



Occupational Injuries Among Adolescents in Washington State, 1988-1991:

A Review of Workers' Compensation Data

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Appendix A. Technical Notes: Missing Birthdates on State Fund Claims

Appendix B. Amputation Injuries Among Minors, Accepted State Fund Claims: 1988-1991

Acronym List

BLS.....	Bureau of Labor Statistics
CPS.....	Current Population Survey
DNR.....	Washington State Department of Natural Resources
ESAC.....	Employment Standards and Crime Victims Compensation
FLSA.....	Fair Labor Standards Act
FTE.....	Full-Time Equivalent
IRA.....	Industrial Relations Agent
L&I.....	Washington State Department of Labor and Industries
NEISS.....	National Electronic Injury Surveillance System
NIOSH.....	National Institute for Occupational Safety and Health
NTOF.....	National Traumatic Occupational Fatalities surveillance system
OSHA.....	Occupational Safety and Health Administration
PEL.....	Permissible Exposure Limit
PSA.....	Parent/School Authorization form
SIC.....	Standard Industrial Classifications code
WISHA.....	Washington Industrial Safety and Health Act

Executive Summary

Overview

The Safety and Health Assessment and Research for Prevention (SHARP) program at the Washington State Department of Labor and Industries reviewed workers' compensation claims and analyzed the reported injuries to minors 11- to 17 years of age in Washington State from 1988 to 1991. While there are limitations in the workers' compensation data, they provide an estimate of workplace injuries in children. The study was a result of the an identified need for more information regarding injuries, illnesses, and health and safety issues among minor workers. This report also includes a review of the scientific literature regarding adolescent workplace injuries, issues and trends found elsewhere in the United States, and background on child labor issues and regulations in Washington State.

Methods

Accepted claims in the State Fund program during the 4-year study period were analyzed; claims from Self-Insured employers were utilized for some limited comparisons. To calculate injury rates for adults and minors, claims were compared to Washington information from the 1990 U.S. Census. There are limitations in the comparability of data in the compensation system and the Census. A major issue is that the census data does not distinguish between part-time and full-time employment. To address this, information from other sources including the Current Population Survey and the U.S. Government Accounting Office, was also analyzed..

Results

From January 1988 through December 1991, there were 17,800 accepted claims for work-related injuries or illnesses to minors reported to the workers' compensation system in Washington State. The majority of these claims were for injuries. The crude injury rate for 16- and 17-year old workers was similar to that seen among adult workers: 9.0 vs.10.4 per 100 workers, respectively. This comparison gives a relatively low impression of injuries in 16- and 17-year old workers, since most adolescents work part-time and for only part of the year, yet have a per-year injury rate nearly as high as adult workers. Injury rates need to be adjusted to account for injuries per hour worked. Since working adults average approximately four times as many working hours per year as 16- and 17-year olds, the injury rate for adolescents actually appears to be more than three times greater than for adults for each hour worked.

There were three occupational fatalities among minors reported during the study period.

Eighty-six percent of accepted claims received medical benefits alone and 14% received time loss compensation. Most injuries (88%) occurred among the 16- and 17-year olds; 12% occurred among 11- to 15-year olds. Males had an injury rate almost twice as high as that seen among females (11.7 vs. 6.4 per 100 workers, respectively).

Most minors are employed in retail trade, primarily restaurants, and in service industries. Food stores and other retail sales also employ large numbers of minors. The highest frequency (total number) of claims occurred in restaurants, food stores, services, sales and agriculture. The highest injury rates (number of injuries per 100 minor workers) were found in public administration, construction, agriculture and restaurants.

Occupations in which most injured minors were working were service jobs (food and farm) and transportation/material moving jobs (laborers and packers). Most of the injuries were lacerations, followed by sprains and strains, contusions, and burns. The upper extremities were the body parts most commonly affected, followed by the lower extremities, and back and neck. The events most often producing an injury included being struck by an object, falls, overexertion, and contact with temperature extremes, mainly hot temperatures. Lacerations most often involved the use of knives.

Although any injury category has the potential for severe disability, certain injuries that occurred are of particular concern. Amputation (22 cases), dislocation (66 cases), fracture (464 cases), concussion (102 cases), and multiple injury (202 cases) accounted for 855 of all injuries among minors (5.7%). The occurrence of these specific injuries indicates that minors are working in environments that place them at risk for long-term consequences.

Conclusions

Like adults, nearly one in ten minor workers had an on-the-job injury each year. This translates to a significantly higher injury rate for minors than for adults, per hour worked. Many of these injuries have serious consequences, including lost time from school. The patterns of injuries found in Washington State are similar to those found in other studies. The failure to prevent work-related injuries and provide adequate protection to children in the workplace can be considered a serious public health problem. This issue is of particular concern since the principal responsibility of most adolescents is education. Young workers deserve to expect a safe work environment as adults do. However, child workers are an especially vulnerable population with special needs, and they require and deserve special protection.

Recommendations

- Use the available data systems to target areas in need of special attention. Develop health and safety programs which focus on prevention activities in targeted areas, and monitor data to identify possible trends. Identify possibilities for improving data sources in order to improve occupational injury surveillance of young workers.
- Promote increased coordination of the various compliance and consultation activities which address the health and safety issues of minor workers.
- Develop an educational outreach strategy to teens, parents, schools, employers, and health care professionals to increase awareness of this problem and to promote the need for the development of preventive strategies. Examples include providing comprehensive health and safety training in high schools in general, and specifically in the implementation of the School-to-Work Act.

Introduction

This report is the result of an evaluation of the workers' compensation claims data to identify the scope of the problem of work-related injuries among adolescent workers in Washington State. The purpose of this evaluation was to determine rates and patterns of work-related injuries for minors, which could eventually lead to prevention strategies. This study was motivated by the need for more information which was identified by the Department of Labor and Industries' Child Labor Advisory Committee convened in 1990. The committee was charged with developing recommendations for updating the non-agricultural child labor rules in Washington State and is described later in this report (see Background on Child Labor in Washington State section). In the early meetings of the process, committee members recognized that it was imperative to have more data about children in the workplace in order to assess the extent of the problems children face and to provide pertinent recommendations for change. Some of the information that was sought included the duties performed at the time of injury; hour and season of injury; types and numbers of injuries; and racial patterns which may be present. Not all of these issues are addressed in this report due to certain limitations in the workers' compensation data. This report also includes a review of the literature regarding adolescent workplace injuries and identifies other issues and trends found elsewhere in the United States. Background on child labor issues and regulations in Washington State is also described.

Background

There are many benefits of work for teenagers. In addition to providing increased income for the individual child or his/her family, participation in employment activities may also contribute to social and personal development. Through work, children may develop an increased sense of responsibility, discipline, and teamwork. Mastering new skills and the accomplishment of specific tasks often bring an increase in self-esteem and a greater sense of personal worth.

However, there are also numerous hazards associated with work. The risk of injury, illness, or toxic exposure is an inherent part of many workplace settings. Non-fatal injuries result in immediate medical costs as well as costs associated with recuperation and disability. In addition, there may be emotional sequelae for individuals who sustain a traumatic injury. Recent studies indicate that adolescents are a high-risk group for occupational injury. This increased risk is due to the differences between adults and adolescents in development, size, maturity, experience, and judgment. Risk-taking behavior is a typical characteristic of adolescence as they explore their capabilities but often lack perception of their limitations and vulnerability. In a workplace setting, teens may not feel capable of refusing to do a task that is inappropriate or dangerous, especially if a desire exists to be treated more like an adult than a child. They may also believe that they would not be asked to do something if it is considered dangerous.

Recently, the issue of work hours for minors has drawn much attention and created controversy in the revision of regulations for teen workers. While there is a general concern about the impact work hours may have on school performance, disability due to injuries, which also interferes with school attendance and possibly performance, must be taken into consideration as well. In addition to the potential direct work-related hazards, there is evidence that some level of employment may interfere with other age-appropriate activities, contribute to increased stress levels, and possibly add to the risk of engaging in activities related to drugs, alcohol, skipping classes and the like (Greenberger and Steinberg, 1986).

Until recently, problems associated with child labor were thought to be a thing of the past (Postol, 1989; 1993). Although attention to this issue almost disappeared, working children and adolescents did not. A number of factors have contributed to an increased awareness of the problems faced by minors in the workplace. While the 1980s saw a reduction in state and federal enforcement capabilities, in recent years there have been several "strike force" operations by the Department of Labor which have identified numerous violations of child labor regulations. Research studies have identified the numbers and severity (including fatal outcomes) of work place injuries in this population. There has also been a re-emergence of illegal sweatshops in large cities such as New York and Los Angeles, often involving immigrant children (Butterfield, 1990a).

The health and safety problems of child workers typically fall outside the arena of pediatric public health efforts, particularly injury control. At the same time adolescent workers fall outside the usual scope of modern occupational health and safety efforts, which generally focus on adult workers. In fact, within the U.S. Department of Labor, the specific health and safety regulations for minors in the workplace do not fall under the Occupational Safety and Health Administration (OSHA), but under the Wage and Hour Division of Employment Standards. This is in part due to the historical development of certain regulatory functions within various federal agencies. As a result of a variety of factors, the needs of working children have not been addressed by efforts to improve health and safety in the workplace, such as research, education, training, and appropriate engineering controls and protective equipment.

Children and young workers have specific needs and limitations and require special protection. This was affirmed in the Declaration of the Rights of the Child issued by the General Assembly of the United Nations in 1959, which state that children have a right to enjoy special protections and opportunities which enable a healthy and normal development. In conjunction with this, a statement on the issue of employment was made:

"The child shall not be admitted to employment before an appropriate minimum age; he shall in no case be caused or permitted to engage in any occupation of employment which would prejudice his health or education, or interfere with his physical, mental or normal development" (WHO, 1987).

Review of the Research Literature

Overview

Nationally, the need to focus attention on child labor and the laws regulating youth in the workplace has become increasingly evident in recent years, primarily as a result of research findings and targeted enforcement efforts. Several studies have identified an increasing trend in the numbers of children in the workplace, the number of violations of child labor laws, and the number and character of injuries experienced by children in the workplace (GAO, 1990; GAO, 1991; Schober et al., 1988; Richter and Jacobs, 1991).

Some of this increase is likely due to increased recognition and detection. However, increases in child employment, injuries, and violations maybe due to factors such as social pressure and acceptance of children to work, adult unemployment and lower wages, increased poverty among American children, relaxation in enforcement, and increased immigration due to unstable world conditions (Pollack and Landrigan, 1990). The failure to prevent work-related injuries and provide adequate protection to children in the workplace can be considered a serious public health problem.

Numbers of children working

Estimates of the numbers of children employed in the United States vary. Using data from a variety of sources, the National Safe Workplace Institute (1992) determined that there are approximately 5.5 million working children in the U.S. between the ages of 12 to 17 years. Approximately 676,000 more work in undocumented employment in a variety of settings. In agriculture, hundreds of thousands of children work on family farms and as migrant and seasonal farm workers. There are an estimated 1 million to 1.5 million farm worker children in the United States (Butterfield, 1990b).

Although the Bureau of Labor Statistics (BLS) has no official figure for the number of workers under the age of 16, it is estimated that 4 million children younger than 16 years of age were employed during 1988 (Nilsen, 1984). A 1991 report by the Government Accounting Office (GAO, 1991) found that in 1988, 28% of 15-year olds worked and averaged 17 hours per week for 19 week a year. Over 51% of 16- and 17-year olds worked and averaged 21 hours a week for 23 weeks a year. Low-income and minority children were less likely to be employed, and when employed worked more hours but fewer weeks than high-income children. Low-income children were also more likely to work in more hazardous jobs than high-income youth. In a survey of 3,051 high school students in both rural and urban areas in Minnesota, Parker (1994a) found that 58% of 10th graders, 80% of 11th graders, and 86% of 12th graders were employed. Overall, 60% of public high school students indicated that they held a regular job at some time during the one-year study period. The average number of hours worked per week during the school year was 16 and during the summer was 30. The Washington State Survey of Adolescent Health Behaviors (NWREL, 1993) found that 28% of 8th-grade students,

33% of 10th-grade students, and 64% of 12th-grade students indicated that they held a part-time job during the school year.

Violations

In 1990 during a 2-week "strike force" known as Operation Child Watch, the Department of Labor detected over 42,000 child labor violations nationwide. Between 1983 and 1990 the detected child labor violations increased almost 5-fold (GAO, 1991). These included violations of hazardous and prohibited duties, allowable hours, and minimum age regulations. Industries such as restaurants, grocery stores, service, manufacturing, and construction were found to have the highest numbers of violations. In Washington State, grocery stores accounted for over 90% of illegal employment in 1989 (GAO, 1990). During fiscal years 1983 through 1989 in Washington State 74% of detected violations were violations of hazardous or prohibited duties and 23% were violations of allowable hours (GAO, 1990).

It was also found during this same time period, 1983 to 1990, that there was a 100% increase in injuries sustained during illegal employment activities in non-agricultural industries (GAO, 1991). Most violations involving serious injuries of working children were associated with violations of hazardous and prohibited duties. The highest percentages of serious injuries associated with violations were found in manufacturing and construction. The GAO (1990) also reviewed 29 fatality cases investigated by OSHA in 1987 and 1988. It was determined by the Department of Labor that 11 deaths were probably due to at least one violation of the hazardous duties orders of the child labor regulations or other health and safety standards. However, it would appear that the remaining 18 minors who were killed on the job may have been performing allowable job duties.

Also in 1990, the Employment Standards program of the Department of Labor and Industries (L&I) investigated approximately 10% (n = 395) of the 4,000 workers' compensation claims filed to the state industrial insurance fund by minors that year (ESAC, 1990). Forty-four percent of employers were found to be in violation of child labor laws including work hours, appropriate permits and prohibited duties. Among the 63 cases with severe injuries, 13% of minors were found to be performing prohibited duties. However, this means that in 87% of the severe injuries investigated by L&I, minors were performing allowable duties. In this evaluation a severe injury was defined as an amputation, asphyxiation, concussion, fracture, or multiple injury; if the body part injured included the head, brain, skull, or multiple body parts; where medical aid paid was over \$1,000; or when time-loss compensation paid was over \$1,000. In a study by Suruda and Halperin (1991), 41% of work-related deaths to minors involved performance of prohibited duties.

Injury and illness data

It has been well established that injuries pose a great risk to youth. Injury is the major cause of death among children of all ages. In 1989 over 9,000 youths ages 10-19 years died from injuries (National Safety Council, 1993), representing nearly half (49%) of all deaths among this age group. Rarely is occupational causation specifically considered in the epidemiological literature of childhood injury or in discussions concerning injury prevention. Only recently have child workers been the focus of investigations of occupational injury and illness. Several descriptive studies have been done which have characterized these injuries, and have attempted to identify injury rates based upon available information and adjusting for part-time employment (Banco et al., 1992; Parker et al., 1991; Belville et al., 1993).

Runyan and Gerken (1989) reviewed the available injury data in order to summarize the various injury risk factors for adolescents - occupational and non-occupational - and found the data sources seriously lacking. Occupational data sources utilized in various studies to identify the number of minors working and the numbers injured on the job have included surveys of student workers, BLS survey data, Census data, workers' compensation data, National Electronic Injury Surveillance System (NEISS) which utilizes visits to hospital emergency rooms, the National Institute for Occupational Safety and Health (NIOSH), and the Occupational Safety and Health Administration (OSHA). However, each differs in the types of data collected and analyzed and each has its limitations, making it difficult to accurately determine numbers of children working and numbers injured or killed on the job. The lack of comprehensive data interferes with the ability to adequately define the scope of the problem, monitor trends and target intervention strategies.

Workers' compensation data

There are several limitations in the available workers' compensation data. For instance, workers' compensation claims data vary from state to state due to differing reporting requirements. Over half the states use differing amounts of lost work time as the criterion for reporting injuries and collecting data, which severely underestimates the number of injuries that occur and makes comparison of data difficult (GAO, 1990). Also, children's schedules vary greatly from adults, therefore accrual of lost work time may not occur in the same manner. This may be another factor contributing to the underreporting of the number of injuries among children. Some states, on the other hand, require reporting of all injuries that receive medical attention and therefore have more information on workplace injuries. Finally, not all workers are covered by state workers' compensation systems and not all injuries are reported.

A descriptive study of adolescent work injuries by Parker (1991) used the Minnesota Department of Labor and Industry workers' compensation files during the two-year period, 1986-1987. An injury is reportable if it results in three or more lost work days. There were 1,607 injuries for adolescents from age 12 through 17 years. Most injuries occurred in wholesale and retail trade (61.2%) and services (24.1%). Injuries most

commonly reported were sprains (27.1%), lacerations (26.5%), heat burns (11.4%), and contusions (8.8%). The average annual injury rates were estimated at 14.0 per 1,000 FTE compared with 24.5 per 1,000 FTE for adults. Adolescent injury rates were estimated using employment information from the Minnesota Adolescent Health Survey and the 1987 Minnesota teen-age population data.

Banco (1992) reviewed nearly 800 worker compensation reports in Connecticut for adolescents between 14 and 17 years of age during a one-year period, and calculated an age-specific injury rate of 15 per 1000 employed 16- and 17-year olds. The 1980 Connecticut Census data was used to obtain the number of 16- and 17-year olds employed by industry and occupation. In this study it was found that the number of injuries increased with increasing age, with boys having 1.5 times as many work-related injuries as girls.

In another retrospective, population-based analysis, Belville (1993) reviewed the worker compensation award data in New York State for 14- to 17-year-olds from 1980 through 1987. In this study 43.5% of compensated adolescents suffered permanent disability; and 31 working adolescents died on the job. Data from the Current Population Survey (CPS) was utilized for the denominator data to calculate injury rates. The overall annual injury rate was 28.2 per 10,000 adolescent workers. Males had an injury rate almost three times greater than females. The highest rates by industry were seen in manufacturing (46.2/10,000) and agriculture (52.3/10,000). Minors in New York State are entitled to workers' compensation if the occupational injury resulted in at least 8 days of disability.

Schober (1988) examined another surveillance system using workers' compensation records to characterize injuries among minor workers. They evaluated worker compensation claims data from 24 states reported to the Supplementary Data System (SDS) of BLS for 1980-1983 for persons under 18 years of age. The source of information was the first report of injury. As mentioned earlier, differences in reporting requirements vary from state to state, and not all workers are covered under the compensation system utilized by SDS thereby contributing to an underestimate of injury rates. Injury rates were calculated for the 9 states which do not require a minimum number of disability days for reporting injuries. For all industries the injury rates for 16- and 17-year olds were 12.6 per 100 full-time equivalent (FTE) for male workers, and 6.6 per 100 FTE for females. Rates of injury for this age group were 11.5 per 100 FTE in retail trade and 9.4 in the service industry.

Emergency room data

Coleman and Sanderson (1983) analyzed the data from the NEISS which collects injury data from participating hospital emergency rooms. The relationship between the injury and work was ascertained from the patient. They found that for 16- and 17- year olds, the occupational injury rate for males was 8.2 per 100 full-time employees (FTE) and for females it was 3.0 per 100 FTE. Denominator data to calculate injury rates was obtained from BLS. Males had 2.5 times more injuries than females. Data from the National

Health Interview Survey indicate that work-related injuries treated in emergency rooms represent approximately 36% of all job-related injuries (Ries 1978, as cited by Coleman, 1983). Brooks (1993) found that work-related injuries were a significant contributor to the overall incidence of injury among 14 to 17-year olds. In their study of hospital emergency department data in Massachusetts, occupational injuries to adolescents accounted for 7-13% of emergency room visits.

Layne and colleagues (1994) used the NEISS to evaluate work-related non-fatal injuries among 14- to 17-year olds during the last 6 months of 1992 that required hospital emergency room treatment. These data represents a national sample of 91 hospital emergency departments in the United States. They estimated that 64,100 adolescents were treated in emergency departments during 1992, with an overall work-related injury rate of 5.8 per 100 FTE. Males represented 65.8% of injuries with a rate of 7.0 per 100 FTE, while females had a rate of 4.4 per 100 FTE. The CPS which is obtained from the Bureau of Census was used to obtain the denominator figures.

In the same study, industries with the highest injury rates (per 100 FTEs) among minors included retail trade (6.3), manufacturing (5.1) and construction (4.8). Rates among other industries were comparable and ranged from 4.1 to 4.5 per 100 FTEs. In agriculture males represented a higher proportion of injuries compared to all industries (87.7% vs. 64.2%, respectively). Also, 40% of injuries in agriculture occurred among 14- and 15-year old males compared to all other industries (12.4%) for this youngest age group studied. The most common injuries were lacerations (34.5%), contusions or abrasions (18.2%), sprains or strains (16.2%), burns (12.4%), and fractures or dislocations (4.2%). The authors emphasize that the actual injury rates are likely much higher since only injuries treated in emergency departments were included in their study. Another study by Fingar (1992), which evaluated occupational injuries among all ages of workers, found that emergency department data identified twice as many work-related injuries as did workers' compensation records.

Adolescent survey data

Most studies which have evaluated the occurrence of work-related injury and illness among adolescent workers have done so by analyzing data collected through various administrative systems already described. The study by Parker (1994b) was a cross-sectional survey of 3,051 10th through 12th graders from 39 high schools throughout Minnesota. Information was gathered about work and work injuries. An injury was defined as an event which caused loss of consciousness, seeking medical care, and/or restricting normal activities for at least one day. The rate of reportable injuries was 12 per 100,000 hours worked for rural females and 13 per 100,000 worked for urban females; and 16 per 100,000 hours for urban males and 20 per 100,000 hours for rural males. Ongoing medical problems were reported by 26% of the injured workers.

Lundberg (1993) surveyed 430 9th through 12th graders at a Seattle high school. Students were questioned about their perceptions of the impact of employment on issues

related to academic achievement and health. Comparisons were made between those who "never" worked and those who "ever" worked; between those "currently" and "previously" worked; and between those working less than 20 hours per week and those working more than 20 hours per week. The major finding of significance was among those who worked greater than 20 hours per week when compared to those working less than 20 hours per week. Those working more than 20 hours per week perceived a greater impact on a number of variables of academic achievement than students working less than 20 hours per week, including homework completion, study time, classroom attentiveness, grades, and amount learned in school. Regarding health impacts, students working greater than 20 hours per week reported a statistically significant greater impact on recovery time from colds and flu and amount of stress experienced, than those working less than 20 hours per week.

Fatal injuries

In addition to non-fatal injuries, a few studies have investigated work-related fatalities among children and adolescents. Suruda and Halperin (1991) estimated that at least 100 children under 18 years of age die due to work-related injuries each year in the United States. In an analysis of 104 OSHA fatality investigations for 1984-1987, they found that 30% involved industrial vehicles and equipment, 17% were electrocutions and 11% resulted from falls. Thirteen percent of these fatalities occurred in children 15 years of age or less. Also, 41% of deaths occurred while children were engaged in activities prohibited by the Fair Labor Standards Act (FLSA). This means that over half the deaths occurred while minors were performing allowable duties. For instance, three deaths involved work around conveyors which is currently allowed under the FLSA. However, this study underestimates the actual number of deaths since OSHA investigates only 25% of all recognized work-related deaths (Suruda and Emmett, 1988). They do not investigate work-related homicides, transportation fatalities, or deaths in industries regulated by other agencies. Also, few deaths are reported in agriculture where injuries in children are known to be common.

Rivara (1985) found that 300 children and adolescents die each year in the United States from farm injuries. In 1992, The National Safe Workplace Institute estimated that nationally there are more than 139 work-related fatalities to minors each year, one-third of which occur in agriculture.

Dunn and Runyan (1993) reported 71 fatalities among persons younger than 20 years of age over a 10-year period, 41% of which occurred in adolescents 17 years of age or younger. Farms were the most frequent location of fatal injury deaths (27%). Fifty percent of deaths involved a motorized vehicle, frequently a tractor. At the time of injury, 86% workers under the age of 18 years (minors) were involved in activities which appeared to violate the FLSA.

In a recent study, Castillo (1994a) analyzed data from the National Traumatic Occupational Fatalities (NTOF) surveillance system at NIOSH, for 1980 through 1989.

Due to the minimum age included in this system, their analyses was limited to those 16 years of age and older. Sixteen and seventeen year olds were compared to adult workers. They found 673 occupational injury deaths to 16- and 17-year olds during the study time frame. The average annual rate of occupational injury death for 16- and 17-year olds was 5.11 per 100,000 FTE compared to adults which was 6.09 per 100,000. Although the industry information was missing in 53% of records, among those for which industry information was available, most deaths to minors occurred in agriculture, forestry and fishing, followed by construction, services, retail trade and manufacturing. Most deaths involved motor vehicles, machines, electrocution and homicide.

In the study by Belville (1993) in which 31 work-related deaths were identified , 5 involved farm work and agricultural machinery. All 5 of the 15-year olds killed on the job were struck by motor vehicles and died of head trauma, most as newspaper carriers. Three of the 16-year-old workers died of gunshot wounds during holdups in a gas station, grocery store, and restaurant.

Illness data

Little research has been done which evaluates children for acute, chronic or latent health effects from toxic chemical exposures or physical hazards. Due to differences in body size, mass and metabolism, children are known to have different tolerances and reactions to a variety of substances such as medications and chemicals, including lead and pesticides (McCabe, 1979; National Research Council, 1993). This is an area which needs further attention. One study which investigated noise exposure among teen-aged farm children enrolled in vocational agricultural programs, found that individuals who worked on farms had an increased prevalence of noise-induced hearing loss (Broste et al., 1989). The participants were mostly male and a high percentage reported use of various types of heavy machinery, although few reported use of hearing protection.

Agriculture data

Agriculture is known to be one of the most dangerous industries in the United States with a high incidence of fatal and non-fatal injuries (National Safety Council, 1993). Agriculture injuries are even more difficult to characterize since often those working on farms are exempt from regulatory efforts or ineligible for compensation benefits, such as those working on family farms, those working on farms with less than 10 employees, and migrant and seasonal farm workers (this may vary from state to state). In a study of farm injuries, Rivara (1985) found 23,500 children and adolescents suffer non-fatal trauma each year in the United States. Another population-based study in 1991 of Midwest farms found 20,000 work-related injuries on an annual basis to youths aged 0-14 years who live and/or work on farms (Lee, 1994). In the study of New York workers' compensation data, agriculture was the second most hazardous industry overall, but accounted for the highest injury rates among 16- and 17-year-old workers (Belville et al., 1993).

Heyer (1992) evaluated 16,481 worker compensation claims filed by children under the age of 18 in Washington State during the time period 1986-1989. Although farm work accounted for only 7% of all claims, agriculture made up for 36% of claims filed by children under the age of 14. In addition, injuries classified as serious accounted for 26% of farm work claims compared to only 16% of all claims filed by children. Serious injuries were defined by nature of injury codes for amputation, asphyxiation or drowning, concussion, fracture, or multiple injury, in addition to receiving time loss payments. Comparisons were also made between farm workers, food service workers, and all other workers. It was found that the proportions of severe and/or disabling injury claims were much higher among farm workers in all age categories (under age 18) than among food service or other workers. Using data from the NTOF surveillance system, Castillo (1994a) found the highest number of fatalities among 16- and 17-year olds in the U.S. (for which industry data was available) occurred in agriculture. Information from this and other studies has led to questions regarding the appropriateness of hazardous agricultural work for young people.

Other health issues

In addition to exposure to health and safety hazards in the workplace, the actual occurrence of an occupational injury or illness, and the physical or emotional sequelae which may result from such trauma, there are several other considerations which have emerged as having an impact on the health and well-being of employed adolescents. The mental health and psychosocial costs of adolescent employment were first described in detail by Greenberger and Steinberg (1986). Other more recent research have described similar findings (Bachman and Schulenberg, 1993; Steinberg and Cauffman, in print). Sleep deprivation and violence in the workplace are also issues which should be considered when evaluating work hours, work tasks, supervision and other conditions in the work environment, but which have received little attention with regard to working teens.

Mental health issues

Mental health problems and dysfunctional developmental behaviors have been associated with adolescent school-year employment, primarily with increasing the amount of part-time work (i.e., number of work hours) during school weeks. Some of these include anxiety, depression, fatigue, insomnia, psychological and somatic distress, drug and alcohol abuse, and higher rates of delinquency (Steinberg & Dornbusch, 1991). Longer hours of employment were found to be associated with higher levels of dysfunction. Highest levels of self-esteem were associated with working 10 hours or less, while the lowest levels were among those working 20 or more hours per week. They also found that diminished school performance was associated with longer work hours during the school year.

Bachman and Schulenberg (1993) studied the relationship between work intensity (number of hours worked per week) and indicators of psychosocial functioning and adjustment. They used a nationally representative sample of 70,000 seniors from the classes of 1985 to 1989. They expanded the number of time intervals under consideration from four used by Steinberg and Dornbusch (1991) to seven intervals, to attempt to more clearly define linear patterns between various indicators and hours worked. In their study work intensity was positively correlated with use of cigarettes, alcohol, and illicit drugs; interpersonal aggression, theft, victimization, trouble with police, arguments with parents; and lack of sleep and exercise.

A selected analysis of the Washington State Survey of Adolescent Health Behaviors (NWREL, 1994) found that students who worked more hours at a part-time job during the school year were also more likely to be moderate or high users of alcohol and other drugs. Although specific reasons for this finding were not identified, the implications of this association provide opportunities for prevention.

Sleep deprivation

There is a common misperception and societal expectation that adolescents "need" less sleep than pre-adolescents. This may be due to the observation that they get less sleep, still manage to juggle many activities, and appear to function adequately under certain circumstances. A number of researchers have found that older adolescents may actually have a physiological need for more sleep than pre-adolescents (Danner, 1993; Carskadon, 1990a). Even when sleep patterns are not disturbed, a tendency for daytime sleepiness exists as part of normal adolescent development. Adolescent sleepiness combined with a chronic insufficient sleep pattern can lead to increased vulnerability for a teenager (Carskadon, 1989; 1990b). It is believed that normal experimentation and limit-testing behavior of adolescence combined with decreased alertness may contribute to a high injury rate in this population (Adduci 1988, as cited by Carskadon, 1990b).

In a survey of Rhode Island high school students, 58.7% of students reported working part-time, with 28% working 20 hours or more per week (Carskadon et al., 1989). Many of these students continued to participate in extracurricular activities as well. It was found that those students who reported working greater than 20 hours per week accrued a significant sleep debt compared to those who reported working fewer than 20 hours per week. Based on their survey, researchers determined that 41% of the study population had an increase in vulnerability to injury episodes due to sleepiness and related risk factors. They found that it is the most active, hardest working and most involved students who may face the greatest risk. They conclude that the margin for safe experimentation which includes various risk-taking behaviors, attempts to master new tasks, and the use of drugs and alcohol is diminished due to the physiological sleepiness of adolescence, and is even further compromised when a sufficient sleep debt occurs.

Sleep deprivation is one potential contributing factor to the occurrence of injuries which may not necessarily be identified by the time-of-injury data. For example, if a child works

until 11 p.m. or midnight, gets home to bed an hour or so later, rises at 6 a.m. for school, then returns to work at 4 p.m., s/he may be just as likely to be at risk for an injury at 4 p.m. or 12 a.m., possibly due to the effects of sleep deprivation. This is an area in need of further research.

Violence in the workplace

Violence in the workplace is a growing concern with regard to fatal and non-fatal injury. Although the data of violent assaults to workers in general, and minor workers in particular, is incomplete, some conclusions can be made about risks to workers from research findings on occupational homicide. Homicide was found to be the third leading cause of occupational injury death in the U.S. in the 1980's, and the most common cause for women (Jenkins et al., 1993). Castillo and Jenkins (1994) analyzed the data on occupational homicide for this same time period for workers 16 years of age and older. This study found homicide to be the fourth leading cause of occupational injury deaths to 16- and 17-year olds, and the number one cause of death for females in this age group. Castillo and Jenkins (1994) found that the highest frequencies of homicide among workers of all ages occurred in retail trade, service and public administration industries. Nearly 30% of all occupational homicides occurred in grocery stores; eating and drinking places; and justice, public order, and safety. Dunn and Runyan (1993) found that 10 out of the 71 work-related deaths in their study of individuals 19 years of age and younger were due to homicide, 60% of which occurred in retail establishments.

Industries in which an exchange of money occurs is thought to be at increased risk for occupational homicide (Castillo et al., 1994b; Jenkins et al., 1993). Other risk factors include working alone, and working in the late evening and early morning hours. Retail trade, specifically grocery stores and restaurants, and service industries are known to hire many youth placing them at the same risk as adults for violence. This information needs to be considered when evaluating the places and times of teen employment. The development of intervention activities to prevent violence in the workplace should recognize the needs of minor workers.

Injury prevention

The occurrence of injuries involves a variety of factors. In attempting to identify strategies to prevent workplace injuries, it is important that some attention be paid to injury prevention theory that has been developed for use regardless of the setting in which injuries occur. The term "injury" has replaced the term "accident" in the injury prevention literature (Christoffel, 1993). "Accident" implies an occurrence due to chance, luck or a random act of God, and is considered unpreventable because it is unforeseeable. This notion has been challenged since the 1960's (Haddon et al., 1964). Injuries are known to have recognizable patterns of occurrence, which means they can be anticipated and prevented. Concepts utilized to study infectious disease have been found to be useful in studying injuries and targeting prevention strategies (Layde, 1990). These include the

evaluation of risk factors related to the host (person affected), agent (thing causing the injury) and environmental conditions (setting in which the health problem occurs). The term "injury control" emphasizes the goal of controlling or preventing injuries and reducing their sequelae, not controlling people (Baker, 1981).

Injury prevention in the workplace requires attention to the "hierarchy of controls" which include engineering controls, administrative changes in relation to work practices, use of personal protective equipment, and education and training programs. Caution is needed if education is the only focus of injury prevention efforts, especially if the task involved is beyond the skill or developmental level of the individual. Experience with driver education programs for high school students has demonstrated that education of those not ready for the task actually increases the fatal and serious crash incidents involving motor vehicles due to the increased early exposure to a hazardous activity (Robertson and Zador, 1978; Robertson, 1980). Adolescents are not just small adults and interventions must address characteristics of this age group such as differences in developmental and skill level, maturity, and risk-taking behavior. Like workers in any workplace safety training program, adolescents also need to be involved in the process of injury prevention as well. It is important to identify how adolescents view the injury problem and potential solutions, including voluntary or mandatory behavior changes, changes in tasks, product or tool design, or other issues related to working conditions in various settings.

Background on Child Labor in Washington State

Washington State has demonstrated a strong commitment to protection of children. In 1989 the state adopted its own agricultural child labor regulations for the first time, which had then become more stringent than those governing non-agricultural work for minors. In 1990 the Washington State legislature mandated that the rules which regulate non-agricultural child labor be updated. At the same time, the Employment Standards program at L&I, which is responsible for minors in the workplace, produced a report that summarized injuries for which a claim had been filed during 1989-1990. This report also documented violations of the existing laws mentioned earlier.

Child Labor Advisory Committee

The report that summarized the findings of the investigations during 1989-1990 provided a framework for discussion of the problems of adolescent workers by L&I's Child Labor Advisory Committee. This committee was formed to unite community interests and originally consisted of bipartisan representatives from the legislature, as well as representatives from labor, business, education, and health. Various state agencies provided staff for technical assistance. This committee was directed to evaluate the scope of the problems of the existing child labor laws and provide recommendations for any necessary revisions. The findings of the committee were used in the rule making process. New regulations were adopted in December, 1992 and all sections became effective by September, 1993.

Child labor regulations

Federal regulations for minors in the workplace are contained in the FLSA of 1938 and are administered by the Department of Labor's Wage and Hour Division. In Washington State L&I is responsible for the enforcement of the federal and state regulations, and investigation of violations. The areas regulated by the child labor laws in Washington State extend to those under the age of 18 years with some exemptions like newspaper carriers. Employment under the age of 14 is prohibited in non-agricultural settings and most agriculture jobs. Twelve- and thirteen-year olds can be employed for hand harvest of certain crops (berries, bulbs, cucumbers and spinach) when school is not in session. Children on family farms are exempt from regulations.

The areas which are covered by these regulations include the Permitted Hours of work for children under age 18 during school and non-school weeks, Prohibited Duties which include occupations and tasks not permitted to minors due to concerns over health and safety, the use of Parent School Authorization forms, and the procedures and criteria used by the Department in granting Permits and Variances.

In the new non-agricultural regulations, the most significant change reduced the number of hours 16- and 17-year olds can work from 40 to 20 hours per week during school weeks. A self-executing variance for 28 hours is available for those with adequate academic achievement and is determined by the parents, school, student and employer. A departmental variance is necessary for any hours above this up to 48 hours per week. The number of work hours permitted for 14- and 15-year olds was decreased from 18 to 16 hours per week. Quitting times have also been revised to 10 p.m. on school nights for 16- and 17-year olds. Formerly, quitting time on school nights was not specified unless two consecutive nights were worked which then required a 9 p.m. quit time. Quit time for 14- and 15-year olds is 7 p.m. on school nights, and is the same as the previous regulations.

Most of the revisions in the Prohibited Duties clarified and expanded safety regulations to prevent traumatic injury, such as prohibiting driving of motor vehicles, or entering assigned hotel guest rooms alone. However, new concepts introduced by the committee and adopted into the regulations include protection from hazardous exposures. An effort was made to integrate provisions available in the Washington Industrial Safety and Health Act (WISHA) and enforced by the Consultation and Compliance Division, but which have not specifically been applied to children. Few states have developed regulations which address contemporary health and safety issues for children. The integration of several health and safety regulations from WISHA with the minor work rules in the Employment Standards Program provides an opportunity to improve the emphasis of health and safety among our teen workforce.

New sections on prohibited duties for the first time address exposures to toxic chemicals, infectious agents and excessive noise levels. Occupations involving potential exposure to hazardous substances as defined in the Hazard Communication Standard are prohibited, with some exceptions. Occupations requiring the use of Personal Protective Equipment for hazardous chemical or noise exposures are also prohibited. The requirement to wear

respiratory or hearing protection indicates an exposure is at or above a Permissible Exposure Limit (PEL). Since PELs are typically based upon effects to adult males, a situation in which a child is exposed at these levels is considered unsafe. Children can not be provided adequate protection with protective equipment not only due to size, but also because their perception of risk and motivation for compliance is limited. Even exposures at levels below the PELs should often be excluded for children, but due to the lack of scientific information, it was not possible to provide recommendations for specific exposure levels for children. There may be situations where certain protective equipment may be recommended even if a PEL is not exceeded, such as hearing protection for noise exposure. Occupations are prohibited where there is a risk of exposure to bodily fluids or transmission of infectious agents such as Hepatitis B or Human Immunodeficiency Virus (HIV). Programs in health career training or work as a lifeguard are exempted.

Methods

This evaluation utilized the Washington State workers' compensation claims database. In Washington State any workplace injury for which medical benefits are paid can be found in this system, whether or not there is time lost or wages replaced. Approximately two-thirds of Washington's employees are covered through the State Industrial Insurance Fund for worker compensation benefits, while one-third work for employers who are self-insured through the Self-Insurance program, which generally includes the state's larger employers. Not included in these systems are workers employed by the federal government, longshore and harbor workers, railroads, the self-employed, and those for whom workers' compensation is not required, such as domestic employees and those working on family farms.

The results of this analysis represent primarily an evaluation of the accepted claims in the State Fund program for the 4-year period between 1988-1991, including agricultural and non-agricultural claims data. Because minor workers include those under the age of 18 years, claims data for employees 11- to 17-years of age were the focus of the evaluation. Most data are presented as frequency distributions of the claims in specific categories, although some figures were available to also calculate specific injury rates, which are described below. Computerized claim data collected from the initial accident report utilized in this analysis included the year the claim was filed, birthdate, gender, and time of injury. The Z16.2 codes developed by the American National Standards Institute (1985) were used to categorize nature of injury, type of injury, body part injured, and source of injury. Compensation status (medical benefits only or wage replacement due to time loss) and claim status (accepted or rejected) for this 4-year period were also summarized. In Washington State, individuals with accepted claims receive benefits for either medical care alone or additional wage replacement due to time loss greater than 3 days.

Self-Insurance claims data were utilized for several limited comparisons. Information was obtained from these claims to add to the total number of reported injuries for 1990 in order to calculate and compare the claim injury rates for adults and minors. A comparison between adult and minor worker claims in 1990 was also made by industry, compensation status, liability, claim status, and nature of injury and included data from both the State Fund and Self-Insurance programs. A limited comparison was also made between State Fund claims and Self-Insurance claims among adolescents for the years 1988-1991 to examine distributions of claims by age, gender, compensation status, and industry. More detailed comparisons using Self-Insurance claims were not possible because L&I does not receive medical information on claims for self-insured employers receiving medical benefits alone; therefore, these claims can only be utilized to evaluate industry, nature of injury in most instances, and demographic information.

Claim injury rates were calculated as the number of accepted claims (numerator) divided by the number of potentially affected workers (denominator). Numerator data were obtained from the State Fund and Self-Insurance compensation programs for 1990.

Because denominator data are not available by age category from the Washington State workers' compensation claims database, these data were obtained from the 1990 U.S. Census for Washington State (Census, 1993). Claim injury rates for 16- and 17-year olds were compared to rates for adults (18 years of age and older) by industry and gender. Information that distinguishes full-time and part-time work status is not available from the 1990 Census data; thus, rates are expressed as number of injuries per 100 workers (full- and part-time) regardless of hourly status. There are no rates available for workers under the age of 16 years since the census has not collected employment data on those under the age of 16 years since the 1970 Census. Calculations for injury rates among adult workers were made in the same manner as that used to calculate rates for minors. For the calculation of rates and the comparison of claim data between minors and adults only data from 1990 were utilized and information from both State Fund and Self-Insurance programs was included.

Although exact figures are not available to calculate injury rates adjusted for the number of hours worked, information obtained from the CPS conducted for BLS can be used to make some comparisons between adult workers and adolescent workers. The available information provides the average number of hours worked, as well as the average number of weeks worked during the year. Using national figures comparisons were made between 16- and 17-year olds and adults, and applied to the Washington State data. Hours worked and weeks worked can be viewed as equivalent to exposure time on the job which may be an indicator of the level of risk for an injury.

Due to the age distinction utilized in the child labor regulations with regard to permitted work hours and prohibited duties, age categories of 11 to 15 years and 16 to 17 years were used in the analyses. Those under the age of 11 years were excluded due to coding problems, which are described in Appendix A.

Standard Industrial Classifications (SIC) codes were utilized to identify "Industry". The classifications utilized in the 1990 Census correspond to the classifications developed from the 1987 Standard Industrial Classification. Since most teens are known to work in restaurants and grocery stores, "Retail Trade" was divided into three categories in order to allow for a more specific evaluation: 1) "Restaurant" which consists of any eating and drinking establishment, 2) "Food Store" which is any retail food or grocery store, and 3) "Sales" which includes all other wholesale or retail businesses excluding those with a unique category, such as restaurant and food store.

Service includes amusement and recreation services, hotels and motels, health service, social services, auto services, business services, member organizations, motion pictures, and educational services among others. Agriculture/Forestry/Fishing includes industries involved with crops (agriculture or timber) livestock, and fishing. Manufacturing includes production facilities such as lumber and wood, food production, metal products, machinery and textile, and others. Construction includes residential or commercial building. Public Administration (i.e., public agency) includes executive, legislative, and general government; justice, public order, and safety; administration of human resource programs; administration of environmental quality and housing programs; and

administration of economic programs. Transportation consists mainly of motor freight transportation and warehousing, water transportation, and transportation services.

The 1980 Bureau of Census' occupational classification system's coding structure was utilized to identify the type of work in which a claimant was engaged at the time of injury. The two major occupational classifications are Service and Transportation/Material Moving, which were broken down into more specific sub-groupings. Technical/Sales/Administrative Support includes a variety of small groupings such as dental and health technicians, clerks, receptionists, messengers and the like. Precision/Production/Craft/Repair includes mechanics and repairers; construction trades and the corresponding apprentices such as carpenters, drywallers, roofers, painters, plumbers and the like; and production jobs such as machinists, sheet metal workers, bench carpenters, meat cutters and bakers. Machine Operating/Assembling/Inspecting includes a number of job classifications with small numbers such as assembler, grinding/polishing machine operator, welder, laundry/dry cleaning and textile machine operator, slicing/cutting machine operator, sewing machine operator and others. The final occupational category used was Managerial/Professional which includes recreation workers, teachers, and others.

For "Body Part Injured" the categories have been collapsed to represent a more true anatomic position of body parts. These categories differ from those created by other researchers utilizing this database, which use "trunk" to include back, chest, hips, and shoulders. Shoulder has been placed with upper extremity, hip with lower extremity, back and neck as a separate category, and eye separated from face and head. Trunk includes abdomen, chest, trunk-unspecified, and trunk-multiple which may include body parts that would more appropriately be placed in the other categories listed, but lack of information in the record prevented more specific identification. These groupings are aimed at targeting specific areas of concern either discussed by the Child Labor Advisory Committee or which have been mentioned by other researchers.

The "Type" of injury is the proximal event that contributed to the injury. The "Source" of the injury is the object directly involved with the specific part of the body sustaining an injury. Time of injury is recorded on the claim form at the time the claim is filed. The "Nature" of injury is the injury description. In this category, "Sprain" includes sprains and strains.

Claims were evaluated in several "two-way" analyses. The "Industry" classification was evaluated by nature of injury, type of injury, source of injury, body part injured, occupation, gender, age group and compensation status. The "Nature of Injury" classification was evaluated by source of injury, type of injury, body part injured, gender and age group. The "Type of Injury" classification was evaluated by body part injured.

Due to the severity of amputations and the number and serious nature of fractures, these two categories were evaluated in detail. Microfiche records of the 22 claimants with amputation injuries were reviewed and summarized.

Results

There were 17,800 accepted workers' compensation claims during the 4-year evaluation period among adolescent workers. Eighty-five percent of claims were filed to the State Fund, and 15% to Self-Insured employers. Because little variation was noted from year to year, most of the data from the 4-year evaluation period are presented as a summary. Areas in which trends were evident are specified. The tables (which begin on page 57) present the data for the broad categories identified, while the text in this section provides more specific information within certain categories.

Census Data

According to the 1990 Census, approximately 44,000 sixteen- and seventeen-year olds (36%) were employed in Washington State. Sixteen- and 17-year olds represent 3% of the total population in Washington State and comprise 2% of the total working population. The gender proportion of workers in this age group is 50% male and 50% female and reflects the same proportion by gender in the total population of 16- and 17-year olds (male 51% and female 49%).

Most 16- and 17-year-old minors were employed in Restaurants (33.5%), Services (22.9%), Sales (15.5%), Food Stores (13.8%), Agriculture (5.3%), and Manufacturing (5.0%) (See Table 1). Adolescent workers comprised 13% of the total work force in Restaurants and 9% in Food Stores. More females were employed in Services than males (27.9% vs. 17.9%) and males exceeded females in Agriculture, Construction, Manufacturing, Transportation (See Table 2).

Two-Way Analyses Using State Fund and Self-Insurance Claims Data for 1990

Injury rates (Tables 1-3)

The injury rates for 1990 are presented in Tables 1-3 by industry, age group, and gender. The claim injury rate for 16- and 17-year olds was 9.0/100 workers compared to 10.4/100 workers for adults (Table 1). The rate for 16- and 17-year old males was 11.8/100 workers, and for females it was 6.4/100 workers (Table 2).

The highest injury rates for 16- and 17-year olds (per 100 workers) were in Public Administration (27.0), followed by Construction (21.1), Agriculture (11.4) Restaurants (11.0), and Food Stores (9.6) (Table 1). Injury rates for 16- and 17-year-old males were higher compared to females for all industries, with a range from 1.3 times greater in Food Stores to over 3 times greater in Construction (Table 2).

In comparing injury rates for minors and adults (Table 1), the injury rate for minors in Public Administration was 3.4 times higher than for adults. Rates were similar for minors and adults in Agriculture, Construction, and Services. Minors had lower injury rates in Manufacturing, Transportation, Food Stores, Restaurants, and Sales.

Although the injury rate for 16- and 17-year-old males was slightly lower than that for adult males, the overall injury rates for minor and adult workers were comparable by gender. However, for both males and females, injury rates for minors in Public Administration were over 3 times greater than for adults (Tables 2 and 3). The injury rates for 16- and 17-year-old females and males were only slightly lower than adults in Agriculture and Construction; 16- and 17- year-old males had a slightly higher injury rate in Services than adult males.

Claim status (Table 4)

Table 4 presents a comparison of the distribution of claims within each age group and between minors and adults for 1990 by gender, liability, compensation status, and rejected claim status. There was a higher proportion of female claimants among minors than among adult claimants. A lower percentage of minor claimants received wage replacement due to time loss than adult claimants. The accepted claims filed by minors to the State Fund during 1988-1991 represented 92% of all claims filed, while approximately 8% were rejected. Accepted claims to Self-Insurance represented 88.3% of claims filed, while 11.7% were rejected. Analysis of patterns that may be present in rejected claims was not done. Fewer claims were rejected by the State Fund for minors than adults, while more Self-Insurance claims were rejected for minors than adults.

One- and Two-Way Analyses Using State Fund Claims Data, 1988-1991

Claim distribution by year and age (Tables 5 and 6)

Table 5 presents the numbers of accepted State Fund claims for minors by age group and year the claim was filed for the 4 years reviewed. In 1991 there appears to be a decrease in claims filed by minor workers. However, this decrease may have been the result of an increase in coding errors rather than an actual decrease in injuries or reporting trends. See Appendix A for further details.

Overall, the 11- to 15-year-old age group comprised 11.7% of these claims; the 16- and 17-year-old age group represented over 88% of claims. Table 6 shows the proportion of claims by a more specific age breakdown for the 4-year period; the number of claims filed increased with age, most likely reflecting the increasing numbers of employed adolescents with increasing age.

Claim distribution by sex and age (Table 7)

Table 7 presents the accepted state fund claims by age group and sex. The claim distribution by gender remains consistent across the two age groups, approximately 65% male and 35% female.

Compensation status (Table 8)

Compensation status by age group and sex is presented in Table 8. The vast majority of accepted claims (86%) received benefits for medical care only. In addition to medical benefits, 14% received some type of wage replacement due to time loss or other wage supplement. This proportion remained consistent within each age group and among males and females.

Three fatalities (all males) were reported during these 4 years; two were in agriculture and one in construction. A 17-year-old boy suffered compression injuries when he was caught in the power take off (PTO) of a liquid manure feeder. The PTO guard had been removed for repair and had not been replaced. In another agricultural incident, a 15-year-old boy who was working with his family in a hop field had lain down to sleep between rows. A truck leaving the field crushed his head. The third fatality occurred on a construction site when the motorized compactor which was operated by a 17-year-old boy rolled over and crushed him.

Claim distribution by industry (Tables 1 and 9)

In addition to presenting employment figures and injury rates, Table 1 also compares the distribution of claims for 16- and 17-year-old minors and adults (18 years and older) by industry for 1990 and includes data from both State Fund and Self-Insurance claims. Proportionally, there were almost 7 times more claims for minors in restaurants than adults. Food Stores and Agriculture had 4 and 1.5 times more claims among minors than adults, respectively. All other industries had a lower proportion of claims among minors than adults.

The proportion of accepted State Fund claims for 11- to 17-year-old minors during the 4-year study period is presented by industry in Table 9. The highest frequency of claims was in Restaurants (45.3%) followed by Services, Sales, Agriculture/Forestry/Fishing, and Food Stores. When Restaurants, Food Stores, and other Sales were combined the total distribution of claims for Retail Trade was 64.1%. Restaurants comprised 71% of claims in Retail Trade.

Claim distribution by occupation (Tables 10-12)

Table 10 provides the distribution of accepted State Fund claims by occupational classification. Service (61.8%) and Transportation/Material Moving (20.8%) were the dominant occupational classifications, which are described in further detail below. Job categories with the most frequent claims were Food Service (47%), Laborer/ Helper (9.2%), Packer (7.4%), and Farm Service (6.1%). Information was missing or unknown for 3.0% of claimants.

Service

Table 11 provides the distribution of accepted State Fund claims for job categories within the Service occupational classification. Food Service comprised 76% of service jobs and included cooks and food preparers, waiters, counter and kitchen workers, and dishwashers. Farm Service included all agricultural jobs most of which were identified as farm workers. In the remaining service occupations, Garden Service included gardeners and groundskeepers, nursery workers, animal caretaker (excluding farms), and forestry (excluding logging). Health included dental assistants and health and nursing aides. Cleaning Service included maids/housemen and janitors/cleaners. Amusement/Recreation included attendants at amusement and recreational facilities. The "other" category included protective services, guards and firefighters, child care workers, and miscellaneous personal services.

Transportation/material moving

Accepted State Fund claims for minors in occupations involving Transportation and Material Moving are shown in Table 12. Laborer/Helper, with 44.1% of claims, was the dominant group in this category and included generic laborers as well as those in construction. Seventy-four percent of packers were stock handlers or baggers. Others included in this category were freight handler, hand packer, and machine feeder/off bearer. Sixty-one percent of service station workers were vehicle washers and equipment cleaners. Logging jobs included faller/bucker, chaser, skidder, loader, choker setter, truck driver, and logger not elsewhere classified (NEC).

Nature of injury (Table 13)

The distribution of accepted State Fund claims by the nature of injury is presented in Table 13. Lacerations comprised the majority of injuries with 40.6% of claims, followed by sprains and strains, contusions, and burns involving primarily contact with hot temperatures and chemicals.

The "other" category includes a number of serious conditions for the 4-year study period including 22 amputations, 66 dislocations, and 102 concussions.

Body part injured (Table 14)

Table 14 presents the distribution of accepted State Fund claims by body part injured. The upper extremities were the most frequently involved body parts with 56% of injuries occurring in the fingers, hands, wrists, arms, and shoulders. Lower extremities were involved in 17.2% of injuries and included hip, thigh, lower leg, knee, ankle, feet, and toes. The back and neck accounted for 10% of injuries followed by injuries to the trunk and other musculoskeletal (MSK, other) eye, face and head, and systemic conditions. "Other" includes claims where the affected body part was unknown or not otherwise classified.

Type of injury event (Table 15)

The distribution of the accepted State Fund claims by type of injury event is presented in Table 15. Approximately 50% of injuries involved the person or body part being struck by a person or object. This category included being struck against a still or moving object, being stabbed by an object, or having stepped on an object. Sixty-one claims identified in this category involved being struck by a person, five of which were known to have involved a crime.

Falls (14.6%) involved falling off an above ground structure or location, as well as slips and trips. Overexertion due to lifting, carrying, pushing, pulling, or throwing accounted for 10.1% of injuries. Contact with temperature extremes (9.1%) involved primarily contact with hot surfaces, objects, or liquids. Toxic exposure (4.9%) involved contact with chemicals primarily through skin, although inhalation or ingestion may also occur. Being caught in, under, or between an object or machine accounted for 3.3% of injuries. Abrasions or scratches occurred in 3.3% of injuries, and bodily reactions occurred in 2.1% of injuries. Moving vehicle (0.7%) included those driving or riding in a vehicle, as well as those hit by a moving vehicle. The remaining "other" includes explosion, electric current, and unknown or not otherwise classified.

Source of injury (Table 16)

Table 16 presents the distribution of accepted State Fund claims by the source of injury. Non-powered hand tools were the major source of injuries (18.0%), most of which were knives. Surface (11.7%) contact included work surfaces such as stairs, floors, ramps, roofs, or the ground outdoors. Container (11.3%) indicates contact with boxes, cartons, cans, barrels, buckets, grocery bags, pots and pans, etc.

Machine (8.1%) included shears or slicers (n = 543), farm equipment (n = 114), conveyors (n = 68), saws (n = 63), mowers (n = 35), and a small number of other machinery and electrical sources, such as fans, conductors, office machines, crushers, buffers and polishers, printing and wrapping machines, among others. Metal object (6.2%) included

metal fasteners or metal bands for cartons, pipe fittings, structural metal, nails, auto parts, and others not specified. Liquid (5.7%) indicates contact with cooking oil or water.

Vehicle (4.5%) included powered and non-powered vehicles (dollies, hand-trucks) for either highway or in-plant use. Furniture (4.3%) included tables, beds, cabinets, shelving, counters, home appliances, and the like. Glass/ceramic (3.9%) included primarily unspecified glass items and dishware. Chemical (3.9%) included primarily detergents, disinfectants, and chlorine products, plus others such as solvents, alkaline solutions, petroleum products, acids, and insecticides. The remaining "other" (22.1%) includes a large number of very small specific categories which are presented in further detail in subsequent tables.

Time of injury (Table 17)

Table 17 presents available information on time of injury by 4-hour intervals. The time period associated with the most claims (25.3%) was 5 p.m. to 9 p.m. There was also a large number of claims with no time information (13.6%). Since there is no information available on the proportions of children working during these time periods, it is not possible to determine a time-of-injury rate based on this claim information.

Two-Way Analyses by Industry Using State Fund or Self-Insurance Claims Data, 1988-1991

The following tables present the two-way analyses of many of the claims variables previously presented as individual summaries. Tables 18-24 present the two-way analyses of the claim data for minors by industry and other individual categories, including age group, sex, compensation status, occupation, nature of injury, body part injured, event type, and source of injury. Primarily, proportions of claims within injury categories for each industry are presented, and these tables can be used to characterize the injury experience of minors within a specific industry. However, injury categories with high numbers of claims associated with one industry will be identified by the industry in which they are found. For instance, while heat burns represented 16.9% of claims in the Restaurant industry, 84% of all burns due to hot items or liquids occurred in restaurants.

Age, sex, and compensation status (State Fund) (Table 18)

There was a higher proportion of the youngest workers (11- to 15- years old) represented in Agriculture and Public Administration than in the total claim population for all minors (23.5% and 29.5% respectively vs. 11.7%). Industries in which the 16- and 17-year olds represented a larger percentage than their make-up in the total claim population for all minors included Construction, Manufacturing, Sales, and Restaurants.

Females represented a higher proportion of claims in Restaurants and Food Stores than their proportion in the total minor claimant population. Males represented 65% of the total claims among minors, but represented a greater proportion in Construction, Transportation, Manufacturing, Agriculture, Sales, and Public Administration.

Claimants who receive wage replacement due to lost work time greater than 3 days most likely represent those with more severe injuries than those receiving medical benefits alone. Agriculture, Transportation and Construction had higher proportions of claims receiving wage replacement than claims for all industries among minors. Public Administration had a lower proportion of claims receiving time loss compensation compared to all claims for minors.

Age, sex, and compensation status (Self-Insurance) (Table 19)

Table 19 presents information for claims filed by minors to self-insured employers during the 4-year period. There was a lower proportion of claims in the 11- to 15-year-old age group than in the State Fund (6.8% vs. 11.7%). However, as in the State Fund, there was a higher frequency of claims among 11- to 15-year olds in Agriculture and Public Administration than in other industries. There was a higher proportion of females among Self-Insurance claims than in the State Fund (41.9% vs. 34.3%). Food Stores (40.8%) was the industry with the highest proportion of claims in Self-Insurance whereas Restaurants (45.3%) had the highest proportion of State Fund claims. Differences present in the distribution of claims between the State Fund and Self-Insurance may reflect differences in the distribution between employers in these two programs.

Occupation (Table 20)

As mentioned earlier, the dominant occupation of minor claimants is Service (61.8%). This dominance is primarily due to the high proportion of claims that the service occupation represented in the Restaurant, Agriculture, Service, and Public Administration industries. The highest proportion of claims for Transportation/Material Moving occupations were found in Transportation, Food Stores, Construction, Sales, and Manufacturing.

Nature (Table 21)

Several types of injuries mentioned in the text above for Table 13 as part of the "other" category are presented individually in Table 21 and subsequent tables for more specific delineation in the two-way analyses. The three leading injury categories for each industry are highlighted in bold in this table.

Lacerations were the most commonly reported injuries in all industries, with 49% of these injuries occurring in Restaurants. Sprain and strain injuries, typically the second most

common injury category were most frequent in Service, Agriculture, Public Administration, Sales, and Food Stores. Contusions comprised 15% or more of injury claims in most industries. Forty percent of claims due to contusions occurred in Restaurants.

Following lacerations, the highest proportion of injuries in the Restaurant industry was due to heat burns (16.9%). Eighty-four percent (1,154) of all claims for heat burns among minors occurred in Restaurants. The Service industry had the next highest number of claims for heat burns (100). Most chemical burns occurred in Restaurants (43%) followed by Service (19.6%) and Sales (16%). There was a total of 102 concussions with 35 in Restaurants, 21 in Service, 16 in Agriculture, and 14 in Sales. Of the 66 claims for dislocation, 23 occurred in Restaurants, 13 in Service, 8 in Food Stores, and 7 in Sales. Almost 40% of the 200 claims for a multiple injury occurred in Restaurants, followed by Service, and Agriculture. Most claims for dermatitis came from Restaurants (55%) followed by Agriculture (14.1%) and Service (13.5%).

Body part injured (Table 22)

Data on State Fund claims for minors by body part and industry are shown in Table 22. The upper extremity was the most commonly injured body part in all industries. Industries with comparably high proportions of injuries to the lower extremities included Construction, Agriculture, Public Administration, Service, and Transportation.

Type of injury event (Table 23)

Being struck by an object (e.g., a knife) was the dominant type of injury event in all industries followed typically by falls. The highest frequency of injuries due to hot temperatures and overexertion occurred in Restaurants.

Most toxic exposure events occurred in Restaurants, Service, Sales, and Agriculture. Being caught in or around an object or machine occurred most frequently in Restaurants, Agriculture, Service, Sales, and Food Stores. Industries with the greatest number of abrasion injuries (which mainly involved the eye) included Restaurants, Service, Sales, Manufacturing, and Agriculture. Agriculture, Service, and Sales had the highest frequency of injuries involving moving vehicles.

Source of injury (Table 24)

Several categories already presented in Table 16 are separated into more specific items in Table 24. For instance, knives are separated from non-powered hand tools; and shears, slicers and conveyors are separated from machines. The three leading sources of injury for each industry are highlighted in bold.

Knives were the dominant source of injury accounting for almost 15% (2,223) of all injuries most of which occurred in Restaurants. This was also the dominant source of injury for Food Stores and Sales. The dominant injury source in Agriculture and Service was contact with work surfaces; for Construction and Manufacturing it was metal objects; and for Transportation and Public Administration the leading source was vehicles. Other industries with a high frequency of injuries involving vehicles included Food Stores and Agriculture.

Most of the injuries resulting from contact with liquids (primarily cooking oil), and contact with hot objects, occurred in Restaurants. The highest frequencies of chemical injuries were found in Restaurants, Service, Sales, and Agriculture. Injuries from shears or slicers occurred primarily in Restaurants (69.4%) and Food Stores (19.9%). Of the 63 injuries associated with conveyors, almost 40% occurred in Agriculture followed by Manufacturing (23.8%) and Sales (20.6%).

Two-Way Analyses by Nature of Injury

Tables 25-29 present the two-way analyses of the claim data for minors by nature of injury and other individual categories including age group, sex, body part injured, event type, and source of injury. As in the previous two-way tables, dominant proportions in specific injury categories will be identified, and when important, those with the highest numbers will also be described.

Sex and age (Table 25)

Table 25 presents data comparing the injury categories from accepted State Fund claims for minors by gender and by the two age groupings, 11- to 15-year olds and 16- and 17-year olds, for the 4-year study period.

Females had higher proportions of claims for heat burns, concussions, contusions, dermatitis, dislocations, multiple injuries, and sprains relative to their representation in the total claim population. Males had higher proportions of claims for abrasions, amputations, chemical burns, eye injuries, fractures, and toxic exposures relative to their representation in the total claim population.

With respect to age, the youngest workers represented a higher proportion of claims in amputations, concussions, dermatitis, eye injuries, fractures, and toxic exposures.

Age (minors and adults) (Table 26)

The comparison between minors and adults for injury categories in 1990 is presented in Table 26. Data from both State Fund and Self-Insurance are included. When compared to the proportion of claims among adults by injury category, minors exceeded adults in a

number of categories. The most notable of these include lacerations (33.9% vs.17.6%), heat burns (7.9% vs. 1.6%), concussions (0.8% vs. 0.4%), {and amputations (0.2% vs. 0.1%).}

Body part injured (Table 27)

Most injuries to the upper extremity were due to lacerations (60.3%) followed by heat burns, contusions, and sprains. The upper extremity was the dominant location of a number of injury types including lacerations (83.2%), heat burns (69.9%), fractures (59.9%), contusions (44.0%), and amputations (100%).

The major injury type for the back and neck areas was sprains (87.7%). Most abrasions and chemical burns occurred to the eye (82.2% and 65.4%, respectively). Other face and head injuries involved lacerations, contusions, concussions, and chemical, and heat burns. Systemic injuries involved exposure to a chemical, toxin, or injury by another source, such as electric shock.

Type of injury event (Table 28)

Concussions involved either a fall or being struck by an object. All dermatitis involved contact with toxicants, most of which were chemicals. Most irritant eye injuries involved contact with chemicals. Claims with multiple injuries most often resulted from falls and being struck by an object. Almost half the sprain injuries involved overexertion (46.4%) followed by falls (29.6%). Fall was the dominant event involved in the occurrence of a multiple injury claim and concussions (49.0% and 48.0%, respectively).

Source of injury (Table 29)

Most abrasions involved particulates followed by metal and wood objects. Most amputations involved shears, slicers, and machinery, such as conveyors and are described in further detail below. Most heat burns involved contact with hot liquids (59.8%), primarily cooking oil and water, followed by hot objects, such as grills; steam or fire; food; and containers, such as pots and pans.

The dominant source of concussions involved contact with work surfaces. Dislocations were primarily due to bodily motion; and contact with containers and work surfaces. The dominant source of laceration injuries was knives, followed by metal objects, and shears or slicers. A multiple injury involved contact with work surfaces, vehicles, and machines. Most "poisonings" resulted from contact with live animals and insects (59.2%), and contact with chemicals (31.6%)

Two-Way Analysis by Type of Injury Event

Body part injured (Table 30)

Table 30 presents the two-way analysis of the type of injury event by body part injured.

Injury profiles

Two particularly severe injury categories are fractures and amputations. They occurred with sufficient frequency to warrant further characterization of them. The profiles from the summary of the available information are provided below.

Fractures. There were 464 fractures during the 4-year study period comprising 3.1% of all claims. Most fractures were located in the upper extremity (59.9%) followed by lower extremity (27.6%), face and head (5.1%), back (3.7%) and trunk (3.7%). Most fractures occurred in Restaurants (22.2%) followed by Agriculture (19.4%), Service (16.4%), Sales (14.4%), Construction (9.5%), Manufacturing (7.8%) and Food Stores (5.6%). Agriculture and Construction had an excess proportion of claims for fractures of more than two times that found in the total for all industries.

Almost one-half of fracture injuries occurred as a result of being struck by an object such as containers, furniture, machinery, non-power tools, and vehicles. Thirty-two percent of the events leading to fractures were characterized as falls, followed by being caught in or around an object (10.8%). The main sources of fracture injuries included contact with work surfaces (n=135) primarily due to falls, vehicles (n=56), machinery (n=48), containers (n=36), metal parts (n=30), timber or wood items (n=22), conveyors (n=12), and power or non-power tools (n=16). Fracture injuries occurred with the highest frequency in Service occupations primarily Food Service, Farm and Garden, Laborer/Helper, and Packer. The 11- to 15-year olds represented a greater proportion of fracture injuries than their proportion of the minor claim population as a whole (20.5% vs. 11%). Males were also over represented in these injuries compared to their total proportion of claims for all minors (76.3% vs. 66%). More of these claims received time loss payments than in the total claim population (55% vs. 14%).

Amputations (Appendix B). There were 22 amputations during this 4-year period. Twenty-one claimants lost all or part of one or more fingers, and one was the partial loss of a hand. Many individuals sustained multiple other injuries as well. Eight occurred in Restaurants, four in Manufacturing, three in Food stores, three in Sales, two in Agriculture, and two in Service. Occupations in which these injuries occurred were eleven in Service jobs, including eight in Food Service, three in Farm and Garden, seven in Laborers/Helpers, one in Machine Operator/Assembler, one in Production, one in Technical/Sales, and one Unknown. Sources of amputation injuries included shears or slicers (n=7), machinery (n=5), conveyor (n=3), knife (n=2), other power or non-powered hand tool (n=2), container (n=2), and metal object (n=1).

Eighteen amputation injuries occurred among 16- and 17-year olds, while four occurred among 11- to 15-year olds. Nineteen amputations occurred in males and three in females. Seventeen were severe enough to receive wage replacement for time loss, while five received medical benefits alone. The injury that caused a partial hand amputation occurred to a 17-year-old male in a woodworking machine operation. See Appendix B for descriptions of each of these injuries obtained from a review of the microfiche claim files.

Discussion

Overview

This study reviewed the workers' compensation claims data base to summarize the reported injuries experienced by minors during a 4-year period in Washington State. While there are shortcomings of workers' compensation data for purposes of injury surveillance, these data provide an important view of workplace injuries in this population. No attempt was made to evaluate the occurrence of work-related injuries in relation to whether or not violations to state or federal child labor regulations were involved. Reports from other studies indicate that this is a common occurrence. Investigation of these data for evidence of violations may provide useful information for identification of areas in need of special attention.

Data Issues

Most of the injury rates found in this study exceed the federal government's goal to reduce work-related injuries to no more than 6.0 per 100 FTE for all workers (U.S. Department of Health and Human Services, 1991). While this may be an acceptable target for adults, it may be reasonable to strive for greater occupational injury reduction among teens, given their protected status in society.

The injury rates and frequencies of claims as they have been calculated for this report may seriously underestimate the problem of workplace injuries for minors and adults alike due to a number of factors. It is known that filed and accepted claims typically underrepresent the true proportion of injuries and illnesses that occur in the workplace for a variety of reasons, such as lack of knowledge of the system by some workers, lack of recognition of work-related illnesses by health care providers and workers' fears of repercussions for filing a claim (Baker et al., 1988). Also, as mentioned earlier, not all workers are covered by this system. Parker (1994b) estimated that two thirds of adolescent work injuries were not reported to the Minnesota Department of Labor and Industry. In Minnesota, reporting requirements are for injuries that lead to 3 or more days of lost work time. A pilot study by Discher and Kleinman (1975) at the University of Washington also found that only one-third of work-related injuries were identified through Washington State's industrial insurance system.

In addition, while data on the number of employed teens were obtained from the U.S. Census, which includes all workers in the state including those working on family farms, the workers' compensation data do not include those working on family farms. For instance, three fatalities to minors were identified in the workers' compensation data during the 4-year study period - two in agriculture and one in construction. However, a number of other deaths are known to have occurred to teens on farms during the same

time period, for which claims were not filed because an employment arrangement did not exist. Consequently, such work-related fatalities were not part of this evaluation. Others not covered by workers' compensation include newspaper carriers, domestic workers, family employees, self-employed and others. Detailed evaluation of the workers' compensation data for this study was also limited to the State Fund due to the limitations of the Self-Insurance data mentioned earlier. Thus, a significant quantity of data was not extensively evaluated because one-third of the state's employees are covered by self-insured employers, including many fast-food and grocery stores known to hire a significant number of youths.

Regardless of the problems with the worker compensation system, there are a number of advantages to using this system in Washington State to obtain injury data for analyses. It is a large administrative system which is used to manage the occupational injury insurance for two-thirds of the state's employees. The same system is also used for payment of bills. Therefore cost of injuries, incidence of injuries, and other descriptive information can be determined from the same system. The complete claim record is available on claims filed to the State Fund, while limited information is available from Self-Insured employers.

Another limitation of the various data systems used in this study is that the census does not distinguish between part-time and full-time employment. Also, the workers' compensation system and the Employment Securities Department do not record number of hours worked by age in order to determine full- or part-time status by age group. However, using an estimate of the number of hours worked by teens, and given that adults are more likely to work full-time and children are more likely to work part-time, the injury rates identified in this report are likely to be a dramatic undercount per hour worked. That is, since the hours at work per year for employed teens is likely to be much less than that for most adults, the injury rate per hour worked by minor workers may actually be much greater than that for adults.

The Government Accounting Office (1991) found that the average work time for 16- and 17-year olds was 21 hours per week and 23 weeks per year. Data from the same source (CPS Supplement, 1989) shows that 80% of employed adults were working full-time; and 65% of all adults worked full-time for 48-52 weeks of the year. BLS data from 1990 (BLS, 1991) shows the average number of hours worked averaged over the course of the entire year was 19.1 for 16- and 17-year olds, and 39.4 for adults. The work experience data for 1990 (CPS Supplement, 1991) is comparable to that seen in 1988: 80% of employed adults were working full-time; and 64% of all adults worked full-time for 48-52 weeks of the year, while 86% of employed 16- and 17-year olds worked part-time with 55% working 1-26 weeks per year. Combining these data indicates that minor employees average approximately one-fourth as many hours worked per year as adults do. As a result, the injury rate calculated per working child underestimates the actual injury rates by a factor of four when adjusted for work hours.

Limitations in the available data systems make it difficult to compare injury rates from one study to another, such as those described in the review of the literature, due to differences in the various data sources like hospital emergency department records and worker

compensation claim files, for instance. Even within a similar data source such as workers' compensation systems, it is difficult to make comparisons from one state to another since individual states differ in the reporting requirements necessary for filing a claim. For instance, in Washington State any workplace injury requiring medical attention is eligible to be in the system whether or not there is time lost or wages replaced. However in other states, such as Michigan and Tennessee for example, injuries are recorded based on 7 or more days of lost work time (GAO, 1990). In addition, the GAO found that only 26 of the 34 states surveyed could provide data for work-related injuries to minors (those under age 18).

While good denominator data for determining work-related injury rates for minors is lacking, there are two potential sources which are not currently utilized for this purpose in Washington State. One is the permit issued to employers allowing them to hire minors. In this system the employer is required to obtain a permit for hiring minors, which must be maintained on the employer's premises. Copies are not sent to L&I. If records were also submitted to L&I, it is possible they could be utilized to obtain more information on working teens. Nationwide, 20 states require minors (under age 18) to obtain work permits. These permits provide a mechanism for summarizing information about the population of working teens - how many are working and in what types of work sites. They can also function as a type of license allowing the teenager to work and can be revoked if school performance deteriorates.

A second method for identifying the numbers of minors working is the Parent/School Authorization (PSA) forms which each minor seeking employment must obtain with the appropriate signatures allowing him/her to work. Copies of the PSA form, which is signed by parent, school, employer and student, are required to be kept by the school and the employer, but none is required to be sent to L&I. In order to improve data accuracy, one of these systems currently in use could be utilized more efficiently and effectively for helping to obtain more accurate denominator data.

A third mechanism for identifying the number of teen workers and the number of hours they work which would provide more accurate information for calculating injury rates, is through the Employment Security Department. Employers currently must report the number of hours worked for all their employees to the Employment Security Department by social security number. However, this information is not reported by age of employee and linkage to social security number to obtain age information is not possible. The availability of such information could provide a mechanism for evaluating certain work and injury variables in relation to the employment status (part-time or full-time) of minors.

Findings

In this study, the claim injury rate per year for 16- and 17-year olds was equivalent to the injury rate for adult workers. As discussed earlier, this likely means a much higher rate for minor workers than adults per hour worked since most adolescents work part-time part of the year, and most adults work full-time for most of the year. In addition, it should be

noted that children who work have two jobs - school and work activities - which in combination often may be equivalent to more than a full-time schedule.

Most teens were employed in Retail Trade (restaurants, food stores and other sales) and Service industries which also had the highest proportions of injury claims, as seen in other studies (Schober et al., 1988; Banco et al., 1992; Belville et al., 1993). In this study, the injury rate for minors in all categories of Retail Trade was 9.7 per 100 workers. Within Retail Trade, restaurants had the highest proportion of teen workers and had an injury rate of 11.0 per 100 workers.

Nearly 85% of all injuries to teens were due to lacerations, sprains and strains, contusions and burns, primarily involving the upper and lower extremities, and the back and neck. These data are consistent with what has been found in other studies already mentioned. Except for sprains and strains, the other dominant injury categories represented a larger fraction of injuries than found among adults. Lacerations, mostly to the upper extremity, were primarily due to knives and occurred with the highest frequency in the restaurant industry. Further investigation of the tasks involved in the high frequency of laceration injuries may prove useful in identifying specific intervention strategies to decrease their prevalence. Most sprains were due to exertions and falls, and primarily involved the back and neck. Parker (1994b) found the likelihood of sustaining a back injury had a positive association with the amount of weight lifted at work and contributed to a high proportion of severe disability, including injuries to the lumbar disc. Although work-related cumulative trauma disorders have not been adequately studied among teen workers, the prevalence and cost of conditions like carpal tunnel syndrome and back pain in adult workers is well known. Prevention activities should begin during the early work years and throughout an individual's work experience.

Burns most commonly occurred in restaurants, primarily due to hot liquids like hot oil and grease. Hot objects, steam, fire, and food were also involved. Burns have been found to be a serious cause of morbidity for teen workers often requiring hospitalization (Rossignol et al., 1989, Hayes-Lundy et al., 1991). Parker (1991) found that 13% of claims were due to burn injuries among Minnesota teen workers, the third most common injury. Of those teens hospitalized for work-related injuries 36% were from heat burns. Fifty percent of burn injuries occurring in fast-food restaurants are due to hot grease (MMWR, 1993). The greatest risks for grease burns were found to be associated with older-model deep fryers which require certain operation and cleaning procedures found to be dangerous. Hayes-Lundy (1991) reviewed the safety practices of a group of restaurants found to have a high incidence of burn injuries. Their study found deficiencies in a number of areas including orientation and training about the risk of burns, proper work practices around grills, methods used for grill cleaning - often without gloves and in a manner that contributed to splashes, floor maintenance that did not include use of degreasers or lacked nonslip mats (greasy floors contributed to slips into grease vats), and grease handling often done while hot and involved movement of large containers without secure lids.

Although any injury category has the potential for severe disability, certain injuries are of particular concern. Amputations, dislocations, fractures, concussions and multiple injuries

accounted for 855 (5.7%) of all injuries among minors. Other injuries may be equally severe and can lead to temporary or permanent disability, but the presence of these specific conditions provides an indicator that teen workers are working in environments that place them at serious risk for long-term consequences. Specifically, the tasks and tools require further evaluation to identify preventive strategies.

While the teen population is distributed approximately equally according to gender in both the total population of 14- to 17-year olds and in the working population of 16- and 17-year olds, the injury rate for males is almost two times greater than that for females. This is consistent with findings by other researchers (Banco et al., 1992; Belville et al., 1993; Brooks et al., 1993; Layne et al., 1994). The reasons for this trend have not yet been identified. Some possible explanations may include that males work in more hazardous jobs, work longer hours, exhibit more risk-taking or reckless behavior, or have a tendency to report more injuries. This is an area that requires further study.

Although the numbers employed in Public Administration is smaller than any other industry and the frequency of claims is also low, this industry had the highest injury rate for all minors (27.0 per 100 workers), with males having twice the rate as that seen for females. As in other industries, most of these claims were for medical benefits alone. Due to the high rates found in this industry, a more detailed review of the microfiche records for these claims was undertaken to identify any possible errors in the data with respect to age, and also to obtain more detailed information on the actual tasks involved in the occurrence of the injuries.

There was a total of 65 claims in the public administration industry category filed by 16- and 17-year olds during 1990. Forty-seven (72%) of these were in the State Fund and 18 (28%) in Self-Insurance. Since these data were utilized to calculate the injury rates a detailed review of the microfiche claim records was performed on 44 of the State Fund claims. Information was not available for 3 of the State Fund claims. Access to the Self-Insurance claim records with detailed information was not available. All 44 claims reviewed had appropriate age information recorded. All were employed by municipalities or state agencies, including 12 for the Department of Natural Resources (DNR). Most were involved in summer jobs as trail crew, grounds keeper, and park maintenance; five were lifeguards. Several were involved with pruning or felling trees, including the use of pruning shears, hand and power saws, and a chain saw. Most injuries were sprains (14) almost half of these to the back, followed by lacerations (9), contusions (7), eye injuries: abrasions (3) and chemical burn to the eye (1), head injury (3), puncture wounds (3), bee sting (2), fracture (1), and displaced tooth (1). One received multiple injuries when he was assaulted by four men while cleaning road signs. The eleven minors working for DNR were inmates working out of assigned youth camps.

Similar findings about injuries in public administration have been noted elsewhere. In the study by Banco (1992), public administration had the third highest injury rate among minors with 30.3 injuries per 1000 worker after general merchandise store (55.6) and food store (41.9). The public sector has also been found to have high injury rates in adults. Preliminary results of a worker safety and health survey in New Jersey found that public

employees were almost twice as likely as private sector workers to suffer a job-related illness or injury in 1993 (BNA, 1995).

Construction had the second highest injury rate for minors (21.1 per 100 workers), and the highest for adult workers (24.6 per 100 workers). Injuries in construction were found in the older age group (16- and 17-year olds), primarily among males, and included lacerations, sprains and contusions. Most of these claims were for medical benefits only. Jenkins (1993) found the construction industry to have the second highest rate of occupational injury death among workers of all ages and contributed to the deaths of at least 59 young workers. The appropriateness of youth employment in the construction industry has been questioned and requires further evaluation (Castillo et al., 1994).

In this population as well as in other studies, in general, the proportion of work-related injuries tends to increase with age among adolescents (Banco et al., 1992; Heyer et al., 1992; Belville et al., 1993). It is possible that this reflects the proportion of the various age groups in the work force. Without denominator data on those under the age of 16 years, comparisons using rate of injury can not be made. However, Parker (1994a) found that younger students tended to have injuries more frequently than their older peers. In this study, among all claims for minors in both the State Fund and Self-Insurance data there was a greater proportion of claims among 11- to 15-year olds in Agriculture and Public Administration than found in other industries. Among Self-Insurance claims for minors there was a higher proportion of claims for the youngest age group in Service industries. This finding may reflect the industries in which a higher number younger workers are found because they are not prohibited from participating in occupations or tasks found in these jobs. Further conclusions can not be made from these data.

The finding regarding a higher proportion of claims among the youngest workers (under 16 years of age) in Agriculture has been identified in previous studies (Layne et al., 1994; Heyer et al., 1992). In a study of Washington State worker compensation claims, Heyer (1992) found that there was a higher proportion of claims in general among children aged 13 years or younger working on farms than among all minors working in Agriculture (36% vs. 7%), and specifically more severe and disabling claims. Fourteen- and fifteen-year olds in agriculture also had a higher proportion of injury claims (17%) compared to 16- and 17-year olds (5-7%). Their study included data from 1986 to 1989, which was prior to changes in the agricultural child labor regulations in Washington State which occurred in 1990. In this current study the proportion of claims among 11- to 15-year olds doing farm work decreased from 21.7% of claims in 1989 to 14.8% in 1990. For 16- and 17-year olds this trend was not evident. It is not known if this decrease in Agriculture claims among the youngest age group is due to changes that occurred in the child labor regulations, which raised the minimum age for agricultural employment to 14 years of age (except for selected tasks mentioned earlier).

In this study the vast majority of claims received medical benefits only rather than time loss compensation. Time loss compensation or wage replacement under the Washington State workers' compensation system begins after the loss of 3 or more work days. Conclusions about this finding that most claims do not lead to lost work time must be

qualified with more information about adolescent's schedules and information from other research studies. Compensation status (medical benefits alone vs. wage replacement) is generally thought to identify the severity of an injury or condition and possible disability since an individual has to miss more than 3 days of work to qualify for time loss benefits. For working adolescents who miss 3 or more days of work due to an injury when they are more than likely to work part-time may indicate an even greater difference in level of severity than for adults. On the other hand, it is possible that since most children do not depend on the income from a job in the same way that adults do, they may not have as many concerns about missing work time.

Although certain injuries may not lead to lost work time, missed school time must also be taken into consideration. Parker (1994b) found that missed work time due to injury also contributed to missed school time, although individuals tended to miss more work days than school days. In their study, sprains and strains, lacerations, burns, contusions and fractures constituted 96% of injuries reported to the Minnesota Department of Labor and Industry. Fourteen percent of teens missed 2-7 school days, and 4% missed 8-90 school days. Nearly 40% reported missing 4-29 work days, and 14% missed 30 days or more. In particular, the amount of school missed was associated with injury to the back and neck. This is an area in need of further research.

Implications For Prevention

The information obtained from this study has identified where teens are most commonly employed and injured, and provided details regarding those injuries. Although there are limitations in the data systems used for this study there are sufficient data available to target areas in need of special attention and to develop ideas for health and safety programs which focus on prevention activities. For instance, the restaurant industry employs the highest percentage of teen workers and has the highest frequency of claims overall, especially lacerations and burns. Lacerations involve primarily knives, and burns involve primarily hot grease and water. Intervention strategies which look at both the tools and tasks involved may need to assess a variety of job factors, such as redesign of the knives and deep fat fryers; changes in the performance of the tasks in which they are used; use of specific personal protection, such as knife-resistant-gloves, or safety glasses and long sleeve material to prevent contact from splashes with hot grease; and increased training and supervision. Managers, teens and health and safety professionals should be involved in identifying the most useful mechanism for designing and implementing age-specific accident prevention programs.

The available data can also be utilized for hazard surveillance to identify problem areas, monitor trends over the course of time and identify areas that may require modification. Improvements in the data, however, may be necessary to enhance such activities. For instance, the ability to determine the number of hours worked by age from the Employment Security Department, or use of work permits to identify the number of teens working would allow a more accurate determination of the rate of injuries. Also, possible specific associations between employment and the occurrence of work-related injuries in this age group may be identified.

Enforcement and consultation activities may also be areas for improvement. The central office programs at L&I responsible for child labor regulations (Employment Standards) and the general health and safety standards (Consultation and Compliance) are separate in their focus. Enforcement of the new regulations adopted in December, 1992 will require increased communication and cooperation between the two programs in order to address the hazard communication, blood-borne pathogens, respiratory protection, and hearing conservation standards cited in the new rules. This collaboration would promote increased efficiency in the utilization of the resources of both programs. An intra-agency agreement already exists which allows Employment Standards and Safety and Health Compliance staffs to cross-enforce each other's regulations. This was the result of the February, 1991 OSHA mandate to develop cooperative efforts between the former divisions for Employment Standards (ESAC) and Industrial Safety and Health (WISHA) (see CPL 2.92). Other existing WISHA health and safety regulations which apply, should also be extended to minors and tailored to adolescent learning needs such as Accident Prevention Programs (WAC 296-24-040).

The industrial relations agents (IRA's) who enforce the minor work rules and investigate violations do not have specific training regarding regulations supported by safety and health consultation or compliance officers, and would benefit from increased training around these issues. At the same time, safety and health compliance inspectors generally are not likely to visit workplaces in which the majority of children typically work, i.e., fast food restaurants and grocery stores, nor are they versed in the specifics of the child labor regulations. However, they are a valuable resource for the IRA's. Employers who hire minors may not be aware of the consultation services of the agency which could provide assistance in addressing health and safety concerns of their younger workers.

NIOSH has begun to place special emphasis on the health and safety of minor workers. At a recent conference, the director of NIOSH, Dr. Linda Rosenstock, identified the need for increased enforcement activities, re-evaluation of the appropriateness of current permitted occupational activities, especially in agriculture and construction, and the incorporation of health and safety training in all job-training programs (Rosenstock, 1994). The research priorities identified include the use of surveillance activities to identify hazards and trends of workplace injuries; the evaluation of the organization of work and the effects of the conditions of work on health outcomes; the evaluation of control technology to improve engineering designs which may prevent injury and illness; an increase in the use of intervention research to assess the effectiveness of recommendations and prevention activities; and health services research to evaluate a variety of issues involved with the delivery of health care to workers (Smith, 1994). Currently, NIOSH has convened a special work group on child labor whose focus is to identify research and data issues, and preventive strategies needed to address occupational injuries among minors.

Conclusions

This study has identified a serious injury problem among teen workers in Washington State. It appears that minors have more than three times as many injuries when adjusted for the number of hours worked than do adults. The frequency, rate, and severity of injuries experienced by young workers is significant and has been largely unrecognized by many health professionals, regulators, employers, teens, parents, and schools. The information presented in this report represents a challenge for those involved with the health and well-being of adolescents. Young workers deserve to expect a safe work environment the same as adult workers do. Their experience with work during such formative years can affect their health and outlook for years to come. Their educational, developmental, and health needs require special protection on the part of those with whom their well-being has been entrusted. It is the responsibility of those with knowledge of unsafe environments or situations to eliminate the hazards, modify the conditions, and strive for effective controls.

The new child labor regulations are one part of the effort to protect of young workers from injury, illness and death in the workplace. Other efforts that focus on education and training regarding enforcement and compliance activities are also needed. Educational and training efforts which target employers, teens, parents, and schools regarding the health and safety problems encountered in the workplace should also be developed. Health and safety training must be incorporated into injury and illness prevention programs in employment settings for teens as well as in job-training programs. Strategies and solutions for prevention require the interaction and active participation of all concerned parties. The principles of injury control and prevention should be applied in the work environments in which teens are employed.

Recommendations

Based on the findings of this study and others reviewed here, further efforts are needed to reduce the occurrence of occupational injuries in this population. Recommendations to achieve this goal are provided below and are addressed to the broad range of health and safety professionals, policy makers, and others concerned with the healthy growth and development of our youth.

- Use the data systems within L&I to target areas in need of special attention, and develop health and safety programs that focus on prevention activities. For instance, determine strategies for reducing injuries such as lacerations, sprains and burns in the restaurant industry. Continue to monitor these data for possible trends in the incidence of injuries.
- As more research becomes available, periodically review allowable duties to determine if the tasks are age-appropriate, determined in part by injury data as well as through knowledge of the developmental abilities of adolescents.
- Investigate the possibilities for improved data sources such as the use of hospital emergency department data for inclusion in efforts for workplace injury surveillance among adolescents and the availability of reported hours data from the Employment Security Department with age information.
- Consider utilizing a work permit system or the PSA form as a method to identify the numbers of working adolescents in order to more accurately determine injury rates.
- Promote increased cooperation between regional staff who provide consultation services and ensure enforcement of the minor work rules and those who deal with the health and safety standards. Consider providing cross-training individuals in the two programs most involved in health and safety and child labor to increase the capacity and resources available for activities related to the health and safety of adolescent workers.
- Encourage the use of safety interventions and personal protective equipment such as safety glasses, long sleeves and special gloves to prevent abrasions, burns and lacerations in specific industries in which high frequencies of these injuries have been found.
- Promote the development of an educational outreach strategy to teens, parents, schools, employers and health care professionals regarding these findings to alert involved individuals of the risks of injury in the workplace and the need for the development of preventive strategies.

- Promote age-appropriate education and training programs on workplace health and safety issues to employers and schools including hazard communication, injury and illness prevention, and safe task performance and tool-handling.
- In the implementation of the School-to-Work Act, ensure the inclusion of health and safety training for teenagers enrolled in these programs. Such training should include not only basic concepts applicable to any workplace setting they may encounter in the future, but also information specific to a job placement while enrolled in a school-based program.
- Collaborate with the Washington State Department of Health to include the problem of workplace injuries among adolescents in their strategies for injury prevention and in the targeted interventions in the Public Health Improvement Plan for Washington State.

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Tables

List of Abbreviations

Industry

Ag/For/F.....Agriculture/Forestry/Fishing
Construct.....Construction
Sales.....Other Retail Sales
Manufact.....Manufacturing
Transport.....Transportation
Public Ad.....Public Administration

Occupation

Transport/Material.....Transportation/Material
Moving
Tech/Sales/Admin
Technical/Sales/Administrative Support
Prec/Prod/Craft/Repair
Precision/Production/Craft/Repair
MachOp/Assembling.....Machine
Operator/Assembling/Inspecting

Body part injured

Trunk/MSK.....Trunk, Other Musculoskeletal

Type of injury

Hot Temp..... Hot Temperature
Toxic Exp..... Toxic Exposure
Reaction..... Bodily Reaction
Vehicle..... Moving Vehicle

Nature of injury

Burn/Chem..... Burn/Chemical
Multiple..... Multiple Injury
Sprain..... Sprain/Strain

Appendix A

Technical Notes: Missing Birthdates on State Fund Claims

Technical Notes: Missing Birthdates on State Fund Claims

In the process of evaluating the State Fund worker compensation data base for injury claims among minor workers for the years 1988-1991, it was discovered that a significant number of claims had entries with **Age = 00**. Age is a calculated field based upon the birthdate entered. On further investigation it was discovered that **Birthdate** on these claims was either coded as 00/00/00, while others had a birth year entered that produced a calculated age ranging from 1-10 years.

The claims for those with age listed as 1 to 10 years were reviewed to determine the if these claims were for children or adults. In most cases, birth year as entered on the claim form was found to be incorrect, and that the task involved in the injury could not have been performed by a child. Due to concerns over data integrity, claims with age < 11 years were dropped from the evaluation. This was approximately 60 claims for these 4 years. This elimination risks losing any actual claims for the very young, especially in agriculture where they were most likely to be working.

It was also found that the absent data (those with "Age" = 00) increased dramatically over the course of the 4 years. The total claims among all age groups in the worker compensation system remained relatively stable over these years. However, the field in which "Age" was coded 00 increased from 0.2% (n=384) in 1988 to 1.3% (n=2,545) in 1991.

To determine the nature of this problem, microfiche were reviewed on 185 (7.3%) of those claims filed in 1991 to the State Fund in which "Age" and/or "Birthdate" were coded as 00 in the database. Self-insurance claims were not evaluated for missing data.

Of the 178 microfiche records with the actual claim form included, 21 (11.7%) had "Birthdate" completed correctly on the Worker Section of the claim form, but the records in the database reflected no entry. This leaves 157 claims (88.3%) with absent (124) or incorrect (33) information in the "Birthdate" field of the Worker Section. Among the 33 claims with incorrect information, birth year was always listed as "91" (the year the claim was filed). Occasionally the "Birthdate" corresponded to the "Date of Injury". However, it is likely that it was a mistake of current year being substituted for birth year.

The actual claim form record was missing for 7 claimants, but in an effort to assess the minor/adult proportion of claims missing age, the rest of the record was reviewed for "Age". It was determined that 136 of claimants missing age were adults, 6 were minors, and 43 could not be determined. The proportion of claims misclassified or missing information among minors reflects the representation of this age group in the total claimant population. In other words, neither adults or minors are more likely to be over represented with coding errors.

Recommendation

In order to increase the possibility that this information is captured, add an "Age" field in the Worker section of the claim form, and "Birthdate" field in the Provider section. Also, increased training of those involved in data entry. An increased level of awareness regarding the importance of this information may also contribute to improved accuracy.

Appendix B

**Amputation Injuries Among Minors, Accepted State
Fund Claims: 1988-1991**

Amputation Injuries Among Minors, Accepted State Fund Claims: 1988-1991

1). 17-year-old Male:

While operating a router, a piece of particle board got jammed and pulled my finger into the rotating blade cutting almost all my right index finger. Diagnosis: amputation by disarticulation at metacarpophalangeal joint. Employer type: custom doors and cabinets (family owned).

2). 17-year-old Male:

Right hand caught in gears of crab pot maker and cut part of fingers off. Greasing machine while gears still moving; glove became caught. Diagnosis: amputation mid-proximal (thumb) phalanx; amputation base proximal (index) phalanx; amputation base (3rd digit) long phalanx (middle). Employer type: crab pot manufacturer; occupation: laborer

3). 16-year-old Female:

Slicing tomatoes and cut right thumb. Using electric slicer, amputation distal right thumb. Job: Food preparer/waitress, employed 2 days. Employer type: deli (employer questioned time loss).

4). 16-year-old Male:

Dumping cheese out of totes, slipped and fell with load in arms onto pallet crushing left middle finger. Amputating injury to distal phalanx of left middle finger. Job: Warehouse; Employer: Food processor.

5). 12-year-old Male:

Cleaning meat slicer with a rag and bumped by coworker. Amputation of right index finger distal phalanx. Employer: grocery store.

6). 16-year-old Male:

Operating (cleaning) a meat slicer, two-thirds amputation between tip and DIP joint of left 3rd and 4th digits with fracture and tendon involvement. Employer: Deli.

7). 16-year-old Male:

Passing the end of conveyor belt, shirt caught on some metal on the machine, tried to push off, leather mitten became caught in belt, tearing my finger off. Amputation at

DIP left ring finger, fracture DIP left 3rd digit. Job: laborer/stocker; Employer: Lumber industry.

8). 17-year-old Male:

Working near a rotating belt, slipped and lost balance and caught right index finger in rotating chain. Amputation distal 1/3 right index distal phalanges. Job: helper; Employer: potato packing.

9). 14-year-old Male

On meat slicer blade, Amputation fingertip right thumb. Job: dishwasher; Employer: restaurant.

10). 15-year-old Male:

Cutting green peppers with knife and cut off tip left thumb. Amputation tip of left thumb. Job: food prep/cashier; Employer: fast food restaurant.

11). 16-year-old Female:

Cleaning electric meat slicer. Amputation of distal right index fingertip (including sensory loss and inability to use distal phalanx, and development of osteomyelitis). Job: Deli clerk; Employer: Grocery store.

12). 17-year-old Male:

Using automatic slicer to cut lettuce heads, pulled down top weight, hand was bumped into slicer. Amputation of left 4th and 5th finger tips. Job: Cook; Employer: Restaurant.

13). 17-year-old Male:

Slicing mushrooms with slicing machine, pushed mushrooms further down and got fingers caught in blade. Amputation of distal 2 mm pad right 3rd finger. Job: dishwasher/food preparer; Employer: Restaurant (pizza parlor).

14). 17-year-old Female:

Using cheese shredder, grinding cheese and hand got caught. Amputation of left thumb, index, middle, and ring fingers. Job: General duties; Employer: Restaurant (pizza parlor).

15). 17-year-old Male:

Cutting with lopper. Amputation tip of left index finger. Job: Laborer; Employer: Orchard.

16). 17-year-old Male:

Using meat band saw, amputated distal end of left ring finger. Job: Helper; Employer: Meat market.

17). 15-year-old Male:

In attempt to adjust mower deck height, placed hand near blade. Amputation of distal end left 3rd and 4th digits with comminuted fractures of distal phalanges. Job: Maintenance assistant; Employer: Job Training Center.

18). 16-year-old Male:

Unloading hay caught finger in hay escalator. Amputation distal end of right index finger, and fracture of right olecranon (elbow) with retained internal fixation. Job: Farmhand; Employer: Farm.

19). 16-year-old Male:

Slicing mushrooms, cut tip of finger off. Amputation of left 4th and 5th digits. Job: prep Cook; Employer: Restaurant (pizza).

20). 17-year-old Male:

Lost footing and fell on hedge trimmer. Incomplete amputation left 4th finger distal phalanx with fracture. Job: Laborer; Employer: Landscaping.

21). 16-year-old Male:

Helping customer load railroad ties, and left thumb was smashed between several. Incomplete amputation distal phalanx of left thumb with open fracture. Job: Laborer; Employer: Farm Supply.

22). 17-year-old Male:

Using drill press, finished first six starter holes, drilled two normal holes and went to move board down - can't remember it happened so fast. Amputation of left 3rd, 4th, and 5th digits at level of metacarpophalangeal joint; neurovascular laceration injuries to left index finger. Job: Wood crew; Employer: Wood fabrication.