Improving Occupational Health in Oregon: Turning Data to Action

Final Progress Report

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List of Terms and Abbreviations

ABLES	Adult Blood Lead Epidemiology and Surveillance
AIHA	American Industrial Hygiene Association
ASSE	American Society of Safety Engineers
ASSP	American Society of Safety Professionals
CDC	Centers for Disease Control and Prevention
COVID-19	Coronavirus Disease 2019
CPWR	Center for Construction Research and Training
CSTE	Council of State and Territorial Epidemiologists
DCBS	Oregon Department of Consumer and Business Services
DEQ	Oregon Department of Environmental Quality
EPA	US Environmental Protection Agency
EPHT	Environmental Public Health Tracking
ESSENCE	Electronic Surveillance System for the Early Notification of Community-based Epidemics
ICD	International Classification of Diseases
LBP/I	Low Back Pain and Injuries
LPHA	Local Public Health Authority
MPH	Master's in Public Health
MPI	Multiple Principal Investigators
NAICS	North American Industry Classification System
NIOSH	National Institute for Occupational Safety and Health
OCTRI	Oregon Clinical and Translational Research Institute
OIICS	Occupational Injury and Illness Classification System
OHA	Oregon Health Authority
OHI	Occupational Health Indicators
OHSU	Oregon Health & Science University
OPHP	Occupational Public Health Program
OR-FACE	Oregon Fatality Assessment and Control Evaluation
Oregon OSHA	Oregon Occupational Safety and Health Division
Orpheus	Oregon Public Health Epidemiologists' User System
OSHA	U.S. Occupational Safety & Health Administration
OSU	Oregon State University
O[yes]	Oregon Young Employee Safety Coalition
PI	Principal Investigator
PPE	Personal Protective Equipment
REDCap	Research Electronic Data Capture
SAIF	State Accident Insurance Fund Corporation (Workers' Comp. Insurer)
SENSOR	Sentinel Event Notification System for Occupation Risk
SOC	Standard Occupational Classification
TBI	Traumatic Brain Injury

Abstract

This final progress report summarizes accomplishments for the overall, fundamental and expanded fatal work-related injury state-based surveillance projects of the Oregon *Occupational Public Health Program (OPHP)* cooperative agreement (U60 OH008472) between July 1, 2015 and June 30, 2021.

The overall program contributed to the success and growth of state-level occupational health programs and projects, including the Oregon Healthy Workforce Center, Oregon Young Employee Safety Coalition, Oregon Governor's Occupational Safety and Health Conferences, and multi-agency investigations and rulemaking. The overall program investigated innovative areas for occupational health surveillance including traumatic brain injuries, back injuries, high-risk shiftwork and risks attributed to climate change. The overall program invested in the future occupational health workforce through internships contributing to development of a new surveillance database, social network analysis of safety opinion leaders, evaluation of the Occupational Health Indicator (OHI) surveillance system and evaluation of non-disabling claims for young workers.

Through fundamental OHI surveillance, staff generated up to 25 primary OHIs annually. OHI supported development of a pesticide poisoning investigation and reporting module in Oregon's reportable conditions database (known as Orpheus). OHI also supported the addition of a new data source: emergency department and urgent care clinic reports of pesticide poisonings from the Oregon syndromic surveillance system (known as ESSENCE). These changes improved the quantity and quality of pesticide poisoning case investigations. OHI participated in the surveillance system evaluation and made subsequent improvements to the timeliness and usefulness of program data. OHI piloted innovative data sources, including the Oregon Trauma Registry, ESSENCE and Orpheus, to assess work-related illness and injury.

The Oregon Fatality Assessment and Control Evaluation (OR-FACE) program continued core activities in surveillance, investigation, assessment and outreach. These efforts produced annual reports of Occupational Fatalities in Oregon, in-depth investigations of selected cases and a broad range of additional outreach activities and outputs. Work related to additional specific aims resulted in additional resources, discoveries and outputs including creation of a new state-of-the-art REDCap database for fatality surveillance data. The program also partnered with the SAIF Corporation's (workers compensation insurer) Agricultural Seminar Series to reach thousands of agricultural workers with fatality prevention information. We also conducted a social network analysis within a specific wine growing region in the state that identified a trusted source of safety information to assist with targeted outreach in that industry. Field research to inform fatality prevention efforts showed that mobile phone delivery of safety toolbox talks to construction supervisors increased the frequency of safety meetings. Other lessons learned in that project will guide future dissemination of our evidence-based safety toolbox talks. We partnered with the SAIF Corporation to conduct fall prevention research with small-to-medium sized construction policy holders. In that project we discovered that policy holders that had

recently experienced a serious loss fall injury were more likely to be responsive to an invitation to participate in a fall prevention practices survey than policy holders that had not experienced a recent injury. This project resulted in offering small grants for competent person training that were accepted by several survey completers.

Section 1 – Executive Summary

I. Overall and Occupational Health Indicators

Significant Findings

Overall and OHI aims, research plans and activities throughout 2015-2021 were mutually supportive and significantly intertwined. As a result, findings and outcomes significantly overlapped between the Overall and OHI components and are presented in this report in a combined manner.

During Years 1-4, the Overall program investigated innovative areas for future occupational health surveillance research through speaker series and conference panels. OHI supported this work through investigating and developing new sources of occupational health surveillance data. In Year 1 OPHP collaborated with partners in organizing a symposium focused on the theme of occupational traumatic brain injury (TBI). Following the symposium, OHI developed a plan to pilot the use of the Oregon Trauma Registry in combination with death certificate data to evaluate occupational TBI burden.

In Year 3 OPHP collaborated with partners in organizing themed seminars and a workshop focused on work-related low back pain and treatments. Following the workshop, OHI developed the capacity to mine Oregon's syndromic surveillance system (known as ESSENCE) for relevant emergency department and urgent clinic care clinic data. This analysis showed there were more than 1500 emergency room visits for work-related low back pain and injury in Oregon each year.

The Overall program aimed to develop and implement surveillance and outreach innovations in OHI and OR-FACE sub-projects. In addition to piloting and implementing the use of the Oregon Trauma Registry and ESSENCE for occupational health surveillance, OHI supported improvements to Oregon's reportable condition surveillance system (known as Orpheus) to include acute pesticide illness and injury as a content area, consume ESSENCE data as potential pesticide cases to be evaluated and include industry and occupation fields in all reportable condition content areas.

The Overall program supported a partnership between OHI and Oregon State University (OSU) to evaluate Oregon's core OHI surveillance system. Partnership between OHI and OSU also resulted in an analysis of the feasibility of using non-disabling claims in addition to disabling claims for occupational health surveillance.

Translation of Findings

Findings from the exploration of innovative areas for future occupational health surveillance research presentations to OHA and OHSU executives ensured high-level institutional awareness and connectivity to related programs. Presentation to the External Advisory Board provided constructive feedback and focused program efforts. Findings were shared with professional audiences at the Oregon Governor's Occupational Safety and Health conference. OHA published an agency report on work-related TBIs.

Agency executives and the External Advisory Board likewise guided and also contributed to the evaluation of the Oregon OHI Surveillance System. Findings were presented to a

conference of the Council of State and Territorial Epidemiologists and via peer-reviewed publication. A secondary translation outcome resulting from this work was a web-based story map displaying county-level OHIs for high-risk industries, work-related fatalities and work-related hospitalizations. The story map was publicized via OHSU's "Oregon and the Workplace" web blog.

Findings from the investigation of usefulness of non-disabling claims data for young workers were presented directly to the membership and board of directors for the Oregon Young Employee Safety Coalition (O[yes]); a manuscript was published by a peer-reviewed journal.

Outcomes/Relevance/Impact

A significant outcome of OPHP's exploration of innovative areas for future occupational health surveillance research related to occupational TBI burden. OHI found 8.4 per 100,000 workers experience TBIs annually in Oregon and that workers with occupations such as construction, logging, fishing, farming, installation, maintenance, repair, production, transportation and material moving had higher risk of work-related TBI. This analysis also showed that males and people who identified as Latinx had a higher risk for this type of injury. The most common types of injuries leading to TBIs were falls, followed by struck by or against objects and motor vehicle traffic incidents. OHI found approximately one third of severe work-related injuries involved TBIs, and TBI was involved in 37% of work-related injury deaths in Oregon. Understanding work-related TBI risk factors, occupational association, risk behaviors for male workers and developing prevention strategies need to be explored and further researched. It is critical to develop prevention programs to reduce the incidence of work-related TBIs, to implement occupational TBI surveillance and to use this data for subsequent research.

Evaluation of Oregon's OHI surveillance system found a need for improved timeliness, representativeness and usefulness of our surveillance systems. OHI responded by developing the capacity to capture real-time data from ESSENCE and Orpheus, improving our ability to act on timely and representative health outcome data. OHI also published, in partnership with the Oregon Environmental Public Health Tracking program, a story map presenting county-level OHIs thus improving the usefulness of OHI data for local partners. A secondary finding was that existing public health surveillance evaluation guidance was insufficient for evaluation of occupational health surveillance systems.

In the analysis of claims data for young workers (age 24 years and under) from 2013-2018, disabling claims show the most frequent severe injury type was work-related musculoskeletal disorders, while for the less severe nondisabling claims injuries stemming from "struck by/against" were most common. Both types of claims pointed to work-related musculoskeletal injuries as the having the highest median cost. Young workers most commonly experienced work-related musculoskeletal injuries in the healthcare industry as reflected by both disabling and nondisabling claims.

II. Fatality Assessment and Control Evaluation (OR-FACE)

OR-FACE Specific Aims (2015-21)

1. Maintain and evaluate core research processes of occupational fatality surveillance, investigation, and outreach.
2. Implement surveillance and electronic database innovations in partnership with the Oregon Clinical and Translational Research Institute (OCTRI).
3. Partner with established training series to prevent transportation-related fatalities, and to conduct social network analysis research to further target communications.
4. Establish and evaluate a mobile marketing system to promote fatality prevention "toolbox talks" in logging and construction.
5. Test a novel targeting strategy to engage small residential construction firms in fall prevention research and establish fall prevention grants for equipment and training.

Significant Findings

The expanded occupational fatality surveillance of the OR-FACE program addresses gaps in existing Oregon surveillance systems. For example, in a prior evaluation analysis conducted by our program, only 46% of fatalities identified by OR-FACE were also registered by the state workers' compensation system.

During the project period we produced a new REDCap database for fatality surveillance data (Aim 2). Each case was coded for occupation, industry, and event and described in an abstract. Annual reports assessed and summarized Occupational Fatalities in Oregon (Aim 1).

OR-FACE maintained a robust investigations program throughout the project period (Aim 1). This was accomplished through a renewed and continued unique collaborative investigations agreement with Oregon OSHA, new and renewed contracts with industry experts, and through employment of two highly experienced safety and health professionals as staff investigators during the project period (Barbara Epstien, Barbara Hanley).

Our surveillance and intervention development research resulted in three scientific publications (plus a fourth under review) related to workplace fatality outreach and prevention. These included a publication describing field research and the development of our evidence-based safety toolbox talk format which saved supervisors preparation time and increased productive discussion time with crew members (the format used to evaluate mobile phone delivery of talks in Aim 4); a description of recruitment methods to involve construction supervisors in a study of receiving toolbox talks on mobile phones (Aim 4); and evidence that small-to-medium sized construction firms were more likely to engage in fall prevention research if they had recently experienced a fall injury compared to firms that had not experienced a recent injury (Aim 5). The fourth manuscript under review reports the discovery that mobile phone delivery of toolbox talks increases safety meeting frequency among construction supervisors (Aim 4; see potential outcomes below and Publications).

To reach agricultural workers with fatality prevention information we partnered with the SAIF Corporation's (workers compensation insurer) Agricultural Seminar Series to reach thousands of employers and workers (Aim 3). We also conducted a social network analysis within a specific wine growing region in the state that identified a trusted source of safety information (orchard and vineyard supply store) to assist with targeted outreach in that area (Aim 3).

We continued significant outreach work to other high-risk industries (Aim 1) through a variety of communication channels and formats, including dissemination of physical in depth safety handbooks in logging and electronic resources through blogs, email distribution lists, and social media.

Translation of Findings

The REDCap database was designed with the assistance of an MPH graduate student and the Oregon Clinical and Translational Research Institute at Oregon Health & Science University. It was launched in the current cycle and has been used continuously since that date. Its many useful features include associating electronic documents with case records, control of access privileges, and auditing trails. OHSU houses REDCap servers in a data center at OHSU, and all web-based information transmission is encrypted, and compliant with requirements for storing protected health information. Surveillance data were used to produce 7 annual reports of Occupational Fatalities in Oregon which were disseminated through our many outreach channels (website, electronic email lists, blogs, Twitter).

Our work maintaining a robust investigation program, including our renewed agreement with Oregon OSHA, resulted in a total of 14 OR-FACE investigations (plus 3 in progress). The cases selected for investigation represented many of Oregon's highest risk industries (forestry/logging, agriculture, crab fishing, construction) and common fatal events (mobile machinery rollovers), but also unique hazards that our program had not addressed or investigated before (e.g., maintenance of a vertical storage machine, working on a festoon rubber processing line). Eleven of our fatality investigations were highlighted in the National Safety Council's monthly magazine during the project period.

Our partnership with the SAIF Corporation's (an Oregon workers compensation insurance provider) "Agricultural Safety Seminar Series" reached over 2250 company/farm owners and workers each year for three years. This included the creation and dissemination of an updated outreach document in English and Spanish at these training events titled "Identifying Hazards on your Farm or Ranch." Social network analysis research identified an orchard and vineyard supply store as a trusted source of safety information in a specific wine grape growing region in the state. Subsequently OR-FACE partnered with that store to set up an outreach booth during Farm Safety Week in September 2019.

After publishing an initial set of construction toolbox talks in our new evidence-based format, the talks quickly became the most popular monthly downloads on the OR-FACE website. Our subsequent field research studying mobile phone delivery of the talks resulted in 11 total talks being developed with 8 translated into Spanish, and also 7 made available as YouTube videos in English that could be played directly to crews (with pauses at time points for discussion). We also received a small grant from CPWR to increased incentives and research assistant time to recruit construction supervisors into that study. A report of

that project was published on the CPWR website and will be helpful to other researchers aiming to recruit and involve small construction firms in prevention research and outreach.

Other outreach efforts included presentations, posters, and talks for safety professionals (17 safety & health conferences/scientific meetings, 3 Oregon OSHA Agency meetings, 22 industry/community advisory committees (OR-OSHA Forest Activities Advisory Committee, OR-OSHA Construction Advisory Council, Oregon Trucking Associations Safety Management Council). Outreach included engagement with Associated Oregon Loggers to plan future training projects, the Oregon Home Builders Association to work on the safety toolbox talk project, as well as meeting with the local chapter of American Society of Safety Engineers, and attending the Mid-Oregon Construction Safety Summit. The use of social media to disseminate fatality prevention recommendations also increased, including 35 blogs related to OR-FACE resources and events that were often promoted through additional social media channels (e.g., Twitter, Facebook). Logging and young worker safety resources remained in high demand and were requested and distributed across the state and beyond.

Outcomes/Relevance/Impact

Potential outcomes were produced by OR-FACE through in-depth fatality investigations. To illustrate the many potential outcomes from our investigations program, we share examples from two cases below. First were investigations that identified contributing factors and made recommendations to prevent fatalities in unique manufacturing environments. This included a case involving a worker who was killed during maintenance of a vertical storage machine, where prevention recommendations included:

- When selecting and installing equipment, ensure that maintenance can be performed without exposing employees to hazards. Making safe access easier and quicker will encourage safer work practices.
- Follow lockout/tagout procedures to reduce the risk of hazardous movement of machines prior to work in a confined space, and seek advice or consult the machine manual if unsure how a task can be accomplished in a de-energized machine (e.g., hand crank).
- Employers should never allow entry into a confined space that contains physical hazards until there is a positive movement control method developed.
- Routinely assess job hazards, provide regular, periodic training and communications on site-specific hazards and safe work practices, and take corrective action when needed. Check and monitor employees' knowledge of job hazards and implementation of safe practices to control hazards.
- Ensure the equipment manual is available and reviewed prior to working with equipment.
- Provide appropriate audits of lockout/tagout use (annually at a minimum).
- Equipment/Facility owners should ensure safe work practices are followed, and inform contractors and their employers when discrepancies are observed.

Another example case highlighted the importance of communication, planning, and following best safety practices during multistage construction work involving prime and subcontractors. The project involved the installation of a fire suppression system, including

an underground pressurized water pipes, for a new building. A worker was struck in the chest by a pressurized pipe and killed.

Prevention recommendations for that case were:

- Employers should ensure employees do not work on pressurized water systems.
- Pipe systems should be pressure-tested and inspected before pipes are backfilled. Use checklists during tasks and the inspection process to reduce risk of overlooking critical steps that could endanger workers.
- Prime contractors should establish a realistic project schedule in collaboration with subcontractors.
- Prime contractors should develop and follow a communication plan so that subcontractors are made aware of project design modifications in a timely manner and to work out how design changes will impact project schedule, so as not to compromise workplace safety.
- Employers should provide written procedures to employees prior to performing the work, and ensure employees receive adequate training so they understand the hazards and how to execute procedures safely.

Intermediate outcomes included observed impacts of our toolbox talk format and mobile phone delivery of toolbox talks to residential construction supervisors. Relative to talks given with long-form investigation reports, the new talks were preferred by over 80% of supervisors and saved 15 minutes of preparation and presentation time. All talks based on fatal events impacted workers' intentions to take preventive actions. Sixty construction supervisors participated in a study to receive safety toolbox talks by mobile phone. Engagement in that process led to a 19.39% increase in the proportion of supervisors reporting compliance with the Oregon OSHA safety meeting frequency standard. Other intermediate outcomes in construction included our involvement of 88 construction policy holders in fall prevention research by partnering with their workers' compensation insurer (392 policy holders were invited). In that study we learned that policy holders were more likely to fully engage in the survey if they had experienced a recent fall injury claim compared to those who had not experienced a recent injury claim. In addition, respondents to the survey were offered the chance to receive a small grant for free competent person training, and several accepted and sent a person who completed that competent person training.

Other intermediate outcomes included our direct engagement with Agricultural workers through the SAIF Corporation Agricultural Safety Seminar Series which reached approximately 6800 (2250 per year over 3 years) employers and workers with fatality prevention recommendations. We also, through social network analysis research with vineyard owners in the Eola Amity Hills viticultural area, we identified an organization previously unknown to us that was nominated by vineyard owners as a trusted source of safety advice and information. We partnered with that organization (orchard and vineyard supply store) for direct outreach to workers during National Farm Safety Week in September 2019.

Other outreach the continued demand for and distribution of our logging safety resources directly to the logging community. This included 310 Fallers Logging Safety booklets and 10 Yarding & Loading Handbooks (developed in partnership with OR-OSHA).

The end outcome of fatal workplace incidents continued to be monitored through expanded OR-FACE surveillance. It is complex and difficult to attribute direct impacts of our small, yet incredibly active, OR-FACE research program on rare and dispersed fatal events that result from complex and multi-level factors. However, Oregon fatal incidents averaged 51 per year (count), with an average rate of 2.59 per year (per 100,000 workers) during the project period (through 2019; see Table 1 below). Provisional data from 2020 has 33 definitive cases and 52 cases that are still being decided.

Table 1: OR-FACE Reported Fatal Incidents, by Count and Rate

Year	Fatality Count	Fatality Rate (per 100,000)
2015	38	2.10
2016	57	2.92
2017	52	2.59
2018	55	2.73
2019	53	2.61

Section 2 – Scientific Report

I. Overall and Occupational Health Indicators

Background

The mission of the Oregon Occupational Public Health Program (OPHP) is to provide quality surveillance data and intervention recommendations to agencies and individuals who can prevent injuries and save lives. Our Overall program operates as a unique university-government collaboration between the Oregon Health Authority (OHA) and Oregon Health & Science University (OHSU). OPHP's Occupational Health Indicators component is housed at OHA; the Fatality Assessment & Compliance (OR-FACE) component is housed at OHSU.

Overall and OHI aims, research plans and activities throughout 2015-2021 were mutually supportive and significantly intertwined. As a result, findings and outcomes significantly overlapped between the Overall and OHI components and are presented in this report in a combined manner.

Overall Aim 1: Implement an expanded vision and strategic plan to advance occupational public health surveillance research and outreach in Oregon.

Overall Aim 2: Support the success and growth of existing state-level occupational health initiatives and programs.

Overall Aim 3: Invest in innovative areas for future occupational health surveillance research through speaker series and conference panels.

Overall Aim 4: Develop and implement surveillance and outreach innovations in Occupational Health Indicators and OR-FACE sub-projects.

OHI Aim 1: Maintain an effective surveillance system for occupational health in Oregon.

OHI Aim 2: Conduct innovative analysis utilizing both new and existing data sources to better understand conditions affecting Oregon workers.

OHI Aim 3: Develop and implement a comprehensive communication and outreach plan to increase the reach of the program.

OHI Aim 4: Leverage partnerships to develop policy initiatives that will improve occupational health in Oregon.

Procedures/Methodology

Occupational Health Indicators

OHI maintained its core surveillance activities during the project period using methods and guidance developed by the Council of State and Territorial Epidemiologists (CSTE) and the Centers for Disease Control and Prevention (CDC) National Institute of Occupational Safety and Health (NIOSH). Each year, OHI provided up to 25 indicators (Table 2) to NIOSH,

depending on annual guidance and data availability. OHI's are calculated using various data sources. Protocols for obtaining data and performing calculations are established by CSTE and issued annually.

Table 2- CSTE/NIOSH Occupational Health Indicators

Occupational Illnesses and Injuries Combined Indicator 1: Non-fatal injuries and illnesses reported by employers Indicator 2: Work-related hospitalizations Acute and Cumulative Occupational Injuries Indicator 3: Fatal work-related injuries Indicator 4: Amputations reported by employers Indicator 5: Amputations identified in state workers' compensation systems Indicator 6: Hospitalizations for work-related burns Indicator 7: Musculoskeletal disorders reported by employers Indicator 8: Carpal tunnel syndrome cases identified in state workers' compensation systems Occupational Illnesses Indicator 9: Pneumoconiosis hospitalizations Indicator 10: Pneumoconiosis mortality Indicator 11: Acute work-related pesticide poisonings reported to poison control centers Indicator 12: Incidence of malignant mesothelioma Occupational Exposures Indicator 13: Elevated blood lead levels among adults Occupational Hazards Indicator 14: Workers employed in industries with high risk for occupational morbidity Indicator 15: Workers employed in occupations with high risk for occupational morbidity	Occupational Hazards (continued) Indicator 16: Workers employed in industries and occupations with high risk for occupational mortality Intervention Resources for Occupational Health Indicator 17: Occupational safety and health professionals Indicator 18: Occupational safety and health administration (OSHA) enforcement activities Socioeconomic Impact of Occupational Illnesses and Injuries Indicator 19: Workers' compensation awards Cumulative Occupational Injury Indicator 20: Work-related low back disorder hospitalization Occupational Illnesses (continued) Indicator 21: Asthma among adults caused or made worse by work Health Effect Indicator 22: Work related severe traumatic injury hospitalizations Hazard Prevention Indicator 23: Influenza vaccination coverage among healthcare personnel Occupational Illnesses and Injuries Combined (continued) Indicator 24: Occupational heat-related emergency department visits Indicator 25: Hospitalizations for or with Occupational Eye Injuries

Traumatic Brain Injury

Methods for determining the burden of work-related traumatic brain injury (TBI) in Oregon are fully documented in an online agency report. In brief, International Classification of Diseases (ICD) codes for TBI were used to search death certificate and Oregon Trauma Registry System data. These records were further evaluated to determine whether the TBI was work-related. Demographic, industry/occupation and external cause (by manner/intent and by cause) variables were analyzed and rates were calculated based on employment data from the Bureau of Labor Statistics.

Syndromic Surveillance as a Source of Low-Back Pain Data

Methods for evaluating the utility of a syndromic surveillance system (Electronic Surveillance System for the Early Notification of Community-based Epidemics, ESSENCE) to

characterize work-related low back pain and injuries (LPB/I) in Oregon are fully documented in an internal agency report. In brief, key words and ICD-10 codes associated with work-related LBP/I in the fields of chief complaint, triage note and discharge diagnosis were assessed and determined based on data in the Oregon ESSENCE syndromic surveillance system. Then an advance ESSENCE query was built to measure work-related LBP/I in Oregon for years of 2016 and 2017.

OHI Surveillance System Evaluation
Methods for evaluating OPHP's OHI surveillance system are fully documented in a peer-reviewed published manuscript. In brief, OPHP followed the CDC updated guidelines for evaluating public health surveillance systems, engaging internal and external stakeholders using a mixed methods approach. Operational measures for ten surveillance attributes were developed. Multiple data collection methods resulted in credible evidence for evaluation conclusions. Analyses included summary statistics and qualitative analysis of interviews, a focus group, and online surveys.

County-level OHIs
Methods for developing the county-level OHIs in the OPHP story map correspond to CSTE's Occupational Health Sub-State Measures Technical Guidance and Examples.

Burden of Injury and Illness to Young Workers Using Nondisabling and Disabling Claims
Methods for determining the burden of work-related illness and injury to young workers using disabling and nondisabling claims data are fully documented in a peer-reviewed published manuscript. In brief, disabling claims data were obtained from the Oregon Department of Consumer and Business Services, nondisabling claims from SAIF Corporation (Oregon's largest workers compensation insurer), and employment data from the Quarterly Workforce Indicators dataset. Both claims datasets were analyzed for injury year, worker demographics (age and gender), employer industry, injury characteristics (nature, body part and event/cause) and compensated medical cost. Claim rates were estimated by year, age group, gender and industry for disabling and non-disabling claims separately; non-disabling claim rates were adjusted to account for sample size. Industries were ranked by risk using a prevention index.

Results

Overall Aim 1: Implement an expanded vision and strategic plan to advance occupational public health surveillance research and outreach in Oregon.
Our Program Steering Team met at least quarterly throughout the 6-year grant to review project progress and coordinate program activities. Multiple Principal Investigators (MPIs) Mr. Cude and Dr. Olson monitored progress of the Overall program and subproject activities. Mr. Cude served as the communicating Principal Investigator (PI) and Overall project coordinator to ensure centralized and cross-institutional support for the Program Steering Team. Representatives from each project prepared and presented a chalk talk once per year on methods, progress, timeline and findings. This process served to provide both accountability for our progress, as well as generate helpful feedback and guidance from our multi-disciplinary team. Institutional leaders from both OHSU and OHA attended chalk talks to hear progress and ensure connection to institutional-level initiatives.

The OPHP Advisory Committee met twice yearly except during 2020 and 2021 due to the Coronavirus Disease 2019 (COVID-19) pandemic. Committee agendas included program initiatives, project progress and findings including: shift work hazards, OR-FACE social network analysis in agriculture, a story map showing county-level indicators, fall prevention practices among small homebuilding companies, findings and opinions on continued collaboration related to work-related lower back injury and treatment surveillance, OHI surveillance system evaluation results, proposed work on fishnet lead lines, emerging silicosis hazards for manufactured stone fabricators, analysis of pesticide exposure contributing factors, work on younger workers using nondisabling worker's compensation claims, demographics study, results of field study work focusing on fatalities, dissemination of "Share a Story, Save a Life" campaigns and work on fall prevention tools, fatality investigations, engagement with a fall protection survey among representatives of small residential construction firms that experienced a fall-related injury claim. Program capacity and administrative topics updates have included discussion of syndromic surveillance, use of ORPHEUS for surveillance, potential datasets, staffing updates and discussion of CSTE updates.

Overall Aim 2: Support the success and growth of existing state-level occupational health initiatives and programs.

MPIs Cude and Olson facilitated communications and a strong letter of support from Oregon Public Health Division Director Lillian Shirley for the 2016 competing renewal application of the Oregon Healthy Workforce Center (NIOSH Center of Excellence in *Total Worker Health*®). Further ties between the OHA and Center were forged, including the addition of Dr. Laura Chisholm (Section Manager, Injury & Violence Prevention, Oregon Health Authority) to the Center's External Advisory Committee.

OHI program coordinator Dan Cain, Overall program outreach specialist Dede Montgomery, OHI program coordinator Magali Blanco and OHI program coordinator Crystal Weston provided continuous support to the Oregon Young Employee Safety Coalition (O[yes]). Ms. Montgomery is the current chair of the O[yes]) advisory board. Additional support has included providing new data on young worker injuries, collaborating on research focused on young workers, serving on the O[yes] board, attending Women in Trades events and judging annual video contests. Analyses of nondisabling worker's compensation claims and insights about younger workers were presented by Dr. Liu Yang, a former doctoral candidate and temporary staff member of the OPHP program, in 2020.

Ms. Montgomery, Ms. Epstien (fatality investigator, now with the Oregon Associated General Contractors), Dr. Mansfield (OR-FACE program coordinator, now with Senior Human Resources Consultant with CPS HR Consulting) and Ms. Weston represented the Overall program by participating in the planning committee for the 2017 and 2019 Oregon Governor's Occupational Safety and Health (GOSH) Conferences, which is the largest occupational safety and health conference in our region. This included work on the Construction, Emerging Issues and other tracks.

Mr. Cain provided subject matter expertise to multiple OHA projects, including participation on the Ebola Assessment Hospital State Team (focused on occupational health, personal protective equipment (PPE) and waste management). This included visiting and consulting with all 6 Oregon Ebola assessment hospitals. Mr. Cain also

supported a joint OHA/Department of Environmental Quality (DEQ) investigation of cadmium, chromium and arsenic exposures from a local glass factory, provided toxicology, PPE, and occupational health training to Oregon clandestine drug lab cleanup contractors, and maintained the OHA respiratory protection program, including training and fit testing of OHA employees.

Ms. Montgomery assisted OR-OSHA with administrative rulemaking on temporary workers. As noted above, Ms. Montgomery chaired the O[yes] coalition advisory board and represented the Oregon Institute of Occupational Health Sciences in statewide initiatives to support the safety and health of young workers. Ms. Montgomery also served as a member of ASSE's (now ASSP) Committee on Professional Affairs where she co-led a discussion relevant to young worker safety, and she led development of a white paper on *Total Worker Health*®. Ms. Montgomery represented the Overall program in participating in planning, presenting at and exhibiting at regional occupational safety and health conferences in the state, including providing resources relevant to OR-FACE initiatives and investigations. She organized the Institute-sponsored symposium on Pain in the Workplace held in 2018.

Mr. Cude provided subject matter expertise to a collaborative DEQ, OR-OSHA, OHA and Polk County Public Health project to investigate high levels of lead in a retail commercial building that had previously housed a battery manufacturing facility. Agencies worked together to identify and communicate risks to workers, customers and neighbors of the building, and to ensure cleanup proceeded in a manner protective of worker and community health. Mr. Cude also coordinated in 2020 with Public Health Division programs and the Oregon Department of Consumer and Business Services (DCBS) to bring workers compensation costs into an analysis of health impacts and costs due to the 2017 Chetco Bar and Eagle Creek wildfires. Mr. Cude is currently engaged with OHA environmental epidemiologist Dr. Carol Trenga, DCBS, CDC and others to develop a health impact assessment (to include workers compensation costs) of the 2020 statewide wildfire conflagration.

Ms. Epstien served on the AIHA Pacific NW Section's conference planning committee and outreach team and was co-coordinator for the Portland area industrial hygiene education committee.

OHI research analyst Dave Dreher and Ms. Weston collaborated with Adult Blood Lead Epidemiology and Surveillance program (ABLES) and Child Lead Poisoning Prevention Program team members at OHA to start investigating lead-core fishing nets and hazards workers bring home to their families. Ms. Weston also conducted preliminary investigation of silicosis as an emerging hazard in Oregon in close cooperation with OR-OSHA.

Ms. Weston and Mr. Cude worked on the Incident Management Team for COVID-19, contributing to contact tracing for occupational and non-occupational COVID-19 cases. Ms. Weston also contributed to a workgroup focused on health recommendations for agricultural workers during the pandemic, which informed OR-OSHA temporary rule making efforts. Ms. Weston also contributed to collection of occupation and industry for COVID-19 and other reportable conditions and worked on automatic coding of these fields (still underway due to overwhelmed data systems from COVID-19 work). She also added all agricultural worksites with ten or more units registered with OR-OSHA to the reportable

conditions database as a value list so that local public health authorities could be more easily collect data.

Ms. Weston, Mr. Cude, Dr. Trenga, OR-OSHA and others met in November 2020 to plan development of new worker protection standards for exposure to heat and wildfire smoke. Participants collaborated with DEQ partners and with peers in Washington and California engaged in parallel processes to inform each other on developments in the practice of heat and wildfire smoke protection. Participants worked with a Rules Advisory Committee to begin drafting administrative rules in the first half of 2021; this work continued after the end of this reporting period.

Other project team members also represent the overall project and sub-projects, at state and regional events. For example, members of the OR-FACE team represented the Overall program in supporting and attending the annual Oregon Workers' Memorial Day service in Salem, as well as participating in National Safety Stand Down events and Safety Summits in Oregon.

Overall Aim 3: Invest in innovative areas for future occupational health surveillance research through speaker series and conference panels.

Occupational Traumatic Brain Injuries: In Year 1, OPHP engaged with Dr. Kathleen Carlson, a specialist in TBI from the Portland Veterans Administration Medical Center, to assist the program in organizing a symposium focused on the theme of occupational TBI. Through discussions with Dr. Carlson and Dr. Dagan Wright, an injury epidemiologist with the OHA Injury and Violence Prevention Section, we determined that we had sufficient data resources and expertise to begin an exploratory analysis of the burden of occupational TBI using death certificates and Oregon Trauma Registry data as initial sources of surveillance data. Following consultation with our External Advisory Committee and executive directors, OPHP program epidemiologist Dr. Xun Shen began analyses of this data.

OHA published findings from the Year 1 project on work-related TBI during Year 3. This report found 8.4 per 100,00 workers experience TBIs occur annually in Oregon and that workers with occupations such as construction, logging, fishing, farming, installation, maintenance, repair, production, transportation and material moving had higher risk of work-related TBI. This analysis also showed that males and people who were Latinx had a higher risk for this type of injury. The most common types of injuries leading to TBIs were falls, followed by struck by or against objects and motor vehicle traffic incidents.

High-Risk Shiftwork: In Year 2, our team invested in themed seminars to bring together scientists distinguished in extended and high-risk shift work. In the fall of 2016, the Northwest Occupational Health Conference featured a short course on "Health and Safety in the 24/7 Economy". The event brought together a panel of speakers including Drs. Shea and Butler who examine the physiological impacts of shift work, Drs. Bowles and Olson (MPI) who develop interventions for shift workers in high-risk industries, Doyle Anderson of the Port of Portland Dredging Operations, Isaac Howard of the University of Washington and retired fire chief, and Dr. Fischman of Intel who presented the unique challenges and solutions of shift work in their respective occupations. After the seminar, we hosted a dinner with five of the speakers to discuss potential data sources or strategies for obtaining data and help with the definition of high-risk shift work. The result of this collaboration

indicated that defining high-risk will be an essential next step. We also learned the firefighter schedules may be public and accessible. Finally, we were pointed to the NHANES data set as a potential dataset in which we could infer shift work.

Occupational Back Injuries: In Year 3, our team planned themed seminars to bring together scientists distinguished in back injuries and treatments. This area of expanded surveillance was explored during a two-part event in May of 2018. Dr. Gary Franklin provided a scientific noon-hour seminar on work-related pain and treatments at the Oregon Institute of Occupational Health Sciences. After that seminar Dr. Franklin and the OPHP team discussed possible surveillance datasets and issues related to work-related low-back pain and treatments. The following day, Dr. Franklin and four additional nationally regarded experts presented in the Institute's Spring symposium for practitioners titled "Pain at Work: How to prevent, recognize and treat." Ms. Montgomery and Dr. Olson played key roles planning the event with Dr. Franklin and other invited speakers, and our research team attended for further learning and networking on this problem area.

Additionally, Overall program staff at OHA used the exploratory theme of back injury as an opportunity to evaluate and improve our ability to mine ESSENCE for work-related injuries and illnesses; in this case with a focus on work-related LBP/I. At that time, ESSENCE received real time diagnostic data from all of Oregon's hospital-based emergency departments (it later added urgent care data in 2018). OPHP demonstrated this data source, in combination with workers compensation claims data, could provide a fuller picture of work-related illness and injury. This inquiry showed there were more than 1500 emergency room visits for work-related LBP/I in Oregon each year. The ESSENCE system can track work-related LBP/I.

Workplace Exposures that may increase with Climate Change: In Year 4, Ms. Weston represented the Overall program in collaboration with OHA Climate and Health Program Coordinator Emily York and Multnomah County Environmental Epidemiologist Brendon Haggerty from to develop a presentation on climate change and potential occupational health impacts. The group presented and led a discussion at the March 2019 GOSH conference. This seminar related to the occupational hazards projected in association with climate change. As part of this effort, we surveyed attendees to uncover previously unknown hazards associated with climate change, such as fluctuating waters for dredge workers on the Columbia River and people operating cranes during more frequent storms.

The overall program also explored using ESSENCE to track occupational heat-related illness by combining work-related and heat-illness sub-syndromes. ESSENCE at this point held de-identified and searchable data from urgent care and emergency room electronic medical records. Validated collections of search terms, or "syndromes," allow users to track particular issues. Although Oregon does not currently have many occupational heat-related illnesses, the occupational heat illness syndrome allows for a quick respond to such hazards in the future.

In Year 5-6 we continued to focus on communications, presentations and publications about the findings of innovation efforts from years 1-4.

Overall Aim 4: Develop and implement surveillance and outreach innovations in

Occupational Health Indicators and OR-FACE sub-projects.
The Overall program supports the accomplishment of OHI and OR-FACE surveillance and outreach innovations (highlighted in component report summaries).

The Overall program supports sub-projects by facilitating student internship and field placements. Early in the grant cycle, OR-FACE hosted a graduate-level intern (200-hour field placement) from Oregon State University (OSU) to assist with the design and implementation of a new occupational fatality surveillance database developed in Research Electronic Data Capture (REDCap).

Subsequently, OR-FACE hosted a second graduate-level intern from OSU to help with design and implementation of a new occupational fatality surveillance database. This intern worked on the OR-FACE field study to conduct a social network analysis of safety opinion leaders in a sub-sector of the agricultural industry, focused on owners and managers of vineyards in the Eola-Amity Hills region in the north Willamette valley. This student went on to obtain a position with OR-OSHA. A third Oregon State MPH student completed a field placement (200 hours) with OR-FACE in later years of the project cycle to assist with fatality abstracts and annual reports of *Occupational Fatalities in Oregon*.

In Year 1 OHI hosted a Pacific University bachelor's-level student for over 100 hours to investigate injuries to young workers. In Year 4, OHI hosted a PhD-level epidemiologist intern, Liu Yang, from OSU who conducted a rigorous evaluation of the core OHI surveillance system. OHA then implemented recommendations to increase timeliness, representativeness and usefulness of our surveillance systems based on this evaluation. A second outcome of this work was development of surveillance system evaluation guidance specific to occupational safety and health surveillance. The same PhD-level epidemiologist intern also worked with us on an analysis of nondisabling worker's compensation claims for young workers. This study used both disabling and nondisabling worker's compensation claims to gain insight into less severe but more frequent injuries. Considering only disabling claims from 2013-2018, the most frequent injury type for young workers (age 24 years and under) was work-related musculoskeletal disorders, while for the less severe nondisabling claims injuries stemming from "struck by/against" were most common. Both types of claims pointed to work-related musculoskeletal injuries as the having the highest median cost. Young workers most commonly experienced work-related musculoskeletal injuries in the healthcare industry as reflected by both disabling and nondisabling claims.

We also hosted another PhD level intern from OSU, Richard Evoy, to work on an analysis of hazardous industries and assess our data for any demographic data available. This analysis assessed the demographics of industries with the most worker's compensation claims. For example, agriculture, fishing and hunting and construction had more male workers while education and healthcare had more female workers.

OHI Aim 1: Maintain an effective surveillance system for occupational health in Oregon.
OHI maintained its core surveillance activities during the project period and provided all indicators annually to NIOSH. OHI responded promptly to NIOSH requests, such as for silicosis deaths and hospitalizations. OHI also responded to requests from the US

Environmental Protection Agency (EPA) for data informing the review of particular pesticides, using new database features that support case finding by chemical identification number.

Existing institutional review board approval, data agreements and data sources were maintained, and new data management protocols were developed in correspondence to development of new indicators. Pesticide exposure data was migrated to a newer database (ORPHEUS) that is used for all reportable conditions at OHA. This will ensure a functional database for the future.

Oregon took part in the NIOSH Sentinel Event Notification System for Occupation Risk (SENSOR) Pesticides program, although the state does not receive NIOSH funding for this effort. Oregon's Pesticide Exposure, Safety & Tracking (PEST) program uses SENSOR's case definition and classification criteria for reports of acute pesticide exposure cases it investigates, and exports de-identified case data for SENSOR-Pesticides. As a result, since July 2015, the reported burden of occupational acute pesticide exposure in Oregon has been included in four articles published in peer-reviewed journals by SENSOR-Pesticide.

OHI designed a new pesticide illness and injury database within our existing reportable diseases database in Oregon. The PEST program also updated Oregon's investigative guidelines for pesticide poisoning, incorporated syndromic (ESSENCE) case finding, improved on data collection for industry and occupation fields, incorporated collection of race, ethnicity and other demographic data, added the ability to search by chemical, streamlined program processes, and addressed most of a case classification and data entry backlog. The new database allows data imports from multiple sources, something we lacked the capacity for previously. This new database also allows OHI to link contributing factors identified by other state agencies to OHA data for pesticide illness and injury cases, by including case number fields for other state agencies. Due to the COVID-19 pandemic, progress on an analysis stalled in 2020 as staff pivoted to respond to the crisis. The analysis commenced in June 2021.

OHI conducted an evaluation of its OHI surveillance system, using the CDC Updated Guidelines for Evaluating Public Health Surveillance Systems, to understand the system performance and to identify gaps for future improvement. The evaluation team developed measurable constructs for all the ten attributes recommended in the guidelines and designed an overall evaluation plan. The evaluation plan included methods for engaging stakeholders and collecting data. Credible evidence collected included information from semi-structured interviews, a focus group, online surveys, and literature review. Mixed methods were used for data analyses. The OHI surveillance system was found to be simple and highly accepted by its stakeholders. The system has flexibility to accommodate changes related to OHI calculations over time. Long-term funding security presents challenges for stability of the system and the overall program. The system is not considered timely due to a long lag time, limiting the system's usefulness. The system lacks usefulness given the limited use of OHIs at a local level and the system's lack of capacity for active data dissemination. A review of key data sources for the system showed that they exhibited good data quality and predictive value positive, but relatively poor sensitivity and representativeness. Among the three local data sources, Oregon Workers' Compensation

claims data and ABLES data had better overall performance than the Hospital Discharge data.

There were challenges using CDC updated guidelines to guide our evaluation as the attributes and demonstrations included in the guidelines are not specific to occupational health surveillance, however we were able to collect relevant feedback. It is imperative to enhance the usefulness of the Oregon OHI surveillance system at the state and local level by exploring the use of existing and new data sources to gain more actionable information, developing indicators that reflect local occupational health burdens and disparities, and promoting active data dissemination.

OHI worked to act on recommendations from the OHI evaluation. For example, our syndromic surveillance has excellent timeliness and representativeness and can be used strategically for case finding with few false positives. For example, OHI implemented a new project using ESSENCE to find pesticide cases by searching the discharge diagnosis field for ICD-10 codes T60 (pesticide poisoning) and T59 (chlorine gas exposure). Although ESSENCE contains de-identified case data, we spearheaded a collaborative effort with the OHA Acute and Communicable Disease Program to securely transfer suspect cases from ESSENCE into our reportable disease data base and then identify these cases by requesting medical records. Preliminary results show that these cases only overlap with cases known to us from other sources by about 20%. We also preliminarily found that cases originating from ESSENCE were more severe and classified as more certain than cases originating from other sources. We have also used ESSENCE to locate suspect silicosis cases using ICD-10 codes and attempted to following up on potential cases to determine if manufactured stone is presenting hazards in Oregon as have been found recently in other states (although this investigation was interrupted by the pandemic and the associated public health response). This approach has improved timeliness of our surveillance work and has promise for communicable disease surveillance as well, especially for conditions lacking lab tests such as cryptosporidium.

To address suggestions from the evaluation to make the OHI data more actionable, a Story Map displayed the data by County, to better capture regional occupational elements including hazardous industries, work-related hospitalizations and work-related fatalities.

OHI also collaborated with the Oregon State Cancer Registry program to improve occupation and industry coding of Registry records, and with the OHA Office of Health Analytics to discuss ICD-9 to ICD-10 conversion issues.

OHI Aim 2: Conduct innovative analysis utilizing both new and existing data sources to better understand conditions affecting Oregon workers.

In support of the Overall Aim 3 (Invest in innovative areas for future occupational health surveillance research through speaker series and conference panels), OHI staff piloted the use of public health datasets to conduct innovative occupational public health surveillance.

In Year 1 OHI piloted the use of Oregon Trauma Registry data in conjunction with death certificate data to characterize work-related TBIs. From 2009 to 2014 in Oregon, on average, 149 severe work-related TBIs (crude rate: 8.4 per 100,000 workers) occurred in Oregon each year. Of them, 17 died and 132 were treated and released by a trauma hospital in Oregon. Overall, about one third of severe work-related injuries involved TBIs in Oregon.

Workers with construction, logging, fishing, farming, installation, maintenance, repair, production, transportation and material moving occupations were at increased risk to suffer TBIs. Overall, male workers were more likely than female workers to suffer TBIs and TBI incidence increased with workers' age. Workers aged 65 years and older had the highest rate of TBI. TBI incident rate was higher for workers with Hispanic ethnicity who worked with construction, logging, fishing, farming, installation, maintenance and repair occupations than for non-Hispanic workers. Overall, falls were the leading cause of TBI, followed by struck by or against objects and motor vehicle traffic incidents. Motor vehicle-traffic incidents were the leading cause of TBI-related injury deaths. The majority of work-related TBIs occurred in industrial areas and on the road/street/highway.

In Year 2, OHI piloted use of ESSENCE in finding workplace injuries and illnesses. OHI developed weighted queries to mine emergency room visit records for work-related conditions. OHI worked with ORPHEUS to expand case reporting from occupational health clinics. ORPHEUS captures case notes as well as analytical results. OHI worked with Johnson Controls, the largest employer of lead-exposed employees in Oregon, to collect employment data to supplement evaluation of blood lead test results for employees.

In Year 3, OHI refined and standardized the use of ESSENCE for identifying workplace injuries and illnesses. OHI evaluated our ability to use ESSENCE to capture work-related injuries seen in emergency rooms and urgent care centers, using workers compensation information as a target value and way to validate occupational queries. OHI also continued working with ORPHEUS to increase the reporting of acute pesticide exposures through the development of electronic case report submission capabilities through a related portal called Memento Morbi.

In Year 3 OHI piloted the use of ESSENCE to capture presentation of work-related low back pain visits to emergency departments. This work focused on development of inclusion and exclusion terms to search chief complaints, discharge diagnosis and triage note fields. Given the diagnostic complexity related to low back pain and the numerous related ICD-10 codes, we were unable to quantitatively characterize the burden of work-related low back pain using this method at this time. However, we did help start a collaboration between CDC NIOSH and other state occupational health surveillance programs to refine queries in ESSENCE to identify work-related illnesses and injuries. This "work relatedness query" can be attached to queries for simpler conditions, i.e., heat-related illness or amputation, to characterize burden.

In Year 3 OHI also analyzed data for a Demographics Study and began drafting the study. The data assessed included information about the demographics of the state of Oregon as a whole, the population age 16 and over, and the workforce. Demographics included in the longitudinal assessment include age, sex, race and ethnicity, disability status, and educational attainment.

In year 4 OHI evaluated use of ESSENCE to capture work-related injuries seen in emergency rooms and urgent care centers for work-related heat illness, silicosis and pesticide poisoning. OHI developed a roadmap for syndromic surveillance of pesticide illness and injury.

In Year 5, OHI implemented a project for syndromic surveillance of pesticide illness and injury. Cases identified using ESSENCE now flow into the ORPHEUS pesticide module via an Application Programming Interface. This has increased case finding significantly for acute pesticide exposures. The pesticide module in ORPHEUS pulls ESSENCE syndromic surveillance deidentified data into the pesticide module, at which point an investigator follows up. OHI also reviewed mortality data, ESSENCE and All Payers All Claims data for silicosis case finding.

In Year 5, OHI also continued work on the Demographics Study and created an internal draft, which informed our program priorities and pointed to the impact of employment on mentally unhealthy days for Oregonians overall and for particular demographic groups. OHI presented findings within OHA to inform discussions on this topic. OHI also worked with graduate student Richard Evoy to assess demographics and OHI trends, which informed OHI's understanding of the most hazardous industries in Oregon and the industries with the most financially burdensome worker's compensation claims. Challenges with the public health response to COVID-19 interfered with our ability to complete these assessments.

In Year 5 OHI worked on investigating young workers by analyzing non-disabling claims. Results were published during Year 6. Average annual disabling and non-disabling claim rates were 111.6 and 401.3 per 10,000 young workers. Workers aged 19-21 (disabling:119.0 per 10,000 and non-disabling: 429.3) and 22-24 years (115.7 and 396.4) and male workers (145.3 and 509.0) had higher claim rates than workers aged 14-18 (80.6 and 297.0) and female workers (79.8 and 282.9). The most frequent injury types were "struck by/against" (35.6%) and "work-related musculoskeletal disorders (WMSDs)" (19.5%). High-risk industries included agriculture, construction and manufacturing for both genders combined. For female young workers, the highest risk industry was healthcare. Multiple presentations of these findings also occurred at OHA, CSTE and for the [O]yes board.

OHI Aim 3: Develop and implement a comprehensive communication and outreach plan to increase the reach of the program.

OHI developed a communication and outreach plan with identified goals (Raise awareness about occupational health in Oregon, Advance the state of occupational health research, Unify the efforts of stakeholders to improve occupational health in Oregon) and objectives (Improve use and visibility of OHI information, Present findings at conferences and meetings, Build outreach networks relevant to occupational hazards, specifically to pesticide exposures) each with specific, measurable activities. Most outreach was conducted in the form of presentation to local, state, regional and national audiences of occupational health and safety, industrial hygiene and public health professionals and students. Specific efforts are ongoing to improve reporting of occupational pesticide exposures from migrant workers.

OHI program coordinator Dan Cain presented initial findings on the "Burden of Injuries on Oregon Young Workers" at the Oregon Public Health Association annual conference. OHI contributor Justin Waltz attended Oregon's Rural Health Conference in Year 1 to connect with rural health care practitioners and explore avenues of increasing reportage of rural/agricultural/forestry occupational illnesses and injuries. We have continued to work

with providers to promote understanding and proper treatment and diagnosis of pesticide poisoning in a treatment setting. Staff turnover prevented some communication and outreach activities in Year 2 and 3. More recently, OHI program coordinator Ms. Weston and program intern Leticia Campos attended the 2019 Latina Health Symposium and distributed EPA's Recognition and Management of Pesticide Poisonings, 6th Ed. to interested providers. Ms. Weston also attended the Western Forum for Migrant and Community Health in 2019 to network and share information with providers working on related issues.

Ms. Weston designed a new pesticide illness and injury module within ORPHEUS in Year 4 and 5. She has also taken steps to link this system to labs testing for cholinesterase levels so that pesticide illness cases come from electronic lab reports and electronic case reports from providers rather than from those seeking healthcare. This may help to identify cases related to workers who feel pressure not to report workplace exposures, e.g., undocumented workers.

This new system not only improves case reports but improves communication about pesticide poisoning with local public health authorities (LPHAs). Previously, OHI only reported multi-household incidents of pesticide poisoning to LPHAs and had less frequent coordination with LPHAs about individual cases. However, the ORPHEUS system is also used by LPHAs, who have access to pesticide cases for their jurisdiction (such as tribe or county). This has made communication with LPHAs seamless and has removed layers of administrative approvals that had previously complicated and delayed communication about pesticide cases. As a LPHA or OHA enter a pesticide case, now all local or state officials with access to the condition and jurisdiction can securely view the case, add data or run analysis.

More recently, Ms. Weston also implemented yet another innovative approach to document pesticide exposures. To identify cases without migrant farmworkers needing to proactively report, and without busy providers or migrant clinics needing to do special reporting processes, OHI can now proactively find cases if the person was diagnosed with pesticide poisoning. Using ESSENCE, which has de-identified data streams from emergency rooms and urgent cares across the state, a pesticide query "finds" the cases without any overt reporting occurring by searching ICD-10 codes. The medical record number contained within ESSENCE enables investigators to then request medical records on the cases. Migrant farmworkers will not need to report to authorities in order for us to find these cases and all records have full privacy protection. The related component of this work is making sure providers do use an ICD-10 code that will come up in our ESSENCE query. To encourage providers to use the T60 and T59 ICD-10 codes if applicable, Ms. Weston contributed a short announcement about the new system to the Oregon-based “Provider Matters” newsletter. This newsletter targets providers and has short articles and announcements.

OHI has previously struggled to effectively communicate about reportable conditions because of legal requirements to publish data before being able to share any element of the data. In Years 5 and 6, Ms. Weston collaborated with OHA’s Acute and Communicable Disease Program to include occupational illness, including pesticide poisoning and lead poisoning, with aggregated weekly, monthly and annual tabulations of other reportable

conditions in Oregon. This new feature supports discussion of OHI findings of occupational illnesses and injuries with other state agencies by fulfilling the publication requirement before discussing findings. Inclusion of occupational illnesses in these reports also means these case reports become published in Morbidity and Mortality Weekly Reports (MMWR) and in Tableau data visualization efforts.

OHI Aim 4: Leverage partnerships to develop policy initiatives that will improve occupational health in Oregon.

OHI engaged with many partners to create public health actions, which should in turn lead to development of policy initiatives. OHI worked with the Oregon Environmental Public Health Tracking program to pilot county-level indicators on a story map. This story map displays county-level rates of employment in state-defined high-hazard industries as well as rates of work-related emergency department visits, hospital discharges and mortality. The purpose of the story map is to inform occupational safety & health, industrial hygiene and public health professional and academic audiences, and to enable more informed hypothesis generation.

During investigation of a community-wide exposure to cadmium from artisanal glass manufacturing facilities, OHI helped OHA by developing capacity to capture and analyze biomonitoring data related to cadmium exposure. OHI led development of new investigative guidelines, relevant to occupational and environmental health, and partnered with OR-OSHA to refer occupational cadmium exposure information.

2016 national coverage of lead hazards in military armories was facilitated with an information request by a reporter from The Oregonian to Oregon OHI. No added follow-up is expected although it is likely that interventions will be developed by military armories as a result.

OHI maintained ongoing partnership with OR-OSHA and OHA's Child Lead Poisoning Prevention Program to share blood lead data and cross-refer to aid occupational and community lead exposure investigations. Ms. Weston also facilitated expansion of our data-sharing agreements to better share pesticide poisoning and other reportable conditions. We hope this will allow OR-OSHA to focus on current hazards that our surveillance has identified.

We have also collaborated closely with the OHA Acute and Communicable Disease Program to improve our database system, improve race and ethnicity data collection, improve case count reporting processes, implement syndromic surveillance for reportable conditions, and coordinate investigations for occupational reportable conditions.

Discussion

During the project period OPHP's Overall program and OHI component was successful at accomplishing its specific aims, as listed in the background section above. One overarching objective was to regain capacity afforded by the improved 2015-2021 budget, relative to the previous project cycle (2010-2015) which had experienced a significant budget and program reduction relative to the 2005-2010 project cycle. The significant accomplishments related to each specific aim, as described in sections above, took place during a period where the program experienced significant staff turnover, in both the OHI and OR-FACE subcomponents. An OPHP emphasis on contributing to the training of the

next-generation occupational safety and health professionals contributed to program productivity. Certainly, the onset and continuing duration of the COVID-19 pandemic impacted staff capacity to accomplish some projected activities but did not cause the program to come to a complete halt.

In addition to the success of core surveillance and investigation processes in the face of challenges, highlights of accomplishments during the current period included the Overall program's exploration of areas for innovation in occupational safety and health surveillance (traumatic brain injuries, high-risk shiftwork, work-related back pain and workplace exposures related to climate change). OHI also explored surveillance innovation, developing the use of new sources of surveillance data (ESSENCE, ORPHEUS, Oregon Trauma Registry, non-disabling claims). The Overall program supported an evaluation of the OHI surveillance system, which led to development of the capacity to collect, investigate and act on real-time data, publication of county-level OHI data and initial development of a framework for occupational safety and health surveillance systems. The project period was also characterized by expanded presentations and communications with scientific peers, industry, and safety professionals, including contributions to three peer-reviewed journal articles as well as increased social media activity through the Oregon and the Workplace Blog and Oregon Institute of Occupational Health Sciences Facebook and Twitter.

Conclusions

The mission of the Oregon Occupational Public Health Program (OPHP) is to provide quality surveillance data and intervention recommendations to agencies and individuals who can prevent injuries and save lives. Having received continuous extramural funding from NIOSH since 1992, the OPHP has developed robust surveillance systems and effective partnerships with stakeholders in occupational health. Beginning in 2002, our expanded program has operated as a unique university-government collaboration between Oregon Health & Science University (OHSU) and the Oregon Health Authority (OHA). Our OPHP Advisory Committee has become the de facto forum for strategic planning to address important occupational health issues in Oregon. Oregon's OHI surveillance system includes unique data sources that provide essential information for state and nationwide occupational surveillance. These state surveillance data exceed the national data standards and add value by providing the opportunity to evaluate county-level risk and access real-time data for timely reporting and intervention. The accuracy, completeness and detail the data provide are critical for targeting intervention efforts at the local and state level and for measuring their impact. Accomplishment highlights from this past grant period provide evidence of a productive and healthy overall program.

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II. Oregon Fatality Assessment and Control Evaluation

Background

Oregon Fatality Assessment and Control Evaluation (OR-FACE) conducts surveillance, investigation, and assessment of traumatic occupational fatalities in Oregon, and engages in educational outreach activities to help prevent traumatic occupational fatalities and promote safety. OR-FACE 6-year grant period – July 1, 2015 to June 30, 2021 – operated with the following aims.

1. Maintain and evaluate core research processes of occupational fatality surveillance, investigation, and outreach.
2. Implement surveillance and electronic database innovations in partnership with the Oregon Clinical and Translational Research Institute (OCTRI).
3. Partner with established training series to prevent transportation-related fatalities, and to conduct social network analysis research to further target communications.
4. Establish and evaluate a mobile marketing system to promote fatality prevention "toolbox talks" in logging and construction.
5. Test a novel targeting strategy to engage small residential construction firms in fall prevention research and establish fall prevention grants for equipment and training.

Procedures/Methodology

1. Surveillance

The OR-FACE surveillance system uses: (a) a Google alert keyword search, (b) quarterly reports of death certificates marked "at work" from Oregon Vital Records, (c) Oregon OSHA fatality notification reports, (d) a daily search of numerous websites, and (e) fatality reporting from the Oregon Emergency Response System. The use of the Google alert keyword search has improved our first-notification system and significantly augmented the span of our surveillance. Primary data sources include death certificates, Oregon OSHA, Medical Examiner, police investigation, and news reports, Workers' Compensation records, and occasionally other records, such as photo disks, business profiles, hospital or emergency response records, or investigation reports from other sources. OR-FACE shares de-identified data comparing OR-FACE to Oregon CFOI fatalities.

2. Investigation

Incident investigation continued with the occasional support of three subject matter experts: one for logging, one for transportation, and one for general industry. OR-FACE staff investigators (Barbara Epstien 2016-2019; Barbara Hanley 2020-21) or contractors in selected cases developed the first draft of each investigation report using all gathered evidence and input from relevant experts as needed, including Oregon OSHA investigators, industry experts, or other safety professionals. Reports were published following an iterative review process, with a first review by the program director and the OR-FACE publications review board composed of safety and health professionals and agency regulators, and then a final review by NIOSH FACE personnel.

Fatalities were analyzed using root cause and contributing factor models to identify ways to eliminate or control the hazard, considering factors from the broad environment to

individual perspectives. Safety recommendations in the investigation reports were prioritized according to the accepted hierarchy of controls—elimination, substitution, engineering, administrative, personal protective equipment. The focus is on hazards that may be eliminated or substituted by employers; followed by conditions and actions the worker could control; and finally, as appropriate, best industry practices and regulatory controls that government, equipment manufacturers, or other agencies should consider implementing.

3. Assessment
OR-FACE analyzes incident data to identify and summarize trends, grouping incidents by coded industry (North American Industry Classification System (NAICS)), occupation (Standard Occupational Classification (SOC)), and event (Occupational Injury and Illness Classification System (OIICS)), and by demographic and other variables, such a specific source of setting of the injury. Fatal case data were independently coded by two raters for all variables measured. Disagreements between scorers were reconciled in consultation with original evidence prior to analysis and publication. Each OR-FACE incident is summarized with an abstract. Abstracts and incident data are presented in an annual report. Safety recommendations for particular incidents are developed in investigation reports, hazard alerts, safety booklets, toolbox talk guides, and other materials.

4. Outreach
OR-FACE safety materials were published on the OR-FACE website (https://www.ohsu.edu/oregon-fatality-assessment-control-evaluation) and as printed products. Along with electronic circulation to e-publication subscription list, electronic and print materials were also disseminated via the Oregon Institute of Occupational Health Sciences many outreach channels (e.g., blog, twitter, Yourworkpath website) and at partner events and locations as relevant or planned in our aims (e.g., SAIF Agricultural Seminar Serices, Orchard and Vineyard Supply store). Regular mail distribution of publications were used in a selected and targeted basis. Members of the OR-FACE team attended conferences and events to give presentations on safety issues and provide safety materials. OR-FACE also participates in and coordinates with the Oregon Institute of Occupational Health Sciences outreach program; the outreach team maintains tables at numerous work and safety conferences in every region of the State and presents OR-FACE safety materials.

Results

Aim 1. Maintain the core occupational fatality surveillance, investigation, assessment, and prevention activities of the existing OR-FACE program.

In the 6-year grant period (July 1, 2015- June 30, 2021) OR-FACE recorded 284 traumatic occupational fatalities (51 provisional) in 272 incidents – an average of 47 fatalities per year. OR-FACE regularly identified more fatalities than that reported by Oregon OSHA as "program-related" fatalities. In the 6-year grant period OR-FACE published 14 investigation reports. These investigation reports covered established priority areas, with an emphasis on forestry/logging and construction. Table 3 lists the number of investigation reports (by priority industry). The number of investigations where a Hispanic worker was

fatally injured is also provided. They are accounted for in a priority industry or event and not included in the total.

Table 3. OR-FACE Priority Areas and Investigation Reports, July 2015-June 2021

Priority Areas	Investigation Reports
Forestry/Logging	1
Construction	6
Agriculture	2
Fishing, Crabbing and Boating	2
Machine-related	5
Hispanic	2*
Total	**16**

*These are not included in the Total. They are accounted for in Agriculture.

All OR-FACE publications are posted on the program website; distribution for e-publication subscribers is then initiated. In addition, notification of these publications was included in the Oregon Institute of Occupational Health Sciences Facebook page, Twitter, and blog. Selected print materials are distributed at conferences, events, and to policy groups such as the State's Management Labor Advisory Committee. Over the 6 year period, we had more than 2,265 website users (of which 75% are a returning user), more than 5,000 unique page views and 1,839 downloads.

Many of these publications are highlighted in trade publications and news stories (see Publications). A database with all OR-FACE cases coded for industry, occupation, and event along with an abstract is available for download. The incident abstracts page includes a search function and industry filter. Where available, abstracts are linked to investigation reports.

We continued surveillance and rigorous data coding methods. We published six annual reports of Occupational Fatalities in Oregon (see Publications). A unique feature of our reports is the in-depth abstracts for each fatal case. The abstracts provide safety professionals with rich information to identify the hazardous exposures and contributing factors to formulate prevention and control strategies given the circumstances. Surveillance data collection efforts and the production of annual reports were strengthened through a new formal data sharing agreement with the state Medical Examiner's office (in December 2020) Accessing worksites, witnesses, and primary evidence is a potential barrier to FACE investigation programs. To support investigation efforts, OR-FACE renewed its unique collaborative investigations agreement with OR-OSHA in 2017 (and expected again fall of 2021). Our investigators conduct site visits with OR-OSHA Compliance Safety Officers. During the project period we completed and published 14 investigations, and 3 more are in progress.

Aim 2: Implement surveillance and electronic database innovations in partnership with the Oregon Clinical and Translational Research Institute (OCTRI).

We designed and launched a new state-of-the-art REDCap database (Research Electronic Data Capture). A graduate student from Oregon State University, Liu Yang, collaborated on this project through her MPH field placement with OR-FACE. REDCap was originally developed for the collection and management of research and clinical trials data. Its many useful features include associating electronic documents with case records, control of access privileges, and auditing trails. OHSU houses REDCap servers in a data center at OHSU, and all web-based information transmission is encrypted, and compliant with requirements for storing protected health information.

Aim 3: Partner with established training series to prevent transportation-related fatalities, and to conduct social network analysis research to further target communications.

We partnered with SAIF (Oregon's largest workers' compensation insurer) to develop OR-FACE content for the seminars for three annual Agricultural Safety Seminary series offered in both English and Spanish (reaching nearly 7,000 farm owners and workers over the 3-year period). We conducted a social network analysis study to advance the science of dissemination and further target our fatality prevention communications in agriculture. In a wine grape growing region we studied pathways of information flow and key actors in influencing members' decisions about safety and equipment (social network analysis). Our analyses identified one organization as a trusted source of safety and equipment advice, and we partnered with this organization to conduct outreach during National Farm Safety and Health Week in 2019.

Aim 4: Establish and evaluate a mobile marketing system to promote fatality prevention "toolbox talks" in logging and construction.

OR-FACE developed an evidence-based safety Toolbox Talk format that was summarized in a peer-reviewed journal publication (see Publications). The format includes a one page script for a supervisor to share a fatal incident with their crews and lead a discussion about fatality prevention and recommendations. A second page includes a drawing/graphic with bullet pointed prevention recommendations to be held up and shown to crew members. We partnered with SAIF, the Oregon Home Builders Association, and many other organizations to test the hypothesis that a mobile alert system would increase the proportion of construction supervisors who exceed the OR-OSHA minimum frequency of safety talks (monthly for each project lasting longer than one week). Toolbox talks were created in the OR-FACE format in English and Spanish, and also in a video-based style that could be played directly to crews instead of being read. OR-FACE talks were supplemented with links to CPWR talks on additional construction safety topics. With the assistance of a small grant from CPWR to increase participant incentives and research assistant time, we ultimately recruited 60 supervisors from 12 organizations to participate in the project (see

CPWR report in Publications; due to the time and effort required to complete the work in the construction industry we did not include logging supervisors in the project). Construction supervisors received toolbox talks to their mobile phone every other week for 14 weeks. Receiving the toolbox talks via text increased the proportion of supervisors compliant with the OR-OSHA standard for safety meeting frequency by 19.4% (manuscript under review with a peer-reviewed journal; see Publications).

Aim 5: Test a novel targeting strategy to engage small residential construction firms in fall prevention surveillance research and establish fall prevention grants for equipment and training.

Small-to-medium sized residential construction contractors are notoriously difficult to engage in research, and we know little about their fall prevention knowledge and practices in Oregon. We partnered with the SAIF Corporation to test the hypothesis that companies that had an employee experience a serious fall injury claim would increase contractors' motivation to engage in fall prevention and control research. SAIF sent out a survey to 392 policyholders – half of whom had a recent (past year) fall-related claim. Representatives from companies that had experienced a recent fall-related injury claim were more likely to complete 50% or more of the survey (57.6% vs. 42.4%). Following the survey, we invited all survey respondents to enter a drawing to receive fall protection equipment or competent person training which was provided by ACME Construction Supply Co, Inc. Results of the project were recently published in a peer-reviewed journal (see Publications).

Discussion

During the project period OR-FACE was successful at accomplishing its 5 Specific Aims. The significant accomplishments related to each specific aim, as described in sections above, took place during a period where the program experienced - yet successfully managed - staff turnover and transitions (retirement of the program manager and investigator in 2015; turnover and replacement of project manager and investigator in 2019/20). It took 8-9 months to successfully recruit and replace the OR-FACE investigator, but we remained productive in producing investigations by activating contract investigators during that time period (who ultimately produced 5 investigations). Core surveillance and investigations processes (Aim 1) produced 7 annual reports and 14 in depth investigation reports. These processes were supported with our renewed and unique investigations agreement with Oregon OSHA, as well as a new formal data sharing agreement with the state Medical Examiner's office. The investigations program in its most recent years is vibrant, and on pace to consistently meet its goal of investigating 4-6 cases annually (roughly 10% of cases). Outreach activities included the production of numerous new outreach publications (e.g., evidence-based toolbox talks, identifying hazards on your farm or ranch, blogs). We also continued distribution of unique Oregon fatality prevention resources for high risk working populations, such as the Fallers Safety Handbook in both Oregon and Washington.

In addition to the success of core surveillance, investigation, and outreach processes in the face of challenges, highlights of accomplishments during the current period included a new state-of-the art REDCap database (Aim 2), training partnerships and social network analysis research with agricultural partners to reach at-risk populations identified in peer reviewed research (Aim 3), and three scientific publications related to our field research as well as a fourth under review (Aims 4 and 5). Scientific findings included using social network analysis to identify a trusted source of safety advice in a specific viticultural region in Oregon; mobile phone delivery of toolbox talks increases safety meeting frequency in construction; and that experiencing a recent fall injury claim increases construction firm engagement in fall prevention research – ultimately leading to some firms accepting small grants for competent person training. The project period was also characterized by expanded presentations and communications with scientific peers, industry, and safety professionals, as well as increased social media activity through the Oregon and the Workplace Blog and Oregon Institute of Occupational Health Sciences Facebook and Twitter.

Conclusions

The Oregon Fatality Assessment and Control Evaluation Program (OR-FACE), founded in 2002, is a strong and productive component of the overall Oregon Occupational Public Health Program and a valued partner as a community resource for injury prevention. The OR-FACE mission is to prevent traumatic work-related deaths through surveillance, investigation, assessment, and targeted outreach. Our research is prioritized to understand and impact high-risk industries (e.g., construction, logging, agriculture, transportation) in Oregon and beyond. Particular OR-FACE strengths include the depth of surveillance data produced, strong partnerships that result in high-quality products, and the innovative use of field studies to develop and recommend interventions. As a result, OR-FACE has built substantial fatality surveillance capacity, produced an outstanding portfolio of resources, been awarded supplemental funding, and continuously striven to impact policy.

Publications

Overall and OHI

Peer-reviewed journal articles

1. Syron, L., Kincl, L., Yang, L., Cain, D., Smit, E. (2017). Analysis of workers' compensation disabling claims in Oregon's seafood preparation and packaging industry, 2007-2013. *Am J Ind Med. 2017;* 60:484–493. https://doi.org/10.1002/ajim.22706
2. Yang, L., Branscum, A, Smit, E, Dreher, D., Howard K & Kincl K. (February 2020) Work-related injuries and illnesses and their association with hour of work: Analysis of the Oregon construction industry in the US using workers' compensation accepted disabling claims, 2007-2013. Journal of Occupational Health. 2020; 62:e12117. https://doi.org/10.1002/1348-9585.12118
3. Yang, L., Weston, C, Cude C, Kincl K. (June 2020). Evaluating Oregon's occupational public health surveillance system based on the CDC updated guidelines. American Journal of Industrial Medicine. 2020; 63: 713– 725. https://doi.org/10.1002/ajim.23139.

Additional Publications

1. Work-related Traumatic Brain Injury in Oregon: Trauma Registry Data and Deaths, 2009–2014. Oregon Health Authority. Portland, OR. https://sharedsystems.dhsoha.state.or.us/DHSForms/Served/le9401.pdf.
2. Cadmium Toxicity Investigative Guidelines (October 2019). Oregon Health Authority. Portland, OR. https://www.oregon.gov/oha/PH/DISEASESCONDITIONS/COMMUNICABLEDISEASE/REPORTINGCOMMUNICABLEDISEASE/REPORTINGGUIDELINES/Documents/Cadmium_toxicity.pdf
3. Weston, C. (May 2020) COVID-19 Occupation & Industry data collection in Orpheus. Occupational Public Health Program (2017). https://www.oregon.gov/oha/PH/DISEASESCONDITIONS/COMMUNICABLEDISEASE/REPORTINGCOMMUNICABLEDISEASE/Documents/Orpheus/Occ-Industry_COVID-19-data-collection-RefGuide-May2020.pdf

Annual OHI 10-year Tables

1. OHI 2008-2017 Ten-year table. https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/WORKPLACEHEALTH/Pages/fundamental.aspx

Presentations

1. Cain, D. (2015). O[yes] Oregon Young Employee Safety. Quick Takes presentation at Western Occupational Network (WestON), Denver, CO.
2. Cude, C., Olson, R., Cain, D., Shen, X., Gilbert-Jones, I. (2015). Focus on Plans for Innovation. Presentation at OPHP External Advisory Board meeting.

3. Cude, C., Olson, R., Shen, X. (2016). Chalk Talk for Directors: Overall Component (featuring occupational TBI). Presentation to OPHP Executive Directors.
4. Shen, X. (2016). Work-related Traumatic Brain Injury in Oregon - Trauma Registry Data and Deaths, 2009-2014. Presentation at OPHP External Advisory Board meeting.
5. Cain, D. (2015). Burden of Injuries on Oregon Young Workers. Presentation at Oregon Public Health Association conference, Corvallis, OR.
6. Cain, D. (2016). Occupational Health Indicators (OHI) Project. Presentation to OPHP Executive Directors.
7. Cude, C. (2016). Work-related Traumatic Brain Injury in Oregon. Quick Takes presentation at Western Occupational Network (WestON), Denver, CO.
8. Olson, R. (2016). High-Risk Work Shifts Update. Presentation at the OPHP External Advisory Board meeting.
9. Olson, R. and Cude, C. (2017). Extended & High-Risk Work Shifts: Results and Next Steps; Intro to Back Injuries & Treatments. Presentation at the OPHP External Advisory Board meeting.
10. Dreher, D. (2016). Occupational Health Indicators (OHI) Project. Chalk Talk presentation to the Executive Directors of the OPHP program's host institutions.
11. Dreher, D. (2016). Investigating New Data Sources: ORPHEUS and ESSENCE. Presentation at the OPHP External Advisory Board meeting.
12. Dreher, D. (2017). Electronic case reporting of pesticide exposures; story-map of county-level OHIs. Presentation at the OPHP External Advisory Board meeting.
13. Cude, C., Shen, X. & Olson R. (2017). Occupational Health Indicators: Story Map; Back Injury and Treatment Surveillance; The Future of Expanded Surveillance. OPHP External Advisory Board meeting.
14. Shen, X. (2018). Low Back Pain and Syndromic Surveillance. Symposium: Pain at Work: How to prevent, recognize and treat. Oregon Institute of Occupational Health Sciences, Portland, Oregon.
15. Cude, C. (2018). OPHP Contributions to Traumatic Brain Injury, High Risk Work Shifts, and Back Injuries and Treatment. Discussion facilitator for Climate Change topic. Chalk Talk presentation to Executive Directors of OPHP program host institutions. Cude, C., Yang, L. & Olson, R. (2018) OHI Evaluation Plan; FACE Field Studies; Climate Change Work Hazards. OPHP External Advisory Board meeting.
16. Weston, C. (2018). Occupational Health Indicators (OHI) Project. Chalk Talk presentation to Executive Directors of OPHP program host institutions.
17. Montgomery, D. (2018). Symposium: Pain at Work: How to prevent, recognize and treat. Oregon Institute of Occupational Health Sciences, Portland, Oregon.
18. Weston, C. (July 2018). Occupational Health Indicators & Oregon Demographics. Director's Chalk Talk at OHSU.
19. Cude, C., Yang, L. and Weston, C. (November 2018). OHI Story Map and Surveillance System Evaluation Project Results. Advisory Committee Meeting.
20. Cude, C. and Olson. R., Oregon Public Health Program Overview. (February 2019). Director's Chalk Talk at OHA.
21. Weston, C., York, E. & Haggerty, B. (March 2019). Resilience in the Face of Climate Change. The Oregon Governor's Occupational Safety & Health Conference (GOSH).

22. Weston, C. (April 2019). Employment in a Changing Oregon. Oregon Health Authority, Grand Rounds.
23. Cude, C. and Weston, C. (May 2019). OHI Non-disabling claims project and "Employment in a changing Oregon, demographics of the Oregon Workforce." Advisory Committee Meeting.
24. Cude, C. and Olson, R. (May 2019). Overall Program strategic planning for next competitive reapplication. Advisory Committee Meeting.
25. Liu, Y. (June 2019). Evaluating the Occupational Health Indicator (OHI) Surveillance System in Oregon based on CDC Updated Guidelines. Council of State and Territorial Epidemiologists (CSTE).

Social Media

1. Mapping technique reveals spatial clustering of workplace injuries and potential new venues for outreach (Aug 2015). Oregon Environmental Public Health Tracking Facebook.
2. NIOSH renews Oregon occupational health grant (Sep 2015). Oregon and the Workplace Blog.
3. The Occupational Health Internship Program is recruiting interns for their summer program (Jan 2017). Oregon Environmental Public Health Tracking Facebook.

OR-FACE

Peer-reviewed journal articles

1. Olson, R., Varga, A., Cannon, A., Jones, J., Gilbert-Jones, I., Zoller, E. (2016). Toolbox talks to prevent construction fatalities: Empirical development and evaluation. Safety Science, Volume 86, 122-131. https://doi.org/10.1016/j.ssci.2016.02.
2. Olson, R., Rimby, J., & Smart, N. (pub Nov, 2019). Using mobile phone marketing technology to increase safety meeting frequency among small residential construction companies: Final report. CPWR Tools & Guides to Reach the Industry (e.g., Tech Transfer, Vulnerable Workers, Partnerships); Resources on Reaching Vulnerable Workers. www.cpwr.com/wp-content/uploads/publications/Oregon-Using-Mobile-Phone-Tech-to-Increase-Safety-Meetings-CPWR-final-report-2019_11.1.19.pdf
3. Hurtado, D., Greenspan, L., Vogt, M., Mansfield, L., & Olson, R. (accepted May, 2020). Does experiencing an injury claim impact small construction company leaders' participation in a fall protection survey? Annals of Work Exposures and Health. Volume 64, Issue 6. https://doi.org/10.1093/annweh/wxaa060
4. Rice, S.P.M., Rimby, J., Hurtado, D.A., Gilbert-Jones, I., & Olson, R. (submitted). Does sending safety toolbox talks by text message to residential construction supervisors increase the frequency of safety meetings?

Investigations

1. OR-FACE fatality investigation report OR 2015-02-1: Crane operator killed by falling beam (2016). Available online https://www.ohsu.edu/sites/default/files/2018-12/ORFACE-Pub-IR-Constr-Fallingsteelbeam.pdf

2. OR-FACE fatality investigation report OR-2014-42-1: Forestry worker in vehicle killed from timber falling activity (2017). Available online https://www.ohsu.edu/sites/default/files/2018-12/ORFACE-Pub-IR-LogFor-TimberFalling.pdf

3. OR-FACE fatality investigation report OR-2015-12-1: Construction worker died after falling 20-25 feet from a pump-jack scaffold platform (2017). Available online https://www.ohsu.edu/sites/default/files/2018-12/ORFACE-Pub-IR-Constr-PumpjackScaffoldPlatform.pdf

4. OR-FACE fatality investigation report OR-FACE number 2016-16-1: Construction worker killed when trench collapsed (2019). Available online https://www.ohsu.edu/sites/default/files/2019-03/ORFACE-Pub-IRConstr-trench-collapsed.pdf

5. OR-FACE fatality investigation report OR-FACE number 2017-7-1: Farm mechanic died after torch cutting explosion (2019). Available online https://www.ohsu.edu/sites/default/files/2019-03/ORFACE-Pub-IR-Ag-Explosion.pdf

6. OR-FACE fatality investigation report OR-FACE number 2018-29-1: Rubber equipment operator died after his head was caught between bars of operating machinery (2019). Available online https://www.ohsu.edu/sites/default/files/2019-06/OR-FACE%20Fatality%20investigation%20report-Rubber%20Mill%20final.pdf

7. OR-FACE fatality investigation report OR-FACE number 2017-22-1: Maintenance Mechanic Crushed Working Inside of a Vertical Storage Machine (2019). Available online https://www.ohsu.edu/sites/default/files/2019-08/OR-FACE%20Vert%20Storage%20Crush%20final.pdf

8. OR-FACE fatality investigation report OR-FACE number 2018-08-1: Skid Steer Operator Crushed While Attempting to Remove Attachment (2019). Available online https://www.ohsu.edu/sites/default/files/2019-10/OR-FACE%20Fatality%20investigation%20report%20final.pdf

9. OR-FACE fatality investigation report OR-FACE number 2016-06-1,2,3: Crab fishing vessel capsizes and drowns three crew members (2020). Available online https://www.ohsu.edu/sites/default/files/2020-05/Crab%20Fatality%20Vessel%201%20Final%205.28.20.pdf

10. OR-FACE fatality investigation report OR-FACE number 2018-30-1: Pipefitter Struck by Pressurized Pipe and Killed (2020). Available online https://www.ohsu.edu/sites/default/files/2020-07/OR-FACEREPORT%20DRAFT%20ID-6MAR2018%20V8.pdf

11. OR-FACE fatality investigation report OR-FACE number 2016-07-1: Crab fishing vessel capsizes and one crew member drowns (2020). Available online https://www.ohsu.edu/sites/default/files/2020-07/Crab%20Fatality%20Vessel%202%207.30.20%20FINAL_0.pdf

12. OR-FACE fatality investigation report OR-FACE number 2018-40-1: Newly hired lighting technician electrocuted while working night shift (2020). Available online https://www.ohsu.edu/sites/default/files/2020-11/OR-FACE-REPORT%20ID-26SEPT2018-FINAL%20compressed.pdf

13. OR-FACE fatality investigation report OR-FACE number 2020-10-1: Forklift Operator Crushed by Full Pallet of Soft Drink Cans (2020). Available online https://www.ohsu.edu/sites/default/files/2020-12/ORFACE-REPORT%20ID-2020OR010%20Final.pdf

14. OR-FACE fatality investigation report OR-FACE number 2020-02-1: Farm worker crushed in ATV Rollover during herbicide application on a hillside (2021). Available online https://www.ohsu.edu/sites/default/files/2021-09/OR-FACE-REPORT%202020OR02%20final%2001Sept2021.pdf

15. OR-FACE fatality investigation report OR-FACE number 2019-27-1,2: Two arborists killed in boom crane rollover (in progress)

16. OR-FACE fatality investigation report OR-FACE number (TBD): Two killed on farm – run over by excavator (in progress)

17. OR-FACE fatality investigation report OR-FACE number (TBD): Farm worker dies from excessive heat exposure (in progress)

Annual Reports

1. OR-FACE Annual Report 2013 Occupational Fatalities (2015)

2. OR-FACE Annual Report 2014 Occupational Fatalities (2016)

3. OR-FACE Annual Report 2015 Occupational Fatalities (2017)

4. OR-FACE Annual Report 2016 Occupational Fatalities (2019)

5. OR-FACE Annual Report 2017 Occupational Fatalities (2020)

6. OR-FACE Annual Report 2018 Occupational Fatalities (2020)

7. OR-FACE Annual Report 2019 Occupational Fatalities (2021)

Toolbox Talk Guides

English

1. OR-FACE toolbox talk guides. Young worker dies after falling through skylight (2015).

2. OR-FACE toolbox talk guides. Hispanic laborer drowns after falling into landscaping pond (2015).

3. OR-FACE toolbox talk guides. Millwright fatality involving a hydraulic accumulator (2015).

4. OR-FACE toolbox talk guides. Worker killed when ejected from aerial lift (2016).

5. OR-FACE toolbox talk guides. Worker falls when ladder slips (2016).

6. OR-FACE toolbox talk guides. Collapsed roof trusses kill carpenter foreman (2016).

7. OR-FACE toolbox talk guides. Trench collapse kills construction worker (2016).

8. OR-FACE toolbox talk guides. Worker dies from electrocution (2016).

9. OR-FACE toolbox talk guides. Dump truck driver drives off embankment after losing control (2017).

10. OR-FACE toolbox talk guides. Forestry worked killed in vehicle from tree falling activity (2017).

11. OR-FACE toolbox talk guides. Worker falls 20-25 feet from pump-jack scaffold platform (2018).

Spanish

1. OR-FACE toolbox talk guides. Trabajador de construcción muere cuando se asoma del armazón protector de un minicargador y es aplastado (2015).

2. OR-FACE toolbox talk guides. Un trabajador de excavación fue matado por un ensamblaje volando cuando un gancho falló (2015).

3. OR-FACE toolbox talk guides. Mecánico fue matado por cuchara de una excavadora (2015).

4. OR-FACE toolbox talk guides. Trabajador de la construcción de viviendas se cayó dentro de un hueco de ascensor (2015).

5. OR-FACE toolbox talk guides. Instalador novato de tablas de yeso muere en una caída de 7 pies (2 metros) de un andamio (2015).

6. OR-FACE toolbox talk guides. Cercha de techo derrumbada mató a carpintero líder (2017).

7. OR-FACE toolbox talk guides. Trabajadores caen cuando la escalera se resbala (2017).

8. OR-FACE toolbox talk guides. Trabajador de construcción cae de un andamio desde 6 a 7 m. de altura (2018).

Hazard Alerts

1. OR-FACE hazard alert. Follow manufacturer's instructions (2016).

2. OR-FACE hazard alert. Can you identify fatal hazards on your farm or ranch? (2017).

3. OR-FACE hazard alert. ¿Puedes identificar los peligros fatales en tu rancho? (2018).

Presentations

1. Montgomery, D, Frisco, M., & Gilbert-Jones, I. (2015). The changing work environment: The role of the safety professional. ASSE Columbia Willamette Chapter, Tualatin, OR.

2. Gilbert-Jones, I. (2015). OR-FACE and OR-OSHA: Collaboration on FACE Investigations. Oregon OSHA Managers' Meeting, Salem, OR.

3. Gilbert-Jones, I. (2016). Prepare for the 2016 National Safety Stand-down. ASSE Columbia Willamette Chapter, Tualatin, OR.

4. Gilbert-Jones, I. (2016). Prepare for the 2016 National Safety Stand-down. ASSE Santiam Section.

5. Gilbert-Jones, I. (2016). 2016 national safety stand-down. OR-OSHA Construction Advisory Council, Tualatin, OR.

6. Gilbert-Jones, I. (2016). National safety stand-down to prevent falls in construction. OR-FACE Toolbox Talk, Portland, OR.

7. Olson, R., Gilbert-Jones, I., & Malach-Fuller, J. (2016). Oregon FACE update. NIOSH Fatality Assessment and Control Evaluation (FACE) Meeting, Morgantown, WV.

8. Gilbert-Jones, I. (2016). Temporary/Contingent worker fatal injuries: Case studies and prevention recommendations. NIOSH Fatality Assessment and Control Evaluation (FACE) Meeting, Morgantown, WV.

9. Olson, R., & Gilbert-Jones, I. (2016). Oregon Fatality Assessment & Control Evaluation update. Oregon Occupational Public Health Program Advisory Board Meeting, Portland, OR.

10. Olson, R. (2016). High-risk work shifts update. Presentation at OPHP External Advisory Committee Meeting.

11. Gilbert-Jones, I. (2016). OR-FACE and OR-OSHA: Collaboration on FACE Investigations. Oregon OSHA Managers' Meeting, Salem, OR.

12. Olson, R., & Mansfield, L. (2017). Oregon Fatality Assessment and Control Evaluation (ORFACE) Agriculture Social Network Study. Wine Tech Group, Chemeketa Wine Studies Center, Salem, OR.

13. Gilbert-Jones, I. & Epstien, B. (2017). Oregon Fatality Assessment and Control Evaluation: Surveillance, investigation, research, and outreach. Oregon Governor's Occupational Safety and Health (GOSH) Conference, Portland, OR.

14. Olson, R., & Mansfield, L. (2017). Oregon Fatality Assessment and Control Evaluation (OR-FACE): Update and planning for next grant period. Presentation at OPHP External Advisory Committee meeting.

15. Epstien, B. & Gilbert-Jones, I. (2017). Oregon Fatality Assessment and Control Evaluation (ORFACE): Fatal injury surveillance, field research, and outreach and prevention. American Industrial Hygiene Conference & Expo (AIHce), Seattle, WA.

16. Mansfield, L., & Strenke, H. (2017). Update on the Agriculture Social Network Analysis Project. Wine Tech Group, Chemeketa Wine Studies Center, Salem, OR.

17. Epstien, B., Olson, R., Mansfield, L. R., & Strenke, H. (2017). Partnering to prevent agricultural fatalities in Oregon. Quick Takes presentation at the Western States Occupational Network (WestON) 2017, Denver, CO.

18. Epstien, B. (2017). Multi-state projects and efforts. NIOSH Fatality Assessment and Control Evaluation (FACE) Meeting, Morgantown, WV.

19. Olson, R. (2017). Oregon FACE update. NIOSH Fatality Assessment and Control Evaluation (FACE) Meeting, Morgantown WV.

20. Olson, R., & Mansfield, L. (2017). Oregon Fatality Assessment & Control Evaluation update. Oregon Occupational Public Health Program Advisory Board Meeting, Portland, OR.

21. Epstien, B., & Schoonover, T. (2017). FACE program perspectives on fatal logging injuries in the PNW: A review of Oregon and Washington surveillance data, investigation, field research, and prevention outreach. Pacific NW Section-AIHA NW Occupational Health Conference (NOHC), Spokane, WA.

22. Epstien, B. (2017). Oregon FACE overview and occupational safety and health career pathways. ASSE Student Chapter Meeting, Corvallis, OR.

23. Mansfield, L. (2017). OR-FACE field studies: Mobile Toolbox Talks Study. Associated General Contractors (AGC) Oregon-Columbia Chapter Meeting, Wilsonville, OR.

24. Epstien, B. (2018). Trends and key factors in Oregon construction fatalities. Construction Safety Summit Safety Directors' Roundtable quarterly meeting, Portland, OR.

25. Epstien, B. (2018). Toolbox talks. Portland Safety Stand-down event, Portland, OR.

26. Mansfield, L. (2018). OR Occupational Public Health Program: OR-FACE Chalk Talk. Directors' Meeting, Portland, OR.

27. Mansfield, L., Epstien, B., & Olson, R. (2018). Learning from fatal case studies. Oregon Trucking Associations (OTA) Safety Management Council (SMC), Portland, Eugene, Redmond, Medford, and Pendleton, OR.

28. Epstien, B. (2018). Keep on partnering: OR-FACE meets Oregon Trucking Associations. Quick Takes presentation at Western States Occupational Network (WestON) 2018, Denver, CO.

29. Mansfield, L. (2018). OR-FACE State update. Annual FACE meeting, Morgantown, WV.

30. Epstien, B. (2018). Oregon partnership to prevent fatalities in agriculture. State FACE presentations at NOIRS, Morgantown, WV.

31. Mansfield, L. (2018). Oregon Public Health Advisory Board: OR-FACE update. Advisory Board Presentation, Tigard, OR.

32. Epstien, B. (2018). Construction field research: Building engagement through multipronged recruitment. Brain Buster session at Western States Occupational Network (WestON) 2018, Denver, CO.

33. Epstien, B. (2019). OR-FACE & OR-OSHA collaboration. OR-OSHA Managers Meeting, Salem, OR.

34. Olson, R. (2019). Occupational Public Health Program. OPHP External Advisory Committee meeting, Portland, OR.

35. Mansfield, L. (2019). OR-FACE Chalk Talk. Program Directors Meeting, Portland, OR.

36. Epstien, B. (2019). OR-FACE case presentation. Quarterly National FACE Meeting, Morgantown, WV.

37. Olson, R., & Smart, N. (2019). OR-FACE presentation. Annual National FACE Meeting, Morgantown, WV.

38. Olson, R., & Hurtado, D. (2019). Occupational Public Health Program. External Advisors Meeting, Portland, OR.

39. Olson, R., Rimby, J., & Smart, N. (2019). Using mobile phone marketing technology to increase safety meeting frequency among small residential construction companies: Final report. Discussion with Washington University School of Medicine (by phone).

40. Olson, R., Rimby, J., & Smart, N. (2019). Using mobile phone marketing technology to increase safety meeting frequency among small residential construction companies: Final report. CPWR Roundtable on Reaching Small Employers & At-Risk Workers (by phone).

41. Yang, L (2020) Analyses of nondisabling worker's compensation claims and insights about younger worker. Oregon Young Employee Safety Coalition (O[yes]) board of directors.

42. Yang, L. (2020). Injuries and illnesses among Oregon young workers: Analysis of accepted workers compensation claims data. Oregon Young Employees ([O]yes) Safety meeting.

43. Yang, L. (2020). Injuries and illnesses among Oregon young workers: Analysis of accepted workers compensation claims data. Environmental Public Health, Oregon Health Authority, Section Meeting.

44. Hurtado, D. (2020). Does experiencing an injury claim impact small construction company leaders' participation in a fall protection survey? Investigating Fall Fatalities and Injury claims on Prevention Efforts. CPWR Webinar. https://www.youtube.com/watch?v=GtOmxsdF5Hc

Oregon in the Workplace blogs

1. "NIOSH renews Oregon occupational health grant." (Sept 2015)

2. "OR-FACE publishes Spanish toolbox talk guides." (Sept 2015)

3. "Thankful for those who contribute to a safer community." (Nov 2015)

4. "Role of the safety professional in a changing work environment." (Nov 2015)

5. "OR-FACE report used in SAIF Ag seminars." (Jan 2016)

6. "Oregon FACE helps with OSHA 10 for high schoolers." (Jan 2016)

7. "New fatality report and upcoming rigging/signaling course." (Feb 2016)

8. "New OR-FACE hazard alert: Follow manufacturer's instructions." (Mar 2016)

9. "National Safety Stand-Down." (Apr 2016)

10. "Oregon Workers Memorial Day." (Apr 2016)

11. “Oregon campaign to prevent falls in construction.” (May 2016)

12. “2014 OR-FACE Annual Report published.” (Sept 2016)

13. “New OR-FACE toolbox talk guides published.” (Sept 2016)

14. “Updated Letter of Agreement signed by OR-OSHA and OR-FACE.” (Jan 2017)

15. “OR-FACE posts workplace fatality reenactments.” (Mar 2017)

16. “National Safety Stand-Down May 8-12, 2017.” (Apr 2017)

17. “Fall hazard training offered in Spanish.” (May 2017).

18. “Industrial hygienists flood Seattle.” (Jun 2017)

19. “New OR-FACE toolbox talk guides published.” (Jun 2017)

20. “Western States occupational health community gathers in Denver.” (Sept 2017)

21. “OR-FACE 2015 annual report published.” (Sept 2017)

22. “Industrial hygiene research meets practice in Spokane.” (Nov 2017)

23. “New OR-FACE fatality investigation report.” (Jan 2018)

24. “New OR-FACE agriculture safety resource.” (Mar 2018)

25. “Share a Story, Save a Life! April 27 – May 11, 2018.” (Apr 2018)

26. “OR-FACE shares safety week messages.” (May 2018)

27. “OR-FACE joins WestON in Denver.” (Sept 2018)

28. “New OR-FACE fatality investigation report published.” (Oct 2018)

29. “OR-FACE report on fatal torch cutting explosion published.” (Apr 2019)

30. “OR-FACE resources target fall prevention: National Safety Stand-Down.” (Apr 2019)

31. “Two New Investigation reports from OR-FACE.” (Aug 2019)

32. “September 15-21 is National Farm Safety and Health Week 2019!” (Sept 2019)

33. “Marking Worker’s Memorial Day and OSHA’s Anniversary.” (Apr 2020)

34. “Safety Stand-Down Week, 2020.” (Sept 2020)

35. “National Farm Safety and Health Week 2020.” (Sept 2020)

News Media/Trade Publications

1. *Safety + Health*, (Aug 2015) National Safety Council monthly magazine featured *"Motor vehicle incidents continue to be top cause of Oregon worker fatalities: 2013 OR-FACE Annual Report."*

2. *Safety + Health*, (Sept 2015) National Safety council monthly magazine featured OR-FACE toolbox talks, *“New safety resources available for Spanish speaking workers.”*

3. *Safety + Health*, (Dec 2015) National Safety council monthly magazine featured “*Oregon FACE releases new toolbox talks.”*

4. *Safety + Health*, (Feb 2016) National Safety Council monthly magazine featured *“Disregarding manufacturer’s instructions can be deadly, Oregon FACE warns.”*

5. Electronic Library of Construction Occupational Safety & Health (Sept 2016) featured OR-FACE toolbox talk *“Worker dies from electrocution.”*

6. *Safety + Health,* (June 2017) National Safety Council monthly magazine featured *“Death for forestry worker prompts new toolbox talk”*

7. *Safety + Health,* (Jan 2018) National Safety Council monthly magazine featured “Death of Oregon forestry worker prompts new toolbox talk”

8. *Safety + Health,* (Jul 2018) National Safety Council monthly magazine featured *“Worker dies after falling from scaffold.”*

9. Safe Construction Network (Dec 2018) CPWR Construction Safety and Health Network featured *“OR-FACE trench collapse fatality investigation.”*

10. *Safety + Health*, (Oct 2020) National Safety council monthly magazine featured *“Pipefitter Killed by Pressurized PVC Pipe.”*

11. *Safety + Health*, (Jan 2021) National Safety council monthly magazine featured OR-FACE investigation report, *“Newly hired lighting technician electrocuted while working night shift.”*

Inclusion Reports

Inclusion of gender and minority study subjects

Male and female subjects were included in the OHI and OR-FACE components. The distribution of study subjects by gender is provided on the *PHS 2590, Inclusion enrollment report*. A separate report has been prepared for each component of the cooperative agreement.

Nearly all of the secondary data used for the OHI component did not include ethnic or racial origin and so this information cannot be provided for this closeout report. However, staff was able to collect this information for the OR-FACE component. This data can be found in the *PHS 2590, Inclusion enrollment report*.

Inclusion of children

Children 15-21 years of age were included in the OHI and OR-FACE components since many 15–21-year-olds have a job and there is evidence that this population is at greater risk for suffering a work-related injury than their older counterparts. For this cooperative agreement, cases of work-related injury, illness, and death among children were collected from existing data.

OHI Cumulative Inclusion Enrollment Report

This report format should NOT be used for collecting data from study participants.

Study Title: Improving occupational health in Oregon: Turning data into action OHI component

Comments: Grant Number: 5U0OH008472; Total enrollment (7/1/2015-6/30/2021)

Racial Categories	Ethnic Categories									Total
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	0	0	0	0	0	0	0	0	0	0
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
Black or African American	0	0	0	0	0	0	0	0	0	0
White	0	0	0	0	0	0	0	0	0	0
More Than One Race	0	0	0	0	0	0	0	0	0	0
Unknown or Not Reported	0	0	0	0	0	0	35,085	61,937	0	97,022
Total	0	0	0	0	0	0	35,085	61,937	0	97,022

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Cumulative Inclusion Enrollment Report

OR-FACE Cumulative Inclusion Enrollment Report

This report format should NOT be used for collecting data from study participants.

Study Title: Improving occupational health in Oregon: Turning data into action OR-FACE Component

Comments: Grant Number: 5U0OH008472-08; Total enrollment (7/1/2015-6/30/2021)

Racial Categories	Ethnic Categories									Total
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native	0	5	0	1	0	0	0	0	0	6
Asian	0	3	0	0	0	0	0	0	0	3
Native Hawaiian or Other Pacific Islander	0	1	0	0	0	0	0	0	0	1
Black or African American	0	1	0	0	0	0	0	0	0	1
White	11	140	0	1	15	0	1	10	0	178
More Than One Race	0	1	0	0	4	0	0	0	0	5
Unknown or Not Reported	0	2	0	0	3	0	10	70	87	172
Total	11	153	0	2	22	0	11	20	87	366

Data Sets

OHI Datasets and calculation instructions available online at:
http://public.health.oregon.gov/HealthyEnvironments/WorkplaceHealth/Pages/fundamental.aspx

OR-FACE provides a dataset available for free download with industry, event, occupation, and abstract for every fatal case since 2003 on the program website. In 2021 enhancements to the layout and back-end design were made to the fatal case website. Where available, search results include links to investigation reports.

Materials available for other investigators

Many materials and publications (toolbox talk guides, investigation reports, annual reports, hazard alerts and brochures) were created and published during the period and are available for free download online.