
Data Watch

Shooting In The Dark: Estimating The Cost Of Firearm Injuries

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Abstract: The cost of firearm injuries in the United States in 1990 was an estimated \$20.4 billion. This includes \$1.4 billion for direct expenditures for health care and related goods, \$1.6 billion in lost productivity resulting from injury-related illness and disability, and \$17.4 billion in lost productivity from premature death. While these are the best available national estimates, it is likely that they underestimate the economic impact of firearm injuries because they are based on relatively old data and on many assumptions necessitated by data gaps. The need for better data and improved estimates, and their policy relevance, are discussed.

Firearm injuries result in substantial health care expenditures, illness, and death. Firearms are the second leading cause of injury death in the United States. In fact, they are the second most frequent cause of death overall for youth ages fifteen to thirty-four.¹ In 1988 firearm injuries resulted in nearly 34,000 deaths: 1,501 unintentional deaths, 18,169 suicides, 13,645 homicides, and 442 deaths of unknown intent.² In addition, for every fatal firearm injury, there are many more less serious injuries.

The number of firearm injuries has increased dramatically in recent years. The firearm death rate increased 160 percent nationwide between 1960 and 1980, while the rate for other homicides declined.³ The Senate Committee on the Judiciary reports that the number of murders in the United States increased 25 percent between 1985 and 1991, and this is attributed to an increase in the use of assault guns, increased illegal drug activity, and increased numbers of young adults ages eighteen to twenty-four.⁴ Growing public attention is being focused on the problems of firearms and children.⁵

The costs associated with firearm injuries are correspondingly high. To determine what policies should be implemented to reduce the burden of firearm injuries, it is necessary to have a measure of their economic cost to society. This measure can help policymakers to determine which interventions and treatments are cost-effective. Understanding the economic impact of firearm injuries is particularly important because of the controversial

nature of some interventions (for example, gun-control policies), which need to be evaluated objectively.

Despite the magnitude of the problem, few studies have focused on the economic consequences of firearm injury. There has been some research on fatal firearm injuries and hospitalization costs but very little work on the long-term costs and consequences of less severe firearm injuries. Public funds cover a substantial proportion of medical care costs for persons injured by firearms.⁶ This DataWatch reviews the state of knowledge of firearm injury costs. It presents detailed estimates that were developed as part of a larger study of the 1985 cost of all injuries and updates them to 1990.⁷ While these estimates are the best available at the national level, they rely on dated information, state-level data, and many assumptions necessitated by gaps in the data.

Past Research On The Cost Of Firearm Injuries

Past studies of the cost of firearm injuries are few and have focused primarily on hospitalization costs at single hospitals. Michael Martin and colleagues calculated the costs of initial hospitalization for 131 firearm injuries treated at San Francisco General Hospital in 1984.⁸ Costs were based on hospital records and were found to be \$6,915 per person for initial hospitalization.

Garen Wintemute and Mona Wright reviewed medical records for 250 patients treated for firearm injuries at the University of California, Davis, Medical Center from January 1984 through June 1985 and also any subsequent hospitalizations through June 1989.⁹ They found that 12 percent of the patients were rehospitalized and that half of the readmissions occurred during the first year following the injury. Average costs per person were \$13,190 for the initial hospitalization and \$6,310 for readmission. Diane Moribido found that the average hospital cost for 306 firearm-injured persons under age twenty-five admitted to Highland Hospital in Oakland, California, during 1987 and 1988 was \$11,517.¹⁰ The average cost for persons seen in the emergency room only (and released because their injuries were minor or they died) was \$1,238 for the same time period.

Edwin Hayashi and colleagues recently estimated the cost of hospitalization, morbidity, and mortality for 134 cardiovascular gunshot-wound patients admitted to San Francisco General Hospital between 1980 and 1990.¹¹ Average hospitalization costs were \$15,004 per patient; lost productivity costs due to injury were \$33,077 per patient, and due to death, \$247,707 per patient. While these patients are among the most severely injured, the \$40 million total societal cost and the \$2 million cost for hospitalization alone illustrate the huge amount of resources that are re-

quired for only a few patients.

Updating the initial hospitalization estimates from these studies to 1990 dollars (using the percentage change in personal health expenditures for hospital care) yields a range of estimates from \$11,670 to \$21,200.¹² This range reflects the variation in hospital costs and differences in patient populations included. More importantly, these studies capture only a piece of the total picture. None of these studies includes all of the costs incurred by these patients as a result of their firearm injuries. Although Wintemute and Wright include rehospitalization, Moribido includes emergency room charges, and Hayashi and colleagues include indirect costs, the costs of medications, outpatient physician and other professional services, home care, and other costs are not considered in any study. Furthermore, these studies are limited to patients who are hospitalized as a result of their injuries. Many fatally injured patients die before hospital admission, and many more firearm-injured patients do not require hospitalization but do seek medical attention or miss productive days. To enable full understanding of the economic impact of firearm injuries, all costs must be included and all severities of injuries must be considered.

Methodology

The most comprehensive estimate of total firearm-injury costs at the national level was developed as part of the Cost of Injury report to Congress.¹³ The methodology used to develop those firearm-injury cost estimates is discussed briefly here. Further details are contained elsewhere.¹⁴

The model. Estimating the societal cost of firearm injuries requires an economic model to estimate direct and indirect costs and life years lost. This model estimates lifetime or incidence-based costs. That is, all of the costs associated with new injuries occurring in a given year are included. The cost of firearm injuries is estimated as the product of incidence (the number of persons injured) and the cost per person.

Direct costs are the value of resources that could have been allocated to other uses in the absence of the injury. Direct costs include spending for hospitals and long-term care, physician and other professional services, rehabilitation, medications, emergency transportation, medical equipment, and supplies. Related spending for home modifications also is included. These direct costs represent actual spending for goods and services. Indirect costs are the value of lost productivity due to injuries. Indirect costs represent an economic cost to society but do not result in any dollar expenditures. Included are morbidity cost (the value of days lost from usual activities because of injury) and mortality cost (the current monetary value of future output lost due to premature death). Two alternative measures of lost

productivity that are not dependent on valuing productivity-years of life lost due to injury-related disability and years of life lost due to premature death from injury-also are estimated. The latter are estimated as the difference between age at death and life expectancy.

Estimation. The model was estimated for three classes of injuries for which the class was used as a proxy for severity: fatal, hospitalized, and nonhospitalized injuries. National data were used to the extent possible, but state and regional data were used where national estimates were unavailable. Charges were used as a proxy for costs. The base year of the estimates is 1985.

Fatalities. The number of fatalities was obtained from the 1985 National Mortality Detail File, in which all deaths are coded by external cause. The place of death was assumed to follow the same distribution as that of deaths in Maryland, for which detailed data specific to firearm-related deaths are available. Thus, it was assumed that 65 percent of deaths occurred out of the hospital, 21 percent occurred in emergency departments, and 14 percent occurred after admission to a hospital. This distribution is similar to that for California (60 percent, 28 percent, and 12 percent, respectively).¹⁵

For out-of-hospital deaths, it was assumed that an ambulance was sent to the scene, and one-way charges from the National Medical Care Utilization and Expenditure Survey (NMCUES) were applied. Injured persons who died in the emergency department were assumed to have been transported by ambulance, with charge estimates developed from the NMCUES. These persons also incurred emergency room charges; an average charge per person is derived from the work of Howard Champion, Patricia Gainer, and Elizabeth Yackee.¹⁶ Deaths in the hospital incurred both ambulance and emergency room costs. In addition, hospitalization and physician costs must be considered. Ambulance charges from the NMCUES were used. For these cases, emergency department charges were included in the hospital bill. Per person hospital charges were estimated using the mean cost per firearm death from Maryland data (distributed by age) and adjusting it to reflect U.S. per diem charges. Finally, hospital charges were increased by a factor of 25 percent to allow for physician and other professional fees.¹⁷

Another cost that is relevant to firearm injuries is that of health insurance-namely, overhead and administration. Settlements are excluded because they are transfer payments used to cover the medical costs already estimated. Based on 1985 data, private insurance paid for 30.4 percent of personal health care expenditures, and overhead was 13.1 percent of total premiums.¹⁸ Hence, the health insurance administration cost is estimated to be 4 percent (30.4 percent times 13.1 percent) of medical care cost.

Mortality cost-the value of forgone productivity due to early death-is estimated as the product of firearm injury deaths and the present value of

future earnings. Lifetime earnings for each age and sex take into account life expectancy at each age, labor-force participation, average annual earnings, discounting of future earnings, and wage supplements such as employer contributions for social insurance, pensions, and welfare funds. An estimate also is included for the value of household production, based on a regression analysis of hours of household labor as a function of family structure, education, income, and race.¹⁹ These hours were then valued on the basis of wage rates by activity.

Hospitalized injuries. The number of persons hospitalized for firearm injuries was developed in two steps. First, data from the National Hospital Discharge Survey (NHDS) were used to estimate the number of injured persons. Three years of data (1984-1986) were analyzed to increase the reliability of the 1985 estimates. The NHDS includes discharges, rather than injured persons. Therefore, this data set might overestimate the number of injured persons, because of transfers and readmissions. The number of transfers is less than 2 percent.²⁰ An adjustment was made for readmissions based on data from Maryland and New Zealand.²¹ Unfortunately, the NHDS does not code the external cause of injury. Therefore, the percentage of injuries resulting from firearms was assumed to be the same as the percentage known to occur in Maryland, based on analysis of three years of Maryland hospital discharge data in which almost 60 percent of the discharges include the external cause of injury. This distribution includes the percentage of each nature and severity of injury (for example, thoracic injury with an Abbreviated Injury Severity score of 3) that resulted from firearms.

The first-year direct cost associated with firearm injuries was estimated by applying service use rates to the number of injured persons and then applying average charges, which are derived from several sources including the NMCUES. Costs for later years were obtained as a multiple of first-year costs, with an adjustment factor obtained from analysis of the National Council on Compensation Insurance (NCCI) data file.²²

Morbidity costs represent forgone productivity due to days lost from work or household production. Losses during the first year were estimated by subtracting the earnings (both market and imputed housekeeping services) of the injured person from those of a healthy person of the same age and sex. Losses after the first year were estimated by assuming that persons not working four years after an injury would remain unemployed.²³

Nonhospitalized injuries. Data on nonhospitalized injuries are sorely lacking. The estimates of incidence in this DataWatch were developed from an analysis of 1984-1986 data from the National Health Interview Survey (NHIS). Injuries resulting in medical attention without hospitalization or in one or more days of restricted activity are included. The NHIS does not

include data on external cause of injury (except for motor vehicle injuries). Therefore, it was necessary to distribute injuries by cause by using the NHIS supplement conducted in 1972, the most recent year for which detailed information on the cause of injury for a national sample was obtained.²⁴ This yielded an estimate of the number of nonhospitalized firearm injuries broken down by age, sex, and nature of injury.

The direct cost of nonhospitalized firearm injuries was estimated using NHIS utilization data and NMCUES cost data. Lifetime cost was estimated based on the percentage of cost incurred in later years from the analysis of the NCCI data.²⁵ The morbidity cost of nonhospitalized firearm injury consists of forgone productivity due to days lost from usual activity. Days of restricted activity were calculated from the NHIS for employed persons, persons keeping house, and persons involved in some other activity. Lost days then were multiplied by average daily earnings, an imputed value for housekeeping services, or a weighted average of the two, for the three groups, respectively.

Results

Incidence. In 1985 firearms caused nearly 268,000 injuries, including 31,556 fatalities, 65,127 hospitalizations, and 171,000 injuries that required some outpatient medical care or resulted in at least one day lost from usual activity (Exhibit 1). That is, for every fatal firearm injury, there are an additional two injuries requiring hospitalization and an additional 5.4 injuries not severe enough to be hospitalized. Four-fifths of injured persons in 1985 were male, and young adults ages twenty-five to forty-four were injured most often.

Type of cost. Firearm injuries cost society \$14.4 billion in 1985 (Exhibit 2). The largest proportion of the cost was for fatal injuries—\$12.2 billion (84 percent)—and most of this represents the value of productivity losses from premature death. Hospitalized injuries account for \$2 billion, or 15 percent of the total. For this group, two-thirds of the cost is lost productivity resulting from illness and disability, and the remaining one-third is direct cost, primarily for hospitalization. The cost associated with the nonhospitalized injuries represents only 1 percent of the total cost and is divided almost equally between direct costs and morbidity costs.

The most severe injuries drive the economic impact of firearm injuries, as shown in Exhibit 3. Although fatal injuries represent only 12 percent of the total number of injuries, they account for 84 percent of the societal cost. Conversely, two-thirds of firearm injuries are not severe enough to require hospitalization, and they result in only 1 percent of total costs. On a per person basis, fatal injuries are most costly, considering both the direct and

Exhibit 1
Incidence Of Firearm Injuries By Age, Sex, And Class Of Injury, 1985

Age/sex	Total	Fatal ^a	Hospitalized	Nonhospitalized
Male and female	267,683	31,556	65,127	171,000
0-4 years	303	104	199	0
5-14 years	24,274	590	2,684	21,000
15-24 years	60,299	6,879	28,420	25,000
25-44 years	164,158	13,140	26,018	125,000
45-64 years	12,445	6,398	6,047	0
65 years and older	6,204	4,445	1,759	0
Male	216,083	26,366	56,717	133,000
0-4 years	132	61	71	0
5-14 years	19,650	4,664	2,186	17,000
15-24 years	52,350	5,894	25,456	21,000
25-44 years	128,503	10,831	22,672	95,000
45-64 years	5,261	5,217	4,970	0
65 years and older	10,187	3,899	1,362	0
Female	51,600	5,190	8,410	38,000
0-4 years	1,711	43	1,288	0
5-14 years	4,624	126	498	4,000
15-24 years	7,949	985	2,964	4,000
25-44 years	35,655	2,309	3,346	30,000
45-64 years	2,258	1,181	1,077	0
65 years and older	943	546	397	0

Source: D. Rice et al., *Cost of Injury in the United States* (University of California, San Francisco, Institute for Health and Aging; and The Johns Hopkins University Injury Prevention Center, 1989).

^a Excludes 1,030 deaths occurring in later years as a result of 1985 injuries.

indirect costs: \$374,000 per injured person versus \$33,000 and \$500 per person, respectively, for hospitalized and nonhospitalized injuries. Direct costs per injured person are greatest for hospitalized injuries (\$12,000),

Exhibit 2
Lifetime Cost Of Firearm Injuries By Type Of Cost And Class Of Injury, 1985

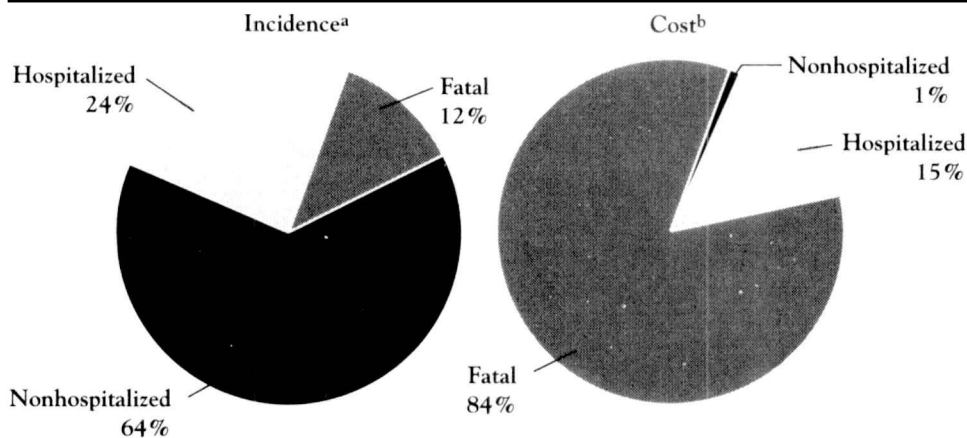
Type of cost	Total	Fatal	Hospitalized	Nonhospitalized
Total cost (millions)	\$14,410	\$12,172	\$2,160	\$78
Direct	911	92	784	36
Morbidity	1,418	0	1,376	43
Mortality	12,080	12,080	0	0
Total cost per injured person	\$53,831	\$373,520	\$33,159	\$458
Direct	3,405	2,813	12,038	209
Morbidity	5,298	0	21,122	250
Mortality	45,127	370,706	0	0
Incidence (1985)	267,683	31,556	65,127	171,000

Source: D. Rice et al., *Cost of Injury in the United States* (University of California, San Francisco, Institute for Health and Aging; and The Johns Hopkins University Injury Prevention Center, 1989).

^a Based on 32,586 deaths, including 1,030 deaths in later years as a result of 1985 injuries.

^b Discounted at 6 percent.

Exhibit 3
Incidence And Cost Of Firearm Injuries, 1985



Source: D. Rice et al., *Cost of Injury in the United States* (University of California, San Francisco. Institute for Health and Aging; and The Johns Hopkins University Injury Prevention Center, 1989).

^a 268,000 injuries.

^b \$14.4 billion.

followed by fatalities (\$2,800) and nonhospitalized injuries (\$200).

Direct cost components. Direct costs are presented in further detail by type of expenditure in Exhibit 4. For fatal injuries, four-fifths of the direct costs represent the cost of hospitalization. These persons also incur costs for emergency room services, ambulance transportation, and health insurance. The direct costs for hospitalized persons are primarily for hospitalization and rehospitalization (84 percent). However, these persons also incur costs for physician and other professional services (9 percent) and nonmedical items. Two-thirds of the direct costs for nonhospitalized firearm-injured persons are accounted for by physician services and emergency room visits.

Gender and age. The fact that males are much more likely than females to be injured by firearms is reflected in the cost (Exhibit 5). Of the total \$14.4 billion cost of firearm injuries, \$12.3 billion (86 percent) is accounted for by males. Most of this cost (\$10.6 billion) is due to male fatalities. Young adults incur most of these costs; more than half of the total cost is for injured persons ages twenty-five to forty-four. Within each class of injury, males specifically and young adults generally account for most of the cost. Per person costs for males (\$57,000) are 1.4 times those for females (\$40,000). Costs per death increase with age up to ages twenty-five to forty-four for males and females. This results from both the lifetime pattern of earnings and the impact of discounting. The lack of clear patterns in the per person costs by age for hospitalized and nonhospitalized injuries reflects the limitations of the data and small sample sizes for the nonhospitalized estimates.

Exhibit 4
Lifetime Direct Cost Of Firearm Injuries, By Type Of Expenditure,
Thousands Of Dollars, 1985

Type of expenditure	Total	Fatal ^a	Hospitalized	Nonhospitalized
Total direct	\$911,411	\$91,476	\$784,002	\$35,733
Medical	863,586	as,150	741,170	34,266
Hospitalization	455,157	74,678	380,479	0
Physician	54,423	0	39,197	15,226
Emergency room	18,404	9,988	0	8,416
Kehospitalization	279,546	0	279,546	0
Medication	6,078	0	2,658	3,420
Physical therapy	18,114	0	18,114	0
Ambulance	9,335	3,484	5,339	512
Attendant	11,508	0	11,508	0
Other expenses	11,021	0	4,329	6,692
Nonmedical	47,825	3,526	42,832	1,467
Home modification	10,020	0	10,020	0
Vocational rehabilitation	3,723	0	3,626	97
Health insurance	34,082	3,526	29,186	1,370

Source: Unpublished analyses from D. Rice et al., *Cost of Injury in the United States* (University of California, San Francisco, Institute for Health and Aging; and The Johns Hopkins University Injury Prevention Center, 1989).

^a Includes 1,030 deaths in later year as it result of 1985 injuries.

Years of potential life lost. Firearm injuries resulted in 1.4 million years of potential life lost in 1985 (Exhibit 6). Most of these losses are attributable to premature death (1.2 million). However, 187,000 years of productivity were lost because of persons hospitalized from firearm injuries; even nonhospitalized injuries accounted for the loss of 1,350 years. Fatally injured males lost an average of 34.6 years each, and females lost 41.0 years, reflecting the fact that typical victims are relatively young. The per person losses for hospitalized males (2.2 years) and females (7.4 years) indicate the substantial disability that a firearm injury can cause.

Updated costs. Estimates for 1985 were updated to 1990, taking into account both inflationary and real changes. Direct costs were adjusted using the percentage change in personal health care spending between 1985 and 1990.²⁶ These data incorporate inflation into the medical care market as well as the effect of changing demographics and patterns of health care use. Cost components were adjusted separately using personal health care spending on hospital care, physician services, other professional services, drugs, other personal health care, and program administration and net cost of insurance. For indirect costs, inflation and real change were estimated separately. The increase in hourly compensation in the business sector from 1985 to 1990 was used for inflation, the change from 1985 to 1990 in the number of episodes of persons injured was used to reflect real change for morbidity, and the change in firearm-injury deaths from 1985 to 1990 was

Exhibit 5
Lifetime Cost Of Firearm Injuries, By Age, Sex, And Class Of Injury,
Total And Per Person, 1985

Total cost ^a	Total	Fatal ^b	Hospitalized	Nonhospitalized
Male and female	\$14,409,544	\$12,171,513	\$2,159,631	\$78,400
0-4 years	32,842	22,924	9,918	0
5-14 years	293,403	208,556	80,989	3,858
15-24 years	4,204,064	3,465,337	731,764	6,963
25-44 years	7,837,865	6,820,229	950,057	67,579
45-64 years	1,848,283	1,546,806	301,477	0
65 years and older	193,087	107,661	85,426	0
Male	12,328,116	10,567,262	1,694,188	66,666
0-4 years	19,556	14,502	5,054	0
5-14 years	240,553	171,988	65,372	3,193
15-24 years	3,668,595	3,057,966	604,666	5,963
25-44 years	6,740,014	5,921,904	760,600	57,510
45-64 years	1,534,544	1,314,396	220,148	0
65 years and older	124,854	86,506	38,348	0
Female	2,081,428	1,604,251	465,443	11,734
0-4 years	13,286	8,422	4,864	0
5-14 years	52,850	36,568	15,617	665
15-24 years	535,469	407,371	127,098	1,000
25-44 years	1,097,851	898,325	189,457	10,069
45-64 years	313,739	232,410	81,329	0
65 years and older	68,233	21,155	47,078	0
Cost per injured person				
Male and female	\$ 53,831	\$373.520	\$ 33,160	\$458
0-4 years	108,389	220,423	49,839	0
5-14 years	12,087	270,852	30,175	184
15-24 years	69,720	471,603	25,748	279
25-44 years	47,746	507,646	36,515	541
45-64 years	148,516	240,299	49,856	0
65 years and older	31,123	23,962	48,565	0
Male	57,053	387,221	29,871	501
0-4 years	148,152	237,738	71,183	0
5-14 years	12,242	267,062	29,905	188
15-24 years	70,078	486,937	23,753	284
25-44 years	52,450	533,409	33,548	605
45-64 years	150,637	250,075	44,295	0
65 years and older	23,732	21,917	28,156	0
Female	40,338	309,104	55,344	309
0-4 years	77,696	195,860	38,000	0
5-14 years	11,429	290,222	31,359	166
15-24 years	67,363	381,434	42,881	250
25-44 years	30,791	385,051	56,622	336
45-64 years	138,946	196,791	75,514	0
65 years and older	72,357	38,745	118,584	0

Source: Unpublished analyses from D. Rice et al., Cost of Injury in the United States (University of California, San Francisco. Institute for Health and Aging; and The Johns Hopkins University Injury Prevention Center, 1989).

^a Thousands of dollars.

^b Based on 32,586 deaths, including 1,030 deaths in later years as a result of 1985 injuries.

Exhibit 6
Years Of Potential Life Lost Because Of Firearm Injuries,
Total And Per Injured Person, 1985

	Total	Morbidity (hospitalized)	Morbidity (nonhospitalized)	Mortality ^a
Male and female	1,350,467	187,117	1,350	1,162,000
Male	1,071,013	124,853	1,160	945,000
Female	279,454	62,264	190	217,000
Per injured person				
Male and female	—	2.87	0.01	35.7
Male	—	2.2	0.01	34.6
Female	—	7.4	0.00	41.0

Source: Unpublished analyses from D. Rice et al., *Cost of Injury in the United States* (University of California, San Francisco, Institute for Health and Aging; and The Johns Hopkins University Injury Prevention Center, 1989).
 a Includes 1,030 deaths that occurred in later years as a result of 1985 injuries.

used to reflect real change for mortality.²⁷

In 1990 the total cost of firearm injuries is estimated to have been \$20.4 billion (Exhibit 7). Taking into account changes in the number of injuries, patterns of health care use, and inflation, the cost of firearm injuries increased 42 percent in the five-year period from 1985 to 1990. Direct costs show the greatest increase over that period—55 percent.

Discussion And Policy Implications

The estimates of the cost of firearm injury in the United States detailed here are based on the best data available but have some limitations that must be acknowledged. They rely on some relatively old studies for firearm-injury incidence. Data on the number of nonfatal firearm injuries are scarce and often conflicting. The last national survey to collect data on cause of injury, health service use, and health status was the NHIS supplement conducted in 1972-1973.²⁸ Given the well-documented increase in rates of

Exhibit 7
Cost Of Firearm Injuries, By Type Of Cost And Class Of Injury,
Millions Of Dollars, 1990

	Total	Fatal	Hospitalized	Nonhospitalized	Percent increase over 1985
All costs	\$20,417	\$17,502	\$2,806	\$109	42%
Direct	1,410	141	1,209	60	55
Morbidity	1,647	0	1,597	50	16
Mortality ^a	17,361	17,361	0	0	44

Source: Authors' calculations.

^a Discounted at 6 percent.

firearm injuries, it is likely that this survey greatly underestimates the number of firearm injuries. While Cost of Injury reported 7.5 nonfatal firearm injuries for each fatality, other researchers report ratios ranging from 3:1 to 105:1.²⁹ The American Medical Association (AMA) Council on Scientific Affairs summarized this aptly: "There are virtually no reliable data on the number of nonfatal firearm injuries."³⁰ Until national data sets such as the NHDS and the NHIS code injuries by external cause, making it possible to identify firearm injuries, it will be difficult to develop good incidence estimates.

A number of assumptions made to derive the national estimates described here may not be appropriate for firearm injuries. For example, private health insurance coverage for persons injured by firearms is probably much less than average because persons with firearm injuries are often of below-average socioeconomic status, which suggests less likelihood of insurance coverage. Coverage through Medicaid and other public programs, on the other hand, is probably relatively high. However, this cannot be documented from national data. Productivity-loss estimates assume average income levels, but it is generally thought that the population most likely to suffer gunshot wounds is of below-average income level. Again, this has yet to be documented nationally. Some unresolved economic and ethical issues arise when applying aggregate data to specific subpopulations such as firearm-injured persons, who are known to differ from the statistically average person. In this case, for example, it is known that many firearm assaults occur in the context of illegal drug-related activities. How should one treat illegal income in valuing lost productivity? This issue warrants further study. Suicide, on the other hand, is known to be impulsive and occurs among a cross-section of persons; thus one could argue that these victims' earnings approximate the U.S. average.

Other gaps in the data warrant attention. First, given children's increasing risk of firearm injury, cost estimates developed from data specific to this younger population are needed. Good data on health care use and cost by firearm-injured children are not now available. Also, no attempt is made here to quantify the economic burden of pain and suffering that results from firearm injury. However, other studies have attempted to assign a cost to this loss of quality of life and have found it to be substantial.³¹

Better data sources need to be developed to facilitate improved cost estimates. In particular, current nationally representative data on external cause of injury, long-term consequences of injury, and expenditures are needed. National surveys, including the NHIS and the NHDS, should include coding for the external cause of injury (e-coding) to permit identification of firearm injuries. Many states are now coding hospital discharges by external cause, and all states should be encouraged to do so. The 1987

National Medical Expenditure Survey (NMES) provides updated expenditure estimates and permits the analysis of payer sources, but firearm injuries cannot be identified. Future expenditure surveys should include e-coding. Longitudinal data on health care use and expenditures should be developed that permit the identification and tracking of firearm injuries over time.

Mitigating the impact of violence. Firearm injuries represent less than 0.5 percent of the total number of injuries, yet they account for 9 percent of the total costs of all injuries.³² The cost per firearm fatality is higher than for any other type of fatal injury or for any of the four leading causes of death. Firearm injuries are responsible for greater morbidity per person than are any other injuries. Hence, firearm injuries are relatively more costly compared with both other injuries and other illnesses in general.

These costs represent a huge potential liability for health care providers and payers. A study at a Los Angeles trauma center of patients admitted with intentional injuries found that 75 percent of their hospital costs were uncompensated.³³ During the years studied—1986 and 1988—one-third to two-thirds of these patients suffered gunshot wounds. This has important implications for the trauma care system. Elsewhere in this volume Donald Trunkey discusses the reasons for the large number of trauma center closings. Several studies cite the high cost of uncompensated care as a primary reason. Reducing the number of firearm injuries, which are known to be costly both in total economic terms and in terms of public dollars, would help to mitigate a major problem in trauma center financing.

From a public health perspective, then, the most important question regarding firearm injuries is how to prevent them. We need to develop policies that reduce the likelihood of firearm injury. Good cost estimates are needed to determine which approaches are cost-effective and to convince policymakers that resources should be used for firearm interventions as opposed to other competing uses. A number of interventions have been proposed—such as imposing waiting periods and requiring background checks for potential gun buyers, redesigning firearms, limiting types of weapons available, and so forth—but the absence of good cost data makes it impossible to evaluate these policies effectively.

Estimating the cost of firearm injuries given available data really is “shooting in the dark.” It is likely that the estimates presented here grossly underestimate the economic impact of firearm injuries in the United States. We simply do not know the number of people injured by firearms, and cost data specific to this population are inadequate. Yet these estimates are critical elements in any rational debate of firearm policy. We must work to refine our data sources and estimates for measuring the economic burden of firearm injuries, to better inform the national debate on firearm policy.

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