MMWR™
Morbidity and Mortality Weekly Report
www.cdc.gov/mmwr

Weekly April 24, 2009/ Vol. 58 / No. 15

Workers' Memorial Day — April 28, 2009

Workers' Memorial Day recognizes those workers who died or sustained work-related injuries or illnesses during the previous year. In 2007, a total of 5,488 U.S. workers died from occupational injuries (*1*). Another 49,000 annual deaths are attributed to work-related diseases each year (*2*). In 2007, an estimated 4.0 million private-sector workers had a nonfatal occupational injury or illness; approximately half of them were transferred, restricted, or took time away from work (*3*). An estimated 3.4 million workers were treated in emergency departments in 2004 (the most recent data available) because of occupational injuries, and approximately 80,000 were hospitalized (*4*).

Work-related injuries and illnesses are costly. In 2006, employers spent nearly $87.6 billion on workers' compensation (*5*), but this represents only a portion of total work-related injury and illness costs borne by employers, workers, and society overall, including cost-shifting to other insurance systems and most costs of work-related illness. Additional information on workplace safety and health is available from CDC at http://www.cdc.gov/niosh.

References

1. US Department of Labor, Bureau of Labor Statistics. National census of fatal occupational injuries in 2007. Washington, DC: US Department of Labor; 2008. Available at http://www.bls.gov/news.release/pdf/cfoi.pdf.
2. Steenland K, Burnett C, Lalich N, Ward E, Hurrell J. Dying for work: the magnitude of U.S. mortality from selected causes of death associated with occupation. Am J Ind Med 2003;43:461–82.
3. US Department of Labor, Bureau of Labor Statistics. Workplace injuries and illnesses in 2007. Washington, DC: US Department of Labor; 2008. Available at http://www.bls.gov/news.release/pdf/osh.pdf.
4. CDC. Nonfatal occupational injuries and illnesses—United States, 2004. MMWR 2007;56:393–7.
5. Sengupta I, Reno V, Burton JF Jr. Workers' compensation: benefits, coverage, and costs, 2006. Washington, DC: National Academy of Social Insurance; 2008. Available at http://www.nasi.org/usr_doc/nasi_workers_comp_report_2006.pdf.

Work-Related Fatalities Associated with Tree Care Operations — United States, 1992–2007

Workers in various industries and occupations are involved in the care and maintenance of trees, such as tree trimming, pruning, and removal. This work is recognized as having many safety hazards (*1*). Although previous analyses have involved subgroups of workers who perform this type of work (*2*), no analysis has focused on identifying injured workers from all industries and occupations that perform tree care operations. This report summarizes the characteristics of fatal occupational injuries, using data from the Census of Fatal Occupational Injuries (CFOI) and a case series of fatality investigations conducted by CDC's National Institute for Occupational Safety and Health (NIOSH) Fatality Assessment and Control Evaluation (FACE) program. During 1992–2007,* a total of 1,285 workers died while performing tree care and maintenance; 44% were trimming or pruning a tree when fatally injured. The most common causes of death were being struck by or against an object (42% of deaths), most commonly a tree or branch; falls to a lower level (34%); and electrocutions (14%). Most of the decedents (57%) worked for small establishments with 10 or fewer employees. Employers, trade and

* 2007 data are preliminary. Final 2007 data are expected to be released in spring 2009 and will be available at http://www.bls.gov/iif.

INSIDE

DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION

The *MMWR* series of publications is published by the Coordinating Center for Health Information and Service, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30333.

Suggested Citation: Centers for Disease Control and Prevention. [Article title]. MMWR 2009;58:[inclusive page numbers].

worker associations, and policymakers should take additional steps to improve the safety of workers involved in tree care, such as providing formal training to workers and ensuring that personal protective equipment (e.g., fall protection equipment) is used properly.

The analysis consisted of two parts. For the first part, NIOSH reviewed data for 1992–2007 (the most recent data available to NIOSH) from CFOI, a national surveillance system for work-related deaths attributed to traumatic injury maintained by the U.S. Department of Labor's Bureau of Labor Statistics.[†] CFOI derives fatality data from multiple sources (e.g., death certificates, medical examiner/coroner reports, workers' compensation reports, and police reports) (*3*). Potential cases of tree care–related deaths were identified in the CFOI database using specific data elements: industry, occupation, injury source, and narratives describing the injury event.[§] A case was defined as a fatal event that was a direct result of a tree care operation, as determined by the injury narrative. After the initial selection of potential cases, a manual case-by-case review of injury narrative confirmed relevance. Events among workers conducting the following activities were included: tree topping, tree trimming/pruning, tree felling, tree removing, and tree clearing. Because of changes in classification methods in 2002, industry and occupation are reported only for 2003–2007.

For the second part of the analysis, NIOSH reviewed all fatality investigation reports concerning tree care operations from the NIOSH FACE program for 1985–2007. Through on-site investigations, NIOSH and cooperating states[¶] collect detailed information on the circumstances for select incident types (including falls and electrocutions) for purposes of making recommendations for preventing future similar deaths (*4*).

[†] The Bureau of Labor Statistics provides the NIOSH Division of Safety Research with a special research file for analysis through a memorandum of understanding. The CFOI data analyzed by NIOSH include data for New York City for 2003–2007 but not for previous years.

[§] Cases were selected for initial review if 1) the decedent was coded as working in the tree services and ornamental shrubs industry (for 1992–2002, *Standard Industrial Classification Manual, 1987 Edition*, code 0783); 2) the decedent was coded as working in the landscaping services industry (for 2003–2007, *North American Industry Classification System, 2002 Edition*, code 56173); 3) the injury source was wood chippers (Occupational Injury and Illness Classification System (OIICS) source code 3231 and secondary source code 3231) or a tree (OIICS source code 587); or 4) the case narrative contained the keyword "tree" with the trunks of the following keywords: "fell," "trim," "prune," "landscape," "removal," "excavation," or "care." The initial review excluded cases in which the decedent was coded as working in the logging industry (1992–2002, *Standard Industrial Classification Manual, 1987 Edition*, code 027; for 2003–2007, *North American Industry Classification System, 2002 Edition*, code 1133) or coded as a logger (1992–2002, 1990 Bureau of Census occupation classification system occupation code 613; 2003–2007, 2000 Standard Occupational Classification occupational code 45-4020).

[¶] States apply through a competitive process to receive funding to conduct state-based FACE programs. Since 1990, a total of 22 states have had cooperative agreements with CDC for varying periods.

FACE investigations collect information on employer safety programs, worker training, and use of personal protective equipment, information that is not available from national surveillance systems such as CFOI.

Fatality Surveillance

During 1992–2007, a total of 1,285 worker deaths associated with tree care in the United States were reported to CFOI, an average of 80 deaths per year. The decedents were nearly all males (99%) (Table 1). The majority of decedents (70%) were non-Hispanic whites, but the proportion of deaths involving Hispanic workers increased over time, from 12% in 1992 to 29% in 2007 (Figure). Substantial proportions of the decedents worked for pay or compensation (59%) or were self-employed (38%), and 57% worked in establishments with 10 or fewer employees (Table 1). Nearly half of the fatalities occurred at a private residence (44%). The most common events leading to death were being struck by or against an object (such as a tree or branch) (42% of deaths), falls to a lower level (34%), and contact with electric current (14%) (Table 2). Regarding job tasks, 44% of decedents were either trimming or pruning a tree when they were injured, and 23% were involved in tree felling.

During 2003–2007, most of the decedents (74%) worked for the landscaping industry, which includes arborist and tree trimming services. Less commonly, decedents worked in construction (8% of deaths), crop production (7%), and utilities (1%). Regarding occupation, 50% of decedents were tree trimmers or pruners, 15% were landscapers or groundskeepers, 10% were first-line supervisors or managers in landscaping and grounds keeping, 7% were agricultural managers, 6% were in construction occupations, and the remainder were in various other occupations.

Fatality Investigations

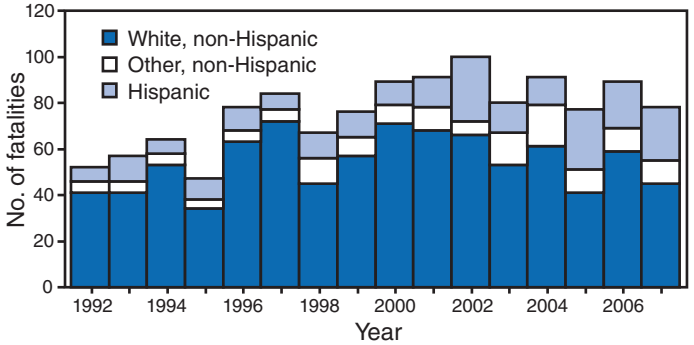
A total of 45 fatality investigations completed during 1985–2007 were found to be related to tree care operations, including 14 fall deaths, 13 electrocutions, and nine struck-by deaths. Among the 14 fall deaths, four involved falls from a height of 35–50 feet when an aerial lift bucket broke; four resulted from being tied to a branch, limb, or tree trunk that broke off from a height of 30–60 feet; five occurred when the climbing rope broke or was cut by a chainsaw or the climbing safety mechanism failed; and one occurred because of tripping and falling from a height of 12 feet while exiting an aerial lift bucket. Among the 13 electrocutions, five deaths resulted from bodily contact with a power line, five resulted from equipment (i.e., chainsaw or aerial lift bucket) that provided an electrical pathway, two involved a branch falling onto the power line

TABLE 1. Number and percentage of occupational injury deaths associated with tree care operations, by selected characteristics of the worker and employer — United States, 1992–2007

Characteristic	No.	%
Total*	**1,285**	**100**
Sex		
Male	1,274	99
Female	11	1
Age group (yrs)		
≤24	145	11
25–44	563	44
≥45	571	44
Race/Ethnicity		
White, non-Hispanic	870	70
Black, non-Hispanic	114	9
Hispanic	216	17
Other, non-Hispanic	85	7
Employment type		
Self-employed	486	38
Work for pay or compensation or other	752	59
Other or not reported†	47	4
Establishment size		
1–10 employees	733	57
11–49 employees	109	8
≥50 employees	108	8
Not reported	335	26
Location of injury		
Private residence	568	44
Farm	136	11
Industrial location	87	7
Recreational place	26	2
Street or highway	151	12
Public building	22	2
Other places§	295	23

SOURCE: Census of Fatal Occupational Injuries, 1992–2007.
* Percentages for certain characteristics might not add to 100 because of rounding.
† Includes work in family business, volunteer, off-duty police, and type of employment not reported.
§ Includes mines, residential institutions, outdoor locations, and not reported.

FIGURE. Number of fatal work injuries, by race/ethnicity and year — United States, 1992–2007



SOURCE: Census of Fatal Occupational Injuries, 1992–2007.

TABLE 2. Number and percentage of occupational injury deaths associated with tree care operations, by event circumstances — United States, 1992–2007

Circumstance	No.	%
Total*	**1,285**	**100**
Injury event†		
Contact with objects and equipment	595	46
Struck by or against	*546*	*42*
Caught in, compressed, or crushed	*49*	*4*
Falls	441	34
To lower level	*434*	*34*
Exposure to harmful substances or environments	180	14
Contact with electric current	*174*	*14*
Transportation accidents	65	5
Highway accident	—§	—
Nonhighway accident	*34*	*3*
Pedestrian	*27*	*2*
Other/Nonclassifiable	—	—
Primary injury source†		
Machinery	88	7
Chippers	*38*	*3*
Parts and materials	103	8
Power lines	*79*	*6*
Persons, plants, animals, and minerals	548	43
Trees and logs	*540*	*42*
Structures and surfaces	418	33
Floor or ground	*406*	*32*
Tools or equipment	63	5
Powered hand tools	*24*	*2*
Vehicles	56	4
Highway vehicle	*33*	*3*
Other sources	9	1
Activity¶		
Trimming/Pruning	569	44
Felling	300	23
Clearing/Removing	114	9
Operating machinery	81	6
Topping	39	3
Not specified	182	14

SOURCE: Census of Fatal Occupational Injuries, 1992–2007.
* Percentages for certain characteristics might not add to 100 because of rounding.
† Coded according to the Bureau of Labor Statistics' Occupational Injury and Illness Classification System. This is a hierarchical system; indented text reflects data that is part of a group.
§ Did not meet the Census of Fatal Occupational Injuries minimum reporting requirements.
¶ Coded based on narrative review of record.

and then making contact with the worker, and in one case a power line downed in a hurricane was wrongly assumed to be de-energized. The nine struck-by deaths involved a tree branch or tree trunk, two involved an entire tree ranging from 30 to 70 feet high, and two involved being struck by a vehicle while performing a tree care operation.

In eight of the 45 incidents, the decedent was working alone. In most of the other incidents (60%), the decedent was working as part of a crew but outside visual contact with his or her coworkers. In 70% of the incidents, safety training consisted of only informal or on-the-job training, and in 75% of the incidents, the employer did not have written safety policies and procedures in place.

Reported by: *DN Castillo, MPH, Div of Safety Research, National Institute for Occupational Safety and Health; CK Chaumont Menéndez, PhD, EIS Officer, CDC.*

Editorial Note: In 2006, the Tree Care Industry Association petitioned OSHA to consider a safety standard specific to tree care operations because of the hazardous and unique nature of these activities. In response, OSHA began collecting data to inform next steps (*1*). NIOSH provided information based on the 45 fatality investigation reports from FACE and then conducted the analysis of surveillance data presented in this report (*5*). This report is the first to comprehensively examine injury fatalities specifically associated with tree care operations and their circumstances. The results confirm that although most tree care fatalities occur in the landscaping industry, at least one quarter occur in other industries, such as farming, construction, and utilities.

A substantial proportion of fatalities occurred in workers who were self-employed or worked for establishments with fewer than 10 employees. Small businesses typically do not have the resources to employ occupational safety professionals, and might lack the knowledge, skills, and resources to identify safety hazards and develop safe work practices. NIOSH has a guide for small businesses to help them connect with governmental and other resources (e.g., trade associations, worker associations, and safety organizations) that can provide expertise and guidance on safe work practices (*6*). OSHA also has a guide for small businesses to help them be in compliance with OSHA regulations (*7*). Trade associations also are a useful resource for employers who conduct tree care, given the specialized nature of this work.

The findings in this report are subject to at least three limitations. First, the number of deaths reported to be associated with tree care probably is undercounted because of a reliance on inconsistent narrative information. Additional deaths associated with tree care might have occurred but were not identified through the CFOI analysis because of limited and vague descriptions of the event (such as "struck on head by falling tree limb," which did not necessarily occur as a result of a tree care operation). Second, rates of occupational injury death, which would support comparisons of risk with other types of work, could not be calculated because the numbers of workers who provide tree care is unknown and cannot be derived from national labor statistics, which are coded by industry and occupation rather than specific types of work. Finally, the information from fatality investigations on circumstances contributing to occupational injury deaths is from a small convenience sample, and although it provides

illustrative information that is not available elsewhere, it is not meant to represent the universe of tree care occupational injury deaths.

NIOSH and others previously have made recommendations for preventing deaths and injuries associated with tree care and landscaping (*5,8–10*). Results from the analysis described in this report generally affirm those recommendations. Employers, regardless of establishment size, should seek out information on worker safety before initiating tree care operations, and should develop, implement, and enforce a comprehensive safety program that includes formal training in tree safety, fall protection, electrical hazards, machine safety, safety along roadways, first aid, and cardiopulmonary resuscitation (CPR). Worksite surveys should be conducted before each new job and daily, by a knowledgeable person, to identify workplace hazards and control strategies. NIOSH recommendations for safety during tree work include 1) wearing appropriate personal protective equipment; 2) always working in teams in visual contact with each other; 3) checking the condition of tree branches before cutting them, climbing on them, or tying off safety equipment; 4) inspecting equipment before each shift and removing damaged equipment from service until repaired; 5) maintaining minimum distances from power lines as specified by OSHA**; and 6) prohibiting the use of conductive tools and equipment near power lines (*5,9,10*).

Acknowledgments

This report is based, in part, on contributions by the Bureau of Labor Statistics, US Department of Labor; and DF Utterback, PhD, National Institute for Occupational Safety and Health, CDC.

References

1. US Department of Labor. Advanced notice of proposed rulemaking (ANPR) for tree care operations. Federal Register 2008;73:54118–23.
2. Poulin Buckley J, Sestito JP, Hunting KL. Fatalities in the landscape and horticultural services industry, 1992–2001. Am J Ind Med 2008;51:701–13.
3. Bureau of Labor Statistics. Bureau of Labor Statistics handbook of methods. Washington, DC: US Department of Labor, Bureau of Labor Statistics; 2007. Available at http://www.bls.gov/opub/hom/homch9_a1.htm.
4. CDC. Fatality assessment and control evaluation program: FACE program. Cincinnati, OH: US Department of Health and Human Services, CDC, National Institute for Occupational Safety and Health; 2003. Available at http://www.cdc.gov/niosh/docs/2003-146.
5. CDC. Comments of the National Institute of Occupational Safety and Health in response to the Occupational Safety and Health Administration (OSHA) advance notice of proposed rulemaking for tree care operators. Docket no. OSHA 2008-012. Cincinnati, OH: US Department of Health and Human Services, CDC, National Institute for Occupational Safety and Health; 2008.
6. CDC. Safety and health resource guide for small businesses. Cincinnati, OH: US Department of Health and Human Services, CDC, National Institute for Occupational Safety and Health; 2003. Available at http://www.cdc.gov/niosh/docs/2003-100/2003-100b.html.
7. Occupational Safety and Health Administration. Small business handbook. Washington, DC: US Department of Labor, Occupational Safety and Health Administration OSHA; 2005. Available at http://www.osha.gov/Publications/smallbusiness/small-business.pdf.
8. New York State Department of Health. Fatality Assessment and Control Evaluation (FACE): tree-work fatal injury facts. Troy, NY: New York State Department of Health, Bureau of Occupational Health, New York FACE Program; 2006. Available at http://www.health.state.ny.us/environmental/investigations/face/facts/logging.htm.
9. CDC. NIOSH alert: request for assistance in preventing falls and electrocutions during tree trimming. Cincinnati, OH: US Department of Health and Human Services, CDC, National Institute for Occupational Safety and Health; 1992. Available at http://www.cdc.gov/niosh/92-106.html.
10. CDC. NIOSH fact sheet: fatal injuries among landscape services workers. Cincinnati, OH: US Department of Health and Human Services, CDC, National Institute for Occupational Safety and Health; 2008. Available at http://www.cdc.gov/niosh/docs/2008-144.

** US Department of Labor, Occupational Safety and Health Administration. Standard 29 CFR part 1926.416. Electrical. Available at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=10717.

Malignant Mesothelioma Mortality — United States, 1999–2005

Malignant mesothelioma is a fatal cancer primarily associated with exposure to asbestos. The latency period between first exposure to asbestos and clinical disease usually is 20–40 years (*1*). Although asbestos is no longer mined in the United States, the mineral is still imported, and a substantial amount of asbestos remaining in buildings eventually will be removed, either during remediation or demolition. Currently, an estimated 1.3 million construction and general industry workers potentially are being exposed to asbestos (*2*). To characterize mortality attributed to mesothelioma, CDC's National Institute for Occupational Safety and Health (NIOSH) analyzed annual multiple-cause-of-death records for 1999–2005, the most recent years for which complete data are available.* For those years, a total of 18,068 deaths of persons with malignant mesothelioma were reported, increasing from 2,482 deaths in 1999 to 2,704 in 2005, but the annual death rate was stable (14.1 per million in 1999 and 14.0 in 2005). Maintenance, renovation, or demolition activities that might disturb asbestos should be performed with precautions that sufficiently prevent exposures for workers and the public. In addition, physicians

* Since 1968, CDC's National Center for Health Statistics (NCHS) has compiled multiple-cause-of-death data annually from death certificates in the United States. CDC's NIOSH extracts information on deaths from occupationally related respiratory diseases and conditions from the NCHS data and stores the information in the National Occupational Respiratory Mortality System, available at http://webappa.cdc.gov/ords/norms.html.