
Overview of Causes and Costs of Injuries in Massachusetts: A Methodology for Analysis of State Data

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Synopsis

Massachusetts has developed the first State profile of the causes and costs of injury based on the national study, "Cost of Injury in the United States: A Report to Congress." Incidence of fatal injuries is based on Massachusetts data; nonfatal hospitalized injuries, on Massachusetts age and sex rates and U.S.

cause data; and nonhospitalized injuries, on U.S. rates applied to Massachusetts census data. Lifetime costs per injured person are based on national data adjusted for higher personal health care expenditures and for higher mean annual earnings in Massachusetts.

The estimated total lifetime cost for the 1.4 million injuries that occurred in 1989 is \$4.4 billion—\$1.7 billion for health care and \$2.7 billion for lost earnings. Injuries attributed to motor vehicles and falls account for more than half of the total cost. The other cause categories are poisonings, fires-burns, firearms, drownings-near drownings, and other. For every person who dies from an injury, 17 people are hospitalized, and an estimated 535 people require outpatient treatment, consultation, or restricted activity.

Development of a State-based cost report can be useful in monitoring the contribution of injuries to health status and in planning effective injury prevention strategies in a community-based health care system. The methodology described in this paper can be replicated by other States through accessing their State-specific mortality and hospital discharge data bases.

ALTHOUGH INJURY has been recognized as a major public health problem, data on incidence and cost continue to be limited. The lack of complete and accurate data restricts our ability to focus on a variety of data-oriented aspects of injury control that potentially could reduce the incidence, health care cost, and lost productivity associated with injury.

Massachusetts has developed the first State profile of injury (*I*) based on the national study, "Cost of Injury in the United States: A Report to Congress" (2). It is also the first Massachusetts injury report to integrate the estimated incidence of fatal and nonfatal injuries with the estimated lifetime costs of health care and lost earnings by cause for residents in all age groups. Seven cause categories are highlighted: motor vehicles, falls, poisonings, fires-burns, firearms, drownings-near drownings, and other causes of

injury (stabblings, suffocations, struck by object or person, and so forth).

Although Massachusetts has been a national leader in injury control, gaps in injury data have persisted. The Massachusetts Department of Public Health (MDPH) first initiated an injury prevention and control program in 1979 with a grant from the Federal Maternal and Child Health Bureau to develop a childhood injury surveillance system. Surveillance efforts have focused on two existing sources of data, the vital statistics mortality file maintained by the MDPH and the uniform hospital discharge data set maintained by the Massachusetts Rate Setting Commission. There is no central repository of non-hospitalized injury data. While death records must include cause of injury, hospital records do not require this information.

Methods

Estimates of the incidence of injuries for Massachusetts use the same inclusion and exclusion criteria for the three classes of injury (fatal, nonfatal hospitalized, nonhospitalized) as the national study. Estimates of the cost of injuries for Massachusetts use the national costs per injured persons for 1985 inflated to 1989 and adjusted for higher costs in Massachusetts. Readers interested in a full explanation of the methodology should refer to the national report (2) and to the technical appendix of the Massachusetts report (3).

Incidence. Incidence of fatal injuries was annualized from all resident deaths with an underlying cause of injury (International Classification of Diseases E codes 800–999) (4) during 1988–90, excluding misadventures (E870–879) and adverse effects (E930–949). Incidence of hospitalized injuries was annualized from all live resident discharges from non-Federal acute care hospitals with a principal diagnosis of injury (ICD N codes 800–999) (4) during FY 1988–90, excluding late effects (N905–909), adverse effects (N995), complications of care (N958, N996–999), elective admissions, and transfers from other acute care hospitals. These exclusions were intended to eliminate hospital readmissions for injuries from the incidence rate (5).

Because only a third of discharge records include the cause of injury, incidence by cause was calculated by multiplying the national percentage distribution of cause within each age-sex group for 1985 by Massachusetts incidence within each age-sex group. Incidence of nonhospitalized injuries was calculated by multiplying the national rates per 100,000 persons by cause within age-sex groups for 1985 by the Massachusetts population for each age-sex group. National rates included in the national report were based on the National Health Interview Survey annualized for 1984–86. Nonhospitalized injuries include acute injuries resulting in medical attention or phone consultation without hospitalization or in one or more days of restricted activity without medical attention with the same exclusions as for hospitalized injuries.

Our definition of the incidence of fatal injuries is conservative because it does not include deaths for which an injury was a contributing factor but was not assigned as the underlying cause. Because firearms are an increasing cause of injury, our estimates of hospitalized and nonhospitalized firearm-related injuries, which are based on 1984–86 and 1972 data respectively, are probably understated more than for

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other causes. In assigning cause for hospitalized injuries and calculating rates for nonhospitalized injuries, our methodology is based on the assumption that age and sex largely determine injury patterns.

Cost. Unpublished tables of the cost per injured person for age-sex groups by class of injury and cause for estimated lifetime health care and lost earnings were provided by the authors of the national study, Dorothy Rice and Wendy Max. National costs are based on a 6 percent discount rate that converts future costs to present dollars. Health care costs include hospital stays for acute, psychiatric, and rehabilitative care, physician visits, prescription drugs, physical therapy, nursing home stays, medical appliances, emergency transportation, home modification, and insurance administration. It should be noted that national estimates were based on available data that may not include the full spectrum of health care and rehabilitation.

For health care, the national cost per injured person in 1985 was inflated for Massachusetts using the percentage increase in the national per capita personal health care expenditure from 1985 to 1989 (37.8 percent) and multiplied by the percentage difference in per capita personal health care expenditure between the United States and Massachusetts in 1989 (23.6 percent), resulting in a total inflator of 1.703 (6). The 1989 per capita personal health care expenditure for Massachusetts was obtained from the U.S. Health Care Financing Administration.

For lost earnings, the national cost per injured person by sex in 1985 was inflated for Massachusetts using the percentage increase in the national mean annual earnings of persons from 1985 to 1989 (women: 23.4 percent, men: 20.9 percent) and multiplied by the percentage difference in mean annual earnings between the United States and the Northeast region in 1989 (women: 11.4 percent, men: 9.0 percent), resulting in a total inflator for women of 1.375 and a total inflator for men of 1.318 (7,8).

Table 1. Estimated incidence (thousands) and lifetime cost of injury in 1989 dollars (millions) by cause and class of injury for Massachusetts, 1989

Cause	Total		Fatal		Hospitalized		Nonhospitalized	
	Number	Cost	Number	Cost	Number	Cost	Number	Cost
Total.....	1,406	\$4,405	2,549	\$1,116	44	\$2,165	1,360	\$1,125
Motor vehicles	132	1,240	729	379	9	562	122	300
Falls.....	306	1,151	367	54	17	855	289	242
Poisonings.....	41	310	366	199	4	101	37	11
Firearms.....	6	213	284	156	1	54	4	3
Fires, burns.....	37	97	89	30	1	48	36	19
Drownings.....	1	58	113	54	0	4	1	0
Other.....	885	1,336	601	245	12	541	872	550

NOTE: Estimated incidence numbers for hospitalized, nonhospitalized, and total injuries have been rounded to the nearest thousand; all estimated costs

have been rounded to the nearest million; numbers may not add to totals because of rounding.

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37,000, firearms 6,000, and drownings-near drownings 1,000. All other causes account for 885,000 injuries.

Males have higher overall injury rates than females: 2.4 times higher for fatal injuries, 1.2 times higher for hospitalized injuries, and 1.4 times higher for nonhospitalized injuries. Adolescents and young adults 15 to 24 years old have the highest overall injury rate. The largest proportion of injuries (34 percent) occurs among people 25 to 44 years old, followed by 15 to 24 year olds (22 percent). Age and sex patterns of incidence vary by cause and class of injury.

Results

Incidence. One of every four Massachusetts residents is injured each year, or approximately 1.4 million persons in 1989. For every person who dies from an injury, an estimated 17 people are hospitalized, and an estimated 535 people suffer injuries but are not hospitalized. Overall, injury rates tend to be lower in Massachusetts than in the nation as a whole. However, the comparison of crude rates is misleading. Unintentional injury rates tend to be higher in rural areas (9), and Massachusetts is primarily urban. Also, injury rates are higher for younger persons, and the population of Massachusetts is slightly older than the population of the United States as a whole.

Motor vehicle crashes are the leading cause of death from injury and the second leading cause of nonfatal injuries (hospitalized and nonhospitalized) for Massachusetts residents (table 1). Falls are the leading cause of nonfatal injuries and the second leading cause of death from injury (equal to poisonings). Almost a third (31 percent) of suicides and 44 percent of homicides are committed with firearms. Over all classes of injury, the six major causes of injury rank as follows: falls 306,000, motor vehicles 132,000, poisonings 41,000, fires-burns

Cost. The estimated total lifetime cost for the 1.4 million injuries that occurred in 1989 is \$4.4 billion—\$1.7 billion for health care and \$2.7 billion for lost earnings. Fatal injuries cost an estimated \$1.1 billion or 25.3 percent of the total, but account for only 0.2 percent of all injuries (table 1). Hospitalized injuries cost an estimated \$2.2 billion or 49.1 percent of the total, but account for only 3.1 percent of all injuries. Nonhospitalized injuries cost an estimated \$1.1 billion or 25.5 percent of the total and 96.7 percent of all injuries.

Motor vehicle crashes account for the highest cost of fatal (\$379 million) and nonhospitalized injuries (\$300 million). Falls account for the highest cost of hospitalized injuries (\$855 million). Firearms and drownings-near drownings are responsible for much higher proportions of total cost than of total incidence—4.8 percent and 0.4 percent for firearms and 1.3 percent and 0.1 percent for drownings-near drownings, respectively. Over all classes of injury, the six major causes rank as follows: motor vehicles (\$1.2 billion), falls (\$1.2 billion), poisonings (\$310 million), firearms (\$213 million), fires-burns (\$97 million), and drownings-near drownings (\$58 million). All other causes account for \$1.3 billion.

Table 2. Estimated lifetime cost of injury in 1989 dollars (millions) by cause and age group for Massachusetts, 1989

Cause and cost	Total	Age group (years)				
		0-14	15-24	25-44	45-64	65 or older
<i>Total</i>						
Health care.....	\$1,695	\$206	\$304	\$439	\$253	\$494
Lost earnings.....	2,710	153	683	1,321	397	156
<i>Motor vehicles</i>						
Health care.....	418	30	129	151	58	50
Lost earnings.....	822	58	268	381	91	25
<i>Falls</i>						
Health care.....	587	52	34	66	67	369
Lost earnings.....	564	45	127	220	93	80
<i>Poisonings</i>						
Health care.....	56	7	10	16	8	17
Lost earnings.....	254	1	37	178	31	8
<i>Firearms</i>						
Health care.....	26	1	11	11	2	1
Lost earnings.....	188	2	62	98	21	3
<i>Fires, burns</i>						
Health care.....	31	7	5	10	3	5
Lost earnings.....	66	7	16	29	12	2
<i>Drownings</i>						
Health care.....	2	1	0	1	0	0
Lost earnings.....	56	5	13	30	7	1
<i>Other</i>						
Health care.....	575	108	116	184	115	51
Lost earnings.....	761	33	162	385	143	38

NOTE: Estimated costs for health care and lost earnings have been rounded to the nearest million; numbers may not add to totals because of rounding.

Residents 65 years or older account for the largest proportion (29 percent) of the estimated lifetime cost of health care due to injury (table 2), followed by those 25 to 44 years old (26 percent). Residents 25 to 44 years old account for the largest proportion of lost earnings (49 percent).

Age and sex patterns of cost vary by cause and class of injury. For example, elderly women hospitalized for falls account for more lifetime health care expenditures than any other individual age-sex group for any other individual class or cause of injury. Men 25 to 44 years old who died as the result of motor vehicle crashes account for more lifetime lost earnings than any other individual age-sex group for any other individual class or cause of injury.

Discussion

The incidence and cost data for Massachusetts presented in this report are conservative estimates based on available data and methodologies. Injuries have a significant impact on the people, health care systems, and economy of Massachusetts. If current knowledge about injury prevention strategies were applied, human suffering, lost lives, and health care costs could be reduced. Injuries are a multifaceted

problem and require a multifaceted approach to prevention. Education, the enactment and enforcement of legislation, and the use of technology have proven effective in reducing the injury toll.

Accurate and comprehensive data for all classes of injury are needed (a) to develop, improve, and evaluate prevention strategies, (b) to target high-risk groups, (c) to allocate scarce resources, (d) to formulate public health policy, and (e) to support passage of legislation. For example, the cost of injuries from motor vehicle crashes was used by advocates to support the recent passage of a universal safety belt law in Massachusetts.

The cause of injury (E code) is required on death records but is not required on hospital discharge or emergency department records. Injury surveillance, both statewide and community-based, would be more useful if cause of injury were coded on all records. The revised national uniform billing form (UB-92) for hospitals includes a separate field for an E code, and several States have mandated E-coding of hospital discharge records (10). As of January 1, 1994, Massachusetts' acute care hospitals were required to include E codes on discharge abstracts submitted to the Massachusetts Rate Setting Commission.

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Development of a State-based cost report can be useful in monitoring the contribution of injuries to health status and in planning effective injury prevention strategies in a community-based health care system. If more consensus on definitions and methods were developed nationally, comparisons across States could be useful in designing and implementing regional and national injury prevention policies and programs. The methodology described in this report can be replicated by other States through accessing their State-specific mortality and hospital discharge data bases.

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