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Findings from a Major U.S. Survey of Persons Hospitalized with Head Injuries

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SYNOPSIS

In 1974, work began on the first national survey of head and spinal cord injuries in the United States. The survey was a project of the National Institute of Neurological and Communicative Disorders and Stroke of the Public Health Service. This article presents highlights of the survey, particularly the findings about head injuries (that is, brain injuries).

The survey population consisted of people admitted to U.S. hospitals as inpatients between January 1, 1970, and December 31, 1974. To be medically eligible, patients must have experienced physical injury (except birth trauma) caused by an external, mechanical force. Probability sampling was used in a three-stage plan to select appropriate hospital records.

Findings of the head and spinal cord injury survey follow:

- *Of all age groups, 15- to 24-year-olds had the highest rate of head injuries.*
- *Males had a rate of head injuries more than twice that of females.*
- *Head injuries occurred most often on Fridays, Saturdays, and Sundays.*
- *The chief cause of head injuries was motor vehicle accidents.*

A CLEAR NEED FOR STATISTICS on head and spinal cord injuries in the United States prompted the Head and Spinal Cord Injury Survey (HSCI Survey). Among those who needed the statistical information were (*a*) people concerned with the prevention of head and spinal cord injuries, (*b*) specialists providing medical or rehabilitative treatment for injury victims, (*c*) workers engaged in social services for injury victims and their families, and (*d*) relatives of injury victims.

The first national survey of head and spinal cord injuries, begun in 1974, was funded by the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS) of the Public Health Service. The full report was published in 1980 (*1*); this article summarizes the survey findings about the head, that is, brain injuries.

Methodology

Survey strategy. Because a complete census of injury victims was not feasible, a sampling technique—

probability sampling—was used. The distinctive advantage of probability sampling is that it has built-in ways of ascertaining the degree of precision of the statistical estimates produced. The HSCI Survey was designed and conducted by the Research Triangle Institute of Research Triangle Park, N.C.

The survey population consisted of people admitted to hospitals as inpatients between January 1, 1970, and December 31, 1974. Both short- and long-term hospitals located within the contiguous 48 States of the United States were included in the study. Hospitals in Alaska and Hawaii were excluded because of financial considerations. Therefore, in this study, "national" means 48 States.

Medical eligibility. To be medically eligible for inclusion in the study, a person must have been admitted to a hospital for inpatient care as a result of a physical injury (except birth trauma) caused by an external, mechanical force. Thus, a person injured slightly and never hospitalized for the injury would be ineligible, as would a person injured severely and dying before being admitted as an inpatient.

In this study, hospital admission as an inpatient was required because the vast majority of people with serious injuries are hospitalized. These people could be located in a cost-effective manner by first drawing a sample of hospitals and then another sample of discharges from the selected hospitals. To prevent people with multiple hospital admissions from being selected more than once, only the first hospital admission following the injury was considered.

A patient discharged from the hospital could be selected for the study only if the hospital records of that patient contained certain ICDA-8 codes. These were either "included" or "casefinding" codes. Included codes referred generally to diagnoses that were indicative of direct injury to the brain or spinal cord (for example, ICDA–851—cerebral laceration and contusion); casefinding codes referred to diagnoses frequently associated with a brain or spinal cord injury but not in themselves indicative of that type of injury (for example, ICDA–345—epilepsy). The use of casefinding codes increased the coverage of hospitalized patients in the survey population.

Medical records that correspond to selected discharges had to be examined by hand. If casefinding codes but no included codes were found in the medical record, the patient was eligible for the survey only if certain clinical symptoms were documented in the record as occurring within 5 days of the physical injury. For head injuries, at least one of the following symptoms was required: unconsciousness, seizures, headaches, vomiting, or cerebrospinal fluid rhinorrhea. (Of eligible patients who had sustained head injuries, about 91 percent had one or more included codes mentioned in their medical records.)

Three-stage sampling plan. For the HSCI Survey, a descriptive study, techniques of probability sampling were essential. Probability sampling offers the opportunity for generalization from sample estimates to population characteristics on the basis of statistical theory.

Sampling was performed in three stages. In the first stage, the contiguous United States was divided into smaller geographic areas (counties or groups of counties) called primary sampling units (PSUs). A total of 58 PSUs were selected randomly from the 1,675 PSUs available. In the second stage, hospitals were selected randomly from the PSUs already selected. Of the 305 hospitals selected for study, 197 agreed to participate in all aspects of the study, 50 agreed to participate in some aspects (especially those that did not require the tracing and direct contact of patients), and 58 would not (or could not) participate at all. In the third stage, medical records of patients were selected randomly from within the 247 participating hospitals. Some 9,745 records were selected for study from 204,122 identified records. Of the 9,745 records, 9,061 were abstracted (3,516 met the clinical criteria for medical eligibility and 5,545 did not). The remaining 684 records were unavailable; they could not be located.

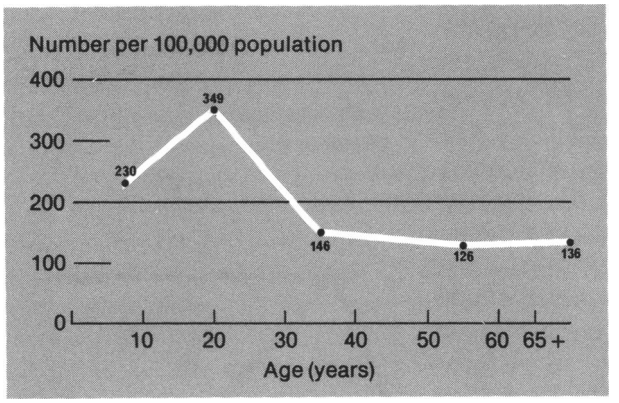
To compensate for nonparticipating hospitals and missing records in the survey, statistical adjustments were performed on the data from responders. It was intended that these adjustments would reduce any selection bias that might stem from the nonresponse.

Head Injury Findings

Unless otherwise specified, these findings refer to the calendar year 1974. Using statistics from the U.S. Bureau of the Census to calculate morbidity rates, we estimated that 422,000 cases of head injury occurred during 1974—a rate of 200 cases per 100,000 population. Age-specific rates for new cases of head injury peaked in the 15- to 24-year age group (fig. 1).

For males, there were 272 new cases of head injury in 1974 per 100,000 population; for females, there were 132 new cases per 100,000. Males experi-

Figure 1. Age-specific rates for cases of head injury that occurred in 1974 and were treated during inpatient hospital stays. The age categories are under 15, 15-24, 25-44, 45-64, and 65 and over



enced a rate of head injuries that was more than twice the rate for females. There was no important difference in the rates of new cases of head injury for white and nonwhite populations, nor was there any noteworthy difference in the rates for the major regions of the United States.

The leading cause of head injuries in 1974 was motor vehicle accidents (49 percent); falls were the second leading cause (28 percent). Other causes, for example, suicides and firearm or recreational accidents, accounted for the remainder.

From 1970 through 1974, motor vehicle accidents resulted in a higher percentage of head injuries with concussions and a lower percentage of intracranial hematomas than did other causes of head injury. This trend is even more evident for head injuries associated with coma. When coma follows a head injury produced by a fall or a blow on the head, it is likely that the coma has resulted from brain compression due to an intracranial hematoma. By contrast, coma following a motor vehicle accident is more likely to be due to severe primary brain damage caused by the excessive force imparted to the head and brain at the time of impact.

From 1970 through 1974, head injuries occurred more commonly (*a*) during the summer months and (*b*) on Fridays, Saturdays, and Sundays. People responsible for staffing hospital emergency rooms and inpatient care facilities should take these patterns into consideration.

From 1970 through 1974, about 55 percent of the patients with head injuries had first hospital stays of 3 days or less, while 10 percent had stays of 20 or more days. This latter statistic means that, in 1 year in the United States, more than 40,000 patients spent 3 weeks or more in the hospital as a result of head injury. Patients in the 15- to 24-year age group had the longest average hospital stay, and this age group also had the most frequent occurrence of head injuries due to motor vehicle accidents. Contributing causes of longer hospital stays in this age group were severe primary head injury and multiple systemic injuries—well known features of motor vehicle accidents. Long hospital stays were also seen in patients over the age of 45 years, perhaps reflecting an increasing occurrence of medical complications of head injury (such as pneumonia). In the HSCI Survey, hospital stays were considered terminated by death, convalescence, or transfer to another hospital.

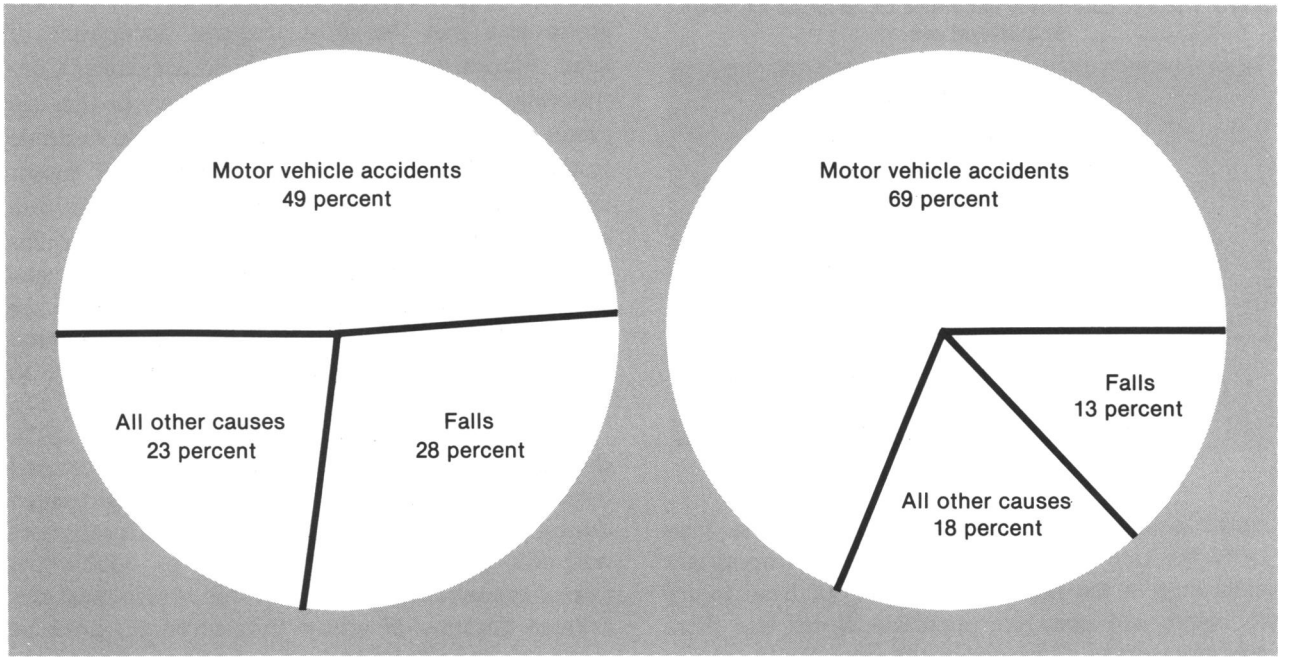
Data on cases of head injury existing in 1974 showed that 926,000 such cases that had occurred between 1970 and 1974 were still being treated during 1974. The rate of frequency of existing cases was 439 per 100,000 population, or double the rate of occurrence. This relationship, which measures average duration of injury (not severity), must be taken into consideration by those planning long-term care of patients with head injuries.

For the total population in 1974, the indirect and direct care costs associated with head injury were approximately $2.4 billion ($3.9 billion in 1980 dollars), an average of $2,534 ($4,114 in 1980 dollars) per injured person. Among the age categories, the largest average annual cost for head injury was for patients in the 25- to 44-year age group. This result is largely because head injuries of people in their prime wage-earning years represent bigger indirect costs.

The average cost of head injuries caused by motor vehicle accidents was higher than that for any other cause: motor vehicle accidents, $3,647; falls, $1,375; all other causes, $1,830. The higher average cost for motor vehicle accidents may be related either to the greater severity of primary brain injury or to the concurrent presence of multiple systemic injuries. Of the $2.4 billion total for head injuries, 69 percent is attributed to injuries caused by motor vehicle accidents, more than implied by the number of head injuries from that cause (fig. 2). These costs are for 1974.

'The leading cause of head injuries in 1974 was motor vehicle accidents (49 percent); falls were the second leading cause (28 percent).'

Figure 2. Causes of head injury (left) compared with distribution of $2.4 billion in direct medical care and indirect costs, by cause of head injury (right), 1974. See reference 1 for definitions of direct care and indirect costs



The HSCI Survey emphasizes the magnitude of the consequences of head injuries in the United States: the large number of injury victims, the use of hospital beds, and the financial costs. Moreover, the contribution of motor vehicle accidents to this major socioeconomic problem is enormous.

Assessment of the Survey

The HSCI Survey was not a full-scale epidemiologic investigation; the clinical verification of injury cases was not extensive. Nevertheless, the survey represents a major effort, and its results will be useful to people of diverse backgrounds—from health professionals to relatives of injury victims.

The survey results, for 1974, provide a benchmark by which specialists interested in head injuries can make informed guesses about current levels of morbidity and related health costs. The results increase in importance because the HSCI Survey has not been replicated in the United States, nor is it likely that a comparable survey will be carried out soon because of budget constraints and the high cost of such research.

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Evaluation of an Extended Degree Program in Public Health for Working Professionals

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SYNOPSIS

The faculty of the School of Public Health, University of California at Berkeley, developed an extended degree program in health services administration for persons who could not attend the university full time. Course formats were redesigned so the courses could be taught off campus in Sacra-