Injury Among Persons 1–24 Years of Age In the United States:
Data From The National Center for Health Statistics

by Lois A. Fingerhut, M.A. and Brenda S. Gillum, M.A.

Introduction

Data systems of the National Center for Health Statistics (NCHS) are the source of national estimates of injury morbidity and injury mortality in the United States. Each of the data systems collects, defines and disseminates injury data differently. Briefly, mortality data are from the National Vital Statistics System and are based on information recorded by physicians or coroners on the death certificate for **all** deaths from the 50 States and the District of Columbia. National estimates of injury morbidity are derived from several different NCHS **survey–based** data systems. Two are hospital–based medical abstract surveys: the National Hospital Discharge Survey (NHDS) and the National Hospital Ambulatory Medical Care Survey (NHAMCS)–Emergency Department component. A third is a household–based door–to–door survey: the National Health Interview Survey (NHIS). The technical details for each of these data systems can be found in published documents of the NCHS (1,2,3,4).

Definitions of injury

Rules for defining injury as an underlying cause of death are set forth in the International Classification of Diseases (ICD) published by the World Health Organization. Methods and rules for classifying injury morbidity are less clear and are often developed by individual users (5). The ICD provides codes that are specific to the nature and the cause of injury. In the United States, it is common practice to code nonfatal injuries using codes defined in the ICD's Chapter 17 (Injury and Poisoning) for nature of injury and in the Supplementary Classification of External Causes of Injury and Poisoning for cause of injury. The completeness of external cause (E) coding for morbidity data varies with the data collection site (e.g., hospital inpatient versus hospital emergency department). Beginning in 1979, the Ninth Revision of the ICD was adopted for in use in the United States.

Mortality

Cause of death statistics are based on the *underlying cause* of death which is defined as "(a) the disease or injury which initiated the train of events leading directly to death, or (b) the circumstances of the accident or violence which produced the fatal injury." (5) Thus, it is the cause of the injury (i.e., the motor vehicle crash) rather than the nature of the injury (i.e., intracranial injury) that is selected as the underlying cause of death. These "external" or E–codes are E800–E999 from the ICD–Ninth revision.

Contributing causes of death: Data on the nature of the injury, that is for example, a fracture, burn, poisoning or head injury are found in the multiple cause of death files (6). These are not routinely published by NCHS, but are available on public use tapes.

Morbidity

Cause–specific morbidity data from the NHDS are based on the ICD, 9th revision, Clinical Modification (CM) and are coded and published by the nature of the injury, based on codes 800–999. Because only about 40 percent of hospital injury discharge records have E–codes, they are not considered valid for making national estimates of cause–specific hospitalizations. Cause–specific injury data from the NHAMCS–ED are coded by both E–code and N–code. Annual household interview data on acute injury conditions are based on self–reports and are usually categorized by nature of the injury. In addition, NHIS data on episodes of injury differentiate between injuries involving motor vehicles. (2,3,4)

Cross–system comparisons

Injury rates are often published on different bases making the potential for confusing cross system comparisons quite likely. For example, death rates are generally published per 100,000 population, hospitalization discharge rates are per 10,000 population, and emergency department visit rates and reported conditions are per 100 persons. Injury pyramids can be useful for simplifying this. Based on NCHS data systems, for every 1000 injury conditions reported for persons 1–24 years of age in the NHIS, there are approximately 510 visits to emergency department; 25 hospitalizations; and 1 injury death (fig.1). Looked at another way, for every injury death at ages 1–24 years, there are 17.4 injury related hospitalizations, 356 injury visits to emergency departments and 700 self– reported injuries.

Mortality (figures 2 through 9)

Approximately 1 in a thousand or one tenth of one percent of reported injuries in this age group result in death. Despite this, most national analyses of injury data in this country are based on mortality. One can offer several reasons: 1) the data are coded as to the external cause of the injury which is crucial for prevention, 2) the data are for all persons and not based on a sample, 3) the level of geographic detail is far more extensive than for morbidity data, and 4) the high quality of mortality data (due, in part, to State laws which mandate the completion of a standard death certificate for every death occurring in the State). Information on the death certificate is also subject to local, and national quality control measures concerning the completion, filing and later amendments to the certificate.

In 1991, 36,140 persons 1–24 years in the United States died as a result of an injury compared with 16,005 who died as a result of a natural cause of death. Overall, 70 percent of deaths among persons 1–24 were the result of an external cause of death– varying from 43 percent for those aged 1–4 years to 81 percent for teenagers 15–19 years. Approximately 40 percent of deaths at ages 1–24 (with very minimal variation by age) were the result of an unintentional injury. Intentional injury (which includes homicide and suicide) varies significantly by age, from 3.5 percent for those 5–9 years, to 36 percent of all deaths among persons 20–24 years of age.

The single leading cause of death for persons 1–24 years is motor vehicle crashes. Among young children 1–4, drowning and fires are also among the top ranked causes of unintentional injury death. At 20–24 years, homicide and suicide together cause more deaths than do motor vehicle crash related injuries.

Differences by sex in injury mortality increase with age. Among young children 1–4 years, the death rate from drowning among young boys is twice that for young females. At 5–9 years, the sex difference in drowning is about 3:1, and the motor vehicle death rate for boys is 1.6 times that for females. At 10–14 years, the sex ratio from drowning is 4:1; the motor vehicle death rate for boys is twice that for females; for suicide it is 3:1 and for homicide it is 2:1. Injury death rates for males 15–19 and 20–24 are 3–4 times those for females, with the larger differences in homicide and suicide rates, than in unintentional injury mortality.

At ages 10–14, 15–19 and 20–24 years, firearms are associated with more deaths than any cause with the exception of motor vehicles. More than half of these firearm deaths are associated with homicide. Death rates associated with firearms for persons 10–24 years have been increasing, while motor vehicle death rates have been falling. Even among children as young as 10–14 years, the firearm death rate has been increasing. From ages 25–34 on, both firearm and motor vehicle crash death rates have been stable or have been declining.

Mortality data also have the benefit of geographic detail. County level data are often beneficial in helping to target prevention activities. As an example, one can look at county level firearm death rates among males 15–24 years of age. In 1990–91, the death rate in Orleans, Louisiana and Washington, DC were similarly high, more than three times the rate in Duval, Florida.

Hospital discharge data (figures 2, 10 and 11):

In 1991, there were approximately 629,000 injury related discharges from short–stay hospitals among persons 1–24 years. These national estimates are based on a sample of discharges from short–stay hospitals. Demographic, diagnostic, and procedure data are collected using both manual and automated abstracting. The NHDS has been conducted annually since 1965. In 1991, there were approximately 25 discharges for every 1,000 reported injury conditions, with the ratio being slightly higher for those 15–24 years than for those 1–14 years.

Discharge rates for persons 1–24 follow an age pattern similar to that for mortality, with discharge rates for children 1–4 years higher than for children 5–14 years, but considerably lower than at 15–24 years. Also, at each age, the discharge rate for males exceeds that for girls.

Among children 1–4 and 5–14 years, hospitalization rates for males with head injuries and burns are about 3 times the rates for girls. At 15–24 years, laceration and open wound rates are about 3 times higher for males than for females. Discharge rates associated with poisoning, on the other hand, are higher for females than for males.

Emergency department visits: (figures 2, 12 and 13)

The first national estimates of cause–specific visits for injury are from the 1992 NHAMCS–ED component which is based on a sample of visits to emergency rooms. The cause–specific data were manually abstracted and coded according to the ICD–9–CM.

In 1992, there were an estimated 13 million injury related visits to ED's among persons 1–24 years of age. ED visit rates for injury show less variation by age than do mortality or hospitalization rates for injury. Unlike mortality, visits to EDs are often related to falls. For children 1–14 years, one third of injury visits that were E–coded were fall–related. Among those 15–24 years, 16 percent were falls, 21 percent were motor vehicle and 8 percent were assault related.

Household Interview Survey (figures 2 and 14)

In the NHIS, injuries are defined by whether or not medical attention was received or if there were any days of restricted activity associated with the injury. In 1992, there were about 26 million injuries reported for persons 1–24 years of age, with the incidence of reported injuries higher for males than for females at ages 5–14 and 15–24 years and similar at 1–4 years.

Childhood injury incidence data have been the subject of several of the rotating NHIS supplements, but are not reported in detail on an annual basis.

One reason for the lack of annual detail has been that the sample size is too small as a result of only using a two week recall period. Plans are currently underway to revise the injury questions in the NHIS (in addition to other parts of the core questionnaire) so as to enable a more detailed and comprehensive understanding of injury morbidity in the US.

In 1961, Drs. Kerr White, Franklin Williams and Bernard Greenberg described an illness pyramid very similar to the injury pyramid that has been referred to. (7) To paraphrase from their summary: "in a population of 1,000 adults, in an average month 750 will experience an episode of illness; 250 will consult a physician; 9 will be hospitalized; 5 will be referred to another physician and 1 will be referred to a university medical center. The latter

sees biased samples of one tenth of one percent of the sick adults from which students of the health professions must get an unrealistic concept of medicine's task ..."

So too, must injury researchers be cautious in not relying solely on injury mortality statistics for the characterization of injury. We must always be cognizant of the very important differences between the epidemiology of fatal and of nonfatal injuries.

References

1.   National Center for Health Statistics. Advance report of final mortality statistics, 1991. Monthly vital statistics report; vol 42 no 2, suppl. Hyattsville, Maryland: Public Health Service. 1993.

2.   Graves EJ. 1992 Summary: National Hospital Discharge Survey. Advance data from vital and health statistics; no 249. Hyattsville, Maryland: National Center for Health Statistics. 1994.

3.   McCaig LF. National Hospital Ambulatory Medical Care Survey: 1992 emergency department summary. Advance data from vital and health statistics; no 245. Hyattsville, Maryland: National Center for Health Statistics. 1994.

4.   Benson V and Marano MA. Current estimates from the National Health Interview Survey, 1992. National Center for Health Statistics. Vital Health Stat 10(189). 1994.

5.   World Health Organization. Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death, based on the recommendations of the Ninth Revision Conference, 1975. Geneva: World Health Organization, 1977.

6.   National Center for Health Statistics. Vital statistics, instructions for classifying multiple causes of death. NCHS instruction manual; part 2b. Hyattsville, Maryland: Public Health Service. Published annually.

7.   White KL, Williams F, and Greenberg BG. The ecology of medical care. The New England Journal of Medicine. vol 265, no 18, pp.885-92. Nov 2, 1961.

	Defined by:	Number of events	Published per	For every 1,000 conditions
Death	E800-E999	36,140	100,000	1
Hospitalization	N800-N999	629,000	10,000	25
Emergency department visit (1992)	E800-E999	12,883,000	100	510
Reported condition	Self report	25,267,000	100	

Figure 1. Injury in the population 1-24 years of age: United States, 1991

Injury resulting in:	All, 1-24 years	1-24 years	1-14 years	15-24 years
	Number	For every 1,000 reported conditions:		
Death	36,140	1	0.6	3
Hospital discharge	629,000	25	19	32
Emergency department visit 1992	12,883,000	510	513	506
Reported conditions	25,267,000			

Figure 2. Injury in the population 1-24 years of age: United States, 1991
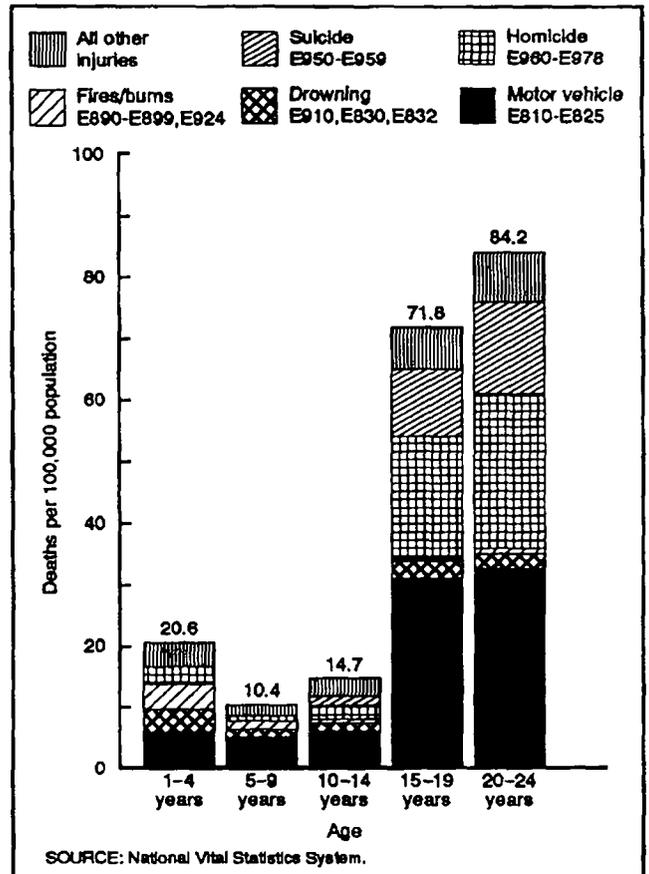
Figure 4. Injury mortality among persons 1-24 years: United States, 1991
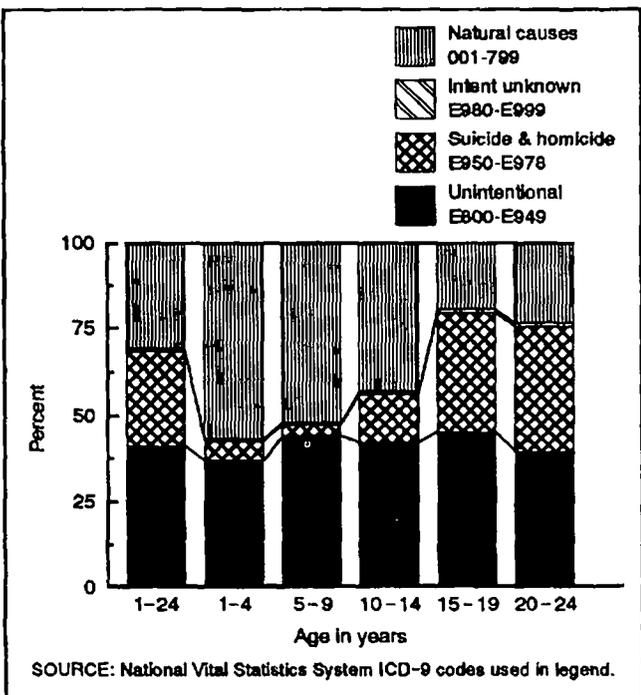
Figure 3. Deaths among persons 1-24 years by cause and age: United States, 1991
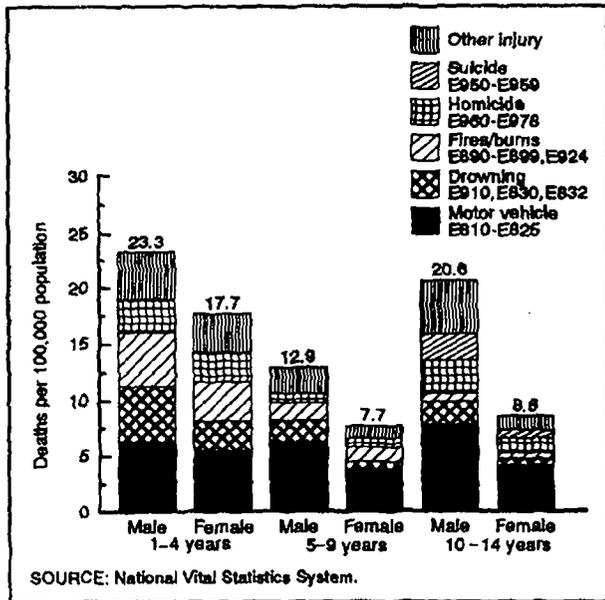
Figure 5. Injury mortality among males and females 1-14 years: United States, 1991
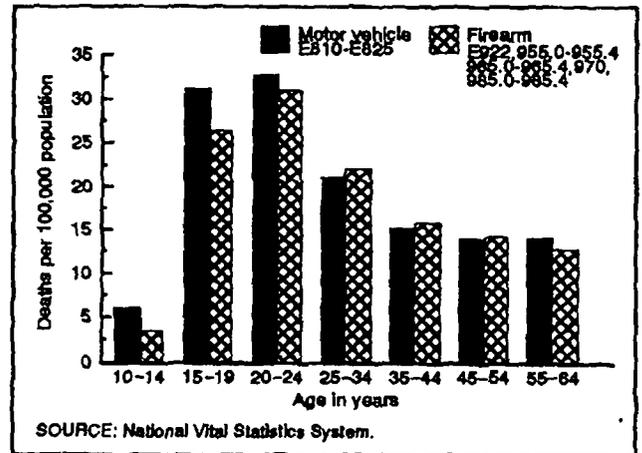
Figure 7. Firearm and motor vehicle crash death rates for persons 10-64 years by age: United States, 1991
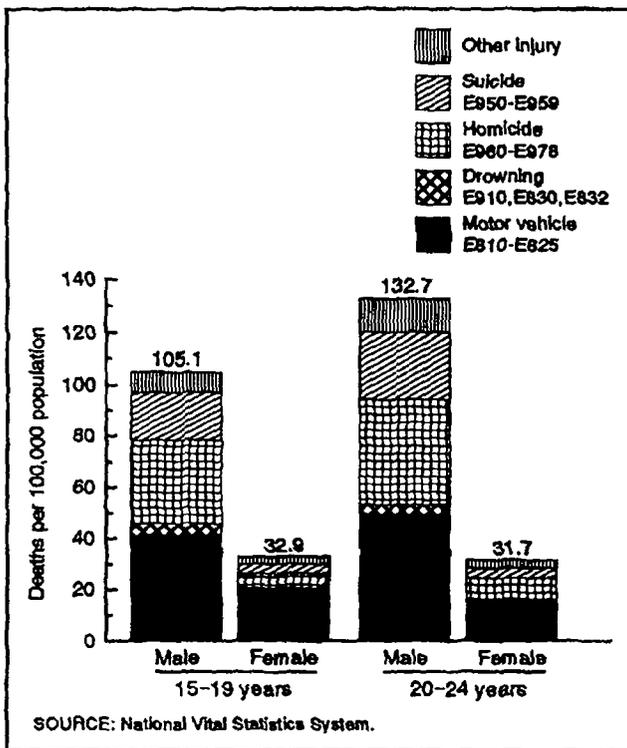

Figure 6. Injury mortality among males and females 15-24 years: United States, 1991
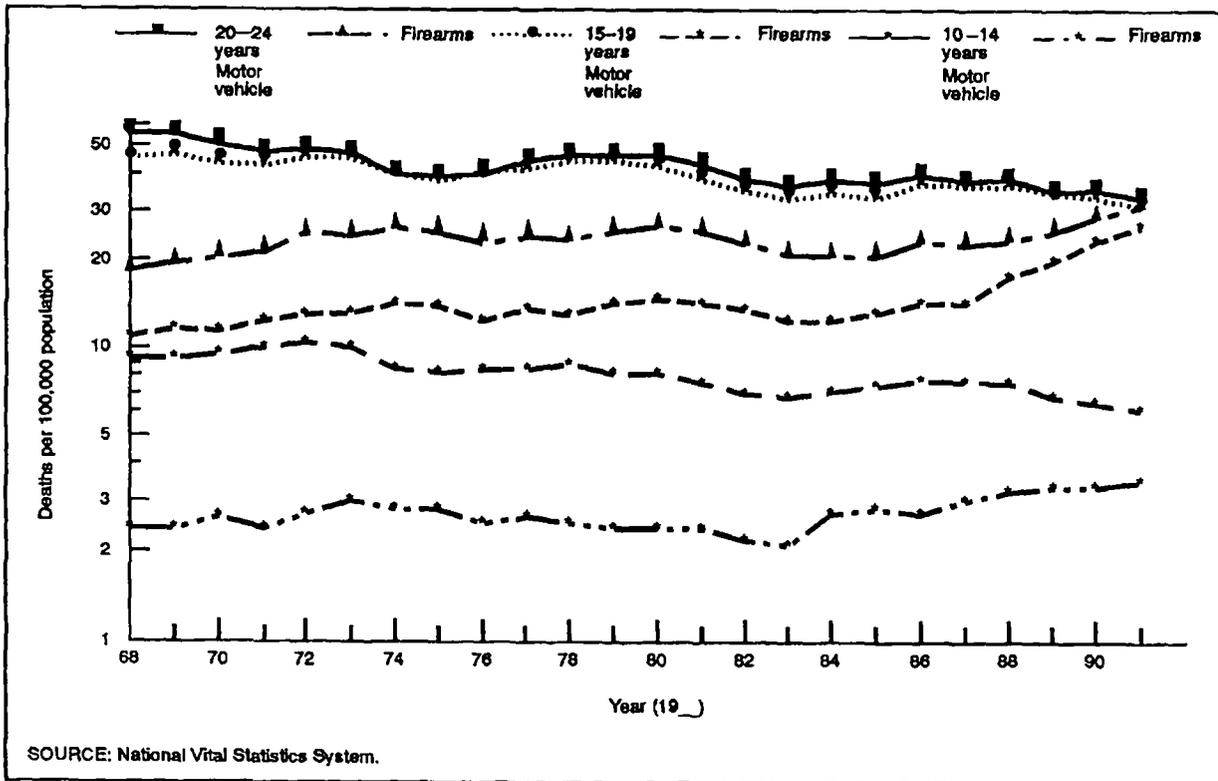
Figure 8. Firearm and motor vehicle mortality among persons 10-24 years by age: United States, 1968-1991
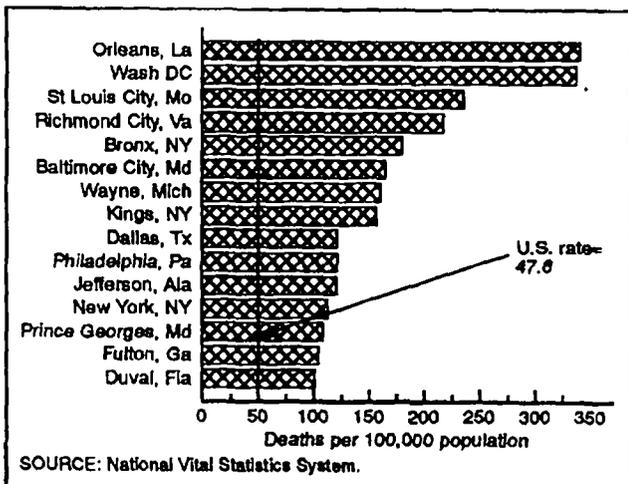

Figure 9. Firearm death rates for males 15-24 years by county: United States, 1990-91
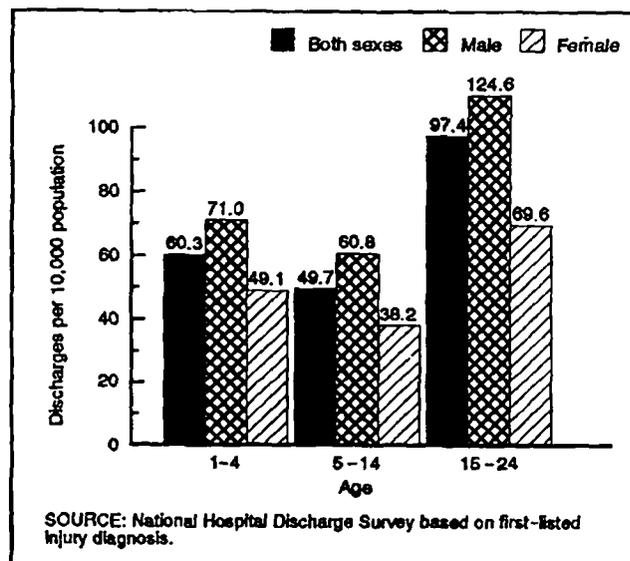
Figure 10. Hospital discharge rates due to injury for persons 1-24 years, by age and sex: United States, 1992

6-7

Bums
Poisoning
Intracranial Injury
Lacerations/open wounds
Fractures

Discharges per 10,000 population

100
80
60
40
20
0

Male Female Male Female Male Female
1-4 years   5-14 years   15-24 years
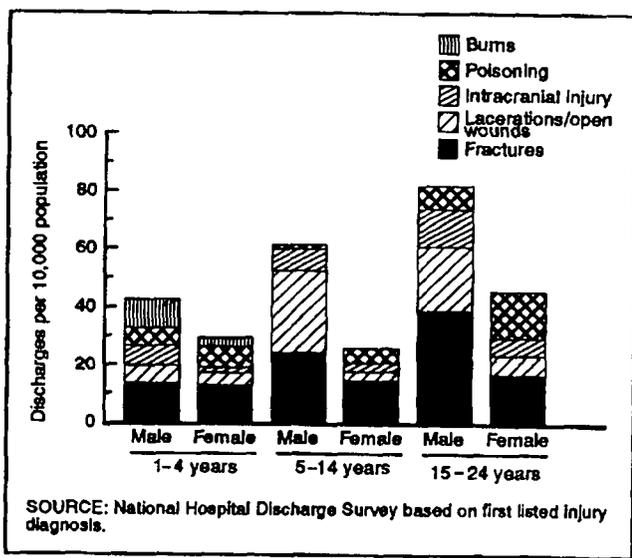
Figure 11. Hospital discharge rates for selected injuries for persons 1-24 years: United States 1992

1-14 years
15-24 years

Falls
Motor vehicle
Homicide (assault)
Natural/ environment

0   10   20   30   40
Percent of visits
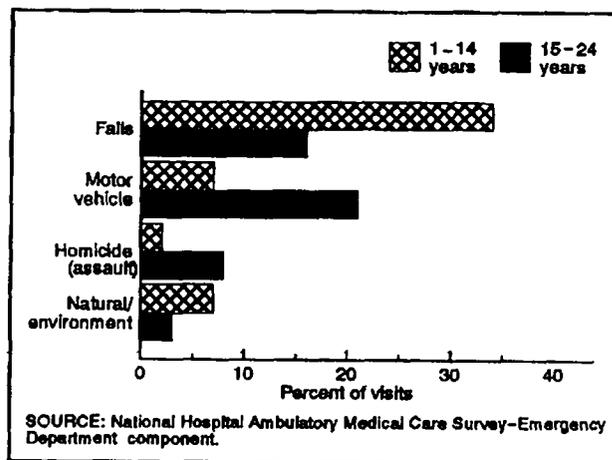
Figure 13. Selected leading causes of injury visits to emergency departments by age: United States, 1992

Visits per 100 persons per year

20
15
10
5
0

13.5   11.3   14.6   17.2   17.2

Under 5   5-9   10-14   15-19   20-24
Age
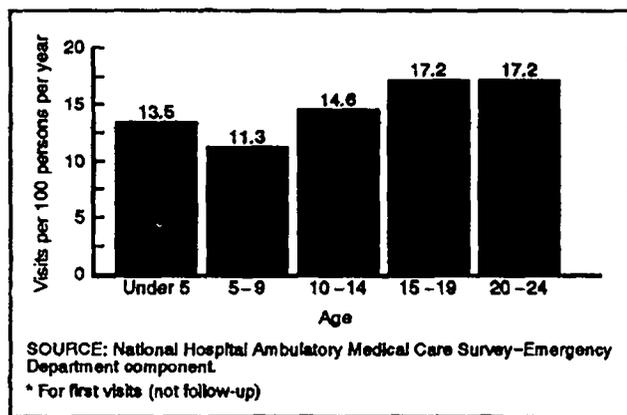
Figure 12. Emergency department visit rates for injuries* among persons under 25 years: United States, 1992

Male   Female

Conditions per 100 persons per year

50
40
30
20
10
0

1-24 years   1-4 years   5-14 years   15-24 years
Age
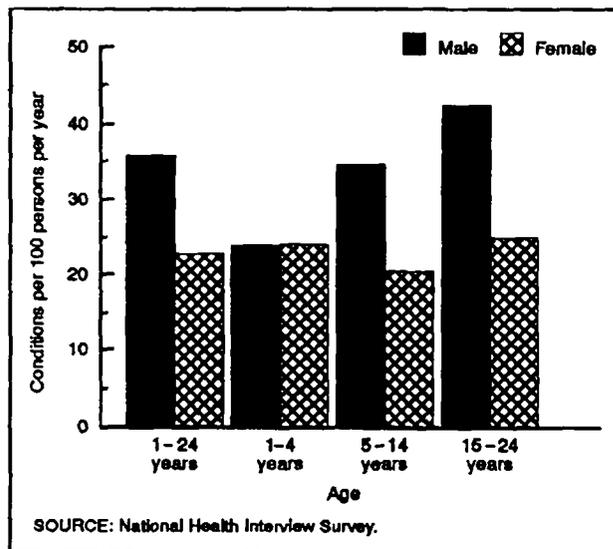
Figure 14. Injuries reported in household interviews among persons 1-24 years by sex: United States, 1991

6-8