



# Traumatic Brain Injury

IN THE UNITED STATES

Emergency Department Visits,  
Hospitalizations and Deaths 2002–2006

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
CENTERS FOR DISEASE CONTROL AND PREVENTION



[www.cdc.gov/TraumaticBrainInjury](http://www.cdc.gov/TraumaticBrainInjury)

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention (CDC).

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## THE POWER OF DATA

### *A Message from a TBI Survivor*

“Society is more likely to take action against the ravages of traumatic brain injury if it understands how pernicious, pervasive, and huge the problem is.



This body of work is a vital tool for those who devise the strategies for prevention and treatment. However, a critical dimension will be lost if one sees it only as data, if one does not try to put even a fleeting face behind the numbers. They represent people who — if they survived — have had their lives significantly affected. Through research, we are finding better ways to prevent injury and improve acute care. We who are injured may experience improvement both in function and the quality of our lives when we have access to rehabilitation and support to develop and utilize our remaining strengths and abilities. With so many lives affected, we seek and have the potential for independence, to have the chance to move beyond our disabilities and give back to society.

As a survivor, as a disabled physician, I applaud this publication as a step toward making that possible.”

CLAUDIA L. OSBORN, DO, FACOI  
COLLEGE OF OSTEOPATHIC MEDICINE, MICHIGAN STATE UNIVERSITY

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## EXECUTIVE SUMMARY

Traumatic brain injury (TBI) is an important public health problem in the United States. TBI is frequently referred to as the “silent epidemic” because the complications from TBI, such as changes affecting thinking, sensation, language, or emotions, may not be readily apparent. In addition, awareness about TBI among the general public is limited.

Through the TBI Act of 1996 (Public Law 104–166), Congress first charged the Centers for Disease Control and Prevention (CDC) with “determining the incidence and prevalence of traumatic brain injury in all age groups in the general population of the United States.” In response, CDC has produced, *Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations and Deaths 2002–2006*.

Population-based data on TBI are critical to understanding the impact of TBI on the American people. This report presents data on TBI-related emergency department visits, hospitalizations, and deaths for the years 2002 through 2006 and can be used to determine the number of TBIs occurring each year, groups most affected, and the leading causes of TBI. This important information can be used to document the need for TBI prevention, to identify research and education priorities, and to support the need for services among individuals living with a TBI.

This report is an update to CDC's previously published report released in 2004 and is intended as a reference for policymakers, health care and service providers, educators, researchers, advocates, and others interested in knowing more about the impact of TBI in the United States.<sup>1</sup>





# KEY FINDINGS IN THIS REPORT

## TBI in the United States

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- An estimated 1.7 million people sustain a TBI annually. Of them:
  - 52,000 die,
  - 275,000 are hospitalized, and
  - 1.365 million, nearly 80%, are treated and released from an emergency department.
- TBI is a contributing factor to a third (30.5%) of all injury-related deaths in the United States.

## TBI by Age

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- Children aged 0 to 4 years, older adolescents aged 15 to 19 years, and adults aged 65 years and older are most likely to sustain a TBI.
- Almost half a million (473,947) emergency department visits for TBI are made annually by children aged 0 to 14 years.
- Adults aged 75 years and older have the highest rates of TBI-related hospitalization and death.

## TBI by Sex

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- In every age group, TBI rates are higher for males than for females.
- Males aged 0 to 4 years have the highest rates for TBI-related emergency department visits, hospitalizations, and deaths combined.

## TBI by External Cause

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- Falls are the leading cause of TBI. Rates are highest for children aged 0 to 4 years and for adults aged 75 years and older.
- Falls result in the greatest number of TBI-related emergency department visits (523,043) and hospitalizations (62,334).
- Motor vehicle–traffic injury is the leading cause of TBI-related death. Rates are highest for adults aged 20 to 24 years.

## Additional TBI Findings\*

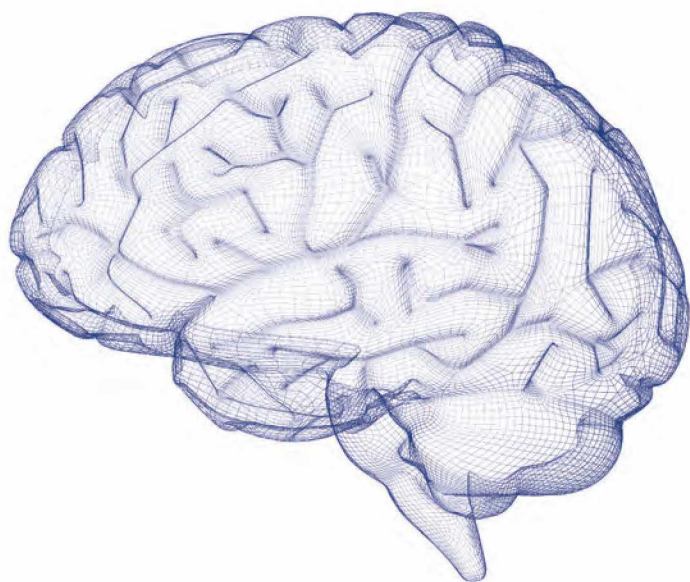
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- There was an increase in TBI-related emergency department visits (14.4%) and hospitalizations (19.5%) from 2002 to 2006.
- There was a 62% increase in fall-related TBI seen in emergency departments among children aged 14 years and younger from 2002 to 2006.
- There was an increase in fall-related TBIs among adults aged 65 and older; 46% increase in emergency department visits, 34% increase in hospitalizations, and 27% increase in TBI-related deaths from 2002 to 2006.

\* Estimates based on one year of data can produce varied results.

## BACKGROUND

Each year, traumatic brain injuries (TBI) contribute to substantial number of deaths and cases of permanent disability. A TBI is caused by a bump, blow or jolt to the head or a penetrating head injury that disrupts the normal function of the brain. The severity of a TBI may range from “mild” (a brief change in mental status or consciousness) to “severe” (an extended period of unconsciousness or amnesia after the injury).



## REPORT CONTENTS AND ORGANIZATION

This report presents data about TBI-related emergency department visits, hospitalizations, and deaths in the United States for the years 2002 through 2006. The findings are organized into two main sections of *Overview* and *Appendices*. The *Overview* summarizes and interprets key findings and the *Appendices* present detailed data tables and a description of the methods and limitations.

Average annual numbers of TBIs per year and annual rates are both reported. While the annual numbers show the magnitude of the problem, the rates show how a certain group is affected by TBI by relating the number of TBIs to the size of the population. For example, a relatively small number of TBIs occurring in a small population would result in a higher TBI rate than if the same number of TBIs occurred in a larger population. This report helps to answer a variety of questions, such as: “Do males sustain TBIs more often than females?; Are children more likely to sustain a TBI than adults?; and, Are motor vehicle–traffic injuries a substantial cause of TBI among older adults?”

Data in the report include:

- TBI as a Proportion of All Injuries
- TBI by Age
- TBI by Sex
- TBI by Race
- TBI by External Cause
- Additional TBI Findings

State-level data on TBI are not presented in this report. CDC’s National Center for Injury Prevention and Control, Division of Injury Response currently funds 30 states to conduct TBI surveillance through the CORE State Injury Program.

For TBI-related death and hospitalization data by participating states, download a copy of the *State Injury Indicators Report: Fourth Edition—2005 Data* at no cost or search the Injury Indicators Web-based Query System, both available at [www.cdc.gov/Injury](http://www.cdc.gov/Injury).

Finally, neither this report nor the *State Injury Indicators Report: Fourth Edition—2005 Data* include TBIs from federal, military, or Veterans Affairs (VA) hospitals.

## FOR MORE INFORMATION

CDC's Division of Injury Response works to reduce injuries and their adverse health effects. For additional information on TBI, including research, programs, and educational initiatives please visit: [www.cdc.gov/TraumaticBrainInjury](http://www.cdc.gov/TraumaticBrainInjury).

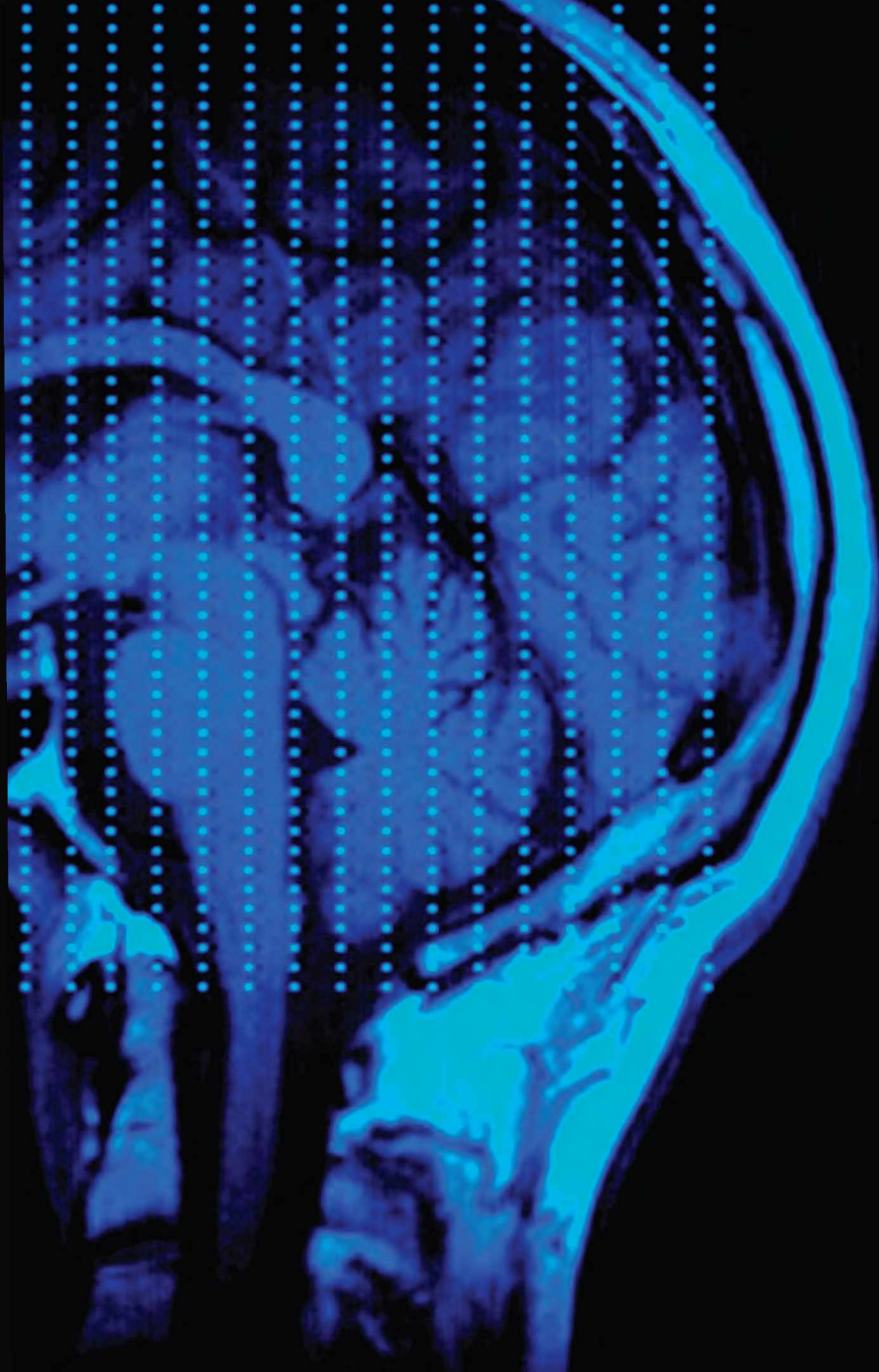
For questions about this report, please contact [CDC-INFO@cdc.gov](mailto:CDC-INFO@cdc.gov) or call [1-800-CDC-INFO](tel:1-800-CDC-INFO) (1-800- 232-4636).

For media inquiries, please contact CDC's Injury Center Press Officer at (770) 488-4902 between 9:00 am and 5:00 pm EST. If there is an after-hours emergency, please call (404) 639-2888 for instructions on contacting the on-call press officer.





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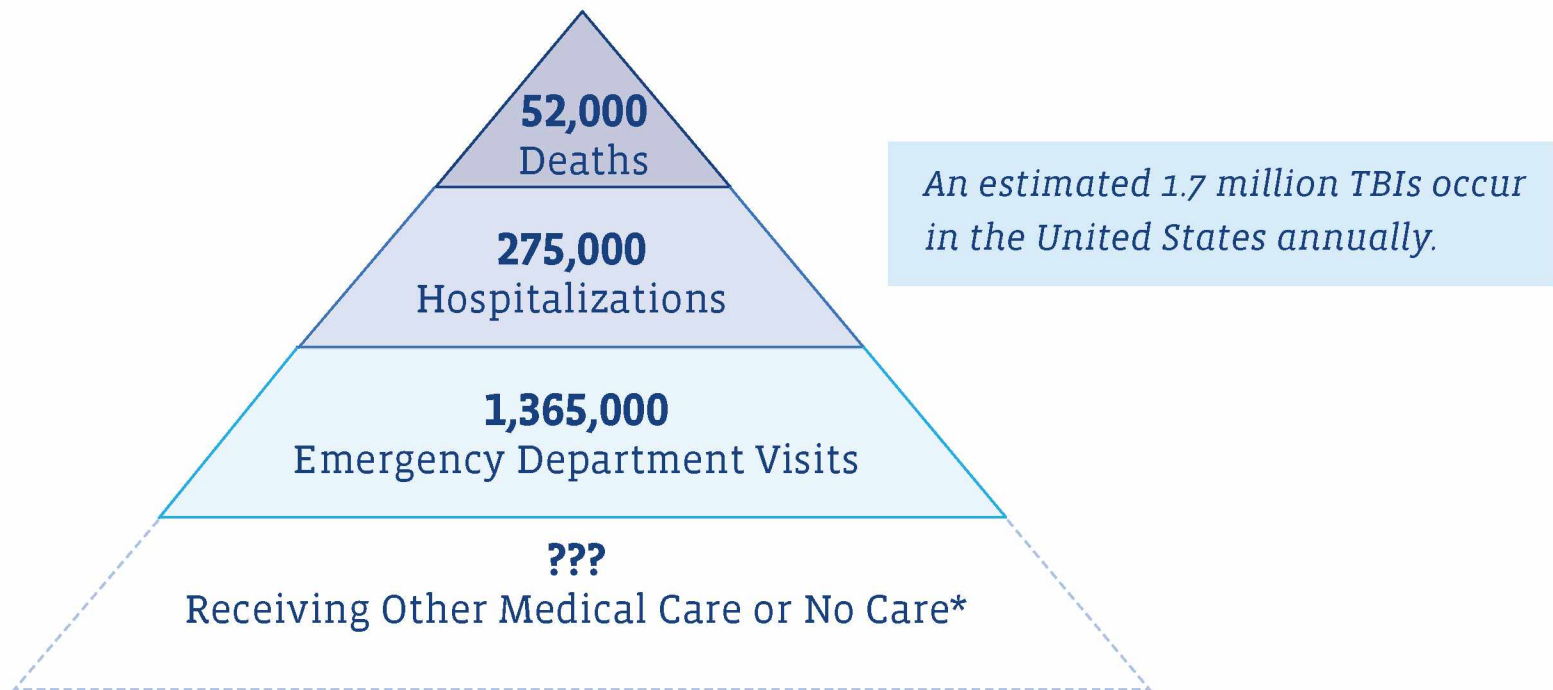
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## ANNUAL NUMBER OF TBIs

**FIGURE 1:** Estimated Average Annual Number of Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths, United States, 2002–2006



Of the 1.7 million TBIs occurring each year in the United States, 80.7% were emergency department visits, 16.3% were hospitalizations, and 3.0% were deaths.

\* Data for this category are not included in this report. See “Limitations” in Appendix B for more information.

## TBI AS A PROPORTION OF ALL INJURIES

**TABLE A:** Estimated Percentage of All Injuries and Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths, United States, 2002–2006

	ALL VISITS	ALL INJURIES		TBIs		
		NUMBER	% OF ALL VISITS	NUMBER	% OF ALL INJURIES	% OF ALL VISITS
<b>ED Visits*</b>	96,839,411	28,697,028	29.6	1,364,797	4.8	1.4
<b>Hospitalizations#</b>	36,693,646	1,826,548	5.0	275,146	15.1	0.7
<b>Deaths</b>	2,432,714	169,055	6.9	51,538+	30.5	2.1
<b>Total</b>	135,965,771	30,692,631	22.6	1,691,481	5.5	1.2

\* Persons who were hospitalized, died, or transferred to another facility were excluded.

# In-hospital deaths and patients who transferred from another hospital were excluded.

+ 128 mortality records (from 2002–2006) were omitted because of missing age information.

The estimated annual average number of emergency department visits, hospitalizations and deaths for all injuries is in Table A. TBIs comprise 4.8% of all injuries seen in emergency department visits and 15.1% of all hospitalizations. Of all the injury-related deaths in the United States, TBI was a contributing factor 30.5% of the time.

# TBI BY AGE GROUP

## COMPARING THE NUMBERS

**TABLE B:** Estimated Average Annual Numbers of Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths, by Age Group, United States, 2002–2006

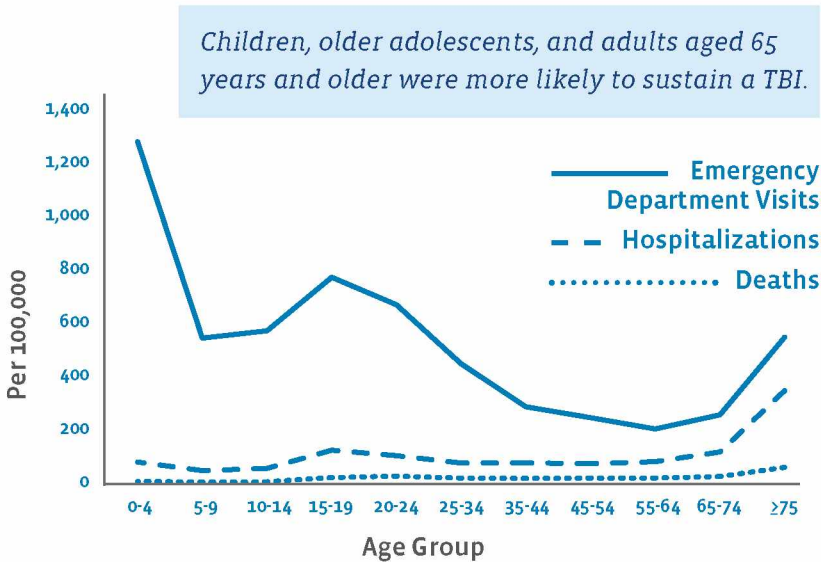
AGE GROUP	EMERGENCY DEPARTMENT VISITS	HOSPITALIZATIONS	DEATHS	TOTAL
<b>Children</b> (0–14 years)	473,947	35,136	2,174	511,257
<b>Older Adults</b> (≥ 65 years)	141,998	81,499	14,347	237,844

The estimated average annual number of TBIs that occur among children aged 0 to 14 years is 511,257. In contrast the number of TBIs in adults aged 65 years and older is 237,844. TBI-related emergency department visits accounted for a larger proportion in children (92.7%) than in older adults (59.7%).



## COMPARING THE RATES

**FIGURE 2:** Estimated Average Annual Rates of Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths, by Age Group, United States, 2002–2006



Very young children aged 0 to 4 years had the highest rate of TBI-related emergency department visits (1,256 per 100,000 population), followed by older adolescents aged 15 to 19 years (757 per 100,000). However, the highest rates of TBI-related hospitalization and death occurred among adults aged 75 years and older (339 per 100,000 and 57 per 100,000, respectively).

## TBI BY SEX

### COMPARING THE NUMBERS

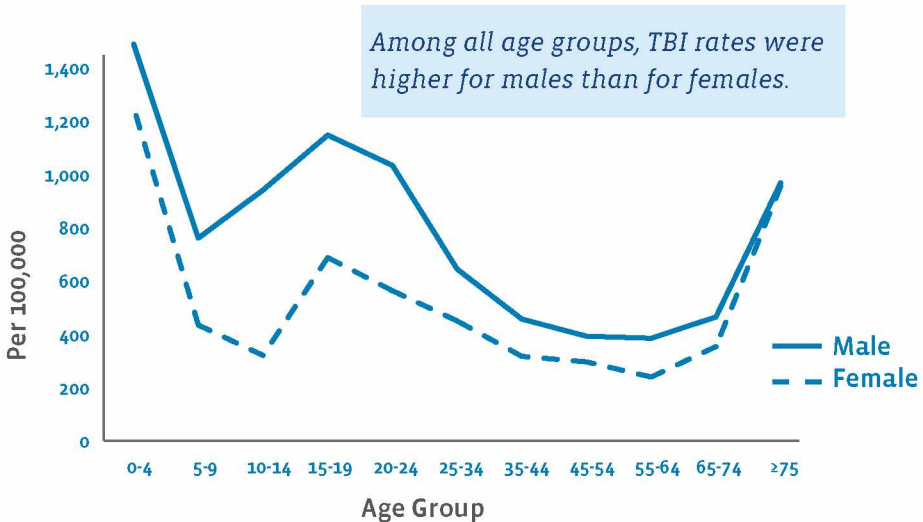
**TABLE C:** Estimated Average Annual Numbers of Traumatic Brain Injury–Related Emergency Department Visits, Hospitalizations, and Deaths, by Sex, United States, 2002–2006

SEX	EMERGENCY DEPARTMENT VISITS	HOSPITALIZATIONS	DEATHS	TOTAL
<b>Male</b>	789,925	170,257	37,994	998,176
<b>Female</b>	574,870	104,890	13,569	693,329

An estimated average annual number of 998,176 TBIs occurred among males compared with 693,329 among females. Overall, approximately 1.4 times as many TBIs occurred among males as among females.

## COMPARING THE RATES

**FIGURE 3:** Estimated Average Annual Rates of Traumatic Brain Injury-Combined Emergency Department Visits, Hospitalizations, and Deaths, by Sex, United States, 2002–2006



Males aged 0 to 4 years had the highest rates of TBI-related emergency department visits, hospitalizations and deaths combined (1,451 per 100,000). Rates were also high for females aged 0 to 4 (1,218 per 100,000), and for both males and females aged 15 to 19 years (896 per 100,000), and 75 years and older (932 per 100,000).

# TBI BY EXTERNAL CAUSE

## COMPARING THE NUMBERS

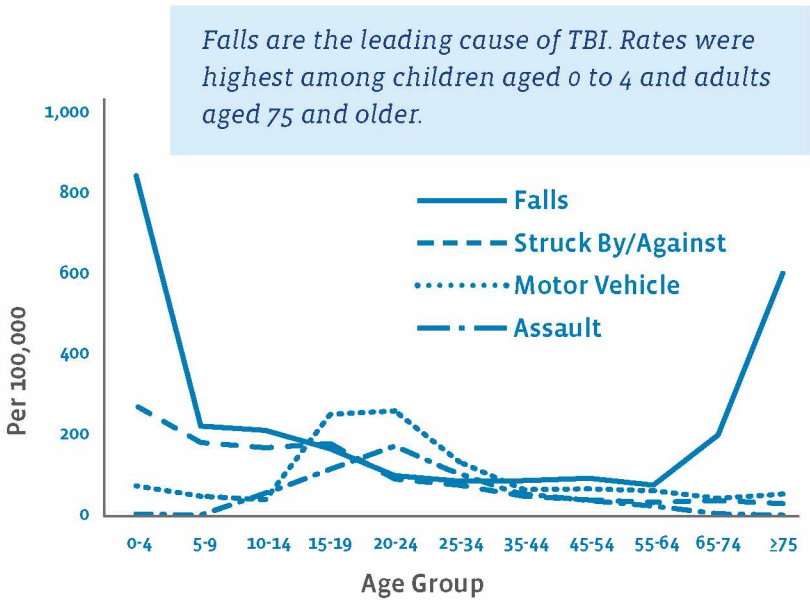
**TABLE D:** Estimated Average Annual Numbers of Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths, by External Cause, United States, 2002–2006

CAUSE	EMERGENCY DEPARTMENT VISITS	HOSPITALIZATIONS	DEATHS	TOTAL
<b>Falls</b>	523,043	62,334	9,718	595,095
<b>Struck By/Against</b>	271,713	7,791	378	279,882
<b>Motor Vehicle- Traffic</b>	218,936	56,864	16,402	292,202
<b>Assault</b>	148,471	15,341	5,813	169,625
<b>Other</b>	108,467	27,536	19,252	155,255
<b>Unknown</b>	94,165	105,282	0	199,447

An estimated average annual number of 595,095 are fall-related TBIs, 292,202 are motor vehicle-traffic TBIs, 279,882 are struck by/against events, and 169,625 are assault-related TBIs. Motor vehicle-traffic resulted in the greatest number of TBI-related deaths; however, falls resulted in the greatest number of emergency department visits and hospitalizations.

## COMPARING THE RATES

**FIGURE 4:** Estimated Average Annual Rates of Traumatic Brain Injury-Combined Emergency Department Visits, Hospitalizations, and Deaths, by External Cause, United States, 2002–2006

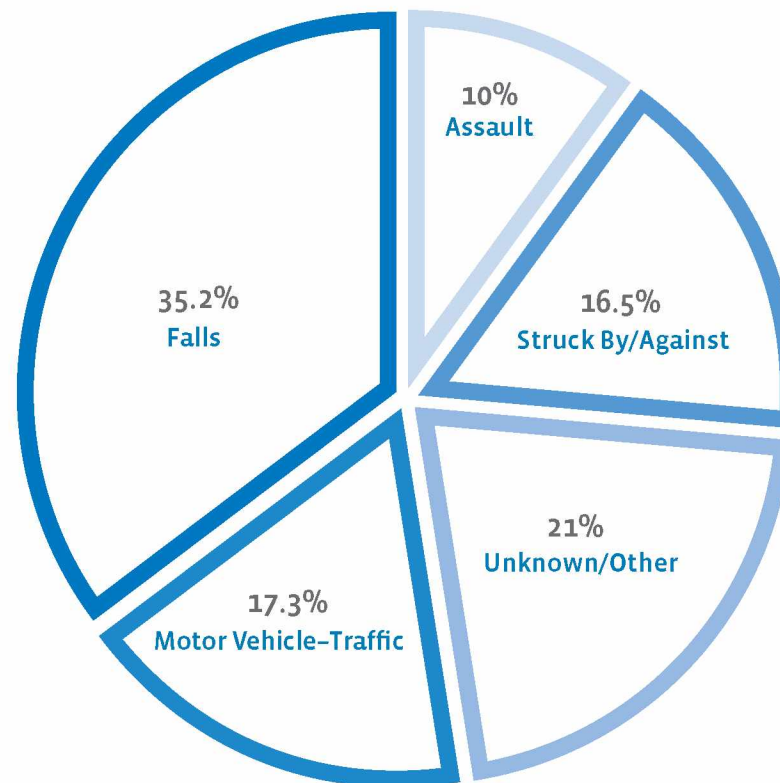


The rate of fall-related TBI was highest among children aged 0 to 4 years (839 per 100,000) and adults aged 75 years and older (599 per 100,000). The rates for both motor vehicle–traffic and assault-related TBI were highest among adults aged 20 to 24 years (261 per 100,000 and 175 per 100,000, respectively).

## TBI BY EXTERNAL CAUSE

### COMPARING THE PERCENTAGES

**FIGURE 5:** Estimated Average Percentage of Annual Traumatic Brain Injury-Combined Emergency Department Visits, Hospitalizations, and Deaths, by External Cause, United States, 2002–2006

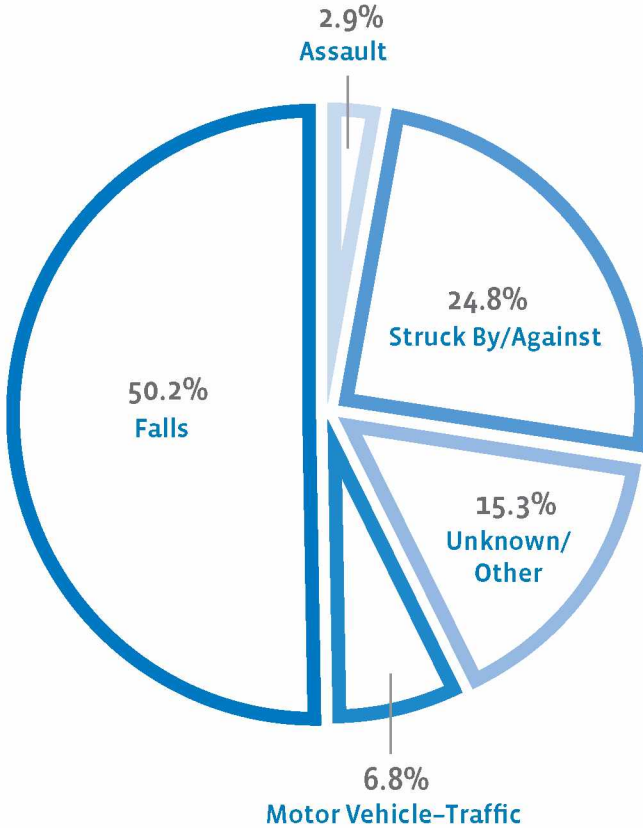




# TBI BY EXTERNAL CAUSE

## COMPARING THE PERCENTAGES BY AGE GROUPS

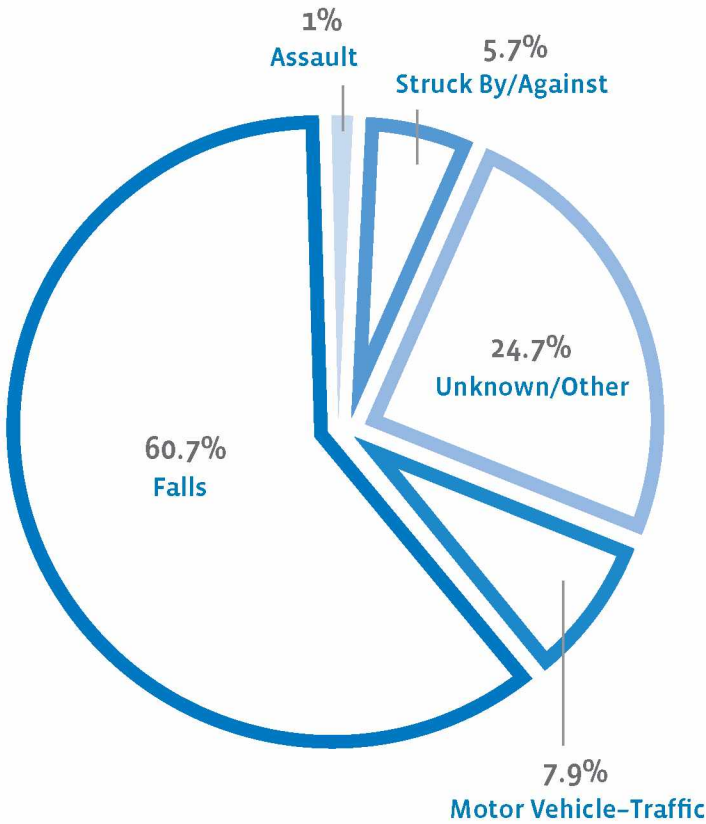
**FIGURE 6:** Estimated Average Percentage of Annual Traumatic Brain Injury-Combined Emergency Department Visits, Hospitalizations, and Deaths Among Children 0 to 14 Years, by External Cause, United States, 2002–2006





**FIGURE 7:** Estimated Average Percentage of Annual Traumatic Brain Injury-Combined Emergency Department Visits, Hospitalizations, and Deaths Among Adults 65 Years and Older, by External Cause, United States, 2002–2006

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# SUMMARY OF FINDINGS BY EXTERNAL TBI CAUSES

## Falls

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- Among all age groups, falls continued to be the leading cause of TBI (35.2%). Falls cause approximately half (50.2%) of the TBIs among children aged 0 to 14 years, compared with 60.7% among adults aged 65 years and older.

## Motor Vehicle–Traffic

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- Among all age groups, motor vehicle–traffic was the second leading cause of TBI (17.3%) and resulted in the largest percentage of TBI-related deaths (31.8%).

## Struck By/Against Events

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- Struck by/against events, which include colliding with a moving or stationary object, were the second leading cause of TBI among children aged 0 to 14 years (24.8%).

## Assault

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- Assaults produced 10% of TBIs in the general population; they accounted for only 2.9% in children aged 0 to 14 years and 1% in adults aged 65 years old and older.

## CONCLUSION

Presenting data on TBI is critical to understanding the impact of this important public health problem in the United States. This information provides the building blocks to inform TBI prevention strategies, identify research and education priorities, and support the need for services among those living with a TBI.

An estimated 1.7 million TBI-related emergency department visits, hospitalizations, and deaths occur each year in the United States. This is an increase from 1.4 million TBI-related emergency department visits, hospitalizations, and deaths from what was reported in the previous edition of *Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations and Deaths*, published by CDC in 2004.<sup>1</sup> The increase in TBI-related injury was most apparent when examining emergency department visits. There were large increases in emergency department visits among children and older adults. Other major reasons for the increase were more fall-related TBIs and overall population growth. It is also likely that the public's awareness of TBI contributed to increased treatment. Further research and education is needed to explore how best to prevent traumatic brain injury.

Although this report provides data on a wide range of TBIs occurring in this country, it is not currently possible to capture all cases of TBI. There is no estimate for the number of people with non-fatal TBI seen outside of an emergency department of hospital or who receive no care at all.





# Appendix A: Tables

Total TBI-Related Emergency Department Visits, Hospitalizations, and Deaths	25
TBI-Related Emergency Department Visits	
by Age Group and Disposition	26
by Age Group and Sex	27
by Age Group and Race	28
by Age Group and External Cause	29
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**TABLE 1:** Estimated Average Annual Numbers, Rates, and Percentages of Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths, by Age Group, United States, 2002–2006

AGE (YRS)	DISPOSITION										
	EMERGENCY DEPARTMENT VISITS*			HOSPITALIZATIONS°			DEATHS*			TOTAL	
	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶
0-4	251,546	1256.2	93.9	15,239	76.1	5.7	998	5.0	0.4	267,783	1337.3
5-9	105,015	532.9	91.9	8,799	44.7	7.7	450	2.3	0.4	114,264	579.9
10-14	117,387	559.8	90.8	11,098	52.9	8.6	726	3.5	0.6	129,211	616.2
15-19	157,198	757.0	84.5	24,896	119.9	13.4	3,995	19.2	2.1	186,089	896.2
20-24	136,079	655.8	84.1	20,683	99.7	12.8	5,048	24.3	3.1	161,810	779.8
25-34	174,811	438.3	83.0	28,953	72.6	13.7	6,826	17.1	3.2	210,591	528.0
35-44	123,436	279.9	75.8	32,310	73.3	19.9	6,995	15.9	4.3	162,741	369.1
45-54	99,715	239.7	73.4	29,068	69.9	21.4	7,125	17.1	5.2	135,908	326.7
55-64	57,612	198.2	67.6	22,600	77.7	26.5	5,028	17.3	5.9	85,240	293.2
65-74	46,365	250.2	64.7	20,990	113.3	29.3	4,252	22.9	5.9	71,607	386.4
≥ 75	95,633	536.2	57.5	60,510	339.3	36.4	10,095	56.6	6.1	166,237	932.0
<b>Total</b>	<b>1,364,797</b>	<b>465.4</b>	<b>80.7</b>	<b>275,146</b>	<b>93.8</b>	<b>16.3</b>	<b>51,538</b>	<b>17.6</b>	<b>3.0</b>	<b>1,691,481</b>	<b>576.8</b>
Adjusted¶		468.0			93.6			17.4			579.0

■ Persons who were hospitalized, died, or transferred to another facility were excluded.

◊ In-hospital deaths and patients who transferred from another hospital were excluded.

\* 128 mortality records (2002–2006) were omitted because of missing age information.

▶ Average annual rate per 100,000 population.

¶ Age-adjusted to the 2000 U.S. standard population.

Numbers subject to rounding error.

**TABLE 2:** Estimated Average Annual Numbers and Percentages of Traumatic Brain Injury-Related Emergency Department Visits, by Age Group and Disposition, United States, 2002–2006

AGE (YRS)	TREATED AND RELEASED		OTHER*		TOTAL
	NUMBER	ROW %	NUMBER	ROW %	NUMBER
0-4	251,546	92.9	19,106 <sup>†</sup>	7.1 <sup>†</sup>	270,652
5-9	105,015	86.1	16,940 <sup>§</sup>	13.9 <sup>§</sup>	121,955
10-14	117,387	92.4	9,617 <sup>§</sup>	7.6 <sup>§</sup>	127,004
15-19	157,198	88.6	20,131 <sup>†</sup>	11.4 <sup>†</sup>	177,329
20-24	136,079	85.6	22,949 <sup>†</sup>	14.4 <sup>†</sup>	159,028
25-34	174,811	92.1	15,005 <sup>†</sup>	7.9 <sup>†</sup>	189,816
35-44	123,436	83.8	23,936 <sup>†</sup>	16.2 <sup>†</sup>	147,372
45-54	99,715	78.8	26,898 <sup>†</sup>	21.2 <sup>†</sup>	126,613
55-64	57,612	74.6	19,623 <sup>§</sup>	25.4 <sup>§</sup>	77,235
65-74	46,365	78.9	12,394 <sup>§</sup>	21.1 <sup>§</sup>	58,759
≥ 75	95,633	66.3	48,681	33.7	144,314
<b>Total</b>	<b>1,364,797</b>	<b>85.3</b>	<b>235,280</b>	<b>14.7</b>	<b>1,600,077</b>

\* Includes people who were hospitalized, died, or transferred to another facility. These records were excluded from the remaining emergency department tables.

<sup>†</sup> Sample size is 30–59; the value of the estimate was reported but may not be stable.

<sup>§</sup> Sample size is less than 30; the value of the estimate was also reported, but it is not considered stable.

Numbers subject to rounding error.

**TABLE 3:** Estimated Average Annual Numbers, Rates, and Percentages of Traumatic Brain Injury-Related Emergency Department Visits, by Age Group and Sex, United States, 2002–2006

AGE (YRS)	MALE			FEMALE			TOTAL	
	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>
0-4	139,001	1357.4	55.3	112,545	1150.3	44.7	251,546	1256.2
5-9	68,671	681.2	65.4	36,343	377.6	34.6	105,014	532.9
10-14	90,221	840.0	76.9	27,166 <sup>†</sup>	265.6 <sup>†</sup>	23.1 <sup>†</sup>	117,387	559.8
15-19	98,761	926.6	62.8	58,437	578.2	37.2	157,198	757.0
20-24	86,669	812.2	63.7	49,410	490.3	36.3	136,079	655.8
25-34	97,845	483.8	56.0	76,966	391.5	44.0	174,811	438.3
35-44	68,527	311.4	55.5	54,909	248.6	44.5	123,436	279.9
45-54	50,941	249.2	51.1	48,775	230.5	48.9	99,716	239.7
55-64	32,226 <sup>†</sup>	230.2 <sup>†</sup>	55.9 <sup>†</sup>	25,386 <sup>†</sup>	168.4 <sup>†</sup>	44.1 <sup>†</sup>	57,612	198.2
65-74	23,146 <sup>†</sup>	273.7 <sup>†</sup>	49.9 <sup>†</sup>	23,218 <sup>†</sup>	230.5 <sup>†</sup>	50.1 <sup>†</sup>	46,364	250.2
≥ 75	33,917 <sup>†</sup>	504.4 <sup>†</sup>	35.5 <sup>†</sup>	61,716	555.4	64.5	95,633	536.2
<b>Total</b>	<b>789,925</b>	<b>547.6</b>	<b>57.9</b>	<b>574,871</b>	<b>385.9</b>	<b>42.1</b>	<b>1,364,796</b>	<b>465.4</b>
Adjusted <sup>¶</sup>		543.9			388.6			468.0

▶ Average annual rate per 100,000 population.

† Sample size is 30–59; the value of the estimate was reported but may not be stable.

¶ Age-adjusted to the 2000 U.S. standard population.

Note: Persons who were hospitalized, died, or transferred to another facility were excluded.

Numbers subject to rounding error.



**TABLE 4:** Estimated Average Annual Numbers, Rates, and Percentages of Traumatic Brain Injury-Related Emergency Department Visits, by Age Group and Race, United States, 2002–2006

AGE (YRS)	WHITE			BLACK			AMERICAN INDIAN, ALASKA NATIVE, ASIAN, OR PACIFIC ISLANDER			OTHER/ UNKNOWN		TOTAL	
	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	ROW %	NUMBER	RATE <sup>▶</sup>
0-4	180,880	1160.8	71.9	56,942	1746.6	22.6	13,576 <sup>†</sup>	1148.5 <sup>†</sup>	5.4 <sup>†</sup>	147 <sup>§</sup>	0.1 <sup>§</sup>	251,545	1256.2
5-9	76,588	499.5	72.9	22,994 <sup>†</sup>	718.5 <sup>†</sup>	21.9 <sup>†</sup>	5,433 <sup>§</sup>	463.1 <sup>§</sup>	5.2 <sup>§</sup>	--	--	105,015	532.9
10-14	84,096	517.2	71.6	27,156 <sup>†</sup>	775.0 <sup>†</sup>	23.1 <sup>†</sup>	5,509 <sup>§</sup>	456.5 <sup>§</sup>	4.7 <sup>§</sup>	625 <sup>§</sup>	0.5 <sup>§</sup>	117,386	559.8
15-19	128,896	793.1	82.0	23,049 <sup>†</sup>	696.5 <sup>†</sup>	14.7 <sup>†</sup>	4,586 <sup>§</sup>	380.8 <sup>§</sup>	2.9 <sup>§</sup>	666 <sup>§</sup>	0.4 <sup>§</sup>	157,197	757.0
20-24	105,796	647.4	77.7	27,030 <sup>†</sup>	867.5 <sup>†</sup>	19.9 <sup>†</sup>	3,253 <sup>§</sup>	251.9 <sup>§</sup>	2.4 <sup>§</sup>	--	--	136,079	655.8
25-34	137,732	438.3	78.8	29,968 <sup>†</sup>	542.9 <sup>†</sup>	17.1 <sup>†</sup>	6,445 <sup>§</sup>	218.9 <sup>§</sup>	3.7 <sup>§</sup>	666 <sup>§</sup>	0.4 <sup>§</sup>	174,811	438.3
35-44	103,176	289.7	83.6	14,158 <sup>†</sup>	247.0 <sup>†</sup>	11.5 <sup>†</sup>	5,767 <sup>§</sup>	209.9 <sup>§</sup>	4.7 <sup>§</sup>	334 <sup>§</sup>	0.3 <sup>§</sup>	123,435	279.9
45-54	76,966	223.4	77.2	20,040 <sup>†</sup>	407.3 <sup>†</sup>	20.1 <sup>†</sup>	2,710 <sup>§</sup>	121.2 <sup>§</sup>	2.7 <sup>§</sup>	--	--	99,716	239.7
55-64	47,644	192.2	82.7	7,385 <sup>§</sup>	253.7 <sup>§</sup>	12.8 <sup>§</sup>	2,584 <sup>§</sup>	187.9 <sup>§</sup>	4.5 <sup>§</sup>	--	--	57,613	198.2
65-74	36,979	230.9	79.8	5,236 <sup>§</sup>	300.9 <sup>§</sup>	11.3 <sup>§</sup>	3,196 <sup>§</sup>	411.4 <sup>§</sup>	6.9 <sup>§</sup>	954 <sup>§</sup>	2.1 <sup>§</sup>	46,365	250.2
≥ 75	88,260	553.4	92.3	4,626 <sup>§</sup>	342.0 <sup>§</sup>	4.8 <sup>§</sup>	2,748 <sup>§</sup>	512.6 <sup>§</sup>	2.9 <sup>§</sup>	--	--	95,634	536.2
<b>Total</b>	<b>1,067,013</b>	<b>448.3</b>	<b>78.2</b>	<b>238,584</b>	<b>618.6</b>	<b>17.5</b>	<b>55,807</b>	<b>334.7</b>	<b>4.1</b>	<b>3,392</b>	<b>0.2</b>	<b>1,364,796</b>	<b>465.4</b>
Adjusted <sup>¶</sup>		456.6			568.7			345.2					468.0

▶ Average annual rate per 100,000 population.

† Sample size is 30–59; the value of the estimate was reported but may not be stable.

§ Sample size is less than 30; the value of the estimate was also reported, but it is not considered stable.

¶ Age-adjusted to the 2000 U.S. standard population.

-- No data for these cells.

Note: Persons who were hospitalized, died, or transferred to another facility were excluded.

Numbers subject to rounding error.

**TABLE 5:** Estimated Average Annual Numbers, Rates, and Percentages of Traumatic Brain Injury-Related Emergency Department Visits, by Age Group and External Cause, United States, 2002–2006

AGE (YRS)	MOTOR VEHICLE-TRAFFIC*			FALLS			ASSAULT			STRUCK BY/AGAINST			OTHER/UNKNOWN			TOTAL	
	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶
0-4	12,852§	64.2§	5.1§	161,455	806.3	64.2	362§	1.8§	0.1§	53,922	269.3	21.4	22,954†	114.6†	9.1†	251,545	1256.2
5-9	7,310§	37.1§	7.0§	42,371	215.0	40.3	1,033§	5.2§	1.0§	35,583†	180.6†	33.9†	18,718†	95.0†	17.8†	105,015	532.9
10-14	6,529§	31.1§	5.6§	42,843†	204.3†	36.5†	11,385§	54.3§	9.7§	34,572	164.9	29.5	22,057†	105.2†	18.8†	117,386	559.8
15-19	40,466	194.9	25.7	32,740†	157.7†	20.8	22,272†	107.3†	14.2†	36,512	175.8	23.2	25,207†	121.4†	16.0†	157,197	757.0
20-24	44,209	213.1	32.5	19,845†	95.6†	14.6†	33,360†	160.8†	24.5†	19,205§	92.6§	14.1§	19,459§	93.8§	14.3§	136,078	655.8
25-34	42,213†	105.8†	24.1†	31,794†	79.7†	18.2†	36,385†	91.2†	20.8†	30,464†	76.4†	17.4†	33,954†	85.1†	19.4†	174,810	438.3
35-44	19,687†	44.6†	15.9†	34,510†	78.3†	28.0†	20,775†	47.1†	16.8†	21,689†	49.2†	17.6†	26,776†	60.7†	21.7†	123,437	279.9
45-54	20,210†	48.6†	20.3†	33,779†	81.2†	33.9†	14,610§	35.1§	14.7§	17,216§	41.4§	17.3§	13,900§	33.4§	13.9§	99,715	239.7
55-64	14,454§	49.7§	25.1§	16,485†	56.7†	28.6†	6,548§	22.5§	11.4§	10,015§	34.4§	17.4§	10,110§	34.8§	17.5§	57,612	198.2
65-74	5,904§	31.9§	12.7§	28,698†	154.9†	61.9†	1,329§	7.2§	2.9§	7,123§	38.4§	15.4§	3,311§	17.9§	7.1§	46,365	250.2
≥ 75	5,102§	28.6§	5.3§	78,523	440.2	82.1	411§	2.3§	0.4§	5,412§	30.3§	5.7§	6,185§	34.7§	6.5§	95,633	536.2
<b>Total</b>	<b>218,936</b>	<b>74.7</b>	<b>16.0</b>	<b>523,043</b>	<b>178.4</b>	<b>38.3</b>	<b>148,470</b>	<b>50.6</b>	<b>10.9</b>	<b>271,713</b>	<b>92.7</b>	<b>19.9</b>	<b>202,631</b>	<b>69.1</b>	<b>14.8</b>	<b>1,364,793</b>	<b>465.4</b>
Adjusted ¶		74.0			180.2			50.2			93.9			69.7			468.0

\* Motor vehicle–traffic includes the following external cause of injury: occupant, motorcyclist, pedal cyclist, pedestrian, other and unspecified person involved in a motor vehicle–traffic incident.

▶ Average annual rate per 100,000 population.

† Sample size is 30–59; the value of the estimate was reported but may not be stable.

§ Sample size is less than 30; the value of the estimate was also reported, but it is not considered stable.

¶ Age-adjusted to the 2000 U.S. standard population.

Note: Persons who were hospitalized, died, or transferred to another facility were excluded.

Numbers subject to rounding error.



**TABLE 6:** Estimated Average Annual Numbers, Rates, and Percentages of Traumatic Brain Injury-Related Emergency Department Visits, by Age Group and Specific Motor Vehicle–Traffic (MVT) External Causes, United States, 2002–2006

AGE (YRS)	MVT-OCCUPANT			MVT- MOTORCYCLE			MVT- PEDAL CYCLE			MVT- PEDESTRIAN			MVT- OTHER OR UNSPECIFIED			TOTAL	
	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>
0-4	9,498 <sup>§</sup>	47.4 <sup>§</sup>	73.9 <sup>§</sup>	--	--	--	--	--	--	--	--	--	3,355 <sup>§</sup>	16.8 <sup>§</sup>	26.1 <sup>§</sup>	12,853 <sup>§</sup>	64.2 <sup>§</sup>
5-9	1,427 <sup>§</sup>	7.2 <sup>§</sup>	19.5 <sup>§</sup>	--	--	--	513 <sup>§</sup>	2.6 <sup>§</sup>	7.0 <sup>§</sup>	514 <sup>§</sup>	2.6 <sup>§</sup>	7.0 <sup>§</sup>	4,856 <sup>§</sup>	24.6 <sup>§</sup>	66.4 <sup>§</sup>	7,310 <sup>§</sup>	37.1 <sup>§</sup>
10-14	2,455 <sup>§</sup>	11.7 <sup>§</sup>	37.6 <sup>§</sup>	787 <sup>§</sup>	3.8 <sup>§</sup>	12.1 <sup>§</sup>	--	--	--	2,959 <sup>§</sup>	14.1 <sup>§</sup>	45.3 <sup>§</sup>	328 <sup>§</sup>	1.6 <sup>§</sup>	5.0 <sup>§</sup>	6,529 <sup>§</sup>	31.1 <sup>§</sup>
15-19	18,828 <sup>†</sup>	90.7 <sup>†</sup>	46.5 <sup>†</sup>	568 <sup>§</sup>	2.7 <sup>§</sup>	1.4 <sup>§</sup>	--	--	--	324 <sup>§</sup>	1.6 <sup>§</sup>	0.8 <sup>§</sup>	20,745 <sup>§</sup>	99.9 <sup>§</sup>	51.3 <sup>§</sup>	40,465	194.9
20-24	24,985 <sup>†</sup>	120.4 <sup>†</sup>	56.5 <sup>†</sup>	3,110 <sup>§</sup>	15.0 <sup>§</sup>	7.0 <sup>§</sup>	37 <sup>§</sup>	0.2 <sup>§</sup>	0.1 <sup>§</sup>	1,420 <sup>§</sup>	6.8 <sup>§</sup>	3.2 <sup>§</sup>	14,657 <sup>§</sup>	70.6 <sup>§</sup>	33.2 <sup>§</sup>	44,209	213.1
25-34	18,786 <sup>§</sup>	47.1 <sup>§</sup>	44.5 <sup>§</sup>	4,847 <sup>§</sup>	12.2 <sup>§</sup>	11.5 <sup>§</sup>	563 <sup>§</sup>	1.4 <sup>§</sup>	1.3 <sup>§</sup>	--	--	--	18,017 <sup>§</sup>	45.2 <sup>§</sup>	42.7 <sup>§</sup>	42,213 <sup>†</sup>	105.8 <sup>†</sup>
35-44	6,632 <sup>§</sup>	15.0 <sup>§</sup>	33.7 <sup>§</sup>	189 <sup>§</sup>	0.4 <sup>§</sup>	1.0 <sup>§</sup>	--	--	--	307 <sup>§</sup>	0.7 <sup>§</sup>	1.6 <sup>§</sup>	12,559 <sup>§</sup>	28.5 <sup>§</sup>	63.8 <sup>§</sup>	19,687 <sup>†</sup>	44.6 <sup>†</sup>
45-54	12,616 <sup>§</sup>	30.3 <sup>§</sup>	62.4 <sup>§</sup>	304 <sup>§</sup>	0.7 <sup>§</sup>	1.5 <sup>§</sup>	--	--	--	1,233 <sup>§</sup>	3.0 <sup>§</sup>	6.1 <sup>§</sup>	6,057 <sup>§</sup>	14.6 <sup>§</sup>	30.0 <sup>§</sup>	20,210 <sup>†</sup>	48.6 <sup>†</sup>
55-64	6,450 <sup>§</sup>	22.2 <sup>§</sup>	44.6 <sup>§</sup>	133 <sup>§</sup>	0.5 <sup>§</sup>	0.9 <sup>§</sup>	--	--	--	169 <sup>§</sup>	0.6 <sup>§</sup>	1.2 <sup>§</sup>	7,701 <sup>§</sup>	26.5 <sup>§</sup>	53.3 <sup>§</sup>	14,453 <sup>§</sup>	49.7 <sup>§</sup>
65-74	2,689 <sup>§</sup>	14.5 <sup>§</sup>	45.6 <sup>§</sup>	--	--	--	--	--	--	1,000 <sup>§</sup>	5.4 <sup>§</sup>	16.9 <sup>§</sup>	2,214 <sup>§</sup>	12.0 <sup>§</sup>	37.5 <sup>§</sup>	5,903 <sup>§</sup>	31.9 <sup>§</sup>
≥ 75	--	--	--	--	--	--	--	--	--	--	--	--	5,102 <sup>§</sup>	28.6 <sup>§</sup>	100.0 <sup>§</sup>	5,102 <sup>§</sup>	28.6 <sup>§</sup>
<b>Total</b>	<b>104,366</b>	<b>35.6</b>	<b>47.7</b>	<b>9,938<sup>§</sup></b>	<b>3.4<sup>§</sup></b>	<b>4.5<sup>§</sup></b>	<b>1,113<sup>§</sup></b>	<b>0.4<sup>§</sup></b>	<b>0.5<sup>§</sup></b>	<b>7,926<sup>§</sup></b>	<b>2.7<sup>§</sup></b>	<b>3.6<sup>§</sup></b>	<b>95,591</b>	<b>32.6</b>	<b>43.7</b>	<b>218,934</b>	<b>74.7</b>
Adjusted <sup>¶</sup>		35.0			3.3			0.4			2.7			32.5			74.0

▶ Average annual rate per 100,000 population.

† Sample size is 30–59; the value of the estimate was reported but may not be stable.

§ Sample size is less than 30; the value of the estimate was also reported, but it is not considered stable.

¶ Age-adjusted to the 2000 U.S. standard population.

-- No data for these cells.

Note: Persons who were hospitalized, died, or transferred to another facility were excluded.

Numbers subject to rounding error.

**TABLE 7:** Estimated Average Annual Numbers and Percentages of Traumatic Brain Injury-Related Emergency Department Visits, by Age Group and Expected Source of Payment, United States, 2002–2006

AGE(YRS)	PRIVATE		MEDICAID		MEDICARE		WORKER'S COMPENSATION		OTHER/UNKNOWN*		TOTAL
	NUMBER	ROW %	NUMBER	ROW %	NUMBER	ROW %	NUMBER	ROW %	NUMBER	ROW %	NUMBER
0-4	121,610	48.3	87,911	34.9	1,025 <sup>§</sup>	0.4 <sup>§</sup>	--	--	40,999 <sup>†</sup>	16.3 <sup>†</sup>	251,545
5-9	58,430	55.6	23,720 <sup>†</sup>	22.6 <sup>†</sup>	797 <sup>§</sup>	0.8 <sup>§</sup>	--	--	22,068 <sup>†</sup>	21.0 <sup>†</sup>	105,015
10-14	74,107	63.1	24,978 <sup>†</sup>	21.3 <sup>†</sup>	670 <sup>§</sup>	0.6 <sup>§</sup>	--	--	17,631 <sup>†</sup>	15.0 <sup>†</sup>	117,386
15-19	91,028	57.9	14,309 <sup>†</sup>	9.1 <sup>†</sup>	3,190 <sup>§</sup>	2.0 <sup>§</sup>	695 <sup>§</sup>	0.4 <sup>§</sup>	47,975	30.5	157,197
20-24	52,094	38.3	5,093 <sup>§</sup>	3.7 <sup>§</sup>	--	--	8,737 <sup>§</sup>	6.4 <sup>§</sup>	70,154	51.6	136,078
25-34	73,054	41.8	17,148 <sup>†</sup>	9.8 <sup>†</sup>	2,348 <sup>§</sup>	1.3 <sup>§</sup>	12,895 <sup>§</sup>	7.4 <sup>§</sup>	69,366	39.7	174,811
35-44	54,807	44.4	16,854 <sup>†</sup>	13.7 <sup>†</sup>	7,118 <sup>§</sup>	5.8 <sup>§</sup>	7,542 <sup>§</sup>	6.1 <sup>§</sup>	37,114	30.1	123,435
45-54	46,457	46.6	12,355 <sup>§</sup>	12.4 <sup>§</sup>	4,426 <sup>§</sup>	4.4 <sup>§</sup>	6,219 <sup>§</sup>	6.2 <sup>§</sup>	30,259 <sup>†</sup>	30.3 <sup>†</sup>	99,716
55-64	24,566 <sup>†</sup>	42.6 <sup>†</sup>	6,412 <sup>§</sup>	11.1 <sup>§</sup>	3,802 <sup>§</sup>	6.6 <sup>§</sup>	4,201 <sup>§</sup>	7.3 <sup>§</sup>	18,631 <sup>§</sup>	32.3 <sup>§</sup>	57,612
65-74	6,558 <sup>§</sup>	14.1 <sup>§</sup>	3,424 <sup>§</sup>	7.4 <sup>§</sup>	29,249 <sup>†</sup>	63.1 <sup>†</sup>	1,773 <sup>§</sup>	3.8 <sup>§</sup>	5,361 <sup>§</sup>	11.6 <sup>§</sup>	46,365
≥ 75	5,636 <sup>§</sup>	5.9 <sup>§</sup>	10,461 <sup>§</sup>	10.9 <sup>§</sup>	70,994	74.2	1,571 <sup>§</sup>	1.6 <sup>§</sup>	6,971 <sup>§</sup>	7.3 <sup>§</sup>	95,633
<b>Total</b>	<b>608,347</b>	<b>44.6</b>	<b>222,665</b>	<b>16.3</b>	<b>123,619</b>	<b>9.1</b>	<b>43,633</b>	<b>3.2</b>	<b>366,529</b>	<b>26.9</b>	<b>1,364,793</b>

\* Includes self pay, no charge, other government, other, and unknown.

† Sample size is 30–59; the value of the estimate was reported but may not be stable.

§ Sample size is less than 30; the value of the estimate was also reported, but it is not considered stable.

-- No data for these cells.

Note: Persons who were hospitalized, died, or transferred to another facility were excluded.

Numbers subject to rounding error.

**TABLE 8:** Estimated Average Annual Numbers and Percentages of Traumatic Brain Injury-Related Hospitalizations, by Age Group and Disposition, United States, 2002–2006

AGE (YRS)	DISCHARGED ALIVE <sup>‡</sup>						IN-HOSPITAL DEATHS <sup>‡</sup>		TOTAL NUMBER
	HOME		TRANSFERRED <sup>*</sup>		OTHER/UNKNOWN <sup>–</sup>		NUMBER	ROW %	
	NUMBER	ROW %	NUMBER	ROW %	NUMBER	ROW %			
0-4	15,564	87.8	855 <sup>§</sup>	4.8 <sup>§</sup>	903 <sup>†</sup>	5.1 <sup>†</sup>	406 <sup>§</sup>	2.3 <sup>§</sup>	17,728
5-9	8,996	89.8	283 <sup>§</sup>	2.8 <sup>§</sup>	281 <sup>§</sup>	2.8 <sup>§</sup>	461 <sup>§</sup>	4.6 <sup>§</sup>	10,021
10-14	10,855	89.4	326 <sup>§</sup>	2.7 <sup>§</sup>	429 <sup>†</sup>	3.5 <sup>†</sup>	535 <sup>§</sup>	4.4 <sup>§</sup>	12,145
15-19	21,971	78.9	2,064 <sup>†</sup>	7.4 <sup>†</sup>	2,459	8.8	1,356 <sup>†</sup>	4.9 <sup>†</sup>	27,850
20-24	18,261	79.8	1,567 <sup>†</sup>	6.9 <sup>†</sup>	1,776	7.8	1,277 <sup>†</sup>	5.6 <sup>†</sup>	22,881
25-34	23,239	75.7	1,976	6.4	4,295	14.0	1,199 <sup>†</sup>	3.9 <sup>†</sup>	30,709
35-44	25,192	73.9	3,154	9.3	4,864	14.3	881 <sup>†</sup>	2.6 <sup>†</sup>	34,091
45-54	23,042	72.4	3,166	9.9	3,782	11.9	1,827	5.7	31,817
55-64	16,359	64.6	4,223	16.7	3,112	12.3	1,617 <sup>†</sup>	6.4 <sup>†</sup>	25,311
65-74	13,331	55.7	5,670	23.7	2,969	12.4	1,983	8.3	23,953
≥ 75	24,751	34.7	30,302	42.4	9,453	13.2	6,926	9.7	71,432
<b>Total</b>	<b>201,561</b>	<b>65.5</b>	<b>53,586</b>	<b>17.4</b>	<b>34,323</b>	<b>11.1</b>	<b>18,468</b>	<b>6.0</b>	<b>307,938</b>

– Includes patients who left against medical advice and who were discharged alive (but no disposition stated), and patients with unknown disposition.

\* Includes both long- and short-term care facilities.

‡ In-hospital deaths and patients who transferred from another hospital were excluded from the remaining hospitalization tables.

† Sample size is 30–59; the value of the estimate was reported but may not be stable.

§ Sample size is less than 30; the value of the estimate was also reported, but is not considered stable.

Numbers subject to rounding error.



**TABLE 9:** Estimated Average Annual Numbers, Rates, and Percentages of Traumatic Brain Injury-Related Hospitalizations, by Age Group and Sex, United States, 2002–2006

AGE (YRS)	MALE			FEMALE			TOTAL	
	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>
0-4	9,019	88.1	59.2	6,220	63.6	40.8	15,239	76.1
5-9	5,296	52.5	60.2	3,503	36.4	39.8	8,799	44.7
10-14	7,407	69.0	66.7	3,691	36.1	33.3	11,098	52.9
15-19	17,189	161.3	69.0	7,708	76.3	31.0	24,897	119.9
20-24	16,341	153.1	79.0	4,343	43.1	21.0	20,684	99.7
25-34	22,438	110.9	77.5	6,516	33.1	22.5	28,954	72.6
35-44	22,417	101.9	69.4	9,893	44.8	30.6	32,310	73.3
45-54	20,085	98.2	69.1	8,983	42.5	30.9	29,068	69.9
55-64	15,269	109.1	67.6	7,331	48.6	32.4	22,600	77.7
65-74	11,437	135.2	54.5	9,553	94.8	45.5	20,990	113.3
≥ 75	23,360	347.4	38.6	37,150	334.3	61.4	60,510	339.3
<b>Total</b>	<b>170,258</b>	<b>118.0</b>	<b>61.9</b>	<b>104,891</b>	<b>70.4</b>	<b>38.1</b>	<b>275,149</b>	<b>93.8</b>
Adjusted <sup>¶</sup>		121.0			66.2			93.6

▶ Average annual rate per 100,000 population.

¶ Age-adjusted to the 2000 U.S. standard population.

Note: In-hospital deaths and patients who transferred from another hospital were excluded.

Numbers subject to rounding error.

**TABLE 10:** Estimated Average Annual Numbers, Rates, and Percentages of Traumatic Brain Injury-Related Hospitalizations, by Age Group and Race, United States, 2002–2006

AGE (YRS)	WHITE			BLACK			AMERICAN INDIAN, ALASKA NATIVE, ASIAN, OR PACIFIC ISLANDER			OTHER/ UNKNOWN		TOTAL	
	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	ROW %	NUMBER	RATE <sup>▶</sup>
0-4	9,361	60.1	61.4	2,075	63.6	13.6	530 <sup>§</sup>	44.8 <sup>§</sup>	3.5 <sup>§</sup>	3,274	21.5	15,240	76.1
5-9	5,412	35.3	61.5	1,126	35.2	12.8	151 <sup>§</sup>	12.9 <sup>§</sup>	1.7 <sup>§</sup>	2,110	24.0	8,799	44.7
10-14	6,278	38.6	56.6	1,669	47.6	15.0	388 <sup>§</sup>	32.2 <sup>§</sup>	3.5 <sup>§</sup>	2,763	24.9	11,098	52.9
15-19	15,243	93.8	61.2	2,413	72.9	9.7	893 <sup>§</sup>	74.1 <sup>§</sup>	3.6 <sup>§</sup>	6,348	25.5	24,897	119.9
20-24	11,676	71.4	56.5	2,272	72.9	11.0	841 <sup>§</sup>	65.1 <sup>§</sup>	4.1 <sup>§</sup>	5,894	28.5	20,683	99.7
25-34	15,981	50.9	55.2	4,044	73.3	14.0	682 <sup>§</sup>	23.2 <sup>§</sup>	2.4 <sup>§</sup>	8,247	28.5	28,954	72.6
35-44	18,916	53.1	58.5	4,456	77.8	13.8	953 <sup>§</sup>	34.7 <sup>§</sup>	3.0 <sup>§</sup>	7,985	24.7	32,310	73.3
45-54	16,648	48.3	57.3	4,369	88.8	15.0	479 <sup>§</sup>	21.4 <sup>§</sup>	1.6 <sup>§</sup>	7,572	26.0	29,068	69.9
55-64	14,064	56.7	62.2	1,829	62.8	8.1	1,165 <sup>§</sup>	84.7 <sup>§</sup>	5.2 <sup>§</sup>	5,543	24.5	22,601	77.7
65-74	13,455	84.0	64.1	1,679	96.5	8.0	899 <sup>§</sup>	115.7 <sup>§</sup>	4.3 <sup>§</sup>	4,957	23.6	20,990	113.3
≥ 75	42,735	268.0	70.6	2,644	195.5	4.4	1,370 <sup>†</sup>	255.5 <sup>†</sup>	2.3 <sup>†</sup>	13,761	22.7	60,510	339.3
<b>Total</b>	<b>169,769</b>	<b>71.3</b>	<b>61.7</b>	<b>28,576</b>	<b>74.1</b>	<b>10.4</b>	<b>8,351</b>	<b>50.1</b>	<b>3.0</b>	<b>68,454</b>	<b>24.9</b>	<b>275,150</b>	<b>93.8</b>
Adjusted <sup>¶</sup>		69.8			78.7			58.2					93.6

▶ Average annual rate per 100,000 population.

+ Sample size is 30–59; the value of the estimate was reported but may not be stable.

§ Sample size is less than 30; the value of the estimate was also reported, but it is not considered stable.

¶ Age-adjusted to the 2000 U.S. standard population.

Note: In-hospital deaths and patients who transferred from another hospital were excluded.

Numbers subject to rounding error.

**TABLE 11:** Estimated Average Annual Numbers, Rates, and Percentages of Traumatic Brain Injury-Related Hospitalizations, by Age Group and External Cause, United States, 2002–2006

AGE (YRS)	MOTOR VEHICLE-TRAFFIC*			FALLS			ASSAULT			STRUCK BY/AGAINST			OTHER/UNKNOWN			TOTAL	
	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶
0-4	2,182	10.9	14.3	6,458	32.2	42.4	893 <sup>†</sup>	4.5 <sup>†</sup>	5.9 <sup>†</sup>	867 <sup>†</sup>	4.3 <sup>†</sup>	5.7 <sup>†</sup>	4,840	24.2	31.8	15,240	76.1
5-9	2,566	13.0	29.2	1,733	8.8	19.7	10 <sup>§</sup>	0.1 <sup>§</sup>	0.1 <sup>§</sup>	543 <sup>†</sup>	2.8 <sup>†</sup>	6.2 <sup>†</sup>	3,946	20.0	44.8	8,798	44.7
10-14	2,111	10.1	19.0	1,892	9.0	17.0	520 <sup>§</sup>	2.5 <sup>§</sup>	4.7 <sup>§</sup>	1,244 <sup>†</sup>	5.9 <sup>†</sup>	11.2 <sup>†</sup>	5,331	25.4	48.0	11,098	52.9
15-19	9,598	46.2	38.6	2,119	10.2	8.5	1,622 <sup>†</sup>	7.8 <sup>†</sup>	6.5 <sup>†</sup>	1,069 <sup>†</sup>	5.1 <sup>†</sup>	4.3 <sup>†</sup>	10,488	50.5	42.1	24,896	119.9
20-24	7,571	36.5	36.6	1,251 <sup>†</sup>	6.0 <sup>†</sup>	6.1 <sup>†</sup>	1,998	9.6	9.7	237 <sup>§</sup>	1.1 <sup>§</sup>	1.1 <sup>§</sup>	9,626	46.4	46.5	20,683	99.7
25-34	9,208	23.1	31.8	3,391	8.5	11.7	3,496	8.8	12.1	888 <sup>§</sup>	2.2 <sup>§</sup>	3.1 <sup>§</sup>	11,970	30.0	41.3	28,953	72.6
35-44	7,744	17.6	24.0	4,738	10.7	14.7	3,529	8.0	10.9	996 <sup>†</sup>	2.3 <sup>†</sup>	3.1 <sup>†</sup>	15,303	34.7	47.4	32,310	73.3
45-54	6,712	16.1	23.1	5,332	12.8	18.3	1,736	4.2	6.0	459 <sup>§</sup>	1.1 <sup>§</sup>	1.6 <sup>§</sup>	14,829	35.6	51.0	29,068	69.9
55-64	3,217	11.1	14.2	5,559	19.1	24.6	1,134 <sup>§</sup>	3.9 <sup>§</sup>	5.0 <sup>§</sup>	515 <sup>§</sup>	1.8 <sup>§</sup>	2.3 <sup>§</sup>	12,176	41.9	53.9	22,601	77.7
65-74	1,918	10.3	9.1	7,392	39.9	35.2	68 <sup>§</sup>	0.4 <sup>§</sup>	0.3 <sup>§</sup>	467 <sup>§</sup>	2.5 <sup>§</sup>	2.2 <sup>§</sup>	11,145	60.1	53.1	20,990	113.3
≥ 75	4,038	22.6	6.7	22,468	126.0	37.1	334 <sup>§</sup>	1.9 <sup>§</sup>	0.6 <sup>§</sup>	504 <sup>§</sup>	2.8 <sup>§</sup>	0.8 <sup>§</sup>	33,164	185.9	54.8	60,508	339.3
<b>Total</b>	<b>56,865</b>	<b>19.4</b>	<b>20.7</b>	<b>62,333</b>	<b>21.2</b>	<b>22.7</b>	<b>15,340</b>	<b>5.2</b>	<b>5.6</b>	<b>7,789</b>	<b>2.7</b>	<b>2.8</b>	<b>132,818</b>	<b>45.3</b>	<b>48.3</b>	<b>275,145</b>	<b>93.8</b>
Adjusted <sup>¶</sup>		19.4			21.2			5.2			2.7			45.1			93.6

\* Motor vehicle-traffic includes the following external cause of injury: occupant, motorcyclist, pedal cyclist, pedestrian, other and unspecified person involved in a motor vehicle-traffic incident.

▶ Average annual rate per 100,000 population.

† Sample size is 30–59; the value of the estimate was reported but may not be stable.

§ Sample size is less than 30; the value of the estimate was also reported, but it is not considered stable.

¶ Age-adjusted to the 2000 U.S. standard population.

Note: In-hospital deaths and patients who transferred from another hospital were excluded.

Numbers subject to rounding error.



**TABLE 12:** Estimated Average Annual Numbers, Rates, and Percentages of Traumatic Brain Injury-Related Hospitalizations, by Age Group and Specific Motor Vehicle–Traffic (MVT) External Causes, United States, 2002–2006

AGE (YRS)	MVT-OCCUPANT			MVT- MOTORCYCLE			MVT- PEDAL CYCLE			MVT- PEDESTRIAN			MVT- OTHER OR UNSPECIFIED			TOTAL	
	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶
0-4	1,426 <sup>+</sup>	7.1 <sup>+</sup>	65.3 <sup>+</sup>	--	--	--	--	--	--	744 <sup>§</sup>	3.7 <sup>§</sup>	34.1 <sup>§</sup>	12 <sup>§</sup>	0.1 <sup>§</sup>	0.6 <sup>§</sup>	2,182	10.9
5-9	1,487 <sup>+</sup>	7.5 <sup>+</sup>	57.9 <sup>+</sup>	100 <sup>§</sup>	0.5 <sup>§</sup>	3.9 <sup>§</sup>	147 <sup>§</sup>	0.7 <sup>§</sup>	5.7 <sup>§</sup>	677 <sup>+</sup>	3.4 <sup>+</sup>	26.4 <sup>+</sup>	156 <sup>§</sup>	0.8 <sup>§</sup>	6.1 <sup>§</sup>	2,567	13.0
10-14	984 <sup>+</sup>	4.7 <sup>+</sup>	46.6 <sup>+</sup>	91 <sup>§</sup>	0.4 <sup>§</sup>	4.3 <sup>§</sup>	360 <sup>+</sup>	1.7 <sup>+</sup>	17.0 <sup>+</sup>	650 <sup>+</sup>	3.1 <sup>+</sup>	30.8 <sup>+</sup>	26 <sup>§</sup>	0.1 <sup>§</sup>	1.2 <sup>§</sup>	2,111	10.1
15-19	6,802	32.8	70.9	1,182 <sup>§</sup>	5.7 <sup>§</sup>	12.3 <sup>§</sup>	243 <sup>§</sup>	1.2 <sup>§</sup>	2.5 <sup>§</sup>	650 <sup>§</sup>	3.1 <sup>§</sup>	6.8 <sup>§</sup>	722 <sup>§</sup>	3.5 <sup>§</sup>	7.5 <sup>§</sup>	9,599	46.2
20-24	5,567	26.8	73.5	614 <sup>§</sup>	3.0 <sup>§</sup>	8.1 <sup>§</sup>	143 <sup>§</sup>	0.7 <sup>§</sup>	1.9 <sup>§</sup>	703 <sup>§</sup>	3.4 <sup>§</sup>	9.3 <sup>§</sup>	543 <sup>§</sup>	2.6 <sup>§</sup>	7.2 <sup>§</sup>	7,570	36.5
25-34	6,048	15.2	65.7	1,428 <sup>+</sup>	3.6 <sup>+</sup>	15.5 <sup>+</sup>	357 <sup>§</sup>	0.9 <sup>§</sup>	3.9 <sup>§</sup>	792 <sup>+</sup>	2.0 <sup>+</sup>	8.6 <sup>+</sup>	583 <sup>§</sup>	1.5 <sup>§</sup>	6.3 <sup>§</sup>	9,208	23.1
35-44	5,216	11.8	67.4	1,299 <sup>+</sup>	2.9 <sup>+</sup>	16.8 <sup>+</sup>	66 <sup>§</sup>	0.1 <sup>§</sup>	0.8 <sup>§</sup>	852 <sup>§</sup>	1.9 <sup>§</sup>	11.0 <sup>§</sup>	311 <sup>§</sup>	0.7 <sup>§</sup>	4.0 <sup>§</sup>	7,744	17.6
45-54	4,263	10.2	63.5	1,114 <sup>+</sup>	2.7 <sup>+</sup>	16.6 <sup>+</sup>	131 <sup>§</sup>	0.3 <sup>§</sup>	1.9 <sup>§</sup>	697 <sup>§</sup>	1.7 <sup>§</sup>	10.4 <sup>§</sup>	506 <sup>§</sup>	1.2 <sup>§</sup>	7.5 <sup>§</sup>	6,711	16.1
55-64	1,872	6.4	58.2	434 <sup>§</sup>	1.5 <sup>§</sup>	13.5 <sup>§</sup>	49 <sup>§</sup>	0.2 <sup>§</sup>	1.5 <sup>§</sup>	498 <sup>§</sup>	1.7 <sup>§</sup>	15.5 <sup>§</sup>	364 <sup>§</sup>	1.3 <sup>§</sup>	11.3 <sup>§</sup>	3,217	11.1
65-74	1,374	7.4	71.6	88 <sup>§</sup>	0.5 <sup>§</sup>	4.6 <sup>§</sup>	28 <sup>§</sup>	0.2 <sup>§</sup>	1.5 <sup>§</sup>	212 <sup>§</sup>	1.1 <sup>§</sup>	11.1 <sup>§</sup>	215 <sup>§</sup>	1.2 <sup>§</sup>	11.2 <sup>§</sup>	1,917	10.3
≥ 75	3,009	16.9	74.5	--	--	--	--	--	--	741 <sup>§</sup>	4.2 <sup>§</sup>	18.3 <sup>§</sup>	289 <sup>§</sup>	1.6 <sup>§</sup>	7.2 <sup>§</sup>	4,039	22.6
<b>Total</b>	<b>38,048</b>	<b>13.0</b>	<b>66.9</b>	<b>6,350</b>	<b>2.2</b>	<b>11.2</b>	<b>1,524</b>	<b>0.5</b>	<b>2.7</b>	<b>7,216</b>	<b>2.5</b>	<b>12.7</b>	<b>3,727</b>	<b>1.3</b>	<b>6.6</b>	<b>56,865</b>	<b>19.4</b>
Adjusted <sup>¶</sup>		12.9			2.2			0.5			2.5			1.3			19.4

▶ Average annual rate per 100,000 population.

+ Sample size is 30–59; the value of the estimate was reported but may not be stable.

§ Sample size is less than 30; the value of the estimate was also reported, but it is not considered stable.

¶ Age-adjusted to the 2000 U.S. standard population.

-- No data for these cells.

Note: In-hospital deaths and patients who transferred from another hospital were excluded.

Numbers subject to rounding error.

**TABLE 13:** Estimated Average Annual Numbers and Percentages of Traumatic Brain Injury-Related Hospitalizations, by Age Group and Expected Source of Payment, United States, 2002–2006

AGE(YRS)	PRIVATE		MEDICAID		MEDICARE		WORKER'S COMPENSATION		OTHER/UNKNOWN*		TOTAL
	NUMBER	ROW %	NUMBER	ROW %	NUMBER	ROW %	NUMBER	ROW %	NUMBER	ROW %	NUMBER
0-4	7,029	46.1	6,339	41.6	54 <sup>§</sup>	0.4 <sup>§</sup>	--	--	1,818	11.9	15,240
5-9	4,823	54.8	2,659	30.2	--	--	--	--	1,317	15.0	8,799
10-14	6,690	60.3	3,031	27.3	--	--	--	--	1,376	12.4	11,097
15-19	14,619	58.7	4,863	19.5	193 <sup>§</sup>	0.8 <sup>§</sup>	331 <sup>§</sup>	1.3 <sup>§</sup>	4,891	19.6	24,897
20-24	9,097	44.0	3,319	16.0	407 <sup>§</sup>	2.0 <sup>§</sup>	861 <sup>†</sup>	4.2 <sup>†</sup>	6,998	33.8	20,682
25-34	12,715	43.9	4,479	15.5	848 <sup>§</sup>	2.9 <sup>§</sup>	1,337	4.6	9,574	33.1	28,953
35-44	13,062	40.4	4,051	12.5	2,495	7.7	1,899	5.9	10,804	33.4	32,311
45-54	13,743	47.3	3,516	12.1	2,702	9.3	1,648 <sup>†</sup>	5.7 <sup>†</sup>	7,459	25.7	29,068
55-64	11,306	50.0	2,795	12.4	3,893	17.2	1,188 <sup>†</sup>	5.3 <sup>†</sup>	3,419	15.1	22,601
65-74	3,847	18.3	728 <sup>†</sup>	3.5 <sup>†</sup>	14,735	70.2	400 <sup>§</sup>	1.9 <sup>§</sup>	1,279 <sup>†</sup>	6.1 <sup>†</sup>	20,989
≥ 75	7,045	11.6	500 <sup>§</sup>	0.8 <sup>§</sup>	51,278	84.7	23 <sup>§</sup>	0.0 <sup>§</sup>	1,663	2.7	60,509
<b>Total</b>	<b>103,976</b>	<b>37.8</b>	<b>36,280</b>	<b>13.2</b>	<b>76,605</b>	<b>27.8</b>	<b>7,687</b>	<b>2.8</b>	<b>50,598</b>	<b>18.4</b>	<b>275,147</b>

\* Includes self pay, no charge, other government, other, and unknown.

† Sample size is 30–59; the value of the estimate was reported but may not be stable.

§ Sample size is less than 30; the value of the estimate was also reported, but it is not considered stable.

-- No data for these cells.

Note: In-hospital deaths and patients who transferred from another hospital were excluded.

Numbers subject to rounding error.

**TABLE 14:** Average Annual Numbers, Rates, and Percentages of Traumatic Brain Injury-Related Deaths, by Age Group and Sex, United States, 2002–2006

AGE (YRS)	MALE			FEMALE			TOTAL*	
	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶
0-4	574	5.6	57.5	424	4.3	42.5	998	5.0
5-9	259	2.6	57.6	191	2.0	42.4	450	2.3
10-14	477	4.4	65.7	249	2.4	34.3	726	3.5
15-19	2,977	27.9	74.5	1,018	10.1	25.5	3,995	19.2
20-24	4,140	38.8	82.0	908	9.0	18.0	5,048	24.3
25-34	5,551	27.4	81.3	1,275	6.5	18.7	6,826	17.1
35-44	5,428	24.7	77.6	1,567	7.1	22.4	6,995	15.9
45-54	5,592	27.4	78.5	1,533	7.2	21.5	7,125	17.1
55-64	3,913	28.0	77.8	1,115	7.4	22.2	5,028	17.3
65-74	3,125	36.9	73.5	1,128	11.2	26.5	4,253	22.9
≥ 75	5,935	88.3	58.8	4,160	37.4	41.2	10,095	56.6
<b>Total</b>	<b>37,971</b>	<b>26.3</b>	<b>73.7</b>	<b>13,568</b>	<b>9.1</b>	<b>26.3</b>	<b>51,539</b>	<b>17.6</b>
Adjusted †		27.1			8.6			17.4

\* 128 mortality records (2002–2006) were omitted because of missing age information.

▶ Average annual rate per 100,000 population.

† Age-adjusted to the 2000 U.S. standard population.

Numbers subject to rounding error.



**TABLE 15:** Average Annual Numbers, Rates, and Percentages of Traumatic Brain Injury-Related Deaths, by Age Group and Race, United States, 2002–2006

AGE (YRS)	WHITE			BLACK			AMERICAN INDIAN, ALASKA NATIVE, ASIAN, OR PACIFIC ISLANDER			TOTAL*	
	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶	ROW %	NUMBER	RATE▶
0-4	693	4.4	69.4	253	7.8	25.3	52	4.4	5.2	998	5.0
5-9	336	2.2	74.6	90	2.8	20.1	24	2.0	5.3	450	2.3
10-14	568	3.5	78.2	129	3.7	17.8	29	2.4	4.0	726	3.5
15-19	3,179	19.6	79.6	653	19.7	16.4	163	13.5	4.1	3,995	19.2
20-24	3,841	23.5	76.1	1,000	32.1	19.8	207	16.0	4.1	5,048	24.3
25-34	5,202	16.6	76.2	1,366	24.7	20.0	259	8.8	3.8	6,827	17.1
35-44	5,795	16.3	82.8	976	17.0	13.9	224	8.2	3.2	6,995	15.9
45-54	6,108	17.7	85.7	813	16.5	11.4	204	9.1	2.9	7,125	17.1
55-64	4,440	17.9	88.3	444	15.3	8.8	144	10.5	2.9	5,028	17.3
65-74	3,830	23.9	90.1	301	17.3	7.1	122	15.7	2.9	4,253	22.9
≥ 75	9,409	59.0	93.2	431	31.9	4.3	255	47.5	2.5	10,095	56.6
<b>Total</b>	<b>43,401</b>	<b>18.2</b>	<b>84.2</b>	<b>6,456</b>	<b>16.7</b>	<b>12.5</b>	<b>1,683</b>	<b>10.1</b>	<b>3.3</b>	<b>51,540</b>	<b>17.6</b>
Adjusted ¶		17.7			17.3			11.2			17.4

\* 128 mortality records (2002–2006) were omitted because of missing age information.

▶ Average annual rate per 100,000 population.

¶ Age-adjusted to the 2000 U.S. standard population.

Numbers subject to rounding error.

**TABLE 16:** Average Annual Numbers, Rates, and Percentages of Traumatic Brain Injury-Related Deaths, by Age Group and External Cause, United States, 2002–2006

AGE (YRS)	MOTOR VEHICLE-TRAFFIC*			FALLS			ASSAULT			STRUCK BY/AGAINST			OTHER/UNKNOWN			TOTAL <sup>-</sup>	
	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>
0-4	395	2.0	39.6	37	0.2	3.7	364	1.8	36.4	22	0.1	2.2	180	0.9	18.1	998	5.0
5-9	303	1.5	67.5	10	0.0	2.1	48	0.2	10.7	12	0.1	2.7	76	0.4	17.0	449	2.3
10-14	436	2.1	60.0	15	0.1	2.0	86	0.4	11.9	10	0.0	1.3	180	0.9	24.8	727	3.5
15-19	2,344	11.3	58.7	52	0.3	1.3	634	3.1	15.9	14	0.1	0.4	951	4.6	23.8	3,995	19.2
20-24	2,444	11.8	48.4	95	0.5	1.9	979	4.7	19.4	22	0.1	0.4	1,509	7.3	29.9	5,049	24.3
25-34	2,740	6.9	40.1	182	0.5	2.7	1,315	3.3	19.3	46	0.1	0.7	2,543	6.4	37.3	6,826	17.1
35-44	2,458	5.6	35.1	414	0.9	5.9	982	2.2	14.0	59	0.1	0.8	3,083	7.0	44.1	6,996	15.9
45-54	2,110	5.1	29.6	760	1.8	10.7	712	1.7	10.0	67	0.2	0.9	3,476	8.4	48.8	7,125	17.1
55-64	1,281	4.4	25.5	896	3.1	17.8	349	1.2	6.9	49	0.2	1.0	2,454	8.4	48.8	5,029	17.3
65-74	832	4.5	19.6	1,375	7.4	32.3	169	0.9	4.0	37	0.2	0.9	1,839	9.9	43.2	4,252	22.9
≥ 75	1,053	5.9	10.4	5,882	33.0	58.3	164	0.9	1.6	40	0.2	0.4	2,956	16.6	29.3	10,095	56.6
<b>Total</b>	<b>16,396</b>	<b>5.6</b>	<b>31.8</b>	<b>9,718</b>	<b>3.3</b>	<b>18.9</b>	<b>5,802</b>	<b>2.0</b>	<b>11.3</b>	<b>378</b>	<b>0.1</b>	<b>0.7</b>	<b>19,247</b>	<b>6.6</b>	<b>37.3</b>	<b>51,541</b>	<b>17.6</b>
Adjusted <sup>¶</sup>		5.6			3.3			2.0			0.1			6.5			17.4

\* Motor vehicle–traffic includes the following external cause of injury: occupant, motorcyclist, pedal cyclist, pedestrian, other and unspecified person involved in a motor vehicle–traffic incident.

<sup>-</sup> 128 mortality records (2002–2006) were omitted because of missing age information.

<sup>▶</sup> Average annual rate per 100,000 population.

<sup>¶</sup> Age-adjusted to the 2000 U.S. standard population.

Numbers subject to rounding error.



**TABLE 17:** Average Annual Numbers, Rates, and Percentages of Traumatic Brain Injury-Related Deaths, by Age Group and Specific Motor Vehicle–Traffic (MVT) External Causes, United States, 2002–2006

AGE (YRS)	MVT-OCCUPANT			MVT- MOTORCYCLE			MVT- PEDAL CYCLE			MVT- PEDESTRIAN			MVT- OTHER OR UNSPECIFIED			TOTAL*	
	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>	ROW %	NUMBER	RATE <sup>▶</sup>
0-4	174	0.9	43.9	0	‡	0.1	2	‡	0.6	97	0.5	24.6	122	0.6	30.8	395	2.0
5-9	131	0.7	43.2	3	‡	0.9	21	0.1	7.1	60	0.3	19.6	89	0.4	29.2	304	1.5
10-14	200	1.0	45.9	14	0.1	3.1	38	0.2	8.7	76	0.4	17.3	109	0.5	25.0	437	2.1
15-19	1,300	6.3	55.5	87	0.4	3.7	26	0.1	1.1	119	0.6	5.1	812	3.9	34.7	2,344	11.3
20-24	1,245	6.0	50.9	219	1.1	9.0	17	0.1	0.7	132	0.6	5.4	832	4.0	34.1	2,445	11.8
25-34	1,268	3.2	46.3	345	0.9	12.6	34	0.1	1.2	208	0.5	7.6	885	2.2	32.3	2,740	6.9
35-44	1,044	2.4	42.5	373	0.8	15.2	54	0.1	2.2	262	0.6	10.7	726	1.6	29.5	2,459	5.6
45-54	856	2.1	40.6	353	0.8	16.7	56	0.1	2.7	263	0.6	12.5	582	1.4	27.6	2,110	5.1
55-64	530	1.8	41.4	162	0.6	12.6	33	0.1	2.6	181	0.6	14.2	375	1.3	29.2	1,281	4.4
65-74	369	2.0	44.3	45	0.2	5.5	18	0.1	2.2	139	0.8	16.7	260	1.4	31.3	831	4.5
≥ 75	464	2.6	44.1	13	0.1	1.3	13	0.1	1.3	202	1.1	19.2	360	2.0	34.2	1,052	5.9
<b>Total</b>	<b>7,581</b>	<b>2.6</b>	<b>46.2</b>	<b>1,614</b>	<b>0.5</b>	<b>9.8</b>	<b>312</b>	<b>0.1</b>	<b>1.9</b>	<b>1,739</b>	<b>0.6</b>	<b>10.6</b>	<b>5,152</b>	<b>1.7</b>	<b>31.4</b>	<b>16,398</b>	<b>5.6</b>
Adjusted <sup>¶</sup>		2.6			0.5			0.1			0.6			1.7			5.6

\* 33 mortality records (2002–2006) were omitted because of missing age information.

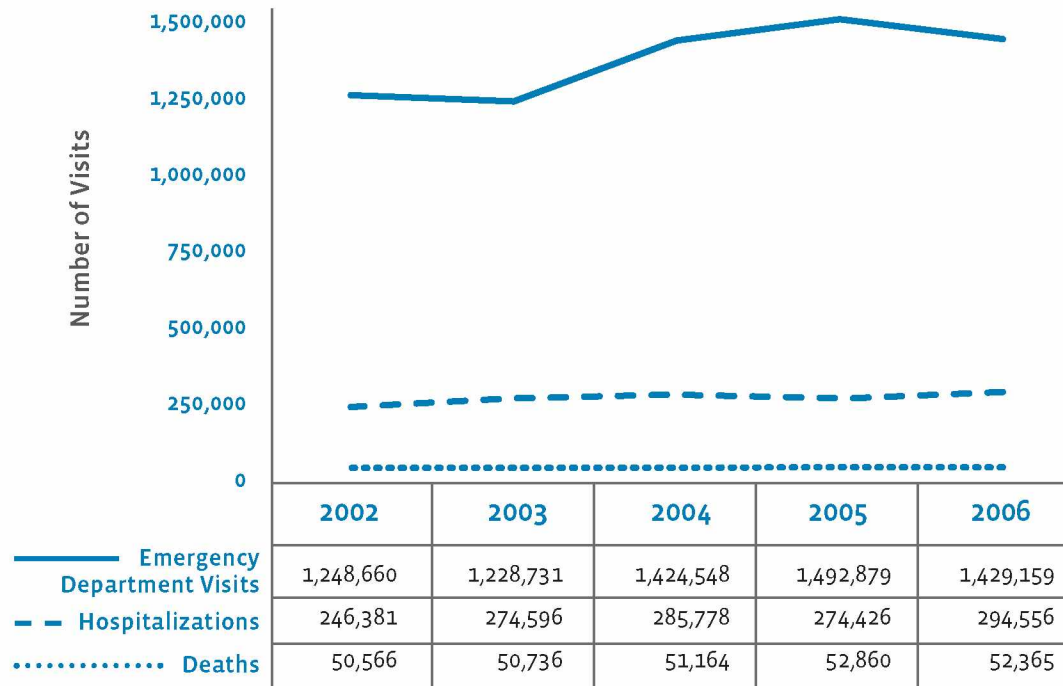
▶ Average annual rate per 100,000 population.

¶ Age-adjusted to the 2000 U.S. standard population.

‡ Sample size was less than 20 for the 5 years combined, so the rate was suppressed.

Numbers subject to rounding error.

**FIGURE 8:** Annual Estimates of All Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths, United States, 2002–2006

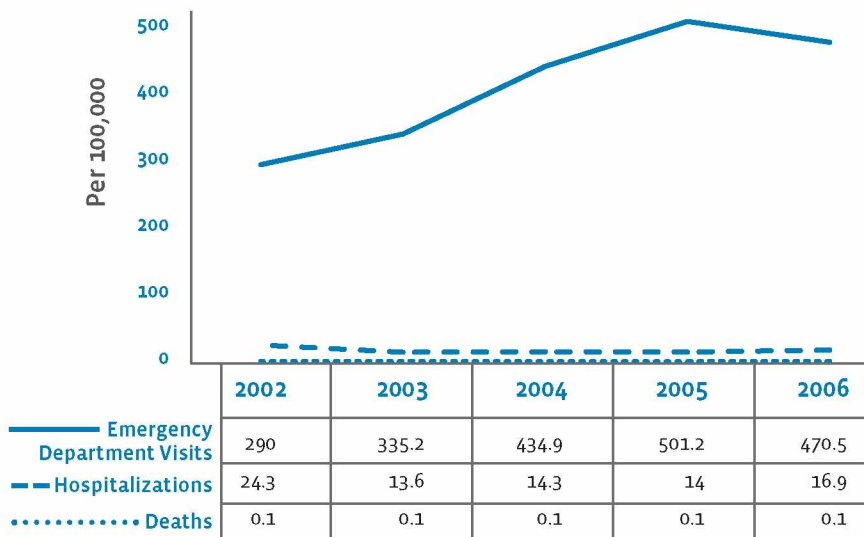


*From 2002 to 2006, there was an increase in TBI-related emergency department visits and hospitalizations.*

During the period 2002 through 2006, TBI-related emergency department visits increased by 14.4%, hospitalizations increased by 19.5%, and deaths increased by 3.5%. The estimated population in the United States increased by 3.8% during the same period.

**FIGURE 9:** Annual Rate Estimates of Fall-Related Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths Among Children Aged 0–14, United States, 2002–2006

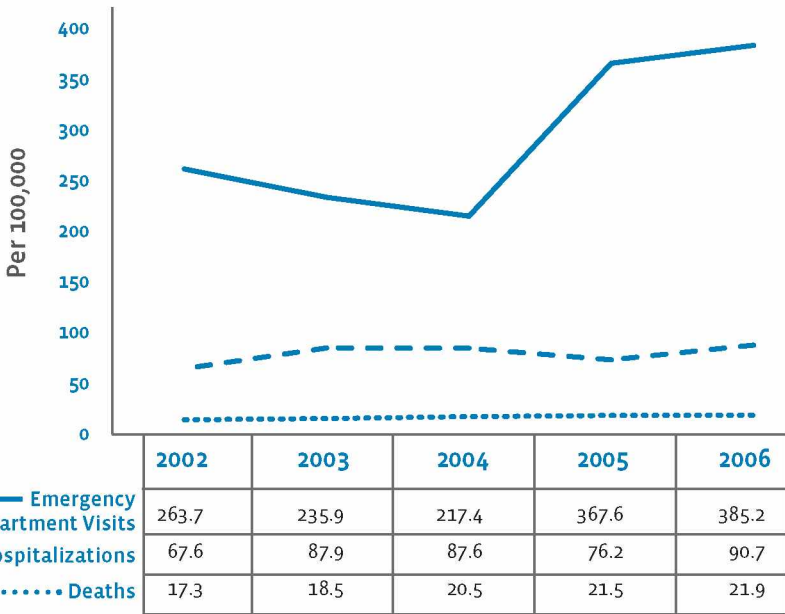
*From 2002 to 2006, there was an increase in fall-related TBIs in emergency department visits among children aged 14 years and younger.*



From 2002 to 2006, there was a 62% increase in fall-related TBIs in emergency department visits among children aged 14 years and younger. Hospitalizations decreased by 30% and deaths remained the same.

**FIGURE 10:** Annual Rate Estimates of Fall-Related Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths Among Adults Aged 65 and older, United States, 2002–2006

*From 2002 to 2006, there was an increase in fall-related TBIs in emergency department visits among adults aged 65 years and older.*



From 2002 to 2006, fall-related TBI rates increased in the older adult population. There were large increases in emergency department visits (46%), hospitalizations (34%), and deaths (27%) among this age group.







# Appendix B:

## Methods and Data Sources

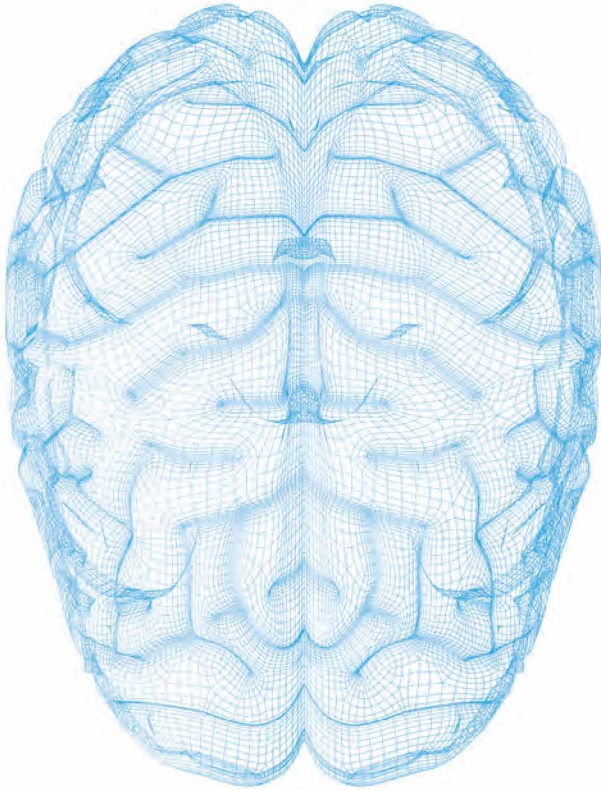
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## **APPENDIX B: METHODS AND DATA SOURCES**

The data presented in this report were based on three different national data sources: the National Hospital Discharge Survey (NHDS), the National Hospital Ambulatory Medical Care Survey (NHAMCS) and the National Vital Statistics System (NVSS). These data sources were selected because national estimates for traumatic brain injuries can be calculated using visits to emergency departments, hospitalizations, and deaths. Data for the years of 2002 to 2006 were used to obtain the most recent estimates of the burden of traumatic brain injuries and to increase the stability of the estimated numbers and rates for hospitalizations and emergency department visits.





# DATA SOURCES

## Emergency Department Visits

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The National Hospital Ambulatory Medical Care Survey (NHAMCS), conducted by CDC's National Center for Health Statistics (NCHS), was used to characterize TBIs treated in emergency departments in the United States. The target population of the NHAMCS was in-person visits made in the United States to emergency departments and outpatient departments of nonfederal, short-stay hospitals (hospitals with an average stay of less than 30 days), hospitals that specialize in general medicine or surgical procedures, and children's hospitals. Of the NHAMCS data, only emergency department visits were included in this report. The NHAMCS used a four-stage probability design with the stages being primary sampling units (PSUs), hospitals within PSUs, clinics or emergency departments within hospitals, and patient visits within clinics or emergency departments. Hospital staff were asked to complete patient record forms for a systematic random sample of patient visits occurring during a randomly assigned four-week reporting period. Each visit was assigned a sample weight based on the inverse probability of selection with adjustments for non-response. The individual sample weights were summed to produce national estimates of TBI-related emergency department visits. For age, sex, and race, missing values were imputed by randomly assigning a value from a record with similar emergency department volume, geographic region,

immediacy with which the patient should be seen, and primary diagnosis. Additional information about the NHAMCS emergency department component is available elsewhere.<sup>2</sup>

For this report, TBI-related cases were selected if one of the three diagnosis fields contained an ICD-9-CM diagnosis code for TBI<sup>6</sup> (see Table 18). The external cause of injury (E-code) was assigned based on the first E-code field. Emergency department patients who died in the emergency department, who were later hospitalized or transferred to another facility were excluded from the analysis of emergency department visits. During 2002 to 2006, the number of hospitals that participated in the survey ranged from 352 to 406 (more than 91% of eligible, sampled hospitals each year), with the total number of unweighted emergency department visits ranged from 33,605 to 40,253. The annual number of unweighted TBI-related emergency department visits identified in the sample ranged from 412 to 460 for a total of 2,198 TBI-related emergency department visits sampled during 2002 to 2006.

## Hospitalizations

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The National Hospital Discharge Survey (NHDS) of the NCHS was used to estimate annual number and rates of TBI-related hospitalizations. The NHDS provided data on discharges from nonfederal, short-stay hospitals (those with an average length of stay for all patients of less than 30 days), general (medical or

surgical) hospitals, or children's general hospitals in the United States. The NHDS used a modified, three-stage probability design to select records, with the stages being PSUs, hospitals within the PSUs, and discharges within the hospitals. The modification of the design involved selection with certainty of the largest PSUs and hospitals. Demographic and medical data were collected for the selected discharges, and weights were assigned based on the inverse probability of selection with adjustments for non-response. The individual record weights were summed to produce estimates of TBI-related hospitalizations each year for the total United States population. Additional information about the NHDS data is available elsewhere.<sup>7</sup>

For this report, TBI-related cases were selected if one of the diagnosis fields contained an ICD-9-CM diagnosis code for TBI<sup>3</sup> (see Table 18). External Cause codes, or E-codes, were contained within the seven diagnosis fields, and the external cause of injury was classified using the first E-code that appeared in the list of codes. Hospitalized patients who died during hospitalization or were transferred to another hospital were excluded from the analysis. During 2002 to 2006, the number of hospitals that provided data for the survey ranged from 426 to 445 (88.9% to 93.9% of eligible, sampled hospitals), and the total number of

unweighted discharges ranged from 319,530 to 376,328. The annual number of unweighted TBI-related hospitalizations identified in the sample ranged from 2,104 to 2,583 for a total of 11,880 unweighted TBI-related discharges sampled during 2002 to 2006.

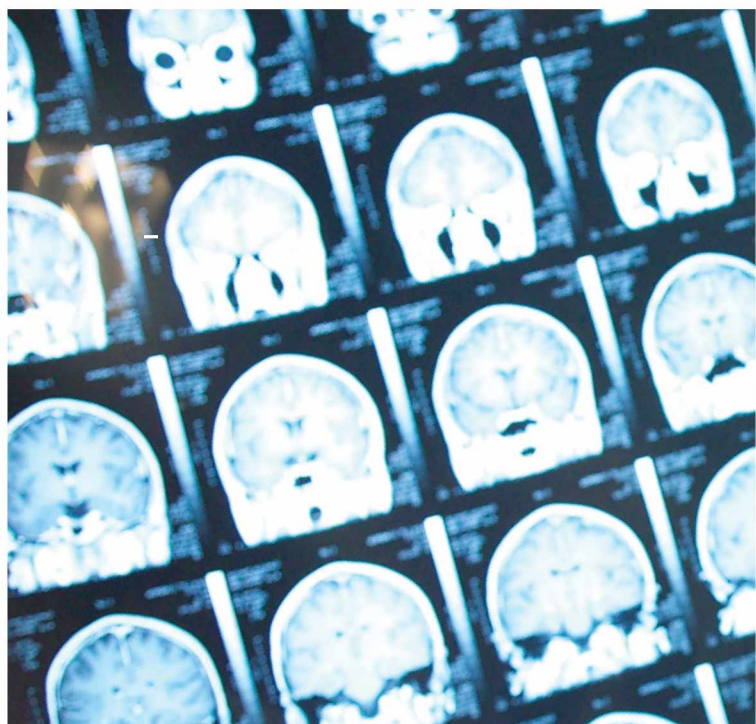
## Deaths

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Multiple cause-of-death data from the mortality files of the National Vital Statistics System (NVSS) were used to describe TBI-related deaths. In the United States, state laws require completion of death certificates for all deaths; federal law mandates national collection and publication of deaths and other vital statistics. The NVSS, the federal compilation of these data, is the result of cooperation between NCHS and the states to provide access to statistical information from death certificates. Additional information about these data is available elsewhere.<sup>4</sup>

For this report, TBI-related cases were selected if an ICD-10 diagnosis code<sup>5</sup> (see Table 19) for TBI appeared in Part I of the death certificate. The E-code was obtained from the underlying cause of death field.







## IDENTIFICATION OF TRAUMATIC BRAIN INJURY CASES

For all data sources, TBI cases were identified using CDC's case definition.<sup>6,7</sup> All NHDS and NHAMCS records that contained in one or more of the diagnosis data fields the ICD-9-CM diagnosis codes in the appropriate range, as shown in Table 18, were identified as a TBI emergency department visit or hospitalization. All records that contained in Part I of the death certificate the ICD-10 diagnosis codes (for years 2002–2006) in the appropriate range, as shown in Table 19, were identified as a TBI death.

A record was counted only once regardless of the number of diagnosis codes that met the criteria for TBI. The increased use of 959.01<sup>5</sup> was accompanied by a corresponding drop in the use of 854.<sup>3</sup> Thus, to avoid underestimating TBIs, cases coded as 959.01 were included. This is consistent with a previous CDC publication on TBI<sup>8</sup> and the current CDC TBI case definition.<sup>6,7</sup>



**TABLE 18:** ICD-9-CM Codes for Traumatic Brain Injury-Related Emergency Department Visits and Hospitalizations (2002–2006)

DESCRIPTION	ICD-9-CM (EMERGENCY DEPARTMENT VISITS AND HOSPITALIZATIONS)
Fracture of the vault or base of the skull	800.0–801.9
Other and unqualified multiple fractures of the skull	803.0–804.9
Intracranial injury, including concussion, contusion, laceration, and hemorrhage	850.0–854.1
Injury to optic nerve and pathways	950.1–950.3
Shaken baby syndrome	995.55
Head injury, unspecified	959.01

**TABLE 19:** ICD-10 Codes for Traumatic Brain Injury-Related Deaths (2002–2006)

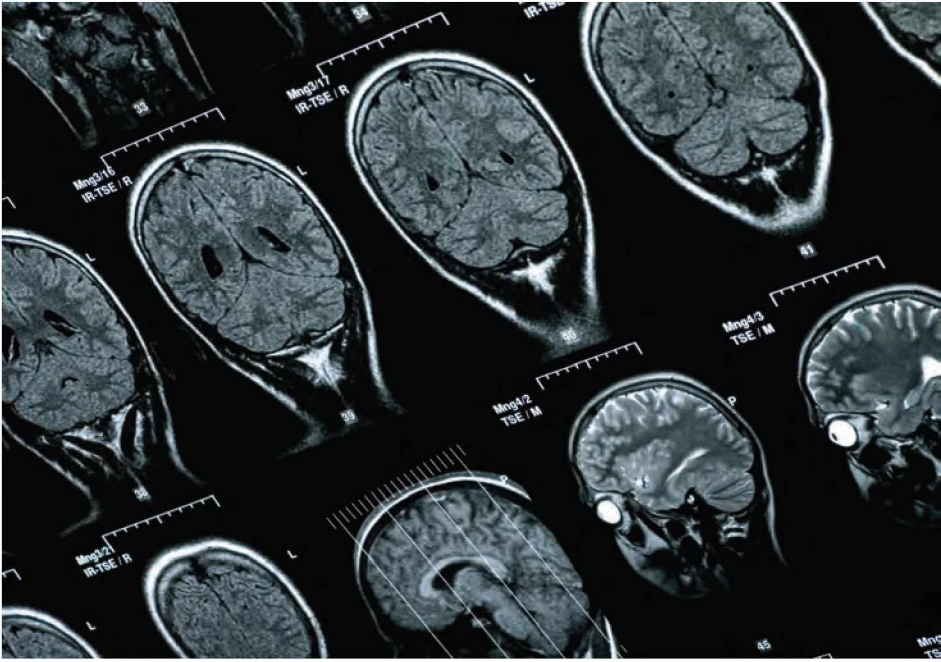
DESCRIPTION	ICD-10 (DEATHS)
Open wound of the head	S01.0–S01.9
Fracture of the skull and facial bones	S02.0, S02.1, S02.3, S02.7–S02.9
Injury to optic nerve and pathways	S04.0
Intracranial injury	S06.0–S06.9
Crushing injury of head	S07.0, S07.1, S07.8, S07.9
Other unspecified injuries of head	S09.7–S09.9
Open wounds involving head with neck	T01.0
Fractures involving head with neck	T02.0
Crushing injuries involving head with neck	T04.0
Injuries of brain and cranial nerves with injuries of nerves and spinal cord at neck level	T06.0
Sequelae of injuries of head	T90.1, T90.2, T90.4, T90.5, T90.8, T90.9

## EXTERNAL CAUSE OF INJURY

External cause of injury categorization was based on E-codes and classified using categories adapted from CDC's recommended frameworks for presenting injury data.<sup>9,10</sup> The categories used are presented in Table 20.

Several changes occurred in the classification of external cause of injury between ICD-9 and ICD-10, including the prefixes used to distinguish external cause (from E-codes for ICD-9 to codes beginning with V, W, X, Y, and \*U [terrorism] for ICD-10) and the organization of transport incident codes (based on type of vehicle in ICD-9 and characteristics of the injured person in ICD-10). For this report, the external cause of injury categories were motor vehicle–traffic, unintentional falls, assaults, and struck by/against.

Struck by/against events are those in which a person was struck unintentionally by another person or an object, such as falling debris or objects, struck against an object, such as a wall or another person. For this report, only unintentional and undetermined struck by/ against events were included. Struck by/against events related to assaults were in the assault category. Struck by/against events were reported for all age groups, even though sometimes small sample sizes produced estimates that were not considered stable.





**TABLE 20:** External Cause of Injury Categorization for ICD-9-CM Codes (Emergency Department Visits and Hospitalizations, 2002–2006) and ICD-10 Codes (Deaths, 2002–2006)

DESCRIPTION	ICD-9-CM	ICD-10
Motor vehicle traffic–related (unintentional)	E810–E819	V02–V04 (.1, .9), V09.2, V12–V14 (.3–.9), V19 (.4–.6), V20–V28 (.3–.9), V29 (.4–.9), V30–V79 (.4–.9), V80 (.3–.5), V81.1, V82.1, V83–V86 (.0–.3), V87 (.0–.8), V89.2
Occupant	E810–E819 (.0, .1)	V30–V79 (.4–.9), V81.1, V82.1, V83–V86 (.0–.3)
Motorcycle	E810–E819 (.2, .3)	V20–V28 (.3–.9), V29 (.4–.9)
Pedal cycle	E810–E819 (.6)	V12–V14 (.3–.9), V19 (.4–.6)
Pedestrian	E810–E819 (.7)	V02–V04 (.1, .9), V09.2
Other and unspecified	E810–E819 (.4, .5, .8, .9)	V80 (.3–.5), V87 (.0–.8), V89.2
Falls (unintentional and undetermined)	E880–E886, E888, E987	W00–W19, Y30
Assault (includes firearm and other)	E960–E969	X85–Y09, Y87.1
Struck by and against	E916, E917	W20–W22, W50–W52, Y29
Other and unspecified	All other E-codes	All other cause codes

## POPULATION DATA

This report uses the United States' Census bridged race population estimates from 2002 to 2006 obtained from NCHS.<sup>11</sup> The average annual population, derived by dividing the total population by five, is presented in Table 21. The 2000 standard population from the U.S. Bureau of the Census was used to calculate the age-adjusted rates by using the direct method.<sup>12</sup> The weights applied to the average annual population from the 2000 standard population are also presented in Table 21.



**TABLE 21:** Estimated Average Annual 2002–2006 Population by Age Group, Sex, and Race; Weights for 2000 Standard Population by Age Group

AGE (YRS)	SEX		RACE			TOTAL	WEIGHTS*
	MALE	FEMALE	WHITE	BLACK	AMERICAN INDIAN, ALASKA NATIVE, ASIAN, PACIFIC ISLANDER		
0-4	10,240,416	9,784,061	15,582,248	3,260,109	1,182,120	20,024,477	0.0691356496
5-9	10,081,063	9,624,631	15,332,058	3,200,397	1,173,239	19,705,694	0.0725328983
10-14	10,740,169	10,229,818	16,259,412	3,503,737	1,206,837	20,969,987	0.0730317441
15-19	10,658,609	10,106,668	16,251,474	3,309,403	1,204,400	20,765,277	0.0721687774
20-24	10,671,421	10,077,694	16,341,821	3,115,714	1,291,580	20,749,115	0.0664775665
25-34	20,226,113	19,659,025	31,421,296	5,519,693	2,944,149	39,885,138	0.1355731628
35-44	22,007,839	22,085,520	35,614,403	5,731,205	2,747,751	44,093,359	0.1626127865
45-54	20,443,508	21,159,542	34,445,963	4,920,675	2,236,412	41,603,050	0.1348339972
55-64	13,997,124	15,075,707	24,786,789	2,911,295	1,374,746	29,072,831	0.0872470269
65-74	8,458,345	10,072,055	16,013,437	1,740,204	776,758	18,530,399	0.0660369801
≥ 75	6,724,189	11,112,062	15,947,766	1,352,384	536,101	17,836,250	0.0603494104
<b>Total</b>	<b>144,248,796</b>	<b>148,986,783</b>	<b>237,996,667</b>	<b>38,564,816</b>	<b>16,674,093</b>	<b>293,235,577</b>	

\* Based on the 2000 standard population.

Numbers subject to rounding error.

## STATISTICAL ANALYSIS

SAS software<sup>13</sup> was used to calculate average annual numbers, rates, row percentages, age-adjusted rates, and total numbers.

Average annual numbers were calculated by adding the numbers for all five years and dividing the totals by 5. Average annual rates were calculated by dividing the total number for all five years by the total population for all five years. Row percentages were calculated by dividing each number by the total number for all five years. Because numbers, rates, and row percentages were all calculated before rounding and were based on the totals for all five years and not the annual average, some results may not be consistent across tables.

An age adjustment rate was made using the direct method to eliminate differences in observed rates that result from age differences in the population distribution. This adjustment was done to allow more accurate comparisons of two or more populations at one point in time or a single population at two or more points in time.

Age-adjusted rates were calculated by the direct method as follows:

$$\sum_{i=1}^n (r_i \times w_i)$$

Where  $r_i$  = age-specific rates for the population of interest,

$w_i$  = age-specific weight based on the 2000 U.S. standard population, and

$n$  = total number of age groups over the age range of the age-adjusted rate.

Age adjustment by the direct method requires use of a standard age distribution; in this report, the year 2000 standard population was selected (see Table 21).

Based on the complex sample design of the NHDS and the NHAMCS, estimates of the number and rate of TBIs requiring emergency department treatment or hospitalization were reported based on the NCHS guidelines below:<sup>2</sup>

- If the sample size was less than 30, the value of the estimates was reported, but it was not considered stable.
- If the sample size was 30 to 59, the value of the estimate was reported, but it may not be stable.

For the death data, if the sample size was less than 20 for the 5 years combined, the rates were suppressed because the data were not considered stable.<sup>12</sup>





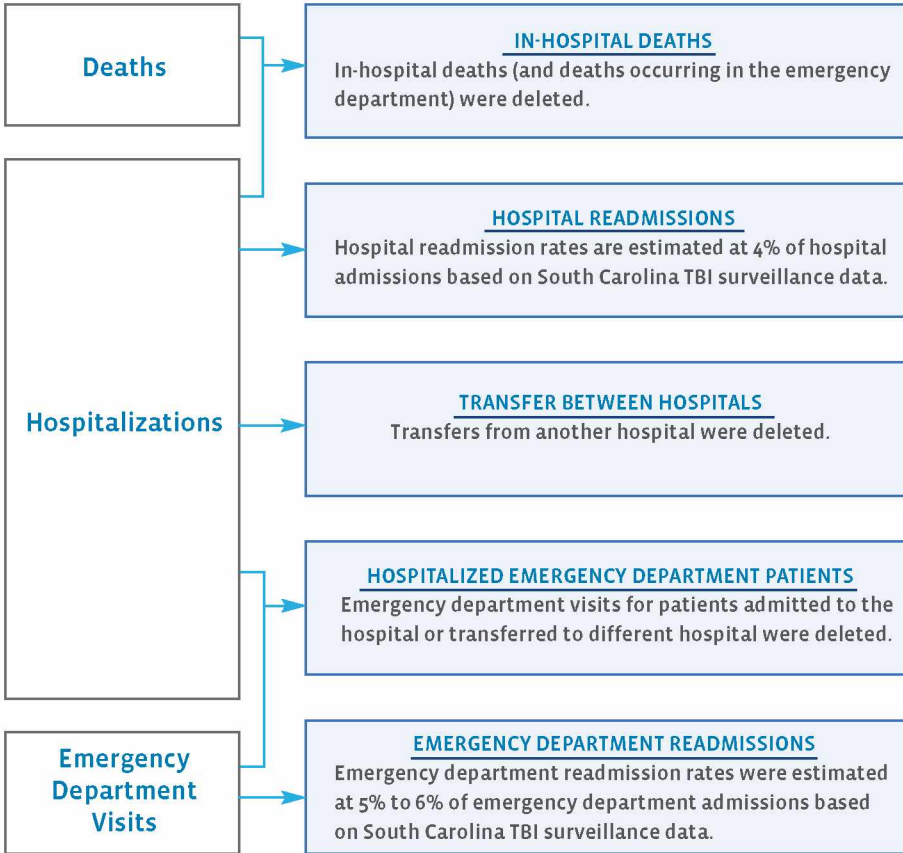
## LIMITATIONS

- Three different data sources were used. Results should be interpreted with caution because differences in study methods may have influenced the findings. The NHDS and NHAMCS were based on a sample of inpatients who were discharged from nonfederal short-stay hospitals (NHDS) and emergency department visits (NHAMCS), while multiple cause-of-death data (NVSS) included all deaths.
- The potential for sampling bias exists with any survey. NHDS and NHAMCS procedures assure this possibility is reduced by using stratified sampling of hospitals, random selection of discharges within hospitals and visits within emergency departments, and even distribution of sampling throughout the year.
- The overall burden of TBI in the United States was underestimated. An estimated 439,000 TBIs treated by physicians during office visits and 89,000 treated in outpatient settings were not included in this report.<sup>14</sup> In addition, TBIs with no medical advice sought, an estimated 25% of all mild and moderate TBIs, were not included.<sup>15</sup>
- This report does not include TBIs from federal, military, or Veterans Administration (VA) hospitals.
- The lack of external cause of injury coding (E-coding) was potentially problematic. For the NHDS data, one third of cases were missing an E-code. Increased E-code reporting could

increase the rates by external cause. Only data by external cause for the leading causes of TBI (falls, struck by/against, motor-vehicle/traffic and assault) for the three data sets combined were reported. The actual leading causes varied among emergency department visits, hospitalizations, and deaths. Causes beyond those were combined as other/unknown due to limitations in sample size and consistency among all three data sources. As a result, some causes were not included individually, such as firearm injuries, which is a factor in some TBI deaths.<sup>16,17</sup> These types of injuries were included in the “other” category.

- E-codes may not capture all of the injuries attributable to a particular cause or intent, especially controversial ones such as assault. Among children, 25% of all injuries resulting from assaults may not be accounted for by E-codes.<sup>18</sup> Assaults may not be clinically recognized, especially in vulnerable populations, such as children<sup>19</sup> and older adults.<sup>20</sup>
- Injury severity was not included in this report for two reasons. First, a measure of severity could not be uniformly applied to all three data sets. ICDMAP-90,<sup>21</sup> a computer algorithm that converts ICD-9-CM diagnosis codes to a 6-level score approximating the Abbreviated Injury Scale (AIS), was only applicable to NHDS and NHAMCS data. Second, the ICDMAP-90 has not been updated to include the ICD code 959.01, which is now part of the TBI ICD coded definition.

**FIGURE 11:** Sources of Potential Case Duplication When Combining Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths



- The NHDS and NHAMCS data are based on hospitalizations and visits to emergency departments — not on individual persons. It is not possible to unduplicate cases in which individuals were hospitalized or treated in emergency departments more than once for the same injury. This limitation precludes calculating the true incidence of TBI; however, the effects on the data are assumed to be quite small. Specifically, data from a population-based follow-up study in South Carolina indicated a readmission rate to the hospital of approximately 4% and a readmission rate to the emergency department of 5% to 6%.<sup>22</sup> Patients who transferred from another hospital were excluded in the hospitalization tables. Patients who have been hospitalized and later died from their injuries could be another source of over-counting. However, deaths that occurred among patients hospitalized or treated at emergency departments were excluded based on information available in the hospital discharge and emergency department data sets. Patients who were seen in the emergency department and later hospitalized could also be double counted; however, documented hospitalizations were excluded from those counted as seen in the emergency department. Emergency department patients reported to have been transferred were also excluded to help limit double counting. Because none of these data sets are mutually exclusive, the combined number or rate of TBI might be overestimated because some cases could still be double counted (see Figure 11).



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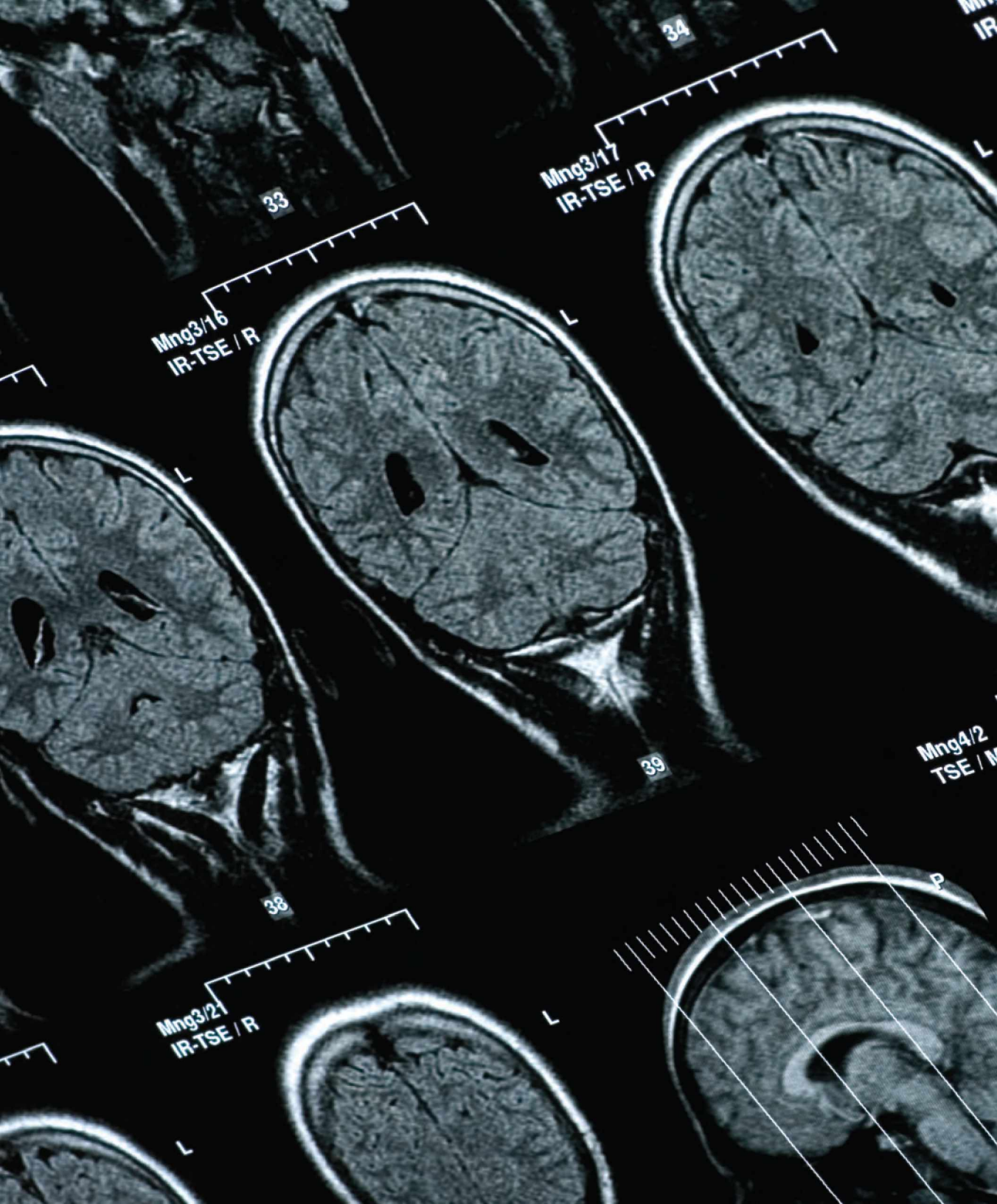
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