Work Related Deaths in West Virginia

TARGETING RESEARCH AND PREVENTION EFFORTS

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Deaths from injuries at work have been identified as a major public health problem in the United States (Bell, 1990; Bureau of Labor Statistics, 1999; National Institute for Occupational Safety and Health,1993). The National Institute for Occupational Safety and Health (NIOSH) monitors occupational injury deaths through death certificates compiled for the National Traumatic Occupational Fatalities (NTOF) surveillance system.* NTOF findings on the magnitude of work related injury deaths for the United States from 1980 through 1994 indicate the annual total number of deaths and crude death rates decreased from 7,405 (7.5 per 100,000 workers) in 1980 to 5,406 (4.4 per 100,000 workers) in 1994 (CDC, 1998). While the downward trend is encouraging, the magnitude of the problem requires more be done to prevent these needless deaths.

Surveillance data are useful for targeting research and prevention efforts. However, the level of detail available is often insufficient for developing specific prevention recommendations. The Fatality Assessment and Control Evaluation (FACE) program, directed by NIOSH's Division of Safety Research, was initiated in 1982 to address this need for detailed information. The primary goal of the program is to prevent work related deaths (WRDs) by identifying situations that put workers at high risk for fatal injury, formulating prevention strategies, and disseminating information to those who can intervene in the workplace. Through employer and witness interviews, examination of the incident site, and multiple source documents, FACE investigators develop detailed narrative reports containing recommendations for the prevention of similar incidents. FACE is a research project seeking to identify organizational, behavioral, and environmental factors associated with workplace fatalities. Through a cooperative agreement with NIOSH, West Virginia and 14 other FACE states perform occupational fatality research. Other FACE states include Alaska, California, Iowa, Kentucky, Massachusetts, Minnesota, Missouri, Nebraska, New Jersey, Ohio, Oklahoma, Texas, Washington, and Wisconsin.

Derived from the research conducted by William Haddon, Jr., (the Haddon model), the FACE model reflects the public health perception that the etiology of injuries is multifactorial and largely preventable (Haddon, 1968, 1980). For each case, factors associated with the agent (mode of energy exchange), the host (worker who died), and the environment are identified during the

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**NTOF is based on death certificates compiled from 52 vital statistics reporting units in the United States. Inclusion criteria for death certificate submission to the NTOF database includes age equal to or less than 16 years; external cause of death (International Classification of Diseases, Ninth Revision codes E800 to E999); and "injury at work" designation.*

pre-event, event, and post-event phases. These contributory factors are investigated in detail in each FACE incident and are summarized in each FACE summary report. The summary report also includes recommendations for preventing future incidents of a similar nature.

West Virginia FACE researchers focus on prevention, not blame, and have no role in the enforcement of occupational safety and health regulations. These researchers can make recommendations extending beyond current regulatory or consensus standards. The FACE program has conducted in depth, onsite investigations for targeted causes of death including confined space incidents, electrocutions, machine related events, falls from elevation, and logging related incidents. Knowledge about contributory factors for specific types of events accumulates over time and a breadth of prevention recommendations are developed and communicated to those who can intervene in the workplace. Targets for the FACE program are revised periodically. New targets are identified from an examination of surveillance data and from an assessment of the potential for prevention actions based on FACE recommendations. The FACE program is currently targeting investigations of deaths associated with machinery, deaths of youths and street and highway construction work zone fatalities.

During the period 1990 to 1995, West Virginia had the fifth highest WRD rate of 8.9 deaths per 100,000 workers, exceeded only by Alaska (22.9), Wyoming (11.6), Montana (9.5), and Mississippi (9.3). The West Virginia rate was more than twice the overall national rate of 4.3 deaths per 100,000 workers (NIOSH, 1999). During this 6 year span, an average of 63 workers were killed on the job annually in West Virginia. The leading external causes of WRD were:

- Motor vehicle crashes (29%).
- Machine related incidents (17%).
- Being struck by falling objects (15%).

The average annual rate for years of potential life lost was 204 per 100,000 workers for West Virginia, which significantly exceeded the national average of 103 (NIOSH, 1999).

This article briefly summarizes West Virginia FACE data for the 18 month period July 1996 through December 1997. Several representative case investigation summaries are presented.

SURVEILLANCE METHODS

The West Virginia FACE program began in October 1996. The first fatality investigation was conducted in April 1997 by the certified occupational health nurse coordinator responsible for surveillance and investigation related research activities. For continuity purposes, WRD surveillance data were retrospectively collected from July 1996 and combined with ongoing data collection efforts to better assess trends within the state and to identify priority areas. Information about WRDs was ascertained from a variety of sources making up the West Virginia FACE statewide surveillance network. These sources included medical examiners and coroners, emergency care providers, law enforcement agencies, newspaper clipping services, government agencies, and the public. The West Virginia FACE program provides a variety of mechanisms to encourage reporting of fatalities, including a toll free number, a fax and phone number, and a fatality reporting form located on the West Virginia FACE Program's website (http://www.hsc.wvu.edu/som/crem/face/), and on the West Virginia FACE brochure (West Virginia FACE, 1997).

Inclusion criteria for WRD submission to the West Virginia FACE program include decedents who are:

- Assigned an external cause of death related to traumatic injury (E code) between E800 and E999, according to the *International Classification of Diseases*, Ninth Revision (WHO, 1977).
- Injured while at work,. according to the "Operational Guidelines for Determination of Injury at Work" located in Table 1 (NIOSH, 1993).

West Virginia FACE collects basic data elements on all WRDs using the FACE "First Report of Fatality." These data elements include date and time of incident, source and date of notification, number of fatalities, industry and occupation of victim (usual and at the time of the incident), age, sex, state of residence, race and ethnicity of the victim, the official cause of death, type of incident, and E code. A narrative describing what occured at the time of the fatal injury and other sources of information, such as police reports and OSHA reports, are also collected by West Virginia FACE to document the accident.

In addition to collecting basic data elements through the first report surveillance system on all WRDs, in depth field investigations during the 18 month period of study detailed three targeted injury fatality categories: falls from elevation, machine related, and logging related injuries. The field investigator traveled to the site of the fatal incident and interviewed the victim's employer and coworkers as well as personnel who responded from the emergency medical services, law enforcement, Occupational Safety and Health Administration, and the coroner's office. These interviews, along with photographs and measurements taken at the scene and a literature search, form the basis for identifying multiple factors that may have contributed to the fatal event. These factors provide information needed to develop viable preventive strategies. The data from these field investigations are recorded on supplements developed specifically by the NIOSH FACE program for each targeted cause. Key supplemental data elements include:

- Company size.
- Safety programs.
- Assignment of safety responsibilities.
- Site inspections.
- Training.
- Environmental conditions.
- Availability and use of personal protective equipment.
- Make and model of machines.
- Site characteristics and measurements.

Fall fatalities are defined as incidents in which the victim received fatal injuries as a result of a fall from elevation (E880 to E884). Machine related fatalities are incidents in which the victim received fatal injuries as a result of contact with, or operation of, a machine (E919).

TABLE 1

Operational Guidelines for Determination of Injury at Work

Criteria	Injury at Work	
	Yes	No
On Employer Premises		
• Engaged in work activity, apprentice, vocational training.	√	
• On break, in hallways, rest room, cafeteria, storage area.	√	
• In employer parking lots while working, arriving, or leaving.	√	
• Engaged in recreational activities on employer controlled facilities (games, etc.) for personal enjoyment.		√
• As a visitor for non-work purposes, not on official business.		√
Off Employer Premises		
• Working for pay or compensation, including at home.	√	
• Working as a volunteer EMS, firefighter, or law enforcement officer.	√	
• Working in a family business, including family farm. Activity should be clearly related to a profit oriented business.	√	
• Traveling on business, including to and from customer/business contacts.	√	
• Engaged in work activity where vehicle is considered the work environment (e.g., taxi driver, truck driver, etc.).	√	
• Homemaker working at homemaking activities.		√
• Working for self—non-profit, i.e., mowing lawn, repairing own roof, hobby, or recreation activities.		√
• Student engaged in school activities.		√
• Operating vehicle (personal or commercial) for non-work purposes.		√
• Commuting to or from work site.		√

These guidelines were developed jointly by the Association for Vital Records and Health Statistics (AVRHS), the National Institute for Occupational Safety and Health (NIOSH), the National Center for Health Statistics, (NCHS), and the National Center for Environmental Health and Injury Control (NCEHIC).

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Contact your State Vital Statistics Office for further information.

Logging fatalities include any "at work" fatality that occurred while the worker was performing any logging or timbering function. A variety of E codes may apply to logging fatalities, but they usually are designated as struck by objects (E916). Descriptive analysis of data collected on all WRDs is performed using the CDC's Epi Info shareware (Version 6.0).

SURVEILLANCE RESULTS

Table 2 summarizes several of the key surveillance characteristics of the 83 WRDs that occurred in West Virginia during the 18 month period July 1996 through December 1997. Ninety-five percent of the 83 victims were male and all were white. Their mean age was 42 years (range 17 to 82). Half of the deaths occurred in workers aged 25 to 44. Seventy-eight percent of the workers were West Virginia residents and the remainder were from nine nearby states. The estimated 1997 WRD rate for West Virginia was 7.3 per 100,000 workers. This rate was based on 55 WRDs, including residents and nonresidents, and an annual average and seasonally adjusted employment force of 749,000 (West Virginia Bureau of Employment Programs, 1998).

Fatal injuries at work occurred most frequently in the construction (17), transportation and public utilities (15), mining (12), and services (11) industry sectors. Occupations in which the WRDs were most common included truck drivers (11), coal miners (8), and loggers (8).

Mechanism of Injury

Forty-four unique E codes were assigned to the 83 workers who died on the job during the 18 month period. Four external causes accounted for nearly two thirds of the WRDs. These included motor vehicle crashes (23%), machine related (17%), falls (12%), and struck by falling objects (10%). Examples of deaths caused by motor vehi-

TABLE 2

Characteristics of WRDs in West Virginia, July 1996 through December 1997 (N=83)

	n	%
Male	79	95
White	83	100
Age		
15-24	6	7
25-34	24	29
35-44	18	22
45-54	22	26
55-64	9	11
65+	4	5
Mean age: 42		
Industry		
Construction	17	20
Transportation/Public Utilities	15	18
Mining	12	14
Services	11	13
Manufacturing	9	11
Retail Trade	6	7
Wholesale Trade	5	6
Public Administration	3	4
Agriculture/Forestry/Fishing	2	2
Other	3	4
Occupation		
Truck Driver	11	13
Coal Miner	8	10
Logger	8	10
Manager/Owner	4	5
Laborer	4	5
Carpenter	4	5
Other	44	52
External Cause of Injury (E-code)		
Motor Vehicle Crash	19	23
Machinery Related	14	17
Fall from Elevation	10	12
Struck by Object	8	10
Air Transportation	6	7
Electrocution	4	5
Other	22	26

cle crashes included a tractor trailer driver who went over a mountainside and crashed after he lost control of his vehicle and a pizza delivery truck driver who crashed when he lost control of his vehicle. Examples of deaths caused by machines included a miner who was entangled in mining equipment and a farmer who was crushed when his tractor rolled over on him. Examples of deaths caused by falls included a carpenter who fell 120 feet from a bridge under construction and a roofer who fell 20 feet from a roof. Examples of deaths caused by workers struck by falling objects include a logger who was struck on the head by a dead limb and a logger/heavy machine operator struck on the head by a tree that became uprooted and fell on him.

Contributing Factors

Approximately one third of the WRDs occurred in the spring (35%) with a decreasing proportion occurring in the other seasons: summer (29%), fall (20%), and winter (16%). Not surprisingly, a majority of WRDs occurred during the most common work period—from 8 a.m. to 4 p.m. (59%), with 23% occurring from 4 p.m. to midnight and the remaining 18% from midnight to 8 a.m.

Onsite investigations provide a unique opportunity to identify a variety of factors that may contribute to the fatal incidents, FACE investigators use this information to develop preventive strategies. Information is distributed to employers, workers, organizations representing both labor and management, and to safety and health professionals in a position to intervene in the workplace and prevent similar incidents. Six onsite investigations were performed in 1997 and comprehensive reports were completed on each. Cooperation of the employer and others who responded to the incident, including the medical examiner or coroner, emergency medical services, law enforcement, and other state and federal government agencies, was essential to collect indepth information on the circumstances surrounding each fatality investigated.

Three case summaries provided below demonstrate the development of prevention recommendations from analysis of cause and circumstance information. These recommendations are disseminated to the established state surveillance network and to the employers involved. Nurses working in occupational health, public health, and emergency services are an integral part of the West Virginia surveillance network.

CASE INVESTIGATIONS

Case 1. Farmer dies following a tractor rollover (West Virginia FACE 97-057). A 61 year old farmer was killed when the tractor (manufactured between 1970 to 1980) he was driving rolled end over end down a steep hillside. Prior to the incident, the farmer had successfully pulled his tractor out of deep, muddy ruts in a field road. Evidence suggests that after getting out of the ruts, the farmer tried to drive the tractor forward up the field road. Tire tracks indicate the tractor's back tires slid over the steeply sloped hillside, which lay adjacent to the field road, and then rolled down the slope. The tractor was not equipped with rollover protection, although manufacturers produce a retrofit kit for tractors of this make and model. The tractor was found at the base of the hill approximately 50 feet from the roadway above. When the farmer did not return home for supper, a neighbor searched the field and found the victim on the ground approximately 3 feet from the tractor. Emergency medical services were summoned and the victim was pronounced dead at the scene. To prevent similar occurrences, the West Virginia FACE investigator recommended employers:

- Equip all tractors with rollover protective structures and seat belts.
- Evaluate environmental conditions and terrain prior to using field roads.
- Make necessary adjustments to accommodate for hazardous conditions.

Case 2. Hog farmer/logging company owner dies after being struck by a falling tree (NIOSH FACE 97-05). A 35 year old hog farmer/logging company owner had just completed felling a yellow poplar tree at a rural logging site when he was struck and killed by the falling tree. Using a chainsaw, the victim made an undercut on one side of a 70 foot high yellow poplar tree; he then moved to the opposite side of the tree, made a back cut, and the tree began to fall perpendicular to the hillside on which he was working. Evidence suggests he shut off the chainsaw, set it on the ground, turned his back to the falling tree, and began to move away in an uphill direction. As the tree was falling, it struck and bounced off a locust tree located approximately 21 feet away (which altered the direction of the falling tree). The yellow poplar fell on the victim. A coworker, who was hooking up a choker on a downed tree, saw the tree fall and went to help the victim. He checked for vital signs and, finding none, went to get help. Emergency medical services arrived in approximately 20 minutes and pronounced the victim dead at the scene. To prevent similar occurrences, investigators from West Virginia FACE and NIOSH recommended logging employers and tree fellers:

- Properly evaluate the area around timber to be felled so potential hazards can be identified and appropriate control measures implemented.
- Prepare adequate escape paths and move a safe distance away from the base of a tree as the tree is falling.
- Develop, implement, and enforce a written safety program which includes, but is not limited to, worker training in hazard identification, avoidance and abatement.

Case 3. Pipefitter dies following a fall from a stepladder (West Virginia FACE 97-042). A 26 year old pipefitter died and a coworker was injured when air pressure was released unexpectedly in a chill water line they were testing, precipitating a fall. The two men were standing on opposite sides of a stepladder reaching overhead to remove a plug they had placed in the water line earlier in the day, prior to conducting an air pressure test. The men thought they had released all the air from the line after the test, but air remaining in the line was suddenly released and caused the plug to blow out. Both workers fell from the ladder to the concrete floor 6 feet below. Following prompt emergency response, the coworker was treated at the local hospital and released. The 26 year old pipefitter was declared dead approxi-

IN SUMMARY

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Targeting Research and Prevention Efforts.

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1. The primary goal of the Fatality Assessment and Control Evaluation (FACE) research program is to prevent work related deaths by identifying work situations causing high risk for fatal injury, formulating prevention strategies, and disseminating information to those who can intervene in the workplace.
2. The National Institute for Occupational Safety and Health has cooperative agreements with 15 states to conduct fatality research using the FACE protocol.
3. From the West Virginia FACE data for the 18 month period from July 1996 to December 1997, it was revealed that West Virginia has the fifth highest rate for work related death in the nation. Eighty-three workers died during the period and four external causes—motor vehicle crashes, machine related, falls, and struck by falling objects—accounted for nearly two thirds of these deaths.
4. Occupational health nurses work in the FACE research program as field investigators and principal investigators. Other occupational and environmental health nurses are in a vital position to disseminate FACE research findings.

mately 30 minutes following the incident. To prevent similar occurrences, investigators from West Virginia FACE recommended employers:

- Develop, implement, and enforce a comprehensive safety program including a thorough hazard analysis and use of controls specific to the job.
- Train each employee to recognize and avoid unsafe conditions applicable to their work environment including safe pressure testing procedures and safe access to elevated work areas.
- Incorporate work safety in the planning phases of construction.

DISCUSSION

West Virginia FACE research findings for the 18 month period of study indicate West Virginia continues to lose relatively young, white, male workers. The highest percentage were working in construction, transportation and public utilities, mining, or in service related industries. The highest percentage were working as truck drivers, coal miners, or loggers. West Virginia's rugged terrain and its abundant natural resources of coal, natural gas, minerals, and timber create a unique set of circumstances that may contribute to injury at work. Workers in the state are employed in industries that are very often labor intensive, such as underground mining and timber harvesting (West Virginia Bureau of Employment Programs, 1998). Materials must be moved throughout the state to isolated and nearly inaccessible locations over narrow, winding roads. It is a formidable challenge to understand these and other unique circumstances and to develop comprehensive safety programs protecting those working in West Virginia.

The West Virginia FACE program is in the third year of a 5 year cooperative agreement with NIOSH. A comprehensive, statewide surveillance network has been established and mechanisms for the dissemination of prevention recommendations are in place. Basic information is collected on all WRDs and targeted causes are fully investigated. Cooperation among many state agencies facilitates the sharing of valuable information and professional resources. This makes findings more complete and intervention strategies more relevant.

Although there is no direct way to measure the success of the West Virginia FACE program, agencies and individuals working collaboratively with the West Virginia FACE program indicate information provided to them contributes to their understanding of work related injuries in West Virginia. They indicate they use the information to reduce hazards in the workplace and to lessen the impact of these preventable injuries. For example, the West Virginia Division of Forestry uses the West Virginia FACE logging fatality investigative reports to educate West Virginia loggers about the fatal consequences of uncorrected hazards on worksites similar to their own. The West Virginia Division of Forestry has received sufficient positive feedback from West Virginia loggers about the usefulness of this information. They have asked the West Virginia FACE program to provide them with the investigative report, a fact sheet, and a set of slides on each fatality investigated for use in their logger certification program. It will require the continued coordinated efforts of employers and employees and their representatives, as well as safety, health, and legal professionals throughout the state and the region to prevent work related deaths in West Virginia. These combined efforts exemplify how systematic data collection and assessment of injury circumstances—when combined with engineering, education, enforcement, and behavioral controls—can contribute to a safer work environment.

OCCUPATIONAL HEALTH NURSING PRACTICE IMPLICATIONS

Occupational and environmental health nurses throughout the United States are involved in occupational and environmental health and injury research and prevention programs. Through their work in academia, government, health care facilities, and on worksites, nurses play an important role in promoting safety and health for

workers. Occupational and environmental health nurses are part of the FACE team and work with other safety and health professionals conducting surveillance and investigations, writing summary reports, and developing recommendations for prevention. Additionally, occupational and environmental health nurses are in a vital position to disseminate the research findings to their peers, to other safety and health professionals, to employers, and to workers and the organizations representing them.

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For More Information

Visit the National Institute for Occupational Safety and Health's website at: http://www.cdc.gov/niosh. To obtain Fatality Assessment and Control Evaluation reports to guide safety efforts, contact NIOSH Surveillance and Field Investigations Branch at (304) 285-5916, or fax (304) 285-6047. The NIOSH documents can be obtained through the NIOSH Education and Information Division (EID), call (800) 35 NIOSH or 1(800) 356-4674 or fax (513) 533-8573.