National Institute for Occupational Safety and Health

Oregon Fatality Assessment and Control Evaluation: Final Report

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TABLE OF CONTENTS

LIST OF ABBREVIATIONS

BLS	U.S. Bureau of Labor Statistics
DCBS	Oregon Department of Consumer and Business Services
CFOI	Census of Fatal Occupational Injuries
CROET	Center for Research on Occupational and Environmental Toxicology
DHS	Oregon Department of Human Services
FACE	Fatality Assessment and Control Evaluation
IMD	Oregon Information Management Division
MSHA	U.S. Mining Safety and Health Administration
NAICS	North American Industry Classification System
NIOSH	National Institute for Occupational Safety and Health
NTOF	National Traumatic Occupational Fatalities
NTSB	National Transportation Safety Board
OHSU	Oregon Health & Science University
OIICS	Occupational Injury and Illness Classification
OR-FACE	Oregon Fatality Assessment and Control Evaluation
Oregon OSHA	Oregon Occupational Safety and Health Division
OSHA	U.S. Occupational Safety & Health Administration
PI	Principal Investigator
SOC	Standard Occupational Classification System

ABSTRACT

Oregon Fatality Assessment and Control Evaluation conducts surveillance, investigation, and assessment of traumatic occupational fatalities in Oregon, and engages in outreach and education to prevent traumatic occupational fatalities and promote occupational safety. The Oregon Fatality Assessment program significantly expanded previous occupational fatality surveillance, investigation, and prevention activities in Oregon by including workers not covered by existing workers' compensation and occupational safety and health programs, and incorporating risk analysis and outreach to promote safety among workers and employers.

During the initial 4 year funding period, 2003-2006, OR-FACE recorded 278 traumatic occupational fatalities in 250 incidents – an average of 70 fatalities in 62 incidents per year. The count is similar but not identical to the total for the BLS Census of Fatal Occupational Injuries, differing by 1-2 incidents each year due to different inclusion criteria; and about double the count from Workers' Compensation incidents in Oregon, which counts only covered employees. Investigation files including death certificates, EMS and medical examiner reports, law enforcement and OSHA investigations, news articles, and other information sources were assembled for each fatality. Clear priority areas emerged in the 4 years of the program: (a) motor vehicles, both in transportation incidents and as "parked vehicles," (b) logging, particularly working as a tree faller, (c) mobile machinery of various types, and (d) fall hazards, particularly in construction. There was sufficient investigation of each incident to prepare an abstract for each incident that identified key risk factors. The abstracts were published in the annual reports and also aggregated in topical hazard alerts.

Oregon Fatality Assessment followed the template outlined by the National Institute for Occupational Safety and Health in the production of outreach materials: using narrative, artwork, and recommendations. The compelling nature of fatal stories is valuable as an educational tool; artwork helps to engage the reader and identify the topic; and recommendations focus on key points and provide a "take-away message."

In 4 years, 2003-2006, Oregon Fatality Assessment published 35 full investigation reports. Four reports that involved Hispanic workers were translated into Spanish. Other principal outreach activities involved development of a website to publish materials; publication of investigation reports, annual reports, and hazard alerts; conference presentations; and news stories. Feedback from the website indicates that individuals have used the materials for training sessions, personal awareness, and posting on bulletin boards and other locations in the workplace, helping to identify hazards and emphasize the use of safety gear, machine guards, and safe work procedures.

A. HIGHLIGHTS/SIGNIFICANT FINDINGS

Specific Aim 1. Identify traumatic occupational fatalities through the development of a statewide surveillance network that includes government, private industry, labor organizations, community organizations and insurers.

OR-FACE developed collaborative relationships with existing government agencies to obtain notification and documentation of occupational fatalities in Oregon, including prompt notification from the Oregon Occupational Safety and Health Division (Oregon OSHA) for incidents occurring within its jurisdiction, and from death certificates provided by the Oregon Center for Health Statistics. Additional incidents were identified through network contacts in the Oregon Department of Consumer and Business Services, news media, and internet searches of federal safety agencies such as the U.S. Coast Guard (USCG), Mine Safety and Health Administration (MSHA), and the National Transportation Safety Board (NTSB), where a small but significant number of incidents were obtained. A private industry contact provided one case in the 4 years of the program, and a medical examiner provided one case.

Notification in about one-fourth of the total incidents each year occurred within 3 days of the date of incident, and another one-fourth within 30 days. Death certificates were received quarterly, and incidents for a calendar year could be identified as late as 1 year following the date of incident. After the first year of operation, OR-FACE decided to "close" the data year on September 1 of the subsequent year, when it was unlikely further cases would be added (though a later notification and inclusion was possible).

Specific Aim 2. Investigate selected traumatic occupational fatalities using an etiologic model that focuses on process and energy transfer (root causes), and is in some cases supplemented by a management model that explores contributing organizational factors.

Fatalities were analyzed using a root cause model and recommendations were developed to identify and interrupt the causal chain leading to the fatal incident. Recommendations were ranked by reversing the causal chain, usually focusing first on the immediate events preceding the injury, and concluding with the safety environment established by the employer. Using independent subject matter expert investigators through 2006 improved the applicability of recommendations among workers and established credibility with Oregon OSHA investigators, other experts, and employers.

Specific Aim 3. Have a multidisciplinary team analyze the surveillance and investigation data to identify work environments that place workers at a high risk for fatal injury and identify risk factors for these injuries.

OR-FACE continually analyzed incident and victim characteristics and identified priority areas of concern. Procedurally, the program developed a productive team, with collaborative relationships between the OR-FACE investigator, Oregon OSHA investigators when applicable, a research analyst/editor to help draft each investigation report, the program director to ensure quality, and a review board of epidemiologists, safety and health professionals, agency regulators, public health professionals, and a safety engineer to assemble expert knowledge and criticism for the final publications. An iterative review process involving the OR-FACE review board was invaluable in achieving high-quality reports and other published materials. The OR-FACE team also developed an internal review process to ensure all information

recorded in the database was accurate, including multiple coding systems for industry, occupation, and event.

Specific Aim 4. Develop and disseminate prevention strategies for these injuries using popular media, trade and industry journals, meetings, seminars and workshops, websites, and a network that includes government, private industry, labor organizations, community organizations and insurers.

In 4 years, OR-FACE addressed priority areas of concern in occupational safety by publishing 35 investigation reports, 2 annual reports, and 4 hazard alerts; gave presentations at about a dozen conferences; and provided materials for several news stories. Four investigation reports involving Hispanic workers and the "Parked Vehicles Kill" hazard alert were translated into Spanish. Circulation of materials was primarily through publication on the OR-FACE website and electronic mailing to a contact list. The annual reports were sent by mail to an expanded list of about 1,500 addresses. The hazard alerts were circulated to targeted industry audiences, national and state FACE programs, and other safety and health professionals. All materials were made available at conferences and other venues. OR-FACE also gave presentations for proposed regulations to promote safety in relation to specific incidents.

Specific Aim 5. Collaborate with other states and NIOSH to develop intervention prevention strategies to decrease the rate of occupational injuries and fatalities in the United States.

OR-FACE collaborated with NIOSH and other state-based FACE programs in numerous individual instances and specific projects. Publication of OR-FACE reports in the web-based NIOSH electronic FACE library provided a convenient vehicle to share results with other states. OR-FACE personnel presented data, publications, and evaluation results at several regional and national meetings and at annual NIOSH FACE grantee meetings. Dr. Rischitelli served as the Chair or the National FACE Coordinating Committee in 2005-2006.

B. TRANSLATION OF FINDINGS

Oregon Fatality Assessment followed the template outlined by the National Institute for Occupational Safety and Health in the production of outreach materials: using narrative, artwork, and recommendations. The compelling nature of fatal stories is valuable as an educational tool, and the availability of such stories is a unique resource for FACE programs. Investigation of each incident was performed sufficiently to write an abstract for each incident to identify risk factors. The abstracts were published in the annual reports and also reproduced in topical hazard alerts. Equally valuable, artwork helps to engage the reader and identify the topic; and recommendations focus the take-away message. In all OR-FACE materials, readability and attractive design were top priorities.

Fatalities were analyzed using a root cause model and recommendations were developed to identify and interrupt the causal chain leading to the fatal incident. Recommendations were always carefully written to avoid blame, and were ordered by reversing the causal chain, usually focusing first on the immediate events preceding the injury, and concluding with the safety environment established by the employer. Care was also taken in the force of the recommendations, ranging from a legal requirement ("must"), to compelling advice ("should"), to a good idea among other choices ("please consider").

A visual method of summarizing findings for occupation, industry and event was developed after inspecting FACE annual reports from other states and in other publications. Horizontal bars ranked according to frequency provide a rapid overview and highlight the most prominent areas of concern (see examples in the Results section below).

C. OUTCOMES/RELEVANCE/IMPACT

OR-FACE has continually received favorable reviews from safety and health professionals, academic researchers, and managers and workers in private industry and government. The OR-FACE website is now linked from dozens of sites, most notably from a new Oregon OSHA fatality page, and from the Pacific Northwest Agriculture Safety and Health Center.

The self-evaluation of the program in the first year indicated professional endorsement of OR-FACE investigation reports through comments solicited from the OR-FACE review board. Responses were all positive, indicating a general recognition of improvement over time; the reports were described as clear, thorough, accurate, interesting, balanced, and accessible.

In 2005, an evaluation tool was developed and posted on the OR FACE website that provided feedback from actual users of the reports. Individuals have used the materials for training sessions, personal awareness, posting on bulletin boards, and in one instance, to place in the glove box of a forklift; helping to identify hazards and emphasize the use of safety gear, guards, and safe work procedures.

An overall rating of "excellent" for OR-FACE materials published online, and for the website, is substantiated in two gratifying comments from individuals.

- "I think this is a very valuable tool for Oregon employers. It is virtually the only way for me to stay in tune with what is happening in my industry. The depth of information is not available anywhere else. Valuable!"

- "I very much appreciate the program and all that is done to make it happen."

Another anecdote of relevance was observed after distributing the "Parked Vehicles Kill" hazard alert at a transportation conference. A speaker at the podium waved the orange flyer and recommended it to the entire audience as a neglected problem he was finally glad to see getting attention. This was precisely the motivation in producing the alert. Another positive anecdote involved workers directly, hearing that the printers of the annual report took it home to read the abstracts, including the president of the company. All of these examples indicate OR-FACE succeeded in connecting with its intended audience.

D. SCIENTIFIC REPORT

D.1. Background and Significance

On a typical day in the United States, approximately 16 workers are killed on the job and 36,000 are injured. (Jenkins et al., 1993; Leigh et al., 1997). Over 94,000 occupational injury deaths occurred in the USA during the period 1980-1995 (NIOSH, 2001). In 2006, 5,703 work-related fatal injuries occurred in 1 year (www.bls.gov/news.release/cfoi.nr0.htm). By reporting rates of occupational fatalities, previous surveillance systems such as National Traumatic Occupational Fatalities (NTOF), and the more recent Census of Fatal Occupational Injuries (CFOI), have

been helpful in setting research and prevention priorities, but occupational fatalities are a continuing concern in public health.

Efforts to decrease the rates of occupational fatalities must be driven by field-collected data that identify the nature and magnitude of the problem and move beyond descriptive information to analyze risk factors so that specific preventive strategies can be implemented in the workplace (NIOSH, 1998). The FACE research program was developed in 1983 by the National Institute for Occupational Safety and Health (NIOSH), and expanded to multiple states in 1989. The FACE program has provided valuable prevention information by targeting investigative activities toward certain types of workplace fatalities, such as electrocutions, fall hazards, logging, machine-related and highway work-zone incidents, and occupational fatalities among youth. Ongoing and expanded opportunities for in-depth case investigations and research and prevention dissemination efforts are necessary to continue to reduce the number of fatal work injuries.

D.1.1. The Need for Improved Research in Fatality Surveillance Systems

Oregon has recorded compensable workers' fatalities since 1943, and the compensable fatality count remains the count used in official publications. A significant number of workers are not covered by the Oregon Workers' Compensation system and are excluded from this count of compensable workplace fatalities, including (a) household employees, (b) employees subject to federal workplace laws, (c) City of Portland police and firefighters, (d) workers engaged in the transportation of interstate commerce of goods, persons, or property by rail, water, aircraft, or motor vehicle and whose employer does not have a fixed place of business in Oregon (for example, truck drivers employed in the state of Washington), (e) sole proprietors, (f) partners and officers of corporations, (g) amateur athletes, (h) newspaper carriers, (i) employees of religious, charitable, or relief organizations who work primarily for board and lodging or who receive only nominal reimbursements, (j) owners of boating equipment engaged in the transportation of the public for recreational down-river boating activities pursuant to a federal permit, and (k) owners and leaseholders of motor vehicles used as taxicabs or to transport logs, poles, pilings, rocks, gravel, sand, dirt, asphalt, or concrete.

In 1991, the Oregon Department of Consumer and Business Services (DCBS), Information Management Division, began gathering data on work-related fatalities for the new CFOI program. Although the data are used to identify hazardous industries and occupations; to direct government and business funds for safety programs to needed areas; and to encourage employers and employees to promote safe work environments, the program does not allow for in-depth analysis of detailed information on the circumstances of an occupational fatality. Little or no data is collected on the task of workers at the time of injury, or specifics regarding machines, tools, and protective equipment at the site of the accident, which would provide valuable information for designing future preventive strategies and workplace practices.

In previously established occupational fatality surveillance programs, Oregon Workers' Compensation data were incomplete in terms of the number of workers counted, and CFOI data provided only statistics without an analysis of risk factors to direct prevention strategies. The Oregon Occupational Safety and Health Division (OR-OSHA), another division of DCBS, performs onsite investigations, but these are largely focused on enforcement of the occupational safety and health laws of Oregon and its safety publications are directed primarily toward employers.

The FACE Program significantly expanded occupational fatality surveillance, investigation, and prevention activities in Oregon by including all workers, and incorporating risk analysis and outreach to promote safety in both worker and employer behavior. The program linked the activities of the Oregon Department of Human Services (DHS), Oregon DCBS, and the Center for Research on Occupational and Environmental Toxicology (CROET) at Oregon Health & Science University (OHSU). A cooperative effort allowed this consortium to achieve the stated aims of the OR-FACE Project.

1. Identify traumatic occupational fatalities through the development of a statewide surveillance network.

2. Investigate selected traumatic occupational fatalities.

3. Have a multidisciplinary team analyze the surveillance and investigation data.

4. Develop and disseminate prevention strategies for these injuries

5. Collaborate with other states and NIOSH to develop intervention prevention strategies to decrease the rate of occupational injuries and fatalities.

D.2. Research Design and Methods

State-based FACE programs use a multi-agency, multidisciplinary approach to identify occupational fatalities, investigate work situations where fatalities occur, and formulate and disseminate prevention strategies.

D.2.1. Project Collaborators

Originally, letters of introduction were sent to local, state and federal agencies in Oregon to notify them of the initiation of the Oregon FACE program. The letters were used to create awareness of the FACE program and also to suggest how the agencies could be helpful to OR-FACE by providing notification, case information, and investigation results. An OR-FACE brochure was created to highlight the features of the program in an accessible format. The beginning contact list included the following agencies.

- US Coast Guard, Chief State Investigations and Public Relations
- Federal Mines, State Director
- Portland Fire Department, Fire Marshal
- Portland Fire and Rescue Office, EMS Coordinator
- Oregon State Police, Patrol Services, Chief of Operations
- State Medical Examiner Office, Chief Medical Examiner
- Oregon State Farm Bureau, Communications Director
- Oregon OSHA, Director
- Oregon Truckers Association, Safety Director
- Oregon Association of General Contractors, Safety Manager
- SAIF Corporation (State-sponsored Workers' Compensation insurer)

Working contacts as represented in this list grew significantly over 4 years (see the OR-FACE network on p. 6 in the 2004 Annual Report). Although initial skepticism about the role of OR-FACE was present in some quarters, over time the program managed to establish its credibility by showing serious intent, accuracy, and worthwhile products to promote occupational safety. Overall, OR-FACE has been very successful in developing good communication with various agencies in the state that are important for early notification and information gathering.

For the most common functions, OR-FACE collaborated closely with Oregon DHS, Oregon DCBS, and CROET at OHSU in all phases of activity.

- Through Oregon DHS, work-related death certificates were forwarded to OR-FACE as a fundamental contribution to surveillance.

- Oregon DCBS, which administers Workers' Compensation and Oregon OSHA, provided another fundamental contribution to surveillance. Oregon OSHA notified OR-FACE promptly of "program-related" fatalities. Oregon OSHA also provided an essential function in investigation by providing investigation reports, making its investigation files available, and consulting on specific issues in OR-FACE investigations.

- CROET contributed in the administration and funding of OR-FACE program activities by jointly supporting outreach, publication and personnel costs.

- Safety and Health experts from all of these agencies provided necessary information, consulted on surveillance, investigation and assessment of incidents, and participated on the OR-FACE review board to provide feedback on OR-FACE materials prior to publication.

In addition, OR-FACE collaborated with NIOSH by (a) participating in quarterly teleconferences that guided the development of state-based FACE policies and procedures, (b) submitting a monthly report of fatalities and a summary of outreach activities, (c) and submitting all investigation reports for publication in the NIOSH electronic FACE library. In turn, the NIOSH FACE library of investigation reports was a standard resource for assessing particular events in Oregon, helping to identify risk factors and shape recommendations. Also, direct contacts and materials from other FACE states were valuable for information, consultation on particular incidents or coding, and model materials.

In relation to particular projects, OR-FACE developed relationships with:

(a) business associations, such as Associated Oregon Loggers, the Association of General Contractors, and Hewlett Packard;

(b) public agencies, such as Oregon Department of Education, Bureau of Oregon Labor and Industries, Oregon Utility Safety Committee, Eugene Public Utilities Commission, Oregon Veterinary Examining Board; and

(c) academic associations, such as Labor Education Research Center at University of Oregon, Pacific Northwest Agricultural Health and Safety Center at University of Washington, Oregon State University Sea Grant Extension, and researchers at Portland State University.

D.2.2. Priority Areas

OR-FACE completed in-depth investigations of specific workplace fatalities in accordance with priorities identified by NIOSH, in combination with priorities identified by Oregon OSHA in its Five Year Strategic Plan (www.cbs.state.or.us/external/osha/pdf/stratplan.pdf). OR-FACE produced investigation reports in each of these areas (except health care).

NIOSH Priority Areas

Machine-related
Hispanic Workers
Youth workers (<18 years old)
Street or highway work zones

Oregon OSHA Priority Areas

Construction
Agriculture
Health Care
Food and Kindred Products
Lumber and Wood Products
Falls

D.2.3. Notification and Surveillance

Oregon OSHA was the primary source of timely notification of all work-related fatalities. When an Oregon worker is killed on the job, the employer must notify Oregon OSHA within 8 hours. The initial contact is with the Oregon OSHA operations and enforcement assistant, who completes a fatality intake report and then completes a fatal injury report (OSHA-36 Form). This report is forwarded to the Information Management Division (IMD) at DCBS to code and establish a Workers' Compensation claim if appropriate, and was also forwarded directly to OR-FACE at the same time.

Oregon DHS was another primary source of notification by providing to OR-FACE all death certificates with the "work–related" box checked. Other notification sources included news media and internet searches of government agency websites that conducted fatality investigations, primarily the National Transportation Safety Board (NTSB), U.S. Mining Safety and Health Administration (MSHA), and the U.S. Coast Guard.

Supplementary sources included regular consultation with the fatality analyst at DCBS-IMD to compare records and identify cases. Also, OR-FACE contacts with industry associations, other government agencies, or an insurer occasionally identified an occupational fatality that was missed by all other sources, including death certificates.

All identified incidents were accepted provisionally until they could be discussed at the weekly OR-FACE meetings with the entire team of four persons present. Determining eligibility was not always immediately clear and demanded additional information to answer the following questions.

- Did the incident occur in Oregon?
- Did the incident occur in relation to work?
- Did the incident involve a traumatic injury?

Once accepted as a case according to eligibility criteria, the program coordinator created a paper file and entered available information into an MS Access database. Procedures were then initiated to obtain further documentation. Every OR-FACE file contains a death certificate, medical examiner report, and police report. When available, a file also contains an Oregon OSHA investigation report and news clippings. In some instances, other relevant records were obtained for specific details. Electronic data was updated as additional paper records entered the file. All new cases were reported to NIOSH in a monthly report.

The database used to collect, analyze, and report surveillance data, and all files related to OR-FACE investigations are maintained in a secure computer and file cabinets, within a secure, dedicated office in the CROET building on the OHSU campus. The Microsoft Access database used by OR-FACE was initially developed from a template provided by the Alaska FACE program, and was greatly enhanced with data collection guidelines and variables adopted from NIOSH-FACE.

D.2.4. Scene Investigation

Once accepted as a case, the program director determined if the incident warranted an investigation, based on established priority areas. Selected incidents were then forwarded to the OR-FACE investigator. A full investigation included an onsite visit, interviews with employers, employees, and witnesses; and consultation with other investigators and investigation reports, particularly from Oregon OSHA if applicable.

During its first 2 years, OR-FACE employed a staff investigator, but in 2005 changed to employ two independent investigators, one as an expert for logging incidents, and another for machine-related and other incidents. Specific expertise was particularly important for accuracy in logging investigations. The investigator's recognition in the logging community also helped to obtain access and trust. The change in procedure significantly improved the quality of OR-FACE investigation reports. Using independent expert investigators through 2006 resolved initial challenges with credibility from Oregon OSHA investigators, other experts, and employers.

D.2.5. Investigation Reports

All OR-FACE investigation reports and other publications underwent several iterations. The investigator draft was submitted to the OR-FACE research analyst/editor to ensure all necessary information was included, and that factors and recommendations identified in similar incidents reported by other FACE states or safety agencies were incorporated. The NIOSH electronic library of FACE reports was a primary resource.

The reports followed the NIOSH template, composed of a summary page with a brief narrative of the event, artwork, and safety recommendations. The "Introduction" section described the employer's business, size, number of employees, safety training program, the worker's experience, and coworkers involved in the incident. The "Investigation" section described the worker's behavior and conditions on the day of the event, taking care to avoid blame, while also

identifying critical factors related to safety. The Recommendations/Discussion" section elaborated the actions that employees and employers should or must consider to avoid a similar incident in the future.

The investigator and research analyst/editor worked closely together until both were satisfied with the initial draft report. The draft publication was then passed on to the OR-FACE program director, who reviewed and amended it to his satisfaction before passing it to the OR-FACE review committee; or returned it to the editor and investigator for further work.

Draft investigation reports as well as all hazard alerts were delivered to members of the OR-FACE review board prior to publication. The review board was composed of about six persons, including epidemiologists, safety and health professionals, agency regulators, public health professionals, and a safety engineer from NIOSH, Oregon OSHA, Oregon DHS, and CROET. Draft investigation reports were also sent to the Oregon OSHA investigator assigned to the case when applicable.

The OR-FACE review board performed an invaluable service by its detailed criticism, judging the adequacy of the presented information, general readability, accuracy in the description and assessment of the situation, and the coverage and exact language of the recommendations. Oregon OSHA reviewers also determined the applicability of existing regulations, commonly amending the force of recommendations from "should" to "must."

Following review, each investigation report was then returned to the OR-FACE analyst/editor to improve the identified problem areas. Reworking the final draft could involve simple changes, such as modifying language or adding references, or require renewed investigation to justify an interpretation or recommendation. The program director actively participated in reviewing the final draft to be sure reviewer concerns were addressed. Occasionally, the OR-FACE investigator was required to provide additional information or explanations. In most cases, the program director passed the second draft of the report through for publication. In a few difficult instances, the second draft of the report was sent again to select members of the review board to be certain their concerns were adequately resolved.

D.2.6. Assessment

Standard demographic characteristics and coding for industry, occupation, and event were charted annually and published in an annual report. Charting and ranking frequencies directed attention to general areas of concern, based on the frequency of incidents. This function was most conveniently performed by transferring each year of data into Excel, which provided sorting and charting capabilities and a ready overview of all cases together.

The transfer of each case also presented an opportunity to review the original coding in the Access database, and fill in missing cells with the expanded information available in the paper file when each year of data was "closed" on September 1 of the subsequent year. Data such as age and time were especially sensitive to error, reported differently in the various source materials. Death certificates were the most reliable determinant of individual characteristics, such as age, but police or first-responder reports were the most reliable determinant for the situation, related to time, location, occupation, and event.

Standard coding for industry, occupation, and event were not always straightforward. Questionable cases were highlighted each year prior to publication of the annual report, and

discussed again among the OR-FACE team with documentation assembled from the file and specific language from NAICS (industry), SOC (occupation), and OIICS (event) definitions. Discussion persisted until consensus was reached. Occasionally, it was discovered that an original assumption about status was made that was not documented in the accumulated file, or later appeared to be susceptible to different interpretations, and calls were made to obtain more information from local sources, such as the employer, chamber of commerce, or newspaper. In all, OR-FACE devoted considerable energy in making the coding reliable and accurate.

Clarity in coding is essential in order to compare results with other fatality registers. With the completion of 3 years of surveillance, 2003-2005, OR-FACE reviewed demographic and coding data in the entire electronic database, and corrected errors. All coding on industry, occupation, and event were scrutinized again, and problems of interpretation were discussed exhaustively. More information was gathered where necessary.

After collecting the first year of data, the frequency of incidents in specific areas with different risk factors caused OR-FACE to split several combined categories in the original codes for purposes of analysis and reporting.

- Split Agriculture, Fishing, Forestry, Hunting (industry)
  - Agriculture
  - Fishing
  - Forestry/Logging

- Split Farming, Fishing, Forestry (occupation)
  - Farm/Ranch
  - Fishing
  - Forestry
  - Logging

- Split Construction/Extraction (occupation)
  - Construction
  - Mining

- Split Transportation/Material Moving (occupation)
  - Transportation
  - Material Moving

- Distinguished Transportation (event)
  - Motor Vehicles
  - Mobile Machinery
  - Air
  - Water

D.2.7. Outreach

OR-FACE outreach materials included investigation reports, annual reports, and hazard alerts, which were distributed to separate target audiences. OR-FACE developed a website (www.ohsu.edu/croet/face) as a division of the main CROET website, where all publications and incidents were posted. By the end of 2006, the OR-FACE website averaged about 700 hits per month. Publications were also sent electronically to a contact list composed of safety and health

professionals at NIOSH, other FACE states, government agencies, businesses and associations, as well as to individuals who signed up for electronic mailings through the website. At the end of 4 years, the contact list of individuals requesting OR-FACE materials electronically contained nearly 200 names, including 120 in Oregon.

OR-FACE produced three types of publication, targeting different audiences.

- Investigation reports: published online and sent electronically to the contact list.
- Hazard alerts: sent electronically to the contact list and also delivered to target audiences in relevant industry sectors, government agencies, associations, and news media.
- Annual report: an extensive mailing list of about 1,500 names was compiled for mailing the printed annual reports. Names were added from the OR-FACE network, labor unions, and priority industry sectors such as agriculture, construction, and transportation. The mailing list was supplemented with a mailing list obtained from Associated Oregon Loggers as an important target audience.

In other areas of outreach, members of the OR-FACE team attended numerous conferences and seminars where oral and poster presentations were given on fatality assessment, summary data, and case studies, and published materials were made available. Academic information and summary charts composed the body of several of the presentations, but OR-FACE also endeavored to follow the NIOSH format, relying on the compelling nature of the stories of fatal incidents as educational tools. Stories not addressed in OR-FACE investigation reports were commonly integrated in conference presentations and hazard alerts with safety recommendations to highlight additional areas of concern.

D.2.8. Program Evaluation

Surveillance

Comparison of annual OR-FACE data with other occupational fatality registers show that OR-FACE fulfilled its objective to compile a comprehensive record of occupational fatalities in Oregon.

1. CFOI data covered nearly the same set of occupational fatalities as OR-FACE, with 1-2 more per year in OR-FACE data (which include all incidents in Oregon, even those involving out-of-state workers).
2. Workers' Compensation fatality data shared a core in common with OR-FACE data, including about half the OR-FACE incidents: excluding workers in noncovered occupations (which OR-FACE includes), but also including covered Oregonians fatally injured in other states (which OR-FACE excludes).
3. Oregon OSHA fatality data were most exclusive, including only "program-related" workers in Oregon, which were wholly subsumed in the larger number of OR-FACE occupational incidents.

Self-evaluation

An OR-FACE self-evaluation, covering its first year of operation in 2003, identified a lag time of about 6 months in some instances between the date of incident and the date of notification, resulting in the decision to "close" each year of data on September 1 of the subsequent year. Due to the late notification through death certificates, the delay was unavoidable.

The self-evaluation also included the following points.

- Investigations were typically begun within a day or two of notification. The average time for the investigation stage, from begin date to first draft of an investigation report, was 106 days; with a maximum of 290 days, or nearly 10 months.

- Only one-quarter of the investigations conducted had resulted in a publication. Half remained in various stages of draft or review. One-sixth of the investigations were completed with no report planned.

Response: The finding of lag times in the completion of investigation reports resulted in OR-FACE dropping a strict accounting of timeliness, acknowledging a pyramid of results, with some incidents and reports requiring more time than others. A few of the early investigation reports are still in draft form. Since OR-FACE began contracting with independent investigators in 2005, all investigations have resulted in a published report, though the drafts were still filtered through an iterative review process that delayed some more than others.

- Measuring report content by NIOSH guidelines showed generally good coverage of nine topic areas, from industry involved, to person, environment, action, and management. In reviewing the seven earliest published reports, the number of employees was missed in one, the detail of the company safety program in two, and the role of management in two.

Response: The review of report content prompted closer attention to supply all introductory information in all reports. Occasionally a point was missed, because the information was not available.

- Solicited responses from members of the OR-FACE review board produced positive responses. OR-FACE reports were described as clear, thorough, accurate, interesting, balanced, and even enjoyable, with a general recognition of improvement over time. Oregon OSHA respondents were satisfied that the initial concerns of reviewers were adequately addressed in the published draft. Suggestions for further improvements included: identify each draft with a date or number to avoid confusion, avoid too much redundancy, organize the analysis better, and possibly include personal circumstances that may help explain the event.

Response: The suggestions or reviewers were incorporated in subsequent reports.

- The electronic distribution list, with about 80 names, showed minimal development, with less than 10 names in Oregon. Outreach had not connected with many basic areas within the state, such as local sheriffs, medical examiners, deputy fire marshals, and others.

Response: Through readers signing up on the OR-FACE website and other sources, the electronic contact list has expanded to nearly 200 addresses, including 120 in Oregon, and also including other countries, such as India, the Philippines, Singapore, Turkey, Israel, and Brunei.

- The OR-FACE website was evaluated by comparing it to other FACE states. OR-FACE compared well with older programs in other states. The six OR-FACE reports in 1 year were well above the average number. In design, the OR-FACE website was easy to read and navigate: incorporating NIOSH information, links to state FACE programs and other relevant organizations, plus OR-FACE contact information, published reports, and data summaries.

Response: The evaluative review of other FACE websites presented notable examples to emulate, particularly in the hazard alerts produced in California, the chart summaries produced in Washington State, and the ambitious logging safety activities in West Virginia, which all influenced subsequent OR-FACE materials.

Website Survey

In 2005 an evaluation tool was developed and posted on the OR FACE website, and was sent to the electronic contact list. The survey collected data on the reader's occupation and industry; solicited responses on the overall quality, usefulness, and readability of OR-FACE investigation reports and hazard alerts; and asked for feedback on how the materials were used in the workplace, and what changes resulted in the reader's workplace. The results were very favorable, with an overall ranking of "excellent," and usefulness and readability ranked as "very good." Comments indicated OR-FACE materials were appreciated and helped in modifying safety behavior (see p. 7, Section C. Outcomes/Relevance/Impact, where respondent comments are quoted).

D.3. RESULTS

Oregon Fatality Assessment and Control Evaluation (OR-FACE) achieved significant results in its first 4 years of operation, 2003-2006, in accordance with its five specific aims related to surveillance, investigation, assessment, outreach, and collaboration as outlined below.

Specific Aim 1. Identify traumatic occupational fatalities through the development of a statewide surveillance network that includes government, private industry, labor organizations, community organizations and insurers.

In 4 years, 2003-2006, OR-FACE recorded 278 traumatic occupational fatalities in 250 incidents – an average of 62 incidents and 70 fatalities per year.

OR-FACE developed a statewide occupational fatality surveillance network that collected data from numerous sources, primarily from Oregon OSHA reports, state vital records (death certificates), Oregon DCBS, and news media. Notification from news media included stories in statewide newspapers obtained through a clipping service, news reports identified by OR-FACE staff. Internet searches of government agency websites that conduct fatality investigations primarily included NTSB, U.S. OSHA, MSHA, and the U.S. Coast Guard). In singular instances, one notification was obtained from the state medical examiner, and one from the Association of General Contractors during investigation contacts related to other cases. Table 1 shows the source and timing of first notification in 2005 (the most recent year analyzed).

Table 1. Source and Timing of First Notification Following Incident, 2005

	Totals	Oregon OSHA	Death Certificate	Oregon DCBS	News Media	Government and Other Agencies
0-2 days	15	11	-	-	4	-
3-30 days	14	8	1	-	5	-
1-3 months	9	-	4	1	2	2
3-6 months	16	-	14	1	1	-
6-12 months	6	-	4	2	-	-
Over 1 year	4	-	*4		-	-
Totals	64(100%)	19(30%)	27(42%)	4(6%)	12(19%)	2(3%)

* A revision in the forms and system for recording death certificates by the state in 2005 caused a delay in quarterly notification from death certificates in 2005. In previous years, all notification was obtained within 1 year.

Specific Aim 2. Investigate selected traumatic occupational fatalities using an etiologic model that focuses on process and energy transfer (root causes), and is in some cases supplemented by a management model that explores contributing organizational factors.

Full investigations typically resulted in a published report. Partial investigations (no site visit) provided background information for producing abstracts and hazard alerts. Every case was investigated sufficiently to write an abstract. The abstracts were collected and published each year in the OR-FACE annual report. In the first 18 months of the program, several draft reports lacked sufficient information or developed recommendations to be published or were not approved in review, and remain on file for possible action. The first logging reports, for example, were found unacceptable until OR-FACE contracted with a logging safety consultant in 2005. In 4 years, through December 2006, OR-FACE published 35 investigation reports from the 250 incidents recorded. Further reports from the period were published later or are still in preparation. The reports highlight designated priority areas, and in several instances relate to more than one priority (Table 2).

Table 2. OR-FACE Priority Areas and Investigation Reports, 2003-2006

Priority Areas	Incidents	Reports published by Dec 2006 related to priority area	Reports published in 2007 to date related to priority area	Reports in draft related to priority area
Machine-related	57	23	1	6
Forestry/Logging (industry)	40	5	-	6
Construction (industry)	32	6	1	1
Hispanic	24	6	1	3
Agriculture (industry)	23	6	-	1
Highway work zone	5	2	-	-
Youth (under age 19)	4	1	-	2
Other (2 Exposure, 2 Fire/Explosion, 1 Fall)	-	4	1	-
Total incidents and reports (columns do not sum to total)	250	35	3	13

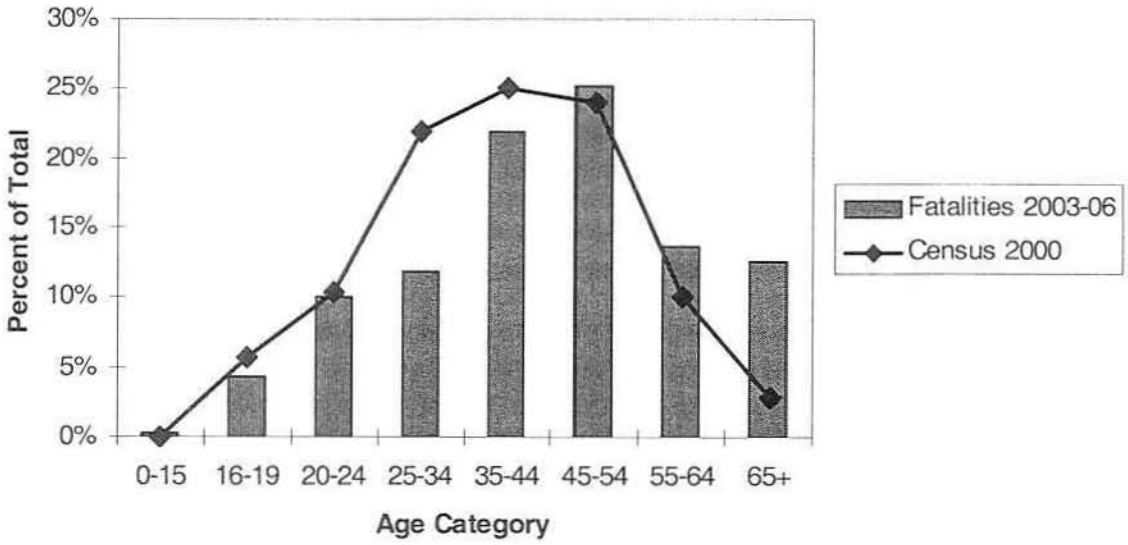
Specific Aim 3. Have a multidisciplinary team analyze the surveillance and investigation data to identify work environments that place workers at a high risk for fatal injury and identify risk factors for these injuries.

The first year of OR-FACE data in 2003 highlighted a disproportionate share of incidents among young workers, aged 16-24. Consequently, OR-FACE began developing a safety booklet dedicated to those workers, compiling representative case abstracts, safety recommendations for each incident, and accompanying artwork. An extensive development and review process has resulted in a final draft currently under review. A collaborative statewide campaign involving other agencies involved with the same agenda for young worker safety is planned.

In 2004, the skewed distribution of fatalities toward older workers became evident, especially for workers aged 65 and older. Falls were the most common event. A high incidence of suicide reflected a concern identified as well in the vital statistics of the general population in Oregon (Shen, Millet & Kohn, 2005). In response to the falls among older workers and others, particularly in construction work, OR-FACE developed a hazard alert in 2006, Gravity Kills, to address fall prevention.

Summary OR-FACE data is shown in the charts below, compiling data for the entire period, 2003-2006 (Figures 1-4).

Figure 1. Occupational Fatalities in Oregon by Age, Compared to Age Distribution of Civilian Labor Force in Oregon, 2003-2006



The analysis of falls by age category demonstrated that the numbers were too small to obtain statistical significance even when a large difference was observed. Relying upon the first 2 years of OR-FACE data, fatal falls were calculated to be 8 times more likely among workers aged 65 and older than for other workers, but a trend was all that could be concluded.

In terms of race/ethnicity, the proportion of incidents involving Hispanic workers, 2003-2006, was 6%, roughly corresponding to the 8% proportion of Hispanic persons in the general population. Similarly, the proportion of incidents involving females, 2003-2006, was 6%, corresponding to the 7% proportion in the national average. There is no indication of higher risk in these categories of workers in Oregon, and no action was taken for a targeted intervention –

though several reports and a hazard alert were translated into Spanish in 2006 to reach Hispanic workers in those occupations where incidents involving Hispanic workers occurred, related to motor vehicles and agricultural work.

Figure 2. Worker Fatalities in Oregon by Industry, Top Ten Ranks, 2003-2006

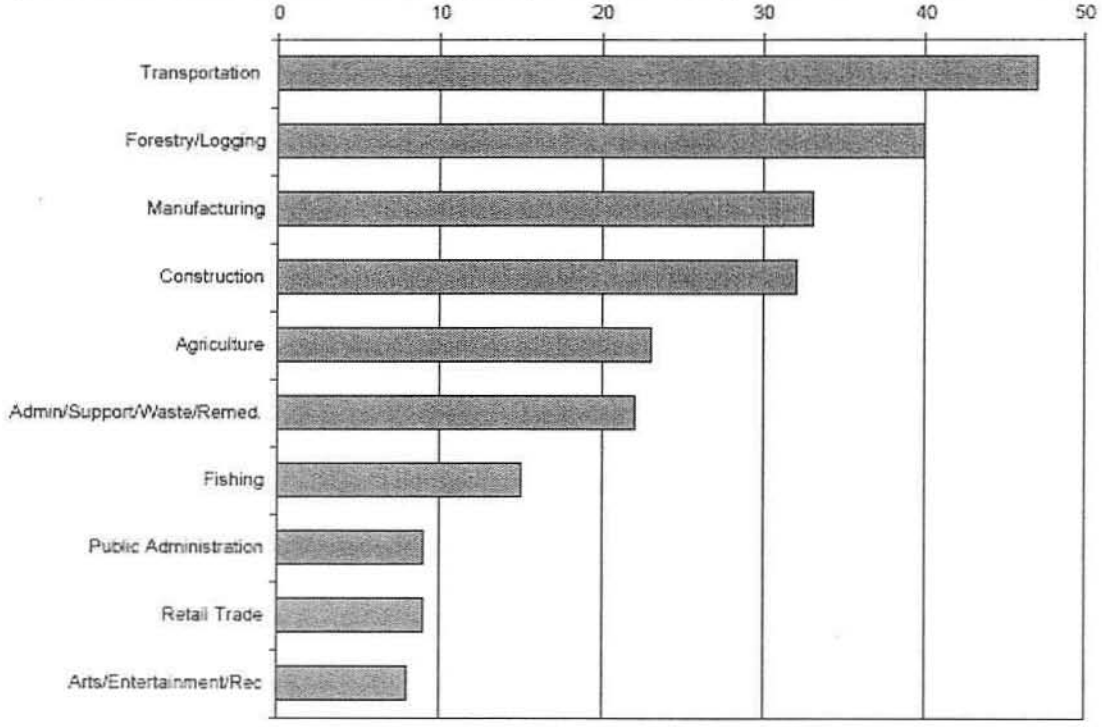


Figure 3. Worker Fatalities in Oregon by Occupation, Top Ten Ranks, 2003-2006

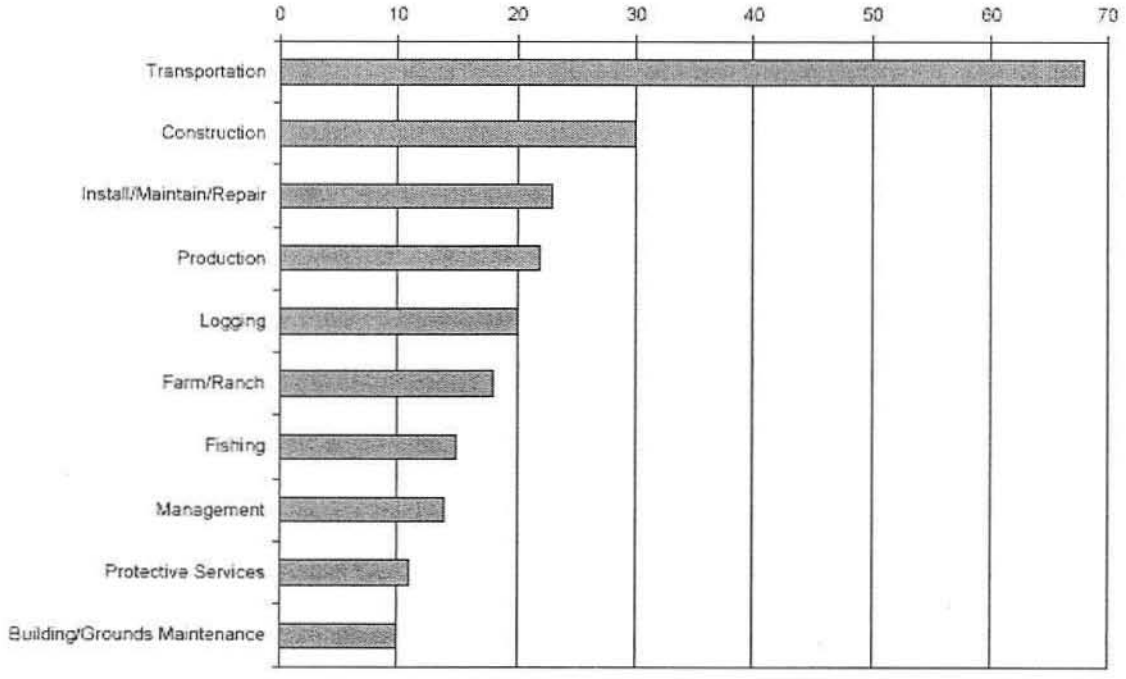
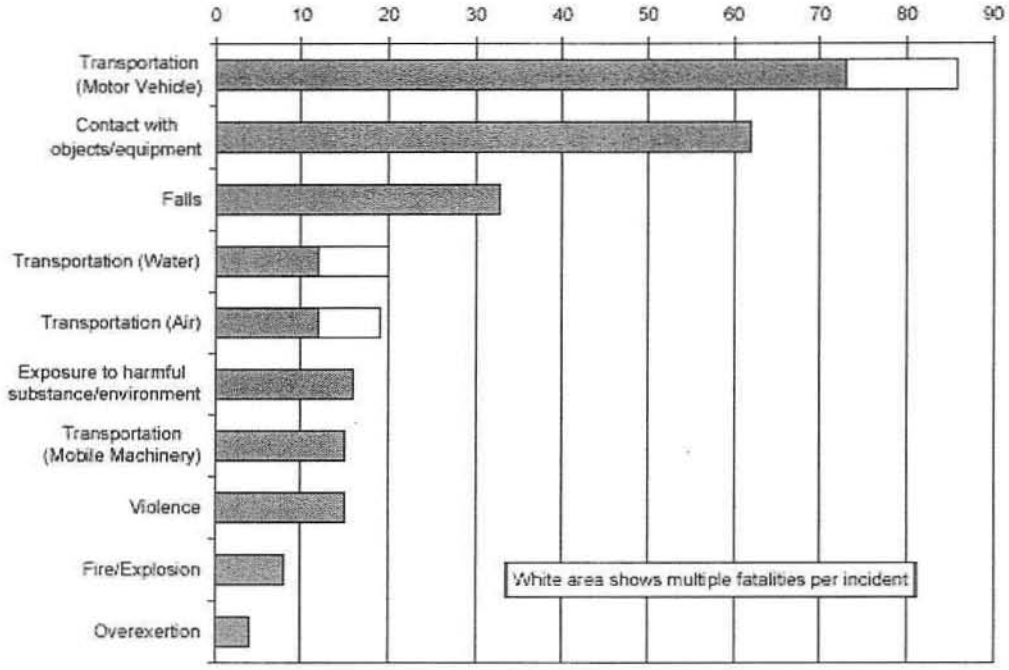


Figure 4. Worker Fatal Incidents and Total Fatalities in Oregon by Event, 2003-2006



Ranking the frequency of incidents by standard codes for industry (NAICS), occupation (SOC), and event (OIICS) draws attention to transportation as a primary area of concern. Although transportation was not among the designated OR-FACE priority areas, the high risk for all workers and particularly for transportation workers was impossible to ignore. In its second year, OR-FACE divided transportation incidents into separate categories to distinguish events related to motor vehicles, mobile machinery, air, and water transport. No OR-FACE investigation reports covered motor vehicle, air, or water transportation events, because these areas are routinely covered in investigation reports by other national and state safety agencies; but transportation was reported as a primary area of concern in OR-FACE annual reports. In 2006, a research report was prepared to deliver to the 2007 session of the Oregon Legislative Assembly related to driver cell-phone use and the risks of driver distraction (appended).

Detailed information collected in OR-FACE files provide a unique resource for closer analysis of incidents. Underlying the codes for industry, occupation, and event, a common theme of mobile machinery was identified as a primary hazard, distributed across construction, logging, transportation, and agriculture occupations, and resulting in different types of event, including transportation, contact, and exposure (electrocution). In 2003, the first OR-FACE hazard alert addressed the hazard of electrocution in guardrail construction work along highways. Two successive fatalities drew attention to the issue. The prevalence of similar electrocution incidents in other states documented a pattern that prompted OR-FACE to produce the alert.

In addition, closer analysis of incidents involving all kinds of vehicles, including both motor vehicles and mobile machinery, produced the surprising discovery that a high proportion of the incidents involved a "parked" vehicle that moved unexpectedly. This pattern was observed in 2004, after seven incidents of this type occurred within a 12-month period. A hazard alert,

Parked Vehicles Kill, was produced in 2004 and distributed in 2005 to raise awareness for this peculiar hazard.

OR-FACE identified and responded to three primary areas of concern from 2003 onward, related to motor vehicle transportation, logging, and mobile machinery. Additional areas of concern were addressed in relation to young workers and fall hazards. By 2006, after investigating numerous incidents and developing specific safety recommendations, OR-FACE published a collection of the safety recommendations related to these primary areas of concern in its 2005 annual report (in press).

Specific Aim 4. Develop and disseminate prevention strategies for these injuries using popular media, trade and industry journals, meetings, seminars and workshops, websites, and a network that includes government, private industry, labor organizations, community organizations and insurers.

From 2003 through 2006, in addition to OR-FACE publications, each with its own circulation (listed separately below under Publications), OR-FACE developed and presented safety information as follows in the list below, divided into categories of (a) program promotion, (b) participation in developing safety regulations, (c) conference presentations, (d) news media, and (e) publication development.

OR-FACE Promotion

Brochure: "Oregon Fatality Assessment and Control Evaluation" (Sep 2003; circ. all deputy state fire marshals, also distributed at conferences).

OR-FACE website: launched online at www.ohsu.edu/croet/face (Sep 2003). Recorded hits in the first month were 223; recorded hits in December 2006 were 767.

Logging safety video: As an introduction to the logging community in Oregon, OR-FACE made 25 copies of a logging safety video produced by the Alaska FACE program and distributed them to Oregon OSHA and Associated Oregon Loggers (2004).

Safety Regulations

Made presentation on use of GPS technology in taxi cabs to support a proposed city ordinance, in response to a homicide involving a taxi driver (Portland City Council meeting, Jul 2003).

Endorsed a rule change by Oregon Bureau of Labor and Industries to restrict employed youth under age 18 from using explosives (2003). [Final rule 839-021-0611, Occupations Involving Use of Explosives, was adopted on Jan 3, 2005.]

Conference Presentations

Moderated session: "Occupational Fatality Assessment and Prevention" (Oregon Governor's Occupational Safety and Health Conference, Portland OR; Mar 5, 2003).

Poster presentation: "Oregon FACE" (Central Oregon OSHA Conference, Redmond OR; Sep 23-26, 2003).

Presentation: "Dying for Work: The Oregon Fatality Assessment and Control Evaluation (OR-FACE) Project" (Northwest Occupational Safety and Health Conference, Seattle WA; Oct 16, 2003).

Presentation: "Implementing a State-based Occupational Fatality Prevention Project: The Oregon Experience." (Council of State & Territorial Epidemiologists Annual Meeting, Boise ID; Jun 9, 2004).

Presentation: "Preventing Fatal Occupational Injuries: The Oregon Fatality Assessment and Control Evaluation (OR-FACE) Project" (Central Oregon Occupational Safety & Health Conference, Redmond OR; Sep 23, 2004).

Presentation: "Their Last Breath: Fatal Occupational Inhalation Injuries from the Oregon Fatality Assessment and Control Evaluation (OR-FACE) Program" (Northwest Occupational Health Conference, Portland OR; Oct 14, 2004).

Presentation: "Occupational Fatality Assessment and Prevention" (Oregon Governor's Occupational Safety and Health Conference, Portland OR; Mar 3, 2005).

Poster: Basic OR-FACE information and frequency charts for industry, occupation, and event (Oregon Public Health Association Annual Meeting, Corvallis OR (Oct 2005): basic OR-FACE charts.

Seminar: Presented "Parked Vehicles Kill" poster; also participated on panel, discussing topic: "How can we use sound research methods to protect and promote public health in Oregon?" About 100 attendees (Epidemiology and Biostatistics Section of the Oregon Public Health Association; Apr 2006).

Poster: "Parked Vehicles Kill" – expanded analysis (2nd North American Congress of Epidemiology, Seattle WA; Jun 2006).

Presentation: "Teens Using Explosives: Rules to Protect Our Younger Workers" (CSTE pre-conference session, Anaheim CA; Jun 2006).

Workshop: Represented OR-FACE at journalists' workshop (Children and Agriculture: Telling the Story, Wenatchee WA, Oct 20-21, 2006).

News Media

"The Oregon Fatality Assessment and Control Evaluation Program (OR-FACE)" (*CROET Newsletter, 11*(1), Spring 2003; circ. 16,000).

Story on OR-FACE in Hewlett Packard newsletter, Corvallis (Spring 2005; circ. 4,500 employees).

"OR-FACE: Working to prevent workplace fatalities" (*CROET Newsletter, 12*(2), Summer 2004, circ. 16,000)

OR-FACE report on mill worker fall (2005-18) summarized in online journal, *Occupational Hazards* by Josh Cable (Nov 30, 2006).

Publication Development

In addition to the completed outreach projects listed above and in the Publications section below, three significant projects were developed during 2006 that were published in 2007, beyond the date of this final report. Recognizing that many incidents that represented areas of concern were not addressed in the selection of investigation reports or one-page hazard alerts, OR-FACE made an effort to collect several characteristic incidents into booklet format. The outreach activities related to these projects were conducted in 2007 or are still in progress, but extensive research and production work was conducted during the 4-year period under review here, resulting in the following publications, all in a 6 x 9 format.

- *State regulation of cell phone use while driving and the risk of driver distraction* (Feb 2007; 16 pages)
- *Fallers logging safety* (Apr 2007; 48 pages)
- *Young workers: Stay alive on the job!* (Sep 2007, in press; 24 pages)

Specific Aim 5. Collaborate with other states and NIOSH to develop intervention prevention strategies to decrease the rate of occupational injuries and fatalities in the United States.

OR-FACE collaborated with NIOSH and other state-based FACE programs in numerous individual instances and specific projects. Principal collaborative activities included the following points.

- OR-FACE submitted a monthly report of occupational fatalities in Oregon, and current OR-FACE activities in investigation and outreach.
- OR-FACE submitted published investigation reports to NIOSH for inclusion in the NIOSH electronic FACE library.
- OR-FACE participated in quarterly teleconferences to guide the development of state-based FACE policies and procedures. The OR-FACE team attended state-based FACE annual meetings and participated in scientific and training sessions.
- OR-FACE personnel presented data, publications, and evaluation results at several regional and national meetings and at annual NIOSH FACE grantee meetings. Dr. Rischitelli served as the Chair or the National FACE Coordinating Committee in 2005-2006
- OR-FACE maintained regular contact with the Washington state FACE program to share information and procedures, particularly in relation to incidents that occurred near the state boundary (the Columbia River), or otherwise involved both states.

Materials from other FACE states were a continuing source of information and support, including the following significant examples.

- The national FACE library, maintained online by NIOSH, containing national and state FACE investigation reports, hazard alerts, and topical safety booklets, provided a valuable resource to assess specific incidents in Oregon.

- The database used by OR-FACE was developed from a model provided by the Alaska FACE program. OR-FACE also reproduced and distributed 25 copies of a logging safety video from Alaska FACE.

- The design of California FACE hazard alerts was used as a model for OR-FACE hazard alerts.

- A tractor safety video from Kentucky helped shape tractor safety recommendations.

- Other state FACE annual reports influenced the design of charts and abstracts in OR-FACE annual reports.

- A logger's pocket safety manual from West Virginia helped shape the format of a similar safety booklet for logging safety in Oregon

OR-FACE expertise in assessing incidents, shaping recommendations, and publishing materials, in turn, made a valuable contribution for others, appreciated at conferences and workshops where OR-FACE team members participated and presented information. Also, OR-FACE annual reports provided a vehicle to communicate comprehensive results in Oregon with other FACE states.

D.4. DISCUSSION

DISCUSSION

With 4 years of data now compiled, coded, and charted, more reliable results can be expected from detailed analysis of specific settings and locations. Further analysis is presently being conducted, primarily in relation to drowning in fishing and recreation, agriculture, and trucking.

Fatality rates were not reported with annual OR-FACE data, because the small number of cases and annual variation were expected to produce unreliable results. For purposes of assessment, however, rates were occasionally computed to test indications of high risk, foremost in logging, where the frequency of incidents among a relatively small category of workers suggested a high fatality rate.

Computing the fatality rate for loggers in Oregon produced rate for loggers in general of 112 per 100,000, similar to the rate calculated from other data sources (Scott, 2004). In specific logging occupations, tree fallers experienced a much higher fatality rate (258 per 100,000), followed closely by log truck drivers (239 per 100,000). OR-FACE highlighted logging in its first annual report and subsequently as the most hazardous industry in Oregon and working as a tree faller as the deadliest job in the state. In 2006, OR-FACE began compiling a logging safety booklet for fallers to address this primary area of concern, which was published in 2007.

Only at the end of 4 years did OR-FACE possess enough data to begin calculating rates with some measure of confidence. Even then, achieving statistical significance to affirm a higher relative risk for any targeted group is impossible. Detecting trends is the best that can be

achieved. The annual OR-FACE charts perform reasonably well to draw attention to trends. The frequency of an event alone may indicate an area of concern.

All OR-FACE efforts at information translation have been text-based with added graphics. From the beginning, OR-FACE acknowledged the challenge of overcoming academic style in order to convey safety information directly to workers and employers, but never overcame an inherent bias toward literate materials. A video project was conceived, but not implemented due to lack of funding. The issue was raised again when OR-FACE materials were translated into Spanish – several sources recommended radio ads as an effective medium. These are potential areas for future development. Printed materials have a particular virtue, however, in being less ephemeral. When published online, communication may be achieved continuously for many years.

Presently, OR-FACE is conducting further analysis of fatality rates and exploring the difficulty of obtaining reliable denominators. The results may help to identify additional areas of concern in subgroups in the collected data.

D.5. CONCLUSIONS

In 4 years, 2003-2006, OR-FACE successfully established a comprehensive surveillance program for occupational fatalities in Oregon, with capacity for expert investigation of selected incidents in priority areas, assessment of annual data to identify areas of concern, and the development of standard procedures and models to conduct outreach activities. A network of government agencies, academic researchers, and private associations has been established to facilitate all phases of OR-FACE activities.

OR-FACE recorded 278 traumatic occupational fatalities in 250 incidents – an average of 62 incidents and 70 fatalities per year. By the end of 2006, 35 investigation reports were published from these incidents, covering a list of priority areas identified by NIOSH, in combination with priorities relevant to Oregon.

In addition, OR-FACE produced four hazard alerts, one on "parked vehicles" responding to a distinctive hazard that appeared in Oregon incidents that has been given little or no attention from other safety agencies. OR-FACE hazard alerts also responded to electrocution hazards in highway work, and fall hazards. Two annual reports, for 2003 and 2004, provided comprehensive results of OR-FACE activities and data, including summary charts and abstracts of each incident.

Additional materials have been presented in conference presentations and news media. Extensive research and development work utilized OR-FACE data to produce three substantial safety booklets – related to cell-phone use and driver distraction, fallers logging safety, and young workers – which were published and circulated in 2007 (subsequent to the period covered in this report).

A core feature of OR-FACE outreach activities involved the development of a website, where all publications and incident data were published. The website is linked from significant related websites, and reached about 700 hits per month by the end of 2006. A web survey developed on the website indicates that safety professionals, managers, and workers highly appreciate OR-FACE materials available online and use them in workplace education to promote safety.

Early challenges in achieving credibility as a new program addressing occupational fatalities in Oregon have been overcome, and OR-FACE now has the experience and a body of data to increase its effectiveness in preventive interventions to help improve safety and reduce injuries and death among workers in Oregon.

E. PUBLICATIONS

Investigation Reports

1. "Construction worker dies when he leans out of the protective cage of a skid steer forklift and is crushed" (2003-15; Feb 2004).
2. "Roofer's family member helping at worksite dies after falling through skylight" (2003-01; May 2004).
3. "Hispanic laborer drowns after falling into landscaping pond" (2003-08; May 2004).
4. "Farmer is killed when he falls beneath moving combine" (2003-19; May 2004).
5. "Worker is thrown from cab of crane and is crushed" (2003-39; May 2004).
6. "Shipyard welder ignites hydraulic fluid and is fatally burned" (2003-22; May 2004).
7. "Load of lumber shifts and falls on construction worker killing him" (2003-16; Jun 2004).
8. "Auto salvage worker killed by unsecured car on transporter" (2003-18; Jul 2004)
9. "Home construction worker falls down elevator shaft" (2003-10; Aug 2003).
10. "Young camp counselor killed when cannon bursts to pieces" (2003-20; Aug 2004).
11. "Vehicle strikes utility worker in short-duration work zone" (2003-32; Nov 2004).
12. "Sawmill worker crushed during debarker maintenance" (2004-03; Feb 2005).
13. "Effort to clear rock jam in operating rock crusher fatal" (2003-40; Apr 2005).
14. "Logger killed as skyline cable whips free of slash pile" (2003-07; Apr 2005).
15. "Farm driver overturns truck in irrigation ditch and drowns" (2003-33; Aug 2005).
16. "Nursery laborer killed in skid-steer loader" (2004-07; Aug 2005).
17. "Parked forklift crushes operator against semi-trailer" (2004-04; Sep 2005).
18. "Forklift crushes operator working underneath on starter" (2004-10; Sep 2005).
19. "Logger killed by falling sheave when yarder tower collapses" (2003-6; Oct 2005).
20. "Machine operator electrocuted while shoveling pellets" (2004-05; Jan 2006).
21. "Operator killed when bulldozer slides off logging road" (2003-29; Jan 2006).
22. "Janitor using propane buffer killed by carbon monoxide" (2004-37; Feb 2006).
23. "Worker killed in wood-dust fire sparked by faulty fuse" (2003-21; Feb 2006).
24. "Technician crushed when aerial platform lift engaged" (2005-07; Feb 2006).
25. "Operator crushed while repairing running machine" (2005-05; Mar 2006).
26. "Fabricator killed by ruptured hydraulic press fitting" (2004-15; Mar 2006).
27. "Mechanic killed while inspecting masonry stacker machine" (2005-08; Apr 2006).

28. "Ranch hand killed by bulldozer while logging" (2004-23; May 2006).
29. "Bulldozer movement kills operator standing on track" (2005-28; May 2006).
30. "Logger killed by swinging tree in yarding operation" (2004-52; Aug 2006).
31. "Excavation worker killed by flying rigging when hook fails" (2005-24; Aug 2006).
32. "Window cleaner killed in fall due to unsecured line" (2005-38; Oct 2006)
33. "Temporary mill worker dies in fall from tower catwalk" (2005-18; Oct 2006).
34. "Truck driver crushed by front-end loader in mill yard" (2004-21; Dec 2006).
35. "Mechanic killed when collar caught on PTO driveline" (2006-05; Dec 2006).

Spanish translations:

1. *"Trabajador hispano se ahoga después de caer en la laguna de un jardín"* (Nove 2006). [#3 above: "Hispanic laborer drowns after falling into landscaping pond"]

2. *"Conductor agrícola vuelca camión en zanja de riego y se ahoga"* (Nov 2006). [#15 above: "Farm driver overturns truck in irrigation ditch and drowns"]

3. *"Trabajador de vivero muerto en cargador de dirección derrapante"* (Nov 2006). [#16 above: "Nursery laborer killed in skid-steer loader"]

4. "Montecargas estacionado atropella al operador contra un camión" (Nov 2006). [#17 above: "Parked forklift crushes operator against semi-trailer"]

Hazard Alerts

1. "Truck mounted pile driver presents fatal electrocution hazard" (HA-1; Nov 2003).

2. "Parked Vehicles Kill." Published online; delivered by hand to a dozen automotive businesses and the automotive department of Portland Community College to observe response; distributed to trucking schools, and to all 64 Department of Motor Vehicle field offices statewide; also as flyer insert in Northwest Automotive Journal (Oct 2005; circ. 4,000); and reprint in Oregon Automotive Parts Association bulletin (circ. 200+ in Oregon) (HA-2; Aug-Oct 2005).

3. "Gravity Kills." Published online; circulated to a target audience, mostly in construction; several agencies and associations forwarded the alert to clients and members via e-mail or linked the alert on their websites, including Oregon OSHA, SAIF Corp. (Workers' Compensation insurer), National Association of Women in Construction, Associated General Contractors of America, Oregon Home Builders Association, and Liberty Northwest (Workers' Compensation insurer) (HA-3; May-Jul 2006).

4. "Preventing Slips, Trips and Falls." Produced an e-mail hazard alert that was sent to 11,000 OHSU employees for Oregon OSHA's Safety Break for Oregon, an annual day for employers to promote a safety message to their employees. The message was produced in collaboration with the OHSU health and safety department (May 10, 2006).

Spanish translations:

1. *"Los vehiculos estacionados matan"* (Nov 2006). [#2 above, "Parked Vehicles Kill"]

2. *"La Gravedad Mata"* (Nov 2006). [#3 above, "Gravity Kills"]

Annual Reports

1. *Annual Report 2003*: Published online and printed 2,000 copies, mailed about 1,500, mostly to list of FACE contacts; safety and health professionals; logging, manufacturing, machinery, construction, agriculture, and transportation firms; unions; state agencies; associations; and assorted other subscribers from the OR-FACE website (Jun-Jul 2005).

2. *Annual Report 2004*: Published online and printed 2,000 copies, mailed about 1,500, mostly to list of FACE contacts; safety and health professionals; logging, manufacturing, machinery, construction, agriculture, and transportation firms; unions; state agencies; associations; and assorted other subscribers from the OR-FACE website (July-Aug 2006).

3. *Annual Report 2005* (Oct 2007; in press)

Safety Booklets (in production through the end of 2006)

1. *State regulation of cell phone use while driving and the risk of driver distraction* (Feb 2007).

2. *Fallers logging safety* (Apr 2007).

3. *Young workers: Stay alive on the job!* (Sep 2007; in press).

F. REFERENCES

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G. INCLUSION OF GENDER AND MINORITY STUDY SUBJECTS

No gender or ethnic groups or sub-populations (such as women of child-bearing potential or non-English speaking Americans) were excluded from the study and their representation among the study population of victims of a traumatic fatal injury was a consequence of their participation in the working population of Oregon, including family farms. Non-English speaking workers were identified as a priority area of investigation and therefore additional emphasis on investigation of these fatal incidents existed.

H. INCLUSION OF CHILDREN

Children were not excluded from the study. Their representation among the study population of victims of a traumatic fatal injury was a consequence of their participation in the working population of Oregon, including family farms. Several child fatalities were identified during the study period and these fatalities were primarily reviewed by the Oregon State Child Fatality Review Team, part of the National Maternal Child Health (MCH) Center for Child Death Review Program.

I. MATERIALS AVAILABLE FOR OTHER INVESTIGATORS

All OR-FACE publications (listed above in Section E) are available on the OR-FACE website (www.ohsu.edu/croet/face). The website also provides information on the aims and definitions related to the FACE program, and provides links to other FACE states and online resources related to occupational fatalities. OR-FACE publications are also sent electronically to individuals registered to the OR-FACE mailing list, and are available upon request.

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Theodore R. Kulongoski, Governor

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RE: Cooperative Agreement U60 OH008324

Dear Dr. Frederick:

Please find enclosed the original and 2 copies of the Oregon Public Health Division, Department of Human Services' closeout report and final invention statement for the Oregon Fatality Assessment and Control Evaluation Program (OR-FACE) cooperative agreement U60 OH008324. The final report covers activities between September 1, 2002 and August 31, 2006.

If you have any questions, or require additional information, please contact Lauren Karam at (971) 673-0974 or lauren.karam@state.or.us.

Sincerely,

Michael A. Heumann, MPH, MA
Principal Investigator
Office of Environmental Public Health
Oregon Public Health Division,
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