

The Economic Impact of Injuries: A Major Source of Medical Costs

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Abstract: Data from the 1980 National Medical Care Utilization and Expenditure Survey were analyzed to place the costs for injuries in the context of all medical costs and to describe the distribution by demographic and diagnostic groups. For the non-institutionalized population, injuries, which include intentional and unintentional, were the second leading cause of direct medical costs, accounting for \$16,745 million in medical care expenditures and a major contributor to work loss and disability in the US. For the working-age population (17-64 years) injuries were the leading cost category (\$11,341 million) and the third most costly category for persons 65 years of age and

over (\$3,479 million). The preponderance of costs were attributable to hospital-based care. Direct medical costs were disproportionately greater for males, White and other persons, and for those with household incomes less than \$5,000. Injury morbidity also accounts for major indirect costs. Fractures accounted for the highest direct medical costs, greatest per capita charges (based on those with charges), and largest number of restricted activity days. These national estimates document the economic importance of injuries and direct public attention to policy imperatives related to research and prevention. (*Am J Public Health* 1990; 80:453-459.)

Introduction

Injuries are the most common cause of death in the United States for persons under the age of 44.¹ In 1986, unintentional injuries ranked as the leading cause of years of potential life lost before age 65.² This consideration and the high incidence of injuries and consequent disability have directed public attention to this problem.^{1,3} Despite the frequency of accidental injury, there is a relative paucity of national data on medical costs and morbidity. There appears to be a major disparity between health costs (both direct and indirect) and research investment for prevention and management.¹ However, valid estimates of the national economic impact have not been available until recently^{4,5} and these total estimates do not provide a full understanding of the impact of accidents and injuries in various age-sex groups. Information on direct medical costs and indirect costs from disability could provide an economic perspective that would buttress recommendations for greater public investment in research in this field.¹ Moreover, the distribution of costs across demographic and diagnostic categories affords a background understanding of utilization that could lead to focused efforts at prevention and cost containment.

To provide a picture of the national expenditures for injuries, we have analyzed data from the 1980 National Medical Care Utilization and Expenditure Survey (NMCUES). This survey provides the most recent national data on the costs of injuries, which include both intentional and unintentional injuries.

Methods

NMCUES, national survey of health expenditures and use of personal health services, was conducted by the National Center for Health Statistics and the Health Care Financing Administration during 1980 on a national sample of the civilian, non-institutionalized population of the United States. The survey included persons living in 6,600 house-

holds. The sample design was a multi-stage probability sample drawn from 135 primary sampling units representing the 50 states and the District of Columbia. Data on 17,123 persons were collected from February 1980 through April 1981. Data were analyzed for Whites and others in one racial category and Blacks in another. The "other" category included American Indians, Alaskan Natives, Asians, and Pacific Islanders. These individuals accounted for approximately 2.5 percent of the "White and other" category. The effect of "others" in the "White and other" category would be expected to be very small. Approximately 7 percent of the NMCUES sample reported themselves as Hispanic. The sample weight was constructed based on race, not ethnicity. The Hispanics are distributed across the racial categories, most being in the White racial category. The estimates obtained if Hispanics were analyzed separately would be non-representative.

Interviews were conducted with each household at approximately three-month intervals. The first two interviews were conducted during a personal household visit by an interviewer; the next two were conducted by telephone; and the final interview was a personal household visit. At the first interview, the respondent was given a diary and asked to record occurrences, conditions, and functional impairments. In addition, the respondent was to record all charges for illnesses and injuries irrespective of who paid these charges, i.e., Medicare, Medicaid, private insurance, or out-of-pocket expenses. Subsequent telephone and personal interviews focused on these diaries. The final response rate was 87.9 percent when attrition over the course of interviewing was taken into account. Detailed information on the survey design, sampling bias, instruments, and statistical analyses are available in several monographs.⁵⁻⁸

The public use files of NMCUES were used for these analyses after edits were performed as outlined in the NCHS methodological monograph.⁷ Conditions were coded using the International Classification of Diseases, ninth revision, ICD-9⁹ and special NCHS codes¹⁰ and grouped into 18 broad diagnostic categories. This report focuses on the "injuries and poisonings" category. In this report, these are referred to as "injuries." The injury category comprised the diagnostic groupings and the relevant ICD codes shown in the Appendix.⁹ Both intentional and unintentional injuries are included in these analyses. It was not possible to determine from the data the cause of the injury.

Direct costs for these analyses were defined as charges incurred and reported for inpatient and outpatient care,

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physician and allied health services, prescribed medication and selected medical equipment and other services. The reports of costs were not verified so it is likely that there was an underreporting of actual charges. Some groups probably underreported their charges more than others. Individuals covered by Medicaid, General Assistance or Veterans Administration benefits may not be informed by the payer of the actual charges and may thereby underestimate charges more than other groups.⁵ In addition, these data include information only on civilian, non-institutionalized individuals. Costs related to individuals in hospitals, nursing homes, and other institutions or the military would not be represented here.

Disability attributable to these diagnostic groups was categorized into restricted activity (usual activity restricted by illness), bed disability (confined to bed more than half a day), and work loss (lost work because of illness). Restricted-activity days is the most inclusive category and include bed-disability days. Bed-disability days include all hospital days, even if a bed was not occupied. The complex sample design, sampling and respondent biases, and entry or attrition from the survey during the survey year were taken into account in the analysis using procedures described in a methodological monograph.⁷ Use of these procedures permits national estimates to be made.

Results

Direct Costs

Direct medical costs for injuries comprised the second largest source of expenditures for medical care in the United States during 1980 (Figure 1). The estimated \$16.8 billion for injuries represents 12 percent of all direct costs. This amount was exceeded only by an estimated \$20 billion in charges for diseases of the circulatory system.⁵

The distribution of medical costs for the four leading condition categories is presented by age groups in Figure 2. Injury and poisoning ranked among the top cost categories for three of the four age groups (<17 years, 17 to 44 years, and >65 years). Injury costs were the greatest (\$9 billion) for young adults (17 to 44 years). This diagnostic category was the third largest contributor to medical costs for older Americans (65 years and over) and was exceeded only by costs related to circulatory conditions and neoplasms. When only the working-age population (17–64 years) was considered, full-time or part-time workers had injuries and poisonings as their major source of medical costs. In contrast, persons not employed had greater charges from other diagnostic categories, generally chronic diseases.⁶

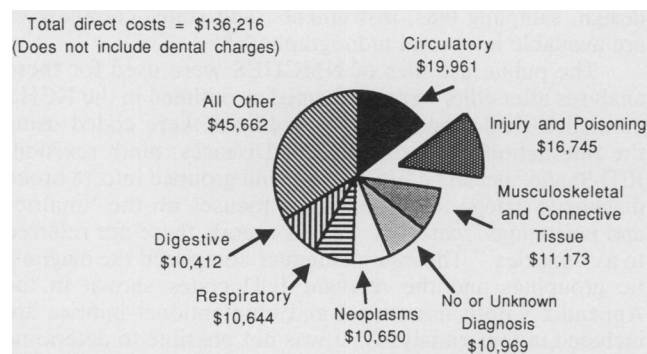


FIGURE 1—Direct Medical Costs for US Civilian Non-institutionalized Population, 1980 (in \$ millions)

SOURCE: National Medical Care Utilization and Expenditure Survey

The proportion of medical costs attributable to injuries are presented by demographic characteristics in Figure 3. Medical costs for injuries are presented as the proportion of total direct medical costs for each referent group; the denominator is the total direct cost for all conditions for that group. Injuries accounted for a greater proportion of medical costs for males than for females. White and other persons also had proportionately greater medical costs attributable to injuries than did Black persons. The distribution of injury costs across income groups indicates that persons with family incomes less than \$5,000 had a greater proportion of medical costs attributable to injuries than did those in the other income groups. The lower income group (<\$5,000) comprised 7.3 percent of the total population, but their total injury costs accounted for 10.3 percent of all injury costs. Thus, the lowest income group had disproportionately greater costs for injuries and disproportionately higher health care expenditures.

The injury category was separated into 11 diagnostic groups which followed the ICD-9 diagnostic categories. The direct costs were determined for each of these groups. The costs attributable to each diagnostic group are presented in Table 1, as are the distributions by age group, sex, and race. Fractures, which includes skull fractures, were responsible for the greatest expenditures and generated \$6.4 billion in charges or almost 40 percent of total costs for injuries. The early treatment of trauma (\$2.6 billion) and management of the late effects of trauma (\$1.7 billion) were also major sources of costs. Sprains and dislocations, wounds (including blood vessel injuries) and complications of medical and surgical care were the only other diagnostic groups leading to over \$1 billion per year.

There were important variations in diagnostic group costs by age, sex, and race (Table 1). The costs attributable to fractures, the most costly category, varied by age group from 27 percent (<17 years) to 43 percent (>65 years). Fractures accounted for more costs for females (42 percent) than for males (35 percent). Black persons had 44 percent of injury costs attributable to fractures in contrast to 38 percent for White and other persons. The costs associated with early treatment of trauma were highest for the 45 to 64 year old group, for females, and for Black persons. This grouping includes multiple traumatic injuries, but excludes specific traumatic diagnoses such as fractures and burns. Costs associated with later effects of trauma were greatest for those over age 65 years, for females, and for White and other persons. Sprains and dislocations generated relatively low charges for those over 65 and for females. Wounds accounted for 21 percent of costs for those under 17 years and wounds and fractures together accounted for almost half (48 percent) of costs in this age group. Poisoning costs were overwhelmingly associated with females and were highest in the 17 to 64 year old group. Costs for burns were higher for males than for females and for those 45 to 64 years.

The immediate cause of the injury (e.g., vehicular accident, fall, attempted suicide, etc.) and contributing causes (e.g., alcohol ingestion, speeding, etc.) were not recorded in NMCUES. Therefore, only indirect inferences can be made about causation. The distribution of injuries suggest a relatively greater cost impact of trauma, i.e., sprains, wounds and head injuries, from leisure and work activity on young males and greater cost impact on older women from fractures and late sequelae of trauma.

These aggregate direct costs do not disclose the costs on a per occurrence or per person basis or the allocation of costs

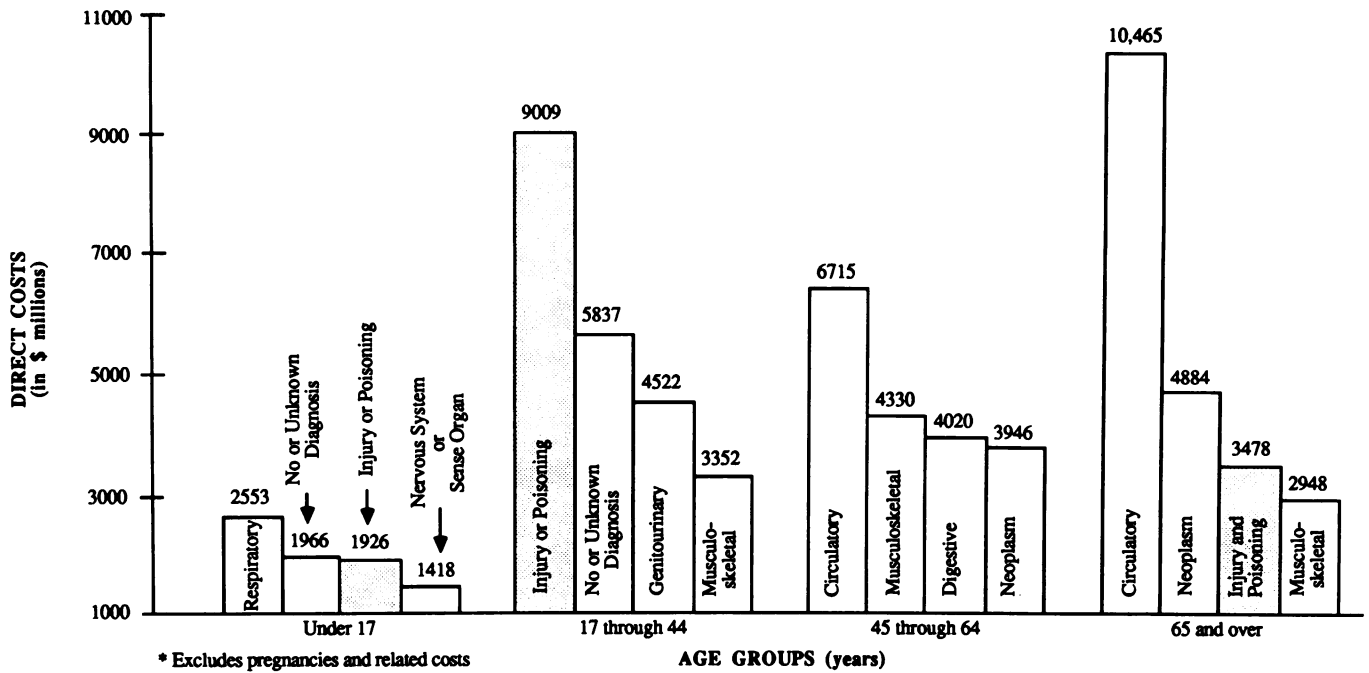


FIGURE 2—Direct Medical Costs for All Persons by Four Leading Diagnostic Categories, Cost, and Age

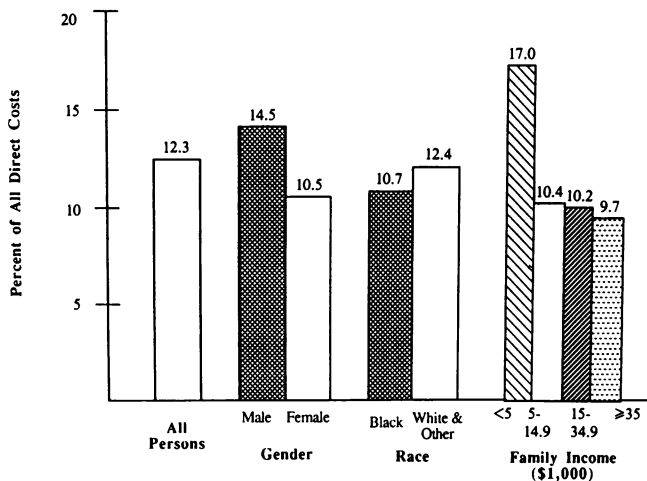


FIGURE 3—Proportion of Total Direct Medical Costs Attributable to Injuries by Demographic Groups
SOURCE: National Medical Care Utilization and Expenditure Survey

across components of care. Therefore, the per capita charges were determined for the diagnostic categories and divided into the charges for four types of health services: hospital care (including emergency room), ambulatory medical care (including outpatient physician charges), hospital physician charges, and medication charges (Table 2). The per capita charges are based on mean cost per individual having charges under each diagnostic and health service category. On a per capita basis, the highest charges were for management of the late effects of trauma and for fractures. For the other diagnostic groups, the rank order of per capita charges differed somewhat from the rank order of total direct charges (Table 1). Sprains had relatively low per capita costs but high aggregate costs because of greater frequency. On the other hand, burns had high per capita costs but low aggregate costs. The most striking finding regarding per capita charges is that

the preponderance of charges for each diagnostic code (except sensory impairment) were generated by hospital care, which includes emergency room services. However, for the diagnostic categories of foreign bodies, burns, and sensory impairment, the estimates are unstable because fewer than 10 individuals in NMCUES were hospitalized in each category during the survey. The next highest category of charges were for physicians' hospital services. Only small charges ranging from \$12 to \$71 were reported for medications and from \$57 to \$224 for ambulatory care. Therefore, over 90 percent of per capita costs for most injury categories were related to hospital-based care.

Disability

Disability and work loss are indirect morbidity costs of medical conditions. Although total disability, work loss, and restricted-activity days were collected on each individual, a single day could be assigned to several conditions. Therefore, days lost for each condition were calculated by multiplying the weighted proportion of days lost due to the condition of interest by the total days lost. A national estimate of 932,300 person years of restricted activity and 292,300 person years of bed disability were attributable to injuries. These days represent about 10 percent of days attributable to all conditions during 1980 and exceed the estimates of disability for circulatory conditions for the same period.¹¹

Restricted-activity and bed-disability days are presented for the diagnostic groups in Figure 4. Fractures were responsible for the greatest mean number of restricted-activity and bed-disability days at all ages. For persons age 65 years and older, the mean number of days approximately doubles. Similarly, two- to three-fold greater disability occurred for older adults with head and internal injuries, late effects of trauma, and complications of medical and surgical care. For sprains, burns, and early effects of trauma, there were no differences by age. On the other hand, poisonings, sensory impairment, and wounds had lower mean days of restricted activity or bed disability for older persons, but the frequency

TABLE 1—Direct Medical Costs for Diagnostic Codes by Age Group, Gender and Race: National Medical Care Utilization and Expenditure Survey, 1980

Diagnostic Category	Total Charges* (in \$millions)		Age Group				Gender		Race	
			<17	17-44	45-64	65+	Male	Female	White & Other	Black
	\$	(%)								
Fractures	\$ 6421	(38.3)	524	3678	709	1510	3071	3350	5763	658
Early Complications of Trauma	2602	(15.5)	280	1171	510	641	1103	1499	2317	285
Late Effects of Trauma	1694	(10.1)	222	730	103	638	695	998	1668	26
Sprains, Dislocations	1599	(9.5)	240	944	295	120	1048	551	1438	161
Wounds (including blood vessels)	1565	(9.3)	406	849	150	160	1089	476	1456	109
Iatrogenic†	1152	(6.9)	87	586	185	295	634	519	1104	49
Head Injuries	816	(4.9)	53	680	55	29	633	183	692	124
Poisonings	383	(2.3)	30	226	80	47	26	357	348	35
Burns	281	(1.7)	36	51	190	4	225	55	264	17
Foreign Body Entry	132	(0.8)	26	54	30	23	70	62	107	25
Impairment of Senses	100	(0.6)	22	40	25	12	80	19	96	4
Total**	16745	(99.9)	1926	9009	2332	3479	8674	8069	15253	1493
(proportion of Total Costs)			(11.5)	(53.8)	(13.9)	(20.8)	(51.8)	(48.2)	(91.1)	(8.9)

*Does not include charges for dental services.

**Do not necessarily add to \$16745 due to rounding.

†Complications of medical and surgical care.

TABLE 2—Per Capita Medical Charge for Individuals with Charges by Diagnostic Codes, National Medical Care Utilization and Expenditure Survey, 1980

Diagnostic Category	Hospital	Ambulatory	Hospital Physi- cian	Prescription & Other Service
Fractures	4548	194	986	39
Late Effects of Trauma	3818	104	1005	33
Early Complications of Trauma	2198	87	112	23
Iatrogenic†	2138	113	1017	27
Burns	2104	67	985	18
Poisonings	1763	57	196	12
Wounds (including blood vessels)	1279	90	776	16
Sprains, Dislocations	1271	102	483	18
Head Injuries	1260	224	449	53
Foreign Body Entry	669	74	263	17
Impairment of Senses	205	175	1068	71
All Injuries	2879	123	817	27

†Complications of medical and surgical care.

was low and the estimates unstable. In general, bed-disability days comprise less than half of restricted activity except for those over age 65 years who had fractures, head and internal injuries, and late effects of trauma. Although not reported here, the distributions of disability by gender and race were similar to the distributions of direct and per capita costs.

Work-loss days were estimated for the working age-population (17 to 64 years), both men and women. The total work loss attributable to injuries was 247,900 person years. This represents 14 percent of all work-loss days attributable to illness. The mean work-loss days by diagnostic groups are plotted in Figure 5. Fractures were responsible for the highest mean work-loss days. Sensory impairment, head and internal injuries, sprains, burns, and the early and late effects of trauma are the other injuries that resulted in a mean work loss of five days or more. There were important differences between men and women for several of the condition groups. Men had more work-loss days than women from all conditions except sensory impairment and fractures. Although not shown, there were no important trends by race, except for greater mean work-loss days for Black persons attributable to

early and late treatment of trauma.

Discussion

These analyses confirm that injuries are a major source of medical costs, both direct medical charges and indirect costs of illness, as measured by disability days. Injuries are the second leading cause for direct medical costs in the civilian, non-institutionalized population. This cost burden is spread across all ages. Injuries are the leading contributor to medical costs for persons 17 to 44 years of age. Importantly, injuries also account for a considerable proportion of medical costs for Americans, age 65 years and over. For this older group, only circulatory conditions and neoplasms are responsible for higher costs. The general perception that medical expenses in older, non-institutionalized persons result primarily from chronic diseases and infections contrasts with these national findings.

These survey data underestimate the actual economic impact on the elderly because NMCUES did not survey institutionalized persons who represent an important proportion (about 10 percent) of those over age 65 years. As such, NMCUES does not address the cost burden related to institutionalized individuals. Hodgson and Kopstein have reported that the costs for this group are different than those living in the community.⁴ Using a variety of data sources, they estimated that per capita expenditures for the elderly institutionalized and non-institutionalized population rank injuries as the 4th and 8th, respectively for women and men. These authors also found that although only 11 percent of the population is over the age of 65, they consume about 31 percent of the personal health care dollars. Therefore, the total cost estimates for the US population would be greater than estimated from this survey. Rice, *et al*, reported that when institutionalized and non-institutionalized elderly are included that diseases of the circulatory system account for 31 percent of the total direct costs.¹² Because the elderly contribute disproportionately to total costs and because chronic disease is responsible for a greater proportion of the cost when institutionalized persons are included, injuries would account for a somewhat lower proportion of medical costs for the elderly.

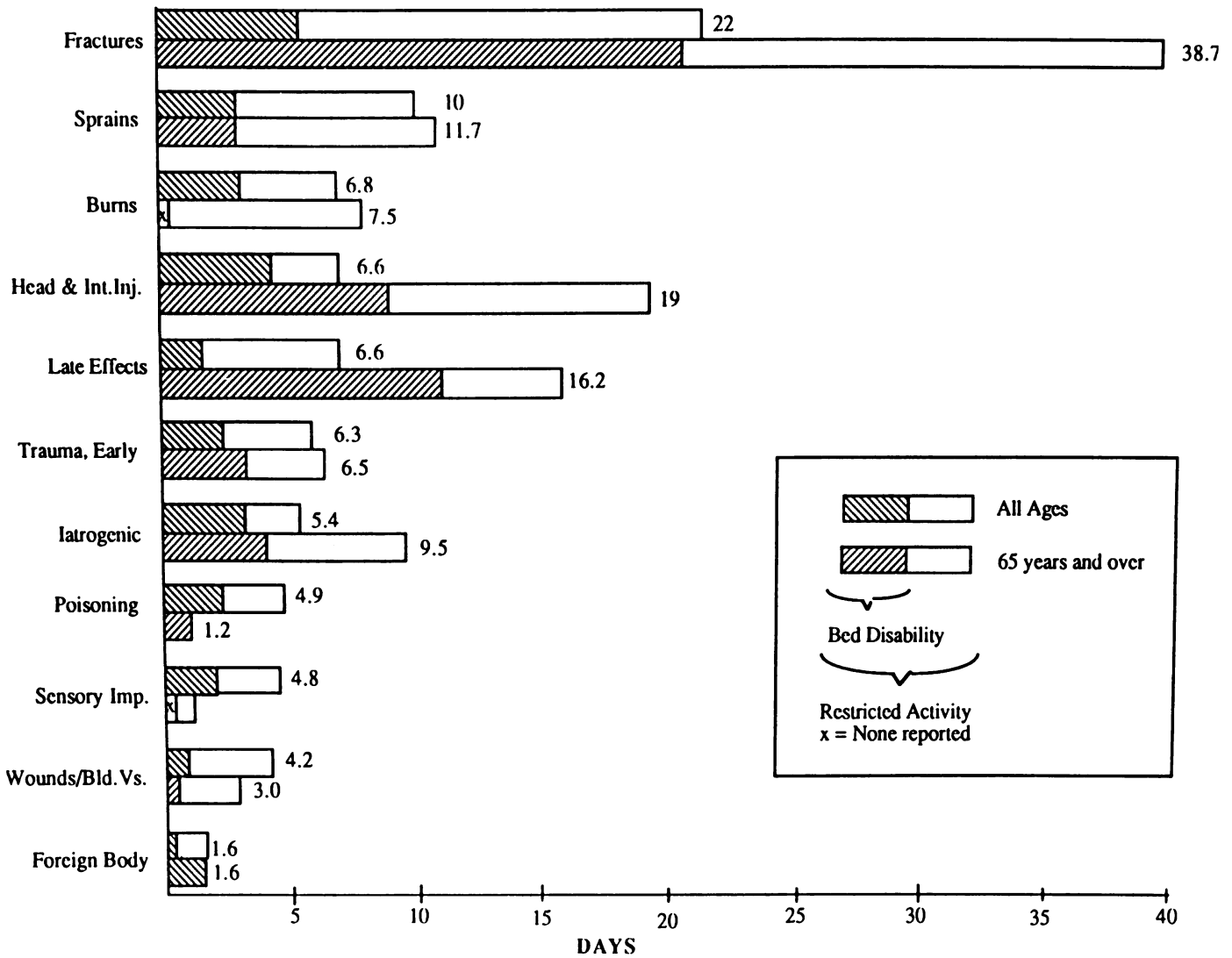
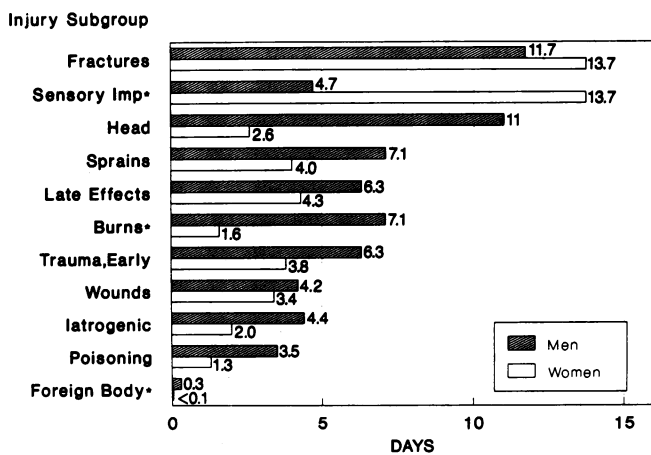


FIGURE 4—Restricted Activity and Bed Disability Days for All Ages and for Age 65+



*Less than 10 Women Subgroup

FIGURE 5—Mean Work Loss Days by Injury Subgroup and Gender

The burden of medical costs from injuries are also disproportionately greater for males, persons other than

Black, and those with family incomes less than \$5,000 (in 1980 dollars). Each of these three groups reports a greater proportion of health care charges attributable to acute injuries and their sequelae than do their counterparts. This maldistribution of costs may reflect differential exposure to potentially injurious situations in the workplace or community. Medical costs for the category of "White and other" might be slightly higher because of the inclusion of "others" in the category. However, the sample weights were computed for "Whites and others" as one category. The "others" category is small and therefore the effect on this category would be minimal.

The economic impact and the demographic pattern of expenditures are concordant with epidemiologic estimates of the health impact of injuries. The potential years of pre-retirement work life lost as a result of premature mortality from intentional and unintentional injuries was over 4 million years in 1982. This toll was roughly twice the years of potential work life lost from either neoplasms or heart disease.² In the National Household Interview Survey of 1980-81, a very high incidence of intentional and unintentional injuries were reported; about 75 million injuries were

reported by 70 million persons.¹³ The injury rates were higher for males than for females (40 million versus 30 million), with the greatest number (21 million) occurring in the 17 to 44 year old age group. Both the NHIS and the NMCUES agree on the high occurrence rate in the US population and on the gender and age distributions. These morbidity estimates also correspond to the patterns of national mortality from injuries.¹⁴ Therefore, the mortality, morbidity, and cost data confirm the remarkable impact of injuries.

The economic burden of disease includes the loss of economic productivity to society and income resulting from work loss. These measures of lost productivity were high, reflecting the frequent occurrence of injuries among the younger, working-age population. Injuries accounted for approximately 10 percent of all restricted-activity and bed-disability days during the survey year and about 17 percent of all work-loss days. These estimates exceed the disability and work loss attributable to acute respiratory conditions, which are the most common acute conditions in the general population.¹⁵ These findings agree generally with data from the larger National Health Interview Survey conducted in 1980-81.¹³ These findings do not address additional mortality costs to society. Depending on the discount rate used, the mortality costs from injuries are reported to be six to eight times the morbidity costs.¹²

There are considerable social costs in terms of work loss, restricted activity, and bed disability; these costs are distributed across the entire age range. The duration of disability and the mean direct costs are greater for older persons, but the impact of total direct costs and work loss is nevertheless severe for younger adults. MacKenzie, *et al*, examined the functional recovery and medical costs of trauma in patients admitted to two trauma centers and discharged to extended care or rehabilitation facilities or home.¹⁶ Of 262 individuals who were working before their accident, only 57 percent had returned to full-time work within one year.

Examination of total and per capita charges for diagnostic groupings provides further insights into the high costs of injuries. Hospital-based services, including physician fees, dominated the costs for all injury groups. This close linkage of injury care to hospital services indicates that costs for these conditions will parallel the general inflation of hospital operating costs. Because those with the least ability to pay—younger persons and those with low family incomes—have disproportionately higher costs for injuries, it is likely that increasing financial pressures may force many hospitals, and especially those with a large indigent or uninsured clientele, to reassess their ability to provide injury services.¹⁷ A number of hospitals have already terminated emergency care services as a result of cost considerations. In a study of nonaccidental injuries, assaults and suicides, 2,451 patients were admitted to a trauma center.¹⁸ The average charges for the victims of assaults were over \$5,000 per patient while the suicide victim's charges were nearly \$13,000. Six months after the study had been completed only about 70 percent of the hospital charges had been reimbursed. The authors noted that even if all of the hospital bills were covered the profit margin would only be 1 percent.

The charges associated with specific diagnoses identify conditions and characteristics of persons responsible for generating costs. Fractures accounted for the greatest total direct costs, and per capita costs were also high for this diagnosis. Moreover, fractures were responsible for greater mean disability- and work-loss days than were other diagnoses. Although fractures occurred more frequently in young

adults (17 to 44 years), the cost and disability impact was greatest for those over age 65 years. However, fractures occurring in the older population are more likely to result from osteoporosis and hip fractures.^{19,20} The diminished resiliency, more frequent requirement for surgical management, and the complicating comorbidity of chronic disease contribute to the greater burden for older persons. For similar reasons, head injuries and late effects of trauma also had a greater effect on older persons. These findings argue that injury research and preventive efforts should not be directed exclusively to the younger adult and employed population, who are generally considered the primary target for these efforts. Prevention and more efficient management of these injuries in the elderly could have considerable economic and health impact.

For conditions other than fractures, the aggregate charges and per capita charges were frequently discordant. For sprains, the per capita charges were relatively low but the high incidence in the population contributed to relatively high total charges. On the other hand, burns occurred less frequently but had higher per capita charges.

The diversity of the conditions included as injuries and the differences among them with respect to per capita costs and disability have implications for public policy. The most effective medical and cost reduction strategy would be prevention. Prevention would affect not only the less common and more expensive conditions but also the total costs of less expensive and commonly occurring conditions by decreasing the incidence of both. Prevention requires specification of the site and circumstances of injury. In NMCUES, there was no inquiry about the causes for the injuries or the sites of occurrence. However, in the contemporaneous National Health Interview Survey, vehicular accidents, industrial accidents, and the home were the most frequent sites of injury.¹³ Examining type of accident or manner of injury as the cause of death for 1981, motor vehicle accidents were by far the leading cause of death,²¹ followed by falls, fires, and drowning. Major cost containment strategies should be directed toward prevention at all potential sites as well as toward cost efficient urgent and emergency care. These data from NMCUES document the cost of post-emergency care for fractures, trauma, and burns and indicate the potential value of developing more cost-efficient care.

The remarkable impact of injuries raises important public policy issues. Compared with the considerable attention directed toward heart disease, cancer, and recently AIDS (acquired immunodeficiency syndrome), the health professionals and the public appear less concerned with injury research and prevention. The federal research investment in prevention and treatment of injuries was estimated to be \$112 million in 1983 or about one-tenth of the research commitment to cancer and one-sixth of that to heart disease and stroke.¹ Moreover, only about one-fourth of federal research investment in injuries was directed toward prevention with the remainder devoted to injury mechanisms, acute care, and rehabilitation.¹ In the context of high medical care costs, this research investment is extremely small. The national costs for injury care exceed those for cancer and are nearly as great as for heart disease. The years of life lost and indirect costs from disability and work loss exceed those for either of these disease categories. The extremely small research commitment to injuries contrasts sharply with the commitment to cancer and heart research. From the perspective of research investment as a proportion of health care

costs, injury had less than 1 percent (actually 0.7 percent) of the care cost invested in research. The comparable proportions for cancer and heart disease were 9 percent and 3 percent, respectively.¹

Several philosophical, political, and financial reasons can be cited for the public oversight. Importantly, injuries may still be considered to result from random and unalterable events and thus be unpredictable and unpreventable. Even the relatively sparse epidemiologic data from investigation of accidents, injuries, and outcomes indicate that this is not true.²² Further investigation should improve prediction and afford major decreases in injury rates and injury costs.²³ The lack of research monies probably relates to the absence of a focus for organizing a professional and public constituency. Without a focus of responsibility for defining and reporting injuries, funding research, and monitoring change, there is little political action to reassess priorities and generate new and useful knowledge. From the economic as well as the health perspective, the need warrants greater attention.

APPENDIX
Diagnostic Categories and ICD Codes for
Accidents and Injuries

Diagnostic Category	ICD Code
Fractures	800-829
Sprains, strains, dislocations	830-839 840-848
Intracranial, internal injury	850-869, 950-957 special NCHS codes
Open wounds, injury to blood vessels	870-879, 880-887, 890-899, 900-904 905-909
Late effects of injuries, poisonings, toxic effects of external cause	910-919, 920-924
Other early complication of trauma	925-929, 958-959, 990-995
Effects of foreign body entering through orifice	930-939
Burns	940-949
Poisonings, toxic effects	960-979, 980-989
Complications of medical, surgical care	996-999
Partial impairment of senses or other special impairment from accident or injury	special NCHS codes for sensory impairment

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