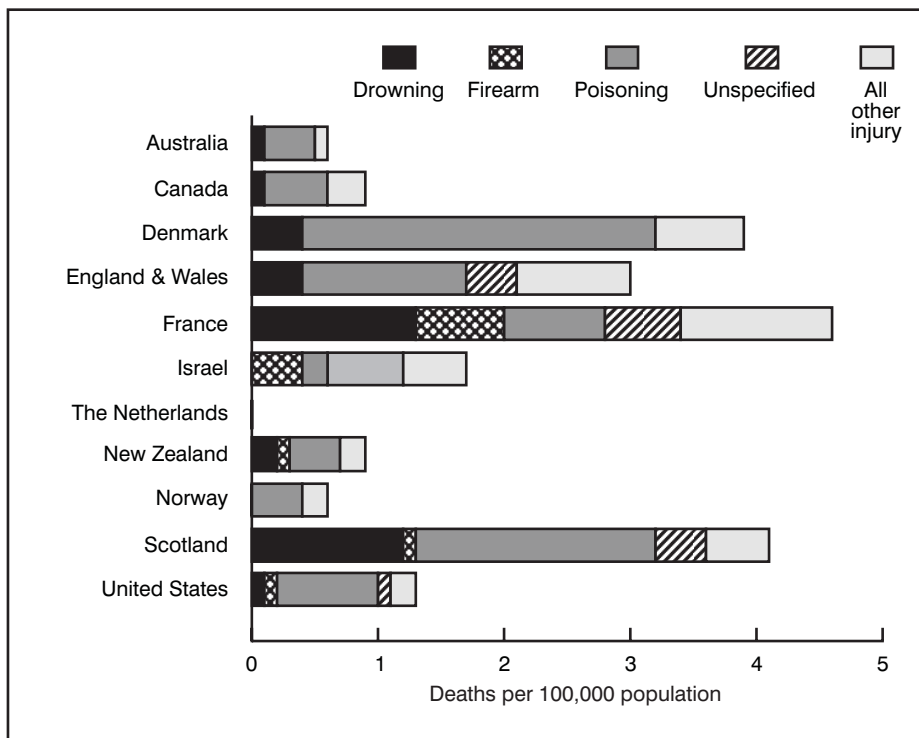


Figure 16. Average annual injury death rates of undetermined intent by mechanism: Injury ICE countries, selected recent years

Discussion

This report presents the first cross-national comparison of injury mortality rates using the framework for injury statistics. Presenting these death rates is the first step in the process of understanding the differences in injury rates between the countries; the next step is to interpret the differences. Although real differences in patterns of injury mortality between countries is probable, some variation is likely to be an artifact of death registration, certification, classification, and population enumeration. One of the purposes of the ICE on Injury Statistics is to improve the comparability of injury data between countries by documenting and, where possible, analyzing the data to minimize these differences.

ICE is developing a detailed questionnaire on national practices relating to death registration, certification, and rate calculation to be completed by each of the countries participating in ICE. With the information provided, the injury mortality rate data presented can be systematically interpreted with reference to the differences. For instance, the results of the questionnaire will document some of the differences in the ways the countries record injury causes of death and ways in which they enumerate their population (e.g., inclusion or exclusion of nonresident, military, and institutionalized populations) that are used as the denominators of the death rates.

The countries in this study coded deaths according to the *International Classification of Diseases*. Despite the use of this standard classification system, classification differences are possible due to interpretation of the coding rules. In addition the countries vary on the sources of information on which classification of the causes of death are based.

In a study of falls in the elderly in New Zealand and the United States, death rates were compared (10, 11). The impetus for this study was the finding that in New Zealand 52 percent of all injury deaths among the persons aged

65 years and over were falls, while in the United States only 28 percent were falls. Although other potential factors were explored, the best explanation appeared to be the very large variation in the number of sources for coding the cause of death. In New Zealand the nosologists who are responsible for coding the causes of death, routinely use coroner's reports, media reports, and occasionally contact physicians to verify the cause of death as reported on the death certificate. In contrast, in the United States coding is based on information provided on the death certificate (12). Generally, the coding of the cause of death will be more accurate and consistent when more details are available.

Some differences in the cause of death may be artifactual, but some are likely to be real. For instance, although coding conventions may differ, the high rates of fatal firearm injuries in the United States are less likely to be artifacts of coding as injuries from firearms are generally easily identifiable as to mechanism in contrast, for example, to injuries from falls.

Injury deaths in this report are only those that are assigned an ICD external cause code. This convention may mask important differences between the countries in rates of fatal poisoning. In a recent analysis of poisoning deaths in the United States (13), a recommendation was made to include deaths in which the underlying cause was the nondependent abuse of drugs (ICD 305) as poisoning deaths. This was also recommended to the ICE participants (unpublished minutes from May 1998 meeting).

The criteria used to rule if a death was intentional (i.e., suicidal or homicidal) or unintentional (i.e., accidental) or undetermined varies by country even when coding deaths using a standard classification system (ICD). Some countries have strictly judicial methods (e.g., coroner's courts) of ruling on the manner of death, while others have medically based methods (e.g., medical examiner's). In addition, social customs, criminal justice systems, and financial implications of the rulings vary by country. Therefore, it is possible that intent is not recorded accurately or

consistently on the death certificates either because of a lack of information (e.g., no witnesses or suicide note) or because of purposeful misrepresentation by either the victim, perpetrator, or person certifying the death. Because the criteria on which intent is determined can vary by country, in addition to the other social implications of the ruling, it is important to consider all the intent categories when considering risk factors of injury deaths.

In France for instance, nearly one-half the drownings among 1–14 year olds are coded as undetermined intent, whereas in the other countries nearly all the drownings are coded as unintentional intent. This discrepancy, which is likely due in part to either coding conventions or the medico-legal systems within the country, highlights the need to examine the leading causes of death without regard to intent. If only unintentional drownings were examined in this paper, it would appear that France had an unusually low rate of drowning.

In the next few years, many of the countries in the analysis will be transitioning to the 10th revision of the *International Classification of Diseases*. Denmark is already coding using the ICD-10. ICE is also proceeding with the adaption of the matrix framework to ICD-10; a draft of this revision was prepared and used by Denmark in this analysis (6). As this revision of the ICD is likely to become the standard for at least the next decade, the agreement on the updated matrix will be an important step in quantifying international differences in mortality.

Results of this analysis have already begun to shed light on areas in the ICD-10 where interpretation differences are possible. In Denmark, for example, the higher fall death rates may in part be due to coding using ICD-10. Fractures of an unspecified cause have been reclassified several times across ICD revisions. In ICDA, the 8th revision (14), "fractures not otherwise specified" were listed in the inclusion criteria for "Other and unspecified falls" (E887). In ICD-9, "fracture, cause unspecified" was given a unique code. In ICD-10 the code for fractures with an unspecified cause was removed and is

not mentioned in any of the inclusion or exclusion criteria. Therefore, following the example given in ICD-8, fractures of an unspecified cause would be included with the falls of an unspecified cause using ICD-10. However, an alternative interpretation might include the fractures with an unspecified cause with the general category of "exposure to unspecified factor." Early identification and discussions of areas where different interpretations of coding rules are possible will help to provide rationale for consistent decisionmaking between countries and is one of the aims of the ICE on Injury Statistics.

Conclusion

This report will help to define areas where interpretation of comparative injury statistics is needed. Careful review of the document with an eye towards real and artifactual discrepancies can only lead to a clearer understanding of international differences in injury rates. By identifying specific topics for further investigation, ICE can work towards reanalysis and interpretation of the rates to make them as comparable as possible. Despite the apparent problems in comparability, some of the differences are not artifacts of process of classifying deaths, but are real and intriguing differences in injury experiences between countries.

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Data table for figures 1–16

Figure 1	Injury deaths per 100,000 population
Accident and adverse effects	46.5
Motor vehicle traffic	21.9
Other transport	2.5
Poisoning	4.3
Fall	5.1
Fire and flame	2.0
Drowning	2.2
Machinery and cutting and piercing instrument	0.9
Firearm	1.0
Other	6.5
Adverse effects	0.1
Suicide	19.6
Homicide	15.9
Other violence	2.0

Figure 2	Average annual population in millions
United States, 1995	262.76
France, 1992–94	57.64
England & Wales, 1993–95	51.62
Canada, 1994–95	29.43
Australia, 1993–95	17.85
The Netherlands, 1995	15.46
Israel, 1993–95	5.45
Denmark, 1994–95	5.22
Scotland, 1986–95	5.11
Norway, 1990–94	4.29
New Zealand, 1984–93	3.34

Figure 3	Injury deaths per 100,000 population
Australia	39.7
Canada	44.7
Denmark	69.9
England & Wales	30.5
France	74.7
Israel	32.9
The Netherlands	33.2
New Zealand	55.8
Norway	57.4
Scotland	49.9
United States	56.3

Figure 4	Motor vehicle traffic	Firearm	Poisoning	Fall	Suffocation	Drowning	Unspecified	All other injury
Injury deaths per 100,000 population								
Australia	11.0	2.9	6.8	2.9	4.4	2.2	3.5	6.0
Canada	10.5	3.9	6.7	5.0	6.1	2.1	4.9	5.5
Denmark	10.5	2.1	13.4	25.7	7.8	3.0	0.6	6.8
England & Wales	6.2	0.4	6.4	4.4	3.8	1.1	4.9	3.3
France	14.9	6.3	4.6	7.1	14.1	4.2	18.6	4.9
Israel	10.3	2.8	0.7	2.6	3.1	1.2	8.7	3.5
The Netherlands	7.7	0.5	2.4	4.2	4.9	1.6	9.2	2.7
New Zealand	21.3	3.1	5.9	7.0	5.6	3.7	1.4	7.8
Norway	7.2	4.3	6.1	6.4	5.3	4.7	16.4	7.0
Scotland	9.8	0.6	7.9	11.8	5.0	3.2	3.9	7.7
United States	16.2	13.7	6.2	4.3	3.9	1.9	3.0	7.1

Figure 5	Motor vehicle traffic	Drowning	Fire/burn	Suffocation	All other
Injury deaths per 100,000 population 1–14 years of age					
Australia	3.4	2.0	0.8	0.7	2.5
Canada	3.5	1.2	0.9	1.4	2.2
England & Wales	2.2	0.4	0.7	0.6	1.3
France	3.6	1.3	0.5	0.8	2.4
Israel	3.8	0.9	*	*	2.4
The Netherlands	2.5	1.1	*	*	2.1
New Zealand	7.0	2.8	0.9	1.2	4.6
Norway	2.3	1.6	0.7	1.3	2.6
Scotland	4.4	0.8	1.4	0.9	1.9
United States	4.9	1.9	1.6	0.9	4.1

* Based on fewer than 20 deaths.

Figure 6	Motor vehicle traffic	Firearm	Poisoning	Fall	Suffocation	Drowning	All other
Injury deaths per 100,000 population 15–24 years of age							
Australia	21.2	3.7	6.6	1.9	6.2	1.9	6.6
Canada	19.7	5.0	4.0	1.6	7.3	2.1	6.6
England & Wales	11.6	0.4	6.3	1.1	4.0	1.0	4.6
France	27.6	4.8	2.0	1.9	4.2	1.9	7.4
Israel	14.9	5.8	*	1.1	2.0	1.2	6.9
The Netherlands	13.1	*	1.4	1.4	3.0	*	5.5
New Zealand	48.7	4.4	7.3	2.5	9.3	4.4	9.4
Norway	14.1	6.6	3.1	1.4	5.1	3.0	5.7
Scotland	16.7	0.9	8.1	2.5	4.9	2.4	6.9
United States	29.1	27.2	3.2	1.0	3.6	2.4	6.5

* Based on fewer than 20 deaths.

Figure 7	Motor vehicle traffic	Firearm	Poisoning	Fall	Suffocation	Unspecified	All other injury
Injury deaths per 100,000 population 65 years of age and over							
Australia	16.0	3.6	5.5	12.3	6.1	26.5	12.4
Canada	14.8	4.3	5.5	28.9	9.4	34.3	11.0
England & Wales	10.0	0.4	5.9	20.1	5.8	21.3	8.9
France	17.9	9.3	7.4	28.2	45.9	96.4	19.4
Israel	23.4	2.6	3.4	14.7	9.3	69.0	10.0
The Netherlands	14.4	*	3.2	20.1	8.8	54.5	9.7
New Zealand	22.6	3.6	6.5	48.0	8.4	10.4	15.0
Norway	11.1	4.1	5.7	27.3	9.1	97.1	20.6
Scotland	14.6	0.4	6.3	59.4	6.7	20.9	19.5
United States	22.2	14.2	4.1	23.5	9.5	16.0	13.4

* Based on fewer than 20 deaths.

Figure 8	Occupant	Motorcyclist	Pedal cyclist	Pedestrian
Unintentional motor vehicle related deaths per 100,000 population				
Australia	7.5	1.1	0.2	2.0
Canada	8.2	0.7	0.2	1.3
Denmark	5.8	1.3	1.3	1.9
England & Wales	3.1	0.8	0.3	1.9
France	^	^	^	^
Israel	^	^	^	^
The Netherlands	3.6	2.1	1.4	0.6
New Zealand	14.1	3.5	0.6	3.0
Norway	4.7	0.8	0.3	1.3
Scotland	5.7	0.8	0.2	3.0
United States	12.7	0.9	0.3	2.3

^ Data not shown because in 88 percent (France) and in 75 percent (Israel) of all unintentional motor vehicle deaths, the person injured was not specified.

Figure 9	Unintentional	Suicide	Homicide	Undetermined	Other
Firearm injury deaths per 100,000 population					
Australia	0.1	2.3	0.4	*	*
Canada	0.1	3.2	0.5	*	0.0
Denmark	*	1.7	0.3	*	*
England & Wales	0.0	0.3	0.1	0.0	*
France	0.1	5.1	0.4	0.7	*
Israel	*	1.7	0.7	0.4	*
The Netherlands	*	*	0.4	*	*
New Zealand	0.3	2.3	0.4	0.1	*
Norway	0.1	3.9	0.3	*	*
Scotland	*	0.4	0.1	0.1	*
United States	0.5	7.0	5.9	0.1	0.1

* Based on fewer than 20 deaths.
0.0 Quantity more than zero but less than 0.05.

Figure 10	Unintentional	Suicide	Undetermined
Poisoning deaths per 100,000 population			
Australia	1.8	4.6	0.4
Canada	2.7	3.5	0.5
Denmark	4.2	6.5	2.8
England & Wales	1.8	3.3	1.3
France	0.6	3.1	0.8
Israel	0.1	0.4	0.2
The Netherlands	0.3	1.9	*
New Zealand	0.6	4.9	0.4
Norway	2.1	3.6	0.4
Scotland	0.8	5.1	1.9
United States	3.5	2.0	0.8

* Based on fewer than 20 deaths.

Figure 11	Unintentional	Suicide	Homicide	Undetermined
Suffocations per 100,000 population				
Australia	0.7	3.6	0.1	*
Canada	1.4	4.5	0.2	0.0
Denmark	1.2	6.3	0.2	*
England & Wales	0.8	2.4	0.1	0.4
France	5.9	7.7	0.1	0.5
Israel	0.4	2.5	0.2	*
The Netherlands	0.6	4.1	0.2	*
New Zealand	1.1	4.3	0.1	0.1
Norway	1.1	4.0	0.2	*
Scotland	1.5	3.2	0.2	0.0
United States	1.6	2.0	0.3	0.0

* Based on fewer than 20 deaths.
0.0 Quantity more than zero but less than 0.05.

Figure 12	Unintentional	Suicide	Homicide	Undetermined	Other	Total
Percent distribution of all injury deaths by intent						
Australia	62.3	31.5	4.6	1.5	0.1	100.0
Canada	64.9	29.3	3.8	2.0	0.1	100.0
Denmark	66.2	26.3	1.8	5.6	0.0	100.0
England & Wales	62.8	23.0	4.4	9.8	0.0	100.0
France	64.6	27.8	1.4	6.1	0.0	100.0
Israel	65.4	21.3	5.9	5.0	2.4	100.0
The Netherlands	65.5	29.4	3.8	1.3	0.1	100.0
New Zealand	71.3	23.6	3.5	1.6	0.1	100.0
Norway	72.2	24.9	1.9	1.0	0.0	100.0
Scotland	64.7	22.4	4.7	8.2	0.0	100.0
United States	61.1	21.2	15.2	2.2	0.2	100.0

0.0 Quantity more than zero but less than 0.05.

Figure 13	Motor vehicle traffic	Fall	Poisoning	Suffocation	Unspecified	All other	All unintentional
Unintentional injury deaths per 100,000 population							
Australia	10.9	2.2	1.8	0.7	3.3	5.8	24.7
Canada	10.4	4.3	2.7	1.4	4.7	5.5	29.0
Denmark	10.4	24.6	4.2	1.2	0.4	5.5	46.3
England & Wales	6.1	4.2	1.8	0.8	3.5	2.8	19.2
France	14.9	5.4	0.6	5.9	16.8	4.6	48.2
Israel	10.3	1.3	0.1	0.4	6.9	2.5	21.5
The Netherlands	7.7	3.3	0.3	0.6	7.3	2.5	21.7
New Zealand	21.3	6.5	0.6	1.1	1.2	9.1	39.8
Norway	7.1	5.7	2.1	1.1	16.3	9.1	41.4
Scotland	9.7	10.8	0.8	1.5	3.2	6.3	32.3
United States	16.1	4.0	3.5	1.6	2.4	6.8	34.4

Figure 14	Firearm	Poisoning	Suffocation	All other	All suicide
Suicides per 100,000 population					
Australia	2.3	4.6	3.6	2.0	12.5
Canada	3.2	3.5	4.5	1.9	13.1
Denmark	1.7	6.5	6.3	4.0	18.4
England & Wales	0.3	3.3	2.4	1.0	7.0
France	5.1	3.1	7.7	4.9	20.8
Israel	1.7	0.4	2.5	2.4	7.0
The Netherlands	*	1.9	4.1	3.8	9.8
New Zealand	2.3	4.9	4.3	1.7	13.2
Norway	3.9	3.6	4.0	2.8	14.3
Scotland	0.4	5.1	3.2	2.5	11.2
United States	7.0	2.0	2.0	0.9	11.9

* Based on fewer than 20 deaths.

Figure 15	Cut/pierce	Firearm	All other	All homicide
Homicides per 100,000 population				
Australia	0.6	0.4	0.8	1.8
Canada	0.5	0.5	0.7	1.7
Denmark	0.7	0.3	0.3	1.3
England & Wales	0.3	0.1	1.0	1.3
France	0.2	0.4	0.5	1.1
Israel	0.7	0.7	0.6	2.0
The Netherlands	0.3	0.4	0.5	1.2
New Zealand	0.7	0.4	0.8	1.9
Norway	0.3	0.3	0.5	1.1
Scotland	0.9	0.1	1.3	2.3
United States	1.1	5.9	1.6	8.6

Figure 16	Drowning	Firearm	Poisoning	Unspecified	All other	All undetermined
Injury deaths of undetermined intent per 100,000 population						
Australia	0.1	*	0.4	*	0.1	0.6
Canada	0.1	*	0.5	0.0	0.3	0.9
Denmark	0.4	*	2.8	*	0.7	3.9
England & Wales	0.4	0.0	1.3	0.4	0.9	3.0
France	1.3	0.7	0.8	0.6	1.2	4.6
Israel	*	0.4	0.2	0.6	0.5	1.7
The Netherlands	*	*	*	*	*	0.4
New Zealand	0.2	0.1	0.4	*	0.2	0.9
Norway	*	*	0.4	*	0.2	0.6
Scotland	1.2	0.1	1.9	0.4	0.5	4.1
United States	0.1	0.1	0.8	0.1	0.2	1.3

* Based on fewer than 20 deaths.

0.0 Quantity more than zero but less than 0.05.

Suggested citation

Fingerhut LA, Cox CS, Warner M, et al. International comparative analysis of injury mortality: Findings from the ICE on injury statistics. Advance data from vital and health statistics; no 303. Hyattsville, Maryland: National Center for Health Statistics. 1998.

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DHHS Publication No. (PHS) 98-1250
8-0788 (9/98)