



TRAUMATIC BRAIN INJURIES IN MASSACHUSETTS: DATA SUMMARY

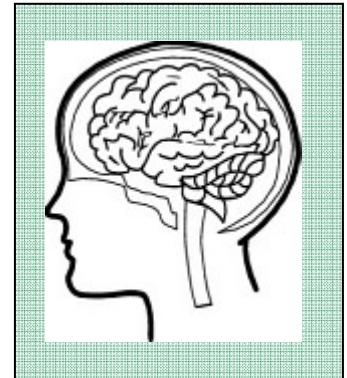
Prepared By: Massachusetts Department of Public Health, Injury Surveillance Program

September 2008

The Public Health Importance of Traumatic Brain Injury (TBI):

Traumatic brain injury is an injury to the head arising from blunt or penetrating trauma or from acceleration-deceleration forces. It is associated with any of these symptoms or signs: decreased level of consciousness, amnesia, other neurologic or neuropsychologic abnormalities, skull fracture, diagnosed intracranial lesions, or death.¹

Each year the number of traumatic brain injuries in the United States is 8 times higher than the number of people diagnosed with breast cancer and 34 times the number of new cases of HIV/AIDS.²



In the United States, about 1.4 million people sustain a traumatic brain injury every year. Approximately 50,000 die, 235,000 are hospitalized and 1.1 million are treated and released from an emergency department.³ Traumatic brain injury happens to the general population from such causes as falls and motor vehicle crashes. Many war veterans returning from current conflicts suffer from blast-related TBI.⁸ Estimates vary as to the number of Massachusetts residents returning with blast-related TBIs. In response, DPH has begun participating with other agencies to improve data collection, assessment, and outreach and services to returning veterans.

Total lifetime costs associated with TBI injuries that occurred in 2000 are conservatively estimated at \$60 billion.⁴ These costs do not take into account undiagnosed TBIs or those treated at a health care center or physicians office.⁴

The majority of individuals who sustain a moderate or severe TBI experience significant physical, behavioral/psychiatric, psychosocial, cognitive, and medical problems.⁵ These health problems negatively impact functional independence, community access and living skills, vocational outcomes, and psychosocial development, which may extend throughout a lifetime. Research has shown that TBI can contribute to an increase in high school dropout rates, unemployment, risk for substance abuse, psychiatric hospitalizations including suicide attempts, and criminal activity.⁵

Predictable – Preventable

Most traumatic brain injuries are preventable. Because the sequence of events leading up to these injuries frequently follow a predictable pattern, points for intervention are possible. Prevention of these injuries often requires a multi-faceted approach involving education, enactment and enforcement of laws, and modifications in the environment where injuries occur.

For information on traumatic brain injury resources please refer to page 8; information on data sources and methodology can be found on page 9.

Massachusetts TBI Statistics: 2006 Deaths, and FY2006 Inpatient Hospitalizations, Observation Stays, and Emergency Department (ED) Visits for Nonfatal TBI's



Massachusetts has a much lower rate of TBI deaths than the U.S. (7.7 per 100,000 and 17.7 per 100,000 respectively for 2005). The age-adjusted rate, however, for TBI-related emergency department visits are higher for Massachusetts (572.3 per 100,000) than the U.S. (415.6 per 100,000) and the TBI-related hospitalization rate among Massachusetts residents (69.2 per 100,000) is noticeably higher than the Healthy People 2010 benchmark of 45 per 100,000.⁶

Magnitude:

- In 2006, 23.5% (N=685) of all injury deaths (e.g., falls, motor vehicle crashes) among MA residents were associated with a traumatic brain injury (TBI).
- In FY 2006, there were 5,393 inpatient hospitalizations, 1,276 observation stays, and 43,698 emergency department (ED) discharges associated with a nonfatal TBI among MA residents.
- 65.1% of TBI-related inpatient hospitalizations had a diagnostic code of intracranial injury or hemorrhage, and 22.1% had a diagnostic code of skull fracture or fractures.
- 36.6% of TBI-related inpatient hospitalizations were discharged to a skilled nursing care facility, rehabilitation, or other health care institution.

Leading Cause and Intent of TBI:

- The leading cause of TBI-related deaths, inpatient hospitalizations, observation stays, and ED visits is a fall (representing 35.5%, 55.5%, 41.2%, and 45.6% of all cases, respectively).
- Most TBIs are unintentional (“accidentally inflicted”). Among 2006 TBI-related deaths, 73.4% were unintentional, 14.6% were suicides, and 8.5% were homicides. Among FY2006 TBI-related inpatient hospitalizations, observation stays, and emergency department visits, 87.8% were unintentional and 9.2% were due to an assault.

Age, Sex, and Racial/Ethnic Groups with the Highest Rates of TBI:

- TBI-related death and inpatient hospitalization rates are highest among individuals 85 years and older (78.8 and 579.5 per 100,000, respectively). TBI-related observation stay and ED visit rates are highest among infants less than 1 year of age (70.0 and 2,008.2 per 100,000, respectively).
- Males have higher rates of TBI-related death, inpatient hospitalizations, observation stays, and ED visits, compared with females (rates of 14.9 vs. 6.6, 99.0 vs. 69.5, 24.5 vs. 15.4, and 782.1 vs. 581.7 per 100,000, respectively).
- Age-adjusted TBI-related death rates were highest among Black non-Hispanic residents (14.5 per 100,000 compared with 9.8, 8.5, and 5.3 per 100,000 among White non-Hispanic, Hispanic, and Asian, non-Hispanic residents, respectively).

Total Acute Care Hospital Charges for TBI-Related Discharges:

- Total acute-care charges for TBI-related inpatient hospitalizations, observation stays, and emergency department visits exceeded \$330 million in FY2006. The average charge per inpatient hospitalization was \$36,817. Among inpatient hospital discharges, 62.5% of cases were paid through public sources. Among observation stays 36.9% were paid through public sources, and for ED visits, 35.6%.

Table 1. Summary of Massachusetts TBI Data

	Deaths, 2006			Nonfatal Hospital Stays, FY2006			Nonfatal ED Visits, FY2006		
		Count	Rate*		Count	Rate*		Count	Rate*
	Total TBI	685	10.6	Total TBI	6,669	103.6	Total TBI	43,698	678.8
Highest Rates:		Count	Rate*		Count	Rate*		Count	Rate*
Sex	Male	466	14.9	Male	3,852	123.6	Male	24,380	782.1
Race/Ethnicity	Black, non-Hispanic	56	14.0	Hispanic	491	96.1	Black	3,055	764.5
Age Group	85+	108	78.8	85+	877	640.0	<1 year	1,550	2,008.2
Leading Causes:		Count	Percent		Count	Percent		Count	Percent
	Fall	243	35.5%	Fall	3,519	52.7%	Fall	19,933	45.6%
	MV Occupant ²	162	23.6%	MV Occupant ²	1,334	20.0%	Struck by/against	10,760	24.6%
	Firearm	121	17.7%	Struck by/against	544	8.2%	MV Occupant ²	6,745	15.4%

Sources: Registry of Vital Records and Statistics, MDPH, MA Inpatient Hospital Discharge Database, MA Outpatient Observation Stay Database, and MA Emergency Department Database, Division of Health Care Finance and Policy.

¹ Fiscal year (October 1, 2005 – September 30, 2006).

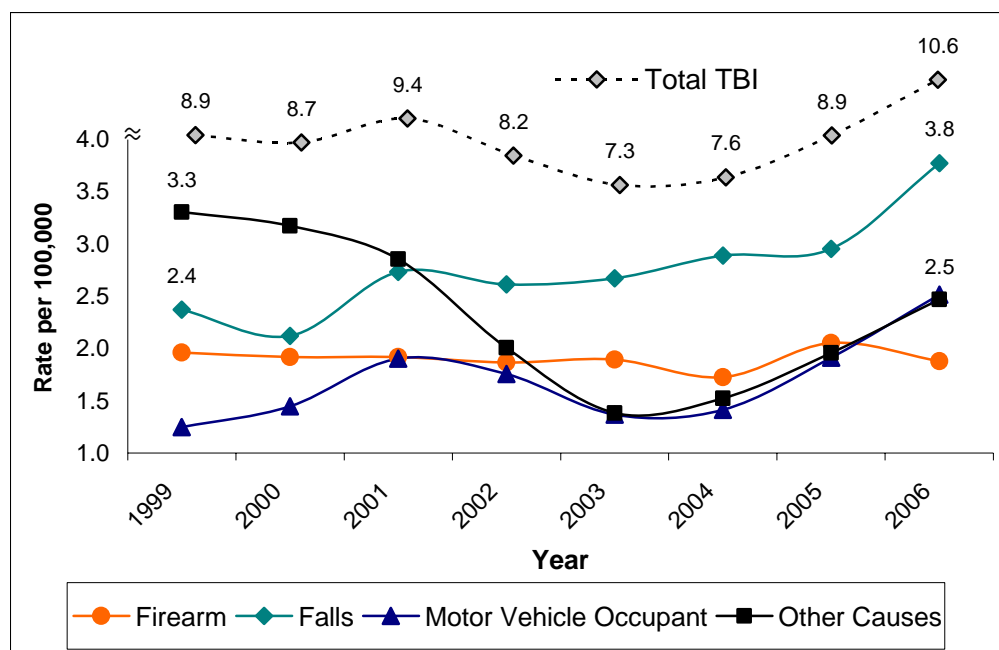
² Motor vehicle occupant includes occupants, motorcyclists, and unspecified persons injured in a motor vehicle traffic related crash.

*Rates provided here are crude rates with the exception of race/ethnicity which are age-adjusted. All rates are per 100,000 residents.

TBI-related Deaths:

The number of TBI deaths among Massachusetts residents varied from year to year between 1999 and 2002 (N=562, 551, 603, and 530 respectively), decreased in 2003 and 2004 (N=471 and N=486, respectively), and more recently increased (N=571 in 2005 and N=685 in 2006). TBI death rates for certain causes such as fall-related and motor vehicle occupant deaths have increased (see Figure 1).

Figure 1. TBI Death Rates by Cause per 100,000 MA Residents, 1999-2006

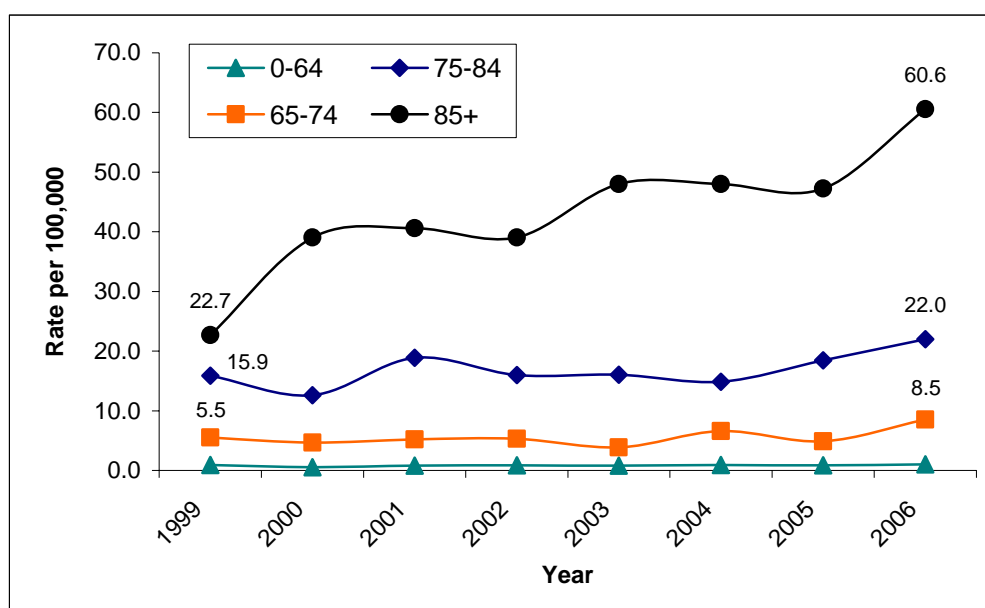


Source: Registry of Vital Records and Statistics, MDPH. **Note** break in Y axis to accommodate findings in graph.

From 1999 to 2006:

- The rate of firearm-related TBI deaths remained relatively stable during the time period (2.0 per 100,000 in 1999 and 1.9 per 100,000 in 2006).
- The rate of fall-related TBI deaths increased 58.3% (2.4 per 100,000, N=150 and 3.8 per 100,000, N=243, respectively). This increase was due to the number of persons ages 75 and older who died as a result of a fall-related TBI.
- The rate of motor-vehicle occupant TBI deaths increased 108%, from 1.2 per 100,000 in 1999 (N=79) to 2.5 per 100,000 in 2006 (N=162).
- The number of TBI deaths in “all other causes” declined sharply from 2000 to 2003 and then increased from 2004 through 2006.

Figure 2. Fall-related TBI Death Rates by Age Group per 100,000 MA Residents, 1999-2006



Source: Registry of Vital Records and Statistics, MDPH

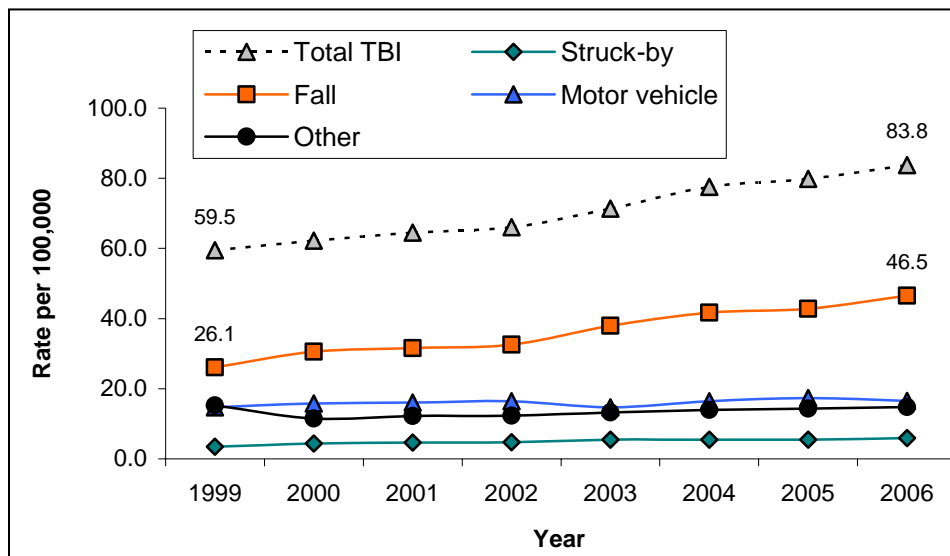
From 1999 to 2006:

- Persons with the highest rates of fall-related TBI deaths were those between the ages of 75 and 84 years, and those 85 years and older.
 - Among persons ages 75 to 84, fall-related TBI death rates increased 38.4% from 1999 (15.9 per 100,000, N=49) to 2006 (22.0 per 100,000, N=68).
 - Among persons ages 85 years and older, fall-related TBI death rates increased by 167% between 1999 (22.7 per 100,000, N=27) and 2006 (60.6 per 100,000, N=83).

TBI-related Nonfatal Injuries:

The rate of hospitalizations for nonfatal TBI in Massachusetts increased 40.8% from 59.5 per 100,000 in 1999 to 83.8 per 100,000 in 2006 (N=3,763 and 5,393 respectively).

Figure 3. Nonfatal TBI Hospitalization Rates per 100,000, MA Residents, 1999-2006

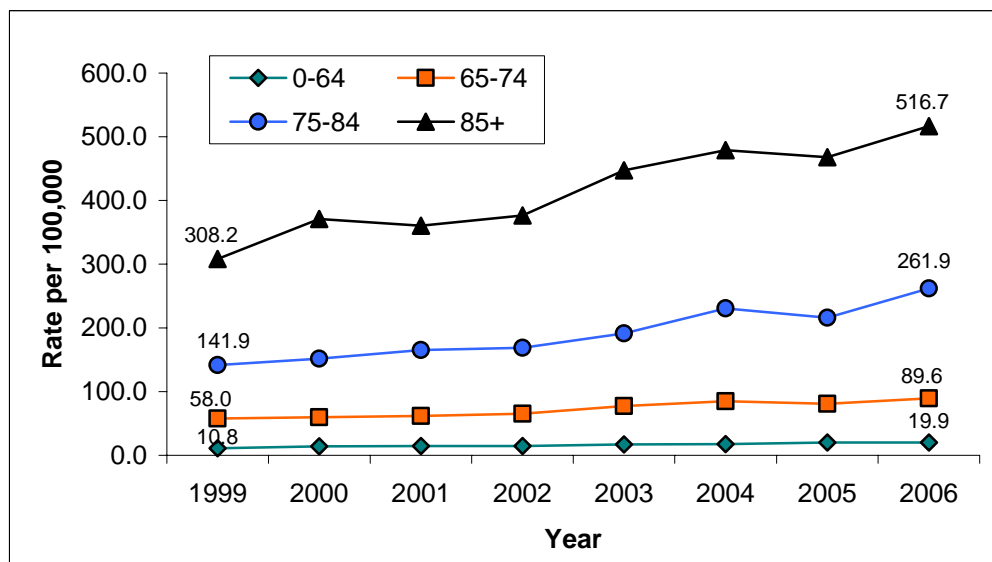


Source: MA Inpatient Hospital Discharge Database, MA Division of Health Care Finance and Policy.

From 1999 to 2006:

- TBI-related inpatient hospitalizations increased 40.8% from 1999 to 2006.
- The increase is primarily due to an increase in fall-related TBIs.
- The rate of inpatient hospitalizations for fall-related TBI increased 78.2% from 1999 (26.1 per 100,000, N=1,650) to 2006 (46.5 per 100,000, N=2,993).
- Rates among other leading causes of TBI-related inpatient hospitalizations (e.g., motor vehicle traffic related TBIs) remained relatively stable over the eight year period.

Figure 4. Nonfatal Fall-related TBI Hospitalization Rates by Age Group per 100,000 MA Residents, 1999-2006



Source: MA Inpatient Hospital Discharge Database, MA Division of Health Care Finance and Policy.

From 1999 to 2006:

- The rate of inpatient hospitalizations for fall-related TBI among MA residents increased 78% from 26.1 per 100,000 in 1999 to 46.5 per 100,000 in 2006.
 - Among persons less than 65 years old, fall-related TBI rates increased 84.3% (10.8 per 100,000, N=592 and 19.9 per 100,000, N=1,108, respectively).
 - Among persons 65 years and older, fall-related TBI rates increased 80% (122.5 per 100,000, N=1,058 and 220.2 per 100,000, N=1,895, respectively).
 - Among persons ages 75 to 84 years old, fall-related TBI rates increased 85% (141.9 per 100,000 in 1999 to 261.9 per 100,000 in 2006).
 - Persons ages 85 years and older had the highest rates overall with 516.7 per 100,000 in 2006; an increase of 68% from 1999 (308.2 per 100,000).

Work-related TBI in MA

Table 2. Summary of Massachusetts Work-related TBI

	Non-fatal Hospital Discharges ¹			Non-fatal ED Visits ¹		
	FY2006			FY2006		
		Count	Rate ³		Count	Rate ³
Work-related TBI Injuries ²		138	4.3		2,252	70.2
Highest Rate:						
Sex	Male	125	7.5	Male	1,456	87.3
Race/Ethnicity	Hispanic	12	6.0	Black	162	107.9
Age Group	65 and older	11	8.6	20-24 years	311	112.9
		Count	Percent		Count	Percent
Leading Occupational Events:	Fall	70	50.7%	Struck by/against	992	44.1%
	Struck by/against	24	17.4%	Fall	752	33.4%
	MV Occupant ⁴	19	13.8%	MV Occupant ⁴	203	9.0%

¹ Fiscal year (October 1, 2005 – Sept. 30, 2006).

² A work-related TBI case had at least one TBI-related diagnostic code and had either an expected payer of Worker's Compensation or an E-Code or V-Code indicating that the TBI occurred at work.

³ Rates are annual averages, expressed per 100,000 workers and are calculated using MA workforce estimates from the Current Population Survey.

⁴ Includes drivers, riders, passengers, and others injured in a motor vehicle crash (excludes pedestrians struck by a motor vehicle).

In 2006:

- There were 138 hospitalizations and 2,252 emergency department (ED) visits associated with TBI's occurring at work, accounting for approximately 2.5% of all work-related hospitalizations and emergency department visits combined.
- Male workers had higher rates of hospitalizations and ED visits than female workers.
- Black workers had the highest rate of TBI-related ED visits (107.9 per 100,000 workers). The rate of TBI-related ED visits was also high among Hispanic workers (106.8 per 100,000 workers). Hispanic workers had the highest rate of hospitalizations for TBI (6.0 per 100,000) compared with the other racial/ethnic groups.
- The TBI-related ED visit rate was highest among workers 20–24 years (112.9 per 100,000 workers) compared with the overall rate for all ages of 70.2 ED visits per 100,000 workers. Workers aged 65 and older had the highest rate of TBI-related hospitalizations (8.6 per 100,000 workers).
- The leading causes of work-related, TBI hospitalizations and ED visits were falls and struck by/against. More than three-quarters (75.7%) of the fall-related hospitalizations for TBI resulted from a worker falling from a height (ladder, scaffold, building, etc.).

Resources for TBI Prevention and Services:

Injury Prevention and Control Program (IPCP)

Massachusetts Department of Public Health
Bureau of Community Health Access and Promotion
250 Washington Street, 4th Floor
Boston, MA 02108
(617) 624-5413

www.mass.gov/dph/fch/injury/index.htm

Statewide Head Injury Program (SHIP)

Massachusetts Rehabilitation Commission
27 Wormwood Street, Suite 600
Boston, MA 02210
(617) 204-3852 or 1-800-223-2559, ext. 2 (in MA)
TTY: (617) 204-3817

www.mass.gov/mrc/ship

Brain Injury Association of Massachusetts

30 Lyman Street, Suite 10
Westborough, MA 01581
(508) 475-0032
(800) 242-0030 - Brain Injury Info Line

www.biama.org

Occupational Health Surveillance Program (OSHP)

Massachusetts Department of Public Health
Bureau of Health Information, Statistics, Research, and Evaluation
250 Washington Street, 6th Floor
Boston, MA 02108
(617) 624-5632

www.mass.gov/dph/ohsp

For further information, please contact:

Injury Surveillance Program (ISP)

Massachusetts Department of Public Health
Bureau of Health Information, Statistics, Research, and Evaluation
250 Washington Street, 6th Floor
Boston, MA 02108
(617) 624-5648

www.mass.gov/dph/bhsre/isp/isp.htm

Data Sources and Method Notes:

Data Sources:

Statewide Deaths: MA Registry of Vital Records and Statistics, MA Department of Public Health; data reported are for calendar years January 1, 1999 – December 31, 2006.

Statewide Acute-care Inpatient Hospitalizations: MA Inpatient Hospital Discharge Database, MA Division of Health Care Finance and Policy; data reported are for fiscal years (FY) October 1, 1998 – September 30, 2006. Deaths occurring during the hospital stay and transfers to another acute care facility were excluded except when calculating charges. All hospitalizations and charges discussed refer to acute care hospitals.

Statewide Outpatient Observation Stays: MA Outpatient Observation Stay Database, MA Division of Health Care Finance and Policy; data reported are for FY October 1, 1998 – September, 30, 2006. Deaths occurring during the visit were excluded except when calculating charges.

Statewide Emergency Department Visits at Acute-care Hospitals: MA Emergency Department Discharge Database, MA Division of Health Care Finance and Policy; data reported are for FY October 1, 2001 – September, 30, 2006. Deaths occurring during the visit were excluded except when calculating charges.

Population Data: Population numbers used to calculate rates include estimates provided by the Massachusetts Institute for Statistics and Economic Research (1995-1998 data), DPH estimates for 1999, the 2000 Census file, and estimates provided by the U.S. Census Bureau (2001-2006 data).

Method Notes:

TBI-related cases were ascertained according to case definitions recommended by the Centers for Disease Control and Prevention (CDC) and are based upon International Classification of Disease Version 9 Clinical Modification (ICD-9-CM) codes for morbidity and International Classification of Disease Version 9 (ICD-9, 1995-1998) and Version 10 (ICD-10, 1999-2006) codes for mortality.⁷

Rates: All rates are per 100,000 residents. All rates are crude rates with the exception of racial and ethnic groups which are age-adjusted.

Payer Source: Payer source was defined as public if expected payer was specified as Medicaid, Medicare, free care, or other government payer.

Categories and groupings for intent and cause are based on a modified version of the CDC's "Recommended framework of E-code groupings for presenting injury mortality and morbidity data."

References:

1. State and Territorial Injury Prevention Directors Association (STIPDA). *Council of State and Territorial Epidemiologists Injury Indicators for Surveillance*; 1999. (www.stipda.org/resol/99nphss-tbi.htm).
2. Centers for Disease Control and Prevention website. (<http://www.cdc.gov/ncipc/factsheets/tbi.htm>) accessed July, 2006.
3. Langlois, JA, Rutland-Brown, W, Thomas, KE. *Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations, and Deaths*. Atlanta (GA): Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2006.
4. Finkelstein, EA, Corso, PS, Miller, TR, et al. *The incidence of economic burden of injuries in the United States*. New York (NY): Oxford University Press; 2006.
5. LaVecchia F. *Final Report of the Massachusetts Traumatic Brain Injury Transition Project*, June, 1996.
6. U.S. Department of Health and Human Services. *Healthy People 2010: Understanding and Improving Health*. 2nd ed. Washington, DC: U.S. Government Printing Office, November 2000.
7. Marr A, Coronado V, editors. *Central Nervous System Injury Surveillance Data Submission Standards – 2002*. Atlanta (GA): Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2004.
8. Wagner, C. *Brain Injuries High among Iraq Casualties*. Veteran Brain Injury News. (<http://www.birf.info/home/library/vet/vet-bino.html>).

This publication was developed by the Injury Surveillance Program with input from the Occupational Health Surveillance Program (Bureau of Health Information, Statistics, Research, and Evaluation) of the Massachusetts Department of Public Health.

This publication was supported by Grant #U17/CCU124799 from the Centers for Disease Control and Prevention. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention.