Surveillance of a Priority Occupational Health Condition in New Jersey — Fatal Occupational Injuries

September 1, 2001 – August 31, 2006

Grant Number: # 5 U60 OH008345

Principal Investigator: David J. Valiante, MS, CIH
e-mail: David.Valiante@doh.state.nj.us

Public Health Services Branch
New Jersey Department of Health and Senior Services
Division of Epidemiology, Environmental, and Occupational Health
Occupational Health Service
Occupational Health Surveillance Program

Trenton, NJ 08625

November 30, 2006

TABLE OF CONTENTS

Appendix

List of Abbreviations and Acronyms

BLS	Bureau of Labor Statistics
CAA	Committee for the Advancement of Arboriculture
CDC	Centers for Disease Control and Prevention
CFOI	Census of Fatal Occupational Injuries
CPWR	Center for Protection of Workers' Rights
CSTE	Council of State and Territorial Epidemiologists
EDD	Emergency Department Data
FACE	Fatality Assessment and Control Evaluation
FFY	Federal Fiscal Year
HDD	Hospital Discharge Data
ICD-9	International Classification of Diseases, 9th Revision
NAICS	North American Industry Classification System
NIOSH	National Institute for Occupational Safety & Health
NJDHSS	New Jersey Department of Health & Senior Services
NJDLWD	New Jersey Department of Labor & Workforce Development
NJDOT	New Jersey Department of Transportation
NORA	National Occupational Research Agenda
OFPAG	Occupational Fatalities Prevention Advisory Group
OSHA	Occupational Safety and Health Administration
PEOSH	Public Employees Occupational Safety & Health
SIC	Standard Industrial Classification
SOC	Standard Occupational Classification

ABSTRACT

The National Institute for Occupational Safety and Health (NIOSH) Fatality Assessment and Control Evaluation (FACE) program is a research program designed to identify and study fatal occupational injuries. The goal of the FACE program is to prevent occupational fatalities across the nation by identifying and investigating work situations at high risk for injury, and then formulating and disseminating prevention strategies to those who can intervene in the workplace. On-site investigations are essential for observing firsthand where fatalities have occurred and for gathering facts and data from company officials, witnesses, and coworkers. For each case, investigators seek to identify how the source of fatal injury, victim and coworker actions, and workplace factors contributed to the fatality in the three significant incident phases: pre-event, event, and post-event. Through employer and witness interviews, examination of the incident site, and review of multiple source documents, investigators develop narrative reports detailing all the factors that contributed to the death of the worker. Close communication with other entities such as manufacturers, safety engineers, government investigators, and industry groups provides investigators with valuable expertise on industry work practices and safety procedures related to a given investigation.

Each day in the United States, on average, 16 workers die as a result of a traumatic injury on the job. Investigations conducted through the FACE program allow the identification of factors that contribute to these fatal occupational injuries. This information is used to develop comprehensive recommendations for preventing similar deaths. Furthermore, analysis of FACE data may suggest the need for new research or prevention efforts, or for new or revised regulations to protect workers.

In New Jersey, an average of 109 workers died each year from workplace injuries from 1995 through 2005. There have been a total 1,672 victims of fatal work-related injuries in New Jersey since the inception of the NJFACE program in 1990. Most (94%) of the victims were male. Age at death ranged from 15 to 89; 69% were 49 years old or younger. Mean and median ages were 43 and 42, respectively. Between 2001 and 2006, there were 184 fatalities (26%) related to motor vehicles or transportation, 101 (14%) were due to falls, and 61 (9%) were machine-related. Overall, 139 (20%) of the fatalities were reported as Hispanic ethnicity. NJFACE has conducted a total of 197 field investigations and distributed 182 investigation reports containing findings and recommendations to employers and other stakeholders since the inception of this surveillance project.

During the five-year FACE grant period, FACE staff developed and disseminated Hazard Alerts: Pizza Restaurant Youth, Sanitation Worker, Wood Chipper, and Tree Trimming. A Crossing Guard Alert is in development. During this period, we initiated the following collaborations: a project with the Center to Protect Workers' Rights to develop and determine the impact of a Ladder Fall Video and Fact Sheets, and a partnership with the Advancement of Arboriculture (CAA), to share technical assistance in the development and review of our Hazard Alert on tree trimming.

Evaluation of the NJFACE program and dissemination materials was conducted. A logic model was created and used to conduct programmatic evaluation, which highlights strengths and demonstrates needs. All educational outreach mailings, FACE reports, and disseminations included a survey and respondent data were analyzed to determine change in employer behavior based on educational materials.

HIGHLIGHTS/SIGNIFICANT FINDINGS

The NJFACE program provided surveillance on fatal occupational injuries, including the identification of cases, conducting site investigations (including an investigation report), analysis of data, participation in collaborations, and the development, dissemination, and evaluation of educational materials and FACE reports. The following provides information on our collaboration with the Center to Protect Workers' Rights, two Hazard Alerts developed from FACE investigations and findings from analysis of surveillance data.

Collaboration with CPWR

Introduction/Broad objectives

Ladder safety in the construction industry is an important public health issue in need of attention. Fatalities and injuries from ladder falls have been on the rise across the U.S. in recent years. According to the Bureau of Labor Statistics' *2004 Census of Fatal Occupational Injuries* there was a 17% increase between 2003 and 2004, with 114 fatal ladder falls reported in 2004. NJFACE registry data show a total of 284 fatal injuries due to falls from 1990 to 2005. Since ladder falls are entirely preventable, proper training on ladder safety techniques is essential to address this public health issue with the ultimate goal of prevention. Moreover, we also proposed to conduct an educational outreach on falls in our grant.

Purpose

The objectives of this collaborative initiative are to develop a ladder fall prevention video and accompanying fact sheets to be administered to construction workers, and to evaluate the impact of these tools on ladder safety. Pilot testing of the video was conducted during its development to evaluate the tool's effectiveness and identify areas in need of improvement.

Methods

Pilot tests were conducted with 25 union laborer apprentices and electrician journey-workers. Pre and post tests were administered to each participant assessing their knowledge, attitude, and behavior regarding ladder safety before and after viewing the twelve minute video. An open discussion followed to gather information about participants' impressions of the video. Pre and post tests were analyzed using the Wilcoxon Signed Rank test and McNemar's test for discordant pairs to test for statistically significant changes in outcomes after viewing the video.

Findings

Overall, viewing the video appeared to improve participants' knowledge and attitudes regarding preventing ladder falls. Specifically, after viewing the video, participants were more likely to report disagreeing with the belief that one can catch oneself if falling from a ladder. Similarly, participants were more likely to report agreeing with the idea that physical strength will not do much to reduce the impact of a fall. Participants in the study were statistically significantly more likely to report that they would inform their supervisor of a ladder safety issue after viewing the video. The analysis indicated the video positively changed the participants' ways of assessing proper ladder angles, and reduced the intended incidence of undesirable behaviors like carrying loads up the ladder by hand, standing on the top of a stepladder, or climbing the back of a step ladder.

These results indicate a short educational video presenting easy-to-understand safety tips and emotional appeals from real workers and their families can have a powerful impact on intended safety practices. The pilot test results from the video were used to improve and modify particular parts of the video, as well as the survey instrument and fact sheets. In 2006, we will conduct a pilot test of these improved

tools with 350 building and construction workers on New Jersey construction jobsites, aiming to expand the initiative into a national campaign targeting the construction industry.

Outreach Projects with Impact Evaluation

Tree Trimming Warning Bulletin

With input from NIOSH and the Committee for the Advancement of Arboriculture, NJFACE finalized and mailed a warning bulletin to approximately 1,400 arborists (both public and private) in the fall of 2005. This one-page bulletin entitled, "Warning! Tree Work Can Be Deadly," outlines summaries of three actual FACE cases (fall, electrocution, and struck by a falling object). Recommendations for preventing similar accidents were listed for each case study. References to organizations that provide job and safety training were also included. The bulletin was mailed with an evaluation survey form and survey results are being analyzed. The warning bulletin is being translated into Spanish.

Hazard Alert on Wood Chippers:

Since 1993, there have been three work-related fatal injuries and more than 52 serious nonfatal injuries in New Jersey as a result of working with mobile wood chipping machines. In 2005, the NJFACE Program initiated a wood chipper fatal and non-fatal injuries intervention project.

NJFACE developed a Hazard Alert entitled, "Wood Chippers," that provides recommendations on the safe operation of wood chipping machines for each of the following areas: Training, Pre-operation, Operation, and Machine Safety. The Alert was reviewed by NIOSH, the NJ Chapter of the International Society of Arboriculture, and two NJ Departments of Public Works (DPW). The Alert was also translated into Spanish, as the Hispanic population has been identified as a high-risk group in this industry. The Alert (in English and Spanish), along with a cover letter, an evaluation form, and a postage-paid return envelope was mailed to 745 private tree-care companies and 673 DPWs in New Jersey. The evaluation survey collected information on the number of injuries and fatalities in New Jersey as well as collecting information on the type, number, condition, and safety equipment in place, of wood chippers that are used in New Jersey.

In addition, an article entitled, "Working with Wood Chipping Machines Can be Dangerous" was published in the May-June 2006 edition of *La Guia del Inmigrante* (The Immigrant's Guide). This newsletter is distributed to over 10,000 Latino households in New Jersey. The article contained information from the Hazard Alert, including safety recommendations, and additional resources.

Summary of Work-Related Fatality Surveillance

There have been a total 1,672 victims of fatal work-related injuries in New Jersey since the inception of the NJFACE program in 1990. Table 1 displays the number of workers by type of incident for the years 1990 to 2005. Table 2 shows the gender, race, and age of the 1,1672 victims. Most (94%) of the victims were male. Age at death ranged from 15 to 89; 69% were 49 years old or younger. Mean and median ages were 43 and 42, respectively.

NJFACE has conducted a total of 197 field investigations and distributed 182 investigation reports containing findings and recommendations to employers and other stakeholders since the inception of this surveillance project.

TABLE 1
Number and Type of Fatal Work-Related Injuries
1990-2005

Type of Incident	Number
MVA or Transportation-related	527
Fall	284
Homicide/Assault	235
Machine-Related	185
Electrocution	96
Struck by Object	69
Suicide	59
Fire/Explosion	52
Toxic Exposure	47
Highway Work Zone	27
Confined Space	15
Drowning	15
Caught by or between	15
Other	14
Heat/Cold-related	11
Youth	6
Farming-related	6
Trenching	5
Unknown	3
Logging	1
TOTAL	**1,672**

TABLE 2
Demographic Characteristics of Fatal Occupational Injuries
New Jersey, 1990-2005

Characteristic	Number	Percent
TOTAL	**1,672**	**100**
Gender		
Male	1,571	94
Female	101	6
Race		
White	1,049	63
Hispanic	276	17
Black	231	14
Asian	76	4
Other	40	2
Age*		
Less than 18	6	0.4
19-29	314	19
30-39	408	24
40-49	423	25
50-59	306	18
60-69	134	8
70-79	63	4
80 and older	9	1

Data Analysis
In-depth data analysis is an integral part of NJFACE surveillance activities, guiding NJDHSS and national efforts to improve worker safety, and to monitor trends and progress over time.

An analysis was conducted to study incidents in two overlapping categories of "in-scope" priorities, namely, machine-related and Hispanics. An increase in work-related fatalities among Hispanics was observed during the years 1998-2004 (Figure 1).

In addition, an analysis comparing the work-related fatality rate of Hispanic to non-Hispanic NJ workers, using the Poisson regression statistical method, indicates a statistically significant increase of the work-related fatality rate among Hispanics for the years 1998-2004. Among Hispanics, there was a 10% increase in the fatality rate each year during that time period. Furthermore, the data show that Hispanic workers were almost twice (1.8 times) more likely to die on the job than non-Hispanic workers during that period. In contrast, the work-related fatality rate among non-Hispanic workers has not been significantly increasing over these seven years (Figure 2). Another area for concern is the

*****Age was unavailable for nine of the victims*
Note: Percentages may not add to 100 due to rounding.

disproportionate number of machine-related fatalities among Hispanics, both of which are NIOSH priority areas for investigations. Hispanic males only comprise 15% of the working population of New Jersey. Yet from 1998 to 2004, 29% of the 85 victims of machine-related fatalities were Hispanic men (Figure 3).

FIGURE 1
Rate Ratios of Hispanic to Non-Hispanic Work-Related Fatalities among Males
Occupational Health Surveillance Program
1998-2004

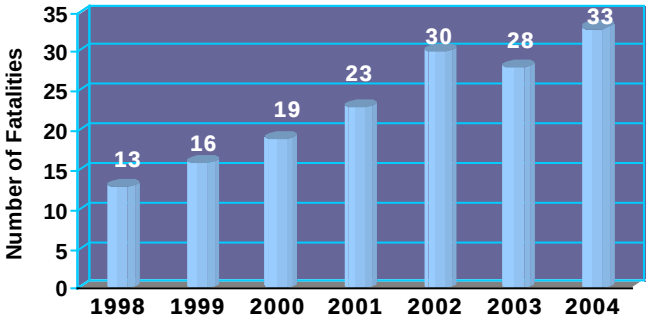


FIGURE 2
Machine-Related Fatalities
by Race/Ethnicity
Occupational Health Surveillance Program
1998-2004; N=85

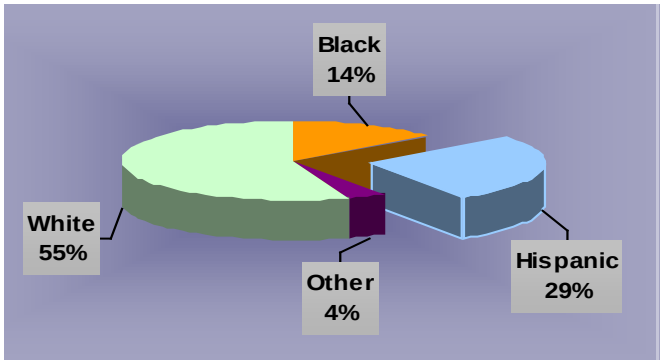
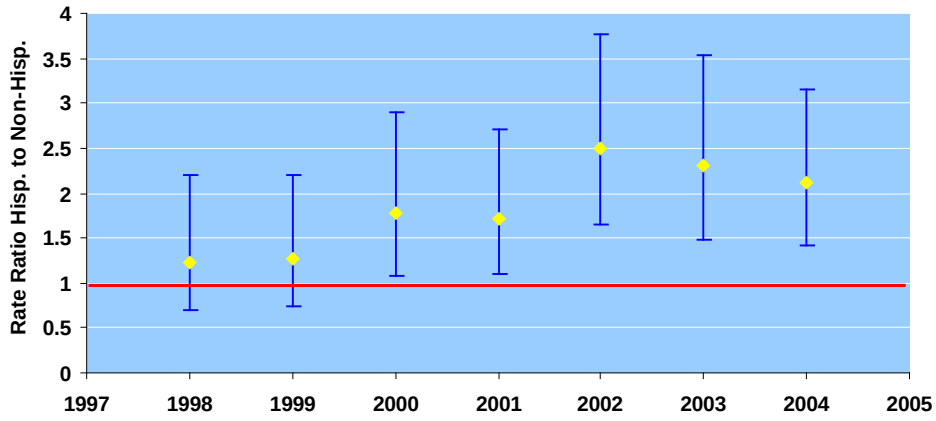


FIGURE 3
Hispanic Work-Related Fatalities
Occupational Health Surveillance Program
1998-2004



The reasons for this increasing fatality rate among Hispanic workers and the elevated risk of occupational fatalities among Hispanic workers are unknown and are being studied to rule out any confounding factors. Since particular racial/ethnic groups may be more likely to work in an industry which has a higher probability of having a fatal incidence, e.g., construction, there may be confounding factors associated with the rates which do not control for the numbers of workers at risk.

In the interim, NJFACE has begun conducting outreach and education activities to this special population based on these findings.

Impact Evaluation

The Tree Trimmer and Wood Chipper Hazard Alerts were disseminated along with a survey that asked specific questions to determine the impact on worker health and safety. The following results are

examples from analyzing respondent data from the surveys. Each Alert provided recommendations regarding safe work practices. Questions were asked on the survey to determine if these recommendations were either already in place or based on the Alert, would affect a change in work practice. Results indicated that although most of the practices were already in place, in many cases, employers would adopt the recommendations. Tables 3 and 4 below show the three recommendations that affected the highest amount of change in work practices in each Alert.

Table 3. Results from Tree Trimmer Alert Survey Recommendations

Recommendation	# Changes Made based on Rec.	# Already in Place or N/A	Not Reported
Keep workers and equipment at least 10 feet from energized power lines	9 (43%)*	189	12
Notify utility company if work is to be done within 10 feet of energized power line	11 (50%)	188	11
Clearly mark work zone boundaries	14 (54%)	184	12

*% refers to the number of establishments that reported they will make the change based on recommendations among all establishments who did not report already having these measures in place

Table 4. Results from Wood Chipper Survey Recommendations

Recommendation	# Changes Made based on Rec.	# Already in Place	Not Reported
Ensure that the "buddy system" is in place (one worker at in-feed, another at control bar	40 (41%)*	128	58
Ensure that workers are putting short materials on top of longer materials while feeding the chipper	12 (23%)	174	40
Ensure that workers feed do not load small raked-up materials like twigs and leaves into chipper	16 (26%)	178	52

*% refers to the number of establishments that reported they will make the change based on recommendations among all establishments who did not report already having these measures in place

Programmatic Evaluation Through Use of Logic Model

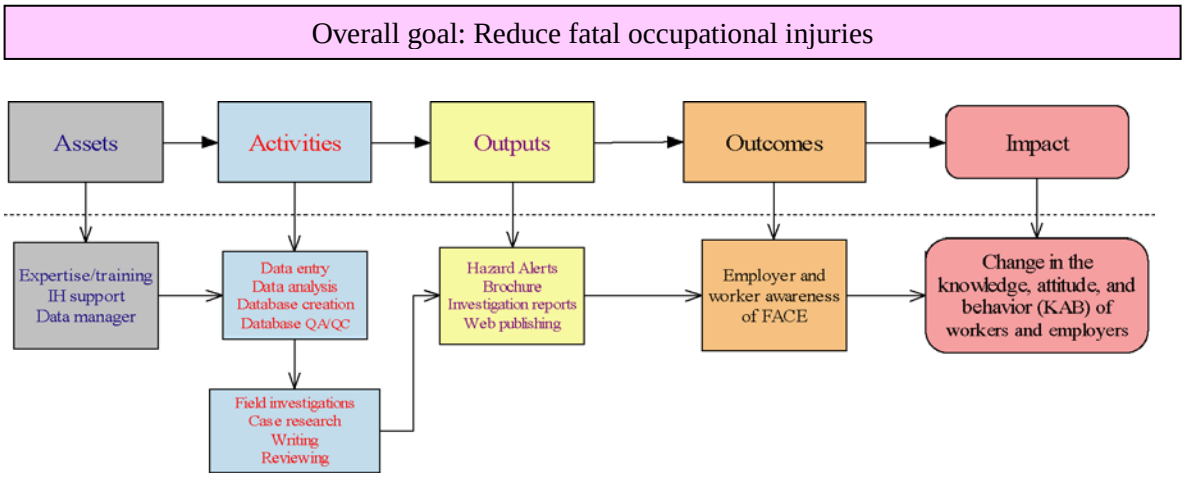
The NJFACE logic model contains several elements that describe overall program assets and activities. These then lead to outputs, in the form of outreach and education products. NJFACE outputs lead to several outcomes, including employer awareness of FACE, increase knowledge, OSHA involvement, and enhancement of site visit entry. The final step is a measurable impact, which we have identified as a change in knowledge, attitude and behavior of employers and workers. The NJFACE program's major impact is reducing fatal occupational injuries.

Figure 4 shows an example of a flow from assets to impact of NJFACE and employer and employee knowledge of workplace safety. This example illustrates both the infrastructure of the program, and the link between processes and effects. In this example, our occupational health and safety expertise and data management are the basis for developing/conducting field investigations, reports, hazard alerts and brochures. These outreach materials lead to an increase in employer awareness of NJFACE. This awareness is then change in knowledge by the employer

This model demonstrates both the strengths and weaknesses of the program, and has helped identify program needs. The process of creating the logic model coupled with connecting logic flow elements helped us identify these programmatic needs and limitations. The following are critical examples:

- The need to enhance surveys designed to assess the impact of NJFACE outputs
- The need to enhance response rate of mailed voluntary surveys
- The need to enhance research to practice activities.

Figure 4. Excerpt of NJFACE logic model.



TRANSLATION OF FINDINGS

The following are findings from two Hazard Alert disseminations and a discussion of a current educational outreach.

Pizza Restaurant Youth Hazard Alert
NJFACE investigated the deaths of two youths who were working at pizza restaurants: a 16-year-old undocumented immigrant who died after being entangled in a dough-mixing machine, and a 17-year-old youth who was killed in a motor vehicle accident while delivering pizzas. In both incidents, the youths were doing work prohibited by the federal regulations as hazardous occupations; however, the employers were exempt from these rules due to their small size. Recognizing the large number of pizza restaurants in the state, and that these hazards may be common in other pizza restaurants, NJFACE staff developed a hazard alert to share the findings of our FACE investigations to these restaurants. After conferring with the NJ State Department of Labor, NJFACE staff created a warning alert outlining the two incidents and giving the employers contacts for additional resources and information. NIOSH assisted by providing us with a comprehensive mailing list of 2,861 NJ pizza restaurants and the *NIOSH Alert: Preventing Deaths, Injuries, and Illnesses of Young Workers*. These materials were assembled into an educational package and mailed to the restaurants.
Products: Warning alert: *Warning! Dangers to Teens Working at Pizza Restaurants*
Article: *Teenage Restaurant workers Die on the Job* Occupational Health Surveillance Update, December 2003

An impact evaluation was conducted on this alert. A survey was included in the dissemination packet to 10% of the identified pizza restaurants in New Jersey. Overall, the survey determined that the alert was well received (>92% reported a rating of "good" or better). A demonstration of the impact of the alert was that many responders were not aware that young employees are not permitted to operate a mixing machine (18%) or make deliveries (29%). The positive impact of the alert is demonstrated as these facilities then change their practices by not allowing youths to participate in these potentially hazardous job activities, thus potentially decreasing the risk of occupational injury.

Sanitation Worker Hazard Alert
An analysis of the NJFACE database found that sanitation workers were at a high risk of being killed while working on or near their garbage trucks. The basic details of the incidents were abstracted and outlined in a hazard alert, which was written using simple language and graphics. A Spanish translation of the alert was printed, and NIOSH provided copies of the *NIOSH Alert: Preventing Worker Injuries and Deaths From Moving Refuse Collection Vehicles*. An educational package was made up of English and Spanish versions and the NIOSH Alert, which was sent to 1,000 private sanitation companies and municipalities.
Products: *Don't Get Hurt Working Around Sanitation Trucks* 2001*; Tenga Cuidado Cuando Trabaja en los Camiones Sanitarios* 2001

Crossing Guard Warning Bulletin
Analysis of NJFACE database showed that there were a total of 12 work-related fatal injuries to crossing guards, all of whom were killed after being struck by vehicles while at work. In year five of the current FACE grant, NJFACE initiated the development of a new hazard alert on the dangers to school crossing guards and protective measures. The Alert will be distributed to all police departments which employ school crossing guards in New Jersey. NJFACE also notified a potential audience of 673 New Jersey school districts that oversee a total of 2,482 individual schools. There are an additional 1,288 non-public (private and parochial) schools targeted for distribution, as well as related labor unions and transportation companies.

OUTCOMES/RELEVANCE/IMPACT

Several NJFACE projects have demonstrated significant impact. The following are highlights of related activities including collaborations, educational outreach, and impact evaluation.

Collaboration with CPWR

Introduction/Broad objectives

Ladder safety in the construction industry is an important public health issue in need of attention. Fatalities and injuries from ladder falls have been on the rise across the U.S. in recent years. According to the Bureau of Labor Statistics' *2004 Census of Fatal Occupational Injuries* there was a 17% increase between 2003 and 2004, with 114 fatal ladder falls reported in 2004. NJFACE registry data show a total of 284 fatal injuries due to falls from 1990 to 2005. Since ladder falls are entirely preventable, proper training on ladder safety techniques is essential to address this public health issue with the ultimate goal of prevention. Moreover, we also proposed to conduct an educational outreach on falls in our grant.

Purpose

The objectives of this collaborative initiative are to develop a ladder fall prevention video and accompanying fact sheets to be administered to construction workers, and to evaluate the impact of these tools on ladder safety. Pilot testing of the video was conducted during its development to evaluate the tool's effectiveness and identify areas in need of improvement.

Methods

Pilot tests were conducted with 25 union laborer apprentices and electrician journey-workers. Pre and post tests were administered to each participant assessing their knowledge, attitude, and behavior regarding ladder safety before and after viewing the twelve minute video. An open discussion followed to gather information about participants' impressions of the video. Pre and post tests were analyzed using the Wilcoxon Signed Rank test and McNemar's test for discordant pairs to test for statistically significant changes in outcomes after viewing the video.

Findings

Overall, viewing the video appeared to improve participants' knowledge and attitudes regarding preventing ladder falls. Specifically, after viewing the video, participants were more likely to report disagreeing with the belief that one can catch oneself if falling from a ladder. Similarly, participants were more likely to report agreeing with the idea that physical strength will not do much to reduce the impact of a fall. Participants in the study were statistically significantly more likely to report that they would inform their supervisor of a ladder safety issue after viewing the video. The analysis indicated the video positively changed the participants' ways of assessing proper ladder angles, and reduced the intended incidence of undesirable behaviors like carrying loads up the ladder by hand, standing on the top of a stepladder, or climbing the back of a step ladder.

These results indicate a short educational video presenting easy-to-understand safety tips and emotional appeals from real workers and their families can have a powerful impact on intended safety practices. The pilot test results from the video were used to improve and modify particular parts of the video, as well as the survey instrument and fact sheets. In 2006, a pilot test will be conducted of these improved tools with 350 building and construction workers on New Jersey construction jobsites, aiming to expand the initiative into a national campaign targeting the construction industry.

Impact Evaluation

The Tree Trimmer and Wood Chipper Hazard Alerts were disseminated along with a survey that asked specific questions to determine the impact on worker health and safety. The following results are examples from analyzing respondent data from the surveys. Each Alert provided recommendations regarding safe work practices. Questions were asked on the survey to determine if these recommendations were either already in place or based on the Alert, would affect a change in work practice. Results indicated that although most of the practices were already in place, in many cases, employers would adopt the recommendations. Tables 5 and 6 below show the three recommendations that affected the highest amount of change in work practices in each Alert. This not only provides some evaluation of impact, but also engenders areas of possible future interventions.

Table 5. Results from Tree Trimmer Alert Survey Recommendations

Recommendation	# Changes Made based on Rec.	# Already in Place or N/A	Not Reported
Keep workers and equipment at least 10 feet from energized power lines	9 (43%)*	189	12
Notify utility company if work is to be done within 10 feet of energized power line	11 (50%)	188	11
Clearly mark work zone boundaries	14 (54%)	184	12

*% refers to the number of establishments that reported they will make the change based on our recommendations among all establishments who did not report already having these measures in place

Table 6. Results from Wood Chipper Survey Recommendations

Recommendation	# Changes Made based on Rec.	# Already in Place	Not Reported
Ensure that the "buddy system" is in place (one worker at in-feed, another at control bar	40 (41%)*	128	58
Ensure that workers are putting short materials on top of longer materials while feeding the chipper	12 (23%)	174	40
Ensure that workers feed do not load small raked-up materials like twigs and leaves into chipper	16 (26%)	178	52

*% refers to the number of establishments that reported they will make the change based on our recommendations among all establishments who did not report already having these measures in place

SCIENTIFIC REPORT

Specific Aims

Aim 1: Design and implement enhanced case reporting, ascertainment, and data analysis.
Aim 2: Utilize surveillance data to identify selected cases for on-site investigation and development of prevention recommendations.
Aim 3: Design and implement in-depth educational interventions for falls and electrocutions in small businesses.
Aim 4: Organize and implement a New Jersey Occupational Fatalities Prevention Advisory Group.
Aim 5: Disseminate findings of case investigations and intervention results using a variety of means.
Aim 6: Evaluate aspects of the enhanced fatality surveillance system, including overall usefulness, utility of the data for targeting industries and occupations, feasibility of replicating the model in other FACE States, and the process of working with stakeholders to develop and implement educational interventions.
Aim 7: Participate in the FACE Consortium Coordinating Committee.

Background

Public health surveillance is vital to the prevention of fatal and non-fatal occupational injuries. There is a need for state-based occupational health surveillance activities as there is currently no comprehensive, nationwide system of surveillance for occupational injuries and hazards. Ongoing systematic data collection and analysis, identification of occupational hazards, interventions through on-site inspections, educational outreach, and evaluating the effectiveness of these actions are part of New Jersey's multifaceted occupational health surveillance system.

Work-related fatal and non-fatal injuries are serious public health concerns which are preventable through occupational health surveillance efforts. In 2003, 104 workers were killed in workplace injuries in New Jersey. NJDHSS surveillance data indicate that there has been a steady increase in the fatality rate in NJ, from 2.5 deaths per 100,000 workers in 1996, to 3.1 in 2002.[1]

Areas of Focus

NJFACE has several in-scope areas, which include the NIOSH priority areas previously established.

Machine-related

Machine-related incidents are a leading cause of occupational fatalities in the U.S., and resulted in an average of 150 deaths each year from 1992-1996.[3] In New Jersey, fatal injuries caused by machinery increased from 8% to 12% of all injuries from 1995-1998.[4] Trades such as manufacturing, construction, and agriculture use extremely diverse types of machinery that can put workers at risk. Equipment such as powered industrial vehicles (e.g., forklifts, manlifts), earth moving/excavating machines, presses, compactors, shredders, conveyors, and mixers are examples of machinery frequently involved in these fatal incidents.[5-7] Common occurrences include being struck by a mobile machine or by a component of a machine, as well as overturning, being crushed by, getting caught, in or falling into a machine.[7] A study examining eight manufacturing facilities from 1992-1995 indicates that interventions such as enhanced powered industrial vehicle safety and training, for both drivers and the pedestrians that work around the vehicles, can significantly reduce risk of injury.[5;6]

Highway Work Zones

Individuals who work in highway work zones comprise another population at risk. This is an important issue in New Jersey as it is one of the most densely populated states and has an extensive roadway network, with over 22,000 miles in the northern region alone.[8] Studies demonstrate that many of these motor vehicle accidents involve ground crew, such as flaggers and surveyors, with females showing a higher fatality rate than males.[9;10] NIOSH targeted highway work zones to study both traffic control factors (as determined by Part IV of the Manual of Uniform Traffic Control Devices), and factors within the work zone such as internal traffic control plans.

Youths

NIOSH has reported that an annual average of 67 U.S. workers under the age of 18 died from work-related injuries during 1992 to 2000. From 1980 through 1995 the death rate in this population was 3.4/100,000 workers.[11] Studies suggest that working long hours during the school year increase the risk or injury in younger workers.[12] In New Jersey, many youths are employed seasonally in the tourist industry which results in large numbers of teenagers placed in potentially hazardous work environments.

Hispanics

The racial/ethnic distribution of New Jersey's working population provides an opportunity to monitor fatal and non-fatal occupational injuries in Hispanic workers (NIOSH in-scope target). Between 1998-2003, Hispanic workers were 1.8 times more likely to die on the job (95% confidence interval 1.5, 2.2) than non-Hispanic workers.[2] The fatality rate ratio by year is shown in Figure 3.

In addition, an analysis comparing the work-related fatality rate of Hispanic to non-Hispanic NJ workers, using Poisson regression, indicates the work-related fatality rate among Hispanics statistically significantly increased between 1998-2003. Among Hispanics, there was a 12% increase in the fatality rate each year during this period (fatality rate ratio of 1.12, with a 95% confidence interval 1.02, 1.23). However, the work-related fatality rate among non-Hispanic workers has not been statistically significantly increasing over these six years, the rate ratio is 1.0 (95% confidence interval 0.95, 1.04). It is also important to note that an overlap exists in the in-scope priorities in NJ. For example, from 1998 to 2004, 30% of the 75 machine-related fatalities in NJ were among Hispanics.[2]

Interventions

An essential component of surveillance is to develop comprehensive and effective strategies to prevent injuries and thereby decrease the number of occupational fatalities. Studies suggest that proper safety training, for example, can reduce the risks for both fatal and non-fatal injuries.[16] For example, one study showed that intervention activities are associated with a 20% decline in lost-time injury rates in the field of construction.[17] New Jersey placed special emphasis on special populations that may be at increased risk for a fatal injury.

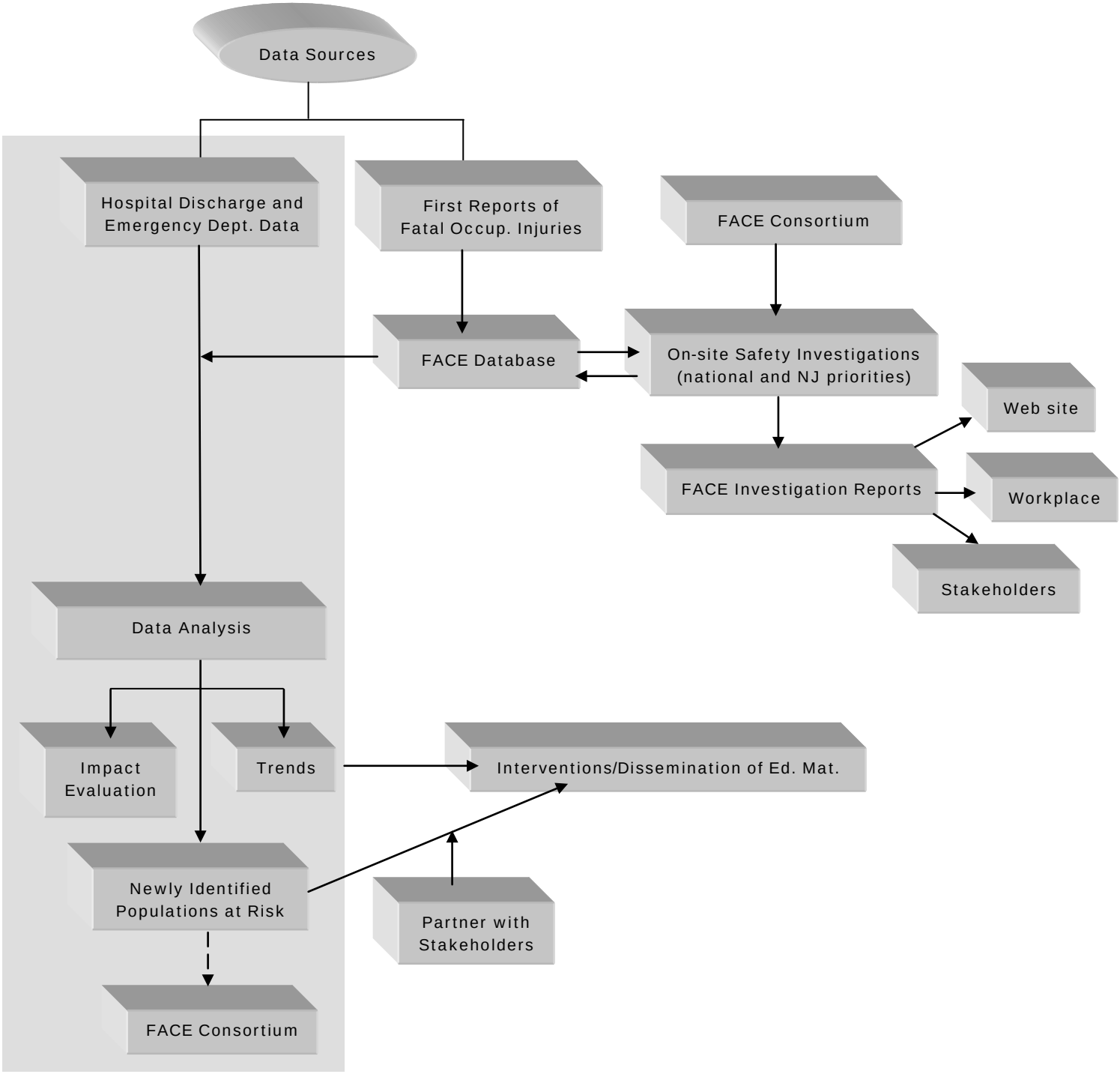
Methods

The NJFACE Project has developed and maintained a surveillance system for identifying work-related fatal injuries in New Jersey based on national priorities defined by NIOSH as in-scope (machine-related, highway work zones, youths, and Hispanics). This system enables us to identify work environments that place workers at a high risk for fatal injury and to identify risk factors for these fatal injuries. The procedures for maintaining and expanding the NJFACE which are outlined in detail below, include receiving fatality notifications through existing primary surveillance sources, investigation and ascertainment of work-relatedness, and data collection. Figure 5 illustrates the enhanced NJFACE surveillance system. The shaded portion on the left side of the figure illustrates the epidemiology component including ongoing data analysis which demonstrates how NJFACE conducts research to practice.

Existing Primary Surveillance Sources

Newspaper Clipping Service and News Media: Thirty-four percent (34%) of all our first notifications of work-related fatal incidents have come from the news media. NJFACE currently contracts with a newspaper clipping service to search New Jersey and selected New York City and Pennsylvania newspapers for news articles on fatal and serious non-fatal occupational injuries. News clips are sent to the FACE project twice each week. Non-fatal serious injury information is sought because it is difficult to obtain information when a worker dies weeks or months after his or her injury. In addition, DHSS staff scans major New Jersey newspapers, radio, and television news media using internet search engines for information about fatal and serious occupational injuries.

FIGURE 5
New Jersey Department of Health & Senior Services
Occupational Health Surveillance Program
NJFACE Flowchart



Medical Examiners:(33% of fatal incident first notifications) The NJ State Medical Examiners Office oversees the 17 individual county and one regional (covering four counties) medical examiners offices. All medical examiners are sent a letter and poster listing the criteria for determining if a fatal injury is work-related. Each medical examiners office was contacted by telephone each month to request information about all work-related fatalities.

Federal and State Occupational Safety & Health Agencies (15% of fatal incident first notifications)*:* NJFACE receives fatality notifications from Federal OSHA, which covers private sector employees, and the two NJ Public Employees Occupational Safety and Health (PEOSH) programs, who cover public employees. Federal OSHA directive CPL 02-00-134 *OSHA Support of NIOSH "FACE" Program* (1/26/04) officially establishes protocols for sharing information and conducting investigations with OSHA. NJFACE has similar agreements with both the NJ Department of Labor and Workforce Development (NJDLWD) and NJDHSS PEOSH programs. NJFACE periodically distributes a small poster to all compliance officers reminding them to contact NJFACE when they are assigned a fatality investigation. Annual meetings are scheduled with each area office to allow NJFACE to present program updates and research results that may be of interest and help maintain this partnership.

Death Certificate Registry Data (11% of fatal incident first notifications)*:* The NJDHSS Vital Records Unit maintains a computer database of all death certificates, which contains a check-off box for a work-related fatality and the ICD-9 code for underlying cause of death. Each month, NJFACE staff checks the database and hand-sorts through recently-filed death certificates to find unreported fatalities.

Other Sources*:* NJFACE continues to encourage fatality notifications from other sources. Past sources include other NJDHSS staff (3%), Census of Fatal and Occupational Injuries (CFOI) (2%), workers compensation (1%), and other sources (1%).

Ascertainment of Work-relatedness

On receiving first notification of a work-related fatal injury, the details of the incident and victim are recorded on a NJFACE First Report form. This First Report form includes information about the employer, type of incident, dates, location of the injury, and demographic and employment information about the deceased. The Standard Industrial Code, Census Occupational Code, and International Classification of Disease (ICD) 9 & 10 External Cause of Injury codes (E-codes) are determined and recorded on the form.

Each first report is given a unique NJFACE identification number. Multiple documents are sought to completely detail each fatality. This information is used to initially ascertain and confirm that the incident was work-related. Once confirmed as work-related, the information is used to further determine if the incident is in-scope for investigation, i.e., that it meets the targeting criteria that would make the case eligible for a NJFACE field investigation.

Data Collection and Data Entry

Data from the NJFACE First Report forms are entered into a Microsoft Access® database. This database is used to monitor trends and identify target groups for interventions. Data records are updated when new information is received.

Variables collected include industry type, number of employees, company safety program, victim demographics (e.g., age, sex, and occupation), production process, working environment, and the tools and machinery used by the victim. Additional variables which collected include the victim's usual working hours and days (shift work), union membership, and if the victim was a temporary worker or permanent employee. If a new fatality type is targeted, a new data collection instrument is designed and field tested to gather specific information for that target. If a data collection instrument is not available for a given fatality type, the investigator uses the relevant general information sections of an existing instrument as a field substitute.

Data Analysis

The reasons for the increasing fatality rate among Hispanic workers and the elevated risk of occupational fatalities among Hispanic workers are unknown and our current work proposes to fill this gap in knowledge. The denominator data used in the following analysis were the total New Jersey working population by race/ethnicity.[13] Since particular racial/ ethnic groups may be more likely to work in an industry which has a higher probability of having a fatal incidence occur, e.g., construction, there may be confounding in rates which

do not control for the numbers of workers at risk. Therefore, industry-specific and racial/ethnic-specific denominator data from United States Department of Labor's Bureau of Labor Statistics (BLS) are utilized to obtain work-related fatality and injury rates to control for confounding.

Obtaining the true risk among this target population is important as crude estimates using overall working population may mask a much more elevated risk, or underestimate the actual risk. The knowledge to be gained by these analyses is useful in focusing interventions on a target group. For example, language barriers and the lack of adequate training may also play a role in the disproportionate number of occupational fatalities among Hispanics, however before conducting interventions or expending resources on a target group, analyses that control for such confounders need to be carried out.

Analysis of surveillance data and characterizing populations that are at greatest risk and who can most benefit from an intervention enables the dissemination of educational materials to be targeted to the groups who have the highest frequency of traumatic and fatal injuries. The New Jersey fatality surveillance data, coupled with the emergency department and hospital discharge datasets, are used to monitor trends and identify target groups through data analysis. These analyses are critical elements to help begin to address the following important gaps in knowledge:

- Why Hispanics suffer a disproportionate percentage of fatal occupational injuries
- Why the numbers of ladder falls are increasing despite intervention and education designed to improve worker awareness
- Obtaining industry, race/ethnic and age-specific fatality and injury rates in New Jersey
- Identifying target groups for occupational motor vehicle accidents

Emergency Department (ED) and Hospital Discharge (HD) Datasets

NJDHSS has been receiving HD data since 1981 and has recently began receiving ED data in January 2004.The NJDHSS surveillance system utilizes ED and HD data to characterize populations most at risk for occupational injuries that frequently result in fatalities. By systematically collecting data on all visits, targeted interventions are developed to prevent or lessen the morbidity and mortality from many injuries. The importance of public health surveillance and the potential of ED for this purpose have been well-documented. [14;15]

Identification of In-Scope Cases

NJFACE utilizes surveillance data to identify selected cases for on-site investigation of in-scope fatalities. Current in-scope targets are machine-related incidents (started FFY 1995 to present), highway work-zone (FFY 2000 to present), and youths less than 18 years of age (FFY 2000 to present). NJFACE started pilot-testing investigations of Hispanic victims in 2003, these investigations are continuing. In addition, NJFACE targeted tree trimmers (arborists), public employees, and multiple fatality incidents as state priorities. Past targets include fatal falls (FFYs 1990 to 1999), electrocutions (FFY 1990 to 1995), and confined space incidents (FFYs 1993 to 1995).

In-scope fatality types are determined by the incident circumstances. The four types of fatal incidents currently targeted by the FACE Consortium as in-scope are defined below:

1. ***Machine-related***: Defined as death caused by contact with machinery.
2. ***Highway work zone***: Defined as death due to the traumatic injury of a worker in a highway work zone. Highway work zones are defined by Part IV of the US Department of Transportation Manual on Uniform Traffic Devices.
3. ***Youths***: Defined by NIOSH as death due to the traumatic injury of a worker less than 18 years of age.
4. ***Hispanic***: Defined as a work-related fatal injury occurring to a Hispanic worker.

In addition, NJFACE investigates certain incidents as state priorities. The current NJ targets include:

Tree Trimmers: NJFACE targeted tree trimmers in 2001 in response to the number of workers killed in this industry, leading to our successful collaboration with several tree care organizations and the publishing of a warning bulletin. NJFACE proposes to continue targeting this industry to utilize our newly established partnerships and expertise in this area. Tree trimming activities are defined under the American National Standard ANSI Z133.1, *Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and Cutting Brush-Safety Requirements.*

Public Employees: NJFACE works closely with the NJDHSS and NJDLWD PEOSH Program, and continues to target public employees due to the high number of non-fatal, work-related injuries in New Jersey public employees and the close relationship with state government programs.

Multiple Victims: Multiple fatality incidents often involve catastrophic events that result in the deaths and injuries of more than one worker. NJFACE has targeted these incidents to better understand the factors and circumstances causing these incidents. Investigations are chosen depending on access, site safety, staff expertise, and the value of the information gathered for prevention purposes.

Incident Investigation Protocols

All cases are investigated using the NJFACE Investigation Protocols. These protocols may vary with the circumstances of a given incident, but follow the following format:

Case Initiation*:* After identifying an in-scope incident, a NJFACE investigator immediately contacts federal OSHA to ask if they are aware of the incident. The investigator then gathers background information on the incident to confirm that it is in-scope. Copies of the Medical Examiner's Report of Investigation and police report are obtained by fax when available. The NJFACE investigator schedules an independent investigation unless a joint investigation with the assigned OSHA compliance officer is possible.

Employer Notification: A NJFACE investigator telephones or otherwise contacts the employer for permission to conduct an investigation. An introductory letter and NJFACE brochure is faxed, e-mailed, or mailed to the employer before the investigation. If the incident occurred on the property of a third party, then a similar notification process is conducted with the owner of the incident site.

Opening Conference: Once on site, NJFACE investigators fully explain the goal of the FACE program and purpose of the visit to all involved parties including (but not limited to) the employer, incident site owner, witnesses, and labor unions. Verbal consent forms are obtained and any questions are addressed before starting the investigation. If conducting a joint investigation with OSHA, OSHA is the lead agency and directs the investigation.

Investigation: After the opening conference, NJFACE investigators explore the circumstances of the incident with the employer or their representative, by asking questions about the victim, production process, machinery, training, and safety policies. Witnesses and co-workers are also interviewed. NJFACE investigators inspect the incident site with the employer and witnesses whenever possible. Sketches and measurements of the site are taken, as well as specific information on any equipment involved. Investigators photograph the site and related equipment with the permission of the employer.

Closing Conference: After completing the incident site visit and all interviews, NJFACE investigators meet with the employer to discuss any findings, hazards, and recommendations. Documents, blueprints, photographs, or other company records examined during the investigation may be copied if the employer permits. Investigators answer any final questions and provide copies of non-confidential information the employer requests.

Post-Investigation: After completing the site visit, the NJFACE investigator obtains all available relevant background source information on the incident. This includes the police report, report of investigation by Medical Examiner, autopsy, toxicology reports, and Federal OSHA files. If needed, additional site visits or calls to the employer are scheduled. NJFACE investigators also collaborate with any organizations or stakeholders that may assist in gathering information on the incident or related industry practices. Federal OSHA or NJ PEOSH routinely provide support on most investigations. The NJ Department of Transportation isl be consulted on investigations regarding highway work zone incidents. The Committee for the Advancement of Arboriculture is also consulted for incidents regarding tree trimmers.

Investigation Reports: Following the completion of the investigation, the information is compiled into a comprehensive NJFACE investigation report. The report provides background on the employer and victim, a detailed description of the incident, and recommendations for preventing future incidents. Computer-generated graphics and digital photographs are added to illustrate most reports. Identifiers such as the name of the victim, employer, witnesses, site of fatality, or next-of-kin are not be included in the report. A NJFACE report is composed of the following sections:

1. First page: Includes a synopsis of the incident and the list of recommendations.

2. Introduction: This section provides information on how NJFACE learned of the incident, along with important dates and sources of information, including a brief description of the employer and victim.
3. Investigation: This is the main narrative of the report that fully describes the incident. The victim's job duties, the production process, and events leading up to the incident are covered in detail. Post-incident actions outline the attempts to save or treat the victim. All personal identifiers are omitted. Photographs are edited for the same purpose.
4. Recommendations and Discussion: This section provides detailed recommendations for preventing similar incidents in the future. Each recommendation has a discussion section to directly link it with the incident and explain how the incident could be avoided. When appropriate, prevention strategies that go beyond OSHA's emphasis on standards and regulations are recommended. Many reports include attachments to fully explain a recommendation, such as a NIOSH Alert or OSHA publication. A list of various safety information sources are included. This includes contact numbers and Internet web addresses to OSHA and PEOSH, NJDLWD OSHA Consultation Service, the NJ State Safety Council, and other general sources of safety information.
5. Other sections: Includes references, attachments, signatures of authors and reviewers, and a distribution list of recipients.

After internal review by the DHSS, the draft investigation report is sent to Federal OSHA or NJ PEOSH for review and comment. The final report is sent to the employer, site owners, labor union(s), the local Health Officer, and other concerned parties. The victim's family is notified of the investigation and provided a copy of the NJFACE report on request. The report is also be posted on the DHSS Web site, and is sent to NIOSH to be posted on the national FACE Web site.

Educational Outreach, Disseminations, and Collaborations

Another important intervention activity is the development and dissemination of educational materials. The dissemination of educational materials to the full constituency of persons who can use and benefit from the findings, including workers, companies, media, and political leaders is the crucial output of an effective surveillance system.[18] In addition, NJFACE conducts interventions for all in-scope occupational fatality categories, and has also focused on falls and motor vehicle accidents.

Falls: The average annual fatality rate of work-related falls in New Jersey is 21 per 4 million workers (95% confidence interval 18, 25) across years 1998-2004.[2]This rate has been statistically significantly increasing about 10% per year over years 1998-2004, with a rate ratio of 1.1 (95% confidence interval of 1.02, 1.18) for each increase in year.[2]

Fifty-nine percent of the 74 fatal falls which were investigated in New Jersey between 1990 and 1999 occurred on non-union worksites.[2] Union members have access to yearly safety and health education/ training in a classroom setting and often participate in on-site safety training by supervisors. These factors may lead to a safer work environment, and may help to reduce injuries and fatalities. In a non-union setting, education and training of employees may be lacking, which could lead to a greater number of injuries and fatalities. Therefore, we expanded our existing ladder falls initiative to target non-union members in New Jersey.

A recent study on fatalities in the construction industry between 1994 and 2002 was conducted utilizing BLS and Occupational Safety and Health Administration's (OSHA) IMIS database.[19] Researchers found that 63% of construction fatalities in the U.S. between 1994-2002 occurred in companies with less than 50 employees while 74% occurred in companies with less than 100 employees.[19] Of 163 construction fatalities occurring in NJ between 1994-2003 where union status was reported, 71% were non-union employees.[19] Moreover, smaller construction companies (<50 employees) appear to have an elevated risk of fatalities. There is a need for interventions to be carried out in small construction companies. In this proposal, we helped bridge this gap in the disparity of smaller construction companies suffering a disproportionate number of fatalities by conducting a ladder education intervention focused on small, non-union construction companies.

Work-related Motor Vehicle Accidents (MVAs): During the years 1993-2002, transportation events were responsible for 36% (423) of the 1,160 deaths of workers in the state. The average age of these decedents was 41 years old, and 125 (64%) were under the age of 45. Forty-five percent of the events occurred on local roads with

truck drivers comprising 36% of the victims. The magnitude of the problem is underscored by the much larger number of non-fatal injuries resulting from work-related MVAs. Specifically, in 2004 there were 229 occupational MV injuries requiring a hospitalization and an additional 1,740 occupational MV injuries requiring a visit to the ED. The estimated medical bills for these 1,969 occupational MV injuries in 2004 totaled over 18 million dollars.[2]

New Jersey Occupational Fatalities Prevention Advisory Group (NJ OFPAG): The advisory group is made up of representatives from trade associations, occupational health professional associations, safety professionals, occupational physicians and nurses, labor unions, universities, and other state and federal agencies. The purpose of the OFPAG meetings is to: 1) identify the special safety needs and problems of small businesses (e.g., economic, social, and technological); 2) identify severe injury trends in industries not identified by NJFACE; 3) obtain input on new initiatives such as the proposed intervention on Motor Vehicle Accidents; 4) solicit feedback on educational materials including evaluations tools. The process of working with the OFPAG involves a two-way sharing of information between project staff and stakeholders to guide discussion of the anticipated effectiveness of intervention activities.

Results

Summary of Work-Related Fatality Surveillance

There have been a total 1,672 victims of fatal work-related injuries in New Jersey since the inception of the NJFACE program in 1990. Table 7 displays the number of workers by type of incident for the years 1990 to 2005 and Table 8 shows show the same information for the 2001-2006 grant period.

TABLE 7
Number and Type of Fatal Work-Related Injuries
1990-2005

Type of Incident	Number	Percent
MVA or Transportation-related	527	31.5
Fall	284	17.0
Homicide/Assault	235	14.1
Machine-Related	185	11.1
Electrocution	96	5.7
Struck by Object	69	4.1
Suicide	59	3.5
Fire/Explosion	52	3.1
Toxic Exposure	47	2.8
Highway Work Zone	27	1.6
Confined Space	15	0.9
Drowning	15	0.9
Caught by or between	15	0.9
Other	14	0.8
Heat/Cold-related	11	0.7
Youth	6	0.4
Farming-related	6	0.4
Trenching	5	0.3
Unknown	3	0.2
Logging	1	0.1
TOTAL	**1,672**	**100**

TABLE 8
Number and Type of Fatal Work-Related Injuries
2001-2006

Type of Fatality	Number	Percent
MVA or Transportation-related	184	25.9
Hispanic	139	19.5
Fall-Related	101	14.2
Homicide/Assault	76	10.7
Machine-related	61	8.6
Struck by	30	4.2
Suicide	26	3.7
Toxic Exposure	21	3.0
Electrocution	19	2.7
Fire/Explosion	16	2.3
Other	7	1.0
Highway Work Zone	6	0.8
Drowning	6	0.8
Heat/Cold Related	6	0.8
Farm-related	4	0.6
Youth	3	0.4
Caught by or between	3	0.4
Unknown	3	0.4
Total	**711**	**100**

Table 9 shows the gender, race, and age of the 1,672 victims. The majority (94%) of the victims were male. Age at death ranged from 15 to 89; 69% were 49 years old or younger. Mean and median ages were 43 and 42, respectively.

NJFACE has conducted a total of 197 field investigations and distributed 182 investigation reports containing findings and recommendations to employers and other stakeholders since the inception of this surveillance project.

TABLE 9
Demographic Characteristics of Fatal Occupational Injuries
New Jersey, 1990-2005

Characteristic	Number	Percent
Gender		
Male	1,571	94
Female	101	6
Race		
White	1,049	63
Hispanic	276	17
Black	231	14
Asian	76	4
Other	40	2
Age*		
Less than 18	6	0.4
19-29	314	19
30-39	408	24
40-49	423	25
50-59	306	18
60-69	134	8
70-79	63	4
80 and older	9	1
TOTAL	**1,672**	**100**

**Age was unavailable for nine of the victims*
Note: Percentages may not add to 100 due to rounding.

For the period of 9/1/01 to 8/31/06, NJFACE has initiated 43 field investigations and has released 34 investigation reports. There have been a total of 197 field investigations and 182 investigation reports completed since the inception of the program in 1990.

Table 10 lists the 28 investigation reports released during the period of 9/1/01 to 8/31/06. Copies are available on the NJDHSS and NIOSH Internet Web sites.

Table 10: NJFACE Investigation Reports Released from 9/1/01 to 8/31/06

Incident Type	Report Title
Machine	Machine Assembler Crushed Between Machine Sections During Assembly (00NJ040)
Machine	Laborer Killed When a Truck Struck A Backhoe and Pinned the Victim Between the Backhoe and a Dumpster (00NJ111)
Machine	Machine Operator Killed While Trying to Repair a Conveyor Belt (01NJ019)
Machine	Machine Operator Killed In Masonry Block Palletizing Machine (01NJ092)
Machine	Worker Killed in Compressed Air Explosion at a Tire Retread Plant (01NJ108)
Machine	Landscaper Crushed between Backhoe and Truck (02NJ025)
Machine	Crane Rigger/Spotter Run Over by Mobile Gantry Crane (02NJ030)
Machine	Forklift Operator Dies After Backing his Forklift Off a Loading Dock (02NJ081)
Machine	Construction Worker Struck and Killed by a Pile Falling From a Crane (03NJ010)
Machine	Forklift Operator Killed When His Forklift is Overturned by a Backing Truck (03NJ020)
Machine	Hispanic Tree Trimmer Killed After Being Pulled into A Wood Chipper (03NJ042)
Machine	Hispanic Arborist's Helper Struck and Killed by A Falling Tree (03NJ043)
Machine	Hispanic Construction Worker Killed when Struck by an Excavator Bucket (03NJ085)
Machine	Laborer Crushed Under Overturned Road Milling Machine (03NJ086)
Machine	Motocross Track Owner Killed When Tractor Overturned (03NJ093)
Machine	DPW Employee Dies After Falling Off The Trailer Hitch of a Leaf Vacuum (03NJ100)
Machine	20-Year-Old Man Killed When Struck By Tree Falling from Tree-Cutting Machine (04NJ013)
Machine	Maintenance Supervisor Crushed Under a Falling Gantry Crane (04NJ074)
Hwy Work-Zone	Truck Driver Killed In Highway Work Zone Collision (01NJ020)
Hwy Work-Zone	Jackhammer Operator Run Over by a Truck in a Highway Work Zone (01NJ098)
Hwy Work-Zone	Field Engineer Struck by Vehicle While Painting Highway Markings (01NJ129)
Hwy Work-Zone	Municipal Road Worker Struck by a Truck at a Worksite (03NJ054)
Hwy Work-Zone	Highway Worker Struck and Killed by an Auto While Filling Potholes (03NJ070)
Youth	15-Year-Old Youth Crushed While Cleaning a Dough Mixing Machine (01NJ118)
Youth	17-Year-Old Pizza Delivery Driver Killed in a Motor Vehicle Accident (02NJ021)
Struck-By	Tree Climber Crushed by Falling Tree Section (01NJ055)
Struck-By	Hispanic Quarry Supervisor Struck by Machine Part During Maintenance (03NJ021)
Fall	Hispanic Construction Worker Dies After Fall from an Improvised Scaffold (03NJ091)
Explosion	Industrial Metals Recovery Worker Killed in Explosion (02NJ003)
Fall	Roofer Killed After Falling From a Ladder Lowered From a School Roof (04NJ034)
Fall	Worker Killed in a Fall in a Bakery Fermentation Tank (05NJ003)
Fire	Hispanic Factory Worker Dies of Burns after Improperly Testing a 480-volt Bus Bar (04NJ059)
Electrocution	Landscaper Electrocuted and Two Workers Seriously Injured When a Felled Tree Landed on an Overhead Power Line (01NJ117)
MVA	Recycling Collector Dies After Falling Under the Wheels of His Truck (05NJ077)

Additionally, the following fatality investigations were initiated:

06-NJ-047: Concrete pipe worker killed when struck by a forklift – The victim was walking across the floor of a plant that manufactured prestressed concrete pipe when he was struck by a forklift which was backing up. Permission from the victim's employer to conduct a full investigation is pending.

06-NJ-045: Warehouse worker crushed by a crate falling from a forklift – A 6,000-pound crate filled with granite slabs fell from a forklift and struck the victim. Permission from the victim's employer to conduct a full investigation is pending.

05-NJ-103: Police officers dead in motor vehicle accident – Two police officers died when they drove off a malfunctioning drawbridge. NJFACE attempted to conduct a concurrent investigation with the NJDHSS Public Employees Occupational Safety and Health Program, but was denied entry by the bridge owner. Consent of the employer to participate in a FACE investigation is pending.

05-NJ-099: Hispanic worker crushed under a collapsing crane – The crane was being moved when the metal at the base of the crane split, causing it to collapse and crush the worker. Permission from the victim's employer to conduct a full investigation is pending.

05-NJ-090: School crossing guard struck by sport utility vehicle – NJFACE conducted an investigation into the death of this crossing guard. The guard was not wearing reflective clothing when she was struck on a dark rainy morning. The investigation report is undergoing Departmental review.

05-NJ-081: Worker struck by falling tree section –NJFACE conducted an investigation into the death of a groundsman at a tree trimming company who died when struck by a falling section of tree that had been cut. The investigation report is being drafted.

05-NJ-078: Print shop worker killed in machine-related incident – NJFACE initiated an investigation of a printing pressman killed when pulled into a printing press. The victim had leaned into the press to adjust the machine when the operator started the press. The investigation was closed when the employer declined entry for an investigation.

05-NJ-077: Worker killed in transportation- related incident – NJFACE conducted an investigation of a recycling/sanitation worker run over by a recycling truck. Victim was riding the driver's side of the truck and slipped as the truck made a turn, falling under the front wheels of the truck. The investigation report is being finalized.

05-NJ-076: Dock worker dead in transportation-related incident – NJFACE initiated an investigation of a tractor trailer driver killed when he drove his truck cab off a shipping dock. Victim was working at a shipping terminal, using the truck to load a barge when he backed off the dock. The investigation was cancelled when it was determined that the victim had a heart attack which caused the incident.

Data Analysis

In-depth data analysis is an integral part of NJFACE surveillance activities, guiding NJDHSS and national efforts to improve worker safety, and to monitor trends and progress over time.

An analysis was conducted to study incidents in two overlapping categories of "in-scope" priorities, namely, machine-related and Hispanics. An increase in work-related fatalities among Hispanics was observed during the years 1998-2004 (Figure 6). In addition, an analysis comparing the work-related fatality rate of Hispanic to non-Hispanic NJ workers, using the Poisson regression statistical method, indicates a statistically significant increase of the work-related fatality rate among Hispanics for the years 1998-2004. Among Hispanics, there was a 10% increase in the fatality rate each year during that time period. Furthermore, the data show that Hispanic workers were almost twice (1.8 times) more

likely to die on the job than non-Hispanic workers during that period. In contrast, the work-related fatality rate among non-Hispanic workers has not been significantly increasing over these seven years (Figure 7). Another area for concern is the disproportionate number of machine-related fatalities among Hispanics, both of which are NIOSH priority areas for investigations. Hispanic males only comprise 15% of the working population of New Jersey. Yet from 1998 to 2004, 29% of the 85 victims of machine-related fatalities were Hispanic men (Figure 8).

FIGURE 6
Hispanic Work-Related Fatalities
1998-2004

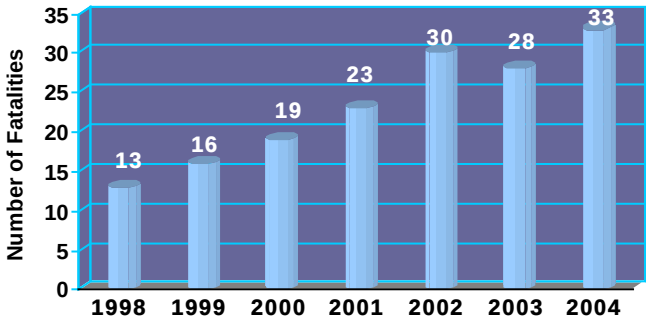


FIGURE 7
Rate Ratios of Hispanic to Non-Hispanic
Work-Related Fatalities among Males
1998-2004

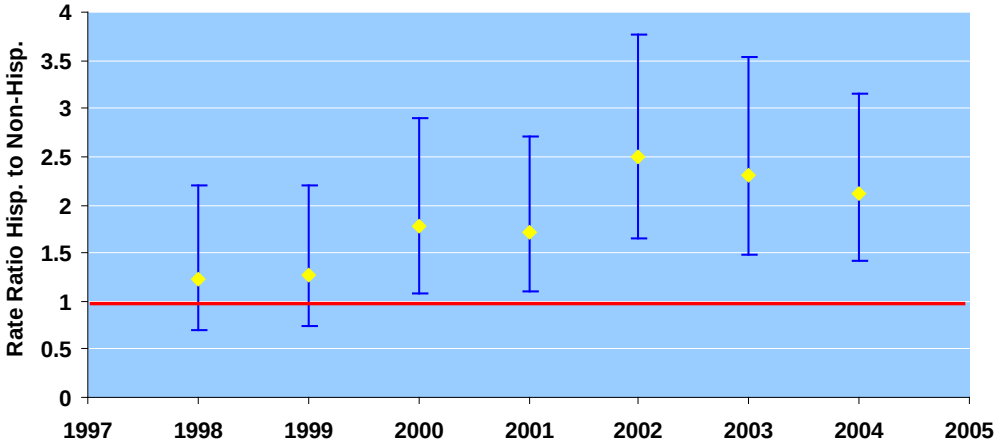
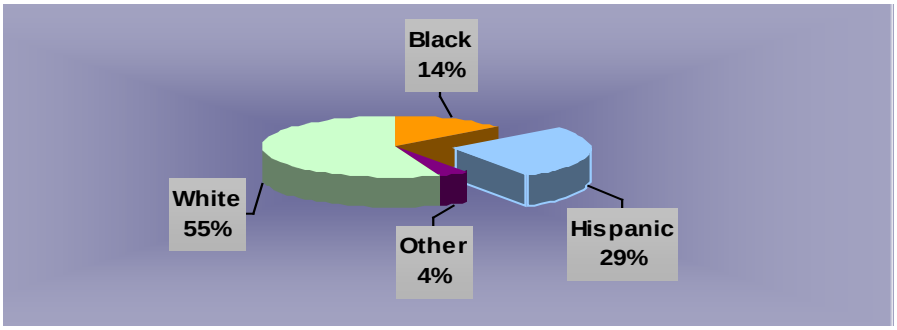


FIGURE 8
Machine-Related Fatalities by Race/Ethnicity
1998-2004; N=85



The reasons for this increasing fatality rate among Hispanic workers and the elevated risk of occupational fatalities among Hispanic workers are unknown and are being studied to rule out any confounding factors. Since particular racial/ethnic groups may be more likely to work in an industry which has a higher probability of having a fatal incidence, e.g., construction, there may be confounding factors associated with the rates which do not control for the numbers of workers at risk.

In the interim, NJFACE has begun conducting outreach and education activities to this special population based on these findings.

Educational Interventions and Collaborations

The Center to Protect Workers' Rights (CPWR)

NJFACE proposed to design and implement educational interventions for preventing falls in small businesses. According to NJ FACE data and information reported by the NJ CFOI project, falls are a leading cause of work-related fatalities in New Jersey. Based on these data, NJ FACE planned an educational outreach to address this issue. In collaboration with CPWR (a non-profit organization affiliated with the Building and Construction Trades Department of the AFL-CIO), a ladder-safety training video and informational fact sheets were developed. The video, entitled *Don't Fall For It*, has been completed, and the following four fact sheets have been drafted and were distributed to the employees who view the training video:

- *Protect Yourself from Fatal or Crippling Falls*
- *Choosing and Inspecting Ladders*
- *Setting up Ladders with Gravity in Mind*
- *Climbing Ladders with Gravity in Mind*

This educational project includes an evaluation component in which pre- and post-tests are administered to the workers before and after watching the video and receiving the fact sheets. The data collected from these tests were analyzed to determine the impact of these materials on the workers. The report has been written and is currently in review at CPWR.

Overall, viewing the video appeared to improve participants' knowledge and attitudes regarding preventing ladder falls. Specifically, after viewing the video, participants were more likely to report disagreeing with the belief that one can catch oneself if falling from a ladder. Similarly, participants were more likely to report agreeing with the idea that physical strength will not do much to reduce the impact of a fall. Participants in the study were statistically significantly more likely to report that they would inform their supervisor of a ladder safety issue after viewing the video. The analysis indicated the video positively changed the participants' ways of assessing proper ladder angles, and reduced the intended incidence of undesirable behaviors like carrying loads up the ladder by hand, standing on the top of a stepladder, or climbing the back of a step ladder.

These results indicate a short educational video presenting easy-to-understand safety tips and emotional appeals from real workers and their families can have a powerful impact on intended safety practices. The pilot test results from the video were used to improve and modify particular parts of the video, as well as the survey instrument and fact sheets. In 2006, we will conduct a pilot test of these improved tools with 350 building and construction workers on New Jersey construction jobsites, aiming to expand the initiative into a national campaign targeting the construction industry.

A synopsis of the project was presented at the 2006 NIOSH NORA Symposium, "Research Makes a Difference." The presentation was entitled *Ladder Fall Prevention Initiative for Construction Industry*.
Committee for the Advancement of Arboriculture Partnership: For over ten years, NJFACE partnered with the committee for the Advancement of Arboriculture (CAA), a non-profit umbrella organization sponsored by ten NJ tree-care organizations. NJFACE staff confer regularly with CAA representative Steve Chisholm, who also assists federal OSHA in fatality investigations involving arborists and logging. In return, NJFACE has provided data which the CAA has used in their training programs. NJFACE is currently advising the CAA on the development of training modules for crane operators working in tree-removal operations.
Products: *Warning! Tree Work Can be Deadly*. NJFACE is collaborating with the CAA to produce an hazard alert on the dangers inherent in the profession. This one-page alert with outlines the major hazards of tree-trimming; falls, electrocutions, and being struck by falling objects, and provides references to organizations that provide job and safety training. This alert is currently in production and is scheduled for release to approximately 2,000 arborists in the fall of 2005. A copy of this alert is included in the Appendix.

New Jersey Occupational Fatalities Prevention Advisory Group (OFPAG)
To date, fifteen NJ stakeholders who come from labor, industry, academia, and various government agencies have participated in the NJFACE OFPAG. OFPAG meetings give members an opportunity to share their knowledge and expertise on projects and initiatives implemented by FACE staff, and to raise new issues for discussion. At the last meeting there was a consensus that the Advisory Group needed to recruit more representatives from the private industry sector. Also, the President of the NJ State Safety Council brought up the topic of the prevention of work-related motor vehicle accidents (MVAs). Other members shared the concern that seemingly little has been done to prevent these fatalities although MVAs are the top killer of workers in both NJ and the United States.

Pizza Restaurant Youth Hazard Alert
NJFACE investigated the deaths of two youths who were working at pizza restaurants: a 16-year-old undocumented immigrant who died after being entangled in a dough-mixing machine, and a 17-year-old youth who was killed in a motor vehicle accident while delivering pizzas. In both incidents, the youths were doing work prohibited by the federal regulations as hazardous occupations; however, the employers were exempt from these rules due to their small size. Recognizing that these hazards may be common in other pizza restaurants, NJFACE staff created a hazard alert to warn these restaurants. After conferring with the NJ State Department of Labor & Workforce Development, NJFACE staff created a warning alert outlining the two incidents and giving the employers contacts for more information. NIOSH assisted by providing us with a comprehensive mailing list of 2,861 NJ pizza restaurants and the *NIOSH Alert: Preventing Deaths, Injuries, and Illnesses of Young Workers*. These materials were assembled into an educational package and mailed to the restaurants.
Products: Warning alert: *Warning! Dangers to Teens Working at Pizza Restaurants*
Article: *Teenage Restaurant workers Die on the Job* Occupational Health Surveillance Update, December 2003

Sanitation Worker Hazard Alert
An analysis of the NJFACE database found that sanitation workers were at a high risk of being killed while working on or near their garbage trucks. The basic details of the incidents were abstracted and outlined in a hazard alert, which was written using simple language and graphics. A Spanish translation of the alert was printed, and NIOSH provided copies of the *NIOSH Alert: Preventing Worker Injuries and Deaths From Moving Refuse Collection Vehicles*. An educational package was made up of English and Spanish versions and the NIOSH Alert, which was sent to 1,000 private sanitation companies and municipalities.

Products: *Don't Get Hurt Working Around Sanitation Trucks* 2001; *Tenga Cuidado Cuando Trabaja en los Camiones Sanitarios* 2001

Crossing Guard Warning Bulletin

Analysis of NJFACE database showed that there were a total of 12 work-related fatal injuries to crossing guards, all of whom were killed after being struck by vehicles while at work. NJFACE initiated the production of a new hazard alert on the dangers to school crossing guards and protective measures. The Alert will be distributed to all police departments which employ school crossing guards in New Jersey. NJFACE also tified a potential audience of 673 New Jersey school districts that oversee a total of 2,482 individual schools. There are an additional 1,288 non-public (private and parochial) schools targeted for distribution, as well as related labor unions and transportation companies.

Tree Trimming Warning Bulletin

With input from NIOSH and the Committee for the Advancement of Arboriculture, NJFACE finalized and mailed a warning bulletin to approximately 1,400 arborists (both public and private) in the fall of 2005. This one-page bulletin entitled, "Warning! Tree Work Can Be Deadly," outlines summaries of three actual cases (fall, electrocution, and struck by a falling object). Recommendations for preventing similar accidents were listed for each case study. References to organizations that provide job and safety training were also included. The bulletin was mailed with an evaluation survey form and survey results are being analyzed. The warning bulletin will be translated into Spanish as recommended by several survey respondents.

Hazard Alert on Wood Chippers

Since 1993, there have been three work-related fatal injuries and more than 52 serious nonfatal injuries in New Jersey as a result of working with mobile wood chipping machines. In 2005, the NJFACE Program initiated a wood chipper fatal and non-fatal injuries intervention project. The number of injuries and fatalities in New Jersey as well as collecting information on the type, number, condition, and safety equipment in place, of wood chippers that are used in New Jersey.

NJFACE developed a Hazard Alert entitled, "Wood Chippers," that provides recommendations on the safe operation of wood chipping machines for each of the following areas: Training, Pre-operation, Operation, and Machine Safety. The Alert was reviewed by NIOSH, the NJ Chapter of the International Society of Arboriculture, and two NJ Departments of Public Works (DPW). The Alert was also translated into Spanish, as the Hispanic population has been identified as a high-risk group in this industry. The Alert (in English and Spanish), along with a cover letter, an evaluation form, and a postage-paid return envelope was mailed to 745 private tree-care companies and 673 DPWs in New Jersey.

In addition, an article entitled, "Hazard Alert: Working with Wood Chippers is Dangerous" was published in the May-June 2006 edition of *La Guia del Inmigrante* (The Immigrant's Guide). This newsletter is distributed to over 10,000 Latino households in New Jersey. The article contained information from the Hazard Alert, including safety

recommendations, and additional resources.

NJFACE Web site

To facilitate the dissemination of FACE investigation reports, the NJFACE program maintains a Web site that contains information about the program, downloadable versions of all the NJFACE investigation reports, and recently issued Hazard Alerts. The Web site also features a link to the national FACE Program which provides access to FACE investigation reports from other states. The following two figures (9 and 10) illustrate the number of hits for each of the above Alerts. It is interesting to note that the hits for the version in Spanish were greater for all months. Also, the two highest months for both were August and September, the two months in which tree work is likely the highest.

FIGURE 9
Web Hits for Wood Chippers Alert
March – September 2006

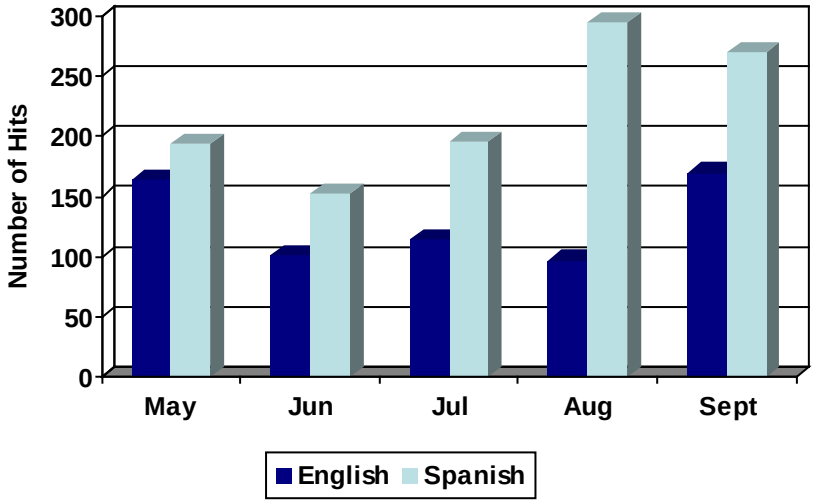
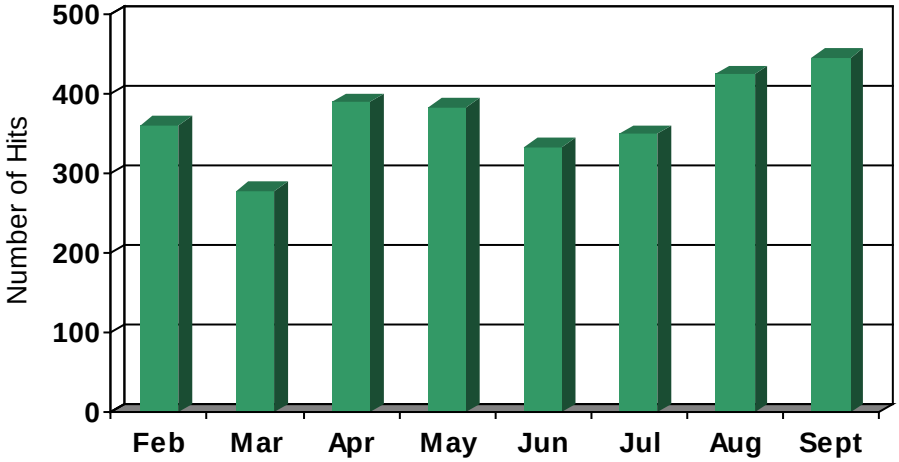


FIGURE 10
Web Hits for Tree Work Alert
February – September 2006



Coding Update

NJFACE maintains the FACE First Report Database. This database, which has been in use since the project inception in 1990, contains the basic incident and demographic information for every work-related fatal injury under investigation. Currently, there are a total of 1,672 records in the Incident Information sub-database, and 1,715 records in the Victim Information sub-database.

The FACE database and associated codes was updated. At least 454 records received either a full or partial update. NJFACE staff also completed a project to update the codes in the FACE First Report Database. Each incident is coded for cause of death, occupation, and industry using different coding systems. A review of all the records in the database was done to locate and rectify missing and incorrect codes, including NAICS codes which were not in effect prior to 2001. Table 11 summarizes the types of codes updated.

TABLE 11
Codes Updated in NJFACE Database

Type of Code	Number of Codes Updated/Corrected
Census Occupation Classification	780
Standard Occupation Classification	1,367
ICD-9 (International Classification of Diseases, 9th Revision)	705
SIC (Standard Industrial Classification)	784
NAICS (North American Industry Classification System)	1,291
TOTAL	**4,927**

Evaluation

Impact Evaluation

Pizza Alert: An impact evaluation was conducted on this alert. A survey was included in the dissemination packet to 10% of the identified pizza restaurants in New Jersey. Overall, the survey determined that the alert was well received (>92% reported a rating of "good" or better). A demonstration of the impact of the alert was that many responders were not aware that young employees (18 years old and younger) are not permitted to operate a mixing machine (18%) or make deliveries (29%). The positive impact of the alert is demonstrated as these facilities then change their practices by not allowing youths to participate in these potentially hazardous job activities, thus potentially decreasing the risk of occupational injury.

Tree Trimmer and Wood Chipper Alerts: The Tree Trimmer and Wood Chipper Hazard Alerts were disseminated along with a survey that asked specific questions to determine the impact on worker health and safety. The following results are examples from analyzing respondent data from the surveys. Each Alert provided recommendations regarding safe work practices. Questions were asked on the survey to determine if these recommendations were either already in place or based on the Alert, would affect a change in work practice. Results indicated that although most of the practices were already in place, in many cases, employers would adopt the recommendations. Tables 12 and 13 below show the three recommendations that affected the highest amount of change in work practices in each Alert.

Table 12. Results from Tree Trimmer Alert Survey Recommendations

Recommendation	# Changes Made based on Rec.	# Already in Place or N/A	Not Reported
Keep workers and equipment at least 10 feet from energized power lines	9 (43%)	189	12
Notify utility company if work is to be done within 10 feet of energized power line	11 (50%)	188	11
Clearly mark work zone boundaries	14 (54%)	184	12

% refers to the number of establishments that reported they will make the change based on our recommendations among all establishments who did not report already having these measures in place

Table 13. Results from Wood Chipper Survey Recommendations

Recommendation	# Changes Made based on Rec.	# Already in Place	Not Reported
Ensure that the "buddy system" is in place (one worker at in-feed, another at control bar	40 (41%)	128	58
Ensure that workers are putting short materials on top of longer materials while feeding the chipper	12 (23%)	174	40
Ensure that workers feed do not load small raked-up materials like twigs and leaves into chipper	16 (26%)	178	52

% refers to the number of establishments that reported they will make the change based on our recommendations among all establishments who did not report already having these measures in place

Descriptive Analysis of Survey Responses

The following are descriptive results collected from the survey from the Tree Trimmer and Wood Chipper Alerts. Figure 11 illustrates the number of employees from the companies that received the Tree Trimmer Alert. It is important to note that over 50% of the companies have 10 or fewer employees, which is a subset we were very interested in targeting. Figure 12 presents the type and number of injuries reported during tree care activities. The large number of chainsaw injuries was particularly interesting, and NJFACE is considering an additional

outreach in this area. According to Figure 13, the Alert will be used by most tree care companies, and over 80 employers responded that they would use the NJFACE Alert in employee training.

Figures 14-17 show the results of the Wood Chipper Survey responses. Figure 14 shows the breakdown of number of employees in the companies that received the Alert. As the previous case, greater than 50% of the companies employed 10 or fewer workers. The different types of PPE *not* reported as worn by the employees is shown in Figure 15. It is noteworthy that over 40 companies reported *no* use of eye protection during wood chipping. Type and number of injuries reported due to working with wood chipping machines are presented in Figure 16. Many of the self-reported injuries that fell into the "other" category were back injuries. Figure 17 presents the reported uses of the Alert, and over 100 employers reported use of the Alert in employee training.

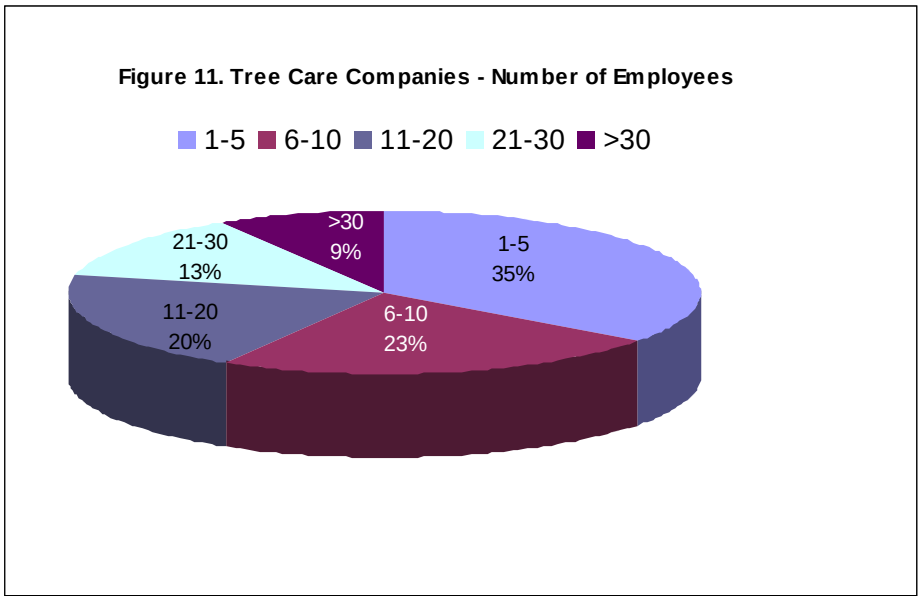


Figure 12
Injuries Reported by Tree Care Companies
(98 reported no injuries)

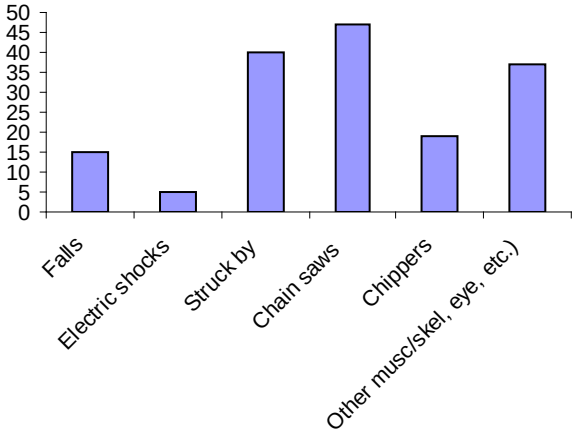


Figure 13: Tree Care Companies - Use of Tree Trimming Alert

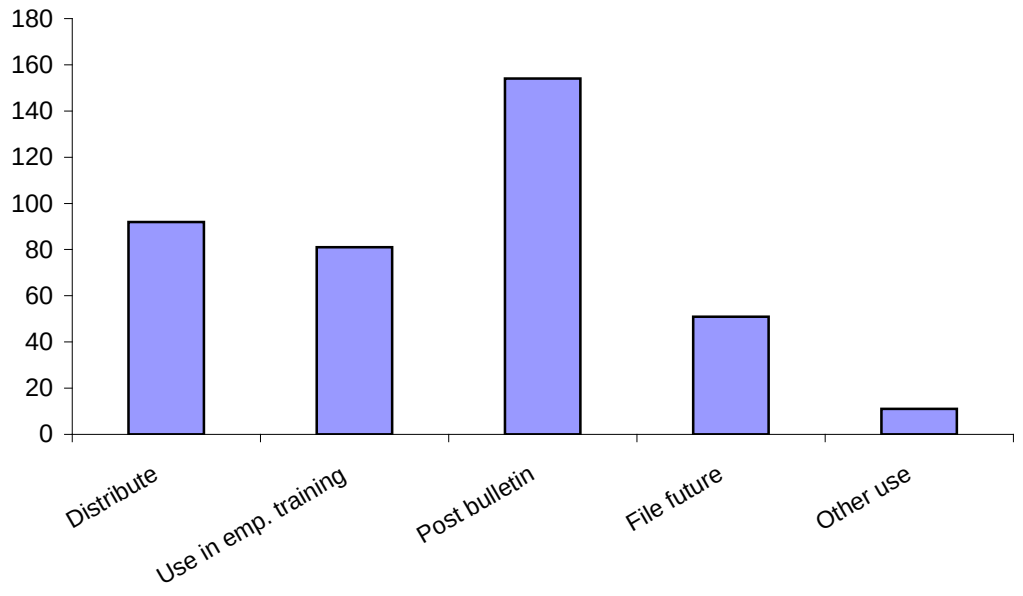


Figure 14: Wood Chipper Survey: Number of Workers

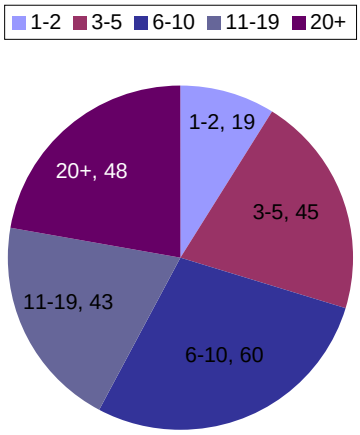


Figure 15: Number of Companies NOT Reporting Wearing PPE

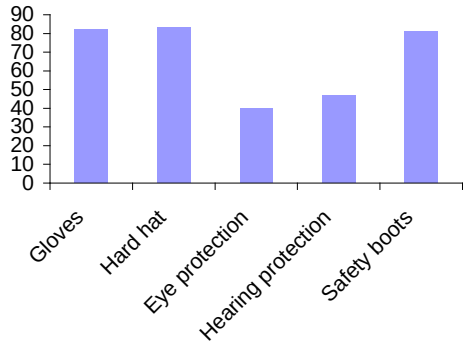
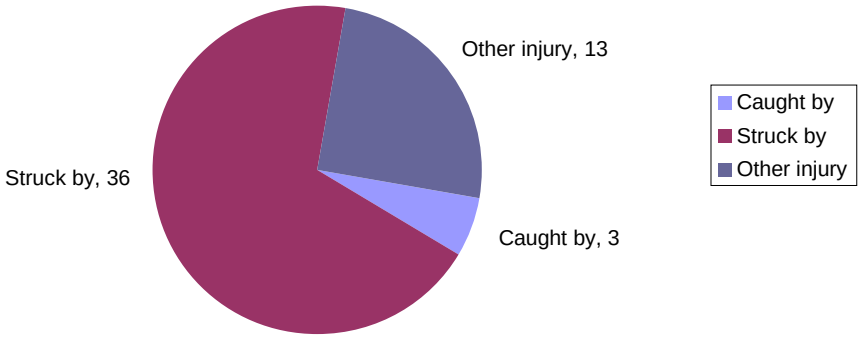
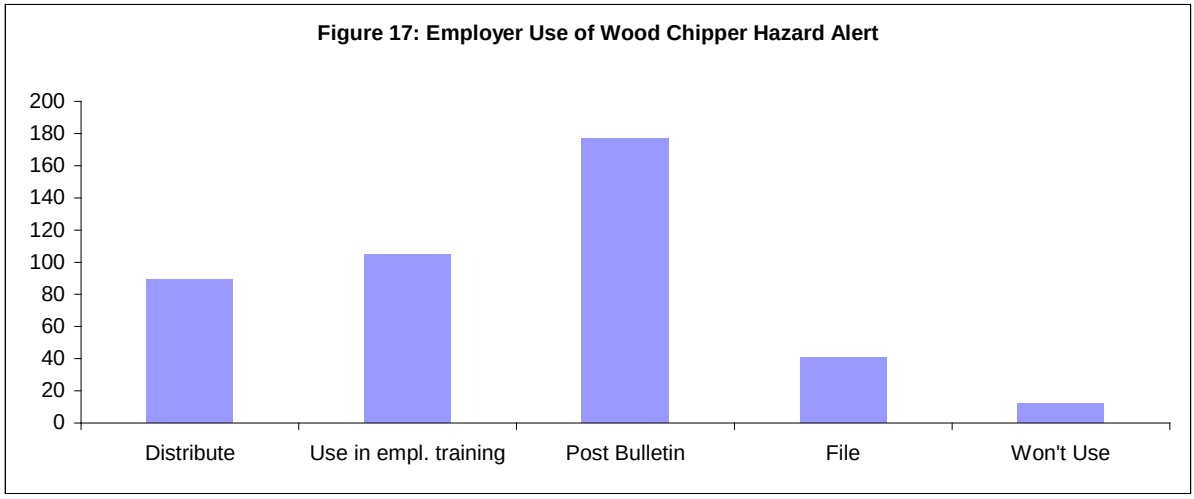


Figure 16: Number of Injuries Reported
(129 Reported no injuries)





Programmatic Evaluation of the NJFACE project

Logic Model

While working with NIOSH (NIOSH representative site visit in 2004), NJFACE developed the building blocks for a programmatic evaluation logic model. After the model was completed, NJFACE staff presented it at the Northeast Regional Occupational Disease and Injury Surveillance Conference in Farmington, CT, May, 2005. Figures 18 (A – B) display the final version of the NJFACE Logic Model. Figure 18 has two parts: A. the overall model of the program and B. a demonstration of one of many logic flows from assets to impact, that can be mapped in overall model.

The NJFACE logic model contains several elements that describe overall program assets and activities. These then lead to outputs, which are outreach and education products. NJFACE outputs lead to several outcomes, including employer awareness of FACE, training information, OSHA involvement, and enhancement of site visit entry. The final step is a measurable impact, which we have identified as a change in knowledge, attitude and behavior of employers and workers. Ultimately, our program looks to reduce fatal occupational injuries.

Figure 18B shows an example of a flow from assets to impact of NJFACE. This example illustrates both the infrastructure of the program, and the link between processes and effects. In this example, our Industrial Hygiene expertise and data management are the basis for developing/conducting field investigations, reports, hazard alerts and brochures. These outreach materials lead to an increase in employer awareness of NJFACE. This awareness is then change in knowledge by the employer. The overall logic model in figure 18A contains many of these logic flow examples.

This model demonstrates several of the strengths and weaknesses of the program, and has helped identify limitations that need to be addressed. The process of creating the logic model coupled with connecting logic flow elements helped us identify these programmatic needs and limitations, and following are critical examples:

- The need to enhance surveys designed to assess the impact of NJFACE outputs
- The need to enhance response rate of mailed voluntary surveys
- The need to enhance research to practice activities.

These needs will be addressed in detail in our upcoming project cycle.

Figure 18A. NJFACE Logic Model.

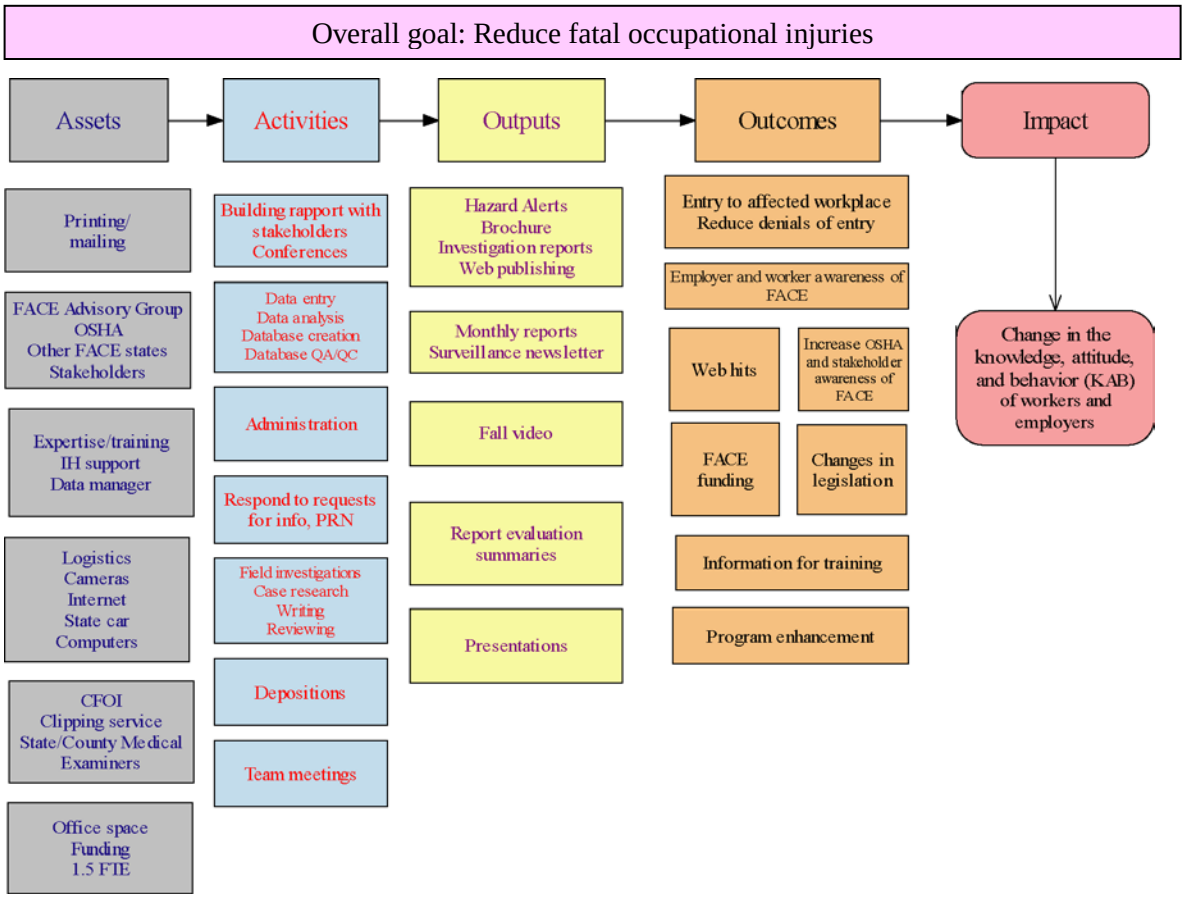
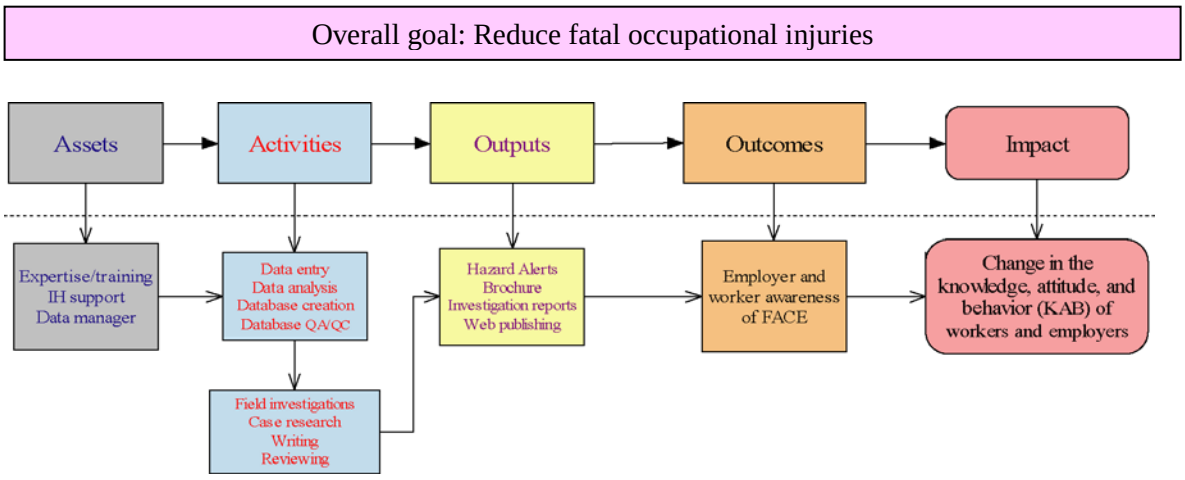


Figure 18B. NJFACE example of logic model flow.



Administrative/Other Activities

Consortium Meetings

NJFACE staff have attended all the FACE Consortium Coordinating Committee meetings, which took place as part of the annual FACE Conferences. Representatives of all the FACE states discussed the targeting of fatalities as in-scope, and NJFACE volunteered to pilot-test Hispanic investigations. Discussions also included the decentralization of data collection to the individual states and the distribution of a new Microsoft Access database format for collections first report information. To save time and resources, the original plan of FACE staff traveling to a second annual meeting was changed to conducting CC meeting conference calls. Discussions centered around updating and planning FACE business, including organizing and planning the future conferences. Other topics relevant to all the FACE states were also discussed, such as professional conferences (CSTE) and updates on grant writing requirement.

IRB

Responsibility for the NJDHSS Institutional Review Board (IRB) was contracted to the University of Medicine and Dentistry of New Jersey during FFY 2004. NJFACE funding was restricted by the CDC for FFY 2005 pending this IRB approval. To conform to the stricter requirements of this IRB, NJFACE staff reviewed all our program protocols for human subject's protection and revised the protocols for fatality surveillance, investigations, data security, and confidentiality. All staff completed the Collaborative IRB Training Initiative course in human subject protection, and a new signed informed consent procedure was established. NJFACE received IRB approval on November 19, 2004.

Certificate of Confidentiality

Certificates of Confidentiality (CC) are issued by the National Institutes of Health (NIH) to protect identifiable research information from forced disclosure. They allow the investigator and others who have access to research records to refuse to disclose identifying information on research participants in any civil, criminal, administrative, legislative, or other proceeding, whether at the federal, state, or local level. NJFACE applied for a CC due to the loss of confidentiality when NJFACE information was revealed due to legal actions. Such a loss may have negative repercussions due to employer retribution against an employee for a statement they made, or potential ramifications due to lawsuits or other legal actions. Related risks are the use of subpoenaed FACE documents and/or FACE personnel to provide evidence in lawsuits against the employers or third parties (such as equipment manufacturers). NIH granted NJFACE a Certificate of Confidentiality effective June 6, 2005.

Federal OSHA

On request from a NJ Area OSHA Office, NJFACE drafted a letter explaining our need and procedures for reviewing OSHA files. The letter was reviewed by the USDOL Office of the Solicitor, who allowed FACE staff "limited disclosure" in reviewing OSHA files and interviewing Compliance Officers.

Conferences & Training

NJFACE has provided funding and support to send staff to professional conferences, meetings, and training. These include:

- Annual FACE Conference and Consortium Committee Meeting: Staff attended the conferences and meetings held in October 2001, August 2002, March 2003, February 2004, and February 2005. In March 2006, NJFACE staff attended the annual NIOSH FACE conference in Morgantown, WV. There, each FACE state gave presentations on current projects and shared information on findings from outreach and education activities. The effectiveness of FACE outreach activities was a major focus of the conference. NJFACE staff presented preliminary results from fatality investigations, as well as the Tree Trimmer hazard surveillance project.

- Council of State and Territorial Epidemiologists (CSTE): Staff attended the conferences held in May 2002, May 2004, and June 2005.
- Northeast Regional Occupational Disease and Injury Surveillance Conference: Staff attended the conferences in April 2004 and March 2005.

- Maine Occupational Safety and Health Research Symposium: Staff presented and attended at the conferences held in April 2003 and April 2005.
- Medico-legal Death Investigator Training Course: NJFACE staff attended the course given by the St. Louis University School of Medicine in December 2003.

In March 2006, NJFACE staff attended the annual NIOSH FACE conference in Morgantown, WV. There, each FACE state gave presentations on current projects and shared information on findings from outreach and education activities. The effectiveness of FACE outreach activities was a major focus of the conference. NJFACE staff presented preliminary results from fatality investigations, as well as the Tree Trimmer hazard surveillance project.

Emergency Response Operations

NJFACE staff participated in DHSS emergency response operations resulting from the 2001 terrorist attacks:

- World Trade Center: Immediately after the September 11 attacks, staff assisted federal OSHA in distributing and fitting respirators to the workers at Ground Zero. Staff also assisted in a NJ state-sponsored memorial service for the victim's family members shortly after the attack.
- Anthrax: Although not directly involved in investigation of the letter-borne anthrax attacks, NJFACE staff provided industrial hygiene and other support necessary to free other DHSS staff for the investigation and cleanup of the anthrax contamination in the Hamilton postal facility.
- TOPOFF 3: NJFACE staff participated in recent Homeland Security efforts by participating in the third Top Officials (TOPOFF 3) drill of a simulated bioterrorist attack in NJ. Staff received training and assisted with the mock distribution of antibiotics and other medical supplies from the Strategic National Stockpile.

Other:

- NIOSH Skylight Alert Mailing: On request from NIOSH, NJFACE mailed the NIOSH Alert: *Preventing Falls of Workers Through Skylights and Roof and Floor Openings* to 136 building material supply stores in New Jersey.
- NJFACE Brochure Update: We revised and updated our brochure, *What is Fatality Assessment & Control Evaluation About?*
- National Violent Death Reporting System (NVRDS): NJFACE assisted the NVRDS in developing a surveillance system for recording all violent deaths that occur in NJ. FACE staff currently serve on the NVRDS general and technical Advisory Boards.
- NIOSH Baler Alert: A NJFACE case study was used in the NIOSH Alert: *Preventing Deaths and Injuries While Compacting or Baling Refuse Material*.

Conclusions

The NJFACE program has conducted occupational health surveillance on fatal occupational injuries following established surveillance models. In addition to the collection and analysis of data, on-site investigations were conducted, and education outreach materials were developed and disseminated. These materials have been evaluated for impact.

Specifically, there have been a total 1,672 victims of fatal work-related injuries in New Jersey since the inception of the NJFACE program in 1990. Most (94%) of the victims were male. Age at death ranged from 15 to 89; 69% were 49 years old or younger. Mean and median ages were 43 and 42, respectively. Between 2001 and 2006, there were 184 fatalities (26%) related to motor vehicles or transportation, 101 (14%) were due to falls, and 61 (9%) were machine-related. Overall, 139 (20%) of the fatalities were reported as Hispanic ethnicity. NJFACE has initiated 43 field investigations and has released 34 investigation reports containing findings and recommendations to employers and other stakeholders since the inception of this surveillance project.

As part of NJFACE surveillance model, the following educational outreach materials were developed and disseminated: Pizza Restaurant Youth Hazard Alert, Sanitation Worker Hazard Alert Alert Wood Chipper Tree Trimmer. A Crossing Guard Warning is also being developed after a fatality involving a crossing guard occurred. In addition as part of education and outreach, the following collaborations were initiated: a project with the Center to Protect Workers' Rights to develop and determine the impact of a Ladder Fall Video, and a partnership

with the Advancement of Arboriculture (CAA), which includes sharing technical assistance with tree-related fatalities, and the development and review of our Hazard Alert on tree trimming.

List of Publications

FORMAT	TITLE
Brochure	• *Don't Get Hurt Working Around Sanitation Trucks* • *Tenga Cuidado Cuando Trabaja en los Camiones Sanitarios*
Journal Article	Higgins DN, Casini VJ, **Bost P**, Johnson W, and Rautiainen R. *The Fatality Assessment and Control Evaluation Program's Role in the Prevention of Occupational Fatalities*. Injury Prevention 2001;7:i27-i33
Hazard Alert	*Warning! Dangers to Teens Working at Pizza Restaurants*
Newsletter Article	*Tree Trimming, A Dangerous Profession*. NJDHSS Occupational Health Surveillance Update, December 2003.
Newsletter Article	*Teenage Restaurant Workers Die on the Job*. NJDHSS Occupational Health Surveillance Update, December 2003.
Hazard Alert	*Warning! Tree Work Can be Deadly*
Training Video	*Don't Fall For It*
Fact Sheet	Four *Don't Fall For It* fact sheets for employees who view the training video: • #1 *Protect Yourself from Fatal or Crippling Falls* • #2 *Choosing and Inspecting Ladders* • #3 *Setting up Ladders with Gravity in Mind* • #4 *Climbing Ladders with Gravity in Mind*
Hazard Alert	• *Wood Chippers* • *Trituradoras de Ramas y Troncos*
Magazine Article	*Trabajar con Trituradoras de Madera puede ser Peligroso(Working with Wood Chipping Machines Can be Dangerous).* Immigration & American Citizenship Organization's La Guía del Inmigrante. Vol VI No. 3 - 2006.

LITERATURE CITED

1. NJDHSS. Census of Fatal Occupational Injuries (CFOI) New Jersey--2003. http://www.state.nj.us/health/eoh/survweb/cfoi03.pdf . 2005. 7-22-2005.
Ref Type: Electronic Citation

2. McGreevy, K. and Lefkowitz, D. New Jersey Occupational Health Surveillance Fatal and Non-Fatal Injury Data Analysis. 2005.
Ref Type: Unpublished Work

3. Janice A.Windau Worker Fatalities from being Caught in Machinery . Compensation and Working Conditions, 35-38, 1998.

4. NJDHSS. Census of Fatal Occupational Injuries (CFOI) New Jersey-2001. http://www.state.nj.us/health/eoh/survweb/cfoi01.pdf . 2005. 7-22-2005.
Ref Type: Electronic Citation

5. Collins JW, Landen DD, Kisner SM, Johnston JJ, Chin SF, and Kisner SM Fatal occupational injuries associated with forklifts, United States, 1980-1994. American Journal of Industrial Medicine, *36:* 504-512, 1999.

6. Collins JW, Smith GS, Baker SP, Landsittel DP, and Warner M A case-control study of forklift and other powered industrial vehicle incidents. American Journal of Industrial Medicine, *36:* 522-531, 1999.

7. Pratt SG, Kisner SM, and Moore PH Machinery-related fatalities in the construction industry. American Journal of Industrial Medicine, *32:* 42-50, 1997.

8. Bureau of Transportation Statistics, I. T. D. Miles of Roadway Section by State for 2001. http://www.transtats.bts.gov . 2005. 7-3-2005.
Ref Type: Electronic Citation

9. Ore T. and Fosbroke DE Motor vehicle fatalities in the United States construction industry. Accident Analysis Preview, *29:* 613-626, 1997.

10. Ore T. Women in the U.S. construction industry: an analysis of fatal occupational injury experience, 1980 to 1992. American Journal of Industrial Medicine, *33:* 256-262, 1998.

11. NIOSH. NIOSH Safety & Health Topic: Traumatic Occupational Injuries Machine Safety. http://www.cdc.gov/niosh/injury/traumamc.html . 2005. 7-21-0005.
Ref Type: Electronic Citation

12. Weller NF, Cooper SP, Basen-Enquist K, Kelder SH, and Tortolero SR. The prevalence and patterns of occpational injury among south Texas high school students. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retreieve&db= . 1999. 7-18-2005.
Ref Type: Electronic Citation

13. Bureau of Labor Statistics. Geographic profile of employment and unemployment. http://www.bls.gov/opub/gp/laugp.htm . 2004. 2-1-2005.
Ref Type: Electronic Citation

14. Garrison HG, Runyan CW, Tintinalli JE, Barber CW, Bordley WC, Hargarten SW, Pollock DA, and Weiss HB Emergency department surveillance: an examination of issues and a proposal for a national strategy. Annals of Emergency Medicine, *24:* 849-856, 1994.

15. Thacker SB and Stroup DF The future of national public health surveillance in the United States. Journal of Public Health Management Practice, *2:* 1-3, 1996.

16. Kinn S, Khuder SA, Bisesi MS, and Woolley S. Evaluation of safety orientation and training programs for reducing injuries in the plumbing and pipefitting industry. Journal of Occupational and Environmental Medicine, *42:* 1142-1147, 2000.

17. Ringen K and Stafford EJ Intervention research in occupational safety and health: examples from construction. American Journal of Industrial Medicine, *29:* 314-320, 1996.

18. Rothman, K. and Greenland, S. Modern Epidemiology. Philadelphia: Lippincott-Raven Publishers, 1998.

19. Francis M.Eubanks and Dinakar M.Gundimeda. A Study of Fatalities in the Construction Industry Between 1994 and 2002. 2004. Clemson University, Department of Construction Science and Management, Clemson, South Carolina. Ref Type: Report

20. Statistical Analysis Software (SAS). [9.1]. 2004. Cary, North Carolina, The SAS Institute. Ref Type: Computer Program

HUMAN SUBJECTS RESEARCH

Protection of Human Subjects

The NJFACE program has received IRB approval through November 18, 2005 (Federal Wide Assurance Identifier FWA00004020, protocol #1120040026). Approval is reviewed annually.

Risks to the Subjects

Human Subjects Involvement and Characteristics
he human subjects in this study are defined as the victims, employers, co-workers, and witnesses to a work-related fatal injury. All fatality victims are included, regardless of age, sex, race, or other characteristic. NJFACE investigations are initiated as per the protocols outlined in the research section.

Sources of Materials
Demographic and incident data is gathered for each fatality victim and entered into the NJFACE first report database. Further detailed data is be collected during NJFACE investigations, including witness statements, photographs, measurements, and available documentation on the incident. Confidential records are only be available to NJFACE staff with IRB clearance to review data. Database records are linked and identified through a unique number, no direct identifiers are included.

Potential Risks
The primary risk is the loss of confidentiality if an interview statement is revealed. Such a loss may have negative repercussions, such as an employer retaliating against an employee, or potential ramifications due to lawsuits or other legal actions.

Adequacy of Protection Against Risks

Recruitment and Informed Consent
Victims of work-related fatal injuries are entered into the study immediately after identification by the NJFACE surveillance system. If the incident is in-scope for investigation, a NJFACE investigator will contact the employer for permission to investigate. The consent form, introductory letter, and NJFACE brochure is faxed or mailed before the investigation. During the visit, the investigator again explains the program to confirm consent. The investigator will similarly explain the program and obtain consent before interviewing any witnesses and co-workers. All parties are informed that they may discontinue the investigation at any time without penalty.

Protection Against Risk
NJFACE has obtained an NIH Certificate of Confidentiality to prevent the forced release of identifying information, such as from legal actions. This mitigates much of the loss of confidentiality risk outlined above. No personal identifiers are included in any databases. All databases are password protected. Paper records are kept in locked file cabinets, and confidential records are purged from the paper files on the completion of a NJFACE investigation.

Potential Benefits of the Proposed Research to the Subjects and Others
Participating employers will directly benefit from the study by receiving a detailed investigation report with recommendations for preventing future incidents. Other employers, employees, safety professionals, and interested parties will benefit by using the NJFACE reports and other publications to make their workplaces safer, thus reducing the incidence of employee injuries and fatalities. The small risk of loss of confidentiality is reasonable in relation to reducing the risk of fatal or serious workplace injuries.

Importance of the Knowledge to be Gained
The knowledge gained from the study will be used to produce educational materials aimed at reducing the incidence of work-related injuries and fatalities.

Inclusion of Women and Minorities

Women and minorities are included in all aspects of this study.

Inclusion of Children

All work-related fatal injury victims aged 21 years and younger are included in this study. Due to the psychological trauma of witnessing a fatality, children under 18 years of age are not interviewed as witnesses or co-workers during a NJFACE investigation. Children aged 18 to 21 may be interviewed with the informed consent of the subject.