Foreword

Injuries are among those unique conditions that exact a substantial toll from persons at each life stage. They are this country's leading cause of death for persons in the first four decades of life and are the fourth leading cause of death for persons of all ages. Fatal injuries are the leading cause of years of life lost prematurely, and when injuries are not fatal, they often result in serious morbidity and permanent disability. A conservative estimate of the societal costs of injuries in the United States is $75–$100 billion. Direct health care costs represent a significant portion of these costs.

As an outgrowth of concern and recognition for the unnecessary morbidity and mortality that injuries place upon society, a national Conference on the Prevention of Injuries, sponsored by the Center for Environmental Health of the Centers for Disease Control (CDC) and the Association of Schools of Public Health, was held in Atlanta, GA, October 15–17, 1984. The conference brought together scientists and leaders in the fields of injury control and public health from schools of public health and medical schools, State and community health departments, nongovernmental agencies and organizations, and CDC and other Federal agencies to address the wide range of contemporary injury issues that relate to the development of policy, research, and intervention initiatives.

Issue papers were presented at the conference that span the spectrum of these contemporary injury issues. The papers were analyzed by conference work group participants, and from the analyses emerged written work group reports that describe the national injury problem and contain recommendations that can serve as the basis for a far-reaching national agenda for injury control. Abstracts of selected issue papers have been topically categorized; these abstracts follow the respective work group reports.

This conference represents an important step forward in addressing a significant public health problem. I am pleased that this publication will permit results of that conference to be shared more widely, as they deserve to be.

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Injury Morbidity and Mortality Overview Workshop

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THE UNITED STATES has a significant endemic injury problem, with certain epidemic features. The agents in injuries, unlike those in many diseases, are identifiable. Although there is scientific documentation of the problem, based largely on mortality data available for many years, decisionmakers in the public and private sectors are only now beginning to recognize the magnitude of the health effects of injuries and to assign a high priority to injury prevention efforts.

Problems and Recommendations

- A coordinated, imaginative strategy is needed to prompt public officials to act to implement available preventive measures. Such a strategy, to be developed by public health organizations, should (*a*) clearly spell out the benefits and costs of known interventions (for example, air bags and childproof packaging), (*b*) deal with common concerns raised by agencies or organizations opposed to such measures, (*c*) compare the importance of injuries to other health problems, and (*d*) provide guidance to public interest groups and the public at large.
- The artificial exclusion of either intended or unintended injuries from population-based studies of injuries has been a barrier to characterizing the problem better (for example, poisonings and firearm-related injuries may be either intentional or unintentional).
- Setting of priorities in the past, based primarily on official mortality statistics, significantly underesti-

mated the magnitude and severity of the injury problem. The incidence, severity, and long-term sequelae of injuries, as well as mortality data on injuries, should all be used in setting priorities for future research and evaluation efforts. Official reporting systems for motor vehicle injuries and assaults substantially underestimate these problems.

- Lack of population-based, cause-specific injury data, both spatial and temporal, is a major obstacle to understanding the injury problem. Questions on the cause of injuries are not a part of the annual National Health Interview Survey. Existing national injury data systems based on hospital emergency rooms are not adequate for injury control data; for example, the National Electronic Injury Surveillance System (NEISS) is limited to product-related injuries. Emergency room (ER) record systems, including the daily ER log, should be standardized and integrated into the hospital's medical record system to depict the injury problem more completely.
- The lack of standard items related to cause of injury on "face sheets" for hospital admission records, ER records, and ambulatory care records is a major obstacle to assigning E-codes. This is a set of codes for injuries and other "external" causes of death. The E-codes are not now required for reimbursement purposes and, as a result, are not likely to be recorded. Efforts should be made to take advantage of current trends toward standardizing records related to the reimbursement mechanism, for example, the insurance industry, Medicare and Medicaid, and the Joint Commission on the Accreditation of Hospitals.
- The structure of the E-codes in the 9th revision of the International Classification of Diseases (for example, the lack of mutually exclusive codes) and the lack of standardized aggregation of E-codes result in problems with comparability and analysis of injury data. An international conference on the revision of the E-codes for the 10th revision should be convened. In part, users of injury data have not been sufficiently involved in the revisions. Before the 10th revision, the Centers for Disease Control and the National Center for Health Statistics should collaborate on the development of recommended aggregations, based on the 9th revision, for injury control purposes.
- Concerns about individual liberty have contributed to the failure to implement intervention strategies and to the elimination of known effective intervention strategies.
- The failure of many existing injury control programs to establish evaluation methods may lead to the ineffective use of resources and a false sense of progress.
- Concentration on one type of intervention strategy—for example, behavior modification—to the exclusion of others has resulted in the adoption of less than optimal control measures.
- The lack of acceptance of high-quality manuscripts on injury prevention and epidemiology by some prestigious, widely consulted medical and scientific journals has hindered dissemination of knowledge related to injuries and an appreciation of the relative importance of injuries compared with other causes of morbidity and mortality. Moreover, this has contributed to a view of injury causation and prevention as a behavioral problem rather than a health problem.
- The lack of an administrative focal point within the Federal Government has been an obstacle to the funding of injury prevention and evaluation research and to the develolpment of a coherent strategy for injury contol.
- The lack of funding to analyze existing data bases fully has limited the potential value of those data bases.

Disabling Injuries: National Health Interview Survey

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THE NATIONAL CENTER FOR HEALTH STATISTICS (NCHS) collects and analyzes injury data from national vital statistics and from surveys. The National Health Interview Survey (NHIS), perhaps the best known of the many surveys conducted, is a continuous sampling of representative households designed to obtain health data on chronic and acute illness, the impact of illness, the use of health services, and other health topics, including unintentional injuries. Interviews are conducted by the Bureau of the Census in a probability sample of about 40,000 households (110,000 persons) each year, representing the civilian, noninstitutionalized population of the United States.

Table 1. Number of persons injured and rates of injury per 100 persons per year, by sex and age groups, United States, 1981

Age group	Males		Females		Total	
	Number (millions)	Rate	Number (millions)	Rate	Number (millions)	Rate
Under 6 years	4.1	40.0	3.2	32.3	7.3	36.2
6–16 years	8.9	44.8	5.9	31.4	14.8	38.2
17–44 years	21.0	44.3	13.4	26.9	34.4	35.4
45–64 years	4.4	20.9	4.9	20.9	9.2	20.9
65 and older	1.7	16.9	2.8	19.2	4.5	18.3
Total	40.1	36.9	30.2	25.9	70.2	31.2

SOURCE: National Health Interview Survey, National Center for Health Statistics.

Table 2. Average number of restricted activity days, bed disability days, and work-loss days per 100 persons per year, by age groups for both sexes, United States, 1980–81

Age group	Restricted activity days[1]	Bed disability days[1]	Work-loss days[2]
Under 6 years	44	14	...
6–16 years	179	34	...
17–24 years	314	72	
25–34 years	421	89	129
35–44 years	399	107	
45–54 years	465	143	
55–64 years	525	115	120
65–74 years	505	133	
75 years and older	664	194	84
Total	357	88	125

[1] Number of days per 100 persons per year.
[2] Number of days per 100 currently employed persons per year.
SOURCE: National Health Interview Survey, National Center for Health Statistics.

Methods used in this survey are detailed in the appendices to Vital and Health Statistics (*1*).

As defined in the survey, an injury includes fracture, laceration, burn, poisoning, adverse reaction to medical procedures, and effects of exposure. A day of restricted activity is one during which a person must limit his or her usual activities; hospital days, bed days, work-loss days, and school-loss days are included in the overall number of days of restricted activities. Rates given are generally per 100 persons per year; except work-loss rates are per 100 currently employed persons 17 years of age and older, and school-loss rates are per 100 children aged 6–16 years.

Results

In 1981, more than 70 million persons suffered 75 million acute injuries. The home headed the list of injury sites with 27 million persons, the workplace was next with 11 million, schools and recreational places had 6 million each, and motor vehicles claimed 5 million. Injury rates were higher for males than females, with those in the 6 to 16 age bracket atop the list (table 1). In the period 1970–81, the rate of injuries ranged from 28.0 to 36.4 per 100 persons per year, with no consistent trends in injuries, bed days, lost workdays, or lost schooldays.

Restricted activity days in 1980–81 due to injuries averaged 357 per 100 persons per year (table 2). Bed disability days averaged 88 per 100 persons per year and work loss days 125 per 100 persons. Both restricted activity overall and bed disability days increased with increasing age. Injuries also resulted in the loss of more than 14 million days of school in 1981.

The incidence of acute conditions exceeded 100 persons per year (table 3). The second most common acute condition reported was injuries, ranking behind only respiratory conditions. The rate of injuries was greater among men; all other conditions occurred more often among females.

Injuries constituted the second most common acute condition seen by physicians, accounting for more than 11 percent of the 874 million physician visits (table 4). Among visits to hospital clinics and emergency rooms, injuries accounted for more than a quarter of the physician consultations. About 2.3 million persons reported they were hospitalized for an injury in 1981.

Conclusion

In summary, injuries are a very common cause of restricted activity, resulting in an enormous number of days in bed and a great loss of productivity among the work force as well as the school population. Injuries prompt physician attention more than 95 million times per year. In this survey, an estimated 2.3 million persons were hospitalized because of injury, and more than 3 million hospitaliza-

Table 3. Number of acute conditions per year and number of acute conditions per 100 persons, by condition group and sex, United States, 1981

Condition group	Males		Females		Total	
	Number (millions)	Rate	Number (millions)	Rate	Number (millions)	Rate
Infective and parasitic diseases	23	21	30	26	53	24
Respiratory conditions	116	107	136	117	252	112
Digestive system conditions	11	10	11	10	22	10
Injuries	42	39	32	28	75	33
All other acute conditions	28	25	49	42	77	34
Total acute conditions	220	202	258	222	478	212

SOURCE: National Health Interview Survey, National Center for Health Statistics.

tions due to injury were estimated on the basis of the NCHS Hospital Discharge Survey (*2*). Thus, the health care burden of this condition is enormous—to the American public, the economy, and the health care system.

References

1. National Center for Health Statistics: Persons injured and disability days due to injuries, United States, 1980–81. Vital and Health Statistics, Series 10, No. 149, Hyattsville, MD, March 1985.
2. National Center for Health Statistics: Utilization of short-stay hospitals, United States, 1981. Annual summary. DHHS Publication No. (PHS) 83–1733. Vital and Health Statistics, Series 13, No. 72, Hyattsville, MD, September 1983.

Table 4. Percent distribution of conditions, by place of physician contact, United States, 1980

Conditions	Place of visit			
	Physician's office	Hospital clinic or emergency room	Telephone	Total
Number in millions	579	121	120	874
All chronic conditions	55.8	43.3	37.9	51.2
All acute conditions	39.7	52.4	58.4	44.2
Infections, parasites	4.5	4.2	9.2	5.1
Respiratory conditions	12.9	8.5	23.5	13.8
Injuries	8.9	25.5	7.2	11.3
Other	13.3	14.1	18.5	14.0
No condition reported	4.5	4.3	3.6	4.6
Total	100	100	100	100

SOURCE: National Health Interview Survey, National Center for Health Statistics.

Northeastern Ohio Trauma Study: Overview and Issues

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IN THE UNITED STATES, injuries are the leading cause of death for nearly the first four decades of life and the fourth leading cause of death for all ages. Nonfatal and fatal injuries are a major health problem in this country, Each year, more than one-third of the nation's population is injured.

Until recently, injury fatality statistics were the primary source of information used to characterize the nature and magnitude of the U.S. injury problem. Clearly, population-based descriptive epidemiology studies of injury incidence, outcome, and severity were needed. In recognition of this need, two cross-sectional regional studies were conducted in a well-defined Northeastern Ohio population (*1,2*).

The first study measured the incidence of all cause-specific trauma reported during 1977 to the emergency departments of 41 of the 42 acute care hospitals in the Cleveland-Lorain-Elyria Standard Metropolitan Statistical Area (population 2.2 million), using a 1.9 percent time-stratified probability sampling plan (incidence $N = 8,850$) (*1*). The second study measured the incidence of motor vehicle trauma in the same population and the same period using an independent 50 percent sequential sample of all emergency department motor vehicle trauma cases (incidence $N = 23,108$) (*2*).

The overall objectives of these studies were (*a*) to establish population-representative nonfatal injury data bases comprising cases entering the health care system through hospital emergency departments over a 1-year period and (*b*) to determine the nature, magnitude, and severity of the cause-specific injury problem in this population. The key findings of these studies follow.

- Overall findings. Each year, about 20 percent of the population is treated for injuries in hospital emergency departments. The leading causes of nonfatal and fatal injury are clearly different. Motor vehicle collisions and falls rank first and fourth, respectively, as causes of traumatic death, yet their ranks are reversed as causes of injury. In 1977, this region's injury rates, based on police reports of motor vehicle collisions and of assaults, significantly underestimated the magnitude of these causes of injury. Only 55 percent of the hospitals' emergency department cases due to vehicle-related injuries could be matched with a police crash report (*3*).
- Elderly. The likelihood of an adverse outcome from both motor-vehicle-related and nontransportation-related injuries was significantly higher for the elderly than for any other age group (*4*).
- Falls. The age-specific incidence and fracture pattern for falls had a bimodal distribution with peaks at both ends of the age spectrum (*5*).
- Motor vehicles. For motor-vehicle-related injuries, clear differences were observed in incidence and outcome patterns by road-use category, age, and sex. In general, relatively unprotected road users (pedestrians and cyclists, compared with occupants of enclosed or partially enclosed vehicles) had higher hospital admission and fatality ratios than occupants of fully or partially enclosed vehicles; pedestrians had the highest ratios of any road-use category.

With respect to age, persons 15–24 years old had the highest vehicular injury rates, but a larger proportion of the elderly died or were hospitalized because of their injuries. Injury rates for males significantly exceeded those for females in all road-use categories and most age groups. Interestingly, this male-dominated pattern began well before the driving age.

- Hospital surveillance. Nearly all hospitals kept daily logs that were adequate for identifying trauma cases, but the logs varied considerably in content and format. Virtually no emergency department logs or records were computerized.

Because the International Classification of Diseases (ICD) E-codes (indicating external causes) are not completely mutually exclusive, about 10 percent of all cases were assigned more than one E-code.

Almost all community hospitals are willing to participate in injury epidemiologic studies if the study objectives, aims, and methods are clearly understood; the protocol contains very strict security procedures for maintaining data confidentiality; and the research team includes medical record professionals who abstract and code hospital records.

These studies (*1,2*) have provided conservative estimates of the incidence, outcome, and severity of the injury problem. On the basis of these findings, the following policy, programmatic, and methodological issues have been identified.

- Injury incidence and outcome cannot be derived simply by extrapolating from mortality data.
- Additional sources of population-representative data for epidemiologic studies of nonfatal injuries are needed to draw inferences about injury risk and to develop ameliorative strategies.
- New or expanded monitoring and surveillance systems are needed because of the nature, magnitude, and severity of the injury problem and the paucity of information about it.
- In official statistics, the significant underreporting of injuries from motor vehicle collisions and from assaults may cause officials to draw potentially misleading conclusions on the impact and importance of these health problems.
- Certain injuries (for example, intentionally induced injuries) appear to elicit greater public interest than other causes (for example, falls and motor vehicles). Efficacious intervention strategies are needed for injury prevention and control irrespective of administrative classification such as "intentional" or "unintentional."
- Standardization of emergency department records and logs is needed to provide adequate information for ICD E and N coding and to reduce the use of "not elsewhere classifiable" or "not specified" codes.

NOTE: The Northeastern Ohio Trauma Study data collection and initial analyses were conducted at the School of Medicine, Case Western Reserve University, Cleveland, OH. This work was funded by a grant from the Insurance Institute for Highway Safety. The opinions, findings, and conclusions expressed in this paper are those of the authors and do not necessarily reflect the views of the Insurance Institute for Highway Safety.

References

1. Barancik, J. I., et al.: Northeastern Ohio trauma study: I. Magnitude of the problem. Am J Public Health 73: 746–751 (1983).
2. Barancik, J. I., et al.: Northeastern Ohio motor vehicle trauma study I: Incidence and outcome by age, sex and occupant classification. [Abstract.] Am J Epidemiol 120: 497 (1984).
3. Barancik, J. I., and Fife, D.: Discrepancies in vehicular crash injury report: Northeastern Ohio trauma study IV. Accid Anal Prev 17: 147–154 (1985).
4. Fife, D., Barancik, J. I., and Chatterjee, B. F.: Northeastern Ohio trauma study: II. Injury rates by age, sex, and cause. Am J Public Health 74: 473–478 (1984).
5. Fife, D., and Barancik, J. I.: Northeastern Ohio trauma study III: Incidence of fractures. Ann Emerg Med 14: 244–248 (1985).

Measuring the Gap for Unintentional Injuries: the Carter Center Health Policy Project

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THE PROJECT ENTITLED "Closing the Gap" is a collaborative effort of the Centers for Disease Control and the Carter Center of Emory University. The project focuses on the gap between the impact of 15 high-priority health problems and the disease burden that could be reduced by applying existing scientific and technical knowledge. A unique aspect of the project is the comparison of a wide variety of health problems, ranging from cancer and arthritis to depression, using the same standards of comparison for all the problems. Intentional and unintentional injuries are included as separate priority health problems.

When compared with other health problems, unintentional injuries are the fourth leading cause of death (following circulatory diseases and cancer) in the United States. They kill more people between ages 5 through 44 than all other causes combined (*1*). Since unintentional injuries affect a greater proportion of young people than most other major health problems, they have become the leading cause (excluding infant mortality) of premature death (years of life lost before age 65) (fig. 1).

Until recently, little attention has been given to this most preventable U.S. health problem. In the Carter Center project, the gap between what we already know about preventing injuries and what is being implemented was determined to be larger than that for any other disease entity (*2*). Of the four highest priority preventable causes of premature death and unnecessary morbidity identified by the project, all but one included unintentional injuries. These causes were the use of tobacco (cigarette-related fires), the use of alcohol (associated with a greatly increased risk of injuries), and injury risks (a generic term used to cover factors involved in nonalcohol-related injuries). Only the fourth highest priority generic risk factor, unintended pregnancy, did not involve unintentional injuries.

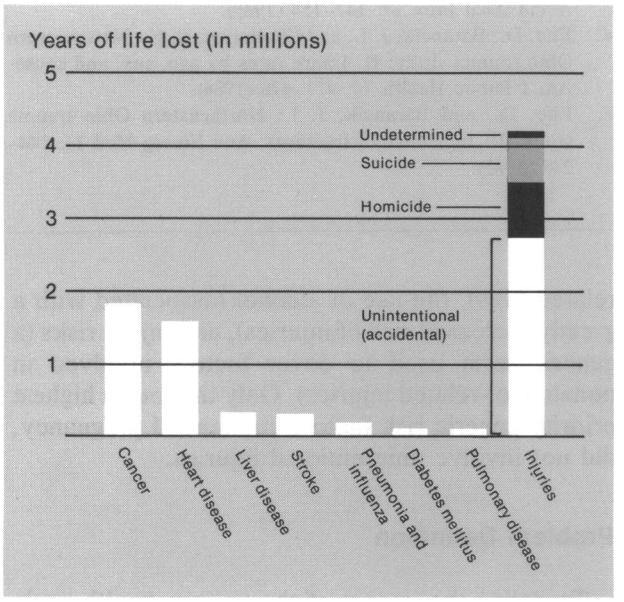
Problem Definition

To define the impact of the various health problems, the Carter Center project staff prepared a standardized set of tables to show data on mortality, morbidity, hospitalization rates, length of stay in hospital, costs (direct and indirect), years of life lost before age 65, days lost from work or normal activity, and long-term disability due to the particular health problem (*2*). However, for unintentional injuries much of this information was not available (see table).

Injuries present a unique problem because two distinct systems are used for coding data—one based on the type or nature of the injury and the other on its cause and apparent intent. Ideally, both coding systems are used; however, few data sources use both systems, and the system used varies from source to source. As a result, most sources of morbidity data on injuries provide little or no data on etiology. This includes the majority of the National Center for Health Statistics (NCHS) data bases, which use the International Classification of Diseases (ICD) coding system (coding only the type of injury and body part injured). Consequently, much of the detailed information required by the Carter Center is available only for all injuries combined, and this causes a major gap in our understanding of the extent of the injury problem. Since the project focuses on developing preventive strategies, we used the ICD Supplementary Classification of External Causes (ICD E codes), in which injuries are coded on the basis of cause and apparent intent.

The leading causes of morbidity are often not the leading causes of mortality. For example, of the 10 leading causes of emergency room visits due to

Figure 1. Potential years of life lost prior to age 65 from eight leading causes of death, 1980



SOURCE: reference 4.

injuries, only 2 are among the 10 leading causes of death due to unintentional injuries (3). This, combined with the lack of good data on morbidity and hospitalization, made the selection of priority injury problems difficult. Because of the good quality of data available on mortality, we chose mortality rates as the basis for selecting injuries for consideration by the Carter Center project.

Impact of Unintentional Injuries

The 12 leading causes of mortality attributable to inquiries are shown in the table. Motor vehicle-related injuries account for more than half of all deaths due to unintentional injuries, and they account for more than 60 percent of all years of life lost before age 65. The direct costs of medical care amount to almost $6.7 billion, and the indirect costs of lost wages and economic productivity amount to more than $13.4 billion (4).

The second leading cause of death due to unintentional injuries is falls, which primarily affect the elderly. Drowning is the third leading cause, and—as is evident from the large number of years of life lost before age 65—it largely affects younger people (see table).

Mortality rates for all injuries are highest in the elderly, primarily because of their vulnerability to injuries and to complications following trauma (4).

In chidren under 5, the leading causes of injury-related deaths are motor vehicles, drownings, and fires. Among persons 15 to 21 years, half of all deaths result from unintentional injuries, primarily associated with motor vehicle crashes, firearms, and drownings. Males are at a particularly high risk of dying from almost all types of injuries; however, where nonfatal injuries are concerned, the injury rates for males are only slightly higher than those for females (5).

Alcohol abuse is a major risk factor for injuries, increasing as a causative factor as the severity of injury increases (5). About 50 percent of drivers killed are—by legal definition—intoxicated, as are 25 percent of seriously injured drivers. Alcohol is also involved in about 30 percent of fatal injuries from other causes.

Interventions

"Passive" interventions—those that work automatically and do not require repetitive active participation ("active" interventions)—have proven most effective in controlling injuries (6). An example of the effectiveness of passive intervention is use of air bags, which could reduce motor vehicle-related fatalities by an estimated 30 percent. Seatbelts, although similarly effective when used, are worn by only 13 percent of all drivers, and most of the drivers in this small group are already at low risk of crashing because of other variables (5).

Many interventions involve legislation that regulates the production, design, or use of hazardous products. One regulation often can save thousands of lives. For example, the 55-mile-per-hour speed limit saves an estimated 5,000 lives per year, and the available but unused crashworthiness standards for automobiles, if implemented, could save 9,000 lives per year (6). A tragic example of the absence of legislation to control injuries resulted from the widespread repeal of laws requiring motorcyclists to wear helmets. Approximately 1,400 unnecessary deaths every year have followed repeal (4). Although manufacturers have failed to manufacture products that emphasize safety within the limits of available technology, the increasing number of product liability suits may stimulate greater attention to this feature in the future (7).

To date, prevention efforts directed at changing human behavior have been disappointing and at times even detrimental. For example, attempts to increase seatbelt usage through insurance incentives and intensive television advertising have been largely unsuccessful (8). By contrast, interventions aimed at reducing hazards in the environment, such

Summary of negative impact of unintentional injuries, United States, 1980

Causes of injury	Number of deaths	Number of years lost before age 65	Number of hospital days	Number of disability days	Cost associated with each specific health problem[1]
Motor vehicles	53,172	1,694,601	3,548,000	145,432,000	$20.1 billion
Falls	13,294	87,662	NA	NA	NA
Drowning	7,257	269,203	NA	NA	NA
Fire and flames	6,016	150,950	NA	NA	NA
Poisoning	4,331	113,376	NA	NA	NA
Suffocation	4,121	88,255	NA	NA	NA
Natural environment	3,194	32,328	NA	NA	NA
Firearms	1,955	71,299	NA	NA	NA
Air transportation	1,494	43,275	NA	NA	NA
Machinery	1,471	34,758	NA	NA	NA
Electric current	1,095	36,660	NA	NA	NA
Being struck by falling object	1,037	27,576	NA	NA	NA
Other	7,281	119,141	NA	NA	NA
Total	105,718	2,769,084	NA	NA	$45.5 billion

[1] Includes direct costs of medical care and indirect costs of lost wages and economic productivity.
NOTE: NA = not available.

SOURCE: The Carter Center of Emory University. For explanation of origin of data, see reference *4*, which contains detailed derivations and calculations for all figures in this table.

as childproof caps on poisons and breakaway poles on roadsides, have met with considerable success.

Impact of Available Interventions

In the Carter Center project (*4*), when we considered the numerous interventions available, we found that the programs that were most likely to succeed used a mixed strategy, with different interventions directed at the same problem. We have identified priority interventions related to four different types of injury control programs. The difference between injury rates that could be expected if these programs were fully implemented and present injury rates is the "gap" referred to earlier.

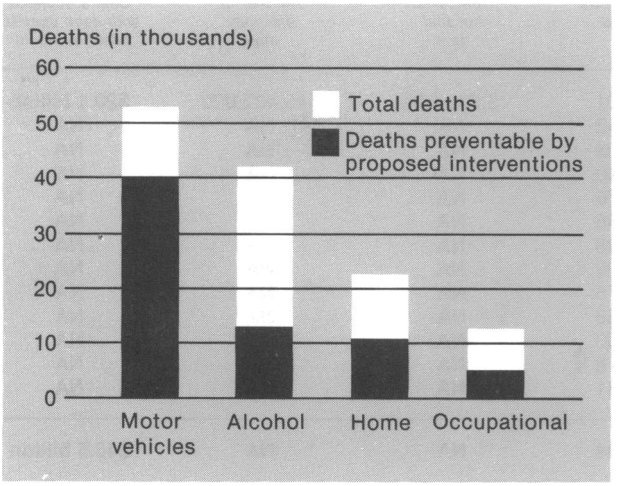
The four programs for priority intervention are

Motor vehicle safety program. About 53,000 deaths per year result from motor vehicle-related injuries. We estimate that a broad-based mixed strategy could reduce motor vehicle-related fatalities, injuries, and their attendant costs (table) by about 75 percent. Such a program would include installation of air bags, enactment and enforcement of laws requiring the use of seatbelts and child-seat restraints, control of vehicle speed, improved road design, and the maximum use of available technology in designing a safe, crashworthy vehicle.

Home injury control program. About 23,000 deaths per year result from unintentional injuries that occur in the home, including 6,700 from fatal falls, 4,400 from burns and fires, 2,400 from suffocation, 3,100 from poisonings, 1,100 from unintentional injuries caused by firearms, and 900 from drownings (the majority of which involve children under 5 years of age). The estimated number of disability days and the estimated costs associated with injuries that occur in the home are 187.9 million days and $8.2 billion, respectively. We estimate that a targeted intervention program directed at these and other home injuries could reduce all home-based injuries by about 50 percent.

Occupational injury control program. Of the estimated 13,000 deaths that occur each year because of work injuries, a third are due to motor vehicle crashes, of which an estimated 75 percent are preventable. The causes of the other two-thirds include falls, industrial equipment, being struck by objects, electrocutions, and firearms. The estimated number of disability days and the estimated costs associated with occupational injuries are 184.6 million days and $11.6 billion, respectively. Using what little data are available, we estimate that 25 percent of the other occupational injury deaths (that is, the two-thirds not related to motor vehicles) could be prevented. This percentage may be significantly increased if basic principles of injury control and further injury control research are applied to the occupational setting. For all causes combined, we estimate that about 40 percent of the occupational deaths and serious injuries could be prevented. This would mean the prevention of about 5,200 deaths per year.

Figure 2. Total number of deaths and deaths preventable by proposed interventions



SOURCE: reference 4.

Alcohol intervention program. About 42,000 deaths per year result from alcohol-related injuries. If a broad-based societal approach against alcohol usage were initiated, we believe that about a 25-percent reduction could be expected in all fatal and serious injuries in which alcohol is an important factor and that a somewhat smaller reduction could be expected in less serious injuries in which alcohol plays a less significant role. It should be noted that many other injury control measures, such as seatbelts and air bags, will also reduce alcohol-related injuries. A specific program for problem drinkers is an essential component of an effective alcohol control effort. Any program that reduces unintentional alcohol-related injuries will also greatly reduce the incidence of other alcohol-related diseases.

Conclusion

The gap between what we know about preventing unintentional injuries and what is actually being done to prevent them appears to be larger than the gap for any other disease entity. The extent to which each of the four proposed injury control programs could reduce the large number of deaths that occur annually is illustrated in figure 2. Many of the interventions proposed are likely to encounter political barriers from special interest groups. However, if we are to increase life expectancy significantly and reduce the burden of diseases in this country, the most effective means we have with current technology is intensive injury control programs such as those outlined.

References

1. Committee on Trauma Research: Injury in America. A continuing public health problem. National Academy Press, Washington, DC, 1985.
2. Closing the Gap health policy project: summary report. The Carter Center, Emory University, Atlanta, GA. In press.
3. Barancik, J. I., et al.: Northeastern Ohio Trauma Study: I. Magnitude of the problem. Am J Public Health 73: 746–751 (1983).
4. Smith, G. S., and Falk, H.: Unintentional injuries: intervention strategies and their potential for reducing human losses. Report for the Carter Center, Emory University, Atlanta, GA, 1984.
5. Baker, S. P., O'Neill, B. O., and Karpf, R. S.: The injury fact book. Lexington Books, Lexington, MA, 1984.
6. Robertson, L. S.: Injuries: causes, control strategies, and public policy. Lexington Books, Lexington, MA, 1983.
7. Teret, S. P.: Injury control and product liability. J Public Health Policy 2: 49–57 (1981).
8. Robertson, L. S., et al.: A controlled study of the effect of television messages on safety belt use. Am J Public Health 64: 1071–1080, November 1974.

Workshop on Injury Risk Groups and Determinants

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WE HAVE BEEN ASKED TO DISCUSS the determinants of injury and groups at increased risk of injury. To define such groups, appropriate measures of injury are necessary. Frequency, severity, outcome, and lost years of life are four important measures that may be appropriate in certain situations.

Risk groups may be classified according to at least two types of variables: personal characteristics and the circumstances of the injury. Important variables reflecting personal characteristics include age, gender, socioeconomic status, rural or urban residence, ethnicity, alcohol use, military status, prisoner status, and education. Interactions among these variables are of interest. Descriptive terms often used in classifying injuries according to circumstances include highway, home, recreational, and occupational.

It may be useful to consider the two types of variables as defining a two-dimensional array in

which, for example, teenagers are at high risk for motor vehicle (highway) injuries, males (especially black) for homicide, poor people for house fire-related injuries, rural residents for injuries from farm machinery, and alcohol-intoxicated people for injuries for all types.

For some types of injuries and risk groups, there is sufficient well-documented information to indicate that the appropriate next step is intervention (or demonstration) and evaluation. For other types, less information is available, and research projects are appropriate.

Intervention and evaluation projects should be conducted through Federal agencies, State and local health departments, or schools of public health. The members of this workshop selected the following interventions as examples of projects that would be useful:

- Install air bags in automobiles
- Incorporate research findings on safety into automobile technology
- Extend the Flammable Fabrics Act to all sleepwear
- Establish a standard for self-extinguishing cigarettes
- Establish standards for sports equipment
- Enforce fire safety codes
- Control handguns and ammunition
- Create a safer roadside environment, with reduced hazard from roadside obstacles
- Improve the quality of sports fields
- Train coaches in injury prevention and assessment
- Promote motorcycle helmet legislation
- Improve truck and passenger car compatibility
- Change building codes to address the leading causes of home injuries
- Make regional poison control centers more available
- Improve the use of restraints for infants in cars
- Require fencing around swimming pools
- Improve rural emergency medical services

Several injury problems need further descriptive and determinative epidemiologic reserch to identify the factors that are amenable to intervention. Environmental and human factors operating in the preinjury, injury,and postinjury phases are worthy of consideration. Workshop members compiled the following list of areas with research potential. The list is not intended to be complete, nor are the areas in order of importance:

- recreational and sports injuries (especially exposure-based incidence rates)
- falls (including the effect of modified building techniques and of exercise in reducing harm from falls among the elderly)
- suicide
- homicide
- alcohol (including measures to reduce alcohol abuse and measures to decrease the injury consequences of alcohol once consumed)
- injuries in high-risk occupations (including mining, oil, construction, and agriculture)
- emergency medical services (including measures to improve them and studies to determine their limits of efficacy)
- low-risk groups (including studies to determine the reasons for their low-risk status)
- the role of drugs other than alcohol in injuries

A mix of countermeasures, as described in Haddon's paper "On the Escape of Tigers" (*1*), should be considered, both in conducting research and in assessing interventions.

Information about advances in injury control should be more accessible to health workers. It would help to have the contents of Accident Analysis and Prevention and the Journal of Safety Research indexed in Index Medicus. It is also important to bring together researchers and practitioners at conferences and workshops and to disseminate information about the implementation of injury control programs.

Evaluation of interventions is essential. Although this seems obvious, few interventions have been evaluated.

Intentional, unintentional, and alcohol-related injuries should not be separated programmatically; they are amenable to similar study methods and countermeasures, the populations at risk for each are often similar, and intent is often difficult to determine.

The preceding proposals require adequate funding, trained personnel, loci, and organizational structures to carry out programs of intervention and research. The limited resources available must be reasonably apportioned among training, research, and implementation programs.

Reference

1. Haddon, W., Jr.: On the escape of tigers: an ecologic note. Am J Public Health 60: 2229–2234 (1970).

Sports Injuries: Implications for Prevention

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CONCOMITANT WITH PARTICIPATION in sports is the potential for injuries. Although data on sports-related injuries and deaths are limited, indications are that most drownings, a large number of firearm fatalities, 10 percent of brain injuries, 7 percent of spinal cord injuries, and 13 percent of facial injuries treated in hospitals are related to sports (*1–4*). The most useful data on the subject have been generated from sports-specific studies and investigations of emergency treatment facilities.

Current Surveillance Systems

NEISS, the National Electronic Injury Surveillance System (*5*), in which data are collected from a sample of 66 emergency rooms throughout the United States, provides the most comprehensive estimates of injuries from a variety of sports activities. The data are limited, however, because the injuries reported are restricted to those involving consumer products and, typically, they do not include information relevant to the mechanisms of injury; in addition, determination of accurate denominator data is not possible through this system. On the positive side, equipment and products associated with injuries have been identified as a result of this system, relevant standards have been developed, and changes in product design have been effected in response to such identification.

The National Athletic Injury-Illness Reporting System (NAIRS) (*6,7*), developed to link high school and college athletes to a common reporting system, facilitated a comprehensive data base of multiple sports activities. Limitations of this system, in use between 1976 and the early 1980s, included the volunteer status of the small number of participating institutions and the lack of personnel with adequate background knowledge and training to maintain the prescribed recording and reporting.

Other data sources relevant to sports participation vary from one State to another. These data encompass a broad spectrum of sports and recreational activities and include surveillance systems specific to nonroadway snowmobile incidents, firearm injuries, and water-related injury and fatality data.

Morbidity and Mortality Costs

Based on available data, it is estimated that between 3 million and 5 million sports-related injuries occur in the United States each year. In 1978, as determined from the International Classification of Diseases (ICD) codes on death certificates reflecting a strong probable association with sports, some 6,000 deaths from such injuries occurred (*2*). These estimates, considered conservative, suggest a significant public health problem.

Fortunately, most sports injuries are not categorized as catastrophic or fatal. Yet, there is the potential for long-term effects of milder but significant injuries to the brain and spinal cord incurred frequently in contact or collision sports (*8–10*).

The magnitude of sports-related injury mortality and morbidity, given the problems inherent in existing data, is substantial for the broad diversity of sports activities. A comprehensive table has been prepared and may be obtained from Dr. Gerberich. It summarizes morbidity and mortality rates, primary mechanisms of injury, injury determinants, and costs. Injury rates within any one sport may vary from study to study because of differences in case-ascertainment methods, the identification and recording of mild versus serious injuries, the age and gender composition of the population, the location, and the period that the data represent.

Costs associated with sports-related injuries and disabilities constitute a largely unexplored territory. In terms of medical care, days lost from work or school, and potential years of life lost, however, the costs of both acute and chronic effects are significant.

Determinants and Populations at Risk

Aside from the identified limitations of existing data, some injury determinants have emerged through various investigations. Generally, persons between the ages of 5 and 14 years are at greatest risk of sports-related injuries; for some activities, the risk is greater among 15 to 24 year-olds (*1,5*).

Although in most sports males appear to be at greater risk of injury than females, there are some exceptions. Assessment of this risk depends on accurate denominator data, in concert with consideration of types of injuries, mechanisms of injury, and other factors.

The incidence and severity of sports-related injuries appear to be greatest in sports involving contact or having the potential for contact. The relationship of experience in a particular sport to injury incidence and severity may vary according to the degree of collision or contact activity involved in that sport.

Variables of health status and the use of alcohol or other drugs also appear to be important determinants of injury (*1,11*). However, these variables have rarely been examined in the context of sports participation.

It has been documented that the preparation of staff responsible for administering certain activities, such as a football coach's training in injury prevention and control, can influence the incidence and severity of injury (*12*). In addition, the design, quality, and integrity of sports equipment have been related to injury outcome. However, the consideration of multiple interacting variables is most important in the injury equation.

Conclusions

Sports-related injuries constitute an important public health problem; they affect people not only in the home and the community but also in workplace recreational programs and facilities. Although the total costs of such injuries cannot be calculated because of limited data, they undoubtedly are significant in terms of medical care costs, restricted activity, disability, and years of life lost.

Although some data on injury determinants and populations at risk have been documented, the deficits in data are evident. Areas of research must be targeted, and a comprehensive surveillance system must be developed to counteract these deficits. In addition, the ICD codes need to be enlarged so that sports-related morbidity and mortality can be identified.

Further needs are (*a*) to develop definitions that facilitate detection of all sports-related injuries, incorporating definitions of symptoms resulting from trauma that may not be detected otherwise, and (*b*) to incorporate criteria reflecting the length of time symptoms persist and the level of disability, that is, the level of discomfort and restricted activity caused by the injuries. A major concern is that many potentially serious injuries, including concussion and spinal cord trauma, may never receive the attention of a physician or skilled health care professional (*9,10*). Moreover, the magnitude of sports-related injuries will not be fully realized until their economic costs and long-term chronic effects can be determined. When these needs are met, strategies to prevent and control sports-related injuries can be developed more realistically.

References

1. Baker, S. P., O'Neill, B., and Karpf, R. S.: The injury fact book. D.C. Heath and Company, Lexington, MA, 1984.
2. Kraus, J. F., and Conroy, C.: Mortality and morbidity from injuries in sports and recreation. Ann Rev Public Health 5: 163–192 (1984).
3. Kraus, J. F., et al.: Incidence of traumatic spinal cord lesions. J Chronic Dis 28: 471–492 (1975).
4. Karlson, T. A.: The incidence of hospital-treated facial injuries. University of Wisconsin, Madison, 1983.
5. U.S. Consumer Product Safety Commission: NEISS Data Highlights, Vol. 6, No. 4 (1982).
6. Clarke, K. S., et al.: The National Athletic Injury/Illness Reporting System, NAIRS–I, recorder's handbook, 1976–1977, Pennsylvania State University, University Park, 1976.
7. Clarke, K. S., et al.: The National Athletic Injury/Illness Reporting System, NAIRS–II, recorder's handbook, 1976–77, Pennsylvania State University, University Park, 1976.
8. Gerberich, S. G., Priest, J. D., Grafft, J., and Seibert, R. C.: Injuries to the brain and spinal cord: assessment, emergency care, and prevention. Minn Med 65: 691–696 (1982).
9. Gerberich, S. G. et al.: Spinal trauma and symptoms in high school football players. Physician Sportsmedicine 11: 122–139 (1983).
10. Gerberich, S. G., et al.: Concussion incidences and severity in secondary school varsity football players. Am J Public Health 73: 1370–1375, December 1983.
11. Robertson, L. S.: Injuries: causes, control strategies, and public policy. Lexington Books, Lexington, MA, 1983.
12. Gerberich, S. G.: Analysis of high school football injuries and concomitant health care provisions. Doctoral thesis (2 vols.). University of Minnesota, Minneapolis, 1980.

Childhood Injuries

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A GREAT DEAL more is known about factors associated with injuries to children than about "determinants" of injuries. I have found it useful to think of a "causal chain of events" leading to injuries rather than to try to isolate "determinants."

Any effort to reduce injuries should begin with a consideration of both intentional and unintentional injuries. Countermeasures are often the same for both types of injuries (for example, airbags, handgun control, and lower hot water temperatures). Determining intent is often impossible on practical or theoretical grounds. Rape, suicide, homicide, child abuse and neglect, and assaults produce the same kinds of physical and emotional devastation as burns, motor vehicle collisions, and falls.

Part of any national strategy for injury reduction should be a recognition of the need to individualize approaches for particular communities. At the Zuñi Pueblo in New Mexico, for example, dog bites and aluminum wiring are priorities for injury control activities, whereas lead poisoning and falls from windows are not.

Data Caveats

Before priorities for action are determined on the basis of readily available data of the sort presented subsequently, several "data traps" should be considered.

Absent data. Certain information on injury causes simply may not be routinely collected. For example, when a large proportion of childhood deaths from fires in New Mexico were related to mobile homes, it was distressing to learn that the State fire marshal had no record of fires by dwelling type. Important problems, such as children's drug and solvent abuse, lead poisoning, and sensory deficits, will be overlooked unless they are specifically screened for. Furthermore, data may be absent if the victims do not seek help. Underreporting of child abuse, incest, and rape are well-known examples.

Neglected data. Information on injuries may be recorded but not included in summary statistics. For example, occupational injuries treated at the worksite do not appear in studies of injuries treated in emergency departments.

Submerged data. Important types of injuries may be lost in larger categories of summary statistics. For example, little attention has been given to farm-related injuries to children, yet injuries related to farm machinery cause high death rates among young children.

Truncated data. When injury data are reviewed for children only up to an arbitrary age, injury prevention opportunities might be overlooked. For example, injury data on young people up to the age of 15 are unlikely to show the savings in lives and morbidity that have resulted from laws requiring motorcycle riders to wear helmets—laws that would affect older teenagers dramatically.

Dangling data. Although the frequency and the severity of injuries are vitally important measures for setting intervention priorities, so, too, is the rate of injuries for the exposed population. Denominators consisting of exposure data are seriously lacking in the injury control field. For example, sex differences in bicycle injury rates disappear when the denominator becomes hours of bicycle use, and minibikes are four times as hazardous as bicycles when injury rates are expressed as injuries per vehicle.

Mortality

Rates of death for particular age groups are often presented by rank order for each age group. Such a presentation is useful, for example, in targeting educational efforts to different age groups. In establishing priorities for injury control within the entire pediatric population, however, an ordering by age- and cause-specific rates is more informative.

Morbidity

Recently, data have become available from two large-scale, population-based studies: the Northeastern Ohio Trauma Study and the Statewide Childhood Injury Prevention Program conducted in Massachusetts. The Northeastern Ohio Trauma Study examined the incidence of cause-specific trauma as reported to hospital emergency depart-

ments serving a population of 2.2 million (*1*). Trauma cases accounted for 52 percent of all visits to the emergency departments during the 1-year study period. In a summary of injury rates by cause and age for children and young adults, falls were a major cause of morbidity in all age groups, as were the categories "cutting/piercing" and "striking/struck/caught by object." Only motor vehicle-related injuries appeared as a leading cause both of deaths and of emergency room visits.

The Statewide Childhood Injury Prevention Program provided population-based injury data on persons 19 years of age or younger in Massachusetts (*2*). Injury rates by external cause showed that although the rank ordering of causes was similar to that found in the Ohio study, sports-related injuries were prominent only in Massachusetts. In the Ohio data, "sports" may have been submerged under "falls," "struck," and "cutting" injuries.

The National Electronic Injury Surveillance System (NEISS) of the Consumer Product Safety Commission involves a representative sample of hospital emergency rooms in the continental United States. A review of NEISS data for patients under 29 years of age treated in hospital emergency rooms for product-related injuries in 1978 (*3*) showed that

- 40 percent of injuries to infants involved the head;
- 147,000 children were injured falling down stairs, 55,000 were injured by the sharp edges of coffee tables, 28,000 suffered lacerations from broken windows, and 20,000 were injured in bathtubs and showers;
- sports and recreational equipment accounted for half of the product-related injuries in the elementary schoolchildren and teenagers.

"Determinants" of Injury: the Child

Both developmental and behavioral characteristics of children may increase their likelihood of injury. These characteristics may be associated with an increased risk of exposure to hazards or with a decreased ability to cope with hazardous situations.

Developmental characteristics. Many aspects of physical development determine a child's risk of injury; for example,

- the ability to crawl, walk, and climb brings different hazards within reach;
- a large head-to-body ratio increases the risk of head injuries; and
- a small airway size increases the danger of aspiration.

Cognitive development and psychosocial development are other factors involved in children's injuries. Developmental considerations provide many explanatory insights into age-specific injury rates: the prevalence of falls in toddlers whose ambulatory abilities are rudimentary, the high prevalence of pedestrian and motor vehicle injuries in children just starting school, and the rise in fatalities among motor vehicle occupants as teenagers enter driving age. Rather than reporting age-specific data according to fixed, arbitrary 5-year intervals, grouping data by developmental stages has much to speak for it. One such grouping, which incorporates aspects of physical, cognitive, and psychosocial development, would be infants, under 1 year of age; toddlers, 1–2 years; preschoolers, 3–5 years; children at early school age, 6–12 years; and teenagers, 13–18 years. For an in-depth analysis of injury rates, data should be presented both by year of age and by developmental group.

Behavioral characteristics. Two issues separate behavioral from developmental considerations: variations in injury rates by gender and the concept of "accident proneness." For many injury types, boys have higher rates of injury than girls. Some, but not all, of these differences can be attributed to differences in exposure; for example, boys have higher rates of bicycle-related injuries because they ride bicycles more. The most likely explanation for sex differences in injury rates when exposure is controlled for is that behavioral differences are important. Generally, boys are more active, aggressive, and risk-taking than girls (*4*).

Some children appear to have more than their share of injuries. Parents of such children often consider them "accident prone"; however, they may simply represent one end of a normally distributed curve. Alternatively, other factors extrinsic to the individual may be associated with repeated injuries. Several controlled studies have pointed to a relationship between childhood injuries and adverse family-life events, such as marital disharmony, financial problems, or a death or an illness in the family (*5*).

Most studies of the psychosocial characteristics of children who are injured have been retrospective or poorly controlled or both. Certainly, no data have suggested that one can identify children at high risk of injury because of specific behavioral characteristics.

"Determinants" of Injury: the Environment

The powerful role environmental factors play in childhood injuries is best illustrated by the association of injury rates with socioeconomic status (*6*)

and by examples of successful injury control interventions through environmental modifications.

Socioeconomic factors that may be translated into differential injury rates for children include

- neighborhood environment: traffic, protected play areas, rural or urban setting;
- home environment: types of housing (apartment, mobile home), quality of housing (fire safety, stairs), crowding, lead paint;
- social environment: parents' type of work, presence of adult supervision, adverse life events;
- personal impact of poverty: hunger and inattentiveness, no shoes, no car safety seats.

House fire-related deaths, which account for three-fourths of all deaths from fires and burns, exemplify the role of socioeconomic effects. Death rates are more than twice as high in areas of low per capita income, and low-income areas have a higher proportion of fires involving faulty heating or electrical systems (*7*).

The arena of childhood injuries provides several of the most outstanding examples of effective environmental approaches to injury reduction, such as the Poison Prevention Packaging Act, the Flammable Fabrics Act, the "Children Can't Fly" Program, and the prevention of lead poisoning (*5*).

Summary

Children warrant special attention within a national strategy for injury control because

- they have high rates of specific types of injury;
- the impact of injuries is often greater on children than on adults because of years of life lost, opportunities for employment foregone, and absence of development of compensating abilities;
- children lack the knowledge, judgment, and skills to protect themselves from hazards and therefore must depend on others to protect them.

With respect to mortality from childhood injuries, teenagers are the population at highest risk, and intentional injuries give rise to the most deaths. With respect to morbidity, falls (for all ages), sports and motor vehicle-related injuries (for older children), and home hazards (for infants and toddlers) are clearly important; however, the specific circumstances of injury in individual communities must be examined before optimal interventions can be recommended. An analysis based only on existing data could lead to false conclusions because some data may be absent, submerged, neglected, truncated, or dangling (lacking exposure-based denominators).

Both developmental and behavioral factors influence patterns of child involvement in injury-producing events. The importance of environmental factors is demonstrated by the dramatic role played by socioeconomic status and by the success of environmental modifications, such as childproof containers and flame-retardant fabrics, in greatly reducing injuries to children.

References

1. Barancik, J. I., et al.: Northeastern Ohio Trauma Study I. Magnitude of the problem. Am J Public Health 73: 746–751 (1983).
2. Gallagher, S. S., et al.: A strategy for the reduction of childhood injuries in Massachusetts: SCIPP. N Engl J Med 307: 1015–1019 (1982).
3. Rivara, F. P.: Epidemiology of childhood injuries. *In* Preventing childhood injuries, report of the twelfth Ross roundtable on critical approaches to common pediatric problems, edited by A. B. Bergman. Ross Laboratories, Columbus, OH, 1982, pp. 13–17.
4. Rivara, F. P., et al.: Epidemiology of childhood injuries. II. Sex differences in injury rates. Am J Dis Child 136: 502–506 (1982).
5. Berger, L. R.: Childhood injuries: recognition and prevention. Curr Probl Pediatr 12: 1–59 (1981).
6. Mare, R. D.: Socioeconomic effects on child mortality in the United States. Am J Public Health 72: 539–547 (1982).
7. Mierley, M. C., and Baker, S. P.: Fatal house fires in an urban population. JAMA 249: 1466–1468 (1983).

The Epidemiologic Basis for Injury Prevention

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INJURY IS A PROBLEM of human and environmental interaction rather than simply a behavioral problem. In the United States, injury is the number 1 cause of death among persons under age 44 and the main cause of prematurely lost years of life among persons under age 70, exceeding heart disease and cancer combined (*1*). The causal agents for injury are the same as those for most chronic and occupational diseases.

The problem of injury has been largely neglected by public health personnel. The reason for this neglect, I believe, is that the agents and mechanisms of injury occurrence have been misunderstood. Consequently, in contrast to many other health problems such as cancer, the prevention or amelioration of injury is not generally viewed as a medical issue but rather as an issue that can be controlled primarily by educational, legal, or engineering personnel.

Over the past several years, five key events have placed injury epidemiology and control in the mainstream of medical epidemiology and control of environmentally caused diseases. The first key event occurred in 1961, when J. J. Gibson observed that all injury events involve the harmful effects of only five agents (*2*). These agents are the five forms of physical energy, namely, kinetic or mechanical energy, chemical energy, and electricity, radiation, and thermal energy. All of the human and environmental components previously thought to be agents then became recognized as either vehicles or vectors—enabling factors for the real agents.

Unintentional injuries usually are considered to be events that occur suddenly, apparently at random or without prior intention, causing unwanted harm. A more appropriate epidemiologic definition is that injury is tissue damage resulting either (*a*) from the rapid transfer to individuals of harmful amounts of one of the five forms of physical energy or (*b*) from the sudden interruption of normal energy management patterns necessary to maintain life.

The second key event occurred when Dr. William Haddon, Jr., divided the injury event into three phases (*3*). During the preinjury or pre-event phase, the energy source goes out of control. In the injury (or event or energy-transfer) phase, the amount of energy released and the nature of its transfer to tissues determine whether injury occurs and its severity. Finally, during the postinjury or postevent phase, personal homeostatic mechanisms and external factors, including the timing, quantity, and quality of emergency, definitive, and rehabilitative care, contribute largely to the final outcome.

Haddon's definitions of the three phases were important for two reasons. First, they emphasized that an injury event is not simply a unimodal occurrence in which a harmful outcome can be avoided only by preventing the initial event. Useful interventions can be designed for any or all of the three phases.

Second, the definitions demonstrated that human and environmental components are contributing factors throughout all three phases. For example, if a car driven by an alcohol-impaired person crashes, it is not enough simply to say that the cause was impairment due to alcohol. One must also ask why the impairment had not caused the driver to get into trouble sooner. The answer often is that only at that time did environmental demands increase so that the impairment became excessive for the task. Thus, in some cases the rates of fatal crashes have been reduced 50 percent or more by modifying the characteristics of roads without altering the characteristics of persons using those roads.

The third key event is also a brainchild of Dr. Haddon. In 1970, in a paper titled "On the Escape of Tigers: an Ecologic Note," Dr. Haddon identified 10 generic categories of countermeasures to prevent injuries or to reduce their severity (*4*). These countermeasures potentially apply to the reduction of morbidity and mortality and are derived from consideration of the agent—physical energy—rather than from consideration only of the event in which control of the agent is lost.

One of the ongoing frustrations of public health personnel is that often perfectly acceptable and feasible technological solutions to major health issues are applied or accepted only after extensive controversy (*5,6*). The fourth key event is still in progress. It is what I call the sociopolitical model for intervention, aimed at permitting useful technological innovations to be applied (*7*). The sociopolitical modeling involves a melding of the skills and concepts of epidemiologists with those of public administrators, economists, sociologists, and political analysts.

The fifth and last key event is the realization that

injury and chronic disease are actually two aspects of the same phenomenon. Long-term analogs that we arbitrarily call chronic diseases have now been found for almost all of the rapid-energy loadings that we arbitrarily call accidents, assaults, homicides, and suicides. Human and environmental characteristics involved in traumatic events are often the same characteristics involved in long-term events. Thus, acute injury events must be understood as being part of the public health problem of diseases caused by the environment.

Some of the unresolved epidemiologic problems in injury prevention can be categorized into seven broad areas.

- Development of a common language for defining injury events for research and administrative purposes.
- Documentation of the numbers, distributions, and trends of different types of injury. Many legally reportable injuries are not in fact reported, and no reporting is required for most injuries that occur in home, recreational, or public settings.
- Collection of exposure data so that injury rates and trends may be better assessed. In the areas of home and recreational injuries, exposure data are almost nonexistent; in other areas, they exist but are inadequate.
- Better quantification of energy loadings for more sophisticated epidemiologic research. A lot of data from laboratory research are available, especially regarding kinetic energy, on thresholds of injury under various energy loadings. These data, however, tend to be highly standardized, usually involving impacts to flat surfaces by impingers of constant size to young, healthy tissues. The effects of factors such as age or surface contour are not well clarified, and attempts to translate even the existing laboratory data into "real world" epidemiologic studies are still rather primitive.
- Identification and quantification of alcohol and other physiochemical interactions during the injury and postinjury phases. One of the important issues concerning environmental contaminants and the occurrence of chronic diseases has been the effects of personal characteristics that increase one's risk of damage—for example, smoking, genetic patterns, and prior health problems. These issues are relevant to acute injury as well. Data suggest, for example, that for given levels of energy loading, the consumption of alcohol increases one's risk of injury.
- Program evaluation. Unfortunately, most injury control programs (*a*) have not been subjected to evaluation, (*b*) have been evaluated, but with inappropriate methods, or (*c*) have been adequately evaluated and found not to work but are continued nonetheless. This is especially true for behavioral countermeasures that people assume must work simply because they seem to be good ideas.
- Better integration of diverse expertise into injury control efforts. Biomechanical engineers, economists, sociologists, and political planners must be increasingly incorporated into the planning and review process for injury research, control, program implementation, and program evaluation.

Over the past two decades, epidemiologic modeling of injury events and outcomes has become increasingly sophisticated. Multifactorial analyses of such events are becoming more common, thus leading to the proposal of more sophisticated countermeasures. Nevertheless, many problems remain in injury epidemiology and programming—problems similar to those found in other areas of environmental health.

References

1. Centers for Disease Control: Table V. Years of potential life lost, deaths and death rates by cause of death, and estimated number of physician contacts by principal diagnosis, United States. MMWR 33:209, Apr. 20, 1984.
2. Gibson, J. J.: Contribution of experimental psychology to the formulation of the problem of safety—a brief for basic research. *In* Behavioral approaches to accident research. Association for the Aid of Crippled Children, New York, 1961, pp. 77–89.
3. Haddon W., Jr.: A note concerning accident theory and research with special reference to motor vehicle accidents. Ann NY Acad Sci 107: 635–646 (1963).
4. Haddon, W., Jr.: On the escape of tigers: an ecologic note. Am J Public Health 60: 2229–2234 (1970).
5. March, J. G.: The 1978 Nobel Prize in economics. Science 202: 858–861 (1978).
6. Joscelyn, K. B., and Jones R. K.: Management of the traffic crash risk: a conceptual framework. J Safety Res 10: 148–161 (1978).
7. Wakeland, H. H.: An array of social values for use in analyzing the need for safety regulations. *In* Proceedings of the 4th International Congress on Automotive Safety, Alexandria, VA, July 14–16, 1975. Department of Transportation, National Highway Traffic Safety Administration, Washington, DC, 1975, pp. 875–906.

Unintentional Injury among the Medically Impaired and Elderly

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COMPARED WITH the role of injury as a cause of death among other age groups, injury among the elderly appears at first glance to be a relatively minor problem; however, when we consider all injury events, especially those with more severe outcomes, the elderly account for a substantial portion. Although persons age 65 or over constitute only 11 percent of the population, they account for 23 percent of deaths from all unintentional injury, 11 percent of deaths from motor vehicles, 13 percent of those from poisonings, 71 percent of those from falls, 28 percent of those from fires and burns, and 15 percent of those from machinery and cutting objects (*1*).

The number of persons injured per 100 persons age 65 or older is actually less than that for most other age groups, but those fewer injuries result in more disability than the injuries in other age groups. The elderly and persons with medical impairment differ from other persons both in the amount and in the types of exposure they have related to work, recreation, and the operation of motor vehicles. The elderly are more likely to be pedestrians than drivers. In addition, they have higher pedestrian injury rates per unit of exposure than younger segments of the population. Elderly persons account for 21 percent of all pedestrian fatalities in the United States, while elderly drivers and workers appear to have higher injury and death rates per exposure unit (*2*).

In an analysis of the effects of exposure on injury patterns for persons with and without medical impairment, persons with disabilities that limit activity did not show an increase in injury risk (*3*). Within that overall pattern, however, impaired men were underrepresented and impaired women were overrepresented in injury events. One explanation for this is that impaired men are less likely than other men to be exposed to occupational and recreational hazards, whereas impaired women may still have to cope with their household chores and related hazards.

Risk among the Elderly: Normative Changes

The following are some of the human and environmental factors associated with aging that may affect risk of injury or of more serious outcomes:

- Changes occur in vision. The lens becomes more opaque and yellowed, more lumens are needed for clear vision, more time is required for adapting both to glare and to dim light, and dynamic visual acuity is reduced.
- Hearing decreases with age; however, this does not appear to be an important factor in most injury events.
- Muscle mass and muscle strength decrease markedly with age, especially among women.
- Bone mass is reduced, and bone fragility is increased.
- Overall stature is reduced.
- Stamina decreases.
- Renal and hepatic functions decrease, affecting one's ability to metabolize normal doses of therapeutic drugs and resulting in greater chances of psychomotor and sensory impairment.
- Reaction time slows, sensitivity to temperature change is lowered, the pain threshold may increase, and tactile and vibratory sensations decrease.
- The ability to learn and to solve problems may decrease.
- Advanced age may be an advantage in societies or occupations with few technological changes, but it is a distinct disadvantage in settings where such changes are occurring very rapidly.
- Because of reduced income, elderly persons often live in poorer, less safe housing—with limited egress in case of fire, with deteriorated equipment, and in neighborhoods with heavy traffic.

Pathological Changes

Not only do normative changes occur, but pathological changes also occur with increasing age. Ten major types of pathology, most of which especially affect the elderly, follow:

- Cardiovascular disease. Various conditions may cause either sudden or less obvious impairment. Alterations in cardiac efficiency and rhythm may reduce the amount of oxygen to the brain, yet the person may be totally unaware of the impairment.
- Diabetes mellitus. Among older persons, diabetes-associated reductions of visual acuity and fields and of peripheral sensation become issues of concern.
- Seizure disorders. Firm data are not available, but a reasonable assumption is that a greater frequency and severity of seizures (for example, grand

mal instead of petit mal) increases the risk of seizure-associated injuries.
- Disorders of mobility. Chief among these in the elderly are Parkinsonism, multiple sclerosis, stroke, and arthritis in its more severe forms.
- Limited vision. Problems include cataracts, diabetic and hypertensive retinopathy, macular degeneration, and glaucoma.
- Senile dementias.
- Disorders of the parasympathetic nervous system.
- Alcoholism. The consumption of alcohol is the single most important human cause of fatal highway crashes, and among adults it is frequently a factor in fatal falls, other home-related injuries, and drownings. It contributes less often, but still not infrequently, to serious injuries among the elderly.
- Disabilities secondary to prior trauma.
- Mixed effects of two or more of the above conditions.

Falls: Factors and Important Questions

In the United States each year, about 13,000 deaths are attributed to falls, and the number may be considerably higher. A study in King County, WA, showed that, in about half of fall-related deaths, the fall was listed on the death certificate simply as a significant other condition rather than as the underlying cause of death (*4*). Thus, there may be two or even more times the number of fall-related deaths than the number officially recorded.

Another study showed that in the United States each year about 200,000 persons are hospitalized because of hip fractures, and most of these fractures are caused by falls; 84 percent of the patients are 65 years of age or older (*1*). In this age group alone, persons with hip fractures require 3.6 million days annually of hospital treatment.

Several studies have documented that children who have seizures, cerebral palsy, and other conditions that affect consciousness or mobility are more likely than other children to have falls. Furthermore, the outcomes from such falls are usually more severe, such as serious burns or drownings, because the underlying medical condition prevents the person's quick extrication from the hazardous situation.

In a study of adult deaths resulting from falls in Sacramento County, CA, 60 percent of the persons had blood alcohol concentrations of .10 percent or higher (*5*). About 75 percent of persons with blood alcohol concentrations in this range had one or more stigmata or an actual diagnosis of alcoholism.

Reports of medical impairments as contributors to falls among the elderly are common. Health problems include dizzy spells, insecure footing because of arthritis, general debilitation, multiple sclerosis, stroke or other disorder of mobility, poor eyesight, and senile dementia.

In a study of 150 falls resulting in medical care for persons age 60 or older, 70 percent of the persons whose falls were due to precipitating medical episodes had had prior chronic health problems (*6*). Despite the importance of medical problems in precipitating these falls, it is noteworthy that in 57 percent of the falls in which medical impairment played a role, environmental factors, such as insufficient lighting, also contributed. In addition, the characteristics of the item a person strikes in a fall affect the severity of the injury.

Successful countermeasures to avoid fall-related injuries include lower hospital beds; guard rails on beds; improved lighting for stairways and walking areas; alterations of surfaces that might be struck in falls (such as sliding glass doors); clinical regimens that decrease impairment due to seizures, stroke, or Parkinsonism, or that decrease bone fragility; and improvements in treatment and rehabilitation programs for persons with hip fractures or head injuries.

Several questions remain regarding falls among the elderly. These include the following:

- What is the actual number of deaths associated with falls among the elderly? Can some common definitions be established? Do the substantial international differences in fall-related death rates reflect different definitions or other factors?
- Is the continuing drop in fall-related death rates due to improvements in medical care or to other factors?
- What are the relative contributions of different types of human and environmental factors in the preinjury, injury, and postinjury phases of falls among the elderly?
- What are the immediate and long-term "costs" of falls to the elderly, and who pays those costs, either in actual dollars, in the injured person's reduced mobility, or in the burden placed on others who care for the injured person?

Thermal Injuries

Thermal injuries can result from exposure to excessive cold as well as to excessive heat. The death rates from both types of exposure increase markedly with age but are about five times higher for

injuries related to heat; therefore, this discussion will be confined to burns and related injuries.

Not only do medical conditions at all ages contribute both to the occurrence and the severity of burns, but also alcohol and alcoholism are important contributors.

Contributing environmental factors include flammability of fabric, unstable containers that spill scalding liquids, exposed hot surfaces, excessive temperature settings on water heaters, and furniture and building components that yield toxic gases on combustion.

Countermeasures to avoid burns include altering flammability of materials used in home structures, furnishings, and clothing; lowering temperature settings on water heaters; lowering the center of gravity for tea and coffee pots; and requiring smoke and fire detectors or alarms. For the postinjury phase, improved methods for skin grafting are being developed.

We know that the rate of fire-related deaths goes up markedly with age, but to what extent does this increase reflect a lesser ability of some older persons to avoid entrapment versus a greater sensitivity of the heart, lungs, and other tissues to toxic gases? To what extent is confusion or impairment caused by medication a factor in thermal injuries among the elderly? And what about senile dementia as a contributory factor? Do home smoke and fire alarms successfully alert persons with hearing deficits or persons under the influence of alcohol? These are some of the questions that remain unanswered.

Highway Crashes

Except for the contribution of alcohol and alcoholism, little is known about how medical impairment and factors associated with aging contribute to highway crashes. We suspect, however, that at least some crashes occur because of subtle impairments that make the driver less able to cope with driving tasks. One study showed that older drivers with medical conditions had higher crash rates than middle-aged drivers, but older drivers in generally good health did not have higher crash rates (*7*). These findings, however, should be interpreted with caution. Persons with medical impairment often drive less than other persons, and they may also drive only at times and under conditions that are not considered hazardous.

The elderly are overrepresented among pedestrian fatalities; however, the frequency and the extent to which disabilities contribute to these fatalities are not known. Environmental countermeasures to reduce the number and severity of pedestrian injuries and fatalities are not commonly applied but, where used, have good records of success. Measures to alter the design of vehicles to reduce injury severity for pedestrians, however, have been less successful than those to reduce injury severity for vehicular occupants.

Some research questions of high priority:

- Regarding alcoholism, which behavioral countermeasures can best prevent recidivism among alcoholics arrested for driving while intoxicated?
- What are the interactions of a person's underlying medical conditions at any given functional level, of a driver's altered exposure characteristics, and of environmental characteristics in determining the frequency and types of crashes?
- To what extent should licensing be regulated for drivers with different categories of medical conditions?
- What are the interactions of impairment due to aging, exposure characteristics, and environmental characteristics in determining the frequency and characteristics of pedestrian-vehicular crashes?

In summary, both normative and pathological aspects of aging have the potential for increasing the frequency and the severity of injury, but data suggest that the increase in severity is by far the more important issue. The elderly and the medically impaired are particularly at high risk of death from falls, heat- and fire-related injuries, and pedestrian-vehicular crashes. Medical impairment plays a role in both the frequency and the severity of these events.

References

1. Baker, S. P., O'Neill, B., and Karpf, R. S.: The injury fact book. Lexington Books, D.C. Heath and Company, Lexington, MA, 1984.
2. Waller, J. A.: Injury control. Lexington Books, Lexington MA, 1984.
3. National Center for Health Statistics: Health characteristics of persons with chronic activity limitations: United States, 1979. Vital Health Stat [10] No. 137. DHHS Publication No. (PHS) 82–1565. Hyattsville, MD, December 1981.
4. Iskrant, A. P., and Joliet, P. V.: Accidents and homicide. Harvard University Press, Cambridge, MA, 1968.
5. Waller, J. A.: Nonhighway injury fatalities. Roles of alcohol and problem drinking, drugs and medical impairment. J Chronic Dis 25: 34–46 (1972).
6. Waller, J. A.: Falls among the elderly: human and environmental factors. Accid Anal Prevention 10: 21–25 (1978).
7. Waller, J. A.: Cardiovascular disease, aging and traffic accidents. J Chronic Dis 20: 615–620 (1967).

Motor Vehicle Injuries

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MOTOR VEHICLES ARE the leading cause of injury-related deaths. They are the leading cause of all loss of life from age 1 to 44 and are the leading cause of loss of preretirement years of life in the United States. The median age at death caused by motor vehicles is 27 years, compared with 76 years for heart diseases and 68 for cancers.

Simply noting risk factors, however, does not lead to national policy for injury control. Many risk factors, such as age and sex of the drivers, are not modifiable. A few strategies are known to change human behavior, but most of the commonly used approaches—such as education and media advertising—have little, if any, effect on self-protective behavior. The following is a partial list of policies that have been studied to such an extent that they can be recommended for adoption. The effects overlap in some cases; therefore, the effects do not sum to a total effect.

• The research safety vehicle. Although prototype research safety vehicles have been developed that provide improved survival rates of occupants, side-crash protection, pedestrian protection, and crash avoidance, no automobile manufacturers use all of this lifesaving technology, and most manufacturers use none of it. This is not because of cost. In mass production, the research safety vehicle could be sold profitably for about the same price per unit as current compact cars. If safety technology were used in all cars, deaths would be reduced by some 18,000 per year at current death rates (*1*).

• High-mounted center brake light. An extra brake light mounted above the trunk in the rear center of the vehicle has been found to reduce by 50 percent the number of rear-end collisions that occur during braking (*2*). A 50-percent reduction in rear-end crashes would result in a reduction of about 13 percent for all crashes, and the quicker braking—and thus lowered speed—would reduce the severity of crashes.

• Modification of roads at high-risk sites. A third of all fatal motor vehicle crashes occur when a vehicle leaves the road and strikes a rigid object, usually within a few feet of the road. Objects such as trees, utility poles, and bridge abutments do not have to be so near the road, and any necessary objects can be designed to absorb energy rather than concentrate it in crashes.

Curves that exceed 6 degrees, particularly those on downhill grades, have been found to produce 25 percent of the fatal crashes into off-road fixed objects. When the Georgia Highway Department increased the use and reflectivity of road stripes at such sites, the single-vehicle crash at night declined 20 percent from crash rates expected from other sites (*3*).

• Longer time for signal changes at intersections. At intersections controlled by signals, the time that the yellow light is lit between green and red or the time that the lights are red in all directions in a signal change sequence strongly correlates with vehicle crash rates at those intersections (*4*). States could require all intersection lights to have a yellow or all-red sequence 10 percent longer than the time recommended by traffic engineering practice for intersections of a given type. Changing the timing of lights would be a simple matter, requiring action only once and taking only a few minutes per intersection. Undoubtedly, the benefits would be many times the cost.

• Required use of seatbelts. Most of the liberal democracies have laws requiring motor vehicle occupants to use seatbelts when the vehicle is in motion. Most U.S. States require restraints for younger children, but only a few States have a law requiring adults to use restraints. The experience of various countries suggests that requiring occupants to use seatbelts would reduce motor vehicle-related deaths and serious injuries from 10 to 30 percent (*5*).

Over the past 15 years, the average proportion of drivers using seatbelts, for the country as a whole, has been found to range from 10 to 15 percent. The adoption of a law requiring drivers to use seatbelts would increase usage to at least 50 percent, and this would be accompanied by a reduction in fatal and severe injuries to vehicle occupants of at least 10 percent. With modest enforcement, these reductions could be increased substantially.

• Reinstatement of laws requiring motrcyclists to use helmets. Laws requiring motorcyclists to use helmets reduce deaths of motorcyclists about 30

percent. In debates on the issue, the costs to those who must pay taxes and insurance and to those who must support and care for motorcyclists with permanent brain damage are seldom considered.

• Raising age of licensure. About one of every five persons licensed to drive on his or her 16th birthday will be in a police-reported crash (more than $400 damage or injury) before age 18. Very little enforcement cost is associated with age of licensure laws. The laws are enforced by parents or guardians, most of whom will not allow an unlicensed teenager to use the family car. A secondary benefit of delayed licensure is better school performance. According to the Allstate Insurance Company, a study of 20,000 teenagers showed that students' grades deteriorate substantially once they begin driving.

• Curfews for teenage drivers. A number of States specify hours of the night during which persons below a specified age cannot drive legally. All of these curfews have had some effect on reducing crashes, with no apparent offsetting crashes occurring during other hours of the day (*6*).

• Increased liquor taxes. Alcohol is a causal factor in about half of the crashes involving fatalities and a third of those involving injury. Legal crackdowns on drinking and driving reduce fatal crashes temporarily, but the effect is not sustained because actual arrests are infrequent. Research has shown that alcohol consumption—including abusive consumption that leads to cirrhosis and impaired driving ability—is sensitive to price. According to one study, an inflation-adjusted decrease of 7 percent in consumption occurs for each $1 increase in the liquor tax (*7*).

References

1. Di Napoli, N., et al.: Research safety vehicle phase II, volume II: Comprehensive technical results. National Technical Information Service, Springfield, VA, 1977.
2. Reilly, R. E., et al.: Validation of the reduction of rear-end collisions by a high mounted auxiliary stoplamp. National Highway Traffic Safety Administration, Washington, DC, 1980.
3. Wright, P. H., et al.: Effect of pavement markers on nighttime crashes in Georgia. Transportation Research Record. In press, 1985.
4. Zador, P. L., et al.: The effect of signal timing on traffic flow and crashes at signalized intersections. Insurance Institute for Highway Safety, Washington, DC, 1984.
5. Robertson, L. S.: Injuries: Causes, control strategies and public policy. DC Heath, Lexington, MA, 1983.
6. Preusser, D. F., et al.: The effect of curfew laws on motor vehicle crashes. Insurance Institute for Highway Safety, Washington, DC, 1982.
7. Cook, P. J., and Tauchen, G.: The effect of liquor taxes on alcoholism. Duke University Center for Demographic Studies, Durham, NC, 1981.

Injury Facts, Risk Groups, and Injury Determinants

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IN RECENT YEARS, health professionals have begun to recognize that injuries are not simply the result of individual behavior and that major reductions in injury-related morbidity and mortality will not be achieved merely through informational activities. Perhaps this conference will speed the day when all health departments and schools of public health will address sources of injury with the same fervor accorded to toxic wastes.

One death in every 12 in the United States results from injury; for more than four decades of life, from ages 1–44, injuries are the leading cause of death (*1*). As a consequence, each year more than 4 million potential years of life prior to age 70 are lost prematurely because of injuries, compared with less than 2 million each for cancer and heart disease. Death rates from 1910 through 1980 declined 30 percent for injuries, but for the other three major disease groups—tuberculosis, gastroenteritis, and influenza/pneumonia—the rates declined by 99, 99, and 85 percent, respectively.

The relative importance of various causes of fatal injuries varies substantially with age (*1*). Similarly, although the death rates by age for all unintentional injuries combined form a J-shaped curve with an intermediate peak at ages 15–24, the shape of this curve does not hold for individual causes of fatal injuries. Mortality patterns for 12 categories of unintentional injury by age and sex exhibit widely differing patterns. Elderly people have the highest death rates from many causes; high death rates also occur in the 15–24 age group.

There are also differences by race, not only in overall death rates from unintentional injuries but

also in age-specific patterns. Native Americans have the highest rates at all ages. Whites have the second highest rates among teenagers and the elderly. Unlike rates for other races, those for blacks do not peak between ages 15 and 24, and they increase after age 25.

For most categories of unintentional injuries, death rates are higher in low-income areas than in high-income areas and higher in rural than in urban areas. There is pronounced geographic variation among unintentional injury deaths. These dramatic variations illustrate the importance of the environment as a determinant of injury death rates.

Almost all causes of death from unintentional injury have weekend peaks, generally coinciding with increased social and recreational activity and greater alcohol use. The patterns of injury deaths by month are different for most causes of injury.

Issues that must be addressed by the participants at this conference include the following:

1. Members of population groups at especially high risk of being injured are often least apt to change their behavior regarding protection against injury. The use of seatbelts, for example, is least common among persons at greatest risk of being in a crash: teenagers, intoxicated drivers, people in low-income areas, and drivers who run red lights or follow other cars too closely. There has been very little emphasis on protecting high-risk groups from injuries by using measures that require only a minimum of effort, although in other public health areas these types of measures (for example, pasteurization) have proved most effective.
2. There is a tragic discrepancy between our knowledge about the etiology of injury and the application of that knowledge. For example, (*a*) certain lifesaving features of car and aircraft design have been known and proved effective, often for decades, but have not been incorporated into vehicle manufacture, (*b*) most roads do not provide state-of-the-art protection against even the most foreseeable crashes into roadside hazards, and (*c*) residences are not required to have automatic sprinkler systems. The effective control of many causes of injury is within our grasp, provided we give them the same priority that we give other major environmental problems and that we address them with the same basic scientific approaches.

Reference

1. Baker, S. P., O'Neill, B., and Karpf, R. S.: The injury fact book. Lexington Books, D.C. Heath and Company, Lexington, MA, 1984.

Injury Surveillance Systems—Strengths, Weaknesses, and Issues Workshop

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THE MOTIVATION FOR CONVENING this workshop was to recommend model injury surveillance systems at the national, State, and local levels; establishing specific details of a model are difficult, however, especially when data collection methods are changing rapidly because of changes in health care delivery and computer technology. For this reason, we present a framework for viewing data needs and data collection under various circumstances, rather than describing a model surveillance system that soon would be outmoded.

Value of Existing Data Sources

Before data are collected, we should understand fully what questions need to be answered and how the data will help answer them. Since the costs associated with collecting data may be very high, it is not surprising that some recurring questions are (*a*) how important is it to have the question answered? (*b*) what costs are associated with collecting the data? (*c*) can less costly alternatives satisfy the need? (*d*) are the answers to the questions worth the costs involved in collecting the data?

Because of the potentially high costs associated with starting and maintaining any surveillance system, we should take advantage of existing data sources as much as possible. Although such data may be obtained easily, they are usually collected for other purposes—such as death certification or workmen's compensation—and may lack information deemed essential for injury surveillance or studies. Nevertheless, all existing sources of information should

be examined carefully for their potential usefulness in injury prevention.

Existing data collection systems can be used more widely and more effectively. For example, injury mortality for a particular State or county can be produced easily and regularly by the State's vital statistics department.

Recommendations:

1. Examine, improve, and make full use of the existing sources of information for injury surveillance and studies. Examples of the diversity of sources are emergency medical services, fire marshals reports, and fiscal data, such as Medicare and Medicaid payment records. For a more complete listing of potential sources, contact Injury Epidemiology and Control, Center for Environmental Health, Centers for Disease Control, Atlanta, GA 30333.
2. Since sources of information vary substantially among geographic areas, develop a comprehensive inventory of sources. The inventory should give the source, form (such as computer tapes and reports), specific items included, and data quality, documentation, coverage, and availability. The purpose of the inventory is to provide a catalog of injury information that is useful at all levels of surveillance.
3. State vital statistics departments and other agencies collecting injury-related data should analyze and disseminate the information in a timely manner.
4. Data sources should be encouraged to report incidence and mortality rates by age groups. Age grouping for children and adolescents should be as follows: less than 1 year, 1–4 years, 5–9 years, and 10–14 years.

Data Needs in Injury Prevention

Data required for injury prevention are varied, depending on the intended uses of the data. Data are needed for planning and evaluating prevention programs, for a better understanding of the factors associated with injuries, and for identifying emerging problems such as injuries related to changes in lifestyle, technology, and consumer products. The myriad data needed require a combination of methods of collecting data from a number of sources, including agencies outside the health care system, such as police and fire departments.

Usually, information-gathering systems cannot keep pace with the information desired. Data needs are continuously changing as more is learned about the nature of injuries and the factors associated with them. Often, the data collected may answer some questions, but also they may present new concerns to be investigated and new hypotheses to be tested. As information needs change, collection systems are frequently unable to satisfy the needs because of the way they are structured. Even minor changes in items of data may require legislation (such as changes in death certificates) or widespread cooperation (such as from staff of a large number of hospitals and physicians when changes in medical records are proposed). Another concern is the confidentiality of records, especially when data have been obtained from multiple sources and merged.

Incompleteness, errors, and bias can affect data at any or all of the multiple steps in collection and analysis. Clearly, data must be collected and processed before they can be interpreted. Data on injured persons treated in hospital emergency rooms, for example, must first be written in the patient's medical chart by the attending physician or medical personnel before they can be coded by the medical records personnel. The coded data then must be entered into a computer system and merged with data from other hospitals. Finally, the data are tabulated, analyzed, and disseminated. Because of resource limitations, only preselected items are coded, and these data will be readily available for analysis only if they are coded and entered into a computer system. Data items must be in agreement and coding schemes must be uniform if data are to be aggregated and compared.

Not only must we specify which items are to be coded, but we must also specify the ones that need to be recorded systematically but not coded (for example, clinical variables used in assessing the severity of the injuries). Such information is important for researchers who require more detailed information.

There are four different methods of collecting injury-related information: routine active surveillance, monitoring sentinel injuries, specialized surveillance and registries, and epidemiologic studies.

Routine active surveillance. The primary goal of surveillance is the continuous monitoring of rates of injury morbidity and mortality in defined populations. Although all injuries need not be identified, a good surveillance system must enable researchers to estimate accurately at least the age-specific incidence and mortality rates for the selected injuries over time. Great care must be exercised in selecting the injuries and the data to be collected; otherwise, the burden and costs of data gathering will cause the rapid demise of the system.

Some significant issues related to surveillance follow:

1. Which injuries should be included?
2. What items of data should be included?
3. What geographic areas or populations should be included?
4. Is demographic information available on the population so that rates can be calculated?
5. How should the data be collected, that is, obtained through routine certificates, reporting, abstracting records, and so forth?
6. How soon must the data be available to those needing them?

Recommendations:
1. Before starting an injury surveillance system, be sure that it will enable researchers to estimate accurately the incidence of selected injuries and injury-related deaths in a defined population over a period of time.
2. Identify important injuries, data items, data collection methods, and costs and make recommendations on injury surveillance systems that are feasible now and in the future.

Monitoring sentinel injuries. The concept of monitoring sentinel injuries or injury-producing events can be useful in identifying emerging problems or changing patterns of injury rates. Persons may be injured in new ways as they change their recreational activities of daily living. Reports of injuries in the news media may prompt further investigation and monitoring of these injuries. Certain types of injuries may serve as sentinels, that is, they may alert us to a much larger problem. For example, changing patterns (time, place, and demographic characteristics of the injured) of severe head and neck injuries may reflect changes in sport or motorcycle activities. Increases in rates should prompt investigators to examine the causes of these and other injuries that may be produced by similar events.

Recommendation: Determine which injuries or injury-producing events can act as sentinels for special monitoring.

Specialized surveillance and registries. In many types of severe injuries, we would like to have more detailed information on the injury-producing event, the nature of the injuries, the patient's survival and disabilities, and outcomes of treatment. If the injury is uncommon, we need to compile information on similarly injured persons from different geographic areas over time. In such situations, reporting cases to centralized registries may be a good method for data collection. Examples of injuries that may be candidates for registries are severe burns, severe head trauma, and spinal cord injuries.

Recommendation: Identify injuries that are candidates for registries and determine what items and coding schemes are appropriate for the different types of injuries.

Epidemiologic studies. In contrast to surveillance, in which the major objective is to show variations in incidence rates over time, place, and personal characteristics, an epidemiologic study may try to establish causative and risk factors in the occurrence and severity of injuries through intensive examination of data on the injury or injuries in question and, where appropriate, of data on noninjured comparison groups. An epidemiologic study may establish incidence rates, but such a study is not a surveillance system unless it is repeated periodically so that trends in incidence can be determined. This distiction between epidemiologic studies and surveillance needs to be kept in mind, since in a surveillance system the amount of data collected must be limited (to assure the feasibility of collection over time), but in an epidemiologic study the amount of information collected may be very large (to control for possible confounding factors). Important risk factors identified through studies may be incorporated into surveillance, especially when interventions related to these factors may be part of an injury prevention program in the community.

Statistical Sampling

Because the cost of collecting and compiling desired injury data can be very high, an alternative strategy is to obtain information only on a statistical sample of injuries. The size of the sample and the way chosen to select the study population depend on many factors, such as the incidence and geographic distributions of the injuries. Sampling is especially useful when the incidence of the injuries in question is high and the distributions are somewhat predictable—such as with motor vehicle injuries, falls, and burns.

With less common injuries or injuries that occur sporadically, an extremely large sample may be needed to obtain reliable estimates, and other methods—such as reporting—may be preferable to sampling for certain uncommon but severe injuries.

Sampling can be applied to one or more hospitals

or emergency rooms as well as to selected types of injuries within the hospitals or emergency rooms.

Severity of Injury

Not only do researchers need information on various types of injuries and their frequency of occurrence, but also they need to know the extent and severity of injuries. Scoring systems for severe trauma have been established, and these scores, if routinely included in medical records, would be very valuable to researchers.

Recommendations:
1. Hospitals should be strongly encouraged to adopt and use the severity of injury scores (Trauma Score and Abbreviated Injury Scale or Injury Severity Score), in addition to coding the nature of injuries in the medical records for trauma patients.
2. Hospitals should be strongly encouraged to adopt and use standard scores, such as the Glasgow Coma Scale in head injuries, and similar scoring systems for the severity of particular injury pathologies.
3. Hospitals should record outcome scores to show the course of recovery and need for rehabilitative care.

Coding of Injuries

A major source of data is the hospital record. The type of injury is usually recorded and reported for a hospital discharge, but often the event or cause of the injury is not. For example, the hospital discharge may mention the diagnosis of hip fracture, but the fact that the fracture resulted from a fall is not routinely reported. Frequently, the physician who writes the note in the hospital chart may not have inquired whether the "fall" resulted from the patient's being pushed or knocked down. When an injury is known to have been intentional, such information is even less likely to be in the hospital chart. A researcher interested in studying fall-related injuries, for example, would have to search through records of many different types of injuries, such as head injuries, lacerations, and fractures. Furthermore, these injuries may have been caused by events other than falls.

For the purpose of monitoring and studying injuries, the diagnoses have to be assigned diagnostic codes. The most widely used coding scheme is the International Classification of Diseases (ICD) codes. For injuries and other "external" causes of death, the ICD provides the separate set of E codes that are used routinely in coding underlying causes of death in death certificates. However, other sources of injury data—such as hospital discharge summaries—often use the nature of disease (N codes) format of the ICD codes. Since the correspondence between the N codes and the E codes is not one to one, it is difficult to compare data from different sources if injuries are coded by different schemes.

Recommendations:
1. Hospitals should code hospital discharge diagnoses by both E and N codes instead of by N codes only—the current practice. The E codes should also be used for future coding of injuries of ambulatory patients.
2. State health departments should establish a model for reporting injury mortality.
3. Physicians and health care workers should carefully record in the hospital discharge record the cause and the outcome, in addition to the nature of the injury.
4. The Centers for Disease Control (CDC), in collaboration with the National Center for Health Statistics (NCHS), should assist State health departments in promoting the use of uniform and comparable reports on injury mortality.

Funding for Surveillance

Ongoing funding for injury surveillance is required if injury rates are to be monitored over time. The most efficient methods need to be used so that costs can be kept to a minimum, yet the needs will be met.

Recommendation: Funding for developing and implementing injury surveillance should be increased. Funding of pilot projects should be encouraged, since new and existing systems need to be evaluated in terms of costs and effectiveness. Funding for surveillance also must match the need for reducing injury rates.

Control Programs

The ultimate goal of injury surveillance is using the information to prevent injuries. Since surveillance often requires considerable expenditure of effort and time, it should be undertaken only if there is a commitment to injury prevention programs.

Recommendation: Injury prevention programs must have clearly defined objectives for injury surveillance.

Death Certificates

Death certificates provide valuable data that contribute to the epidemiologic profile of an injured person. The value of death certificates may be enhanced by implementing proposed recommendations.

Recommendations:
1. Use ICD N codes in addition to E codes for injury-related deaths.
2. Include the location of the injury classified according to (*a*) at home, (*b*) in transportation (not work related), (*c*) in transportation (work related), and (*d*) at work (not transportation related).
3. Include the person's occupation at the time of death; NCHS should code the occupation for all deaths receiving an E code.
4. Include in the death certificate, and in NCHS mortality tapes, whether the injury occurred at work.

Medical Examiners' Records

The value of medical examiners' records may be enhanced by adoption of the following recommendations.

Recommendations:
1. Encourage the sharing of medical examiners' records for injury prevention purposes.
2. Encourage the National Association of Medical Examiners to adopt guidelines for uniformity in data items and coding schemes in the Medical Examiner Record.
3. Conduct routine standardized testing for blood alcohol content in all injury-related deaths if the death occurred within 6 hours of injury.
4. Study the feasibility of having medical examiners submit a supplemental form along with death certificates for selected cases. Identify candidate injuries and data items for this supplement.

Emergency Room Records

For many State and community-based injury control programs, emergency room (ER) records are an integral part of their surveillance system. The following recommendations are aimed at increasing the overall effectiveness of these records.

Recommendations:
1. Hospitals should computerize their ER log books.
2. A CDC-organized interagency committee should study and recommend a minimum uniform set of data to be included in all ER logs.
3. The Joint Commission on Accreditation of Hospitals should require hospitals to keep minimum statistical records on characteristics of patients and injuries treated at the ERs.

Surveillance in Injury Prevention

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EPIDEMIOLOGIC SURVEILLANCE is the continuous monitoring of diseases, their consequences, and their causative and associated factors in defined populations. In the prevention of injuries, surveillance includes the monitoring not only of injury-related deaths, morbidity, and disability but also of agents, events, and situations that produce human injuries or that predispose persons to injuries. One of the primary aims of surveillance is to identify populations at high risk for injuries.

Surveillance can be used to define the epidemiology of injuries and to facilitate control programs. Surveillance data can be used in epidemiology to

- Document the magnitude of injury problems,
- Characterize populations at risk for injuries by using demographic, geographic, and environmental data,
- Identify emerging or recurrent problems in injury prevention and control, and
- Generate hypotheses of injury risk factors.

Before we can decide how to prevent injuries in a community, we need to know what persons and groups are at high risk of injuries; what types of injuries occur; and when, where, and under what circumstances injuries occur. By comparing such data over time and for different populations, we can observe changing patterns of injuries and perhaps

identify alternate strategies for intervention. When specific interventions are carried out, we need similar data to help ascertain their effectiveness.

Surveillance data are used in injury prevention programs to

- Guide program priorities and resource allocation,
- Identify high-risk populations to target program activities,
- Monitor and evaluate program effectiveness, and
- Generate hypotheses for alternate prevention strategies.

Information on injuries and injury-related events must be obtained from various sources. For example, information on severe injuries typically is obtained from hospitals, whereas information on vehicle crashes typically is obtained from police and insurance records. A surveillance system for injury prevention, therefore, requires a combination of information-gathering methods.

Information also is needed on circumstances and events that predispose persons to injuries. In burn prevention, for example, we need to know the number of house fires that have occurred in a community, the times of day the fires started, the number of people in the houses at those times, how quickly victims were rescued and transported, and what medical treatment was available. If the number of deaths from house fires has decreased in a community, we can see from surveillance data what factors contributed to the decrease—for example, whether there were fewer house fires, whether there were fewer people in the house at the time, whether the injured victims were rescued and transported more rapidly, or whether more adequate medical treatment was available.

In a surveillance program, questions must be clearly formulated before data collection begins so that required information will be obtained. In the example of the house fires, accurate data may not be available on the number of people who were in the burning houses unless this specific information is collected. Establishing surveillance systems requires the same degree of planning that is required for implementing injury interventions.

Specifying precisely the objectives of surveillance and knowing what data are required for meeting those objectives are paramount to the success of any injury surveillance system. Standardized data elements are generally needed for surveillance, though the specific program's focus will dictate some elements (see box). When these requirements are met, deficiencies in existing data can be readily identified, and, if necessary, additional methods may be used to obtain data needed to supplement routinely available information. In addition to specifying the data items to be obtained, the epidemiologists must specify the coding schemes to be used in storing and analyzing the data.

Data Elements in Injury Surveillance

1. Time. Date and time of injury event.
2. Place. Location of injury event:
   State, county, city.
   Indoor, outdoor, road, and other factors.
3. Person. Demographic characteristics of injured person:
   Age, sex, race, socioeconomic status.
   Occupation, work-related injury.
4. Types of injuries. Injuries sustained by person in event.
5. Agent causing injury.
6. Circumstances surrounding injury event:
   Host factors—alcohol, underlying diseases, debility.
   Environmental conditions and situation.
   Agent factors—material failure, misuse, and other factors.
7. Medical care. Resuscitation, emergency medical service trauma center, emergency room, hospitalization.
8. Health outcome. Death, amputations, permanent disabilities.
9. Other items, depending on program objectives.

Death certificates (compiled as mortality statistics) are the main sources of data on fatal injuries, but they contain limited information on circumstances associated with injuries and are often delayed by 2 or 3 years. Medical examiners' and coroners' reports contain detailed information on deaths from injuries, but only in a few cities is this information computerized. Computerized discharge summaries can be used to ascertain injuries in which the victim was hospitalized.

There are four major national surveillance systems.

- The National Center for Health Statistics (NCHS) compiles and analyzes mortality statistics for the entire United States and works with hospital discharge statistics; NCHS also conducts a series of health surveys.
- For injuries in which the victim was not hospitalized, the only readily available information is the Consumer Product Safety Commission's surveillance of 66 hospital emergency rooms—the National Electronic Injury Surveillance System (NEISS). This system provides national estimates of injuries related to consumer products only; other injuries recorded at hospital emergency rooms are not routinely reported or tabulated.
- The National Highway Traffic Safety Administration's Fatal Accident Reporting Systems (FARS)

provide surveillance of fatalities caused by motor vehicle crashes and a sample of nonfatal crashes.
• The National Burn Registry conducts surveillance of severe burns.

Injury surveillance can be greatly enhanced by obtaining data from hospital emergency rooms and medical examiners in a form that can be processed and statistically analyzed by computers.

Injury Surveillance—a State Perspective

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THE TERM "SURVEILLANCE," if applied to a disease, means continued watchfulness over the distribution and trends of incidence through the systematic collection, consolidation, and evaluation of morbidity and mortality reports and other relevant data (*1*). In the development of a surveillance system for injuries, three major issues must be addressed: (*a*) what are the goals of injury surveillance? (*b*) what sources of data are available to serve as the base for surveillance? (*c*) how much will the system cost? Because injury epidemiology and injury prevention are relatively new fields, some of the ideas presented in this paper are experimental and will require additional research and experience.

Lessons from Infectious Disease Experience

Experience with the surveillance of infectious diseases provides useful guidelines for developing injury surveillance systems. First, the idea of reporting all infectious diseases has never been entertained! Instead, communicable disease surveillance focuses on specific organisms or conditions of public health importance.

Second, the source of communicable disease surveillance has generally been the voluntary reports of physicians. As a result, data have been underreported, but such surveillance has identified epidemics and has been inexpensive.

Finally, there may be some useful parallels between injury surveillance and the surveillance of poliomyelitis in the 1950s. Most persons with poliomyelitis had subclinical to mild disease, a few had more serious symptoms of systemic and central nervous system infection, and only about 1 percent had paralysis. Yet the case definition in poliomyelitis surveillance was based entirely on paralysis because it was distinctive and serious. Surveillance of paralytic poliomyelitis was adequate for identifying the location and activity of the agent, and it also served as the measure of effectiveness of immunization programs.

Comparable issues apply to injury surveillance. A surveillance system cannot possibly capture all injuries. Surveillance will have to be specific, focusing on particular agents like motor vehicles and household poisons or on severe injuries caused by multiple agents, such as head injuries. Moreover, relying on physician reporting alone is inadequate because persons with significant injuries most likely are taken to emergency rooms or admitted to hospitals. In addition, since population-based incidence rates may be lacking, important types of injuries may be underreported. Finally, like poliomyelitis, injuries with a single etiology occur with a wide range of severity; therefore a "case" must be defined as an injury at a certain level of severity. Thus, the estimated incidence of injuries to children varies widely according to the level of care required (see table).

Sources and Cost of Surveillance Data

Potential sources of injury surveillance data have various advantages, limitations, and costs, as shown by the following examples.

Vital statistics—death certificate. In most States, vital statistical data are available on 100 percent of injury-related deaths. These data are of high quality, verified, and coded to provide information on both the nature of the injury (N code) and the etiology (E codes of the International Classification of Diseases). An analysis of several years of vital statistics provides useful planning information, and the data can be obtained readily and inexpensively.

Hospital inpatient data. For purposes of reimbursement, planning, and cost containment, data are collected on 100 percent of injured persons who are hospitalized. These admissions constitute an inex-

Incidence of injuries of children under 20 years by level of treatment, United States, 1980–81

Level of treatment	Incidence rate (per 10,000 children and youths)	Source[1]
Injuries leading either to restricted activity or any level of treatment	3,800	NCHS (2)
Emergency room treatments for injuries	2,160	SCIPP (4)
Hospital admissions for injuries	113	SCIPP (3)
Deaths from injuries	2.6	SCIPP (3)

[1] NCHS = National Center for Health Statistics. SCIPP = Statewide Childhood Injury Prevention Program, Massachusetts Department of Health.

pensive source of injury data, but several limitations are apparent. Although admissions data are available, in many States a central location where they are collected does not exist. Only a small percentage of injured persons who receive medical treatment are admitted to a hospital; therefore, hospital cases alone underrepresent injury incidence. Another limitation is that few hospitals provide the E code (for example, did the fracture result from a bicycle-related or a motor vehicle-related injury?).

Emergency room visits. Although most injuries requiring an emergency room visit are less severe than those resulting in hospitalization, they cannot be considered minor, and they result in enormous expenditures for medical care. Thus, surveillance of emergency room visits may be the best source of information on significant injury, particularly in an era when pressures for cost containment promote outpatient in lieu of inpatient care.

The major drawbacks to this type of injury surveillance are the high costs and the complex logistics of obtaining necessary information in busy clinical settings not geared to data collection. The costs of supervision, quality control, computerization, and data analysis must be added to field expenses. The data collection costs could significantly decrease with time, however, as hospitals continue to computerize their records. An important variant of emergency room reporting is the National Electronic Injury System (NEISS) operated by the Consumer Product Safety Commission. NEISS is based on a sampling system which collects reports of injuries related to consumer products (*5*). This system has applicability at State and national levels.

Practitioners' offices. Reports from the offices of physicians, dentists, and specialists such as ophthalmologists might uncover some interesting types of injuries that are underreported in other settings; however, the logistics of collecting reliable data from these sources may be prohibitive.

Injury surveys. Door-to-door or telephone surveys can be used in identifying safety hazards and practices as well as in collecting retrospective self-reports of injuries. In these surveys, injury is broadly defined, and all events are captured for a particular recall period. These advantages, however, are also weaknesses of the data source. To obtain an adequate number of injuries for analysis, investigators must contact a large number of households and use a limited recall period. The constraints of this methodology make household interviews and surveys expensive.

Reports from police, fire, and motor vehicle registries. Public safety agencies collect data on motor vehicle collisions and fires for their own surveillance, law enforcement, and insurance purposes. Obtaining these data for epidemiologic purposes, however, is a problem. Incomplete data and significant underreporting have been documented (*6*). Much work remains to be done in this area.

Medicaid, insurers, emergency medical systems, poison centers. Since little research has been done on the characteristics of data sets collected by these health care systems, we cannot assess their value for injury surveillance.

Goals of Injury Surveillance

Attempts to ascertain all injuries using a surveillance net would be neither useful nor desirable and would be prohibitively expensive. Returning to the hierarchy of injury severity referred to earlier, we propose a model of injury that links severity to a sequential interaction of factors—or an "injury syndrome." An injury syndrome implies a set of host factors, etiological characteristics, and environmental circumstances that overlap but come together in a sequential order to result in an injury of a particular severity (*7*). The concept of an injury syndrome is intended to help us explore why one child receives a relatively minor injury from the same agent that may kill another child. Epidemiologic research needs to focus on the characteristics of these injury syndromes, and injury prevention

must be targeted toward interrupting the sequences leading to serious and fatal injuries.

Injury surveillance data must be specific about the nature, etiology, and level of severity of the reported injury syndromes, and they must provide a basis for estimating incidence rates. Data on all fatal injuries, on injuries resulting in hospital admissions, and on selected injury syndromes can become part of such a system.

First, the fatal injuries are clearly of major importance, regardless of the etiology or nature of the injury. Since vital statistics are readily available at the State level, fatal injuries must be collected in a surveillance system. However, such deaths are rare and thus provide a skewed picture of the injury problem.

Second, injuries resulting in hospitalization are serious by definition. In States where Uniform Hospital Discharge Data Sets are centralized, injury data are readily available at little cost. To be useful, however, records on hospital patients must be E coded on a routine basis and reported as such by the hospital. The medical staff's commitment to collecting injury etiology data is critical. Discharge summaries seldom provide the information essential to E coding or to determination of important contributory factors, like seatbelt use or involvement of alcohol or drugs. The infrequent use of E codes is being further aggravated by the demands placed on hospitals to maximize reimbursement under the Diagnosis Related Groups system. Although the surveillance of injury-related deaths and hospitalizations is important, it will provide information on only about 3.5 percent of all injuries (*4*).

Injury surveillance at the emergency room level requires some attention to both theoretical and practical concerns. If data from emergency rooms are to be included in a surveillance system, the size of the data set and the related expenses must be limited by instituting a sampling frame or selecting particular injury etiologies and syndromes for sureveillance, or both.

In the surveillance system of the Massachusetts Statewide Childhood Injury Prevention Program (SCIPP), we sampled 25 percent of emergency room visits at 23 hospitals. We abstracted medical record data for 5 consecutive days, skipped 15 days, and then repeated the process. A total of 270 days were sampled during the 3-year study period. Within the sampling frame, data on approximately 16,000 emergency room visits were collected, representing 56,000 injuries. This methodology had some important limitations, however. The sampling methodology limited our ability to examine the seasonality of injuries or the occurrence of specific injuries on holidays and weekends. To extend the SCIPP methodology statewide, we would need to work in 108 emergency rooms; the cost of such surveillance could be staggering. We are now attempting to look at the severity of specific injury etiologies by examining the ratio of the rate of emergency room visits to the rate of hospitalizations. Such analyses will enhance surveillance efforts toward capturing data on severe injuries.

Uses of Injury Surveillance Data

Injury surveillance must provide population-based incidence data. Unlike communicable disease surveillance, injury surveillance systems cannot simply reflect the presence of a disease agent. Individual injuries are more like chronic diseases; they are relatively rare. The hazards are always present. Only incidence rates accurately reflect the relative importance of various etiologies or changes in the level or nature of injuries.

Although an injury surveillance system cannot be the vehicle for detailed epidemiologic studies, surveillance data can be used in the long-term monitoring and evaluating of efforts to prevent injuries. For such use, the data sets must be population-based and of adequate size to reflect modest changes in incidence. Injury surveillance systems probably cannot be used in evaluating short-term changes related to preventive interventions; additional evaluation strategies will be needed for that.

Recommendations

1. The collection, consolidation, and evaluation of easily available injury data must be a priority. Surveillance must begin with currently available data sets, even though they have limitations. Information on injury-related deaths, obtained from vital statistics and hospital discharge data, can be used at a State level to generate interest and concern. In addition, local reports of injuries, even those from newspapers, must be used to spark interest in implementing a local program.
2. Systems need to be developed to facilitate surveillance for injuries of lesser severity. Case definitions must be based on clearly defined principles, sampling schemes must yield population-based rate estimates, and physicians must recognize the importance of recording etiology and important risk factors.
3. The coding schemes used for injury surveillance must be revised so that common definitions will be

used, thereby facilitating comparisons between different sources of data. For example, N codes for head injury must be clarified, and E codes must be developed that will distinguish sports injuries. Ultimately, a coding system must be developed that not only identifies N and E codes but also includes the event sequence that reflects an injury syndrome.
4. Medically based surveillance systems must be linked to those operated by police, fire, and other agencies. Because the injury problem is multifaceted, multidisciplinary coalitions will be needed to effect injury prevention strategies.
5. Surveillance reports must be regularly disseminated beyond the medical and public health establishment to other groups concerned with injury and safety, to policymakers, and to the public.
6. We must be realistic about the costs of injury surveillance and injury control. Limited State and Federal resources must be coordinated, and new resources must be developed either by redirecting current dollars or obtaining new dollars from our State and Federal legislators.

References

1. Langmuir, A. D.: The surveillance of communicable diseases of national importance. N Engl J Med 268: 182–192 (1963).
2. National Center for Health Statistics: Current estimates from the National Health Interview Survey, United States, 1981. DHHS Publication No. (PHS) 82–1569. U.S. Government Printing Office, Washington, DC, October 1982.
3. Gallagher, S. S., et al.: A strategy for the reduction of childhood injuries in Massachusetts: SCIPP. N Engl J Med 307: 1015–1019, Oct. 14, 1982.
4. Gallagher, S. S., et al.: The incidence of injuries among 87,000 Massachusetts children and adolescents: Results of the 1980–81 statewide childhood injury prevention program surveillance system. Am J Public Health 74: 1340–1347, December 1984.
5. NEISS tabulation of data. U.S. Consumer Product Safety Commission, Washington, DC, 1978.
6. Barancik, J. I., and Fife, D.: Discrepancies in vehicular crash injury reporting: Northeastern Ohio Trauma Study IV. Accident Analysis Prevention 17: 147–154 (1985).
7. Guyer, B., and Gallagher, S. S.: An approach to the epidemiology of childhood injuries. Pediatr Clin North Am 32: 5–15 (1985).

Program Perspective on Injury Surveillance: Rhode Island's Experience

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THIS PAPER PROVIDES a program perspective on injury surveillance in Rhode Island. Most attention will be given to a motor vehicle safety project that is being implemented by the Department of Health (RIDH) under the auspices of the National Highway Traffic Safety Administration (NHTSA). This project is the spearhead of RIDH injury control initiatives.

NHTSA Project

Data on motor vehicle traffic-related injury mortality and morbidity are being generated for calendar years 1984 and 1985. However, this time frame may be expanded. The data collected will form the basis on which legislative countermeasures aimed at reducing the Rhode Island traffic toll can be evaluated. Examples of these countermeasures are the increased minimum legal drinking age, the Child Restraint Law, and an anticipated mandatory seatbelt law.

Efforts are also being made to compile data on variables that could potentially confound the results of the evaluations. All data being gathered can be broadly classified under two categories: (*a*) measures of risk exposure and (*b*) health outcomes of motor vehicle traffic-related misadventures.

Measures of risk exposure. Risk-exposure patterns are being documented for the study period in terms of the following statewide data:

1. Population characteristics—size and background characteristics of the population; births, deaths, and death rates (all causes); and hospital utilization data (all diagnoses).
2. Motor-vehicle and driver-related characteristics —sociodemographic background of drivers; number and characteristics of motor vehicles; miles driven, types of roads, speed, and other environmental factors; number and characteristics of motor vehicle crashes; and number of traffic violation citations issued relative to the use of safety restraints and alcohol.
3. Behavioral and associated characteristics pertaining to restraint use—age, sex, role, and seating position of motor vehicle occupant; vehicle size; road type.

Among the countermeasures aimed at reducing the Rhode Island traffic toll are the increased minimum legal drinking age, the Child Restraint Law, and an anticipated mandatory seatbelt law.

Data on risk exposures are routinely collected and published annually by the Division of Vital Statistics at RIDH. Rhode Island Health Services Research Inc. (SEARCH) maintains the statewide uniform hospital discharge data file from which the hospital utilization data are drawn. All acute-care, nonpsychiatric hospitals in Rhode Island participate in this discharge abstracting service. External cause of injury is coded as a secondary diagnosis in the discharge file where appropriate.

Annual statistics on the number, age, and distribution of licensed drivers, together with a description of registered motor vehicles, are maintained and published by the Department of Transportation's (DOT's) Division of Motor Vehicles. The Safety Responsibility Unit, under this division, is primarily charged with reviewing vehicle operator and police reports, recording the status of insurance and financial responsibility, and tracking the data. A second division of DOT, Planning, enters accident report data in a computer file, matches operator and police reports, and enumerates and analyzes data. Records of traffic-related violation citations are maintained in a third division of DOT, Administrative Adjudication. This division publishes periodic summaries.

RIDH has conducted its own observational restraint-use survey and also obtains data from other sources, such as Emergency Medical Services, police files, and a hospital emergency room surveillance system. Restraint use may also be indicated in mortality records on traffic victims, such as the report of the Medical Examiner.

Health outcomes of traffic-related injuries. Data on health outcomes of traffic-related injuries, which are being documented for the study population, include the following: number and geographic distribution of injuries, and their severity, by background characteristics of persons injured and number and geographic distribution of traffic-related deaths.

The main source of health-outcome morbidity data is a hospital emergency room surveillance system. The uniform hospital discharge data file and the ambulance run records of Emergency Medical Services yield additional data. Mortality data derive from DOT's Division of Planning and a number of RIDH sources; namely, the Division of Vital Statistics, Emergency Medical Services, and the Office of the Medical Examiner.

Emergency room surveillance. The cornerstone of the NHTSA project is a hospital emergency room medical surveillance system. This system incorporates all 12 nonpsychiatric, acute-care hospitals in Rhode Island; thus, it is population-based. For 1984 and 1985, a 25-percent sample of motor vehicle traffic-related emergency room cases is being investigated. The mode of sampling, which involves tapping all cases in every fourth week, circumvents the confounding effects of seasonality. Precautions have also been taken to avoid oversampling or undersampling major holiday periods, which themselves are associated with fluctuations in the incidence of motor vehicle-related injuries.

Since the beginning of 1985, hospitals participating in the surveillance system have been using a special-purpose stamp to facilitate the routine recording of information on safety restraint use and occupant seating position in an automobile. These data will be analyzed in relation to injury incidence and severity. Attention is also being paid to the coverage and quality of hospital entries on restraint use among emergency room cases in 1984. Limited analyses may be made of these data.

Injury Control in Prospect

The main focus of injury control activities at RIDH is clearly the NHTSA project, but by no means is this the exclusive focus. Other arenas of action, in addition to road safety, include poison control, water safety, fire prevention, emergency medical care, and reduction of household hazards. Current efforts to diminish trauma-induced mortality and morbidity in Rhode Island are expected to continue. Moreover, reflecting its strong commitment to the field, RIDH is approaching the State Legislature to fund a separate division of injury control (*1*).

Over 20 data bases are available to the proposed injury control division, which derive from diverse sources, such as RIDH's Division of Vital Statistics, Office of the Medical Examiner, Emergency Medical Services, Catastrophic Health Insurance Program, Division of Drug Control, and Division of Occupational Health and Radiation Control; the

Department of Labor's workers' compensation file; Social and Rehabilitation Services' Medicaid data; Blue Cross-Blue Shield's Medicare data; DOT's traffic violation citations; and the Fire Marshal's records. These data bases are expected to be salient in the construction of population-based community profiles, which are necessary for detecting changing patterns of injury mortality and morbidity and for assisting in designing, targeting, and evaluating a wide range of programs and interventions.

Reference

1. Rhode Island Department of Health: The case for an injury control program. Providence, RI, February 1985.

Surveillance for Suicide, Homicide, and Domestic Violence: Strengths, Weaknesses, and Issues

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In the Violence Epidemiology Branch (VEB) of the Center for Health Promotion and Education, Centers for Disease Control, we are concentrating on three categories of violent (or intentional) injuries: suicide, homicide, and domestic violence. Two priority areas are homicide among young black men and suicide among 15- to 24-year-olds.

Both self-directed and interpersonal types of violence are important public health problems that extract huge tolls from our society in terms of lives lost, health problems, health-care costs, and diminished quality of life.

• Suicide claims about 27,000 lives a year in the United States. Since the 1950s, the suicide rate among young persons has more than tripled (*1*). Young white men are at particularly high risk, and the ratio of males to females among persons 15–24 is approximately four to one.

We estimate that the ratio of suicide attempts to actual suicides is approximately eight to one and that among persons who attempt suicide there are three females for each male. Approximately 10 percent of persons who attempt suicide later complete suicide.

Known risk factors include psychiatric illness, a history of suicide in the family, social isolation, and male gender. Risks associated with drug and alcohol abuse, exposure to friends who have committed suicide or to media accounts of suicide, and battering (a term used to describe frequent and ongoing abuse) may be very important but have yet to be documented. In 1980, firearms were the method of suicide in 57.3 percent of the instances reported to the National Center for Health Statistics (*1*). Firearms are now the leading method of suicide—replacing poisoning—among young women 15 to 24 years of age.

• Homicide accounts for approximately 23,000 deaths a year in the United States, taking its greatest toll among the young, minorities, and males (*2*). Young black men account for a disproportionately high number of homicide victims, and recent reports suggest that young Hispanic males are also at high risk. Approximately 63 percent of homicides are unrelated to other crimes, and only 17 percent occur during the course of another crime (*3*). In about a third of homicides, the victim and the perpetrator are acquainted; in 15 percent, they are related; in 13 percent, they are strangers; and in a third of homicides, the relationship is unknown (*4*). Firearms are used in about 64 percent of all cases.

• Domestic violence ("spouse abuse") results in the assault of approximately 1.8 million to 4 million women each year in the United States. (*5*). The victims who seek medical attention are almost always women. Women who are victims of ongoing assaultive behavior are at increased risk for alcoholism, depression, psychosis, divorce, and maltreatment by the medical system (*6*).

• Sexual abuse and child abuse are very important public health problems in the United States. Rape is poorly reported to the criminal justice system, and recent evidence suggests that many rapes occur within the context of domestic violence and are never officially reported. All States now have child-abuse reporting systems, but they are subject to reporting biases. Furthermore, these systems have not been shown to significantly reduce the incidence or the severity of child abuse.

In the area of intentional injuries, two themes are apparent. (*a*) Violent behaviors and outcomes are complex phenomena with multiple causal factors, and effective research into these areas will require interdisciplinary efforts, new data sources, and new interventions. (*b*) In almost every area of intentional injury, males seem to be more violent than females. We need to understand the factors behind the gender differences so that we can develop effective interventions.

Surveillance Systems

The Centers for Disease Control has recently published its first national surveillance report on suicide—an analysis of death certificate data compiled by the National Center for Health Statistics (NCHS) (*1*). Death certificates, however, provide only limited information. For example, they contain no information on the mental health of the decedent or on other important risk factors related to sociodemographic characteristics other than sex, race, age, and residence. In addition, there is a 3-year lag between the time a suicide occurs and the time that death certificate data become available from NCHS.

A more timely system is needed. For example, VEB is involved in investigating several suicide "clusters" in which adolescents—predominantly young white males—appear to commit suicide in higher than expected numbers within a particular geographic area and within a short period of time. We are trying to analyze these clusters to see how one suicide might lead to other suicides. We hope to develop a surveillance system for detecting ongoing clusters so that health workers can intervene and can prevent additional suicides. Another surveillance problem is the lack of standard criteria for labeling deaths as suicides. The underreporting of suicides has been estimated to run from 25 to 40 percent—and may be even higher.

VEB's first homicide surveillance report, which was based on NCHS death certificate data and the Federal Bureau of Investigation's Uniform Crime Reports, was published in 1983 (*2*). Although both of the data sets used for this report provide helpful information, problems arise with each of them. Death certificates of victims do not give information on the perpetrator, the motivation, the setting, or the victim's relationship to the perpetrator. FBI data are more timely than NCHS data, but there are reporting problems, with many "unknowns" being recorded. In addition, some important aspects of homicide, such as the number of drug-related homicides, are not addressed in either the FBI or the NCHS data.

Most domestic violence results in nonfatal injuries, and data on nonfatal injuries generally are much less adequate than data on fatal injuries; however, a hospital-based data collection system is planned. We would like to move from a passive reporting system, in which information is obtained from hospital records, to an active surveillance system, in which specific information is sought from patients at emergency rooms or in other health-care settings.

One barrier to collecting such information is the resistance of health-care workers to becoming involved in cases of domestic violence. Confidentiality of information is another problem. A final problem is how to link multiple data sources in developing one composite data bank on victims and perpetrators. For example, how could information from hospital emergency wards be combined with that from police departments in developing risk profiles for individuals who may be seen at different times at each agency? Without such links, neither agency would see the whole picture.

Intentional Versus Unintentional Injuries

Often, the initial categorization of an injury as "intentional" or "unintentional" is inaccurate. For example, most hospital records do not contain enough information for intent to be determined by a retrospective record review. Furthermore, many injuries are reported as being unintentional when in fact they result from domestic violence. Health care workers should inquire into the cause of every injury they see, persisting when answers are not compatible with the injury (*6*).

Even when intent can be accurately determined, separating injuries into intentional and unintentional categories can cause problems. For example, when we separate firearm-related injuries into categories (suicides, homicides), the true magnitude of firearm-related injuries is not reflected. Firearms are used in approximately 30,000 intentional fatal injuries each year, and the epidemiology of these injuries is a matter of utmost importance (*1,2*).

A deficiency of the present model used in injury epidemiology is that it fails to take into account behavioral factors. In focusing on the agents of injury, one might overlook the fact that the perpetrator may be a critically important point for public health intervention.

What Remains to Be Done?

In the area of intentional injuries, we must develop much better data sources. Using existing data sources and creating new sources through surveillance will require an interdisciplinary approach and the coordination of efforts among various agencies. We also need cross-fertilization between the disciplines involved in injury epidemiology and those involved in violence epidemiology, where traditionally the emphasis has been on mental health and human behavior.

References

1. Centers for Disease Control: Suicide surveillance, 1970–80. Atlanta, GA, 1985.
2. Centers for Disease Control: Homicide surveillance 1970–78. Atlanta, GA, 1983.
3. Jason, J., Strauss, L. T., and Tyler, C. W., Jr.: A comparison of primary and secondary homicides in the United States. Am J Epidemiol 117: 309–319 (1983).
4. Rosenberg, M. L., Stark, E., and Zahn, M. A.: Interpersonal violence: homicide and spouse abuse. *In* Maxcy-Rosenau: Public health and preventive medicine, edited by J. Last. Appleton Century Crofts, East Norwalk, CT, 1985.
5. Rosenberg, M. L., et al.: Violence: homicide, assault, and suicide. "Closing the Gap" Health Policy Project of the Carter Center. Am J Public Health. In press, 1986.
6. Stark, E., et al.: Wife abuse in the medical setting: an introduction for health personnel. Monograph Series No. 7. National Clearinghouse on Domestic Violence, Rockville, MD, April 1981.

Workshop on Assessment of Injury Prevention Training Needs

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THE TRAINING of staff personnel is only one part of a multifaceted approach to reducing injuries; therefore, training alone will not have the necessary impact. It must be accompanied by other actions, such as appropriate injury prevention legislation and environmental changes. Given that our work group's charge was to assess training needs, however, we accomplished the following tasks:

- Cross-cutting issues related to professional development and training in injury prevention were identified.
- Barriers were identified in the training of specific priority groups in injury prevention: public health professionals and new professionals, medical professionals, and other professionals (for example, lawyers and architects).
- Possible target audiences were identified for training in injury prevention.
- For selected target audiences, we (*a*) determined training needs and existing materials that could be used to help meet those needs and (*b*) suggested development of formats for training.

Broad Issues Relevant to Training

Injuries are perceived by the public as being inevitable or as the result of "accidents." Thus, there is an underlying bias that injuries are chance events and consequently not susceptible to change or prevention through controls. In addition, political, social, and economic factors interfere with injury investigations and control efforts. These factors include liability issues, lack of organized constituencies, and presumed high costs associated with safety. Injury control needs to become a public priority, both to increase consumers' interest and demand for safety in products and to be responsive to control efforts.

Injury control strategists often neglect sound epidemiologic principles and methods when identifying prevention measures. In addition, adequate data on injury control are not available for defining the injury problem. Data that are available often lack essential details and are of inadequate quality. Definitions and classifications of injuries are not used uniformly and consistently.

Not enough health professionals are appropriately trained in injury control, and many health professionals are not aware of the need for training. Further, training is available in relatively few aca-

demic institutions and, in many instances, the training provided is of limited practical value.

The problem of injuries should be compared with other public health problems to facilitate the integration of injury control into existing health programs and to use new and reallocated resources. Not only do public health personnel and students need to be better informed about injuries and injury control, but also others—including decisionmakers who establish policy, allocate resources, and serve the public interest—need a greater appreciation of this public health problem.

Barriers to Training

One barrier to training in injury control is the lack of properly trained or prepared teachers and trainers. As a result, there is a strong need for curriculums that will prepare teachers and trainers in injury control.

Outline of Training Needs

Training public health managers in injury prevention: elements and suggested formats

1. Identify the injury problem.
2. Tap into data sources in the community and evaluate their appropriateness.[1]

Suggested format for step 2
- Annotated bibliography, linked to library, computerized search capacity.
- Seminars, workshops.
- CDC as central link for information and assistance.
- Questionnaire for inventorying of injury prevention activities in the community.

3. Plan program.
4. Sell injury prevention to the public, those in control of the budget, and other concerned parties.
5. Train field staff.[1]
6. Evaluate program.
7. Act as liaison with others.[1]
8. Raise funds.[1]

Suggested formats for steps 5, 8, and 9
- Slide sets and overhead projection visuals (videotapes and computer-assisted instruction require too much equipment).
- Manuals.
- Self-guided study.
- Interpersonal skill development through role playing.
- Apprenticeships or preceptorships.
- Actual field practice (for example, go on survey with staff).

Training environmental health specialists, technicians, and neighborhood workers in injury prevention: elements and suggested formats

Preparation

1. Describe the injury problem.
2. Describe priorities for injury prevention in this community.
3. Describe the epidemiology of injury prevention.
4. Describe injury hazards and various countermeasures.

Suggested format for steps 1–4
- Current resource material incorporated in worker-level manual.
- Lecture.
- Home-study course in epidemiology modified for home injuries and reading level of workers.
- Success stories from other programs.

5. Describe the tools for reducing the injury problem:
   - Home audits.
   - Citizen behavior change.
6. Describe how neighborhood workers make a difference in an injury prevention program.

Suggested format for steps 5–6
- Use of peer leaders as teachers.
- Slides of actual hazards and possible modifications.
- Films.

Conducting home audits

1. Use effective outreach methods (for example, in getting into the home to do audit).

Suggested format for step 1
- Role playing.
- Actual practice with supervision, especially for difficult tasks such as interviewing and problem solving.
- Job aids such as manuals and handbooks.
- Slide show of actual audit.

2. Refer other public health problems to appropriate agencies.

Conducting evaluation

1. Use appropriate survey techniques and reporting skills.

Suggested format for step 1
- Lecture.
- Reading.
- Sample survey as a learning exercise.

[1]Activities for which new training materials are most needed.

Public health professionals and new professionals. Medical and engineering scientists have not recognized injury control as a legitimate area of interest and research. Consequently, few academic institutions offer courses in injury control, and few adequate teaching aids are available. Because of the lack of personnel with experience and expertise in injury control at State and local levels to serve as role models or as preceptors for trainees, it is difficult to obtain specialized training in injury control.

As a result of stereotyping and misinformation about the injury problem, many decisionmakers and public health professionals do not view injury control as a health priority in comparison with other public health concerns. Thus, many public health agencies, institutions, and organizations have not had the time, training, or legislative support to devote resources to injury control.

Medical sector. Injury control is not widely recognized as a legitimate area of specialization and research by medical science, and it cannot successfully compete for the interest of medical scientists. Furthermore, the magnitude of the injury problem has not been completely described for practitioners, because no recognized, fully developed body of knowledge on injury exists. Related to this issue is the lack of resource materials needed by students and practitioners for gathering useful epidemiologic data that lead to strategies for preventing injuries. Finally, some practitioners and scientists consider the field lacking in value, either intellectually or monetarily.

An overreliance on educational approaches to injury prevention has resulted in the neglect of other, perhaps more effective, approaches to injury control. Furthermore, the cost of injury control is assumed to be great.

Other professionals. Inadequate attention in terms of curriculum and training is devoted to the field of injury control by most academic institutions, including schools of engineering, architecture, and law. Outside the public health community, there is even less opportunity for academic exposure or training in injury control. Furthermore, human behavior is often considered a major cause of injuries.

Possible Target Audiences for Training

There are many possible target audiences for training in injury prevention, including

- Managers in public health and students in schools of public health;
- Medical students, house staff, and medical practitioners; and
- "Workers in the trenches," such as local program managers and staff who work in the neighborhoods.

The work group strongly believed that funds for training purposes were extremely limited. They concluded that (*a*) rather than spreading funds so thinly that quality of training would be sacrificed, satisfying the training needs of the third target audience ("workers in the trenches") should be the highest priority and (*b*) CDC should play an integral role in training through curriculum development, resource identification, technical assistance, and consultation. The recommendations of the workshop participants are outlined in the accompanying box.

Sources of Information

Reference and resource materials on injuries are available from many Federal agencies and national organizations, including the following:

Injury Epidemiology and Control
Center for Environmental Health
Centers for Disease Control
Atlanta, GA 30333

Center for Health Promotion and Education
Centers for Disease Control
Atlanta, GA 30333

Epidemiology Program Office
Centers for Disease Control
Atlanta, GA 30333

National Institute for Occupational Safety and Health
Centers for Disease Control
Atlanta, GA 30333

Division of Maternal and Child Health
Health Resources and Services Administration
Parklawn Building
5600 Fishers Lane
Rockville, MD 20857

Indian Health Service
Health Resources and Services Administration
Parklawn Building
5600 Fishers Lane
Rockville, MD 20857

Consumer Product Safety Commission
5400 Westbard Avenue
Washington, DC 20207

National Safety Council
444 North Michigan Avenue
Chicago, IL 60611

Insurance Institute for Highway Safety
Watergate Six Hundred
Washington, DC 20037

American Academy of Pediatrics
P.O. Box 1034
1801 Hinman Avenue
Evanston, IL 60204

Information for Development of Training Materials

1. Baker, S. P., and Dietz, P. E.: Injury prevention. *In* Healthy people. The Surgeon General's report on health promotion and disease prevention, background papers. U.S. Department of Health, Education, and Welfare, Washington, DC, 1979.

2. Baker, S. P., O'Neill, B., and Karpf, R. S.: The injury fact book. Lexington Books, Lexington, MA, 1984.
3. Centers for Disease Control: Handbook for managing a local injury prevention program. In press. Atlanta, GA, 1985.
4. Haddon, W., Jr., and Baker, S. P.: Injury control. *In* Preventive and community medicine, edited by D. W. Clark and B. MacMahon. Little, Brown and Company, Boston, MA, 1981.
5. National Safety Council: Accident facts, 1985. National Safety Council, Chicago, IL, 1985.
6. Robertson, L. S.: Injuries—causes, control strategies, and public policy. Lexington Books, Lexington, MA, 1983.
7. U.S. Department of Health and Human Services: Promoting health/preventing disease: objectives for the nation. U.S. Government Printing Office, Washington, DC, fall 1980.
8. Waller, J. A.: Injury control—a guide to the causes and prevention of trauma. Lexington Books, Lexington, MA, 1985.

Training: an Integral Component of Injury Prevention Programs

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AS PUBLIC HEALTH PRIORITIES change, program managers, leaders, professors, and training professionals need to offer and to participate in professional development and training opportunities at various stages of their careers.

When we examine the direction in which training programs for injury prevention should proceed, we can learn from Dr. Alex Langmuir's conception of the three basic tenets of the Epidemic Intelligence Service: (*a*) pick the best possible officers, (*b*) provide the best supervision, and (*c*) give the officers real problems to solve. You can apply that logic as educators, managers, policy makers, and practitioners by selecting only the best and brightest personnel, by making the assessment of training needs an essential supervisory responsibility, and by ensuring that training can be practically applied in the field.

Where we have failed in injury prevention and control, I think, is by placing too much emphasis on content or information expertise and too little on process or skill expertise. A bridge needs to be built between the content expertise of what we know and the process expertise of how we should perform. For example, consider how much of each type of expertise is required to develop and implement model injury control programs at the State level. Following are some of the main tasks: propose and lobby for injury control programs, develop and implement statewide surveillance systems related to injury control, develop countermeasures for preventing common injuries, evaluate alternative techniques of injury control, inform the public about safety and injury control, and provide economic and other incentives for injury control. To what extent should the training opportunities be characterized by content expertise in these areas, and to what extent should training emphasize the process, or skill-building, expertise in these areas?

A working group was formed during the conference to propose an outline for training programs targeted at both preprofessional and professional groups (see "Workshop on Assessment of Injury Prevention Training Needs," pages 595–598). The resulting training outline offers a balance between acquiring information and building skills.

Over the years, the staff members of the Center for Professional Development and Training, Centers for Disease Control, have worked with program managers in public health agencies to help design training interventions tailored to meet programmatic and health objectives. These performance-based management systems provide the following foundation for public health practice. The analysis specifies program objectives, the essential tasks to accomplish, and the standards of performance; it also defines a mechanism of assessment. If program managers are assisted as they conduct this analysis with their work teams, attention can be best directed to information and skill deficiencies.

The challenge for all managers is to design opportunities across the career continuum for members of their staff to practice skills in simulated environments with guidance. Students need experience in the field as early as possible. In the same spirit, faculty in our universities, schools of public health, and schools of medicine should be given opportunities to work in the field. Classroom teaching needs to be honed by day-to-day realities. In a complimentary fashion, practitioners in the field need to be stimulated and stretched by persons trained in theories of change and by those with technical expertise. Practical orientation, with training and con-

tinuing education, results in the greatest benefit to public health practice and its practitioners.

In describing the professional development and training needs of persons who can help the nation meet the 1990 injury prevention and control objectives, we must consider both the content and the process expertise needed to do their jobs.

Training the Family Physician in Injury Prevention

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A PHYSICIAN HAS THE RESPONSIBILITY not only of caring for and treating ill patients but also of preventing disease and traumatic injury.

Most researchers agree that the epidemiologic method—that is, the collection and synthesis of observations about human populations on the basis of certain variables—is the basic science underlying the prevention of disease and injury (*1*). The epidemiologic method deals with variables relating to agent, host, environment, and time—the "what, who, where, and when" (*2*). In the education of the graduate student or the family physician, the epidemiologic method must have a central role.

Three aspects of the epidemiologic method—rates, time, and controls—are essential to the understanding and prevention of injuries.

Rates. Determining and comparing rates of diseases or injuries are fundamental tasks of persons in public health and preventive medicine. The rates should have accurate numerators (representing cases) and denominators (representing exposure). Rates are used in measuring and comparing the extent of disease in different population groups and in establishing priorities for treatment or prevention. Rates also are used in determining the efficacy of a preventive measure:

$$\text{Efficacy (percent)} = (\text{Rate in control group} - \text{Rate in test group}) \div \text{Rate in control group} \times 100$$

Time. Time as an epidemologic variable is of utmost importance. Rates from as many years as possible should be examined before hypothesizing about changes and trends in rates. Often, an analysis of data over an extended period will lead to a different conclusion than if the same data over a shorter period were analyzed. For example, our analysis of motor vehicle death rates over time suggested that factors other than a speed limit change may have caused decreases in death rates (*3*).

Controls. Controls are necessary in almost all scientific work except descriptive and case studies. One cannot measure the effect of a preventive measure unless the results found in an observed group are compared with those found in a control group that has the same characteristics except for the use of the preventive measure in question. Physicians should recognize the need for controls, and they should be suspicious of any study that does not mention them.

If the family physician understands these principles of epidemiology, he or she can evaluate more competently the data on which a supposedly effective intervention is based. Remembering the concepts of agent, host, environment, time, rates, and controls, physician will also have a firm foundation for collecting data about any problem involving injury or disease.

Another important concept that should be emphasized at medical schools and schools of public health is that good health is the baseline from which a deviation, such as disease or injury, should be measured (*4*). Mental, physical, social, and environmental factors all contribute to a person's good health.

Regarding traumatic injuries, the family physician should know the main types, their relative importance, and the key variables associated with each type.

The family physician should be able to obtain a good occupational history on each patient, including information about past illnesses and injuries; tasks in and durations of former jobs; exposures to chemicals or physical factors; personal habits, such as the use of tobacco; and activities at home, such as a hobby (*5*). This information is necessary if the physician is to advise his or her patients about occupational and lifestyle factors.

The family physician should be acquainted with useful texts and sources of data about injuries and should know what agencies and organizations are involved in injury prevention programs.

Finally, the family physician should be trained to communicate the key concepts of good health and the prevention of injury and disease so that patients will appropriately change their activities and behavior.

References

1. Langmuir, A. D.: The training of the physician—education and training in preventive medicine and public health. N Engl J Med 271: 772–774 (1964).
2. Doege, T. C., and Gelfand H. M.: A model for epidemiologic research. JAMA 239: 328–330 (1978).
3. Doege, T. C., and Levy, P. S.: Changes in fatal and nonfatal crash rates on a toll hignway. Am J Epidemiol 103: 236–241 (1976).
4. Jonas, S.: Health-oriented physician education. Prev Med 10: 700–709 (1981).
5. Hainer, B. L.: The role of the family physician in occupational health care. American Medical Association, Chicago, 1984, p. 5.

Assessment of Injury Prevention Training Needs— a Pediatrician's View

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UNINTENTIONAL INJURIES ACCOUNT for more deaths among children 1 to 14 years old than the next five most common causes: cancer, congenital abnormalities, pneumonia, heart disease, and homicide. One of every three childhood deaths is due to unintentional injury, and one of every eight hospital beds is occupied by an injury victim. Modern pediatricians recognize that injury prevention is an essential component of child health supervision.

In the past three decades, the Committee on Accident and Poison Prevention (COAPP) of the American Academy of Pediatrics (AAP) has conducted a continuing campaign of professional and public education to identify the problem of injuries and to promote the acceptance of injury prevention as an essential part of pediatric practice. As an advocate for children, COAPP helped establish safety standards for items such as toys and children's furniture, recognized the need for and helped establish the Consumer Product Safety Commission, and contributed significantly to the poison control center movement.

In 1980, responding to a growing concern over automobile-related injuries and deaths, AAP lauched a two-part national program. In Part One, "The First Ride—a Safe Ride," the goal was to have all newborns be taken from the hospital in a child's safety seat. In Part Two, "Every Ride a Safe Ride," a nationwide network of State and local coordinators was established to promote automotive safety. As a result of this program, successful carseat loaner programs were established, and laws were passed requiring child restraints in automobiles.

The Injury Prevention Program (TIPP), proposed by COAPP, evolved from a Title V Maternal and Child Health Project (*1*). The program's policy statement reflects a "minimum standard of care":

- All children should grow up in a safe environment.
- Anticipatory guidance for injury prevention should be an integral part of the medical care provided for all infants and children.
- All physicians caring for children should advise parents to acquire for their children's safety:
  1. currently approved child car restraints
  2. smoke detectors in the home that would protect the child's sleeping area
  3. safe hot water temperatures at the tap
  4. window and stairway guards or gates to prevent falls, and
  5. one-ounce bottles of syrup of ipecac.

In addition, all physicians caring for children should counsel parents in age-appropriate, season-appropriate, and locality-appropriate prevention strategies that reduce common, serious injuries. Medical records should reflect this counsel.

In April 1983, in the first phase of TIPP, sample materials were distributed to all AAP members as a guide for implementing the minimum standard of care items.

The second phase of TIPP is the development of a medical school and pediatric residency training curriculum to promote injury prevention. COAPP has concluded from pilot projects that a training module for medical students and residents should include the epidemiology and strategies of injury prevention

coupled with current methods of treating injured persons.

The third phase of TIPP is the development of a resource manual for the student and practitioner that provides useful epidemiologic data and presents strategies for preventing injuries among children and adolescents.

TIPP is an excellent example of how Government, the medical profession, and private industry have combined to produce a meaningful program. Each pediatrician can have a part in this program by obtaining injury prevention training and by developing related skills.

Reference

1. Davis, H. F., Jr., Schletty, A. V., Ing, R. T., and Wiesner, P. J.: The 1990 objectives for the nation for injury prevention: a progress review. Public Health Rep 99: 10–23, January-February 1984.

Assessment of Injury Prevention Training Needs—the Johns Hopkins Injury Control Program

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ADEQUATE TRAINING in injury control should provide a student with (*a*) a formal, academic program in injury control under a full-time faculty working primarily in that field; (*b*) educational tools, including texts, journals, audiovisuals, and research opportunities; and (*c*) experience in developing, implementing, evaluating, and advocating injury prevention programs.

Few schools of public health, medicine, or other professions offer even one formal course in injury control, and even fewer schools have an injury control program. The Johns Hopkins University School of Hygiene and Public Health does have such a program. Other institutions may wish to use the Johns Hopkins experience in planning their own programs in injury control.

The Johns Hopkins program was begun in 1973 with the introduction of a course titled "Issues in Injury Control." Currently, that course addresses prominent sources of injury, including motor vehicles, falls, fires, and firearms, through lectures and class discussion. The biological, behavioral, and social issues relating to injury prevention and the policies of injury control are explored. Emphasized are strategies for preventing injuries and deaths in the workplace, at home, during travel, and during recreation as well as the relative effectiveness of various types of approaches.

In 1978, a course titled "Epidemiology of Injuries" was added to the program. It is now described as a review of current epidemiologic knowledge of injuries related to transportation, occupation, home, sports, assaults, and so on, with emphasis on implications for prevention. Sources of data and the application of epidemiologic methods in injury research are discussed. Each student chooses a special problem in which to do individual work that culminates in a class presentation and a written paper. Attention to underresearched injury problems is encouraged.

At the end of the "Epidemiology of Injuries" course, each student should be familiar with the state-of-the-art of injury epidemiology, recognize the need for greater allocation of resources to research in the area, be able to apply standard epidemiologic methods to the study of injuries, recognize (and be able to avoid) the major pitfalls and problems associated with injury research, and be able to assemble relevant injury data and use them appropriately in the development, implementation, and evaluation of countermeasures and policy.

A third course, "Emergency Medical Services and Systems," is now offered.

Enrollment in the "Issues in Injury Control" course has increased from 15 students in the academic year 1973–74 to 69 students in 1983–84. Enrollment in "Epidemiology of Injuries" has ranged from 9 to 28 students in the 6 years the course has been offered, with 21 students enrolled in 1983–84.

Current course work in the injury control program includes these three courses plus "Special Studies in Injury Research," "Special Studies in Injury Control Advocacy," and continuing education courses, such as a 2-week course, "Injury Problems in Developing Countries." Noon seminars are offered on injury-related topics, and lectures on injury control are given in several other courses.

Slides and motion pictures are used extensively in

the courses to demonstrate problems of injury control, countermeasures, and data. Encouragement of student research has resulted in numerous published papers, presentations, and awards. Students also have opportunities to participate in faculty research.

Students now may pursue doctoral studies in injury control. This expansion of the injury control program will permit students to become more involved in significant, large-scale research projects.

Faculty members and advanced students have frequent contacts with the news media regarding injury control topics. In addition, an outreach program provides injury prevention information to hospital personnel throughout Maryland.

The injury control program personnel collaborate with the World Health Organization's effort in injury control and advise domestic agencies and organizations, including the Consumer Product Safety Commission, National Highway Traffic Safety Administration, the U.S. Congress, and State legislatures.

The injury control program at Johns Hopkins has developed into a center of activity offering educational, research, and service opportunities to students seeking training in injury control.

Workshop on Agency Activities: Collaborative Opportunities for Public Health Organizations

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WITH THE INJURY problem touching all facets of society, a consensus has emerged around objectives for the nation that represent practical targets in injury control. Categories of activities directed to these targets include providing technical assistance and consultation for surveillance and epidemiologic studies and demonstration and evaluation projects to identify prevention opportunities, facilitating the exchange of information on model programs and effective control methods, promoting professional development and training programs, disseminating information to the public, and building coalitions at national, State, and local levels to influence decisionmakers to implement programs and policies that support injury control efforts. These categories of activities can serve as a matrix to define the nature of collaboration.

Major Recommendations

Steering committee. On the basis of the proceedings and results of this and other conferences, the Centers for Disease Control (CDC) should facilitate followup action by appointing a steering committee or task force on injury prevention. The purpose of such a group would be to promote injury prevention as a high-priority policy matter, to foster interorganizational communications, and to oversee the implementation of recommendations, objectives, and standards.

The group should include but not be limited to representatives from the American Academy of Pediatrics, American College of Preventive Medicine, American Medical Association, American Public Health Association (APHA), Association of State and Territorial Health Officials, Association of Teachers of Preventive Medicine, CDC, Consumer Product Safety Commission, Department of Transportation, National Association of County Health Officials, National Environmental Health Association, Organized Nursing, and the United States Conference of Local Health Officers. During its proceedings, the group should maintain communication with a variety of public and private organizations.

Policy statement. The committee requests that CDC, using the proceedings of this conference, draft a national policy statement on injury prevention, to be shared with participants of the conference for suggested changes. The committee also requests that following the reviews, the policy statement be shared with pertinent organizations for consensus building and that suggestions be developed for using such a policy statement.

Other Recommendations

Surveillance, Epidemiology, and Data. Under the guidance of the steering committee, collaboration among CDC and State and local agencies should

build on the work of this conference to develop a model reporting system, including minimum defined data sets. In collaborative efforts with schools of public health and other professional schools, the surveillance system's compatibility with the research agenda should be considered, and the system should be pilot tested in selected jurisdictions. CDC should be asked to work with State and local agencies to develop epidemiology investigation teams that would study selected injury events.

Intervention strategies. In the development of intervention strategies, national guidelines should be developed as a collaborative effort, coordinated through the interorganizational steering committee or task force. These guidelines should correlate with and expand on the Revised Model Standards for Community Prevention Health Services (*1*) and the 1990 Objectives for the Nation (*2*).

Pilot projects should be used to test concepts in injury control and prevention. Pilot projects must contain research and evaluation components and be developed and conducted collaboratively by selected research institutions (schools of public health), CDC, and the State and local official health agencies concerned.

Facilitating mechanisms for exchanging information (that is, newsletters, reports, and computer information networks) should be developed. International information and linkages should be included within the information exchange mechanisms.

Training. The steering committee should arrange for development of a training module on injury control for use in graduate programs. It is suggested that undergraduate curriculums be revised to include injury control. This should be done in schools of nursing, the environmental sciences, and medicine, as a minimum. Field assignments dealing directly with injury control should be a part of the student's training. For persons now in the field, a training module and appropriate in-service training should be designed.

Research. The committee recommends that the steering committee address some key research issues, perhaps by using APHA as a convener. Subjects to be considered include:

1. determining how to emphasize application research rather than basic research in the injury area,
2. developing a list of the highest research priorities for the next 5–10 years,

'Pilot projects must contain research and evaluation components and be developed and conducted collaboratively by selected research institutions (schools of public health), CDC, and the State and local official health agencies concerned.'

3. incorporating appropriate research into pilot intervention strategies, and
4. marketing research on how to make injury prevention acceptable.

Additional concerns for collaboration

Legislation and regulation. The steering committee should identify priority areas for legislative or regulatory changes. Voluntary agencies should be asked to provide the leadership and needed skills to establish a resource center. This center would make assistance available to any State or local effort, including providing model language, guides on coalition building, and the like.

Standard setting. The steering committee should oversee the implementation and progress achieved on the relevant 1990 national objectives and model standards. The emphasis should be on applying the technology already available. Where necessary, the steering committee should facilitate the development of manuals, guides, procedures, and kits for program development, operation, and evaluation. Technical standards, such as for consumer products, should be monitored and recommended for amendment as indicated.

Evaluation. Evaluation should be an expected component of all programs. The steering committee should encourage outside evaluation of new programs wherever possible and should provide for the development of a clearinghouse to share the information obtained. Recent legislation pertaining to Public Law 98–551 authorizes establishment of centers for research and demonstration of health promotion and disease prevention. This will provide the opportunity for broad-scale research and demonstration, involving multiple professional and academic disciplines at institutions that have shown their commitment to preventive concerns. These

new Centers for Prevention Research should be encouraged to include a strong program evaluation component as they develop. The Center for Health Services Research, supported by the National Center for Health Services Research and Health Care Technology Assessment, should be considered a resource in this effort.

Occupational health and safety. State and local health departments should make every effort to integrate occupational and nonoccupational injury prevention and control programs in their jurisdiction in order to have a more complete understanding of the injury control problem and to use intervention resources more efficiently. In addition, health agencies are urged to make their own employee injury control programs models for demonstration to other employees.

Health education. Injury control educators should use the program now being developed for sharing health promotion resources, since the mechanism is in place. There is a need to develop network materials and to present this material to the appropriate decisionmakers. Materials should be distributed and information disseminated at the community level.

Technical assistance. Technical assistance is vital in propagating and maintaining ever-increasing quality and conformity of both surveillance epidemiology data systems and intervention strategies across the nation. Existing arrangements provide models for such technical assistance interchange, such as those for immunization programs and for sexually transmitted disease programs. Funding for such mechanisms should be an implementation priority (including the previously discussed training mechanisms).

Exchange mechanisms should include, but not be limited to, CDC field assignments, newsletters, reports, assistance from schools of public health, and assistance from other national experts. Such interorganizational and intraorganizational communication will be essential to meeting the critical need for effective collaboration, interface, and coalition building.

The larger organizations already have sophisticated methods of information dissemination, such as CDC's Morbidity and Mortality Weekly Report (MMWR), the Association of State and Territorial Health Officials (ASTHO), the General Telephone and Electronics (GTE) Telenet Medical Information Network (MINET), and other telenetworks. Injury prevention should be added to the information systems, and this information should be disseminated to all service delivery units.

References

1. Model standards: a guide for community preventive health services. A collaborative project of the American Public Health Association, Association of State and Territorial Health Officials, National Association of County Health Officials, U.S. Conference of Local Health Officers, and the Centers for Disease Control. Ed. 2. In press. American Public Health Association, Washington, DC, 1985.
2. U.S. Department of Health and Human Services: Promoting health/preventing disease: objectives for the nation. U.S. Government Printing Office, Washington, DC, fall 1980.

Collaborative Opportunities In Injury Prevention: The Perspective of CDC

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THE INJURY PROBLEM touches all facets of our society, both in terms of suffering and death and in terms of opportunities for positive interventions. Therefore, the Centers for Disease Control (CDC) wishes to expand the depth and breadth of its relationships with institutions and individuals engaged in preventing injuries.

A consensus has emerged around a set of objectives for the nation; in effect, these objectives represent practical targets for health promotion and disease prevention (*1*). Two years ago, during a meeting held to review the implementation of these objectives, a representative group of health professionals outlined activities that CDC should undertake in its collaborative efforts (*2*). The first five of these activities relate directly to injury control. I will use these categories of activities as a matrix for defining the nature of CDC's collaborative efforts. The following activities were recommended in the 1982 report.

• *Operational research and evaluation of intervention strategies.* Epidemiologic studies and demonstration and evaluation projects are needed for identifying prevention opportunities, testing the feasibility of possible interventions, and assessing and comparing the effectiveness of prevention strategies. They are also needed for evaluating new and existing strategies and for developing new technology in injury control.

• *Technical assistance in the development of programmatic data.* Improved surveillance methods are needed, with development of uniform definitions for use in data collection and analysis (for example, age groups, race). Among the identified data needs are the development of State injury surveillance systems, surveillance of occupational injuries, and methods by which the results of State surveys can be applied to the behavioral risk factors related to injuries.

• *Information interpretation and transfer.* As a national repository for scientific information on prevention-related subjects, CDC should facilitate the exchange of information on model programs and effective control methods among the various State and local governments and with the academic community and professional organizations.

• *Professional development and training programs.* Injury prevention methods and concepts should be incorporated into clinical training for medical and other health professionals and into public health school curriculums.

• *Building coalitions at the State and local level.* State and local health agencies should play a key role in influencing public decision makers to implement programs and policies that promote health. Health agencies should be responsible for building relationships with schools of public health and medicine and with prevention-oriented private organizations.

CDC not only should assist in the development of coalitions at the State and local level but also should work toward meeting the last two categories of activities:

• *Building coalitions at the national level.* A national leadership role is vital to building relationships among official health agencies, professional associations, and academic institutions around the injury prevention effort. This means working with schools of public health and medical school preventive medicine departments to integrate the 1990 objectives into their academic curriculums; promoting the importance of health department activities among academic leaders; encouraging schools of public health and medicine to begin joint studies with State and local health departments; and, as mentioned previously, assisting these institutions in forming coalitions at the State and local levels.

• *Dissemination of information to the public.* The public needs to be informed about actions that individuals and organizations can take to prevent disease and promote health. CDC should provide leadership in educating the public about disease detection and prevention methods. State and local health departments, Federal health agencies, professional organizations, and private organizations should work with the media to transmit prevention messages to the public; CDC can facilitate such efforts.

CDC welcomes opportunities like this to define the nature of our collaborative efforts and to consider the contributions that a collaborative network of highly motivated professionals and the general public can make. On the basis of these considerations, I make the recommendations that follow:

• After training modules are developed, a formal network between the trainers and trainees should be developed. Such a network should evaluate not only the knowledge gained but also the practical utility of the training in actual implementation of effective injury prevention programs.

• The group of professionals assembled here should make their collaboration an ongoing formal and informal system of feedback.

• We should work toward a uniform language in injury prevention so that comparisons can be made, useful technology can be encouraged, and ineffective strategies can be discarded.

References

1. Department of Health and Human Services: Promoting health/preventing disease: objectives for the nation. U. S. Government Printing Office, Washington, DC, fall 1980.
2. Centers for Disease Control: Implementing the 1990 Prevention objectives: summary of CDC's seminar. MMWR 32: 21–24, July 21, 1983.

Collaborative Opportunities: the View of the U.S. Conference of Local Health Officers

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LOCAL HEALTH DEPARTMENTS have a growing awareness of the role that injuries play in morbidity and mortality. This awareness is heightened by the fact that many injuries seem to be preventable. Nevertheless, a certain frustration has existed within local health departments concerning this problem. The frustration results from a number of factors.

- The surveillance system is inadequate without a standard approach to the gathering of data. This frustration is coupled with a sense of uncertainty among local health departments regarding the interpretation and use of the data.
- Multiple jurisdictions and agencies are involved, each seeing portions of the problems, and this usually results in multiple sources and analyses of the data. Local health departments often are in the awkward position of having to respond to another agency's data or analysis or both.
- Local agencies frequently have little control over the design of proposed solutions.
- The problem of multiple agencies and the pluralistic complexity of the community extends to the matter of implementing solutions. Thus, the local agency must deal with multifactorial solutions, implemented in a multiagency, multijurisdictional environment, requiring considerable use of resources and leadership skills. The implementation of programs requiring seat restraints for infants and children in vehicles is a good example.
- The effects of proposed solutions are difficult to measure and are often indirect, but they are important because of the amount of community investment.
- At the local level, no focus for dealing with injury prevention is recognized.
- Training and continuing education are insufficient to ensure that staff members on the front line are up-to-date professionals.

We endorse the principle that solutions worked out at (or with) the local level are the ones most likely to stick. What, then, are the collaborative opportunities for local health agencies concerning injury prevention?

Surveillance

The local health agency already plays a vital role in traditional public health data gathering. Agency officials know the nature of the sources, the weaknesses in the data, and the comparability of the data, and they have a sense of the completeness of the data. Health departments use techniques such as mandatory reporting, volunteer sentinel systems, and special studies for gathering data to form an epidemiologic picture, albeit an imperfect one. Strategies for gathering data on unintentional injuries could possibly be integrated into extant systems. In some instances, desired information could be added to an existing system or included in plans for a survey or study.

One potential difficulty in any relationship between health departments and academic faculty is that of the user-researcher gap. Refining data to the level of academic or research desirability is not generally a health department priority. Typically, health department personnel are strong pragmatists, and they must base their decisions on data collected in a short time.

The problem flows in the other direction, too. Local implementers obviously need research synthesized and generalized for local solutions. They frequently expect conclusions from the research community that the researcher is unwilling to make, or, on the other hand, so many contingencies are placed on the conclusions that the policy maker is frustrated. The school of public health, in this case, stands at the interface between research and application. Any collaboration in data development must take this into account. It would be sad, though, to have a public health teaching and research institution do direct research in a community (for example, to ensure quality data) without involving the local health department, and then have the local official agency discount the usefulness of the findings because the conclusions were too narrow or impractical.

Mutual benefits argue for collaboration. Teaching and research institutions and local health agencies can learn from each other; therefore, we advocate that we work together in developing collaborative approaches, designing special registries, conducting surveys, and sharing survey results.

What are some data issues relevant to local health departments? An important issue is comparability

of data. There is a need for standardization of categories and for denominator conventions. Data standardization, for example, should include the information collected on each injury reported, such as that contained in the police report and the examiner's report.

Injury Prevention Program

The problems confronting us at the program piloting and implementation phase are those resulting from the complex political and jurisdictional environment. The solutions, no doubt, will be multifactorial, probably more so even than the data strategy. The local health department deals regularly, however, in this environment. The researching institution will have an ideal opportunity not only to pilot a program design but also to develop that design and pilot it in partnership with one or more willing health departments. Again, mutual benefits accrue.

Any approach to injury prevention must be credible, generalizable, and transferable. Local health departments are likely to be implementing agencies. Both local health departments and schools of public health would benefit from collaborative work on any anticipated program implementation. Both would be dealing with new people, perhaps having an intensified or more extensive involvement with local private physicians in implementing collaborative patient education efforts, having closer contacts with occupational physicians and company medical departments, or contacting other professionals wherever a targeted effort may lead. If public health academic institutions and the "field" side of the profession collaborate effectively, a stronger and more vital public health system will result.

Program Evaluations

Local health departments readily admit that the evaluation of proposed approaches is important; however, they rarely have the luxury of integrating a quality evaluation into their programs. Here, too, is an opportunity for collaboration. In the process, for example, academia could teach local health agency professionals the finer aspects of evaluation.

Resources and Continuing Education

Two final issues need to be addressed: resources and continuing education.

Resources. Although local health departments are willing to cooperate, they do not always have the resources necessary to launch a new data effort or a new program. I suspect that academic institutions have a similar problem. Therefore, some resource "glue" is needed in the collaboration on any new initiative, but the benefits will far outweigh the costs.

Continuing education. Local health departments have limited opportunities for continuing education. Let the injury prevention effort launched with this conference be an opportunity to create methods and models for disseminating state-of-the-art public health information to the professionals in local health units where the delivery of services actually occurs and where innovative rapid problem solving must be the order of the day.

We all have a common goal; let us use our respective strengths to address it—together.

Collaborative Opportunities: the Perspective of the Association of Schools of Public Health

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MANY OF OUR SCHOOLS are developing courses or course content in injury prevention. This is a new area for most of the schools, but they are rapidly moving into this field of training. Some examples follow.

- The University of Minnesota School of Public Health offers five courses in injury prevention in two areas: "Injury Prevention in the Workplace, Community, and the Home," which includes a lecture course, a topics course, and a research course, and "Safety in the Workplace," which includes a seminar and a problems course. In addition, the course "Epidemiology of Injuries" is offered through the graduate summer session in epidemiology.

• The University of California at Los Angeles (UCLA) School of Public Health offers the course "Family and Sexual Violence." UCLA is also developing a multidisciplinary injury prevention program involving the School of Public Health and other schools in the University.
• The University of Illinois School of Public Health is developing the course "Traffic Crashes: Implications for Public Health."
• The University of Puerto Rico School of Public Health is developing a 3-week training program in injury prevention for senior medical students.
• The Johns Hopkins School of Public Health has developed a curriculum track in injury control through its Department of Health Policy and Management. The track offers a master's and a doctoral degree. Courses include "Epidemiology of Injuries," "Emergency Medical Services," and "Injury Control Advocacy." Continuing education courses in injuries are also offered. For an assessment of the training needs of the students at Johns Hopkins, see the paper by Stephen Teret on pages 601–602 of this issue.
• Other schools have not yet developed specific coursework in injury prevention, but the schools incorporate course content in injury prevention through courses in maternal and child health, behavioral science, environmental and occupational health, epidemiology, and other courses. Topics include childhood injuries, automobile-related injuries, suicide, workplace-related injuries, child abuse, injuries in nursing homes, and injury prevention programs.

We expect that the schools will continue to develop curriculums in injury prevention. Another training mechanism is the preventive medicine residencies; the University of California at Berkeley School of Public Health plans to have one of its four preventive medicine residencies focus on injury prevention.

Research

School of public health faculty and students are very active in injury prevention research. Current projects have a wide variety of emphases, such as injury policies and programs; injury data bases; epidemiology and prevention of suicides; sports injuries, including those in hockey, tennis, football, and gymnastics; motor vehicle-related injuries, including those resulting from consumption of alcohol; injuries to pedestrians and child passengers; drunk driving legislation; and occupational injuries, including those related to alcohol, low-back injuries, amputations, wrist traumas, and agricultural injuries. Also emphasized are the effects of brain injuries, injuries among the staff and residents in nursing homes, injury surveillance and epidemiologic study data bases, injuries in developing countries, emergency medical services, head trauma consequences, and childhood behavior and injury risks.

Conferences

The Houston-Galveston Injury Prevention groups and the University of Texas School of Public Health are sponsoring a series of conferences on the study and prevention of injury. The latest conference was held October 1–3, 1984, with the theme of "Integrating Perspectives on Injury Prevention: a Preface to Policy Development."

The Berkeley school of public health held its "Alcohol and Trauma Conference" in March 1985.

Collaborative Efforts

There are numerous possibilities for collaborative efforts in injury prevention among the schools of public health, the Centers for Disease Control, health departments, and other agencies. Some schools are already engaged in collaborative activities with local, State, and Federal agencies and institutions.

• Harvard School of Public Health is working with State agencies in Massachusetts and Rhode Island on injury prevention.
• Boston University School of Public Health is evaluating State laws in New England relating to drunk driving and legal drinking age. One study is being funded in part by the State of Maine, the Department of Transportation, and the National Institute on Alcohol Abuse and Alcoholism. A study on alcoholism and child abuse is being initiated with the Division of Welfare in New Hampshire. A study on drug and alcohol use during pregnancy is being funded by the National Institute on Drug Abuse. A study on police training and the enforcement of laws on drunk driving is being conducted in cooperation with the National Association of State Directors of Law Enforcement Training.
• The Berkeley School of Public Health is working with San Francisco General Hospital to collect higher quality data on childhood injuries. Two faculty members are also planning a statewide survey of injury prevention programs. Another faculty

member is analyzing injuries that occur at schools in the Los Angeles School District.

Additional areas where schools of public health could expand their work with other agencies would be to collaboratively:

- Establish local, regional, and national data bases on injuries.
- Assist health agencies in establishing injury prevention programs and in evaluating existing programs.
- Conduct epidemiologic studies.
- Work with school systems in preventing injuries and in establishing health education programs.
- Work with hospitals in evaluating the treatment of injured patients and the emergency room services.
- Work with industries in establishing and evaluating worker safety programs.

In summary, schools of public health have been actively engaged in training, research, and collaboration in the injury area. Because of the magnitude of this public health problem, it will be appropriate for schools to maintain and expand these activities in the future.

Collaborative Opportunities: the Perspective of the American Public Health Association

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THE AMERICAN PUBLIC HEALTH ASSOCIATION (APHA), with a combined national and affiliate membership of nearly 50,000 public health professionals and community health leaders, has as its goal the protection and promotion of personal and enviromental health. Through the years, APHA has expressed its commitment to injury prevention and control through a variety of public policy statements and program activities.

Public policy statements adopted by APHA have dealt with a broad range of injury prevention issues. Examples are: home accident prevention programs (1952), highway safety (1955, 1958, 1970, 1983), accident prevention (1956, 1957, 1959, 1960), alcoholism and drunk driving (1962, 1975, 1983), flammable clothing (1963), sports injuries (1963), gun control (1976), tamper-resistant packaging (1977), fire safety and smoke detectors (1978), food and beverage container safety (1978), window falls (1978), tap-water scalds (1979), and fire-safe cigarettes (1980).

Approaches to Policy

Legislation. APHA attempts to influence legislation that affects injury prevention and control. In recent years, APHA has been involved in legislation dealing with gun control, automobile safety, and product liability. We anticipate that a major issue in 1985 will be the continuation of the 55-mile-per-hour speed limit.

Adequate funding for Federal agencies and injury control programs is also essential. APHA has worked with Congress to secure appropriate funding for the National Highway Traffic Safety Administration, as well as programs administered by the Department of Health and Human Services.

Increasingly, APHA has worked to secure legislation at the State level. Technical experts representing APHA have participated in legislative and regulatory hearings dealing with handgun controls, fire-safe cigarettes, helmet laws, and other safety issues.

Litigation. Legal action can be a mechanism for obtaining desired action by government regulatory agencies. Over the years, APHA has filed five "friend of the court" briefs in cases related to mandating passive restraints in automobiles.

Regulations. As regulatory agencies develop proposed regulations related to injury prevention and control, national organizations must analyze proposals and provide technical guidance. Examples of opportunities in recent years have included flammable fabric standards, tamper-resistant packaging, fire-safety issues, product safety requirements, and passenger safety rules.

Educating professionals and the public. APHA has received funding from the Department of Transportation to provide small grants to State and local health departments for prevention interventions de-

signed to encourage the use of seatbelts. The education of APHA members and other health professionals is an important program. APHA has inventoried occupant protection programs in State health departments and has conducted workshops to help health professionals develop an awareness of occupant safety issues and of opportunities for prevention intervention.

APHA's newspaper, the Nation's Health, has publicized national injury statistics; carried informative articles about passive restraints, State mandatory seatbelt laws, fire safety, and product safety; and provided commentaries about injury control in general. Many APHA injury prevention activities are stimulated by members' affiliations in the Injury Control Special Interest Group. These members provide technical guidance, volunteer services to APHA programs, and help keep injury prevention issues before the membership.

Developing standards. Professional associations can bring experts together for the purpose of developing industry-wide standards. Several years ago, APHA convened a group of environmental health professionals and persons involved in producing, packaging, marketing, and transporting food products to develop, among other things, guidelines for reducing hazards associated with opening certain containers. APHA also publishes health and safety guidelines for persons using swimming pools.

Encouraging research. APHA can recognize areas where the science base for injury prevention and control is lacking and can encourage appropriate groups to conduct needed research. In addition, APHA can disseminate the outcome of injury-related research through its publications and professional and public education efforts.

Opportunities for Collaboration

Because of its many activities related to injury prevention and control, APHA interacts with other organizations and agencies. The effectiveness of an organization is magnified by the extent to which it combines efforts with other organizations working toward the same goals. Alliances are usually fluid and shaped by the specific issue under consideration and by the outreach of those organizations involved. A sampling of organizations that are or could become involved in specific injury prevention and control issues follows.

- Motor vehicle safety—national and State pediatric associations; child welfare leagues; Children's Defense Fund; national, State, and local highway traffic safety departments; policy organizations; insurance companies; State and local health departments; public health associations; consumer groups; victims' associations; Parent-Teacher Associations; civic organizations; schools of public health; Mothers Against Drunk Driving; and physicians' and nurses' associations.
- Gun control—church and religious organizations; victims' organizations; police associations; and public health associations.
- Product safety—industry groups; manufacturing associations; consumer groups; public health associations; child welfare leagues; national and State pediatric associations; national, State, and local health agencies; national and State consumer agencies or product safety commissions; emergency medical groups or rescue squads; and schools of public health.
- Burns—associations of retired persons; nursing home associations; industry organizations; housing departments; Federal, State, and local health departments; firemen's organizations; emergency medical groups or rescue squads; Parent-Teacher Associations; national and State consumer agencies or product safety commissions; architectural associations; tenants' associations; hotel and restaurant associations; State and local governments; physicians' and nurses' associations; and public health associations.

APHA continues its commitment to reducing injury-related deaths and injuries. Because of our broad-based membership, our Injury Control Special Interest Group, and our long history of working with other organizations, APHA is in a uniquely effective position. We look forward to continued relationships with the Centers for Disease Control and with other governmental and professional organizations as we collectively attempt to prevent unintentional injuries.

Collaborative Opportunities: the View of the Association of State and Territorial Health Officials

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THE ASSOCIATION of State and Territorial Health Officials represents the nation's 50 chief public health officials and their counterparts from the seven territories. Although the State and territorial health agencies differ in organization, resources, expectations, and contributions, they have many common issues and concerns.

A State health agency has at least three functions: it is a source of information, a policy director, and a service provider. As a source of information, the State health agency is charged with pooling local information for statewide uses—for example, statistics on births, deaths, and diseases in the community. The State health agency also provides technical assistance for general areas of public health and for specific targeted areas in that State.

As a policy director, the State health agency proposes and implements policy, often with the help of a public health board; more typically, the State health agency proposes policy to the legislature and governor.

Perhaps the most varied role of the State health agency is that of a provider of direct services, because programs and responsibilities vary significantly from State to State.

Interest in Injuries

For many public health officials, injury control differs from other, more traditional public health programs because responsibility for injury control is not clearly delineated. The prevention or control of traffic-related injuries may be the responsibility of a highway traffic safety commission, the department of transportation, the department of motor vehicles, or the State police department. Work-related injuries are generally of primary concern to the occupational safety and health program, which may be located in a workers' compensation department or a bureau of labor. The monitoring and followup of recreation-related injuries may be the responsibility of the fish and game commission, the department of parks, or the department of tourism and recreation. The safety of consumer projects may be under the jurisdiction of the State's department of commerce or the attorney general. The old adage "Everybody's business is nobody's business" may describe an all-too-frequent situation.

Apart from the structural issue, attention to injury control has been slow to develop in many States. The organizational structure of many State health agencies dates from an earlier part of the century when infectious diseases were the single largest cause of death, and it was essential to have a program that could respond rapidly to disease outbreaks or be accountable for environmental regulations that would prevent such outbreaks. Changing this structure to make injury prevention a focal point has been slow, primarily because of the conception that "injury" is not an "illness." Public health officials must point out that protecting the health of citizens includes all causes of disease and mortality.

Finally, injury control is a fragmented problem. Once we moved beyond traffic-related injuries and deaths, the statistics indicate many groups of injuries, each with a separate cause. Deciding how to use scarce resources on these multiple causes of injury is not easy.

State health officials are becoming more aware that injury control must become an ongoing process. At least two factors have been strong influences in this growing awareness. The first is that when mortality information is now reported, the item "years of productive life lost" is routinely included. This has underscored the fact that although we have remarkably reduced some causes of early mortality, we have a long way to go before the leading cause of death is exhaustion at the age of 110! The second factor is the influence of community groups such as Mothers Against Drunk Driving. Without the vigor and focus provided by a group such as this, I doubt that we would have come as far as we have in the last 18 months in raising the public's awareness and in attempting to reduce alcohol-related traffic deaths.

What Is Being Done to Reduce Injuries

Many primary and secondary prevention activities are under way. Among the most common are the child seat restraint programs. In many instances the State health agency is not the direct

provider of the child seats but is a focal point and coordinator, with the actual service being provided by local health departments, hospitals, and other groups. Primary prevention is also incorporated into well-child care, with many States providing materials and information on in-home safety. States that strongly emphasize health care in the home and the care of the elderly have incorporated home safety programs in their organization. A number of State health agencies are participating in programs to reduce the temperature of home water heaters. Ensuring the safe construction of facilities such as swimming pools and residential care facilities is another injury prevention activity. Secondary intervention programs include the provision of poison control information centers, emergency medical services, and trauma systems.

What Is the Potential?

The potential for State health agencies in injury control collaboration can be summarized in four areas.

- *Data system development.* Better data systems are the key to understanding injuries and building systems for their control. State health agencies should build needed data systems into existing local and State reporting systems. We must look for opportunities to improve other data sets to avoid burdening our system.
- *Intrastate communications.* Each State health agency should communicate with all agencies in that State that are involved in injury control.
- *Provision of a focal point.* If injury control is agreed upon as a priority, the State health agency must provide a focal point, a funnel, for information and technical assistance.
- *Collaboration in training and research.* State health agencies are in a good position to collaborate with training and research institutions. They can provide field placement services for persons being trained in injury control, and they can provide data for all sorts of injury control research. Likewise, training and research institutions should offer short-term courses or rotations for staff members of State health agencies to ensure that they have the latest information on injury control.

Over the last year, at least six national or regional meetings have been held regarding potential public health activities in injury prevention and control. This widespread interest reflects our collective attempt to reconsider the basic priorities of public health in this country and to refocus our efforts in the light of current information.

Workshop on 1990 Injury Prevention Objectives: Progress Review, 1985

Jack T. Jones, MPH (Group Leader); Marilena Amoni, MS; Thomas G. Betz, MD; Harvey F. Davis, Jr., MPH; David E. Heppel, MD; Elsie M. Sullivan; Richard J. Smith; and Jeanne G. Trumble, MSW. This work group report was updated following the progress review on Injury Prevention held April 29, 1985, in Washington, DC.

IN 1979, "HEALTHY PEOPLE: The Surgeon General's Report on Health Promotion and Disease Prevention" recognized the injury problem as 1 of 15 health priority areas (*1*). Seventeen objectives to be achieved by the year 1990 were developed to facilitate integrated injury control work by governmental health and other agencies as well as by private entities and individuals (*2*). The magnitude of the unintentional injury problem underscores the need to mobilize the broadest possible effort to deal with this disease. Now, midway to 1990, is an appropriate time to review progress toward the injury prevention objectives, identify recent initiatives of key Federal agencies, and indicate areas for future emphasis. Available data underscore the magnitude of the unintentional injury problem in the United States.

- In 1983, there were more than 143,000 injury-related deaths in the United States, including unintentional, intentional, and occupational injuries (*3*).
- More than 3.4 million years of potential life are lost to injury each year, compared with 1.8 million to cancer and 1.6 million to heart disease (*4*).
- In 1981, there were nearly 75 million unintentional injuries (*5*).
- In 1981, unintentional injuries accounted for more than 490 million days of restricted activity, including 144 million days in bed, 97 million days lost from work, and 14 million days lost from school (*5*).

- More than 75,000 Americans sustain brain injuries each year that result in long-term disability (*6*).
- Unintentional injuries result in 2.3 to 3.6 million persons being hospitalized each year (*5,7*).
- In 1980, there were 99 million physician contacts for injury, compared with 72 million for heart disease and 64 million for respiratory disease (*8*).
- More than 25 percent of hospital emergency room visits are for the treatment of injuries (*5*).
- A conservative estimate of the societal costs of all injuries in 1980 is approximately $75 billion to $100 billion (in 1980 dollars) (*9*).

Progress Toward Health Status Objectives

Eight of the 17 injury prevention objectives relate to health status (table 1), and 7 of these have been followed by the National Center for Health Statistics (NCHS) at least from 1978 to 1982. The Consumer Product Safety Commission (CPSC) estimates the number of persons treated in hospital emergency departments through its National Electronic Injury Surveillance System. On the basis of data collected, we estimate that six of the health status objectives are likely to be achieved, the drowning objective may be achieved, and only the fall fatality objective will probably not be achieved by 1990.

The trend in fatalities caused by falls has been and continues to be downward; however, the goal of 2.0 deaths from falls per 100,000 population will not be reached without a greatly accelerated decrease in falls or in the death rate among fall victims. Since the population group at highest risk of fatal falls—persons 75 years old and over—will become a greater proportion of the total population, the fall fatality rate is unlikely to decrease sufficiently to achieve this 1990 goal.

Progress Toward Other 1990 Objectives

Nine objectives for reducing risk factors, increasing public and professional awareness, and improving services and surveillance were developed for injury prevention (table 2). For tracking purposes, pertinent questions have been included in the 1985 NCHS Health Interview Survey to identify the midpoint status for three of these objectives: the two awareness objectives and the home smoke detector objective. Responses to these questions at the end of the decade will determine whether the 1990 goals have been achieved. The American Association of Poison Control Centers tracks population access to poison control centers; coverage is increasing, but certified centers will not increase in number or the population they cover to achieve the 1990 goal. Tracking systems for the other five objectives have not yet been established, thus limiting their usefulness to managers attempting to implement these aspects of the national injury prevention agenda.

Table 1. Progress toward the 1990 goals by health status objectives, United States, 1978–82

Objective	Baseline 1978	1979	1980	1981	1982	Goal 1990
	Annual rates per 100,000					
Motor vehicle fatality rates:						
Overall population	23.6	23.8	23.5	22.4	19.8	18.0
Children under 15 years	9.0	8.6	8.1	7.5	7.0	5.5
Home fatality rates for children under 15 years	6.0	5.7	5.7	5.6	5.3	5.0
Fall fatality rates	6.2	5.9	5.9	5.5	5.2	2.0
Drowning fatality rates	2.6	2.5	2.7	2.3	2.3	1.5
	Actual numbers					
Tapwater scalds requiring hospital care	4,000	NA[1]	NA	NA	NA	2,000
Residential fire deaths	5,401	5,299	5,083	4,956	4,462	4,500
Firearm fatalities[2]	1,806	2,004	1,955	1,871	1,756	1,700

[1] NA = Not available.

[2] Does not include fatalities in which the intent was undetermined: 640 in 1979, 626 in 1980, 679 in 1981, and 535 in 1982.

Table 2. Progress toward the 1990 goals by risk factor, awareness, services, and surveillance objectives, United States, 1978–82

Objectives	Percent			
	Baseline 1979	1980	1982	Goal 1990
Reduced risk factors				
Automobiles with automatic restraints	1	(1)	(1)	75
Newborn ride home in car seat	NA[2]	(1)	(1)	50
Residential units with smoke detectors	NA	[3]50	[3]67	75
Increased awareness				
Parents of children under 10 know measures for 3 major risks	NA	NCHS[4]	NCHS	80
Care providers give advice on seatbelt and child restraint use	NA	NCHS	NCHS	100
Improved services–protection				
Ambulance response in 20 minutes	20	(1)	(1)	75
Access to regional injury centers	25	(1)	(1)	100
Access to poison control center	30	NA	40	90
Improved surveillance-evaluation				
State plans for surveillance	12 (1981)[5]	NA	[5]15	75

[1] No tracking system has been developed.
[2] NA = Not available.
[3] As reported in study by the Federal Emergency Management Agency (*13*).
[4] NCHS = Currently being tracked by the National Center for Health Statistics.
[5] Ad hoc survey by the Centers for Disease Control.

Federal Agency Activities in 1984–85

Injury prevention activities are a part of many agencies within the Federal Government. A summary follows of recent activities of those agencies with particular injury prevention interests.

U.S. Public Health Service. Four major agencies of the Public Health Service are working to achieve the injury prevention objectives.

Centers for Disease Control (CDC). A group in CDC's Center for Environmental Health (CEH) is a focus for activities related to unintentional injuries occurring outside the workplace. This injury prevention and control group has a broad mandate, including the lead responsibility for the injury prevention area of the 1990 objectives. Activities are grouped into (*a*) surveillance, (*b*) epidemiologic research, (*c*) public health intervention efforts, and (*d*) technical assistance and consultation.

The lack of timely, population-based, cause-specific injury data is a major obstacle to the full understanding of the injury problem. Injury surveillance issues were reviewed at the 1984 conference on injury prevention, and recommendations for actions were made (see "Injury Surveillance Systems—Strengths, Weaknesses, and Issues Workshop," pages 582–586). CEH staff members have assisted four States in reviewing their data on injuries to clarify information that is available and to determine the potential uses of these data. Pilot projects evaluating various surveillance methods for injuries include practitioner reporting of injuries, hospital discharge summary information, and medical examiner reports. Comprehensive surveillance systems are being developed in major projects in Miami and Philadelphia as components of injury control demonstration projects.

As higher priority is given to injuries as a public health problem, public health practitioners at many levels are becoming more interested in epidemiologic research as a means of clarifying the magnitude and distribution of the injury problem and of identifying intervention opportunities. CEH's staff is expanding to support new activities that will lead to a more complete profile of the epidemiology of injuries nationwide. This staff is also available to State and local health agencies in their efforts both to evaluate unusual injury problems and to characterize fully their overall injury problem.

An atlas of injuries is being developed to depict cause-specific injury mortality rates for United States counties over a 14-year period by race, sex, and age. The atlas will (*a*) highlight injury problems for public health interventions, (*b*) stimulate academicians to join in studies of unusual injury issues, and (*c*) visually depict local injury problems, providing powerful messages to public decisionmakers.

Changes in the International Classification of Diseases (ICD) have been proposed by a working group led by CEH and CPSC staff members. The

changes proposed for the 10th revision of the ICD for external causes of injuries will greatly enhance the quality and comparability of available information on injuries.

Although a review of available injury interventions suggests that many of these would be highly effective (see "Measuring the Gap for Unintentional Injuries: The Carter Center Health Policy Project," pages 565–568), a critical evaluation of program interventions is lacking and far too few interventions have been implemented. To promote and stimulate the use of effective interventions, public health officials must see that more evaluation of efficacy is done and that proven interventions, such as the Tennessee child-passenger-restraint law (*10*), are better publicized.

Two local health departments, in collaboration with CDC, have developed demonstration programs for injury prevention. The development of targeted interventions and the critical evaluation of these interventions are essential to both programs. They focus on high-risk population groups—the elderly in Miami Beach and poor blacks in Philadelphia. The injury surveillance systems of these programs will identify the greatest injury problems and suggest interventions. In succeeding years, researchers will use the surveillance systems to evaluate the effect on injury rates of the interventions.

Increasingly, State and local health agencies are seeking assistance and consultation in reviewing their injury problems and in developing control programs. Collaborative evaluation of existing State and local injury control programs is an opportunity for health practitioners to examine practical issues associated with the development, management, and funding of injury control activities. An organizational handbook for managing injury control programs has been developed and will be used with CDC consultation activities. In addition, an updated mailing list allows rapid dissemination of information to key people in injury control.

CDC's Center for Heath Promotion and Education (CHPE) has incorporated injury prevention in its model school health education curriculum, which is widely used in elementary schools. The teenage health modules also focus on prevention of injuries. An annotated bibliography, "Prevention of Injuries to Older Adults: A Selected Bibliography," has been produced and distributed widely.

CHPE assists State and local health agency education workers by helping them identify priority health problems. In nearly a third of these projects, injury has been identified as the highest priority health problem. This process is also designed to facilitate the clarification of citizens' opinions of those problems and to lead to development of appropriate interventions for them. Awards to effective community injury prevention programs have recognized activities designed to prevent alcohol and drug abuse, to encourage use of infant car seats, and to avoid spinal cord injuries. Behavioral risk factor surveillance systems have been initiated by CHPE in 23 States and the District of Columbia. These systems collect information to characterize patterns of some injury risks—for example, the failure to use seatbelts and the combination of alcohol use and driving.

The Violence Epidemiology Branch of CHPE has evaluated national trends and epidemiology of suicides and published "Suicide Surveillance Summary: 1970–80." Other studies have described the demography and situational data from two clusters of suicides; a case-control study will better characterize risk factors for suicide. Collaborative studies in Los Angeles clarify the epidemiology and risk factors for homicide and have led to new hypotheses about intervention. New efforts to identify means to prevent violent injuries are being sought, in cooperation with the State of Georgia, by linking information from social service, health, and justice agencies.

The Division of Safety Research, National Institute for Occupational Safety and Health (NIOSH), CDC, is developing a national strategy to prevent traumatic occupational injuries with the assistance of experts from industry, academia, labor, and other organizations. In addition, NIOSH is developing surveillance systems to identify and rapidly evaluate fatal and severe injuries. Alternative surveillance methods are also being funded through cooperative agreements with selected State health departments. Ongoing research projects are conducted to clarify the settings of injuries, identify causal factors, and describe the injured persons. Recommendations for change are based on the findings of these studies. Cooperative agreements have been developed with academic institutions to create national centers of excellence for training students in the prevention of occupational injuries.

Alcohol, Drug Abuse, and Mental Health Administration. Through contracts and cooperative agreements, the National Institute on Alcohol Abuse and Alcoholism (NIAAA) supports epidemiologic studies and surveys to describe trends in the use of alcohol, alcohol's effects on health, and attitudes toward alcohol use among subpopulations. A broad research program, including extramural and in-

tramural efforts, focuses on the prevention of alcohol-related injuries and the reduction of injury severity. A statewide project will test methods for assessing the role of alcohol in all fatal and nonfatal injuries. NIAAA also disseminates research findings, mounts public information and education campaigns, and provides technical assistance to organizations developing intervention programs.

Health Resources and Services Administration. The Maternal and Child Health Program has continued its injury prevention training for professionals through collaboration with the American Academy of Pediatrics and other organizations, sponsorship of national and regional conferences, and development of publications and other training aids. Efforts to prevent injuries include distribution of educational materials (for example, through community health centers), support for child-passenger-restraint laws, and development of State injury control demonstration programs that focus on the prevention of childhood injuries.

Grants from HRSA to community and migrant health centers have expanded services to the elderly, which now include injury prevention in homes and nursing facilities and wheelchair safety. HRSA also participated in the health-promotion initiative of the National Institute on Aging that emphasized injury prevention.

The Indian Health Service (IHS) has emphasized injury prevention throughout its public and professional education activities. Interagency coordination has involved a broad group of organizational entities. A cooperative agreement with CDC's CEH is expected to enhance epidemiologic assessment of the injury problem and evaluation of injury prevention programs. Thus, new injury surveillance methods will be developed, field tested in several locales, and later modified for widespread adoption in IHS service areas. Injury prevention activities throughout the IHS have focused on child-passenger protection. Grants from five area offices have supported additional community injury prevention programs.

National Institutes of Health (NIH). New and exciting research findings related to injuries are forthcoming from NIH's National Institute on Aging, National Eye Institute, National Institute of Child Health and Human Development, and National Institute of Neurological and Communicative Disorders and Strokes. NIH studies seek to identify risk factors associated with osteoporosis, hip fractures, and falls; examine the effects of smoking and of drug and alcohol use among elderly people; prevent visual impairment from corneal burns and ulcers; identify and evaluate individual factors that promote good health; and seek ways to prevent, minimize, or arrest the sequelae of external trauma to the central nervous system.

U.S. Department of Transportation. The largest and most comprehensive injury-related program is conducted by the Department of Transportation (DOT). Although the Department focuses on the prevention of transportation-related injuries, many of its studies provide the firmest estimates of costs, disabilities, and long-term consequences of such injuries and can be used to assess the impact of other injuries. Projects with individual States recently have been developed to strengthen evaluation of (*a*) the effectiveness of car passenger restraint legislation, (*b*) programs to decrease alcohol use by drivers, and (*c*) programs to promote the voluntary use of passenger restraints. In addition, increasing attention is being given to the correction of roadside hazards on thoroughfares that are not part of the interstate system. Finally, the continuous surveillance system for fatal highway injuries provides comprehensive information on these events at the national and State level, and the nonfatal highway crash surveillance system allows national estimates to be made of this problem.

Consumer Product Safety Commission. In its efforts to protect the public from serious product-associated injuries, the CPSC assists consumers in evaluating the safety of consumer products, develops uniform safety standards for consumer products, and promotes research and investigation into the causes and prevention of product-related deaths, illnesses, and injuries.

The National Electronic Injury Surveillance System (NEISS) is operated by CPSC. The NEISS data on product-related injuries are collected from 66 hospital emergency rooms in the continental United States, and they provide timely information on hazardous consumer products. CPSC analyzes these data, conducts further studies, tests products, and awards contracts for outside research to improve product safety. CPSC also may require the recall, repair, replacement, or refund of products judged unreasonably hazardous, and it has the power to ban hazardous products.

Discussion

Increasing recognition of the magnitude of the injury problem in America is occurring simulta-

neously with a growing appreciation for the preventability of injuries. In 1983, Congress authorized DOT to fund a study of the trauma or injury problem by the National Academy of Sciences. The committee that conducted this review underscored the need to address the injury problem and made two overriding statements: (*a*) "The committee recommends the establishment of a center for injury control within the federal government," and (*b*) "The committee recommends that funding for research on injury be commensurate with the importance of injury as the largest cause of death and disability of children and young adults in the United States." These suggestions for organizational strengthening and new funding may create substantial opportunities for new injury control efforts.

A national consultation group from diverse backgrounds participated in the health policy project "Closing the Gap," held by the Carter Center of Emory University (*11*). This project began with investigations of the burden of 14 priority health problems, including injuries. Preventable morbidity and premature mortality associated with specific risk factors or available interventions were then quantified. The consensus was that injuries were one of the four highest priority intervention areas. It was predicted that the implementation of broad-based home injury prevention programs that used currently available technology could prevent an estimated 50 percent of the 23,000 fatalities that occur each year, along with a similar reduction in nonfatal injuries. The broad application of well-tested interventions could reduce motor vehicle accident injuries and costs by 75 percent. Targeted interventions to control alcohol use could reduce alcohol-related fatalities by about 25 percent and could greatly reduce the incidence of alcohol-related diseases.

To meet the 1990 Objectives for the Nation concerning injury prevention (*12*), we must take advantage of this growing consensus. Both public health and private sector providers must recognize the injury problem of the 1980s, establish compatible State and local surveillance systems, expand epidemiologic research, provide critical evaluation of intervention strategies, and increase prevention efforts.

References

1. Office of the Assistant Secretary for Health and Surgeon General: Healthy people: the Surgeon General's report on health promotion and disease prevention. DHEW Publication No. (PHS) 79–55071. U.S. Government Printing Office, Washington, DC, 1979.
2. Promoting health/preventing disease: objectives for the nation. U.S. Government Printing Office, Washington, DC, fall 1980.
3. Multiple causes of death in the United States. *In* Monthly Vital Statistics Report, Vol. 32. DHHS Publication No. (PHS) 84–1120. National Center for Health Statistics, Hyattsville, MD, 1984, p. 13.
4. Centers for Disease Control: Table V. Years of potential life lost, deaths, and death rates, by cause of death, and estimated number of physician contacts, by principal diagnosis, United States. MMWR 34: 439, July 17, 1985.
5. National Center for Health Statistics: Data related to injuries. Report distributed at the Association of Schools of Public Health–Centers for Disease Control Conference on the Prevention of Injuries, Atlanta, GA, Oct. 15–17, 1984.
6. Kraus, J. F.: Epidemiology of brain injury. *In* Head injury, edited by P. R. Cooper. Ed. 2. Williams and Wilkins, Baltimore, MD. In press.
7. Graves E. J.: Utilization of short-stay hospitals. Annual summary. Vital and Health Statistics, Series 13, No. 78. DHHS Publication No. (PHS) 84–1739. National Center for Health Statistics, Hyattsville, MD, August 1984.
8. Physicians' visits, volume and interval since last visit, United States, 1980. Data from the Health Interview Survey. Vital and Health Statistics, Series 10, No. 144. DHHS Publication No. (PHS) 83–1572. National Center for Health Statistics, Hyattsville, MD, 1983.
9. Committee on Trauma Research, Commission on Life Sciences, National Research Council, and Institute of Medicine: Injury in America, a continuing public health problem. National Academy Press, Washington, DC, 1985.
10. Decker, M. D., Dewey, M. J., Hutcheson, R. H., Jr., and Shaffner, W.: The use and efficacy of child restraint devices. The Tennessee experience, 1982 and 1983. JAMA 252: 2571–2575, Nov. 9, 1984.
11. Closing the gap health policy project. Interim summary of national health policy consultation. Atlanta, Nov. 26–28, 1984. Carter Center of Emory University, Atlanta, GA, 1984.
12. Davis, H. F., Jr., Schletty, A. V., Ing, R. T., and Wiesner, P. J.: The 1990 objectives for the nation for injury prevention: a progress review. Public Health Rep 99: 10–23, January-February 1984.
13. Hall, J. R., Jr.: Two homes in three have smoke detectors. Fire Service Today 50: 18–20, February 1983.

The 1990 Injury Prevention Objectives—NIAAA's Perspective and Current Status

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DESPITE THE VARIETY of circumstances in which unintentional and intentional deaths and injuries occur, a common but incompletely understood thread in many of them is the presence of alcohol, either alone or combined with other drugs. Although data are incomplete and alcohol or drug involvement is routinely underreported, the following estimates have been made regarding deaths and injuries related to transportation, the workplace, the home, and recreational activities. In all instances, the presence of alcohol may be only one of many contributing factors; therefore, it does not necessarily imply a causal role.

According to 1982 data reported by the National Highway Traffic Safety Administration, 50 percent of fatally injured drivers had blood alcohol concentrations above 0.10 percent (indicating intoxication), and 12 percent of the drivers had blood alcohol concentrations between 0.01 and 0.10 percent. If all drivers in this country were exposed only to the risk of persons who do not drive after drinking, there would be an estimated 24 percent fewer deaths (11,700 deaths prevented) and 156,000 to 300,000 fewer injuries (*1*).

Young drivers aged 16–24 are overrepresented in traffic fatalities as well as in alcohol-related fatalities (*2*). Among young persons aged 15–24, unintentional injuries of all types cause nearly five times the number of fatalities as the second leading cause of death. Unintentional injuries account for 55 percent of all deaths for this age group, and traffic injuries are the leading type of injuries (*3*).

As for other modes of transportation, estimates are that 10 percent of fatal general aviation accidents, 10 percent of railway accidents, and 20 percent of fatal marine accidents involve alcohol (*4,5*).

Unintentional injuries on the job have been less extensively researched than those related to transportation, particularly automobiles; therefore, less is known about their occurrence and contributory factors, including alcohol.

In home and recreational accidents, the role of alcohol is even less well understood than in traffic accidents because fewer on-the-scene investigations are conducted; most studies are undertaken in hospital emergency rooms. Estimates are that 40 percent of fatalities caused by falls and 25 percent of fatalities resulting from fire are alcohol related (*6*).

1985 Research Reports

The National Institute on Alcohol Abuse and Alcoholism (NIAAA) is extremely concerned about the absence of uniform reporting of injuries and the often inconsistent or incomplete reporting of alcohol involvement in injuries and death. To address this issue, NIAAA has collaborated in several epidemiologic studies and surveys. Reports will be available for researchers and policymakers in the next 2 years on the following studies:

1. Alcohol Supplement to the National Health Interview Survey (*7,8*). In 1983, an alcohol use supplement (developed jointly by NIAAA and the National Center for Health Statistics) to the National Health Interview Survey was administered to 25,000 persons. The survey results will describe alcohol consumption patterns in various subpopulations, such as the elderly, and assess alcohol use patterns in relation to health sequelae.
2. Hispanic Health and Nutrition Examination Survey (Hispanic HANES) (*9,10*). This National Center for Health Statistics collaborative survey of 16,000 Hispanics aged 18 and over concerns alcohol and drug abuse among the nation's three major Hispanic groups: Cuban Americans, Mexican Americans, and Puerto Ricans.
3. Health and Nutrition Examination Survey I Followup (HANES I Followup) (*11*). As many as possible of the HANES I survey participants (originally studied between 1971 and 1975—approximately 10,000 persons) will be reinterviewed; therefore, followup information will be obtained on a large national sample, with particular focus on older Americans. Alcohol consumption will be studied in relation to various health outcomes.
4. State risk factor surveys (*12–15*). The Center for Health Promotion and Education, Centers for Disease Control (CDC), has collaborated with 20 States to develop risk factor prevalence surveys using a standard telephone interview questionnaire. The States not formally participating in this program will constitute an independent sample pool that will be

stratified by population characteristics and studied by CDC. Thus, estimates of alcohol use and abuse behaviors will be projectable to the entire country.

5. 1982 Youth Cohort National Longitudinal Survey. This survey was conducted by the National Opinion Research Center in collaboration with the Department of Labor. Approximately 13,000 young adults, aged 14–21, participated in the survey. Blacks, Hispanics, and economically disadvantaged whites were overrepresented. The survey results are expected to show the prevalence and the age at onset of drinking, nationally and among special population groups. In addition, the results will allow the influence of occupational status and the level of alcohol consumption to be assessed.

Under an interagency agreement, NIAAA, the Department of Labor, and the Epidemiology Program Office, CDC, are sponsoring a project to develop and pilot-test methods for measuring the role of alcohol in fatal and nonfatal injuries (intentional and unintentional, occupational and nonoccupational). Plans for conducting a pilot surveillance program at the community level of alcohol-related fatal and nonfatal injuries are also under discussion. These surveys are expected to provide information necessary for pinpointing injury prevention activities, especially for high-risk populations.

Through its extramural grant program, NIAAA is supporting research projects that examine the factors that may reduce alcohol-related deaths and injuries, such as the availability of alcoholic beverages. Research on the effects of alcohol and drugs on one's ability to perform certain tasks (such as driving, walking down stairs, and operating machinery) will be expanded through the intramural research programs of the NIAAA and the National Institute on Drug Abuse (NIDA). NIAAA and NIDA will conduct a series of state-of-the-art workshops on research in such areas as drinking and driving and alcohol-related trauma and its prevention. Invited participants will include alcohol and drug researchers, policymakers, regulators, private industry representatives, State government officials, and others.

In prevention education and awareness, NIAAA is engaged in the following activities:

1. dissemination of research findings about educational and community policies and legislative strategies that have implications for preventing injuries and fatalities
2. provision of information about community, family, school, workplace, and media activities directed toward preventing injuries and fatalities
3. provision of technical assistance to volunteers, businesses, colleges, and professional organizations in development of alcohol prevention programs and strategies
4. development and dissemination of public education campaigns to warn the public about drinking and driving

The following activities are planned:

1. public education campaigns to promote prevention and safety
2. wide dissemination of research findings that will help State and local policymakers, decisionmakers, prevention specialists, safety representatives, and others develop and implement comprehensive injury control programs
3. enhancement of a computer simulation that will help State and local planners choose strategies, unique to their situations, for preventing alcohol-related injuries, fatalities, and other problems.
4. conferences to share information about injury control among researchers and other personnel who are responsible for using the research to develop programs at the State and local level.

Cooperative Ventures

In addition, NIAAA works with private organizations in the safety and injury prevention field to ensure that materials distributed to their memberships and the public include information on alcohol. The agency's staff is anticipating projects that will sensitize emergency personnel to the implications of the presence of alcohol on treatment protocols.

NIAAA and NIDA propose to coordinate a broad effort to develop systematically methods to reduce alcohol-related injuries. Advances in legislation, law enforcement, science, and technology could combine to effect nationwide reductions in drunk driving. The establishment of a single focus in the Federal Government to promote participation among key organizations and to develop programs drawing on separate areas of expertise may be the primary step needed to reduce deaths and injuries resulting from alcohol consumption.

In summary, NIAAA and NIDA propose to create a cooperative network composed of all relevant national, international, public, private, and professional groups that have a specialized role in implementing a comprehensive alcohol, drug, and safety program. Such a program would include both research (biomedical, epidemiologic, behavioral,

and clinical) and prevention (national, regional, and local public education campaigns; conferences; and other vehicles to encourage implementation of projects and promote preventive personal behavior).

References

1. Reed, D. S.: Reducing the costs of drinking and driving. *In* Alcohol and public policy: beyond the shadow of prohibition. National Academy Press, Washington, DC, 1981, pp. 336–387.
2. Centers for Disease Control: Alcohol-related highway fatalities among young drivers—United States. MMWR 31: 641–644, Dec. 10, 1982.
3. National Center for Health Statistics: Vital statistics of the United States, mortality, vol. III. Hyattsville, MD, 1977.
4. National Transportation Safety Board: Safety study. Publication No. 84-917003. U.S. Government Printing Office, Washington, DC, May 1984.
5. Ravenholt, R. T.: Addiction mortality in the U.S. National Institute on Drug Abuse Clearinghouse, Rockville, MD, 1983.
6. Alcohol, Drug Abuse, and Mental Health Administration: Fifth special report to the U.S. Congress on alcohol and health. DHHS Publication No. (ADM) 84–1291, U.S. Government Printing Office, Washington, DC, December 1983.
7. Wilson, R., Malin, H., Williams, G., and Aitken, S.: 1983 Health Interview Survey: Alcohol/Health Practices Supplement. *In* Proceedings of the 1985 Public Health Conference on Records and Statistics. National Center for Health Statistics, Hyattsville, MD. In press.
8. Wilson, R., Malin, H., and Williams, G.: 1983 HIS alcohol supplement: general description, methodological issues, and preliminary findings. *In* Proceedings of the Epidemiology of Alcohol Use and Abuse among U.S. Ethnic Minority Groups Conference, Bethesda, MD, September 1985. In press.
9. Christian, C. C., Zobeck, T., Malin, H., and Haynes, S.: Self-reported drinking behavior among Hispanic Americans. *In* Proceedings of the 1985 Public Health Conference on Records and Statistics, National Center for Health Statistics, Hyattsville, MD. In press.
10. Christian, C. C., Zobeck, T. S., Malin, H., and Hitchcock, D. C.: Self-reported alcohol use and abuse among Mexican-Americans: preliminary findings from the Hispanic HANES (Health and Nutrition Examination Survey). Adult sample person supplement. *In* Proceedings of the Epidemiology of Alcohol Use and Abuse among U.S. Ethnic Minority Groups Conference, Bethesda, MD, September 1985. In press.
11. Colliver, J., Barbano, H., and Dufour, M.: HANES I (Health and Nutrition Examination Survey) Epidemiologic Followup Study: general description, methodological issues, and preliminary findings related to differential patterns of alcohol use and associated medical problems. *In* Proceedings of the Epidemiology of Alcohol Use and Abuse among U.S. Ethnic Minority Groups Conference, Bethesda, MD, September 1985. In press.
12. Jones, S. E., et al.: Behavioral risk factor prevalence surveys—United States, first quarter 1982. MMWR 32: 141–143, Mar. 18, 1983.
13. Johnson, B. L., et al.: Behavioral risk factor prevalence surveys—United States, second quarter 1982. MMWR 32: 370–372, July 22, 1983.
14. Liberato, C. P., et al.: Behavioral risk-factor prevalence surveys—United States, third quarter 1982. MMWR 32: 603–604, Nov. 25, 1983.
15. Hefley, P., et al.: Behavioral risk-factor prevalence survey—United States, fourth quarter 1982. MMWR 33: 247–249, May 11, 1984.

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