INJURIES DUE TO FIRES, FLAMES, AND HOT SUBSTANCES AT WORK IN MASSACHUSETTS, 2003 - 2004

Deaths, Hospital Discharges, & Emergency Department Visits

Prepared by: The Massachusetts Department of Public Health, Occupational Health Surveillance Program January 2010

KEY FINDINGS

Work-related injuries arising from exposure to fire, flames, or hot substances ("FFHS") are a serious public health concern in Massachusetts as they are in the nation as a whole.

In Massachusetts during 2003 and 2004, there were 5 deaths, 78 injuries resulting in hospitalizations (1.3 per 100,000 full-time workers), and 4,413 injuries resulting in emergency department (ED) visits (72.9 per 100,000 full-time workers) caused by exposure to FFHS at work.

All of the deaths were related to fires or fire-related explosions. Three of the five fatally injured workers were employed in the construction industry.

Among the non-fatal FFHS injuries, burns were the most common type of injury, accounting for 72% of the FFHS injuries resulting in hospitalizations and 82% of the FFHS injuries resulting in ED visits. Of the hospitalized burns, 39% were 3rd degree and 55% were 2nd degree burns; whereas 1.4% of the ED burns were 3rd degree and 55% were 2nd degree burns.

Rates of work-related FFHS injuries resulting in hospitalizations and ED visits differed by sex, race/ethnicity, and age:

- Males had higher rates of FFHS injuries resulting in hospitalization (2.1 vs. 0.3 injuries per 100,000 full time workers) and ED visits (83.0 vs. 59.8 injuries per 100,000 workers) than females.
- Black workers had higher rates of FFHS injuries resulting in hospitalizations than white workers (3.2 vs. 1.1 injuries per 100,000 full time workers).
- Hispanic workers had higher rates of FFHS injuries resulting in ED visits than white workers (135.0 vs. 64.2 injuries per 100,000 full time workers).
- Younger workers (15-24 years) had a higher rate of FHHS injuries resulting in ED visits than older workers 25-44 years (222.4 vs. 70.1 injuries per 100,000 full time workers).

BACKGROUND AND INTRODUCTION

Injuries caused by exposure to fire, flames or a hot substances (FFHS injuries) can have a variety of different medical diagnoses, including thermal burns, non-burn injuries to the skin or underlying tissue, nerve or sensory organ damage, other systemic effects, smoke inhalation, or carbon monoxide poisoning. The majority of injuries, however, are burns. Nationally, close to 434,000 burn injuries occur each year. Of these, an estimated 42% (183,000) occur in the workplace and account for approximately 3.3% of all work-related injuries reported annually (Smith GS, 2005).

While burns account for a relatively small percentage of the overall occupational injury burden, the costs incurred for burn treatment and rehabilitation are disproportionately high (MDPH-OHSP, 2005; Baggs J, 2002). In Massachusetts, average hospitalization charges for work-related burns were higher than for all other work-related injury types; twice as high as the next most costly (internal organ injuries and amputations) and nearly three times the overall average charge for hospitalized work-related injuries (MDPH-OHSP, 2005). Further, work-related burns result in additional economic and substantial human consequences for injured workers, their families, employers, and society at large. In 2004, two-thirds of work-related burn cases reported by Massachusetts' employers involved three or more lost days of work (BLS SOII, 2006). Washington State reported an average cost per workers' compensation claim of $50,194 (median of $15,648) for hospitalized work-related burns and an average of 135 days (median 38 days) of lost work for these severe burns (Curwick CC, 2006).

METHODS

Data sources: We identified the numbers and rates of work-related FFHS injuries in Massachusetts using three data sources and were able to look at these data by gender, race/ethnicity, and age categories. The three sources were:

- Fatal injuries: the Massachusetts Work-Related Fatality Assessment and Control Evaluation Program (FACE)
- Non-fatal injuries:
    - Massachusetts Inpatient Hospital Discharge (HD) Database
    - Massachusetts Emergency Department (ED) Discharge Database

Surveillance period: October 1, 2002 through September 30, 2004 (HD and ED data in Massachusetts are collected on the basis of the federal fiscal year, which begins in October).

Population under surveillance: FACE provides data on fatal occupational injuries that **occur** in Massachusetts. The findings based on ED and HD data sets provide information about workers who were Massachusetts **residents** and **treated** in Massachusetts hospitals.

Information presented: This bulletin focuses on all work-related injuries *caused* by fires, flames, or hot substances (FFHS). We focus on the ***cause of injury*** rather than the type of injury (i.e. medical diagnosis) to shed more light on the incidents or mechanisms that resulted in injury; information about the cause of injury can lead to more informed decisions about how to prevent work-related FFHS injuries in the future.

For the analysis of inpatient HD data, we excluded repeat hospitalizations for the same injury, in-hospital deaths, and hospitalizations of out-of-state residents. The unit of analysis was the first hospitalization during the surveillance period for the injury, unless otherwise specified. Likewise, for the analysis of ED data, we excluded repeat visits for the same injury (e.g. follow-up care), deaths during transport to or treatment in the ED, and visits for out-of-state residents. The unit of analysis was the first ED visit during the surveillance period for the injury, unless otherwise specified.

We present the number (count) of injuries as well as rates. The rates are presented as the number of injuries per 100,000 full time workers and were calculated as the number of injuries divided by the number of full-time equivalent (FTEs) workers multiplied by 100,000. Rates that are based on counts of less than 20 should be interpreted with particular caution because they are considered to be less stable. The numbers of FTEs used to calculate rates were obtained from the Current Population Survey (CPS). While the counts indicate the number of injured workers, the rates indicate the probability, or risk, of a worker being injured. Both numbers and rates should be taken into account when targeting prevention efforts.

Comparison of rates: In this bulletin, the terms “higher” and “lower” are based on statistical computations which indicate whether the difference between two rates are unlikely to be due to chance (i.e. “statistically significant”). For present purposes, a difference between two estimates is statistically significant if there is a less than 5% chance that it is due to chance alone.

Additional information about data sources and methods used in analyzing the data for this bulletin is available in the Appendix.

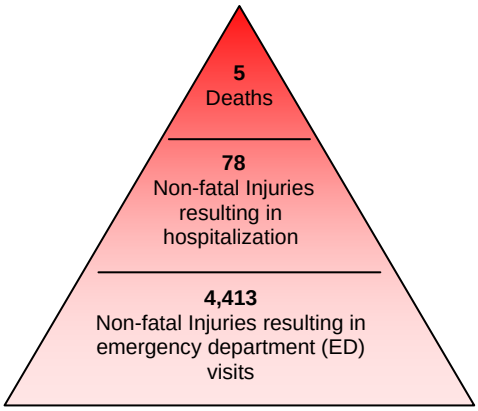
Limitations: Findings based on hospital data sources (both HD and ED data) in this report are conservative estimates of the burden of work-related injuries due to FFHS. These data sources do not include work-related injuries that are treated at home or the worksite, in a clinician’s office or at a health center or other outpatient clinic. Also, injuries in the HD and ED data sets are considered “work-related” only if workers’ compensation (WC) is designated as the expected payer of medical treatment in the hospital record. Under-reporting of work-related conditions (Pransky G, 1999) and under-utilization of WC benefits for work-related conditions are well-documented in the literature and are recognized to vary by industry and workplace (Morse T, 1998; Rosenman KD, 2000; Biddle J, 1998). Further, neither the HD nor ED database includes information about industry where the injured worker was employed. Thus, while these data sources provide important information about the extent of work-related FFHS injuries and their distribution by sex, age, and race/ethnicity, information that can be used to target specific worksites for prevention are not available from these sources. To address this limitation, we looked at three additional sources of information focusing on work-related burns which do include information on industry. These data on industries where burns occurred are presented in a separate section at the end of the bulletin.

Funding source: This work was funded in part through a cooperative agreement with the National Institute for Occupational Safety and Health (U60/OH008490).

Fatal and non-fatal work-related injuries due to fires, flames or hot substances (FFHS) in Massachusetts

There were a total of 4,496 work-related FFHS injuries identified during the surveillance period (Figure 1). The severity of the injuries ranged from non-fatal injuries resulting in ED visits (4,413 injuries) to non-fatal injuries resulting in hospitalization (78 injuries) to fatal injuries (5 injuries). The causes for injuries across this severity spectrum are not necessarily the same. For example injuries resulting in ED visits are more likely to be due to scalds by hot substances, whereas deaths are more likely to be due to fires in burning buildings. In turn, efforts to prevent the less severe injuries that result in ED visits may not necessarily address fatalities due to fire. Understanding the different causes of injuries along this severity spectrum is essential to designing comprehensive strategies to prevent FFHS injuries of different severities.

Figure 1: Work-related injures due to FFHS in Massachusetts, 2003-2004 (N=4,496)



Fatal work-related FFHS injuries

Five workers were fatally injured by FFHS during the surveillance period, accounting for 3% of the all fatal occupational injuries in Massachusetts (n=150) during this time period. All five workers were male and all died as a result of fires or fire-related explosions. Three victims worked in the construction industry, two of whom died when fumes from a floor finishing product ignited causing an explosion and fire in the multi-story house in which they were working. One worked in transportation and warehousing and another in fire services.

The Massachusetts FACE project conducted an investigation of the floor finishing incident and released an alert in conjunction with the Department of Fire Services (in both English and Vietnamese) with recommendations to prevent similar incidents to floor finishers throughout the state: www.mass.gov/Eeohhs2/docs/dph/occupational_health/wood_floor_sanders.pdf.

Non-fatal work-related FFHS injuries resulting in hospitalization

There were 78 non-fatal work-related FFHS injuries that resulted in hospitalization; the rate was 1.3 injuries per 100,000 full time workers.

Hospitalizations for these types of injuries represented 3% of all hospitalizations for work-related injuries among Massachusetts residents during this period.

The majority of the FFHS injuries resulting in hospitalization were caused by exposure to hot substances (62%) such as hot liquids, steam, grease or other hot substances.

Types of injuries (primary medical diagnoses)

The majority of the 78 FFHS injuries resulting in hospitalization were **thermal burns** (72%) (Figure 2).

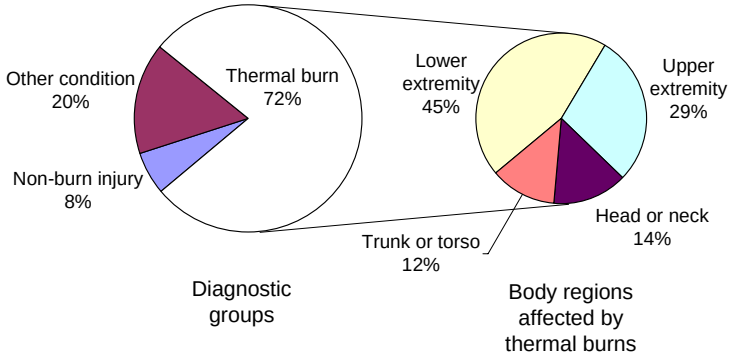
Thermal burns to **the lower and upper extremities** (i.e. limbs) accounted for almost three-quarters (74%) of the burns. Fourteen percent were burns to the **head or neck**.

5% of the burns were 1st degree; 55% were 2nd degree; and 39% were 3rd degree.

Information on the percent of body surface area (BSA) affected was available for 48 of the burn injuries. Among these, 16 (33%) extended over 10% or more of the BSA.

Other types of FFHS injuries included conditions (20%) such as respiratory and skin disorders, and disorders of the eye a nd ear, and non-burn injuries (8%), such as smoke inhalation, fractures, injury complications, abrasions/other superficial injuries, and open wounds.

Figure 2: Types of diagnoses and body regions affected for non-fatal work-related FFHS injuries resulting in hospitalization, Massachusetts residents, 2003-2004 (n=78)



Rates by Sex, Race/Ethnicity, and Age

Sex

The rate of work-related FFHS injuries resulting in hospitalization was *seven* times[1] higher among males than females (Figure 3).

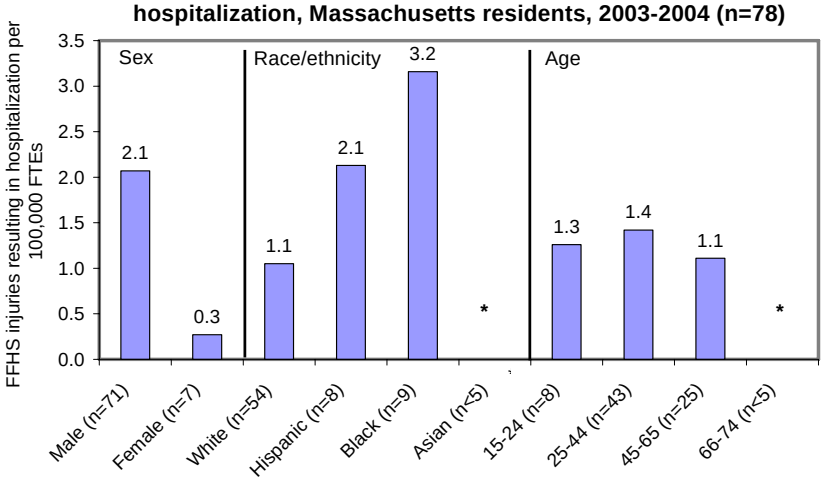
Race/ethnicity

Blacks had a rate of work-related FFHS injuries resulting in hospitalization that was nearly *three* times[2] higher than that for whites (Figure 3).

Age

Rates of work-related FFHS injuries resulting in hospitalization were similar across age groups (Figure 3).

Figure 3: Rates of work-related FFHS injuries resulting in hospitalization, Massachusetts residents, 2003-2004 (n=78)



* Numerator for this stratum is less than five.

[1] The relative difference in rates should be interpreted with caution because of the small number used to calculate the rate for females.
[2] The relative difference in rates should be interpreted with caution because of the small number used to calculate the rate for blacks.

Non-fatal work-related FFHS injuries resulting in Emergency Department visits

There were 4,413 non-fatal work-related FFHS injuries that resulted in (ED) visits; the rate was 72.9 injuries per 100,000 full-time workers.

Emergency department visits for this type of injury represented 3.4% of all visits for work-related injuries.

The majority of the FFHS injuries resulting in ED visits were due to exposure to hot substances (86%) such as hot liquids, steam, grease or other hot substances.

Types of injuries (primary medical diagnoses)

The majority of the 4,413 FFHS injuries were for **thermal burns** (82%) (Figure 4).

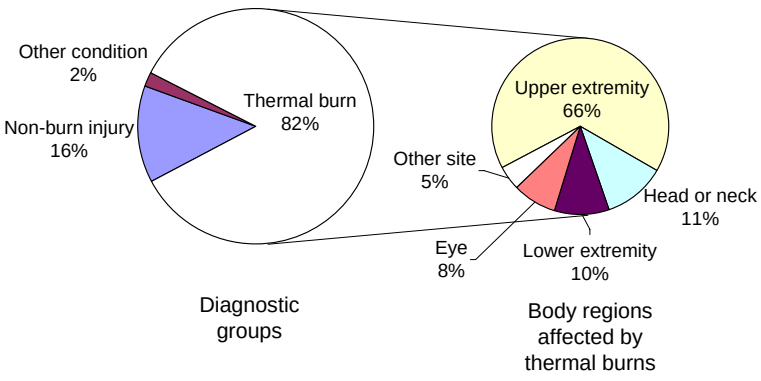
Thermal burns to the **upper extremities** (i.e. limbs such as wrists and hands) accounted for 66% of these burns. Eleven percent were burns to the head or neck and 10% were burns to the lower extremity.

25% of the burns were 1st degree; 55% were 2nd degree; 1.4% were 3rd degree burns; and 18% were not classified with respect to the burn degree.

Information on the percent BSA affected was available for 905 (20.5%) of the burn injuries. Among these, 22 (2%) extended over 10% or more of BSA.

Other types of FFHS injuries included non-burn injuries (16%), such as smoke inhalation, system-wide and late effects, abrasions/other superficial injuries, and open wounds and other conditions (2%), such as nervous system and sense organ disorders, skin disorders, musculoskeletal and connective tissue disorders.

Figure 4: Types of primary diagnoses and body regions affected for non-fatal work-related FFHS injuries resulting in ED visits, Massachusetts residents, 2003-2004 (n=4,413)



Rates by Sex, Race/Ethnicity, and Age

Sex

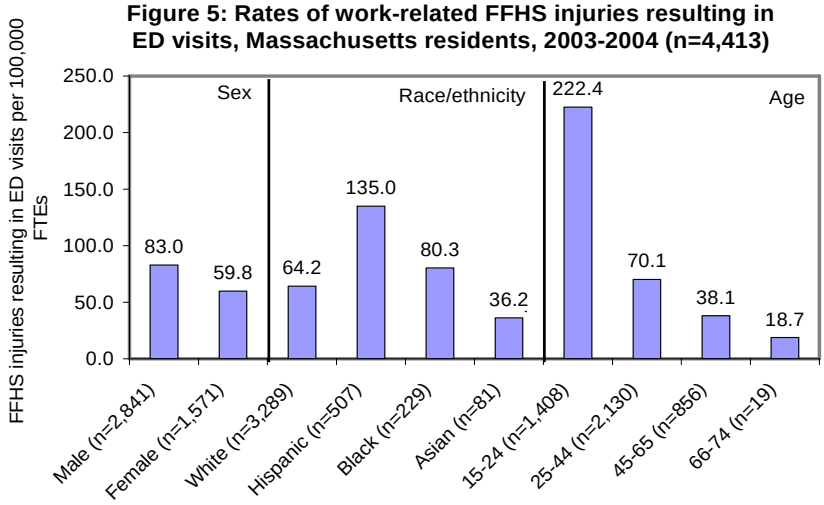
Males had a rate of work-related FFHS injuries resulting in ED visits that was nearly *one and a half* times higher than that for females (Figure 5).

Race/ethnicity

Hispanics had a rate of work-related FFHS injuries resulting in ED visits that was *two* times higher than that for whites (Figure 5).

94% of the FFHS injuries resulting in ED visits among Asians were due to hot substances, verses 85-89% among other racial/ethnic groups (data not shown).

Figure 5: Rates of work-related FFHS injuries resulting in ED visits, Massachusetts residents, 2003-2004 (n=4,413)



Age

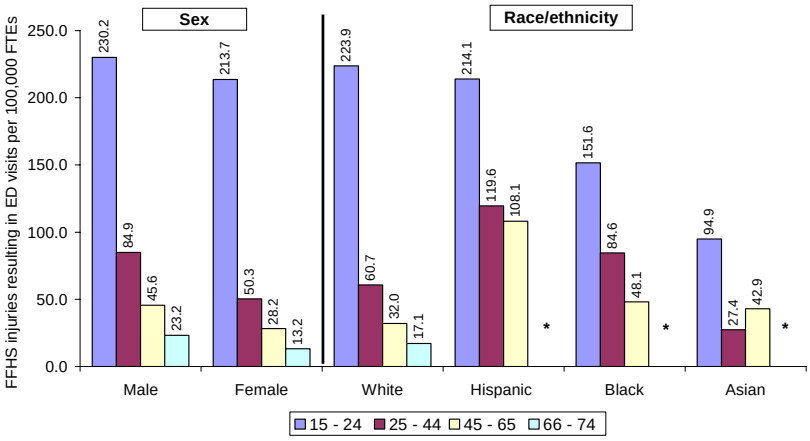
Young workers (aged 15 to 24 years) had a much higher rate of work-related FFHS injuries resulting in ED visits than older workers (three times higher than the next oldest age group of 25-44 years).

An analysis of a subset of teen workers, 15 to 17 years old, showed that teen workers experienced an even higher rate of work-related FFHS injuries resulting in ED visits (414.6 injuries per 100,000 full time workers; n=224) (data not shown).

93% of the FFHS injuries resulting in ED visits among 15 to 24 year olds were due to hot substances, verses 81-84% among the other age groups (data not shown).

Young workers (15 to 24 years old) consistently had higher rates of FFHS injuries resulting in ED visits, across both sex and all racial/ethnic groups (Figure 6).

Figure 6: Age-specific rates of work-related FFHS injuries resulting in ED visits by sex and race/ethnicity, Massachusetts residents, 2003-2004 (n=3,811)



* Numerator for this stratum is less than five.

Industries Where Non-Fatal Work-Related Burn Injuries Occurred

Burns were identified as the most common type of work-related FFHS injuries in the hospital and emergency department data; however, the types of workplaces in which workers were burned could not be identified from these data sources. We used three additional sources of data to identify the industries in which work-related burn injuries most commonly occur.

These data sources were:

- Survey of Occupational Injuries and Illnesses (SOII), Bureau of Labor Statistics, U.S. Department of Labor
- Massachusetts Burn Injury Reporting System (M-BIRS), Massachusetts State Fire Marshal's Office
- Massachusetts Teens at Work Injury Surveillance System (TAW), OHSP, MDPH

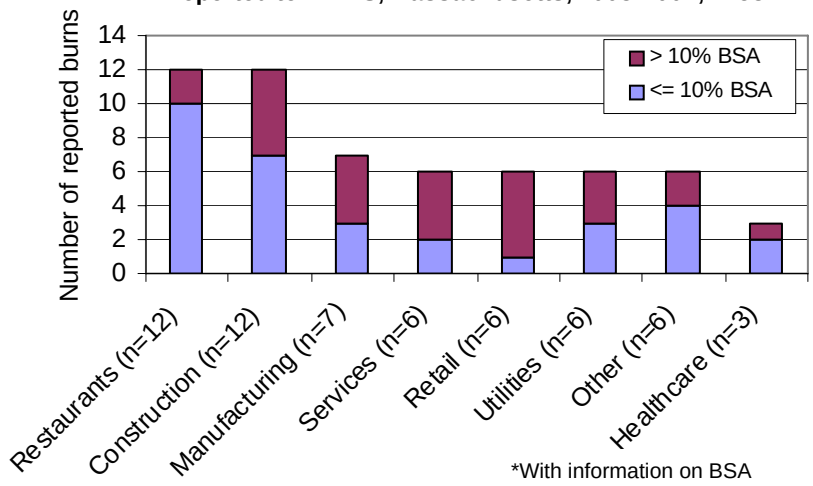
These data sources are subject to an unknown and varying degree of under-reporting, but nonetheless provide important information that can be used to target prevention efforts. Additional information about these data sources as well as the methods used in analyzing the data for this section of the bulletin is included in the appendix.

Note that while the majority burn injuries described in this section (based on the above data sources) are the result of fires, flames and hot substances, a small proportion are from exposure to other substances and external sources such as chemicals, friction, electricity, radiation, and extreme temperatures, both hot and cold.

Findings:

- According to the BLS SOII, in 2004, Massachusetts-based private sector employers reported the highest rate of burns involving days away from work in the **leisure/hospitality sector,** which includes workers in food preparation, service and delivery: 13.2 cases per 10,000 full time workers. The burn rate for all industries was 3.4 cases per 10,000 full time workers (BLS SOII).
- This finding from SOII is consistent with information from M-BIRS. Between 2003 and 2004, the largest number of burns with information on BSA occurred in the **restaurant industry (including retail bakeries)** and **construction,** followed by **manufacturing** and **other services** (MBIRS) (Figure 7).

Figure 7: Industry distribution of work-related burns* reported to MBIRS, Massachusetts, 2003-2004, n=58



*With information on BSA

- Nearly all of the reported burn injuries in the restaurant industry involved 10% or less BSA while burns covering greater portions of the victims' body surface occur most frequently in construction, retail, manufacturing, and other services (Figure 7).
- Based on the TAW, in 2004, of 72 ED visits[3] for burn injuries to teen workers (< 18 years old) with complete industry information, 65% occurred among **restaurant workers** and 7% occurred among **nursing home workers**. These ED visits for burn injuries accounted for 10% of all ED visits for work-related injuries among teens.

Collectively, these data indicate that burns commonly occur in restaurants and that serious burns, as indicated by BSA affected, occur most frequently in construction, manufacturing, and retail, suggesting that the workplace risk factors for serious burns may differ from those for less serious burns.

[3] These data are based on all ED visits, not just the first ED visit for a FFHS injury during the surveillance period.

DISCUSSION

In Massachusetts, work-related FFHS injuries present a significant public health concern. There were five deaths due to fire, with three in the construction industry, one in transportation and warehousing, and one in fire services during 2003-2004. Notably, work-related deaths in prior years due to fires were mostly among firefighters. Non-fatal but serious FFHS injuries resulted in close to 100 hospitalizations and over 4,000 ED visits. Thermal burns which were by far the most common type of injury caused by exposure to fire and/or scalds, represent about 4% of all work-related hospitalizations (MDPH-OHSP, 2005) and about 3% of all work-related ED visits (MDPH-OHSP, 2007); yet these injuries exact a human and economic toll disproportionate to their numbers.

An important finding in this bulletin is that not all workers in Massachusetts experience the same rate of FFHS injuries. Males, black non-Hispanic workers, Hispanic workers, and younger workers (15 to 24 years old, and particularly teenagers), are especially burdened, as evidenced by higher rates of work-related FFHS injuries resulting in hospitalization and/or ED visits.

Young workers in particular experienced higher rates of FFHS injuries resulting in ED visits (224.4 injuries per 100,000 full time workers). It is likely that the higher risk of injury among 15 to 24 year olds, particularly among the subset of teen workers, corresponds with their tendency to work in restaurants or other establishments that have a food service component (e.g., nursing homes). For example, the majority of burn injuries to teens identified through the TAW Surveillance System occurred in food service. Food preparation had especially high rates of burns in the BLS SOII, which was consistent with findings from M-BIRS, of which among the largest number of reported burns were in restaurants.

Also notable in this report was the disparity in rates of more serious FFHS injuries for males – i.e. those that resulted in hospitalization. Specifically, males were 7 times more likely to experience a hospitalized injury due to fires and/or scalds than females, whereas males were only 1.4 times more likely to experience an ED visit for an injury due to fires and/or scalds than females.

Risk of more serious injuries also differed by race/ethnicity – black, non-Hispanic workers were 3 times more likely to experience a FFHS injury resulting in hospitalization than white, non-Hispanic workers, although this finding was based on a small number of hospitalizations (and therefore warrants caution in interpretation). The higher rates of FFHS injuries among Hispanics and Blacks may correspond with these groups' higher likelihood of being employed in occupations that pose the greatest risk for exposure to fire and hot substances, compared with White workers (Hunt PR, 2005); however, data that could directly demonstrate this connection are not currently available.

The substantial number of FFHS injuries and disparate rates across population groups underscore the importance of intervention efforts that prevent or reduce FFHS injuries in these workers. Thermal burns account for the majority of these medically-treated injuries, and this finding is consistent with previous studies of work-related injuries using Massachusetts hospitalization and ED data (MDPH-OHSP, 2005 & 2007). Based on the supplementary data, the differences in industry distribution among burn incidents of increasing severity indicates that different types of intervention and prevention measures are necessary in addressing less serious and more serious work-related burns.

Intervention efforts aimed at both less serious and serious burns have been implemented recently in Massachusetts and are discussed in the next section.

Highlights of Occupational Health Surveillance Program (OHSP) Prevention and Intervention Activities

The high rate of burn injuries among teens in Massachusetts was previously observed through the TAW Surveillance System, prompting a number of prevention and intervention efforts. Interviews conducted with injured teen workers identified coffee brew baskets as a substantial source of scald injuries. Most of these scalds occurred when the brew basket, still containing near-boiling water, was pulled from the coffee pot before the brew cycle was complete, spilling the hot water/coffee mixture on the workers' hands. Sharing findings with a large retail bakery chain, OHSP was successful in promoting a redesign of coffee machine brew baskets; a simple lip was added to the basket limiting the potential for hot liquid spills under these circumstances. Additionally, this lip has made it easier to position the coffee filters in the brew basket, an unanticipated practical benefit.

Further, recognizing that immediate and proper first-aid treatment of a workplace burn or scald can decrease the chance of secondary infection and other sequelae, OHSP collaborated with the Department of Fire Services to create a poster on burn first aid. OHSP partnered with the

Massachusetts Restaurant Association to disseminate the poster to restaurants throughout the Commonwealth. This poster is available in English, Spanish, and Portuguese on the OHSP website at www.mass.gov/dph/teensatwork or by calling 1-800-338-5223.

In addition, TAW has an initiative focused on the safety of teens working in restaurants. The goal of this initiative is to reach out to young workers in the food services and restaurant industries and educate them about safety in the workplace, the Child Labor Laws, and their rights and responsibilities as workers. This project has focused on conducting "train-the-trainer" trainings for high school teachers in vocational technical education culinary arts programs in Massachusetts. This training has used a modified version of the "Youth @ Work: Talking Safety" curriculum, which teaches teens about workplace safety and health. TAW modified the general curriculum for use with culinary arts students. The modified version of the curriculum is available on the TAW website at www.mass.gov/dph/teensatwork.

Additional intervention and prevention activities for serious burn injuries were promoted by two incidents that occurred within 10 months in which three floor finishers were fatally burned and two others sustained serious burn injuries when the flammable lacquer sealer they were applying to wood flooring was ignited by gas pilot lights. A community initiated wood floor finishing task force was established to develop strategies to prevent similar incidents in the future. A wide range of stakeholders participated in the task force including wood floor industry representatives and product suppliers, Boston-based community organizations, health advocates, researchers, and representatives of government agencies. Boston-based community organizations identified the hazards associated with hardwood floor finishing. They then used this information to work with local employers and product distributors in developing strategies to reduce these hazards. This effort met with early success when local product distributors agreed to remove the highly flammable products that caused the fires from their product line. This particular aspect of the intervention was short-lived, however, as local distributors began to restore the hazardous product in response to competition and loss of business to distributors outside the Boston area. The task force remains active and has submitted bills to the Massachusetts legislature to prohibit the use and sale of flammable floor finishing products and require certification of wood flooring contractors and employees (Senate bills 949 and 137, House bills 2304 and 3891). Training for floor finishers on the benefits of alternative products and on application methods for less flammable floor finishing products is underway.

RESOURCES FOR ADDITIONAL INFORMATION

Occupational Health Surveillance Program
Bureau of Health Information, Statistics, Research & Evaluation
Massachusetts Department of Public Health
250 Washington Street, 6th Floor
Boston, MA 02108

Tel: 617-624-5632
Fax: 617-624-5676
www.mass.gov/dph/ohsp

Christine M. Farrell-O'Reilly, Coordinator
Massachusetts Residential Fire Injury Prevention Program
Injury Prevention and Control Program
Massachusetts Department of Public Health
250 Washington Street, 4th floor
Boston, MA 02108

Tel: (617) 624-6076
Fax: (617) 624-5075
www.mass.gov/dph/injury

Fire Data and Public Education Unit
Office of the State Fire Marshal
Department of Fire Services
P.O. Box 1025
State Road
Stow, MA 01775

Tel: 978-567-3380
Fax: 978-567-3199
www.mass.gov/dfs/osfm

Injury Surveillance Program
Bureau of Health Information, Statistics, Research & Evaluation
Massachusetts Department of Public Health
250 Washington Street, 6th Floor
Boston MA, 02108

Tel : (617) 624-5648
Fax : (617) 624-5099
www.mass.gov/dph/isp

Fatal work-related injuries identified through FACE

The Massachusetts Fatality Assessment and Control Evaluation (FACE) project, funded by the National Institute for Occupational Safety and Health (NIOSH), tracks fatal occupational injuries using multiple data sources and conducts in-depth research-orientated incident investigations of select fatalities. The aims of the investigations are to identify and learn about factors that contribute to fatal occupational injuries. FACE reports of these investigations that include recommendations to prevent similar incidents are disseminated to stakeholders throughout the Commonwealth.

Non-fatal work-related FFHS injuries identified in HD and ED databases

In Massachusetts, patient discharge records from all licensed acute care hospitals and emergency departments are collected by the Division of Health Care Finance and Policy (DHCFP) which compiles the Hospital Discharge (HD) Database and Emergency Department (ED) Discharge Database. The HD database collects information on inpatient hospital admission visits and the ED database collects information on ED visits that did not result in either an outpatient observation stay or an inpatient admission to the hospital.

After excluding repeat hospitalizations and ED visits for the same injury, deaths, and out-of-state residents, all available diagnostic fields were screened for at least one injury (i.e. ICD9-CM code between 800 and 900). FFHS injuries were then identified using the ICD-9-CM (E Code) framework for external cause recommended by the Centers for Disease Control, National Center for Health Statistics, www.cdc.gov/ncipc/osp/matrix2.htm (last accessed December 2008). A work-related injury was then identified by either a primary expected payer of worker's compensation or a diagnostic code (E Code or V Code) that indicated that the injury occurred at work.

Supplemental data sources used to identify industries for work-related burn injuries

Massachusetts Teens at Work Injury Surveillance and Prevention Project (TAW): The Massachusetts Department of Public Health's Occupational Health Surveillance Program collects data on work-related injuries to teens less than 18 years of age primarily from two sources: Massachusetts Emergency Department Discharge Database (Massachusetts Division of Health Care Finance and Policy) and Massachusetts Workers' Compensation data (Massachusetts Department of Industrial Accidents). More detailed data on work-related injuries to teens are also collected from a sample of hospital emergency departments on a monthly basis. For statewide ED data used in this report, burn injury visits with a primary ICD9-CM diagnostic code from 940 to 949 were identified among a total of 1,119 work-related ED visits to teens in calendar year 2004. These data include all burns arising from FFHS, contact with electricity, and contact with chemicals/corrosives. Information about the industries that employed injured teens was extracted from requested hospital medical records.

Massachusetts Burn Injury Reporting System (M-BIRS): Under Massachusetts General Law (Chapter 112, Section 12A), acute care hospitals and other health care facilities in the state must report the treatment of all burn injuries extending to 5% or more of a patient's body surface area (BSA) to the State Fire Marshal. Work-related burns are identified on the reporting form by the reporting hospital. Burn injuries included those resulting not only from FFHS but also from other substances and external sources such as exposure to chemicals, friction, electricity, radiation, and extreme temperatures, both hot and cold.

BLS Survey of Occupational Injuries and Illnesses (SOII): The Bureau of Labor Statistics (BLS) annually surveys a sample of private sector employers in Massachusetts and other states to provide estimates of occupational injury/illness burden. SOII reports the number and rate of work-related, nonfatal injuries and illnesses that private industry employers record under U.S. Department of Labor reporting rules. This survey excludes self-employed persons, persons working for private households, public sector workers, and workers on farms with fewer than 11 employees. Burn injuries were identified through the nature code (05) in the OIIC (Occupational Injury and Illness Classification) system which includes all burns arising from fire and flames, hot substance, contact with electricity, and contact with chemicals/corrosives.

Methods for computation of rates and statistical comparisons

The rates in this bulletin are based on Massachusetts employment figures obtained from the Current Population Survey for 2003 and 2004. Rates for HD and ED FFHS injuries are annual averages, expressed per 100,000 full time equivalent (FTE) workers. One FTE = 2,000 hours worked per year and includes hours for all jobs worked by a person.

The statistical comparisons between demographic groups were based on ninety-five percent confidence intervals (95% CI) of the rates. The 95% CI is a range of values determined by the degree of variability of the data within which the true value is

likely to lie, in the absence of bias due to sampling error (i.e. surveying a sample rather than the entire population). The CI indicates the precision of a calculation; the wider the interval the less precision in the estimate. Smaller population subgroups or smaller numbers of respondents yield less precise estimates. The Mid-P test 95% CIs for the rates were computed using the OpenEpi Software Program V7.5.11 available at www.sph.emory.edu/~cdckms/exact-rate.html (last accessed November 2008). Rates that are based on counts of less than 20 should be interpreted with caution as these fluctuate easily.

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