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Terms/Abbreviations

ABLES	Adult Blood Lead Epidemiology and Surveillance
BEOH	Bureau of Environmental and Occupational Health
BLS	Bureau of Labor Statistics
BLLs	Blood lead levels
BRFSS	Behavioral Risk Factor Surveillance System
CSTE	Council of State and Territorial Epidemiologists
DHS	Department of Health Services
DPH	Division of Public Health
EIS	Epidemic Intelligence Service
HHE	Health Hazard Evaluation
HHLPSS	Healthy Homes and Lead Poisoning Surveillance System
I/O	Industry/Occupation
NIOSH	National Institute of Occupational Safety and Health
NORA	National Occupational Research Agenda
OH	Occupational Health
OHI	Occupational Health Indicators
OSAG	WI OH Program Advisory Board
OSHA	Occupational Safety and Health Administration
SENSOR	Sentinel Event Notification System for Occupational Risk
SOII	Survey of Occupational Injuries and Illnesses
THL	Take-home lead
UI	Unemployment Insurance
UW	University of Wisconsin
WC	Workers' Compensation
WEDC	Wisconsin Economic Development Corporation
WEDSS	Wisconsin Electronic Disease Surveillance System

Abstract

State Occupational Health and Safety Surveillance Program

Wisconsin Department of Health Services
Cooperative agreement: 6U60OH010898-05-01
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Wisconsin maintains a fundamental occupational disease and injury surveillance program within the Bureau of Environmental and Occupational Health (BEOH) in the Division of Public Health, Department of Health Services (DHS). These cooperative agreement funds have enabled the Wisconsin Occupational Health (OH) Program to dedicate 1.2 full-time equivalent professional staff to maintain core occupational disease and injury surveillance. The program manager serves as the strategic focal point to promote integration of occupational health into all of Wisconsin's public health programs leveraging state and local public health capabilities, partnerships, and capacity to reduce occupationally-related injuries and death.

The Wisconsin OH Program annually contributes all 25 Council of State and Territorial Epidemiologists (CSTE)/NIOSH occupational health indicators (OHI) to the NIOSH national surveillance system and actively collaborates with NIOSH and the other states' occupational health programs. The OHI showed that some specific Wisconsin industry sectors and occupation groups (manufacturing, agriculture, health care) have rates of injury that are higher than the national average and therefore deserved priority programmatic attention while other indicator data showed stable or decreasing rates for many occupational health injuries and illnesses.

The OH Program developed innovative approaches to augment and enhance available surveillance data. We established a data use agreement in 2017 that allowed access to Unemployment Insurance (UI) denominator data for Workers 'Compensation (WC) analyses. We developed methods to stand up a validated, semi-automated surveillance system for households at risk for take-home lead (THL) exposure among Wisconsin adults and children with records in two separate databases. Wisconsin joined the national initiative of states who have implemented death certificate industry and occupation (I/O) autocoding. Within the COVID-19 effort, we began the process to add NIOCCS autocoded I/O to the Wisconsin Electronic Disease Surveillance System (WEDSS).

Five new occupational illnesses were added to Wisconsin's Administrative Code for reportable conditions in 2018: carbon monoxide poisoning, silicosis, asbestosis, chemical pneumonitis, and lung diseases from exposures to biodusts and bioaerosols. Webpages, investigation protocols, and questionnaires were developed for reporting and case follow-

back (WI DHS, 2019). In year five of the cooperative agreement, we piloted a Wisconsin silicosis surveillance process to address underreporting of cases and obtain case interview data.

The NIOSH cooperative agreement has allowed Wisconsin to build a more robust and diverse surveillance data system to support occupational disease and injury prevention.

Section 1

Significant or Key Findings. The Wisconsin Occupational Health (OH) Program collected, analyzed, and reported all CSTE/NIOSH occupational health indicators (OHI) for all five years of this cooperative agreement. The OH Program developed two OHI Trend Reports in 2016 (WI DHS, 2016d) and 2020 (WI DHS, 2020), which summarize worker health and safety trends during 2003-2018. While some specific state-based industry sectors and occupation groups (manufacturing, agriculture, health care) have rates of injury that are higher than the national average, current Wisconsin CSTE OHI data show stable or decreasing rates for most occupational health injuries and illnesses in Wisconsin.

Five new occupational illnesses were added to Wisconsin's Administrative Code for reportable conditions in 2018: carbon monoxide poisoning, silicosis, asbestosis, chemical pneumonitis, and lung diseases from exposures to biodusts and bioaerosols. Webpages, investigation protocols, and questionnaires were developed for reporting and case follow-back (WI DHS, 2019). This year, we piloted a Wisconsin silicosis surveillance process to address underreporting of cases and obtain case interview data.

Wisconsin's adult blood lead data were submitted each program year to NIOSH's Adult Blood Lead Epidemiology and Surveillance (ABLES) Program. We conducted follow-back activities for elevated blood lead levels (BLLs) at or above 25 µg/dL and provided case information to the Wisconsin Occupational Safety and Health Administration (OSHA) offices. We developed methods to stand up a validated, semi-automated surveillance system for households at risk for take-home lead (THL) exposure among Wisconsin adults and children with records in two separate databases.

We worked on multiple fronts to implement industry and occupation (I/O) autocoding with NIOSH's NIOCCS program. Wisconsin joined the national initiative of states who have implemented death certificate I/O autocoding, and collaborated with NIOSH on a coding fact sheet for funeral directors. We also incorporated NIOCCS autocoding to the Wisconsin Electronic Disease Surveillance System (WEDSS) COVID-19 module. After initial training for local health departments, free text I/O fields for COVID-19 are now captured during case investigations.

After establishing a Worker's Compensation (WC) Data Use Agreement with Wisconsin's Division of Workforce Development during the last grant period, in August 2017 we initiated a second agreement to obtain Unemployment Insurance (UI) denominator data for our WC analyses. These data enable the program to generate claim rates and identify high risk industry sectors and occupations.

Our Program led efforts to write COVID-19 workplace safety and outbreak guidance for businesses and local health departments (WEDC/WI DHS, 2020; WI DHS, 2020a; WI DHS, 2020c). A fact sheet for workers was translated into multiple languages and disseminated broadly (WI DHS, 2020b).

Translation of Findings. Access to supplemental data sources has allowed the Wisconsin OH Program to identify health hazards that may not be captured in routine surveillance systems and inform program priorities. Conducting silicosis surveillance allowed the OH

Program to identify key industries or occupations that contribute to silicosis and allowed us to make informed decisions about next steps for education and outreach.

Follow-back for elevated blood lead levels through the Adult Blood Lead Epidemiology and Surveillance (ABLES) Program continued through this period. A preliminary assessment of THL surveillance was conducted among workers from a company with known lead hazards and found about 15% were associated with children with BLLs >5 μg/dL.

In 2016, Wisconsin and Minnesota Health Departments responded to reports of elevated blood lead levels in shipyard workers in Superior, Wisconsin. An incident management system coordinated the investigation, and approximately 350 exposed workers were surveyed. This investigation strengthened multi-state partnerships, improved outreach to workers and local health departments, and resulted in multiple communication products and publications (Weiss, 2017, 2018). Safety information about lead poisoning prevention was distributed to workers (WI DHS, 2016a), clinicians (WI DHS, 2016b), and company/union representatives. A ship repairers' fact sheet was shared with the NIOSH Maritime Center for national dissemination (WI DHS, 2016c).

The Occupational Surveillance Advisory Group (OSAG) meets twice a year to share information and guide outreach and intervention activities (see Appendix A for list of members). These meetings resulted in new consideration of vulnerable worker groups for outreach and intervention activities, and recent COVID-19 work has provided new contacts with worker and employer groups whom we plan to invite to expand OSAG expertise.

Research Outcomes/Impact. Most of the findings described above include dissemination efforts that have contributed to reduced workplace risks.

Potential outcomes. Presentations, meetings, and CSTE committee engagement at all levels put partnering into practice and increased collaboration and engagement of Wisconsin's OH Program with state and federal agencies as well as professional organizations. Our engagement of partners through OSAG and the Tri-State Collaborative also increased partner awareness of the OH Program and will lead to leveraging of resources and coordinated responses.

Intermediate Outcomes. Upgrades of Wisconsin's ABLES infrastructure will improve recordkeeping and data quality, and improve effective communication with workers and employers most at risk for lead poisoning. Implementing THL surveillance is expected to increase outreach and will estimate the prevalence of childhood THL exposure more accurately. COVID-19 occupational activities in Wisconsin have expanded the scope of occupational health in the state. Autocoding I/O, gaining new contacts with additional worker and employer health and safety expertise, and funding occupational outbreak epidemiologists and exposure assessors offer potential long-term Program benefits. Development of state reporting requirements for occupational lung diseases will introduce effective surveillance in Wisconsin for these chronically underreported conditions.

End Outcomes. OH Program activities contributed to an increased capacity among local/tribal health departments and community partners to collectively address work-related concerns. The Program will continue to monitor surveillance data to prevent work-related injuries and illnesses in Wisconsin.

Section 2: Scientific Report

Background. Wisconsin's occupational health partnership with National Institute for Occupational Safety and Health (NIOSH) began in 1984 with the receipt of NIOSH capacity building funds and participation in the NIOSH Sentinel Event Notification System for Occupational Risk (SENSOR) Program. With NIOSH support, Wisconsin's Occupational Health (OH) Program within the Bureau of Environmental and Occupational Health (BEOH) in the Department of Health Services (DHS) strengthened its Fundamental Occupational Disease and Injury Program and provided a full-time Program Manager. These funds have enabled the OH Program to develop the capabilities, partnerships, and capacity to reduce occupational injuries and death in Wisconsin and contribute occupational health data to the national surveillance system. Wisconsin's OH Program activities effectively contribute to NIOSH priorities, National Occupational Research Agenda (NORA) priorities, Healthy People 2030 objectives, and Healthy Wisconsin objectives.

In Wisconsin, almost 400,000 persons (13% of the working population, slightly lower than the 16% national average) work in an occupation at high risk for occupational mortality, an increase of 23% since 2009 (DHS, 2020). The Bureau of Labor Statistics (BLS) Survey of Occupational Injuries and Illnesses (SOII) estimated 70,400 injuries were reported by Wisconsin employers in 2018. In the same year, 114 fatalities occurred in Wisconsin workplaces. The overall incidence rate of nonfatal injuries in Wisconsin was higher than the national average (3,600 vs 2,800 per 100,000, respectively). The industries with the highest injury rates were health care and social assistance (8,400 per 100,000), public administration (5,500), transportation and warehousing (5,300), and utilities (5,000). Racial/ethnic disparities in workplace injury exist in Wisconsin. In 2018, the rate of injuries involving days away from work was 2 times higher among Black workers and 1.7 times higher among Hispanic workers compared to white workers (726 and 633 vs. 370 per 100,000 workers, respectively). The Wisconsin rate of fatal work-related injuries also exceeded the national average (4.0 vs 3.5 per 100,000, respectively). Agriculture and related industries make up 21% of work-related fatalities; this is double the national percentage (10.9%). According to the National Farm Medicine Center, half of agriculture fatalities are from persons over age 65 (Weichelt, 2020). Other sectors with the highest rates of fatalities in Wisconsin are construction (15%), manufacturing (8%), transportation (6%), and retail (6%). Although the current Wisconsin CSTE occupational health indicator data show stable or decreasing rates for most occupational injuries and illnesses, Wisconsin is seeing increases in work-related asthma (50% to 54% from 2011 to 2017) and work-related severe traumatic injury hospitalizations (8.8 to 10.9 per 100,000 from 2009 to 2014) (WI Division of Public Health, 2020).

There are many human and economic costs of work-related injuries ranging from decreased productivity and missed work, to increased need for disability benefits and increased health care costs. The overall incidence rate of workplace injury involving days away from work in Wisconsin during 2018 was higher than the United States average (1000 vs. 900 injuries per 100,000 full-time workers, respectively). Work-related hospitalizations billed to Worker's Compensation insurance totaled almost $85 million in

2019. Worker's Compensation benefits paid to workers in 2017 were over $1.1 billion dollars.

The core of the OH program's surveillance system is access to data systems that allow annual calculation of the CSTE/NIOSH OH Indicators to track the health of Wisconsin workers. To augment these indicators, Wisconsin has identified other useful data sources that can contribute to occupational health surveillance. Our goal is for Wisconsin's occupational safety and health surveillance to be as comprehensive as possible. Current and expanded data surveillance yield important information about trends, injury clusters, and emerging issues that are used by the OH program to develop effective, science-based interventions for targeted worker populations. These interventions have the ultimate goal of reducing occupational injuries, illnesses and fatalities in the state of Wisconsin. The program has coordinated and facilitated biannual Occupational Surveillance Advisory Group (OSAG) meetings.

The Wisconsin OH program also disseminates information to the public and other OH stakeholders through the OH program website, newsletters and other publications. Another goal of this project is for the OH program to act as the state's leading resource for public health interventions to prevent workplace hazards. Activities conducted through this project to further that aim include publishing occupational health research most relevant to Wisconsin occupational health and safety concerns, establishing and disseminating plans for targeted OH activities through county and city public health departments, and encouraging Wisconsin academics to study occupational health. Through this work, we believe there is an increased understanding of the importance of occupational health and safety concerns, leading to an increase in overall occupational health in the state of Wisconsin.

Specific Aims. The aims of our program have not changed from the original submitted application. These three aims include: 1) Continue and expand Wisconsin's occupational illness, injury, and death surveillance activities; 2) Disseminate OH information to Wisconsin stakeholders and national partners; 3) Identify, develop, and promote public health interventions to improve occupational health and safety. Progress, methodology and results for each aim are detailed below.

Aim 1 - Continue and expand Wisconsin's occupational illness, injury, and death surveillance activities

Methodology. The OH Program calculated and reported all requested Wisconsin occupational health indicator (OHI) data for each program year to NIOSH for publication by CSTE. The Program also developed two OHI trend reports in 2016 (WI DHS, 2016d) and 2020 (WI DHS, 2020), which summarize worker health and safety trends during 2003–2018.

Wisconsin's adult blood lead data were submitted each program year to NIOSH's Adult Blood Lead Epidemiology and Surveillance (ABLES) Program. We conducted follow-back activities for elevated blood lead levels (BLLs) at or above 25 µg/dL and provided case

information to the Wisconsin Occupational Safety and Health Administration (OSHA) offices. Epidemic Intelligence Service (EIS) Officer Debora Weiss updated the literature and guidance on retained bullets, a significant source of lead poisoning (Smith, 2016; Weiss, 2017(2)). The ABLES database was upgraded in 2018 to accept real-time laboratory HL7 electronic records feed. Benefits include a 60% increase in input rate, improved reporting, cleaner data for analyses, and closer affiliations with the Childhood Lead Program's Healthy Homes and Lead Poisoning Surveillance System (HHLPSS) as well as the Wisconsin State Lab of Hygiene, which routes records to both programs. We also converted the adult elevated BLL interview form from paper to electronic and integrated it with the ABLES database. Concurrently, the Wisconsin statute for lead reporting requirements was modified to facilitate electronic reporting. We hosted a visit from NIOSH's ABLES Program staff to describe our electronic records system and proposed THL surveillance, assisting their preparation for a federal agency childhood lead exposure meeting. The database upgrade has assisted our efforts to develop methods to stand up a validated, semi-automated surveillance system for households at risk for take-home lead (THL) exposure among Wisconsin adults and children with records in two separate databases. Preliminary assessment of workers from a Wisconsin company with known lead exposures indicated that about 15% were associated with children with BLLs >5 μg/dL. Stakeholders in this project include the identified households as well as local health jurisdictions, which may handle case management. The proposed surveillance was included in the Childhood Lead Program's successful application for CDC supplemental program support.

We have continued to include NIOSH's industry and occupation (I/O) questions on the Wisconsin Behavioral Risk Factor Surveillance System (BRFSS) survey through 2020 and have published several analyses, including identifying workers at high risk for occupational asthma (Tomasallo, 2017).

We used additional data sources to look at sectors at increased risk for occupational injury or death. 2011-2017 Wisconsin agricultural fatality data from the Bureau of Labor Statistics' Census of Fatal Occupational Injuries were analyzed to determine what is contributing to the death rates for this sector. After establishing a Worker's Compensation (WC) Data Use Agreement with Wisconsin's Division of Workforce Development, in August 2017 we initiated a second agreement to obtain Unemployment Insurance (UI) denominator data for our WC analyses. Using these data sources, initial WC rates were created and analyzed for Wisconsin; findings were presented at the 2019 CSTE Meeting. Cancer registry and mortality data were linked to describe malignant mesothelioma incidence and mortality in Wisconsin (Tomasallo, 2018).

Five new occupational illnesses were added to Wisconsin's Administrative Code for reportable conditions in 2018: carbon monoxide, silicosis, asbestosis, chemical pneumonitis, and lung diseases from exposures to biodusts/bioaerosols. Webpages, investigation protocols, and questionnaires were developed for reporting and case follow-back (WI DHS, 2019).

In year 5, we piloted a Wisconsin silicosis surveillance process to address underreporting of cases and obtain case interview data. The OH Program identified probable silicosis cases

(using the CSTE definition) by searching Wisconsin hospital discharge and emergency department visit data with principal or contributing diagnoses codes of J62 and by requesting records from lung transplant programs in Wisconsin for any patients with diagnosed silicosis. We reviewed medical records for each case including history and physical examination, emergency department documentation, and discharge summaries. Records were reviewed for mention of silicosis, exposure to silica, and occupations where exposure may have occurred. In order to identify cases caused by emerging sources of silica exposure, we attempted interviews with all case-patients under 60 years of age. Data collected during interviews included employment history, social history, silicosis exposure history, symptoms, diagnostic information, and history of other lung diseases.

We worked on multiple fronts to implement I/O autocoding with NIOSH's NIOCCS program. Ten staff from academia, the Bureau of Labor Statistics, and Wisconsin Division of Public Health were trained on the NIOSH I/O auto-coding program (NIOCCS), sponsored by the Wisconsin Division of Public Health in November 2017. The following year, Wisconsin joined the national initiative of states who have implemented death certificate I/O autocoding, and collaborated with NIOSH on a coding fact sheet for funeral directors. Within the COVID-19 effort, we began the process to add NIOCCS autocoded I/O to the Wisconsin Electronic Disease Surveillance System (WEDSS). Free text fields for COVID-19 I/O were created and are in use after initial training for local health departments, and we have implemented the NIOCCS web call for autocoding from these fields.

COVID-19 has raised awareness of the importance of occupation and opened new opportunities to our Program. In addition to the I/O coding implemented for COVID-19 cases, our Program led efforts to write and update reopening and COVID-19 outbreak guidance for businesses and local health departments (WEDC/WI DHS, 2020; WI DHS, 2020a; WI DHS, 2020c), and to provide a basic fact sheet for workers that was translated into multiple languages and disseminated broadly (WI DHS, 2020b). These efforts have expanded our contacts in communicable diseases, worker rights, and groups supporting businesses. Pandemic funds have been obtained and used to support additional capacity in occupational outbreak investigations and exposure assessment, as well as to support professionally managed multiagency Workplace Safety team meetings.

Results and Discussion. Initial analysis of Worker's Compensation rates for Wisconsin creates opportunities to describe workers with information not available from other sources, and to find ways to prioritize sectors in greatest need of intervention.

Upgrades of Wisconsin's ABLES infrastructure will improve recordkeeping and data quality, which will in turn improve effective communication with workers and employers most at risk for lead poisoning. Implementing take-home lead (THL) surveillance is expected to increase outreach and will estimate the prevalence of childhood THL exposure more accurately.

COVID-19 occupational activities in Wisconsin have expanded the scope of occupational health in the state. Initiating autocoded I/O, gaining new contacts with additional worker and employer health and safety expertise to interact with our Advisory Group, and funding

occupational outbreak epidemiologists and exposure assessors offers potential long-term Program benefits.

Developing a surveillance system for THL in a state with separate adult and child lead databases is a first step towards more complete assessment of households' risk of occupational lead exposure, rather than risk to individual adults or children. Methods will be shared with other states to facilitate nationwide surveillance.

Development of state reporting requirements for occupational lung diseases will introduce effective surveillance in Wisconsin for these chronically underreported conditions. Strategies for prevention can be improved as a result. For example, a multi-state response to silicosis in younger workers who work with fabricated stone is critical to its prevention. This year's activities to identify and disseminate information on this newly reportable condition will increase national recognition of this emerging illness.

Implementation of real-time NIOCCS autocoding results for I/O in our primary case investigation database (WEDSS) will be shared with other states seeking to adapt this key occupational data improvement.

Partnering with Wisconsin's Worker's Compensation, adding I/O to Wisconsin BRFSS data, and collaborating with Minnesota on a novel agricultural injury indicator are leading to improved assessment of occupational illness and injury.

Conclusions. The OH program aims to significantly expand our OH surveillance and develop successful intervention strategies based on in-depth investigation of occupational injuries, illnesses and fatalities. Partnerships among OH stakeholders are crucial in developing these interventions targeting Wisconsin workers. With improved surveillance and capacity among partners, we anticipate a reduction in the rate of occupational injuries and deaths in Wisconsin.

Aim 2 - Disseminate OH information to Wisconsin stakeholders and national partners

Methodology. Occupational health queries from local health departments, the public, other government agencies, unions, and industry were addressed and logged in a new tracking system in 2016. Queries increased about 400% to about 100/year during this period.

Adult Lead Program contact materials were updated and improved during this period, including a new website, contact letters, fact sheets, electronic versions of survey instruments, and contact letters and fact sheets for take-home lead households (see Progress Report Publication List for details). Adult lead data were uploaded to the Wisconsin Environmental Public Health Tracking Program's public data portal this year (WI EPHT, 2020).

Wisconsin met with the Tri-State Occupational Health Collaborative several times each program year and initiated generation of Wisconsin agricultural injury indicator data

presented at the 2017 CSTE conference. The Tri-State Collaborative has supported NIOSH's initiative to integrate adult lead data into the Childhood Lead Program's HHLPSS. Wisconsin staff participated in a related NIOSH webinar in March 2018, and all three states contributed to a CDC publication on this topic (Egan, 2019).

The Occupational Surveillance Advisory Group (OSAG) meets twice a year to share information and guide outreach and intervention activities (see Appendix A for list of members). These meetings have resulted in new consideration of vulnerable worker groups for outreach and intervention activities, and recent COVID-19 work has provided new contacts with worker and employer groups whom we plan to invite to expand OSAG expertise.

Funding was provided in 2018 to support Partners in Health and Safety (Compañeros en Salud y Seguridad), the UW-Eau Claire partnership with local public health entities and local dairy producers. To date, 405 individuals during 1,249 visits have received health screenings, immunizations, first aid, TB testing/education/treatment, and PPE education at 18 large central Wisconsin dairies.

Our working relationships with Region 5 and Wisconsin OSHA continue to benefit occupational health in Wisconsin by clarifying how agencies are responding and creating surveillance opportunities for COVID-19, as well as supporting the regular missions of both agencies. Two recent examples illustrate these benefits: 1) sharing letters facilitated limited information exchange, to enable us to create a data dashboard of COVID-19 investigation metrics; and 2) we have discussed possible use of ambulance run data to explore the prevalence of underreported severe workplace injuries.

Occupational resources developed by our Program for COVID-19 have been in high demand, with high numbers of active sessions and page views (see Results and Discussion, below). Wisconsin Economic Development Corporation (WEDC) and Wisconsin Department of Health Services (WI DHS) developed co-branded COVID-19 reopening guidance for businesses by sector in May 2020 (WEDC/WI DHS, 2020). Business outbreak guidance was published by WI DHS in October 2020 (WI DHS, 2020a). Separate, unpublished occupational outbreak guidance for Wisconsin local health departments drawing on NIOSH and Wisconsin resources was drafted in June and uploaded to an internal department website in July 2020. A fact sheet with basic information for workers was published (WI DHS, 2020b) and is being disseminated broadly. These documents were also uploaded to NIOSH's State-Based Occupational Clearinghouse.

Interagency partnerships with the Wisconsin State Laboratory of Hygiene (WSLH) have facilitated ongoing support to employer-facing documentation and dissemination. WSLH's WisCon Consultation Program has accepted support to offer COVID-19 onsite risk assessment and consulting assistance to businesses. Since startup in September 2020, 22 requests have been received from business for consultative services. The WisCon COVID-19 team has also been able to identify and address gaps in COVID-19 respiratory protection. Webinars given by the WisCon and DPH Occupational COVID-19 teams are disseminating COVID-19 prevention and outbreak guidance to businesses.

Accomplishments were shared as NIOSH e-News items and CSTE success stories (1 each per year) during the program period.

At least two lectures/year were given by OH staff at University of Wisconsin-Madison, Department of Population Health Science classes on occupational topics, including asthma and reproductive health.

Discussion at national meetings contributes to communication strategies and activities, developing partnerships and collaboration among states. The OH Program staff contributed to workgroups including the following: CSTE OH Subcommittee; CSTE Occupational Health Indicator (OHI) Workgroup; CSTE COVID-19 Essential Workers Workgroup; CSTE Multi-State COVID-19 I/O Project; NIOSH Worker's Compensation Group; NIOSH BRFSS I/O Workgroup.

The WI OH Program webpage is continually updated to provide occupational health and safety information for the public and making the website more accessible and engaging to the Wisconsin public will continue to be a priority.

Results and Discussion. Presentations, meetings, and CSTE committee engagement at all levels put partnering into practice and increased coordination among agencies. Our engagement of partners through OSAG and the Tri-State Collaborative also increased partner awareness of the OH Program and will lead to leveraging of resources and coordinated responses.

We expect that the dissemination of findings contributed to reduced workplace risks. We expect increased public knowledge of occupational illness, injury and death in Wisconsin's workplaces through our dissemination of data through presentations, peer-reviewed and outreach publications, and the Program's updated websites.

COVID-19 guidance documents for businesses, local health departments, and a worker fact sheet are in active use. The Wisconsin COVID-19 website for Businesses, Employers, and Workers had 62,337 active sessions and 189,169 page views from 47 states and 25 international states/provinces in its first three months. Wisconsin Economic Development Corporation (WEDC) and Wisconsin Department of Health Services co-branded COVID-19 reopening guidance for businesses by sector in May 2020. In its first two weeks, the website had over 281,000 active sessions and 692,000 page views.

The WI OH program is a statewide resource for workplace safety and health information. The OSAG, which consists of experts in occupational health, serves as a resource for the WI OH Program so that it better serves the state's worker populations. Formal and informal partnerships continue to be a focus of the WI OH Program, as they improve the quality and success of the outcomes.

Conclusions. We anticipate that by increasing the amount and effectiveness of our occupational health and safety messages, we will influence workplace hazard and safety

knowledge, attitudes and behaviors. According to the Health Belief Model of behavioral change, this will lead to the reduction of occupational illnesses, injuries, and fatalities.[1]

Aim 3 – Identify, develop, and promote public health interventions to improve occupational health and safety

Methodology. The most significant investigations for these program years are highlighted here. Program staff also consulted and contributed on multiple other investigations for occupational exposures to lead, PFAS, sporotrichosis in sphagnum moss, legionella, and carbon monoxide.

In 2016, Wisconsin and Minnesota Health Departments responded to reports of elevated blood lead levels in shipyard workers in Superior, Wisconsin. An incident management system coordinated the investigation, and approximately 350 exposed workers were surveyed. This investigation strengthened multi-state partnerships, improved outreach to workers and local health departments, and resulted in multiple communication products and publications (Weiss, 2017, 2018). Safety information about lead poisoning prevention was distributed to workers (WI DHS, 2016a), clinicians (WI DHS, 2016b), and company/union representatives. A ship repairers' fact sheet was shared with the NIOSH Maritime Center for national dissemination (WI DHS, 2016c).

EIS Officer Dr. Debora Weiss participated in a NIOSH Health Hazard Evaluation (HHE) at a Coffee Roasting Company in Milwaukee, WI in March 2016.

In 2018, a re-investigation of mercury exposure at a fluorescent bulb recycling facility and new investigation of carbon monoxide poisoning at a food processing facility were conducted in collaboration with OSHA, NIOSH, and local health departments. Reports were published in Morbidity and Mortality Weekly Report (Wilson, 2018; Wilson, 2017).

The COVID-19 response identified a need for an occupational outbreak triage plan. A prioritization scheme was developed by occupational epidemiologists to determine which outbreaks need prioritized attention and which county health departments should be proactively offered outbreak assistance and guidance.

Results and Discussion. Analysis of 2016 ABLES data identified a significant outbreak of elevated blood lead levels in a Wisconsin shipyard. The subsequent investigation ensured that messaging was shared with workers, companies, unions, local health departments, the media, and other public health agencies, including the NIOSH Maritime Center. During this funding period, we continued to provide monthly reports of elevated blood lead levels by county and business to regional OSHA offices in Wisconsin to facilitate their monitoring of industries exposing workers to lead.

Needs identified by the COVID-19 response team resulted in creating a framework to quickly and efficiently triage large numbers of outbreak reports and identify facilities or locations that may need early public health interventions.

Conclusions. The OH program will continue to offer guidance and consultation to develop successful intervention strategies based on in-depth investigation of occupational injuries, illnesses and fatalities. Partnerships among OH stakeholders are crucial in developing these interventions targeting Wisconsin workers. By providing leadership in promoting best practice OH interventions, we anticipate a reduction in worker injuries and fatalities.

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Publications During Grant Period, 2015-2021
Publications from the last year of the grant period are in a separate email attachment named *Publications_combined_file_Meiman_6_U60OH010898.pdf.*

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Website Resources (Fact Sheets, Outreach Resources, and Webpages)

Adult Lead Resources

Keeping You and Your Family Safe from Lead (outreach to women with elevated BLLs). Wisconsin Division of Public Health, Occupational Health Program. 2019. Available at https://www.dhs.wisconsin.gov/publications/p02409.pdf

Lead and Your Health: No Amount of Lead is Safe, Even for Adults. (factsheet for workers). Wisconsin Division of Public Health, Occupational Health Program. 2018. Available at https://www.dhs.wisconsin.gov/publications/p01738.pdf

Lead Testing: Also Important in Adults (factsheet for healthcare providers). Wisconsin Division of Public Health, Occupational Health Program. 2016. Available at https://www.dhs.wisconsin.gov/publications/p01293.pdf

Protect Shipworkers from Lead (factsheet following shipyard lead outbreak). Wisconsin Division of Public Health, Occupational Health Program. 2016. Published at https://www.dhs.wisconsin.gov/publications/p01625.pdf

Keep Your Family Safe - Don't Bring Home Lead from Your Job (fact sheet for workers). Wisconsin Division of Public Health, Occupational Health Program. 2016.

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COVID-19 Occupational Response
Wisconsin Department of Health Services (WI DHS). Outbreak guidance for businesses. Developed in collaboration with Wisconsin Economic Development Corporation (WEDC). WI DHS, 2020a. Published at https://www.dhs.wisconsin.gov/publications/p02787.pdf

Wisconsin Department of Health Services (WI DHS). Working Safely: COVID-19 and Your Job (worker fact sheet). WI DHS, 2020b. Published at https://www.dhs.wisconsin.gov/publications/p02805.pdf

Wisconsin Economic Development Corporation (WEDC) and Wisconsin Department of Health Services (WI DHS). Reopen guidelines for businesses. [Sector-specific and general guidelines for businesses to reopen during COVID-19]. WEDC/WI DHS, 2020. Published at https://wedc.org/reopen-guidelines/

Wisconsin Department of Health Services (WI DHS). COVID-19: Businesses, Employers, and Workers. [Resources for workers and businesses.] June 2019. Published at https://www.dhs.wisconsin.gov/covid-19/employers.htm

Authoritative occupational outbreak guidance for Wisconsin local health departments drawing on NIOSH and Wisconsin resources was drafted in June and uploaded to an internal department website in July 2020, and again revised in October 2020.

Other Occupational Topics
Working Safe for Wisconsin Teens (young worker handbook). Wisconsin Division of Public Health, Occupational Health Program. Revised 2019. Available at https://www.dhs.wisconsin.gov/publications/p00990.pdf

National Institute for Occupational Safety and Health. Using Graphs to Improve Studies of Work Exposures in Pregnancy. (Discusses Johnson CY, Rocheleau CM, Grajewski B, Howards PP. Am J Epidemiol 2019;188(3):562-569). NIOSH Research Rounds July 2019: 5(1), accessed at https://www.cdc.gov/niosh/research-rounds/resroundsv5n1.html

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Meso Is Still A Deadly Problem in Wisconsin (fact sheet for workers in English and Spanish). Wisconsin Division of Public Health, Occupational Health Program. 2018. Available at https://www.dhs.wisconsin.gov/library/p-02298.htm

Tomasallo C. Behavioral Risk Factor Surveillance System (BRFSS) State Spotlight Factsheet on Occupations at Risk for Work-related Asthma. BRFSS Facts and News 9; Summer 2017. Published at https://www.cdc.gov/brfss/factsheets/pdf/Issue_9_508_tagged.pdf

WorkplaceSafety Matters (factsheet describing Wisconsin Occupational Health Indicator Report, 2012). 2016. Available at https://www.dhs.wisconsin.gov/publications/p01593.pdf

Program Webpages

Wisconsin Environmental Public Health Tracking (EPHT) Data Portal. Adult blood lead levels, including counts and rates per 100,000 workers, by county and statewide. Wisconsin Division of Public Health, Wisconsin Department of Health Services. 2020. Published at https://dhsgis.wi.gov/DHS/EPHTracker/#/map/Adult%20Lead/adultLead/NOTRACT/Blood%20lead%20level%20of%20%3E%3D05%C2%B5g%2Fdl

Wisconsin Department of Health Services (WI DHS), Reportable Lung Conditions. [Descriptions of asbestosis, silicosis, chemical pneumonitis, and occupational lung diseases caused by bio-dusts and bio-aerosols. Resources for clinician reporters and workers.] March 7, 2019. Published at https://www.dhs.wisconsin.gov/occupational-health/lung-diseases.htm

Wisconsin Division of Public Health, Occupational Surveillance Program. Outside NIOSH: Gas-burning Fryers Source of Carbon Monoxide Leak at Industrial Kitchen. NIOSH Research Rounds 2019 Jan; 4(7). Available from https://www.cdc.gov/niosh/research-rounds/resroundsv4n7.html

Wisconsin Department of Health Services, Division of Public Health, Occupational Health Program. [Update/redesign of Wisconsin's Occupational Health Webpage, with specific resources for workers, employers, researchers, and clinicians.] April 1, 2018. Published at https://www.dhs.wisconsin.gov/occupational-health/index.htm

Wisconsin Department of Health Services, Division of Public Health, Occupational Surveillance Program. Adult Lead Program. [Update/redesign of Wisconsin's Adult Lead Webpage, with specific resources for workers, employers, researchers, and clinicians.] May 24, 2017. Published at https://www.dhs.wisconsin.gov/occupational-health/ables/index.htm

Cumulative Inclusion Enrollment Table
Inclusion Enrollment Table was not part of the original application for this Fundamental Surveillance Project and is therefore not included here.

Inclusion of gender and minority subjects
During the five years of this cooperative agreement, the population studied included all Wisconsin workers between the ages of 15 years and 85 years of age and did not target any specific age group, gender or racial/ethnic group. There were no criteria for inclusion or exclusion for any portion of this project. This project involved the collection of currently existing population-level data from across the state of Wisconsin.

In 2018 it was estimated that women comprised approximately 48.4 percent of the employed population in Wisconsin (1.5 million). Racial and ethnic minorities comprised 9.9 percent (299,000) and 6 percent (177,000) of the workforce in 2018, respectively. It is estimated at approximately 14.2 percent of the workforce (431,000) is youth under the age of 25 years.

Inclusion of children
During the six years of this cooperative agreement, children were not specifically targeted for data collection. This project involved the collection of currently existing population-level data from across the state of Wisconsin. We did not specifically seek the inclusion of non-working-age children, with the exception of the THL initiative. For this project, matching was performed between adult and child lead poisoning surveillance databases for the purposes of identifying children potentially exposed to take-home lead.

Materials available for other investigators
The Wisconsin OH Program could assist researchers in requesting OH non-public data as needed. These data sources include vital records, hospitalization data, ABLES, and the Wisconsin Electronic Disease Surveillance System (WEDSS). The Wisconsin Division of Public Health (DPH) requires that data requests for individual records or unsuppressed aggregate data receive approval from the DPH Data Governance Board. Approval ensures that data privacy policies are followed, proposed data use is not contrary to state or federal statutes, risk for misuse or inappropriate disclosure of identifiable data is mitigated, and Institutional Review Board oversight has been established. Once a request has been approved by the Data Governance Board, DPH completes a data use agreement with researchers to facilitate access to requested information.

Final Financial Report (FFR)
The final FFR was submitted through the Payment Management System (PMS).

Equipment Inventory Listing
The Equipment Inventory Listing is a separate email attachment.

Final Invention Statement and Certification
There were no inventions that came from this cooperative agreement. The final invention statement is a separate email attachment.

Appendix A. Occupational Surveillance Advisory Group (OSAG) Members

OSAG Member	Title and Affiliation
Tracy Aiello	Director, Bureau of Claims Management, Wisconsin Worker's Compensation
Jameson Bair	Occupational Safety & Health Statistics Program Lead, Bureau of Labor Statistics, Wisconsin State Laboratory of Hygiene, University of Wisconsin-Madison
Kate Barnes	Project Manager, National Farm Medicine Center and National Children's Center for Rural and Agricultural Health and Safety Activities, Marshfield, WI
Megan Elderbrook	Research Scientist-Epidemiologist, Asthma & Occupational Health Programs, Wisconsin Division of Public Health
Dr. Barbara Grajewski	Epidemiologist and Manager, Occupational Health Surveillance Program, Wisconsin Division of Public Health
Chad Greenwood	Director, OSHA – Madison Area Office
Dr. George Gruetzmacher, CIH	Industrial Hygiene Consultant - Engineer, WisCon Program, Wisconsin State Laboratory of Hygiene, University of Wisconsin-Madison
Christine Lilek	Environmental Health Specialist, Asbestos & Lead Unit, Wisconsin Division of Public Health
Dr. Curtis Hedman	Toxicologist, Bureau of Environmental and Occupational Health, Wisconsin Division of Public Health
Ann Jurkowski, CIH	Industrial Hygienist, Division of Industry Services, Department of Safety and Professional Services
Nathan Kloczko	Council of State and Territorial Epidemiologists Applied Epidemiology Fellow, Bureau of Environmental and Occupational Health, Wisconsin Division of Public Health
Justin Kowalski	Senior Environmental Consultant, We Energies
Jane Larson	Worker Protection Program Specialist, Wisconsin Department of Agriculture, Trade and Consumer Protection
Dr. Jonathan Meiman	Chief Medical Officer and Environmental and Occupational Health Epidemiologist, Wisconsin Division of Public Health
James Morrison	Occupational Health Officer, University of Wisconsin—Madison
Dr. Ian Pray	Epidemic Intelligence Service (EIS) Officer, Bureau of Environmental and Occupational Health, Wisconsin Division of Public Health
Steve Strebel	Director, Occupational Health Laboratory, Wisconsin State Lab of Hygiene, University of Wisconsin-Madison
Dr. Carrie Tomasallo	Chief, Environmental Epidemiology and Surveillance Section, Bureau of Environmental and Occupational Health, Wisconsin Division of Public Health
Dr. Donna Vosburgh	Associate Professor of Occupational and Environmental Safety and Health, University of Wisconsin—Whitewater
Dr. Mark Werner	Director, Bureau of Environmental and Occupational Health, Wisconsin Division of Public Health
Christine Zortman	Director, Milwaukee Area OSHA Office
Dr. Henry Anderson	Adjunct Professor at University of Wisconsin-Madison School of Medicine and Public Health