

Profile of work injuries incurred by young workers

Hazardous environments put youths at risk of serious injuries: young workers have been killed on construction sites, during robberies while tending retail establishments, and while working on farms; common nonfatal injuries include sprains and strains, burns, cuts, and bruises

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Over the period from 1992 to 1997, 403 youths aged 17 years and under were killed on the job. These fatal incidents occurred primarily in agriculture, retail trade, construction, and services. One-third of the deaths occurred in family businesses, and about one-half involved various types of vehicles and equipment. Work fatalities among youths, to some extent, mirrored those incurred by older workers: the incidents resulted mainly from homicides, highway crashes, tractor rollovers, falls, electrocutions, and falling objects.¹

This article discusses youth employment and the associated risks. It first presents a historical summary of youth employment in the United States, then examines data on fatal work injuries among young persons, comparing their risks with those of all workers and providing a detailed look at the events, equipment, and industries associated with these workplace fatalities. Finally, the article provides an overview of the nonfatal injuries incurred by young workers during 1996.

Youth employment, historically

The images evoked by the phrase “child labor” have changed dramatically over time.² Early in U.S. history, children helped contribute to the family unit with their labor. These contributions provided families with additional and often necessary sources of food or income; they also served as part of a child’s upbringing and prepa-

ration for adulthood. Indeed, it was believed that work was morally edifying: industriousness was widely considered a virtue and idleness a sin; with work came character, responsibility, and thrift. Many believed that unemployed youths eventually would augment the “poor, idle, vicious elements of society.”³

The industrial revolution changed a predominantly rural populace into an urban one. Many workers left their homes and fields and migrated to cities to find work. Labor shortages created by the many new factories often were remedied by employing children. Many considered this type of work no less fulfilling than the traditional role children played in the labor market—providing extra income for the family while building a sense of self-reliance. In 1791, Alexander Hamilton noted the social benefits resulting from the mixture of manufacturing and youth employment: “In general, women and children are rendered more useful, and the latter more early useful, by manufacturing establishments, than they would otherwise be.”⁴ Youths worked not only in factories, however; many also worked as errand boys, messengers, butcher’s assistants, vendors, and newsboys.

As U.S. society evolved, so too did the demands and expectations for education. Literacy had long been important as a means for people to read the Bible. Long days and weeks spent working made it difficult for youths to study. Thus, in 1813, Connecticut passed laws requiring manu-

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facturers to provide young persons in their employ with skills in reading, writing, and arithmetic. In 1836, Massachusetts passed similar legislation, requiring that children spend a minimum of 3 months per year in school.

By the early 1900s, the often dangerous working conditions of some occupations were well known, propagated by news articles and photographs. Public opinion, fueled by these powerful images and influenced by the education movement, began to turn against child labor. As a result, States passed laws restricting the hours children could work and established a minimum age of employment for young workers. Several attempts by the Federal Government to pass similar laws were struck down by the Supreme Court on the grounds that they were unconstitutional.

President Franklin D. Roosevelt, a strong proponent of child labor laws, significantly changed the makeup of the Supreme Court during his long tenure as President, and the Fair Labor Standards Act was enacted in 1938 and upheld by the Supreme Court in 1941. The Act, the primary Federal law governing child labor, sets limits on the hours that those younger than 16 years may work and restricts persons under age 18 from working in certain hazardous nonagricultural occupations. It also sets age limits and restricts the types of work activities youths can perform on farms other than those owned or operated by their parents. Other Federal laws, such as the Occupational Safety and Health Act of 1970, regulate the workplace for workers of all ages. Additionally, each State has its own set of child labor laws that are sometimes more restrictive than standards set by Federal law.⁵

During the Second World War, greater proportions of women participated in the labor force than had previously, and child labor became less prevalent. A greater emphasis on the importance of education also emerged. For these and other reasons, following the war, most employed youths worked only in part-time jobs. Many of the traditional values associated with youth employment, such as self-reliance and responsibility, are still highly regarded and widely recognized. Hence, by the time they reach age 18, most young people have engaged in some form of employment.

Some disagreement still exists on the appropriate role of work for today's youths. Some of the pending issues revolve around the number of hours a young person should be permitted to work, whether the current definition of "hazardous" (and, therefore, restricted) work is adequate, and whether agricultural occupations should be more closely regulated.

Fatal injuries, 1992–97

Over the 1992–97 period, on average, 67 persons under the age of 18 died each year from injuries incurred on the job, which is about 1 percent of the total number of work

fatalities that occurred over that period. Because both the number of workers in a particular group and the amount of time spent on the job affect fatality counts, fatality *rates* are used to evaluate workers' risks of incurring fatal work injuries. Fatality rates are standardized—usually expressed as the number of fatalities per 100,000 workers—to facilitate comparisons between worker groups with varying exposure levels.⁶

About 3 million youths hold jobs each year, often for short periods and primarily in part-time jobs. The length of time that they are exposed to workplace hazards is, therefore, less when compared with full-time workers. Because of this, rates based on exposure hours were used to evaluate fatality risk. These rates were calculated using actual hours worked for persons in that age group, converted to full-time equivalents (2,000 hours worked per employee, per year). Employment-based rates also were calculated, but studies have shown them to be less accurate when comparing fatality risks for worker groups with widely varying hours of exposure. Employment-based rates typically underreport fatality risks for workers in the youngest and the oldest age categories because these workers are more likely to work part-time.⁷

The following tabulation shows the number of fatalities occurring during the 1992–97 period, and the average fatality rate per 100,000 workers (excluding military and workers under age 15), based on employment and hours worked:

	Number of fatalities		Fatality rate, based on:	
	<i>Total</i>	<i>Annual average</i>	<i>Employment</i>	<i>Hours worked</i>
Total, all ages	37,875	6,313	5.0	5.0
Under 15 years ..	109	18	(¹)	(¹)
15 years	46	8	1.8	5.1
16 years	91	15	1.6	3.4
17 years	157	26	1.9	3.7

¹ Employment and hours-at-work data not available.

When comparing the whole population of workers, both methods yield a rate of 5.0 fatalities per 100,000 workers. The data also show that, in general, the risk of youths suffering a fatal injury is less than that of all workers combined. When fatality rates based on hours worked are used, 15-year-old workers have about the same risk of incurring a fatal injury as adult workers. The fatality rates for 16- and 17-year-olds, however, who make up the majority of employed youth, are about three-fourths the rate for all workers combined.⁸ Although fatal injuries among the youth population occur in much the same way as those among older workers, differences in fatal events are apparent from available data.

Homicides edged out highway incidents as the leading

cause of death among youths at work. Proportionally fewer highway fatalities among young workers may result from restric-

tions on youths' driving as well as from the types of jobs held by young workers.⁹ Vehicle-related incidents occurring on farms, industrial premises, or in parking lots, by contrast, accounted for a larger proportion of the worker fatalities among youth than among all workers. As a result, for both young and older workers, two-fifths of all fatalities involved some type of vehicle. There also were slight differences between the two groups in the share of total fatalities resulting from falls and contacts with objects and equipment. (See table 1.)

By industry. Between 1992 and 1997, 403 young workers (17 years and under) lost their lives as a result of on-the-job injuries. Two-fifths were killed while working in agriculture, and about one-fifth were killed while working for retail establishments. (See table 2.) Specific industry descriptions follow.

Agriculture. The thought of growing up on a farm often evokes images of an idyllic childhood setting with children

being taught the values of daily chores, working alongside their parents or grandparents in the fresh air. Actually, however, agriculture is one of the most dangerous industries for all workers, with fatality rates that consistently rank below only those of mining, which has the highest rates. Adult and youth farmworkers routinely are exposed to many hazards, such as heavy machinery, falls, falling or flying objects, and natural hazards.

Youths working on farms perform varied tasks, such as feeding animals, gathering eggs, harvesting crops, operating equipment, and driving tractors and other vehicles. Tragedy occurs more often among young workers in this industry than in any other—40 percent of the young workers killed over the 1992–97 period lost their lives in farming jobs. All but 10 of the 162 victims were young men. Also, more than half of the fatalities occurred on farms owned by the victims' families.

More than half of the 162 youth fatalities in agriculture occurred in transportation-related incidents. (See table 3.) More specifically, nearly a third (51) involved tractors. Of the tractor-related fatalities, about half resulted from the tractor rolling over onto the worker, either in the field or on a road-

Table 1. Fatalities among young workers and all workers, by event or exposure, 1992–97

Event or exposure	Young workers (under age 18)		All workers	
	Number	Percent	Average per year	Percent
Total	403	100	6,313	100
Transportation incidents	163	40	2,589	41
Highway incidents	70	17	1,304	21
Nonhighway incidents	47	12	396	6
Worker struck by vehicle	25	6	368	6
Water vehicle	9	2	106	2
Railway	8	2	80	1
Assaults and violent acts	82	20	1,247	20
Homicide	72	18	1,003	16
Suicide	3	1	213	3
Animal attack	7	2	29	1
Contact with objects and equipment	82	20	1,004	16
Struck by	36	9	570	9
Caught in objects or equipment	25	6	295	5
Running machinery	17	4	154	2
Collapsing materials	17	4	121	2
Falls	23	6	657	10
Exposure to harmful substances and environments	44	11	588	9
Electric current	25	6	312	5
Exposure to caustic, noxious, allergenic substances	9	2	122	2
Oxygen deficiency	10	2	102	2
Fires and explosions	8	2	194	3

NOTE: Event or exposure is based on the 1992 BLS Occupational Injury and Illness Classification System. The event describes the manner in which the injury was inflicted or produced. Data may not sum to totals because of rounding and the omission of miscellaneous categories.

SOURCE: Census of Fatal Occupational Injuries.

way. About 1 in 8 occurred when the victim fell from a tractor and then was struck by the attached equipment. Other fatalities resulted from being run over by the tractor while standing in the field, being struck by the bucket of a tractor-mounted loader, or being caught in the tractor's power take-off, as shown in the following tabulation:

<i>Incident</i>	<i>Percent</i>
Total	100
Overturn in field	29
Overturn in roadway	25
Fall from tractor and struck by attached equipment	12
Run over by tractor	8
Struck by tractor bucket	6
Caught in power take-off	6
Other	14

In 38 of the 51 tractor-related deaths, the fatally injured youth was operating the tractor. In 20 of these instances, the youth was under 16 years of age.¹⁰ In 7 fatalities, the victims were younger than 16 years and were driving the tractor on public roadways.¹¹ Youths as young as 10 were reported to have been operating a tractor at the time of the incident.¹¹ In about two-thirds of the tractor-related fatalities involving youths, the victim worked on the family farm. Other equipment involved in young farmworkers' deaths included front-end loaders, combines, and various other harvesters, mowers, grain augers, feed wagons, horse-drawn wagons, and pick-up trucks and other highway vehicles.¹²

Young farmworker deaths also resulted from various natural hazards, such as animal attacks, drowning, lightning, falling trees, and grain engulfments. Young persons fatally injured while working on farms typically were younger than those killed in other types of businesses. Farmworkers accounted for about three-fourths of the 109 youths under the age of 15 who were killed while on the job.

Children historically have been seen as an important source of labor on farms, a view that appears to continue today. For example, several States allow local school districts to close for several weeks during sowing and harvesting season.¹³ Others allow temporary relaxation of limitations on children's work hours during these busy times on the farm. Child labor laws are less stringent in agriculture industries than in other industries, and children are allowed to operate machinery at a younger age in agriculture. Children working on a family farm are totally exempt from coverage under Federal child labor laws, unlike working children in some other types of family businesses.¹⁴

Retail trade and services. These two industries employ about three-fourths of all workers between the ages of 15 and 17. Eating and drinking places, grocery stores, and department stores are the most common retail establishments em-

ploying youths. In the services sector, youths are most likely to work in entertainment and recreation, health services, educational services, or in private households.¹⁵

The following tabulation shows the fatalities occurring in the retail trade industry among youths under the age of 18:

<i>Event or exposure</i>	<i>Number</i>	<i>Percent</i>
Total	87	100
Assaults and violent acts	59	68
Homicides	56	64
Transportation	16	18
Highway crashes	13	15
Struck by object	5	6
Exposure to harmful environment	4	5
Other	3	3

As shown, homicide was the leading cause of death among youths in retail trade, accounting for nearly two-thirds of the youth fatalities in the industry, a proportion similar to that of older workers in retail trade. Of the 56 homicides occurring over the study period, 23 (41 percent) were confirmed robberies, and in another 21 cases, the motive was not evident. Combining the two, robberies probably were the cause of between one-fourth and one-half of all youth fatalities in retail trade. Transportation incidents were the second most common cause of youth fatalities in the retail trade industry, with most occurring on public roadways; about a third of the victims were newspaper carriers.

Three-fourths of the young workers killed in retail trade worked in either a restaurant or a food store, such as a gro-

Table 2. Fatalities among young workers and all workers, by industry, 1992-97

Industry	Young workers (under age 18)		All workers		
	Number	Percent	Average per year	Percent	Rate per 100,000 workers
Total	403	100	6,313	100	5.0
Agriculture, forestry, and fishing	162	40	827	13	23.7
Mining	—	—	167	3	26.2
Construction	53	13	1,015	16	14.3
Manufacturing	21	5	750	12	3.7
Transportation and public utilities	12	3	935	15	13.2
Wholesale trade	14	3	257	4	5.3
Retail trade	87	22	728	12	3.5
Finance, insurance, and real estate	—	—	115	2	1.5
Services	32	8	772	12	2.3
Government	13	3	682	11	3.5
Other or unspecified industries	7	2	66	1	—

NOTE: Dashes indicate that no data were reported or that data do not meet publication standards. Percents may not sum to 100 due to rounding. SOURCE: Census of Fatal Occupational Injuries.

cery or convenience store, or a bakery. Males accounted for 74 percent of retail fatalities, and women, 26 percent, with assaults accounting for the vast majority among both sexes. About 11 percent of the fatality victims worked in family businesses (half in food stores), and 5 percent were self-employed (all of whom were newspaper carriers).¹⁶ More than 8 in 10 were wage and salary workers.

In the services industry, young men also accounted for three-fourths of the fatalities. In 84 percent of the fatalities, the victims were working for pay or other forms of compensation; only 9 percent worked as unpaid workers in family businesses. The remainder were self-employed or volunteer workers. In nearly a fifth of the youth fatalities occurring in services, the victims were under the age of 15. In retail trade, by contrast, while the total number of fatality victims under age 15 was greater, their proportion was smaller (7 percent).

As the following tabulation shows, transportation-related incidents were the leading causes of death among young workers in the services industry. Homicides and exposures to harmful environments, such as electrocutions and drownings, were the next most common events.

<i>Event or exposure</i>	<i>Number</i>	<i>Percent</i>
Total	32	100
Transportation	13	41
Homicide	8	25
Exposure to harmful environment	6	19
Other	5	16

Construction. The construction industry reports more job-related fatalities each year than any other industry. During the 1992–97 study period, on average, about 1,000 workers were killed each year in the industry (all age groups). The fatal-injury rate facing its 7.5 million workers is 3 times greater than the rate for the average worker in all industries. The fatality rate for workers in construction was 14.3 per 100,000 over the study period, compared with a rate of 5.0 per 100,000 for all workers. (See table 2.)

From 1992 to 1997, 53 youths under the age of 18 were killed in the construction industry, accounting for about 13 percent of all fatalities in this age group over the period. By contrast, 16 percent of all workers killed on the job during the period worked in the construction industry. The majority of the youths killed worked as construction laborers, particularly for special trade contractors engaged in such activities as roofing and concrete work. Examples of tasks they performed included digging foundations and ditches, moving and stacking lumber, and erecting or dismantling scaffolding. As can be seen in the following tabulation, their fatalities were dispersed by event and exposure, mainly due to the multitude of tasks performed.

Table 3. Fatalities among young workers (under age 18) in agriculture, 1992–97

<i>Event</i>	<i>Number</i>	<i>Percent</i>
Total	162	100
Transportation	87	54
Off highway	40	25
Overturning and falls	35	22
Highway	27	16
Overturning	20	12
Worker struck by vehicle	10	6
Struck by object	15	9
Caught in running equipment	14	9
Grain engulfments	7	4
Animal assaults	7	4
Falls	5	3
Drowning, oxygen deficiency	5	3
Struck by lightning	4	2
Other	18	11

NOTE: The event is based on the 1992 BLS Occupational Injury and Illness Classification System. The event describes the manner in which the injury was inflicted or produced. Data may not sum to totals because of rounding and the omission of miscellaneous categories.

SOURCE: Census of Fatal Occupational Injuries.

<i>Event or exposure</i>	<i>Youths</i>		<i>All workers</i>	
	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>
Total	53	100	6,087	100
Falls	12	23	1,921	32
Electrocution	11	21	830	14
Struck by object	9	17	579	10
Highway incident	6	11	715	11
Excavation and trenching	5	9	201	3
Struck by vehicle	4	8	456	8
Other	6	11	1,335	22

Falls and electrocutions were the leading causes of death for young construction workers—as well as for all construction workers. In three-fourths of the fatal falls, the youths fell from or through roofs and skylights. In contrast, these kinds of falls accounted for only about a third of the fatal falls among all construction workers. (Adult construction workers were more likely to fall from scaffolds, building girders, and ladders.) Half of the electrocutions among young construction workers resulted from contact with overhead power lines, about the same proportion as among all construction workers.

Two-thirds of the 53 killed were 17 years old, and 7 were under the age of 16. Fifteen of those killed worked for themselves or for family businesses, and about half of the fatalities occurred during June, July, and August.

Other industries. Manufacturing accounted for 5 percent of the youth fatalities. Of the 21 killed in the industry over the period, a third were newspaper carriers involved in a vehicle-

related incident or homicide.¹⁷ One-fourth worked in logging and sawmills, where they were struck by falling trees or by vehicles. Transportation and public utilities, wholesale trade, and government each accounted for 3 percent of fatal work injuries among youths; a little more than half of the deaths in these industries resulted from vehicle-related incidents.

Nonfatal injuries, 1996

About 15,000 youths under the age of 18 incurred injuries and illnesses in 1996 that resulted in lost workdays. Due to data limitations, these figures are for private nonagricultural wage and salary workers only.¹⁸ As can be seen from the following tabulation, sprains and strains accounted for about a third of these injuries and illnesses, most commonly resulting from overexertion while maneuvering heavy or bulky objects, such as cartons of inventory or patients in a health-care facility. These kinds of injuries sometimes also result from attempts to break falls on slippery or uneven surfaces.

<i>Nature of injury or illness</i>	<i>Percent</i>
Total	100
Sprains and strains	33
Bruises, contusions	14
Cuts, lacerations	13
Heat burns	9
Fractures	8
Fractures and other injuries	4
Other	19

As with their adult counterparts, nonfatal injuries occurring to youths were less likely than fatal injuries to have resulted from transportation-related incidents. (See table 4.) Similarly, assaults, the leading cause of fatal injuries among youths, accounted for only 1 percent of the total number of nonfatal injuries. Being struck by objects such as knives or other sharp tools, swinging doors, and falling boxes; overexertion in lifting, carrying, or pushing objects; and falls on walking surfaces each accounted for about one-fifth of the nonfatal injuries among youths.

Table 4. Nonfatal injuries and illnesses among young workers and all workers, by event and exposure, 1996

Event or exposure	Young workers (under age 18)			All workers		
	Number of cases	Percent	Median days away from work	Number of cases	Percent	Median days away from work
Total	15,156	100	4	1,880,525	100	5
Contact with objects and equipment	5,136	34	4	492,939	26	4
Struck against object	1,591	10	3	127,481	7	4
Struck by object	2,773	18	4	238,934	13	4
Caught in or compressed by objects or equipment	660	4	3	79,473	4	7
Rubbed or abraded by friction	85	1	1	30,087	2	1
Falls	3,510	23	4	330,913	18	7
Falls to lower level	630	4	11	98,544	5	10
Falls on same level	2,847	19	3	219,416	12	7
Bodily reaction or exertion	3,889	26	3	823,708	44	7
Bodily reaction	980	6	3	196,880	10	6
Overexertion	2,821	19	3	526,594	28	6
Repetitive motion	79	1	5	73,796	4	17
Exposure to harmful substances or environments	2,022	13	3	87,164	5	3
Contact with electric current	70	1	3	4,126	—	7
Contact with temperature extremes	1,346	9	3	29,249	2	3
Exposure to caustic, noxious, or allergenic substances	577	4	2	45,284	2	2
Transportation incidents	324	2	8	77,617	4	9
Highway incidents	58	—	6	50,466	3	9
Nonhighway incidents	79	1	4	10,558	1	7
Worker struck by vehicle	183	1	10	12,031	1	13
Fires and explosions	19	—	3	4,146	—	8
Assaults and violent acts	189	1	2	24,241	1	4
Assaults by persons	112	1	2	18,538	1	5
Animal assaults	78	1	1	5,580	—	4
Other and nonclassifiable	68	—	4	39,796	2	7

NOTE: Event or exposure is based on the 1992 BLS Occupational Injury and Illness Classification System. The event describes the manner in which the injury was inflicted or produced. Dashes indicate less than 0.5. Data may not sum to totals because of rounding and the omission of miscellaneous categories.

SOURCE: Survey of Occupational Injuries and Illnesses.

When compared with injuries incurred by adult workers, young workers' injuries were more likely to result from various contacts with objects and equipment, falls, and contacts with hot objects or substances. Injuries to adult workers, by contrast, were more likely to result from overexertion, bodily reaction, and repetitive motion. Falling from elevations and being struck by vehicles typically resulted in lengthy recuperation times for both adult and young workers.

The median number of days it took to recuperate from all types of injuries and illnesses occurring on the job was 4 for youths and 5 for all workers. This, however, should not be construed to mean that injuries to youths are less severe than those to adults. Because youths work primarily part time, the recuperation time for youths conceivably includes nonscheduled work time and thus would not be included in counts of days away from work.

By industry. About four-fifths of the nonfatal injuries and illnesses among workers under the age of 18 occurred in establishments engaged in retail trade or services—a ratio similar to the proportion of these young workers employed in the two industries. (See table 5.)

Retail trade. The retail trade industry accounted for about three-fifths of the serious nonfatal injuries and illnesses occurring among the youth workforce. The following tabulation shows the distribution of these incidents among individual retail industries:

	<i>Percent</i>
Restaurants	52
Grocery stores	24
Department stores	11
Other	13

About half the injuries in retail trade occurred in the restaurant industry, a major employer of young workers. Common hazards include slippery floors, hot grills, sharp knives, and splattered grease and other hot liquids.¹⁹ As a result, youths most often suffered cuts, burns, sprains and strains, and bruises. When compared with their adult counterparts, teenage cooks and kitchen helpers were more likely to suffer heat burns and less likely to suffer sprains and strains.²⁰

Grocery stores accounted for about a fourth of nonfatal injuries among youths working in retail trade. Sprains and strains are common, typically resulting from workers lifting or moving inventory, lifting customer bags, or pushing strings of shopping carts from parking lots. Lacerations resulting from opening cartons with sharp cutting tools were another common injury among youths employed in the industry.²¹

Table 5. Nonfatal injuries and illnesses with days away from work among private sector wage and salary workers, by industry, 1996

Industry	Young workers (under age 18)		All workers	
	Number	Percent	Number	Percent
Total ¹	15,156	100	1,880,525	100
Agriculture, forestry, and fishing ¹	380	3	38,256	2
Mining	—	—	15,091	1
Construction	447	3	182,334	10
Manufacturing	878	6	462,239	25
Transportation and public utilities	448	3	224,030	12
Wholesale trade	403	3	144,698	8
Retail trade	9,316	62	322,046	17
Finance, insurance, and real estate	94	1	42,784	2
Services	3,186	21	449,047	24

¹ Workers on farms with fewer than 11 employees are excluded.

NOTE: Data may not sum to totals because of rounding and the omission of nonpublishable estimates. Dashes indicate nonpublishable data or percent less than 0.5.

SOURCE: Survey of Occupational Injuries and Illnesses.

Services. About a fifth of the lost-workday injuries among youths occurred in the services industry. The following tabulation shows the distribution of injuries and illnesses among the service industries:

	<i>Percent</i>
Health services	27
Amusement and recreation services	24
Business services	15
Social services	10
Other	24

About a fourth of the serious nonfatal injuries occurred in health services, where injuries typically involve sprains and strains incurred while lifting or otherwise assisting patients in hospitals and nursing homes.²² Another fourth occurred in amusement and recreation services—in this case usually resulting from falls, being struck by falling or flying objects, or lifting heavy objects.

ENCOURAGING THE NATION'S YOUTHS TO WORK has been and continues to be a highly regarded method for teaching young persons responsibility and other values. Through work they often learn the value of saving for costly items such as automobiles or college tuition. Work experience is widely extolled as a virtue in itself. Despite the relatively low frequency, however, youth fatalities and other serious injuries tend to have a greater emotional impact on society, and concerns for their safety will continue to be an important consideration. □

Notes

¹ Data on fatal work injuries are from the Bureau of Labor Statistics' Census of Fatal Occupational Injuries (CFOI). CFOI data cover all fatal work injuries. This program, which has collected occupational fatality data nationwide since 1992, uses diverse data sources to identify, verify, and profile fatal work injuries. Information about each workplace fatality (industry and other worker characteristics, equipment involved, and circumstances of the event) is obtained by cross-referencing source documents such as death certificates, workers' compensation records, and reports to Federal and State agencies. This method assures counts are as complete and accurate as possible.

² The information in this section was drawn primarily from the following two sources: Laura Greene, *Child Labor: Then and Now* (New York, Franklin Watts, 1992) and Richard Wormser, *American Childhoods: 3 Centuries of Youth at Risk* (New York, Walker and Co., 1996).

³ Wormser, *American Childhoods*, p. 57.

⁴ Greene, *Child Labor*, p. 19.

⁵ See the report of the National Research Council, *Protecting Youth at Work* (Washington, DC, National Academy Press, 1998).

⁶ Fatality rates are used to compare the risk of incurring a fatal work injury among worker groups with varying employment or exposure levels. There is more than one method to calculate a fatality rate. An hours-based rate measures the risk of fatality per standardized length of exposure; an employment-based rate measures the risk for those employed during a given period of time, regardless of exposure hours. Hours-based measurements are especially useful for comparing worker groups with varying exposure hours, such as when a large proportion of workers in an industry work part-time.

Fatal work injury rates included in this article were calculated using annual average employment and hours worked that were collected in the Current Population Survey (CPS). There rates are considered experimental measures. They provide the number of fatal work injuries per 100,000 workers for 1992–97. Employment-based rates were calculated as follows:

$$[(N_{92} + N_{93} + N_{94} + N_{95} + N_{96} + N_{97}) / (W_{92} + W_{93} + W_{94} + W_{95} + W_{96} + W_{97})] \times 100,000$$

where,

N = number of civilian worker fatalities, age 15 and older, 1992–97, and
W = annual average number of employed civilians, age 15 and older, 1992–97.

For calculating rates using hours worked, the total hours worked was converted to full-time equivalent workers using a 2,000 hours work year. Thus the rate of fatalities per 100,000 full-time equivalent workers = (fatalities/hours) \times 200,000,000.

Because the Census of Fatal Occupational Injuries program does not collect employment or hours of exposure data, annual average estimates from the CPS for 1992–97 are used in the denominator. The CPS employment and hours data used to calculate rates are estimates based upon a sample of persons employed rather than a complete count. Therefore, the CPS estimates and fatality rates have sampling errors; that is, they may differ from figures that would have been obtained if it had been possible to take a complete census of employed persons. See "Explanatory Notes and Estimates of Error" in the January 1997 *Employment and Earnings* for an explanation of CPS sampling and estimation methodology, and standard error computations. The relative standard errors of the CPS estimates can be used to approximate confidence ranges for the fatality rates.

⁷ See John W. Ruser, "Denominator Choice in the Calculation of Workplace Fatality Rates," in *Fatal Workplace Injuries in 1996: A Collection of Data and Analysis*, Report 922 (Bureau of Labor Statistics, June 1998).

⁸ The relative standard errors of the CPS estimates can be used to approximate confidence ranges for the fatality rates. For example, the confidence factor for hours-based fatality rates for 15-year-olds

from 1992 to 1997 can be estimated as follows: $5.1 \times 0.022 \times 1.6 = 0.2$, where 5.1 = the rate per 100,000 full-time equivalent workers, 0.022 = the relative standard error, and 1.6 = the factor for a 90-percent confidence level. The confidence range for this rate is 4.9 to 5.3 (5.1 plus or minus 0.2). The confidence ranges were estimated for the remaining age groups for the 1992–97 period—both for employment- and hours-based fatality rates. All of these ranges were the rate plus or minus 0.1.

⁹ Most States require drivers to be at least 16 years old for a general license and 18 for a commercial license. In addition, the Fair Labor Standards Act currently prohibits youths from driving at work except on an occasional basis. See "Facts, State Laws 1998" published by the Insurance Institute for Highway Safety; and the National Research Council's report, *Protecting Youth at Work*, p. 171, for additional information on driving regulations pertaining to youths.

¹⁰ Youths under 16 years of age are prohibited from operating tractors larger than 20 horsepower unless working on a farm owned or operated by the youth's parents. See National Research Council, *Protecting Youth at Work*.

¹¹ As of September, 1998, all but six States had a minimum age of 16 to drive without an adult in the vehicle. See "Facts, State Laws 1998" published by the Insurance Institute for Highway Safety. Some States do allow farm tractors to be driven limited distances on public roadways without a drivers license.

¹² See National Research Council, *Protecting Youth at Work*, for various discussions of the appropriateness of youths operating machinery. The report cites an unpublished study conducted by the Consumer Product Safety Commission that found that operators of ride-on mowers that were young, short, or light-weight were more likely than others to be injured.

¹³ See, for example, "Signs of Safety in Agriculture: A Report on National Agricultural Safety Programs," (U. S. Department of Agriculture), p. 5.

¹⁴ National Research Council, *Protecting Youth at Work*, p. 157.

¹⁵ *Ibid.*, p. 46.

¹⁶ News carriers are sometimes considered independent contractors. See National Research Council, *Protecting Youth at Work*, p. 18.

¹⁷ Newspaper carriers are mentioned both here and in the section on retail trade because they are typically employed either in newspaper printing and publishing, and industry in the manufacturing division, or in direct selling establishments in the retail trade industry. See the *Standard Industrial Classification (SIC) Manual*, 1987. There were a total of 11 fatalities among news carriers under age 18 during the study period.

¹⁸ Data on nonfatal injuries are from the BLS Survey of Occupational Injuries and Illnesses. This survey collects information from a random sample of about 200,000 establishments representing most private industry wage and salary workers. Private household workers and workers on small farms are excluded from survey coverage. Worker and case characteristics are collected only for those workers sustaining injuries and illnesses that require days away from work to recuperate. Because the scope and methodology of the Census of Fatal Occupational Injuries and the Survey of Occupational Injuries and Illnesses are slightly different, comparisons of fatal and nonfatal data are problematic. Additional information can be obtained via e-mail (cfoistaff@bls.gov or oshstaff@bls.gov) or from the following Internet address: <http://stats.bls.gov/oshhome.htm>

¹⁹ National Research Council, *Protecting Youth at Work*, p. 73.

²⁰ See Martin E. Personick, "Profiles in safety and health: eating and drinking places," *Monthly Labor Review*, June 1991, pp. 19–26.

²¹ National Research Council, *Protecting Youth at Work*, p. 73.

²² *Ibid.*