FINAL PROGRESS REPORT

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LIST OF ABBREVIATIONS

ACBS	Adult Asthma Call-Back Survey (BRFSS follow-up)
ACS	American Community Survey
AGO	Attorney General's Office
ANSI	American National Standards Institute
APCD	All payer claims database
APO	Alaska Pacific Office (NIOSH)
APHA	American Public Health Association
ASTHO	Association of State and Territorial Health Officials
BCHAP	Bureau of Community Health and Prevention
BLS	Bureau of Labor Statistics
BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CFOI	Census of Fatal Occupational Injuries
CHIA	Center for Health Information and Analysis
COPD	Chronic obstructive pulmonary disease
CPS	Current Population Survey
CPWR	The Center for Construction Research and Training
CSTE	Council of State and Territorial Epidemiologists
CT	Census Tract
DFS	Massachusetts Department of Fire Services
DHCQ	Division of Health Care Quality
DIA	Department of Industrial Accidents
DLS	Department of Labor Standards (Massachusetts Department of Labor)
ED	Emergency Department
EEC	Early Education and Care
EHR	Electronic health record
EID	NIOSH Education and Information Division
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ERC	Educational Research Center
ESE	Massachusetts Department of Elementary and Secondary Education
ETS	Environmental Tobacco Smoke
eWoRLD	Electronic Work Related Lung Disease
FACE	Fatality Assessment and Control Evaluation
FTE	Full time employee (equivalent)
HCP	Health Care Provider
HD	Hospital Discharge
HHE	Health Hazard Evaluation
HIV	Human immunodeficiency virus
HRD	Massachusetts Human Resources Division
HSP	Health Survey Program
HSPH	Harvard School of Public Health
I/O	Industry and occupation
IRB	Institutional Review Board
IT	Information technology

MAAP	Massachusetts Asthma Action Partnership
MassCOSH	Massachusetts Coalition for Occupational Safety and Health
MATRIS	MA Ambulance Trip Record Information System
M-BIRS	Massachusetts Burn Injury Reporting System
MDPH	Massachusetts Department of Public Health
MMWR	Morbidity and Mortality Weekly Report
MOHST	Massachusetts Occupational Health and Safety Team
MSD	Musculoskeletal disorder
MSISS	Massachusetts Sharps Injury Surveillance System
NAICS	North American Industry Classification System
NIOCCS	NIOSH Industry and Occupational Computerized Coding System
NIOSH	National Institute for Occupational Safety and Health
NORA	National Occupational Research Agenda
NVDRS	National Violent Death Reporting System
NYCAMH	New York Center for Agricultural Medicine and Health
OHI	Occupational health indicators
OHIP	Occupational Health Internship Program
OHSP	Occupational Health Surveillance Program
ORI	Office of Refugees and Immigrants
OSAP	Organization for Safety, Asepsis and Prevention
OSD	Massachusetts Operational Services Division
OSH	Occupational safety and health
OSHA	Occupational Safety and Health Administration
PCC	Poison Control Center
PFC	Preventing Falls in Residential Construction
PH-MSD	Patient handling musculoskeletal disorder
PI	Principal Investigator
PtD	Prevention through Design
PUM(S)	Public use microdata (sample)
PPV	Positive predictive value
RADS	Reactive Airways Dysfunction Syndrome
SENSOR	Sentinel Event Notification System for Occupational Risk
SESIP	Sharps with engineered sharps injury protection
SHIP	State Health Improvement Plan
SI	Sharps injuries
SOII	Survey of Occupational Injuries and Illnesses
SPH	Safe patient handling
TAW	Teens at Work: Injury Surveillance and Prevention project
TL@W	MassCOSH Teens Lead at Work Peer Leader Program
TWH	Total Worker Health
UCONN	University of Connecticut
WC	Workers' compensation
WHO	World Health Organization
WRA	Work-related asthma
WRII	Work-related injury and illness
YES	Massachusetts Youth Employment and Safety Team

ABSTRACT

Work-related injuries and illnesses (WRIIs) are a significant public health problem in Massachusetts imposing substantial human and economic costs. Surveillance of WRII is essential to target, design and evaluate prevention efforts at the state and local levels. Since the late 1980s, with support from NIOSH and others, the Massachusetts Department of Public Health (MDPH) has implemented the Occupational Health Surveillance Program (OHSP).

This Cooperative Agreement has enabled OHSP to expand WRII surveillance and intervention activities in Massachusetts during 2010-2015. Specifically, it enabled OHSP to carryout surveillance and prevention activities **fundamental** to an occupational public health program and allowed OHSP to continue and expand four priority focus area projects. These include comprehensive case-based surveillance and intervention systems for **fatal occupational injuries; work-related asthma; occupational injuries to persons under 18, expanded to include surveillance of 18-24-year-olds, and the surveillance and prevention of sharps injuries to hospital workers.** An initiative was undertaken extending this work to address musculoskeletal disorders among hospital workers.

The Expanded OHSP provided important new data highlighting problems to be addressed in Massachusetts ranging from hazards faced by temporary workers, continued risk of burns in coffee shops, and injuries associated with patient handling. OHSP worked with multiple agency and community partners to address identified problems. Case-based surveillance systems included the capacity for worksite follow-up and led to interventions in individual workplaces carried out by OHSP or other government agencies: including for example, over 200 OSHA inspections prompted by OHSP referrals. OHSP collaborated with partners in conducting many broad-based educational activities, placing priority on underserved and hard to reach groups, such as teens and residential construction workers. Surveillance findings and active partner engagement contributed to changes in public policy, e.g. changes in the public health requirements expanding reporting of occupational conditions, new legislation extending OSHA level protections to state agency employees, and issuance of new guidance on safe cleaning practices in childcare. A comprehensive report by a multi-stakeholder Task Force brought new attention to the need for safe patient handling, and teen injury data prompted an engineering change to reduce burns in a large international coffee shop chain.

Program activities helped strengthen the state infrastructure to protect worker health, a highlight being the new Massachusetts Occupational Health and Safety Team that brings together multiple government agencies to coordinate activities. Successful efforts to integrate occupational health into ongoing public health activities, such as worksite wellness and MDPH accreditation, extended OHSP's reach. Access to new data sources, innovative surveillance methods and exploration of alternative employment data sources enhanced OHSP's ability to document WRIIs, and regional collaborations increased occupational public health capacity of Northeastern states.

OHSP has documented "end outcome" impacts in several priority areas: significant declines in the teen occupational injury rate (1994-2013); the fatal occupational injury rate (2004-2013), and the sharps injury rate among hospital workers (2002-2013), which has plateaued in the most recent years. While difficult to draw causal links between any single project and a decline in injury rates, OHSP activities likely have contributed to these improvements in worker health.

SECTION 1. SIGNIFICANT FINDINGS, TRANSLATION, OUTCOMES/IMPACT

a. Fundamental Occupational Health Surveillance in Massachusetts

Significant (Key) Findings

Strengthened state occupational safety and health (OSH) capacity. In Massachusetts, multiple government agencies share responsibility for protecting the health and safety of workers. This shared responsibility often results in missed opportunities to combine forces to maximize limited agency resources and build on health and safety expertise available in each agency. In 2010, with the support of agency leadership, the Occupational Health Surveillance Program (OHSP) launched the Massachusetts Occupational Health and Safety Team (MOHST). This team quarterly brings together representatives of the various agencies to identify opportunities for collaboration and has resulted in a variety of successful joint endeavors to protect Massachusetts workers. (See related success story in this final report.)

Improved protections for public sector workers in Massachusetts (a federal OSHA state). OHSP's work with partners to generate and disseminate data on work-related injuries to state agency workers helped inform the work of a Governor's Advisory Committee charged with exploring approaches to improving protections for state employees. Advisory Committee's findings and recommendations culminated in passage of state legislation extending OSHA level protections to employees of Executive Branch agencies. New interest in extending activities to reduce risks faced by municipal workers led OHSP to conduct the first Massachusetts study of serious nonfatal injuries among employees of local government agencies using workers' compensation indemnity claim data. Local area rates ranged from 5.9 to 28.6/1,000 workers, highlighting communities for outreach.

Increased referrals for worksite follow-up. OHSP fully implemented a system for referring amputations identified through workers' compensation records to OSHA. 303 referrals were made. Of the 262 referrals for which follow-up information is available, 205(78%) led to OSHA investigations, of which 136 (66%) resulted in citations.

Partnered to obtain a new data source. After completion of a successful six month pilot, OHSP now receives bi-weekly reports of work-related poisoning from the regional Poison Control Center (PCC), which is collecting and providing additional information on employment. Findings have been used to provide training about workplace chemicals to PCC staff.

Enhanced a data source for sentinel surveillance. A new system for weekly secure electronic transmission of workers' compensation data on reportable conditions to the Massachusetts Department of Public Health (MDPH) has been implemented, facilitating timelier case follow-up.

Integrated occupational health into public health. Multiple reports using newly available industry and occupation (I/O) data in the MA BRFSS were released. OHSP enlisted occupational health stakeholders from the community to identify multiple occupational health measures and strategies that were included in the State Health Improvement Plan

required for public health accreditation. OHSP also successfully facilitated considerations of workplace organization factors and health and safety risks in MDPH's expanding worksite wellness initiative.

Translation of Findings

Translation of surveillance findings is integral to all OHSP projects. Surveillance, by definition, includes the dissemination of findings to those in a position to use the data to take action. OHSP not only provides information to stakeholders but has developed working relationships with an extensive network of agency and community stakeholders to effect change. Intervention activities are carried out both directly by project staff and by staff working with partners in the community to address identified risks.

Translation highlights this period include the creation of the MOHSTeam, the new working relationship with the regional PCC, and the expansion of referral of serious injury cases to OSHA for follow-up. Publication of MA BRFSS data on a variety of health measures by I/O have extended our reach to other public health domains as has active participation in the public health accreditation process and engagement with the MDPH worksite wellness initiative. OHSP's Advisory Board of 25 OSH experts and advocates met regularly through the project period and continued to serve as an important vehicle for linking surveillance to action in the workplace and the community. This period OHSP also made significant strides in using social media to disseminate OSH information

Outcomes/Impact

OHSP activities made possible by funding for Fundamental surveillance activities under this cooperative agreement led to a number of important intermediate outcomes with significant potential to effect improvements in occupational safety and health. Surveillance findings and active engagement with partners contributed to changes in public policy including: 1) changes in the protections for state agency workers; 2) implementation of labor assurances in the process for approving tax credits for employers developing worksite wellness programs; and 3) amendments to MDPH disease reporting requirements expanding mandatory reporting to include all work-related lung disease and allow MDPH access to medical records on all work-related injuries. OHSP input also informed OHSA's changes to record-keeping requirements that took effect 1/1/15. Additionally, project activities contributed to the development of new interagency and public-private partnerships thus strengthening the infrastructure to protect worker health in Massachusetts. All participating government agencies have demonstration ongoing commitment to continuing the MOHSTeam following changes in the administration. Successful integration of occupational health in other MDPH programs – including the MDPH Health Survey Program which has become a strong advocate for inclusion of I/O in the BRFSS – have likewise expanded OSH capacity. OHSP has also contributed to capacity building beyond Massachusetts. The multi-state OHI project, in which OHSP has played an active role, has led to increased capacity to conduct OSH surveillance in many states, and regional OSH surveillance meetings co-hosted by OHSP have helped states in the Northeast build and enhance occupational health surveillance programs.

The Massachusetts Occupational Health and Safety Team (MOHST): Strengthening state capacity to protect workers

Challenge: In Massachusetts, like many states, multiple government agencies share responsibility for protecting the health and safety of workers. Whereas federal OSHA is responsible for enforcement in the private sector, the state Department of Labor standards (DLS) carries out enforcement in the public sector and offers health and safety consultation services to both. The state Attorney General's Office (AGO) is the lead on criminal and civil enforcement of state wage and hour and child labor laws, and the Department of Industrial Accidents (DIA) not only manages the Workers' Compensation adjudication system but runs a health and safety training grant program for MA employers. The Department of Public Health (DPH) conducts surveillance using a multiple health data sources, conducts field investigations to characterize health and safety hazards, and works with community as well as agency partners to address identified health and safety problems, placing special emphasis on reaching the underserved. This shared responsibility often results in missed opportunities to combine forces to maximize limited agency resources and build on health and safety expertise available in each agency.

Response: In 2010, the Occupational Health Surveillance Program at DPH decided to make the MOHST of what we've got. With the support of agency leadership, OHSP launched the Massachusetts Occupational Health and Safety Team (MOHST). This team, which has met quarterly ever since, brings together representatives of the various agencies to identify opportunities for collaboration. Co-chaired by the Directors of OHSP and DLS, who rotate leading the two-hour meetings, agencies use the time to provide updates on current issues and activities with occasional special topic reports.

MOHST Mission: To reduce work-related injuries and illnesses among the working people of Massachusetts by increasing coordination of state and federal agency efforts to: enforce health, safety and related labor and public health laws; provide training and technical assistance to employers and workers; conduct surveillance of work-related injuries/illnesses and hazards; and mobilize partnerships to address identified health and safety problems and emerging health and safety concerns.

Impact: This simple structure of information sharing, rather than some more ambitious strategic initiative that would "add on work to already overloaded agencies" has led to many successful joint ventures and stronger day-to-day working relationships among agencies.

MOHST has contributed to:

- A Massachusetts Fall Prevention Campaign held in conjunction with the national campaign to prevent falls in construction.
- Early (2012) development and dissemination of new materials on protecting health and safety of temporary workers - more recently identified by OSHA as a national priority.
- Multiple agency participation in DLS initiated training for over 100 temporary agency staff and host employers.

- A jointly sponsored interagency training on wind turbine safety.
- Joint MA FACE and DLS investigations of public sector worker deaths contributing to new legislation extending OSHA protections to state agency workers.
- Expansion of DPH referrals to OSHA with regular OSHA feedback, including over 285 amputation referrals since 2011.
- Implementation of a process to assure that employers granted state tax credits for developing worksite wellness programs are in compliance with OSHA and Wage and Hour regulations.
- Enhanced state capacity to address risk faced by local government workers including:
    - DPH, DIA, DLS collaboration on the first Massachusetts study of work-related injuries and illness among local government workers.
    - A new initiative by DLS to use workers' compensation data to target interventions, based on a model developed by DPH.
    - Joint DPH/DLS outreach providing guidance about health and safety practices to municipalities
- New electronic transmission of clinical laboratory reports of elevated blood levels to DLS and DPH/DLS collaboration in conducting case follow-up activities.
- A successful multiple agency application to NIOSH for funding to maximize use of workers' compensation data for prevention.

b. MA Fatality Assessment and Control Evaluation (MA FACE)

Significant (Key) Findings

Tracking and investigating fatal and serious nonfatal injuries at work. MA FACE conducted 28 in-depth investigations of fatal or serious occupational injuries. MA FACE reports and *FACE Facts* with recommended prevention measures were disseminated to employers, workers and stakeholders. These publications increased public awareness of occupational safety and health (OSH) risks and control measures. This increased awareness was reflected in requests for thousands of copies and website hits for our developed products as well as their use in OSH training programs by community partners.

Protecting public sector workers in MA (a federal OSHA state). MA FACE investigations of nine public sector worker fatalities along with collaborative work with our community partners and the MA Department of Labor Standards (DLS) contributed to the passage of legislation extending OSHA level protections to state workers within the executive branch. MA FACE also worked with DLS to distribute FACE reports, *FACE Facts*, and other OSH materials to municipal public works departments and other public agencies.

The deaths of two municipal crossing guards struck by motor vehicles while assisting children walking to school prompted MA FACE and DLS to collaborate to protect crossing guards. MA FACE developed a *FACE Facts* on crossing guard safety, targeting motorists and the community on being aware of the crossing guards around roadways while DLS developed a bulletin targeting employers on personal protective equipment for crossing guards and crosswalk safety measures. Both documents were disseminated across the state to all municipal school, police, and public works departments. We also worked with the MA Registry of Motor Vehicles to add information about crossing guards to the June 2013 edition of the MA Driver's Manual.

Focusing on temporary worker safety in MA. MA FACE investigations of two temporary worker deaths early in the project period helped reveal the need to protect temporary workers and the complex issues involved in assuring the health and safety of workers in duel employer situations. These investigations prompted us to develop a *FACE Facts* with DLS and OSHA on the shared responsibilities to protect temporary workers which was disseminated to licensed temporary agencies in MA (900+), Worker Centers, and to trade associations of industries with high numbers of temporary workers. It was also disseminated nationally by the American Staffing Association, OSHA, and the National Solid Waste Association. Our FACE investigations and *FACE Facts* contributed to the passage of the new state "Temporary Worker Right to Know Law" that requires staffing agencies to provide their employees with written notice about basic information pertaining to their job placements. MA FACE also participated in a DLS training for over 100 temporary agency and host employers, providing compelling case examples and best practices guidance for protecting temporary workers. Since our initial investigations, temporary worker health and safety has been identified as a national priority. A recent OSHA/NIOSH alert on temporary workers used a MA FACE report to exemplify the risks temporary workers face.

Keeping MA construction workers from falling. Preventing falls in construction has remained a MA FACE priority. This period we led the state "Preventing Falls in Residential

Construction" workgroup (PFC) bringing stakeholders in the construction industry together with academic experts and agency representatives. PFC spearheaded a local, multi-pronged, multi-agency campaign in concert with the national *Campaign to Prevent Falls in Construction*. With PFC input, we revised three residential construction fall prevention brochures and created one on personal fall arrest systems. These brochures are being disseminated in multiple languages through local building permit offices. A *FACE Facts* on ladder safety for painters was also developed and disseminated through paint stores. Additionally, we worked with OSHA, DLS and other state agencies to get national campaign posters on public transit and state digital boards. We coordinated outreach about the campaign, the DLS/OSHA Compliance Program fall prevention trainings, and the National Safety Stand-Down for Fall Prevention in Construction by emailing all licensed contractors through the MA Department of Public Safety. MA FACE is an active partner in the national Campaign, participating in workgroups on outreach, materials development and assisting in evaluation. Our FACE coordinator also participates in the national NORA Construction team, sharing state public health agency perspectives.

Addressing occupational health disparities. This period MA FACE investigated three immigrant worker deaths and disseminated *FACE Facts* in multiple languages through community partners and ethnic media. MA FACE wrote a blog post on fall prevention for residential contractors in Spanish, which was picked up and published in Candela Magazine, the leading Hispanic "lifestyle" magazine in MA.

Translation of Findings

Translation of findings is integral to OHSP. MA FACE not only provides information to employers and employees, but to an extended network of agency and community stakeholders to effect change. This period MA FACE developed and disseminated annual and multi-year data reports, FACE reports and fact sheets, many in multiple languages. As highlighted above, these products have reached thousands of workers, employers and others through our dissemination efforts and subsequent requests for copies. In addition, our partners forward MA FACE products to their networks greatly expanding our reach.

Outcomes/Impact

MA FACE activities this period have resulted in: 1) reported changes in workplace practices, based on materials feedback; and 2) substantial uptake and secondary dissemination of multiple MA FACE products and recommendations locally and nationally, and the use of our materials as teaching tools to influence the next generation of engineers. The MA fall campaign proved a successful platform for training hundreds of contractors and raising awareness about the national Campaign. Our work has also contributed to several substantial policy initiatives: the MA Temporary Worker Right to Know Law, and legislation extending OSHA level protections to state workers. There was a statistically significant 2.9% average annual decline in fatal occupational injuries in MA between 2004 and 2013. While difficult to assess a causal link, MA FACE activities have likely contributed to this decline.

c. Teens at Work (TAW): Injury Surveillance and Prevention Project

Significant (Key) Findings

Middle school students working. Analysis of 2009 MA Youth Health Survey data revealed that 18% of middle school students work, many in formal jobs, which is prohibited under state and federal Child Labor Laws. Findings prompted new outreach to middle schools throughout the state about Child Labor Laws and young worker injuries.

Work-related injuries to young adults (18-24 years old). First ever data on work-related injuries to young adults in MA was released based on analysis of the statewide hospital datasets. As seen nationally, young adults had the highest rates of nonfatal injury. Of particular concern was the significantly high rate of work-related injury hospitalizations among Hispanic young adults. A measure of the rate of work-related injury emergency department visits among young workers was adopted by MDPH as an indicator to be monitored over time to assess public health progress in MA.

The Youth Employment and Safety (YES) Team: a successful forum for government agency collaboration. The continuation of an active YES Team has strengthened the infrastructure for health and safety in MA. TAW continued to chair the YES Team, bringing together state and federal agencies to coordinate efforts to protect youths at work. A highly successful endeavor of the YES Team, together with the MA Coalition for Occupational Safety and Health, was the annual *Safe Jobs for Youth Poster Contest*. The poster contest served as a means to achieve extensive interagency/community engagement as many teens throughout the state entered the contest each year and served as judges. In addition, legislators were engaged via an annual awards ceremony held at the State House and winning posters were displayed on public transportation throughout the summer.

Enhancements to the *Talking Safety* curriculum. Input received from working youth identified sexual harassment at work as an important health and safety concern. In response, TAW published a new module on sexual harassment for use with the national *Talking Safety* curriculum. TAW also developed new summer jobs scenarios for use with the existing curriculum. Additionally, TAW played an active role reviewing the national *Talking Safety* revisions and developing the assessment questionnaire.

Prevention through Design in coffee shops. TAW has continued our working relationship with the headquarters of a national coffee shop chain which redesigned their coffee brewers after surveillance data continued to show an increased number of burns occurring despite a previous retrofit shield to correct the hazard. (See the success story included in this project closeout report.)

Translation of Findings

Translation of findings is integral to all OHSP projects. Surveillance, by definition, includes the dissemination of findings to those in a position to use the data for action. TAW not only provides information to stakeholders, but also has working relationships with a network of agency and community stakeholders to affect change. Intervention activities are carried out both directly by staff and by working with community partners to address identified risks.

This period, annual surveillance summaries and educational materials tailored to targeted audiences were disseminated in both hard and soft copy formats to thousands of stakeholders. Outputs included, annual *TAW Surveillance Updates*, annual data tables on work-related injuries to young adults, new *Talking Safety* materials, and a resource manual for vocational cooperative placement coordinators. Efforts to obtain feedback on materials were continued; thousands of copies of materials were requested and increases in web hits to the TAW website were documented following TAW mailings.

Translation activities went far beyond materials dissemination and included worksite investigations and active partnerships, both within and outside of MDPH, to address identified health and safety problems. Social media played an increasing role in our activities throughout the grant period, including the use of blog posts, tweets, and website content.

Outcomes/Impact

TAW activities made possible by this cooperative agreement have contributed to a number of important intermediate outcomes with significant potential to affect improvements in occupational safety and health. This project provides data on teen work injuries used to target and promote prevention efforts in Massachusetts. The type of information collected in Massachusetts is not available elsewhere, therefore our surveillance findings are also looked to by other states as well as federal agencies. Case referrals have led to worksite intervention and resulted in over $25,000 in employer fines issued to date. Continued work with a national coffee chain led to a technology change in the workplace as new brew baskets with safety features are now available to over 13,000 locations nationally and internationally. The *Safe Jobs for Youth Poster Contests* have increased public awareness and community dialogue around workplace health and safety issues for youth. The TAW Project continued to serve as a critical vehicle for enhancing collaboration across many agencies and organizations, and institutionalizing capacity to protect young workers. Teen injury rates have declined since the project's inception. New surveillance findings for young adults underscore the need to reach this age group. The expanded focus on young adults provides new challenges but also new opportunities for intervention.

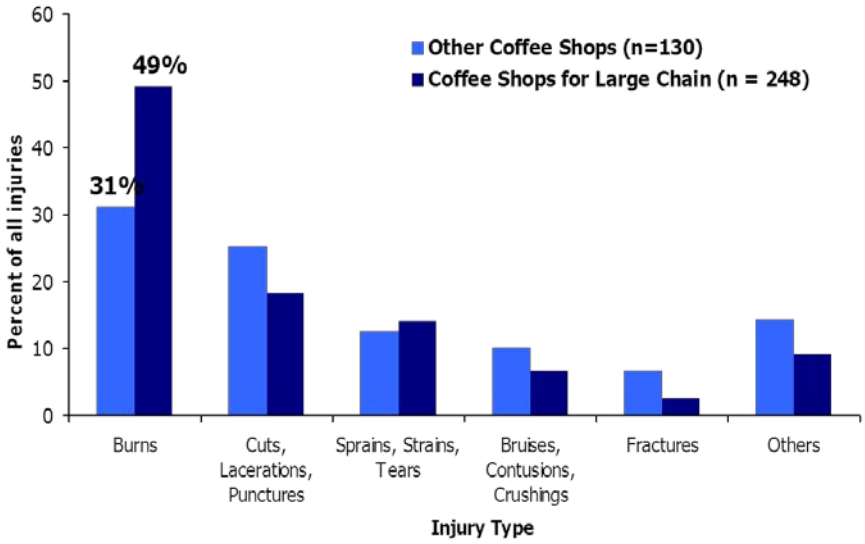
Protecting Youth at Work: A Tale of Data, Coffee and Consequence

"I was pulling out the coffee filter to make more coffee but it was still brewing. Hot coffee and grounds poured over my hand and wrist." –*Injured teen worker*

In 1998, sparked by an injury to a 14-year-old working at a local coffee shop, the Massachusetts Teens at Work Injury Surveillance and Prevention Project (TAW) took a closer look at the retail bakery industry in its surveillance data. Industry analysis revealed not only high rates of injury to teen workers, but a particularly high proportion of burn injuries in coffee shop restaurants for a single large franchised retail bakery chain.

Follow-up interviews with teens and worksite investigations by TAW uncovered a trend and exposed the burn culprit: coffee. Teen workers were going to change coffee filters, but without realizing the machines were still brewing and the filters full of near-boiling water. When they pulled out the brew baskets, hot coffee slurry splashed over their hands and wrists causing 2nd and 3rd degree burns.

Occupational Injuries to Teens Working in Coffee Shops by Injury Type, Massachusetts, 1993-2002, Presented to National Chain



Source: Massachusetts Department of Public Health, Teens at Work Surveillance System

In 2003, after outreach at different levels of the corporate ladder, including presenting compelling summary data of the burn injuries at a series of meetings of franchise owners and corporate staff, corporate headquarters was successful in getting their manufacturer to release a brew basket retrofit that included a guard designed to deflect splash-back of coffee slurry away from worker hands. But years after the retrofit, TAW continued to see the same kind of burn injuries to teens in its data.

Brew basket retrofit released in 2003

In 2011, after additional investigations at franchised restaurant locations in Massachusetts, TAW gained an invitation to meet one-on-one with corporate headquarters about these repeated burn injury cases to teens. Following the meeting, TAW wrote up and mailed a summary report of the meeting to headquarters highlighting key action items—in particular, TAW's recommendation for a safer coffee machine design, and corporate's promise to follow up with their equipment manufacturer on an engineering solution. Less than a year later, there was a prototype, and in 2013 the new brewer model underwent alpha-testing in select restaurant locations.

In 2014, as a result of TAW's case ascertainment, case follow-up and outreach to corporate headquarters, a new coffee brewer with a funnel lock—which prevents the brew basket from being pulled out before the machine has completed brewing—was rolled out. As of 2015, over 3,700 brewer units had been purchased for more than 1,200 restaurants nationwide. While it's too soon to see the injury-reduction impact of the new design, the potential for impact is for all workers—not just teens—in over 13,000 franchised restaurant locations.

Funnel lock brewer released in 2014

d. Surveillance and Prevention of Sharps Injuries and MSDs among Massachusetts Hospital Workers

Significant (Key) Findings

Hospitals comply with sharps injury reporting requirements. Since the inception of the surveillance system in 2002, all MDPH licensed hospitals have reported sharps injury data annually as required, with over 2,850 injuries reported each year. We continued to streamline coding algorithms to enhance efficiency and introduced new methods of analysis (see below) as well as new ways to present the data. In recent years we have presented data by device and time of injury allowing us to identify "never events" defined as those injuries occurring after use which could have been prevented with the use of devices with sharps injury prevention features.

Sharps injury rates. Sharps injury rates have declined significantly since 2002, the first year for which data were available. Using a new analysis method, joinpoint regression, we identified inflection points in the overall trend, indicating a plateau starting in 2009. Injury rates among nurses specifically have followed a similar pattern. It is notable that less than 2% of injuries involving winged steel needles occurred with devices lacking sharps injury prevention features. This likely reflects the wide uptake of devices with sharps injury prevention features.

Regional meetings with hospitals. Sharing findings with data providers is essential step in an effective surveillance program. This period, rather than holding one meeting statewide to discuss sharps injury surveillance and prevention with hospital employee health and infection control staff as was done previously, we held three regional meetings across the state about every 18 months. With this change, there was nearly a three-fold increase in participation. These meetings provided a venue for hospitals to share success stories, identify and discuss barriers, and ask questions of one another about strategies to prevent sharps injuries. Hospital staff also provided possible explanations for trends and changes we have seen in the data over time.

Hospital Ergonomics Task Force. With support from the MDPH Commissioner, the Hospital Worker project convened a multidisciplinary task force with representatives of industry, labor, academia, federal agencies and state agencies. The Task Force reviewed new data on the burden of patient handling related musculoskeletal disorders (PH-MSDs) among Massachusetts hospital workers (see below), policy initiatives in other states, and the scientific literature on the effectiveness of Safe Patient Handling (SPH) programs. The final Task Force report "Moving into the Future: Promoting safe patient handling for worker and patient safety in Massachusetts hospitals" published in December 2014, includes multiple recommendations, establishing a blueprint for action and setting the stage for work proposed in the next project period.

Survey of Safe Patient Handling Activities. The Hospital Worker project's 2012 survey of Massachusetts hospitals regarding SPH activities, had a 90% response rate and revealed that while most hospitals had taken steps to address risks from patient handling, there was a broad range in level of implementation. About one third of hospitals lacked a written SPH policy, although nearly two-thirds had a committee to address SPH. While all hospitals provided training on SPH, only 34% provide training both on hire and annually. There appeared to be a lack of SPH equipment in some departments. This survey provides the first comprehensive

assessment of SPH activities in Massachusetts hospitals, setting a baseline to monitor progress overtime.

Burden of PH-MSDs. Analysis of three administrative data sets revealed that PH-MSD among MA hospital workers are a significant problem. According to data collected by the BLS, the rate of PH-MSDs resulting in lost time among Massachusetts hospital workers was 70% higher than the comparable rate for workers in hospitals nationwide every year (2004-2010). It was conservatively estimated that in 2010 Massachusetts hospital workers lost over 21,485 days of work as a result of PH-MSDs. According to statewide Workers' Compensation data, during 2008-10, 2,049 lost time claims were filed by hospital workers for PH-MSDs: 49% occurred among nurses, and 27% among aides. While rates were higher in larger hospitals, there was substantial variation within hospital size category. Workers' compensation data from the Massachusetts Human Resources Division revealed that 13% of notices of injury filed by public sector hospital workers involved MSDs, and 62% of these were PH-MSDs. The average cost per PH-MSD claim paid was $14,710 which was higher than the average cost for other MSD claims and more than double the average cost for non-MSD claims.

Translation

Translation is an integral part of all OHSP projects. Annual reports of findings from the sharps injury surveillance system continued to be released, since 2011 in a new short format. Findings were presented in a number of venues, from international and national meetings to graduate level academic courses. Translation work goes far beyond information dissemination. Project staff provided technical assistance regarding sharps injury surveillance and prevention to hospitals and, as discussed above, held regional hospital meetings allowing hospital employee health and infection control practitioners to learn from each other and to provide input critical to interpreting surveillance findings. The Hospital Ergonomics Task Force, established this period, was a significant step forward in engaging partners in a new initiative to reduce the high rate of PH-MSDs among Massachusetts hospital workers.

Outcomes/Impact

Project activities contributed to a number of intermediate outcomes with potential to have larger impact on improving hospital worker safety and health. Massachusetts sharps injury data, some of the most representative sharps injury data available, was shared by CDC/NIOSH and WHO and was written about in several trade publications. The Project coordinator was invited to provide a plenary presentation on a national webinar celebrating passage of the Needlestick Safety and Prevention Act and to participate in WHO sharps policy deliberations. Input of Project staff also helped shape new MDPH guidance on testing source patients. The Hospital Worker project has also documented an end outcome success – a significant decline in the overall sharps injury rate over time (2002 - 2013), a pattern seen when using either licensed beds or full-time equivalents as a denominator. The new initiative to address PH-MSDS has also had impacts. Anecdotal information indicates the MDPH survey of SPH handling activities prompted some hospitals took a renewed look at their patient handling programs The Hospital Ergonomics Task force resulted in new knowledge and new working relationships substantially enhancing state capacity to address PH-MSDs among MA hospital workers. OHSP has been increasingly recognized as a trusted resource regarding health and safety in healthcare as reflected in staff involvement in numerous state activities related to protecting healthcare workers and patients.

e. Surveillance and Prevention of Work-Related Asthma

Significant (Key) Findings

BRFSS analyses of adults with asthma by industry and occupation have yielded important lessons and sparked widespread interest. The inclusion of industry and occupation (I/O) in Massachusetts Behavioral Risk Factor Surveillance (BRFSS) telephone surveys has allowed innovative analyses. Massachusetts service workers are much more likely to report that they have asthma (15.6%), particularly those in personal care and service occupations (22.9%), compared to all workers (8.8%) (2012). A 2013 analysis of exposure to environmental tobacco smoke (ETS) at work highlighted the overall success of the statewide Smoke-free Workplace Law, but also groups of blue collar workers in maintenance, construction and transportation, that continue to be exposed to ETS. One of every four workers in the childcare industry has asthma, compared to one in ten in other industries (2015). These findings, presented at CSTE and APHA conferences, within MDPH, and at regional meetings demonstrated the utility of I/O questions in BRFSS to explore how work impacts chronic disease. Our analyses triggered use of I/O by other states, and led the MDPH Health Survey Program to highlight occupational findings in their annual report. The findings about ETS were highlighted by APHA at the 2013 Boston annual meeting, featured by the Boston Globe and redistributed nationally by news outlets.

Demonstrating the links between cleaning and disinfecting chemicals and asthma has led to safer policies. Many Work-Related Asthma (WRA) cases report their asthma is linked to cleaning and disinfecting chemicals, consistent with findings from peer reviewed literature around the world. We worked with partners to change the policy of the Division of Early Education and Care in guiding childcare centers about correct methods to clean toys, eating surfaces and diapering areas, minimizing bleach use and seeking safer alternatives.

In addition, OHSP's leadership in this arena led to an invitation to work on the NIOSH NORA Cleaning and Disinfecting in Healthcare Working Group. In May 2015, OHSP and forty international authors collaborated in summarizing a wealth of information about disinfecting practices and asthma prevention in healthcare settings, including the gaps in research about how to address prevention of healthcare acquired infections and WRA.

Completion of new MDPH asthma website, primary prevention of asthma conference and integration of WRA prevention in Strategic Plan 2015-2020. OHSP has worked to integrate WRA activities and materials into MDPH-wide efforts through the Internal Asthma Working Group. The new MDPH asthma website lists WRA as one of three key programs, with an accompanying photo and active link. OHSP helped plan a first ever "Primary Prevention of Asthma Conference" (April 2013) which applied lessons from WRA and addressed healthcare and school settings as a place to protect the public and workers. The roadmap for prevention and strategic goals for WRA are core parts of the Strategic Plan for Asthma, 2015-2020.

Timely use of workers' compensation indemnity claims for surveillance. OHSP successfully integrated a new data source in ascertaining individuals with WRA. Workers' compensation claims must be searched by nonspecific codes and interviewers must solicit information about healthcare providers. Although labor intensive, use of WC claim data has

substantially enhanced case ascertainment; initially received quarterly, in the final year of this project period, this data source has been accessed on a weekly basis, and accounted for 55% of all possible WRA cases and 16.8% of all confirmed cases.

Translation of Findings

Translation of findings is integral to all OHSP projects. Surveillance, by definition, includes application to practice. Surveillance findings must be linked with prevention efforts targeted at the identified industries, occupations and exposures to accomplish the ultimate goal of reducing WRA. Intervention activities are carried out by staff, through referrals and in partnership with government agencies, unions, employers, and community partners. The findings highlighted above demonstrate use of a new data source to enhance identification of those with WRA, analysis of general survey findings on asthma to raise awareness among researchers and MDPH partners about the links between asthma and work, integration of WRA in MDPH work on asthma and use of findings to reduce the hazards of cleaning and disinfecting chemicals in healthcare and childcare.

Outcomes/Impact

In 11 worksite investigations by OHSP, and in 12 investigations by partner agencies, direction was provided which has the potential to prevent asthma and other harm, if implemented by employers. The most demonstrable intermediate outcome evidence is provided by the changes in specific directions regarding cleaning and disinfection in childcare. We worked to implement policy change by the MA Department of Education which also impacts quality standards for childcare centers; this policy can change the practices of 40,000 early education workers in Massachusetts. Also, the collaboration between infection control and occupational health professionals in developing a framework for cleaning environmental surfaces in healthcare, published in an infection control journal, is an important step in gaining visibility for changes needed to prevent WRA in healthcare workers. The limited nature of sentinel surveillance does not provide accurate information about the underlying incidence of disease.

SECTION 2. SCIENTIFIC REPORT

a. Fundamental Occupational Health Surveillance in Massachusetts

Introduction

Established in 1986, the Occupational Health Surveillance Program (OHSP) at the Massachusetts Department of Public Health (MDPH) has extensive experience in occupational health surveillance, prevention and research. This period, the Fundamental Project enabled OHSP to continue surveillance and associated policy, intervention, and infrastructure-building activities that are basic to an occupational public health program (NIOSH, 2008). The Fundamental Project was responsive to the needs for improved surveillance data identified by multiple National Occupational Research Agenda (NORA) industry sectors, the NIOSH Surveillance and Health Disparities Programs, and the Institute of Medicine review of NIOSH programs (NIOSH, 2001; IOM-NRC, 2009; NIOSH, 2014a; NIOSH, 2014b). It also addressed multiple *Healthy People 2020* Occupational Safety and Health objectives and CDC's call for more efficient surveillance (DHHS; CDC, 2014).

The flexible nature of this Project was critical in allowing us to respond not only to a number of emerging needs but also to opportunities which, in turn, has strengthened our capacity to conduct occupational health surveillance into the future. For example, on the urging of the Massachusetts Occupational Health and Safety Team (MOHST) established this project period, OHSP completed an analysis of injuries/illnesses among local government workers using workers' compensation indemnity claim data, just as the Department of Labor Standards (DLS), the Massachusetts Coalition for Occupational Safety and Health (MassCOSH) and other groups were launching efforts to bring workplace health and safety to these workers, who are not covered by OSHA in MA. This work replaced the proposed analysis of workers' compensation claims data for state employees collected through the Human Resource Division (HRD), as HRD took the lead in this analysis, with OHSP input.

Major accomplishments of the Fundamental Project during the five year project period (July 1, 2010-June 30, 2015) are described below. Some key lessons learned and challenges are discussed. The information is organized according to the aims proposed in the initial Fundamental Project application.

Aim 1. Generate state occupational health indicators (OHIs) annually to track the occupational health status of the Massachusetts population.

OHSP generated the CSTE recommended 19-22 OHIs for 2008-2012 and submitted these data to CSTE and NIOSH for inclusion in the multi-state, web-based document. Because of a significant delay in accessing data for several of the OHIs, there is a subsequent lag time (3 years) in submitting complete data for any single calendar year to CSTE and NIOSH. Given local interest in more timely data, in 2011 and 2013, OHSP prepared an annual OHI report based on the most recent data available for 14 CSTE-recommended OHIs and two state-specific OHIs, 1) sharps injuries to hospital workers and 2) work-related injuries to teens treated in ED departments. OHI findings were used by MassCOSH in several of their reports published annually for Workers' Memorial Day and covered each year by the local media. In the 2013 *Dying for Work in Massachusetts* Report, MassCOSH highlighted OHI data on

mesothelioma. The age-adjusted incidence rate for this rare yet largely fatal cancer has been consistently higher in MA than in the nation (as much as 40% higher). High rates of mesothelioma as well as asbestosis in MA are in large part a legacy of our shipbuilding industry, but a recent analysis in which OHSP collaborated identified other occupation groups at high risk. These included automotive repair and other repair workers, underscoring the need for continued monitoring of these occupations and efforts to prevent exposure to "in-place" asbestos and asbestos products.

Having generated OHIs for 2000-2012, OHSP was able this period to continue examining trends in OHIs over time and where applicable, present OHIs by race/ethnicity and industry sector. OHSP also developed a new state-specific indicator, occupational exposure to environmental tobacco smoke, using data from the Behavioral Risk Factor Surveillance System (BRFSS) to be included in future reports. OHSP decided to track prevalence of ETS annually based on our analysis of 2010 BRFSS data; findings indicated that although on-the-job exposure to ETS had declined since the passage of the MA Smoke-free Workplace Law in 2004, prevalence among certain occupation groups was four to seven times higher than average in 2010. Additionally, we worked with other states to pilot a new indicator on work-related asthma, which was subsequently adopted by CSTE. In 2015, we generated, for the first time, the number and crude rate of work-related inpatient hospitalizations for severe traumatic injury using 2012 data, a newly accepted OHI.

On the national front, OHSP continued to play a role in facilitating the multi-state indicator process, taking a lead role in transitioning responsibilities for OHI quality review from the states to NIOSH. Specifically, we:

- With Michigan, drafted the steps required to 1) do quality assurance on individual states OHI data submissions and 2) prepare the annual Multi-State OHI Report for upload to the CSTE website
- Worked with NIOSH and other state partners to draft 'How-To' guidance for conducting multi-year trend analysis at the state level which is in the final stages of internal review at NIOSH. Specifically, OHSP drafted the section describing the types of regression (linear and Poisson) to consider when evaluating trends and the application of these statistical methods to the OHIs.
- Revised & tailored 'How-To' guidance for two indicators that NIOSH submitted for inclusion in AHRQ's National Quality Measures Clearinghouse, a repository for measures being used for quality performance and/or reporting.
- Included several OHI and other indicators as outcome measures in the Massachusetts State Health Improvement Plan. (*See Aim 5 below.*)

OHSP had initially proposed to include OHI data annually on the Massachusetts Community Health Information Profile (MDPH's queriable public information system). While data from early years in the project period were posted, more recent data have not as MDPH is in the process of substantially revamping the system. Also, the proposed multi-year OHI trend analysis was initiated but publication was placed on hold until the CSTE-NIOSH 'How-To' guidance document for assessing multi-year trends (referenced above) is released.

Aim 2. Conduct more extensive analysis of existing state data sets to characterize work-related injuries and illnesses in Massachusetts; prepare and disseminate surveillance reports on a regular basis.

Periodic analysis of existing state data sets has been identified as a basic occupational health surveillance function (NIOSH, 2008). Priorities this period included the use of workers' compensation claims data to characterize injuries and illnesses among employees of local government agencies, use of industry and occupation variables in the BRFSS data to demonstrate the utility of these data, and a more extensive analysis of hospital data sets (hospitalizations and emergency department visits) to elucidate disparities in occupational injury risks by race, ethnicity and geographic area. As a new initiative this period, substantial effort was placed on refining methods to use the American Community Survey (ACS) for characterizing the working population in MA. Partnerships with academic partners enabled OHSP to update a previous mesothelioma study (see above). Also, OHSP made key contributions in terms of data and input to inform public policy. Key population-based surveillance activities are described briefly below.

Continued a focus on public sector workers

In the previous period, OHSP used the workers' compensation (WC) lost wage claims, maintained by the Massachusetts Department of Industrial Accidents (DIA) to characterize work-related injuries and illnesses among employees of state agencies in response to the growing public concern for the health and safety of public sector workers in Massachusetts. Findings were presented in 2011 to the Massachusetts Employee Safety and Health Advisory Committee, established in response to the Governor's Executive Order 511. With the passage of EO 511, the Committee was charged with exploring approaches to improve protections for state agency workers. Through the project period, the OHSP Director continued to take an active role in this Advisory Committee, providing extensive input to the Human Resources Division (HRD) on a further analysis of WC claim data for state agency workers. These findings were included in a report to the Governor's Office detailing the Committee's key initiatives and recommendations, released in 2014 at a State House event. State legislation requiring that the safety and health measures implemented by state Executive Branch agencies be at least as protective as OSHA standards passed that same year went into effect in March 2015. OHSP's work to provide data on injuries and illnesses among state employees and active participation in the Advisory Committee contributed to this effort and our role will continue as the MA DLS implements this new law.
OHSP also continued to work with HRD (the agency tasked with monitoring injury/illness trends in the data) to enhance the quality of workers' compensation data reported by state agencies to further the use of these data for targeting prevention efforts.

In response to MA Occupational Health and Safety Team (MOHST) interest (*see Aim 4 below*), OHSP initiated an analysis of injuries/illnesses among local government workers using MA WC data maintained by DIA. This analysis as well as a technical document detailing methods have been completed; a public report is scheduled to be released in late 2015. Particularly challenging was the lack of specificity in the industry coding structure in which a substantial proportion of the claims fell into the categories of Educational Services and Public Administration. This led to the decision to report data by government function, which is used by the U.S. Census Bureau and is more specific to the activity and work

environment of local government workers (i.e., water, building/grounds, air transport). Protocols for coding government function, as well as event/cause of injury and occupation titles from narrative text were developed and refined. These efforts support ongoing, collaborative work of the MOHSTeam agencies to use data for targeting interventions to reduce health and safety risks faced by municipal workers in MA.

Data highlights. A total of 8,338 WC claims for work-related injuries and illnesses (WRIIs) resulting in five or more days of lost work were filed for MA local government workers during 2009-2011, with an average annual rate of 14.7 claims per 1,000 full-time equivalent employees (FTEs). Over 10,000 WRIIs were identified, with nearly half being sprains, strains. Almost 30% of claims were for workers in Construction, Maintenance and Repair, Productions, and Transportation occupations. Information about government function was not available for nearly half of claims, a significant limitation of the data. However, among claims with such information, most were for workers in Educational Services (56%) and Public Works (19%). Falls on the same level, slips and trips without falls, and overexertion in lifting were leading causes of WRIIs among Educational Service workers. Workplace violence also stands out as an important hazard faced by these workers. Overexertion in lifting, struck by or against object or equipment, and falls stand out as priorities for prevention among workers in Public Works. By sub-state geographic areas, five workplace Public Use Microdata Areas (PUMAs) had significantly higher rates (≥20.2 per 1,000 FTEs) compared to the state average and should be considered as priorities for preventive outreach.

This study not only added previously unavailable descriptive information about WRIIs among employees of local government agencies in MA, but also provided OHSP with a valuable opportunity to refine methods for generating WC claim rates by sub-state, geographic areas of employment and to explore multiple sources of denominator data. Using the American Community Survey Public Use Microdata Sample (ACS PUMS), we calculated FTE estimates by PUMAs representing the primary location where individuals work. This information will enable partner agencies to target high-risk areas for community-level intervention and prevention efforts. Additionally, the case ascertainment and coding methods developed will enable OHSP to use WC records more efficiently for targeted studies in the future and to share with other states. OHSP will include these methods in the CSTE Occupational Health Sub-state Measures Technical Guidance that is under development.

Demonstrated utility of industry and occupation (I/O) information in the MA Behavioral Risk Factor Surveillance System (BRFSS)

Substantial effort this period was placed on incorporating I/O in the MA BRFSS and demonstrating the utility of these data. Fundamental Project staff collaborated with staff of the OHSP WRA Project and the MDPH Health Survey Program (HSP) in this work.

Using I/O narrative data collected over the course of five years (2010 – 2014) and coded with the assistance of NIOSH, we completed several analyses and prepared several reports/factsheets using the MA BRFSS data.

- A report of asthma prevalence comparing service workers with other workers. On invitation, this work was presented to the MDPH BRFSS Working Group and the internal

Asthma Working Group where it was received with enthusiasm. It also served as a model approach for use by other states. (*See OHSP WRA Project for more details.*)

- A report on occupational exposure to environmental tobacco smoke by I/O, developed with input from the MDPH Tobacco Control Program. Findings received national coverage in several media outlets and was highlighted in the BRFSS national newsletter (*See OHSP WRA Project for more details.*)
- An analysis on the use of workers' compensation to cover medical costs of work-related injuries based on 2007 and 2010 BRFSS data updating previous findings of 2007 data alone. Results were presented to the DIA Health Service Board. Findings suggesting that some MA workers may not be receiving the WC benefits to which they are entitled prompted DIA staff to provide trainings for fiscal administrators of Community Health Centers throughout the state and to disseminate new materials for workers on workers' compensation, available in nine languages.
- An analysis examining obesity among workers by race/ethnicity in relation to occupational physical activity (OPA) at work presented at the 2013 BRFSS conference and 2013 CSTE annual meeting. Occupations were classified either as physically demanding or not. Findings showed that, overall, obesity prevalence was higher among Hispanic and Black workers. Among workers in physically demanding jobs, the racial/ethnic disparity in obesity disappeared. In an additional OHSP study that used a self-reported measure of OPA in the BRFSS, Black workers from lower SES had the highest obesity prevalence, regardless of their OPA levels. Among high SES workers, no racial/ethnic disparities were observed for obesity prevalence or OPA levels. Findings from this second study were presented at the 2014 CSTE annual meeting. These studies raised important new questions about the impact of work, occupational segregation by race, and occupation-specific demands on health and health outcomes.
- Data on five health status indicators by 13 occupational groups were included in the 2012 MA BRFSS Report. The five indicators included asthma, obesity, smoking, fair/poor health status, and inability to see doctor due to costs. More recently, OHSP worked closely with HSP in preparing a special report summarizing 23 health indicators in the MA BRFSS by 20 industry groups and by 16 occupation groups (approved for release October, 2015). The introduction, developed with input from OHSP Advisory Board members, frames work as an important determinant of health to aide our MDPH colleagues and other public health partners in understanding the impact of work on health and in interpreting these data. This report may serve as a template for adaptation by other states.
- An analysis of asthma prevalence among childcare workers revealing a twofold increase in prevalence compared to the statewide average for the working population; findings were presented at the 2015 CSTE conference and in the Fall 2015 *Occupational Lung Disease Bulletin*. (*See OHSP WRA Project report for more details.)*
- Collaborated with Washington State and New Hampshire on a tri-state study using 2011 data to examine health insurance coverage among employed persons by I/O. Still in progress.
- On invitation, presented to colleagues from the University of Massachusetts Lowell findings from an analysis of MA BRFSS data examining the effect of occupation grouping on the relationship between occupational exposure and health outcomes when using population based survey data.

See additional information about BRFSS activities under aim 5 below.

Promoted inclusion of workers compensation (WC) claim data in a new source of data, Massachusetts All Payer Claims Data (APCD)

OHSP submitted testimony to MDPH in support of inclusion of WC claims in the APCD in response to a public request for information (RFI) from the MA Center for Health Information and Analysis (CHIA). This testimony was incorporated into a broader MDPH-wide response to the RFI and submitted to CHIA in October 2013. OHSP also worked to raise this issue nationally through APHA and CSTE. This has proven to be a complex policy issue in MA related to limitations in the scope of the legislation enabling development of the database.

Addressed the needs of underserved and/or vulnerable worker populations: other key population-based activities

- In follow-up to our previously funded Community Health Center Project, we collaborated with a large local health system to provide data to NIOSH for a study to code and analyze 45,000 patient occupation titles collected at registration by the health system-affiliated community health centers in 2010. Initial findings were included in comments advocating for the inclusion of industry and occupation as certification requirements for electronic health record (EHR) software submitted by both NIOSH and MDPH to the Health IT Standards Committee of the Office of the National Coordinator.
- Collaborated with NIOSH and other states on an MMWR publication characterizing non-fatal occupational injuries and illnesses among older workers.
- Prepared a draft of an Occupational Health Disparity report, engaging the OHSP Advisory Board to provide input on content and practical recommendations for public health practitioners and policy makers. This draft updates and expands the section on occupational health disparities included in the MDPH-wide "Health of Massachusetts" Report and a related Powerpoint presentation (posted on OHSP website), both released last period. In this period, several of these findings were presented by the MDPH Commissioner in the broader context of health inequities (June 2011 Webinar hosted by ASTHO). The Commissioner also used these findings in his outreach to the public health regions in the State. Finalization of this report was delayed due to the departure of the OHSP staff member working on the project but will be completed in the new project period.
- Work was initiated this period looking at occupational injury rates by smaller geographic area in the state (PUMA) and by race/ethnicity (within these sub-state PUMAs) using inpatient hospitalization and emergency department data. We piloted the use of the American Community Survey to generate estimates for FTEs which served as the denominator for these rates As mentioned above, we are exploring the use of ACS as a denominator data source for injury rates by sub-state level and race/ethnicity because of this survey's diverse data elements and ability to produce robust estimates. MyDzung Chu of OHSP presented in a national webinar hosted by the Council of State and Territorial Epidemiologists (CSTE) on this use of the ACS in occupational health (April 2015). These efforts have laid the groundwork for additional work proposed in the new project period.
- The OHSP director also contributed to an article describing the role of state and local health departments in developing integrated public health approaches to reducing health inequities among low-income workers.

Contributed data and other input to inform public policy

- OHSP included Massachusetts data on inpatient and outpatient hospital treatment for work-related conditions in comments submitted to OSHA on the proposed changes to the OSHA record-keeping rule. New OSHA regulations were passed that expanded employer requirements to actively report amputations and inpatient hospitalizations. OHSP input was cited in the preamble. In summer 2015, OHSP in collaboration with the Office of Statistics at federal OSHA, completed a preliminary analysis to evaluate whether employers are compiling with the new regulation requiring employers to report all amputation cases. (*See Aim 3 below.*)
- MDPH incorporated OHSP input in its testimony on Meaningful Use Stage 3 submitted to the Centers for Medicare & Medicaid Services (CMS) advocating for the incorporation of I/O information as certification criteria for EHR software. These comments included findings from our prior NIOSH-funded project with Cambridge Health Alliance as well as results from our beta testing of the NIOSH Industry and Occupation Computerized Coding System (NIOCCS) – a web-based application developed to convert I/O free text to standardized Bureau of Census I/O codes. Our collaboration with other CSTE members to prepare and disseminate background materials on I/O in EHRs was also fruitful, contributing to the submission of over 300 stakeholder comments on I/O to CMS.
- Amendments to the MDPH disease reporting requirements proposed by OHSP were adopted in December 2013. Specifically, mandatory reporting was expanded to include all occupational lung diseases and allow MDPH access to medical records for all work-related injuries. This significant policy change set the stage for expanding activities to conduct surveillance of all work-related lung diseases and work-related injuries to young adults in the new project period.

Aim 3. Continue a limited level of case-based surveillance of selected serious occupational health conditions that require immediate public health response to assure that hazards are controlled.

A state occupational health surveillance program should have the capacity to respond to serious occupational health conditions that "signal a need for immediate intervention to prevent additional morbidity" (NIOSH, 2008). Even though the surveillance program may not have the resources to intervene in identified worksites, it should have the working relationships in place with those in positions to take action.

New access to poison control center data

After completion of a six-month pilot in 2013, OHSP fully implemented the system for receiving and reviewing bi-weekly reports of work-related poisonings (electronically via secure email) from the Massachusetts-Rhode Island Regional Center for Poison Control and Prevention (PCC). The PCC receives approximately 42,000 poisoning-related calls and 6,000 inquiries from Massachusetts each year. Since July 2013, 464 work-related exposure calls were made to the PCC, with a median of 18 calls a month. Access to this timely data allowed OHSP to refer a case of a worker exposed to spray polyurethane foam to OSHA for follow-up; OSHA's Special Emphasis Program on isocyanates made this an opportune referral. Additionally, OHSP access to PCC data provides case-level information about the emergence or clustering of chemical exposures at work. For example, when Washington State recently released a hazard alert on exposure to occupational hydrofluoric acid, OHSP was able to

review our PC data and found similar exposures among Massachusetts workers. These findings and the hazard alert were disseminated back to the PCC staff.

The impact of this collaboration has been significant not only because it allows OHSP access to an ongoing sentinel source of data about chemical and other exposures not likely captured elsewhere, but it has also fostered a real partnership in surveillance between OHSP and the PCC. PCC Staff continue to ask key employment questions of callers reporting work-related exposures, on the bequest of OHSP. These questions include occupation, business type, task being performed at time of exposure, employer name, and city/town of employment. OHSP has provided feedback and conducted trainings to the toxicology residents rotating through the Center on how to ask employment questions, common occupational chemical exposures and workplace safety and health. OHSP continues to participate on the PCC's advisory board and recently published a blog on work-related poisonings.

Identification and referral of serious burns and amputations

In 2003, OHSP began implementing surveillance of serious work-related burns (burns covering 5% or more of body surface area) reported by emergency departments on a flow basis to the Massachusetts Burn Injury Reporting System (M-BIRS) in the Department of Fire Services (DFS). MDPH has statutory access to the M-BIRS data. All burns checked off as "work-related" on the hospital reporting forms are faxed by DFS to OHSP. OHSP reviews the reported cases to determine if worksite intervention is necessary, and refers select cases to OSHA or other agencies for follow-up. OHSP receives reports from OSHA about the outcomes of the investigations (e.g., citation made). Results are reported to the DFS and included in the M-BIRS annual report, disseminated to all Massachusetts hospitals.

Surveillance of serious work-related burns continued this period; 170 cases were reported to MDPH and 72 cases were referred to OSHA, and several more to other agencies. OSHA had not been previously notified of 56 of these referral cases.

Case-based surveillance of amputations identified through workers' compensation (WC) records was fully implemented this period. A significant enhancement was the implementation of a new secure system to electronically transfer the WC data from the Department of Industrial Accidents (DIA) to OHSP weekly. Previously, OHSP relied on manual review of a weekly printout of hundreds of printed claim summaries in order to identify amputations and other priority conditions under surveillance by the Fundamental and other Expanded Projects. With the new electronic format, OHSP staff download the data weekly from a secure server, import into an Access database, and run a number of custom queries to produce data reports for each priority condition. Data can then be exported directly to the appropriate surveillance database. This new process eliminates the substantial data entry required with the old paper system. Also, timely access to additional injury narrative information, now available through the electronic system, has increased the efficiency with which OHSP makes referrals to OSHA as well as the accuracy of these referrals.

A total of 303 amputations were referred to OSHA and 20 public sector cases were referred to DLS. For nearly 90% of the cases referred to OSHA, OHSP's referral was OSHA's first

notification of the amputation. Of the 262 amputation referrals for which we have outcome data, 78% resulted in inspections, of which 66% resulted in citations. For the remaining 22%, OSHA did not conduct inspections but sent a formal notice to the employer requesting they address the hazard. A preliminary analysis to evaluate whether employers are complying with the new OSHA regulations requiring employers to report all amputation cases found that 60% of the 48 private sector amputations identified between 1/1/15 and 6/3/15 were reported to OSHA by employers. The percentage of total amputations that OSHA was not aware of prior to the OHSP referral decreased from nearly 90% (before the new rule went into effect) to 40%.

OHSP continued to meet annually with OSHA this period to discuss the outcomes of our referred cases (e.g., investigations completed, citations made, other worksite interventions). OSHA has reported that these referrals have promptly and effectively resulted in action to correct identified hazards, and OSHA staff continue to welcome our referrals as a means of targeting their enforcement activities.

OHSP's successful collaboration with Region 1 OSHA was shared at the 2011 CSTE national meeting, following which OHSP took the lead with Michigan to develop a 'how to' guide for making referrals that was adopted by CSTE, *Guidance: Public Health Referrals to OSHA*. This guidance document was presented by the Fundamental Project's Intervention Coordinator (on behalf of CSTE) at a meeting of OSHA Regional Directors in Washington D.C.

Aim 4. Continue and enhance working relationships with stakeholders to obtain input on program priority and to promote use of surveillance findings to improve worker safety and health.

Working relationships with data providers and those in positions to use surveillance data for action are essential to build surveillance capacity and to assure the critical link between surveillance and intervention. External partners are necessary to assure that the program is responsive to local needs and in meeting its objectives (CDC, 2012). They can also provide needed technical expertise and advocate the surveillance program.

Strengthening the state infrastructure to protect worker safety and health
A highly successful advance this period has been the establishment of the MA Occupational Health and Safety Team (MOHST), initiated by OHSP with support of agency leaders. Co-chaired by the Directors of OHSP and DLS, the MOHSTeam has significantly enhanced collaboration among the multiple government agencies that share responsibility for worker safety and health in MA. The team includes representatives from MDPH, DLS, the Attorney General's Office, DIA, and federal OSHA. Meetings have been held quarterly since October 2010, leading to multiple collaborations and accomplishments including, among others:

- Collectively used data for documenting the health and safety needs of local government workers and for targeting interventions to reduce their workplace risks (*See Aim 2.*)
- Jointly developed and disseminated FACE materials on health and safety responsibilities of temporary agencies which led to the collective hosting of trainings for temporary and host employers on best practices. (*See FACE Project report*.)
- Coordinated state agency efforts to promote the MA Campaign to Prevent Construction Falls (*See FACE Project report.*)

- Implemented labor assurances for the MA Wellness Tax Credit. (*See Aim 5 below.)*
- Collaborated on an OHSP grant application to NIOSH for funding to maximize use of WC data for surveillance and prevention. OHSP was awarded this three-year funding in Spring 2015.
- Jointly held interagency training on wind turbine safety
- Formed a new collaboration to coordinate laboratory reporting of adult and childhood blood lead levels through the development of a centralized, web-based electronic system
- Collectively updated the employment permit forms required under state Child Labor Laws (*See Young Worker Project report.)*

See related success story in this closeout report.

Collaborations with universities

Collaboration with local academic institutions can expand state surveillance capacity, promote research relevant to local community needs, and provide an important public health training ground for future occupational health professionals. Over the project period, a number of students/residents worked at OHSP to complete projects, and OHSP staff regularly lecture in local academic programs. OHSP also continued to serve as a public health practice residency rotation site for occupational medicine residents from the Harvard School of Public Health (HSPH); on average, four residents each year have completed OHSP rotations. Additionally, OHSP collaborated with a local researcher on a study of mesothelioma incidence in MA by I/O. (*See above.*)

OHSP Advisory Board

The OHSP Advisory Board, comprised of 25 occupational health and safety experts and advocates, plays a key role in assuring that the program is responsive to the needs of the community and provides an important vehicle for assuring collaboration among the various groups in the state working to improve worker health and safety. The Board met two - three times annually throughout the project period. During 2014, the Board provided extensive community input into OHSP's application for continued funding of the Expanded Occupational Health Surveillance Program.

Casino worker safety and health

Legislation legalizing gambling in MA established a public health prevention trust fund to support research to address public health impacts of gambling in the state. OHSP, with input from community partners, developed a brief on the need to address health and safety issues of casino workers in the strategic plan for the trust fund under development.

Coordinated with CSTE, NIOSH and staff from other states in planning the 2015 CSTE Annual Conference

OHSP played a leadership role in planning the Sunday Occupational Health Sub-committee Workshop and the Occupational Health Track at the CSTE Annual Conference held in Boston (June 2015).

Occupational cancer surveillance

OHSP provided a letter of support for an internal NIOSH NORA project to expand use of state cancer registry data for occupational cancer surveillance. This project was funded, and OHSP has helped facilitate NIOSH access to the MA Cancer Registry data.

New partnership with agency assisting immigrants in MA
OHSP also established a new working relationship with the MA Office of Refugees and Immigrants (ORI), a state entity responsible for assisting new immigrants and refugees settle in the state. Based on input from ORI employment specialists about the needs of their clients, OHSP provided information about workers' rights as well as health and Safety resources tailored to the worker population that ORI serves. OHSP also linked ORI staff with worker centers in MA for additional resources.

Aim 5. Collaborate with other public health programs to foster integration of occupational health into ongoing public health activities at the state and local levels.

Integrating occupational health into mainstream public health practice is an OHSP priority and is intrinsic to the program. OHSP staff have continued to participate in multiple intradepartmental working groups formed to address different public health concerns. Many of these integration activities were undertaken as part of specific OHSP Projects described elsewhere in this final report. Integration priorities for the Fundamental Project this period fell into four areas described below.

Promoted inclusion of industry and occupation (I/O) information in the BRFSS
An important integration success this period was OHSP's work in conjunction with the MDPH Health Survey Program (HSP) to promote the inclusion of information on I/O in the BRFSS Survey internally in MDPH and to ensure some level of quality reporting of these data. The BRFSS Coordinator in HSP has been a strong supporter of the utility of the I/O data collected through BRFSS and has advocated, on OHSP's behalf, for their continued inclusion at national BRFSS Coordinator meetings. The Fundamental Project, with the WRA Project: 1) modified the I/O questions and worked with the survey vendor to embed 'user prompts' to aid the interviewer in asking a respondent about his/her job; 2) drafted and annually updated the I/O section of the MA BRFSS interviewer training manual and other materials; 3) participated in interviewer trainings; and 4) monitored narrative text 'literals', real-time interviews as well as transcripts of interviews and provided feedback to both HSP and the survey vendor. It was through the quality monitoring techniques in 4) that OHSP identified issues with how the I/O questions were being asked and how respondents were answering these questions. OHSP has continued to participate in the MDPH BRFSS Working Group.

OHSP also worked to promote incorporation of I/O in the BRFSS nationally, participating in the BRFSS I/O Workgroup facilitated by CSTE and NIOSH. As part of this effort, we provided extensive input to NIOSH to inform their efforts to promote collection of I/O in the BRFSS nationwide. NIOSH acknowledged our contributions (interviewer training materials, etc.) in their successful bid to get the industry and occupation questions added as an optional module to the BRFSS nationally in 2013. We also provided SAS code that grouped I/O codes into standard coding schemes (Census, NAICS, SOC) that was shared with Workgroup members through an FTP site.

Continued focus on integrating occupational safety and health with worker wellbeing
OHSP continues to collaborate with MDPH worksite wellness initiatives and has been instrumental in building relationships between the MDPH Division of Prevention and

Wellness and the two NIOSH-funded centers for Total Worker Health (TWH). OHSP shared the findings pertaining to worker health and safety from the MA 2008 Worksite Health Improvement Survey at two annual meetings, the Northeast Regional Occupational Health Surveillance meeting and CSTE annual meeting. OHSP also collaborated with academic partners from UMASS Lowell on a further analysis, published in 2013, that examined the relationship between health promotion and protection activities in MA workplaces. OHSP added new questions related to occupational health to the revised survey instrument used to conduct the MA Worksite Wellness Benchmarking Survey in 2014. With input from OHSP and academic partners, the MDPH Working on Wellness Program incorporated TWH concepts in their guidance for small employers developing worksite wellness programs.

Additionally this period, the MOHSTeam (*see Aim 4 above*), worked to ensure that the eligibility criteria for employer tax credits granted through MDPH for implementing a worksite wellness program included labor assurances. To be eligible for the tax credit, an applicant employer must carry workers' compensation insurance and have had no repeat or willful violations of OSHA standards or Wage and Hour laws within the last several years. MA DLS has conducted labor assurance reviews of approximately 30 employer applications to date.

Legislation establishing the MA Prevention and Wellness Trust Fund (PWTF) has provided MDPH with new funding to expand worksite wellness initiatives. Beginning in late 2015, seed funding for establishing wellness programs will be made available for up to 400 MA employers with less than 300 employees over the next three years. OHSP participated in the review of proposals submitted by outside organizations to implement this program. OHSP also facilitated a presentation to the PWTF Advisory Board. on the use of incentives in wellness programs delivered by the Co-Director of the Center for the Promotion of Health in the New England Workplace, a NIOSH Total Worker Health Center for Excellence at UMASS Lowell.

Involvement in the MDPH public health accreditation process

MDPH has been in the process of applying for public health accreditation through the Public Health Accreditation Board. Early on, OHSP was successful in getting a chapter on occupational health included in the required State Health Assessment, which proved to be a critical milestone in being invited to participate in the next phase - the creation of a State Health Improvement Plan (SHIP). The SHIP was developed in collaboration with outside partners so OHSP enlisted occupational health colleagues from the community to participate in this process. While we were not successful in making prevention of work-related injuries and illness a separate priority "domain," we were successful in getting occupational health measures and/or strategies embedded under multiple public health domains in this document, including, among others, Injury Prevention, Environmental Risk Factors and Health, Chronic Disease Prevention and Control, and Infectious Disease Prevention and Control. Lessoned learned from OHSP's experience in this process to date were presented at the 2015 Regional Northeast Occupational Health Surveillance conference. OHSP staff will continue to actively participate in the next steps of the accreditation process.

Expanded OHSP's use of social media

With other Expanded Program Projects, the Fundamental Project expanded use of social medial tools to disseminate findings and prevention recommendations and to raise awareness of occupational health, including Twitter and the MDPH Blog. We also were

successful in advocating for a new workplace health and safety section on the MDPH blog. (*See the Young Worker and FACE closeout reports for more details.*)

Aim 6. Promote regional collaboration to enhance state capacity to conduct occupational health surveillance and prevention activities.

For the last 24 years, OHSP has participated in an informal network of state OSH surveillance programs in the Northeast (ME, VT, NH, CT, NY & NYC, MA, NJ, RI). OHSP has taken the lead together with the CT DPH, UCONN Health Center, and more recently, the New York Center for Agricultural Medicine and Health (NYCAMH) in co-hosting the annual Northeast Regional Occupational Health Surveillance meeting where states meet informally in May to share surveillance methods, materials, and experiences and identify issues in common that they can work on collectively. The Fundamental Project has enabled OHSP to strengthen this regional collaboration over the last five years by maintaining and updating a distribution list and providing resources necessary to continue to meet annually. OHSP has taken the lead in planning logistics and program content for these meetings for the last four of five years. In 2015, the CT DPH Occupational Health Program took on this role, and we anticipate that this responsibility will be rotated among the states. Last Spring (2015), over 40 people attending representing state/city health departments from five states as well as NYCAMH, NIOSH, the New Jersey ERC, the Harvard ERC, Connecticut OSHA, Rutgers University, and the University of Connecticut.

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b. Massachusetts Fatality Assessment and Control Evaluation (MA FACE) Project

Introduction

The Occupational Health Surveillance Program (OHSP) at the Massachusetts Department of Public Health (MDPH) has had NIOSH funding since 1990 to establish a state-wide system for surveillance, investigation, and prevention of fatal occupational injuries. The Massachusetts FACE Project has provided aggregate data that have identified high risk industries and populations, while the in-depth investigations have provided the specific data on interaction of the worker, the work environment and work processes necessary to develop recommended prevention strategies. FACE investigations have likewise provided the stories or "faces" necessary to make the statistics real and influence public policy makers, and they have served as an important vehicle for providing technical assistance to employers in Massachusetts.

In July 2010, MDPH-OHSP received funding through the Cooperative Agreement to continue and enhance the Massachusetts FACE Project. Major activities undertaken to accomplish the aims of the FACE Project during the subsequent five years (July 1, 2010-June 30, 2015) of the project period are described below. Key lessons learned are discussed. The information is organized according to the aims proposed in the initial FACE Project application. A special highlight this project period was the successful two and one half day annual FACE meeting held in Boston, MA during October 2011, which MA FACE planned, coordinated and chaired.

Aim 1. Surveillance: Maintain the current surveillance system for timely identification and collection of data on all fatal occupational injuries to identify high risk workplaces and populations in Massachusetts.

OHSP has continued to work closely with the Massachusetts Census of Fatal Occupational Injuries (CFOI) and numerous municipal, state, and federal agencies to identify and document all fatal occupational injuries in Massachusetts on a flow basis. Staff use over 25 diverse sources, including, death certificates, OSHA records, and media reports. MA FACE operates a 24-hour Occupational Fatality Hotline and receives calls from police, fire, local Boards of Health, town clerks and medical examiners (ME) to identify and verify these deaths. Our close collaboration with MA National Violent Death Reporting System (NVDRS) and the NIOSH Alaska Pacific Regional Office has assured that all violent deaths in the workplace and fishing-related deaths are documented. MA FACE has negotiated reciprocal agreements with OSHA Region I and the Massachusetts Department of Labor Standards (DLS) to immediately report work-related deaths. This five year project period, we identified 44% of all fatalities by the day following the incident and 60% within ten days of the incident. These percentages are similar to those for the prior project period

OHSP has developed and now uses the Massachusetts Work-related Fatality database to document each fatality. We use this database in conjunction with our previously developed source tracking system to help coordinate and track all telephone or written follow-back to potential information sources. Follow-back is conducted to request additional information and documents that will ensure all in-scope fatalities are confirmed as work-related and that all database variables can be completed for these cases. Since July 2010, 282 fatalities

have been identified and documented. MA FACE has submitted a monthly report to NIOSH summarizing each month's targeted fatalities throughout the project period.

MA FACE has placed additional emphasis on collecting information about union information for all identified fatal incidents. We worked with MA CFOI and the Bureau of Labor Statistics (BLS) on a white paper documenting the availability of information on the union status of victims. We have found that union information is rarely available in the usual data sources but it is feasible to obtain in other ways. MA FACE, MA CFOI and BLS collaborated to write up these results for an article that will be published in the *Monthly Labor Review* (currently under review).

Established procedures are followed to ensure confidentiality of FACE information. Electronic data are maintained in password protected files. Names of persons interviewed are deleted from paper files when case reports are completed. Data sharing between FACE and CFOI is done in accordance with FACE and CFOI confidentiality rules and with data sharing agreements that have been established with data providers. Death records are public in Massachusetts which allows us to share some information in select cases with community partners who help us gather information about immigrant worker deaths.

Aim 2. FACE Investigations: Conduct a minimum of ten on-site investigations of targeted fatalities per year using FACE investigative methods to identify risk factors and develop recommended countermeasures to control or eliminate identified risks.

MA FACE initiated 47 investigations and was able to conduct 28 of these investigations using FACE investigative methods during the current project period. We have continued to struggle with getting employers to agree to participate in a FACE investigation. There have been multiple instances this period where MA FACE was able to schedule an investigation with an employer only to then a few days later receive a call back from the employer or an attorney representing the employer to cancel the site visit. Initiating self-employed fatality investigation has also been challenging. This process starts with sending a letter to the victim's next-of-kin and asking for their participation. This period MA FACE has not heard back from any of the next-of-kin for the self-employed victims we have reached out to, resulting in MA FACE not continuing with these investigations.

Deaths targeted for investigation during the project period included: machine-related and work-zone incidents; deaths of immigrant and minority workers; deaths due to chemical exposures; deaths of public sector workers; and youths less than 25 years of age. During the grant period in MA no youth less than 18 years of age were fatally injured at work, but MA FACE did complete investigations of three serious, nonfatal incidents involving high school students less than 18 years of age when requested by Department of Elementary and Secondary Education (ESE). These three incidents occurred either during shop class or in-school placements. Fatal incidents investigated this period are summarized in Table 1.

Table 1. MA FACE investigations by event and population, July 2010-June 2015

Event Type	Immigrant	Temp Worker	Young Worker <25	Public Sector	Other	Total
Fall-related		1		1	2	4
Machine-related	1*	1	1	1	4	8
Work zone/on the road				6	2	8
Struck-by	1		1			2
Other	1		3	1	1	6
Total	3	2	5	9	9	**28**

* One MA FACE investigation was a machine-related incident of an immigrant young worker. This investigation is counted only once under the immigrant targeted condition.

OHSP has a longstanding interest in work-related injuries to youths under age 18 and conducts statewide surveillance of nonfatal as well as fatal injuries in this population. MA FACE has collaborated with the OHSP Teens at Work (TAW) Project using the FACE methodology to investigate serious nonfatal incidents as well. As noted above, this period, MA FACE along with TAW Project was requested by ESE to investigate three serious nonfatal incidents involving two vocational and one traditional high school students.

Improving the health and safety of MA public sector workers is a state priority. In 2012, the Governor issued an Executive Order directing state agencies to develop an employee health and safety management system and new legislation that extends OSHA level protections to state employees within the executive branch went into effect in 2015 (MGL Ch.149 S.6, Bill 3988). OHSP has been active in this initiative, analyzing data on fatalities and injuries among state workers to inform this effort. MA FACE has collaborated with the Department of Labor Standards (DLS) and jointly investigated seven of the nine public sector workers deaths that MA FACE investigated this period.

Temporary workers are at high risk of being injured at work and the complex issues surrounding shared employer responsibilities for the health and safety of temporary workers has made the health and safety of temporary workers a priority for Massachusetts. MA FACE has seen firsthand the importance of focusing on temporary workers, having conducted two temporary worker fatality investigations in this grant period. These deaths led us to develop the 2012 *FACE Facts*: *Temporary Agencies and Worksite Employers Share Responsibility for Keeping Temporary Workers Safe*. This *FACE Facts* was released in conjunction with a campaign supporting proposed MA legislation giving temporary workers rights to know more about jobs to which they are assigned. MA FACE worked closely with DLS, the department charged with licensing temporary agencies in MA, in disseminating this *FACE Facts* to over 900 licensed temporary agencies in Massachusetts, Worker Centers, Career Centers, and to trade associations of industries with high numbers of temporary workers. It was also disseminated nationally by the American Staffing Association, OSHA, and the National Solid Waste Association. MA FACE efforts helped with the passage of the

landmark Temporary Worker Right to Know Law (MGL Ch.149, S.159C). This law requires staffing agencies to provide temporary employees with written notice about basic information pertaining to their job placements and is enforced by DLS. Notably, the MA *FACE Facts* on temporary workers was one of the earliest in a series of recent documents highlighting risks faced by these workers and has served as a model for other states. A MA FACE report on a temporary worker death was also highlighted as the lead example in the more recent OSHA/NIOSH guidance document *Recommended Practices: Protecting Temporary Workers*.

FACE reports including recommended countermeasures that move beyond compliance to identify innovative prevention strategies are prepared for completed investigations. MA FACE has finalized 25 reports this project period. Several additional reports are currently in various stages of development or review. We have continued and expanded relationships with a variety of labor, industry, and academic experts to enhance our technical skills in developing innovative yet feasible recommendations.

Aim 3. Information Dissemination: Disseminate information on high-risk work environments, workplace risk factors, and injury prevention to stakeholders who can intervene in workplaces throughout the state.

A new initiative this period was a gradual increase over the years in social media use to promote FACE activities. In particular, we used combinations of MDPH's Twitter account, blog, and homepage to promote the Massachusetts Campaign to Prevent Falls in Construction.

FACE Reports. FACE reports are routinely disseminated to those involved in the incidents (employers, worker representatives, police, medical examiners, etc.). Next-of-kin are now contacted while an investigation is occurring and are offered the option to participate and/or ask questions about the investigation. The next-of-kin are notified once FACE reports are finalized and are provided with copies of reports upon request.

Twenty-five FACE reports have been disseminated since July 2010 with tailored evaluation forms. All FACE reports are routinely distributed to a core group of stakeholders in the state that includes dozens of organizations and individuals. In addition, for each FACE report, staff develop a specific dissemination list that includes relevant unions, trade associations, employers and others in positions to effect change in the industry. For example, this period we have developed targeted mailing data bases for bathtub refinishers, landscapers, arborists, crossing guards, refuse collectors, and industries with a large percent of temporary workers. This project period 44% (n=38) of MA FACE report and *FACE Facts* evaluation respondents reported that they will do something differently as a result of receiving the material. In addition, relevant NIOSH alerts, OSHA health and safety bulletins and FACE materials from other states have been included with the MA FACE reports in several of the industry-wide mailings.

FACE Facts. We recognize the importance of short, user-friendly materials and periodically develop two-page *FACE Facts* based on FACE investigations that can be posted in workplaces. As shown in Table 2 below, seven *FACE Facts* have been developed and

disseminated this project period. Many were published in several languages, reflecting our program's longstanding commitment to reach underserved worker groups.

Table 2. MA FACE Material Dissemination – July 2010 - June 2015				
Title	**Hardcopy**	**E-mail**	**Requested ***	**Web Hits**
MA *FACE Facts*				
City Laborer Dies after Falling Off a Moving Refuse Collection Truck (English, Spanish, Portuguese) – March 2010	498	N/A	156	5,163
City Laborer Struck and Killed by a Motor Vehicle while Closing a Water Gate Valve (English) – October 2010	486	N/A	149	1,253
Temporary Agencies and Worksite Employers Share Responsibility for Keeping Temporary Workers Safe (English, Spanish, Portuguese) – April 2012	36	via American Staffing Assoc.	275	6,328
Bathtub Refinisher Dies from Exposure to Methylene Chloride (English) – April 2012	893	N/A	386	3,098
Protect the Crossing Guards that Protect Our Children (English) – October 2012	1,000	1275	350	4,687
Ladder Safety for Painters: Prep Before You Step (English, Portuguese) – October 2013	335	N/A	1,231	1,257
Employees Must Wear Fall Protection when Working from Aerial Lifts (English) – January 2014	947	N/A	601	2,973
Use skid-steer loader lift arm supports during maintenance that requires lift arms to be raised (English) – June 2015	In progress			20
Fall Prevention in Construction				
Having work done on your roof? Ask your contractor to play it safe (English)	44	N/A	2,060	1,679
Falls: The Leading Killer on Construction Sites (English, Spanish, Portuguese)	811	474	7,015	9,507
Ladder Safety: For Residential Construction Contractors (English, Spanish, Portuguese)	811	474	6,994	12,937
Scaffold Safety: For Residential Construction Contractors (English, Spanish, Portuguese)	811	474	6,538	10,766
PFAS Safety: Personal Fall Arrest Systems For Residential Construction Contractors (English, Spanish, Portuguese) – Nov. 2012	87	474	5,011	9,434

*Fax forms to request additional copies are included when disseminating *FACE Facts* and have proved a useful tool for obtaining feedback on how the information has or will be used to promote change in the workplace.

We have placed increased emphasis on translating select FACE reports and *FACE Facts* and disseminating these materials through trade publications and other appropriate media to reach workers and others. Various MA FACE products have been highlighted 21 times throughout this project period in numerous media avenues (see ***Other publications and presentations*** section***)***. MA FACE continued to provide content that is included in the

annual publication *Dying for Work in Massachusetts: Loss of Life and Limb in Massachusetts Workplaces*.

Outreach to public sector. This period MA FACE continued an emphasis on outreach to the public sector. We collaborated with DLS to disseminate health and safety materials to the 384 local public works / utility departments in Massachusetts. The first mailing focused on crossing guard safety and included a the MA *FACE Facts Protect the Crossing Guards that Protect Our Children* and a Bulletin developed by DLS *Recommendations for Crossing Guard Safety*. We also worked with the MA Registry of Motor Vehicles to have information about crossing guards added into the June 2013 edition of the MA Driver's Manual.

The second joint outreach was on wearing fall protection when working from raised aerial lifts. This project period MA FACE investigated two similar fatalities of municipal workers working from raised aerial lifts without fall protection and also identified several other similar serious injuries. In both of the investigated fatal incidents, the truck-mounted aerial lifts were positioned in intersections, accessing traffic lights, and were struck by tractor-trailers, knocking the worker out of the raised bucket. We mailed out our MA *FACE Facts* on this topic to municipal departments of public works and gas and light departments, and police departments. Also DLS has been handing out our *FACE Facts* when they visit municipalities for inspections and injury investigations.

Distribution of Portuguese language materials.
In addition to routine translation of select educational materials into Portuguese in order to reach the sizable Brazilian workforce in MA, MA FACE filled an OSHA request for 1,500 copies of MA FACE health and safety materials in Portuguese to hand out at the 2011 Brazilian Expo – USA that was held in MA.

Other publications and presentations. MA FACE also disseminates information through speaking engagements with industry, labor, and academic groups, and has developed case studies based on FACE investigations for use in teaching. Examples of presentations this project period include Massachusetts Highway Association, Massachusetts Temporary Worker Training Seminar (two presentations), multiple DLS/OSHA sponsored fall prevention trainings, and annual lectures in several courses at the Harvard School of Public Health (HSPH). Our academic colleagues at several institutions also report using FACE reports in their courses.

MA FACE has had success this period in publishing case reports in partner agency publications, including OSHA, NIOSH and CPWR, as well as in a number of third-party publications, including several articles in American Society of Safety Engineers, National Trucker Association, National Safety Council, Tree Care Industry Association, Asphalt association, Lift and Access, and HGTV. In addition, CPWR and American Road and Transportation Builders Association transformed two MA FACE reports into compelling short videos.

In addition, MA FACE has actively disseminated materials that others have developed throughout MA. This includes sending New York FACE snow making safety materials to all MA ski areas and OSHA fall prevention campaign materials to MA residential roofers. FACE

has also used Twitter to promote some topics and materials, such as the NIOSH/OSHA joint hazard alert on methylene chloride hazards for bathtub refinishers.

Data reports. OHSP has annually published a surveillance update on fatal occupational injuries in Massachusetts, integrating information from both CFOI and FACE. Annual updates are disseminated each year to a mailing list of over 3,200 individuals, agencies and our network of Hotline reporters. This period, we have analyzed and are in the process of completing a six-year report *Fatal Occupational Injuries in Massachusetts, 2008-2013*. This multi-year report will be going into review within the next few months.

Some key findings from this multi-year report include that falls to a lower level continue to be the leading single cause of injury death at work in MA, accounting for just over a fifth of all injury deaths. Suicides were the second, followed by motor vehicle crashes. The construction industry, with the highest count and the second highest occupational fatality rate, continues to be a priority for targeted intervention in MA. The construction industry also accounted for the greatest percentage of fatalities among minority workers and foreign-born workers. Workers of Hispanic origin had a higher rate of fatal occupational injury than White non-Hispanic workers. Approximately one in five workers fatally injured at work was born outside of the United States, and the fatality rate among foreign-born workers was higher than the rate for U.S.-born workers.

With the increasing visibility of MA FACE, OHSP also has responded to numerous public information and media requests for statistics regarding occupational fatalities on an ongoing basis. One example is falls in residential construction. This led us to write the multi-year report *Fatal Falls Among Massachusetts Construction Workers, 2007-2011*. Each April, MA FACE has provided information about work-related fatalities in response to requests by the community in preparing for public events, outreach, and education to mark Workers' Memorial Day.

MA FACE posts all *FACE Facts*, educational materials and annual and multi-year reports as well as links to NIOSH and other health and safety internet resources on the OHSP page of the MDPH website. Our full FACE reports are posted directly on the MDPH and NIOSH website. All of MA FACE materials are also posted on the NIOSH State-based Clearinghouse and our *FACE Facts* and other educational materials are posted to the MA Health Promotion Clearinghouse.

Aim 4. Targeted Prevention: Plan, conduct and foster prevention activities targeting identified industries, groups of workers, or hazards to reduce the incidence of fatal occupational injuries in Massachusetts.

MA FACE is involved in a number of prevention activities that go beyond information dissemination and involve working relationships with stakeholders to effect change. These include education and outreach efforts to targeted industries and worker populations, and promotion of technological and policy solutions. The MA FACE coordinator participates on the MA Occupational Health and Safety Team (MOHST), an interagency team that brings together state and federal agency representatives to increase coordination of government efforts to protect worker health and safety. MOHST has been a supportive ally to both OHSP

and MA FACE and has contributed to the success of the targeted prevention activities described below.

MA FACE efforts to prevent falls in construction. Preventing falls in construction has remained a MA FACE priority. Throughout this project period we led the state "Preventing Falls in Residential Construction" workgroup (PFC) that brings stakeholders in the construction industry together with academic experts and agency representatives. PFC spearheaded a local, multi-pronged, multi-agency campaign in concert with the national *Campaign to Prevent Falls in Construction*. With PFC input, we revised three fall prevention brochures and added one on personal fall arrest systems. Available in multiple languages, these brochures are disseminated through local building permit offices and have been extremely popular as indicated by numbers of requests in Table 2. A new *FACE Facts* on ladder safety for painters was also developed and disseminated after we experienced multiple self-employed house painters fall from ladders while working alone. This *FACE Facts* was developed after MA FACE was unable to investigate these fatalities when all of the next-of-kin did not want to participate. One of the strategies we used was to disseminate this *FACE Facts* through paint stores, which was a new venue for us. These materials are all posted on the MDPH and the national campaign websites.

MA FACE worked with OSHA, DLS and other state agencies to get national campaign posters on Boston public transit and state digital billboards. We coordinated outreach about the campaign, the DLS OSHA Compliance program trainings, and the National Safety Stand-Down for Fall Prevention in Construction by emailing all licensed contractors through our contacts at the MA Department of Public Safety. MA FACE is an active partner in the national Campaign, participating in workgroups on outreach and materials development and assisting in evaluation. The MA FACE coordinator also participates in the national NORA Construction Sector Council, sharing state public health agency perspectives.

Public sector workers. Massachusetts is a federal OSHA state, thus public sector workers are not covered by OSHA. This project period, protecting public sectors has emerged as a state priority. MA FACE has investigated nine public sector worker fatalities; seven were joint investigations in collaboration with DLS. OHSP staff also participate in the Governors' Advisory Committee on state worker health and safety, which recently culminated in passage of legislation extending OSHA level protections to state workers.

Prevention through design. We have incorporated recommendation with Prevention through Design (PtD) solutions in multiple MA FACE reports this period. MA FACE continued collaboration with engineers at Harvard and the University of Massachusetts, Lowell, getting their input on PtD solutions to hazards identified in our FACE investigations. In turn, academic partners have used our FACE reports as tools for teaching health and fault tree analysis. OHSP staff likewise use reports in teaching in several university courses every year. While MA FACE has always promoted engineering solutions to identified hazards, our efforts this period have evolved to explicitly emphasize the concept of Prevention through Design in FACE reports.

MA FACE had initially proposed to work with NIOSH Alaska Pacific Office (APO) and with HSPH to develop a report on the work-related fatalities in the New England fishing industry.

However, the APO took the lead, publishing a detailed report on fishing fatalities on the east coast. The possibility of preparing a special topic report on the fishing industry in MA once the *Fatal Occupational Injuries in Massachusetts, 2008-2013* is released is under consideration. MA FACE continues to have a working relationship with the APO that includes at least annually reviewing MA fishing-related fatalities.

Outcomes. MA FACE activities this period have resulted in: 1) reported changes in workplace practices, based on materials feedback; and 2) substantial uptake and secondary dissemination of multiple MA FACE products and recommendations, locally and nationally, and use of our materials as teaching tools to influence the next generation of engineers. The MA fall campaign proved a successful platform for training hundreds of contractors and raising awareness about the national Campaign. Our work has also contributed to several substantial policy initiatives this period: a state law banning use of highly flammable floor finishing products (based on work last period, but went into effect this period); the new MA Temporary Worker Right to Know Law; and legislation extending OSHA level protections to state agency workers. Additionally, the need to improve safety of workers on foot performing tasks on roadways, but not involved in work zones, has been identified as a priority in the MA Highway Strategic Plan, setting the stage for further work in this area. There has been a statistically significant 2.9% average annual decline in the rate of fatal occupational injuries in MA between 2004 and 2013. While difficult to assess a causal link, MA FACE activities have likely contributed to this decline.

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c. Massachusetts Teens at Work: Injury Surveillance and Prevention Project

Introduction

The Massachusetts Department of Public Health (MDPH) considers the prevention of occupational injuries to children and adolescents as a public health priority. In 1992, MDPH promulgated regulations requiring physicians and hospitals to report occupational injuries to youths less than 18 years of age to the Department. Since that time, with support from NIOSH, the MDPH Occupational Health Surveillance Program (OHSP) has worked to establish a model statewide surveillance system for occupational injuries to youths. The surveillance system is designed both to identify sentinel cases for case specific follow-up and to generate summary data that can be used to inform broad-based prevention activities and track progress in meeting prevention goals. Surveillance findings are actively linked to interventions and OHSP works with a wide range of community and agency partners to address identified health and safety problems faced by youths.

This Cooperative Agreement has enabled OHSP to continue the Teens at Work: Injury Surveillance and Prevention (TAW) Project and to take exploratory steps to describe the injury experience of young adult workers (18-24 years of age) during July 2010 – June 2015. This work has contributed significantly to strengthening the state infrastructure for protecting young workers. Major accomplishments of the TAW Project during this period are described below. Key lessons learned and challenges are discussed.

Aim 1: Case Ascertainment: Continue and expand case ascertainment using multiple data sources to identify sentinel cases of young worker injuries and generate representative summary data.

TAW continued to use multiple data sources to identify cases of occupational injuries to youths under age 18: workers' compensation (WC) indemnity claims for injuries resulting in five or more lost workdays; computer-generated emergency department (TAW-ED) reports from a self-selected sample of nine acute care hospitals; statewide hospital discharge (HD) data; statewide emergency department (ED) data; and occasional reports from individual physicians, the Massachusetts Burn Registry, and the Fatality Assessment and Control Evaluation (MA FACE) Project. Of note, the statewide ED dataset contains neither personal nor employer identifiers and is not available to MDPH until approximately 12 months after the close of the fiscal year. While useful for population-based analysis it is not currently useful for case based surveillance. This period (January 2014), a new streamlined process for receiving case reports via weekly electronic submission of WC claims data from the Department of Industrial Accidents was implemented. Receiving these data electronically has helped reduce the amount of data entry allowing for greater efficiency.

From July 2010 through June 2015, there were no workers under age 18 who were fatally injured at work in Massachusetts; this is the first project period in which this has occurred. During this same time period, TAW collected data on 837 personally identifiable teen injury cases. Most of the nonfatal cases (68%) were identified through workers' compensation records; 32% were identified through case reports from a sample of hospital emergency departments that actively report cases to MDPH on a monthly basis. A total of 965 cases were identified in the statewide ED dataset covering calendar years 2010-2012. The

number of cases continued to decline throughout the project period at least in part due to the drop in youth employment during the recession.

Active reporting from the sample of hospitals declined throughout the project period necessitating additional follow-up to obtain the hospital reports. The decline in reportable cases, and staff turnover at hospitals as well as what appear to be shifting responsibilities among hospital personnel in wake of state healthcare reform, have likely contributed to the decline in reporting. Based on this experience, and the additional work involved in expanding surveillance to include young adults, a decision was made to rely on the workers' compensation records for case based surveillance of teen injuries and discontinue case based surveillance via active hospital reporting in the new project period.

This period, we initiated surveillance of injuries among young adults. From July 2010 through June 2015, we identified 14 fatal injuries ages 18-24 via the MA FACE project. Beginning in January 2014, TAW started receiving weekly reports of workers' compensation claims filed by all young adults as well as teens under 18 (see above). Since then, 4,772 claims filed by young adults have been received by TAW. This period, we also initiated annual analysis of the statewide ED and HD data sets; 22,573 injuries were identified in the statewide HD and ED databases for 2010-2012.

We were unable to move forward in implementing standard reporting of injuries to vocational students given competing priorities at the Department of Elementary and Secondary Education (ESE). We were, however, able to maintain our working relationship with ESE through the YES Team and continued informal reporting of sentinel cases to MDPH for investigation.

Aim 2: Conduct timely follow-up interviews with injured youths in order to fully characterize the cases, and target worksite interventions.

TAW continued to conduct follow-up interviews with a sample of injured teens in order to learn more about circumstances contributing to injuries and to triage cases for worksite follow-up. TAW attempted to conduct phone interviews with all cases meeting a standard definition of a serious injury (i.e. amputations, non-digital fractures and dislocations, concussions, chemical burns and exposures, multiple injuries) and all cases in selected subgroups defined by either industry or nature of injury or a combination of the two. In addition, mail surveys were attempted with three injury types (i.e. burns, cuts, sprains and strains). Telephone follow-up was initiated if a survey was not returned after two mailed attempts. As proposed, in an effort to increase Spanish language follow-up of injured teens, this period the letter and fact sheet sent to parents was sent in both English and Spanish.

A total of 153 interviews/questionnaires with injured teens were completed this period. The response rate for the telephone interviews was 21% compared to 32% with the mail surveys with telephone follow-up. Most failure to reach teens over the telephone was due to the inability to reach the teens rather than outright refusals either by teens or parents. The total number of interviews completed is somewhat lower than in prior project periods, which is partially due to the lower number of cases being reported to the surveillance system. Also, as a result of staff turnover and hiring freezes, the interviewer position was

vacant at several points during the project period, which impacted the response rates. Another reason for the decline in completed interviews has been an increase over time in the number of cell phone numbers reported to the surveillance system. This has necessitated additional calls to try to reach a parent at a different phone number in order to obtain consent and then reach the teen again at another time.

Beginning in 2014, TAW piloted mail surveys with all young adults suffering work-related amputations or burns. These targets were chosen since, at the time, they were the only injuries for which we could receive personally identifiable information under state regulations. Two new condition specific survey instruments were developed and approved by the MDPH IRB for this purpose. Protocols for follow-up of young adults were the same as those for the mail surveys of teens, with the exception of not needing to obtain parental consent. A total of 136 letters were sent to young adults through June 2015; 29 interviews were completed. The overall response rate with telephone follow-up was 21%. While the majority of surveys attempted were burn surveys (82%) the response rate for both amputations and burns was 21%.

A significant policy success this period has been a change in the MDPH reporting regulations to allow collection of personal identifiers for all workers with work-related injuries, setting the stage for the proposed additional follow-up of injured young adult workers during the next project period.

Aim 3: Analyze surveillance data and disseminate findings to increase awareness and understanding of work-related injuries to youths.

TAW maintained the TAW relational database system for work-related injuries to teens to facilitate case management and data analysis; and a new database system was created for the young adult data. Established protocols were followed for coding industry, occupation, nature of injury, body part, source, and event for all cases reported during the project period. All interviews from this period were coded for industry, occupation, nature of injury, body part, source, and event. Summary data analysis was carried out annually and included in the TAW surveillance updates and young adult data tables. All TAW materials were posted to the TAW website and to the NIOSH State-based Occupational Health Surveillance Clearinghouse. Surveillance findings were presented at numerous local, state, and national meetings; these included for example: the American Public Health Association, the Council of State and Territorial Epidemiologists, and a plenary address at the 2015 National Occupational Injury Research Symposium. In addition, a number of articles appeared in the popular press that contained Massachusetts findings, including The Boston Globe and local news stations.

This period TAW continued the annual *Teens at Work Injury Surveillance Update* and five issues were published summarizing teen injury and interview data for rolling five year periods. The average annual rate of ED visits decreased from 2.8/100 FTE during 2004-2008 to 1.9/100 FTEs during 2008-2012; the average annual rate for WC lost wage claims remained consistent at 0.6/100 FTEs. Restaurants and Nursing/Residential Care facilities continued to have both high numbers and rates of injuries (see our industry specific fact sheets for more information). Several thousand copies of each update were disseminated in both paper and electronic formats to various school staff (superintendents, guidance

counselors, nurses, principals, and vocational co-op placement coordinators); workforce development groups; injury prevention and youth violence listservs; as well as others interested in young worker health and safety. Middle schools were added to the annual dissemination list following an analysis of the 2009 Massachusetts Youth Health Survey that found 18% of middle school students were working, many in formal jobs. Each surveillance update has included information about TAW educational materials, and requests for thousands of copies of these materials were received following dissemination of the updates in each of the years.

SES is known to be strongly associated with younger persons' risk of injury and mortality and most occupational health data sources lack SES measures. To assess the impact of SES on work-related teen injuries, Census Tract (CT) estimates of the percent-living-below-poverty from the American Community Survey were applied to the Massachusetts WC 5+ lost work day claims for workers <18 years old. CTs with the highest work-related teen injury rates and percent-living-below-poverty were identified, in addition to their demographic, labor force, and SES characteristics to better understand the neighborhood context from which the most vulnerable teens reside. Our analysis showed that teens from CTs with higher percent-living-below-poverty were more likely to be injured at work. Additionally, the most vulnerable teens were more likely to live in neighborhoods with a higher proportion of residents who spoke limited English and were non-White, less educated, and less likely to be employed in white-collar jobs compared to the rest of the state. Overall, we demonstrated the feasibility of geocoding workers' compensation data and the value of using neighborhood SES measures to highlight occupational health disparities.

Prompted by high injury rates for Hispanics, TAW engaged a graduate health communication student in a research project to learn about Hispanic young adult workers' attitudes and knowledge about workplace health and safety. Findings from 23 interviews revealed a lack of awareness about job safety and suggested discordance between employer-provided training and the most appropriate training for this age-group. (See publication list.) TAW's poster presenting these findings received national CSTE recognition.

A new activity this period, beginning in 2013, has been the publication of annual data tables with information on work-related injury hospitalizations and emergency department visits by young adults. Findings indicate that young adult workers have higher nonfatal work-related injury rates than other age groups and that Hispanics have significantly higher rates of hospitalizations compared to Whites. A state specific Occupational Health Indicator on teen workers was calculated annually and included in the MA Indicators Report. Also a young worker injury outcome measure – emergency department visits for work-related injuries by workers ages < 25 – was adopted by MPDH for inclusion in the State Health Improvement Report developed as part of the public health department accreditation process. This is one of the measures that the state will be monitoring over time to assess public health progress. See the Fundamental Project Closeout Report for more information.

As proposed, TAW also explored uses of different denominators for calculating teen work-related injury rates. Working in collaboration with the Fundamental Project, we compared rates of injuries using the Current Population Survey (CPS), and the American Community Survey (ACS), each of which has different strengths and weaknesses. For example, the

overall size of the MA CPS sample (approximately 3,200 workers) is small, thus the data are often not reliable as a denominator source for special populations, such as teens, or when examining industries at a detailed level. Also, CPS data are not available for geographic areas with less than 65,000 residents. However, CPS has the advantage of being administered on a monthly basis to a sample of households for two cycles of four consecutive months. CPS full time employee equivalents (FTE) are calculated based on the reported number of hours usually worked in the reference week, which are then estimated for the month. Monthly estimates are used to calculate an annual average of worker counts or FTEs by employment and demographic characteristics. The ACS has a MA sample of approximately 32,000 workers and, therefore, has the advantage of providing robust annual estimates of total worker counts and FTEs and by smaller geographic regions. However, the ACS is administered on an annual basis. ACS FTEs are calculated based on the reported number of weeks worked and usual hours worked each week in the past 12 months of the survey date. Thus, FTEs calculated from the ACS are potentially subject to higher recall bias and may be less reliable than those from the CPS, particularly for employed persons such as young workers who work part-time or sporadically throughout the year.

Table 1. Estimated counts of employees (EE) and full time employee equivalents (FTE), and ratios of FTE/EE from the ACS and the CPS, overall and by age group, Massachusetts, 2012

	ACS	CPS
EE	2,969,984	2,729793
FTE	2,717,459	2,589,583
Ratio of FTE/ EE by age groups (yrs)		
All Ages	0.91	0.95
16-19 years	0.31	0.51
20-24	0.67	0.78
25-64	0.98	1.00

In a preliminary comparison of estimated employee counts (EE) and FTE from the ACS and CPS for MA, we found the overall ratio of FTE/EE was similar in both surveys. However, this ratio varied by age group (Table 1). Not only was this ratio lower for younger workers in both surveys, as might be expected as younger workers are more likely to be employed part-time, but the absolute difference between the ACS and CPS ratios was much greater for younger workers. The observed discrepancy in estimates for the youngest age group (16 – 19), although based on small sample sizes and warranting caution in interpretation, raises questions about the use of the ACS data for FTE calculations that need to be more fully explored.

As proposed, TAW also completed an analysis of 2010 workers' compensation claims filed by young adults. A total of 2,848 injuries were identified. High rate industries included temporary agencies, and nursing and residential care services. Cleaning and coding the comparatively large number of cases of injured young adult workers from the WC system was a substantial challenge, given available resources. Coding occupation, in particular, proved more difficult than anticipated. Many cases had no occupation listed or the obvious code

identified in the Bureau of Census Occupation Code Manual for the job title provided was not an appropriate match for the actual job. In several instances, there wasn't a code that adequately matched the job title provided highlighting gaps in the existing coding structure. For instance, according to current coding protocols, a residential counselor in a group home should be coded as a professional counselor, when, in reality, his/her job duties and education level do not fall under a professional category. Results of this analysis were presented at CSTE and a written report is underway. This analysis took longer than anticipated to complete in part due to a gap in the senior epidemiologist position at several times throughout the grant period and the difficulty coding this volume of cases manually. Several other data analysis projects initially proposed were also placed on hold.

Aim 4: Plan, conduct, and foster intervention and prevention activities to reduce the risk of occupational injuries to young workers in target Massachusetts workplaces, industries, and communities.

Worksite interventions.
Worksite Investigations. The Massachusetts Fatality Assessment and Control Evaluation Project (MA FACE) in OHSP has initiated research oriented incident investigations of all fatalities of workers under age 18 since 1991, and, this period, expanded to attempt investigations of fatalities of workers under age 25. TAW Project staff collaborates in these investigations, which have resulted in hazard alerts disseminated widely to the relevant industries throughout the Commonwealth.

This period there were no teens fatally injured. However, three investigations of nonfatal incidents were completed. As described above, TAW continued its informal agreement with ESE to investigate injuries to vocational students in shops or cooperative placements. Two of these incidents occurred in vocational school shop classes, resulting in nonfatal electric shocks to the students. A single report with recommendations summarizing the incidents was completed and disseminated to vocational schools throughout the state. The third incident occurred in a comprehensive high school wood shop class and resulted in a fingertip amputation to the student. A report with recommendations is being finalized and will be disseminated to all comprehensive high schools in Massachusetts.

The MA FACE project attempted to investigate six fatalities of workers under age 25, and successfully completed investigations of three of these incidents. One fatality report has been completed, and another is in progress. There was no report written for one of these cases due to circumstances surrounding the fatality (it is believed the young adult experienced a medical event). All final reports are posted to the MA FACE and NIOSH FACE websites. (See MA FACE project closeout report.)

Worksite Referrals. TAW continued to refer priority cases to the US Department of Labor OSHA and/or Wage and Hour Division, or the Massachusetts Office of the Attorney General, which are responsible for enforcing federal and state child labor laws. This period, 33 referrals were made, of which nearly half led to successful enforcement investigations where citations or advisories were issued (six cases are still open). The total penalties issued to employers during this period exceed $25,000; this amount does not include substantial fines for a case still in litigation, in which the Wage and Hour Division issued

enhanced penalties to an employer for 3 counts of child labor violations, including a 15-year-old operating a forklift inside of a warehouse.

Employer Follow-up. TAW directly followed up with six employers following teen worker injury reports that did not rise to enforcement agency referral; this included four employer site visits including written follow-up reports and recommendations. Each year, TAW also provided all employers identified through the surveillance system with information about child labor laws and young worker health and safety. Annually, in response to this outreach, TAW received requests for hundreds of additional educational materials.

Broad-based prevention.
*Dissemination of Educational Materials for Cooperative Placement Coordinators***.** TAW completed work begun in the previous period by piloting and releasing a resource manual for vocational school cooperative education placement coordinators in Massachusetts, who are responsible for placing students in workplaces where they can develop real life skills. The manual includes tools to assess the health and safety of workplaces before and during student placements, including information about child labor laws and vocational education regulations related to safety, key questions to ask employers, industry specific checklists for worksite walkthroughs, recommendations for involving students and parents, and resources. The project PI has continued to serve on the Vocational Technical Education Advisory Council to the Massachusetts Board of Elementary and Secondary Education.

Social Media. A new initiative this period was a gradual increase over the years in social media use to promote TAW activities. We used combinations of MDPH's Twitter account, blog, and homepage to promote the *Safe Jobs for Youth Poster Contest*, our annual *TAW Surveillance Update*, and Safe Jobs for Youth Month. TAW evaluated the impact of its social media use over a three-year period: 2012, in which we used limited social media; 2013, in which we used social media more regularly, but without a strategy; and 2014, in which we strategically used social media to promote our activities. The results showed significant increases in web hits, particularly when a social media strategy was employed. Most notably, we saw a 108% increase in downloads of our Guide for Working Teens in 2013 compared to the same period in 2012, and another 118% increase in downloads in 2014 compared to 2013. Our primary audience is adults who work with or influence teens—not teens themselves—so the increase in teen guide web hits is an indicator that inclusion of social media in our outreach activities has helped us to reach our audience.

Coffee Shop. As a result of TAW's case ascertainment, follow-up and outreach with the corporate headquarters of a national coffee shop chain, a new coffee brewer designed to engineer out a common hazard that can lead to burn injuries has been rolled out by their manufacturer. As of August 2015, 3,730 brewer units had been purchased for more than 1,200 franchised locations nationwide. The potential for impact is over 13,000 franchise locations large. TAW has recently been working with corporate headquarters to strategize ways to promote the new brewer model—including an incentive program—among franchise owners. (See accompanying success story included in this closeout report.)

OHIP. Two of four Massachusetts-placed Occupational Health Internship Program (OHIP) interns were hosted at TAW in 2011. In addition to participating in regular

surveillance/outreach activities, the interns conducted and analyzed in-person interviews with young workers in a Boston summer jobs program and developed three industry-specific safety brochures based on interview results. These brochures were disseminated by the state's workforce development agency to summer jobs programs.

Healthcare. While TAW did not complete a comprehensive health care setting outreach project as initially proposed, due to taking on the *Poster Contest* (see below), we were able to accomplish several collaborative activities. The Hospital Workers Project conducted a survey of all MDPH licensed hospitals about their safe patient handling activities. Included in the survey were questions about the written safe patient handling policy, specifically whether the policy included special provisions for employees under the age of 18. Only 9% of respondents indicated that the policy addressed special provisions for employees under the age of 18. Federal child labor laws place some restrictions on the use of hoisting devices, including patient lift equipment, by persons in this age group. Information about the child labor regulations was included in the final survey report that was disseminated to all hospitals. Among worksite interventions mentioned above, TAW also completed a nursing home employer site visit in response to a teen musculoskeletal injury case. A summary report of the site visit, including safe patient handling and training recommendations, was sent to the nursing home employer. Given the high injury rate among Massachusetts teens working in nursing care facilities (4.8 per 100 FTEs), TAW also included a data feature on the topic in one of the *TAW Surveillance Updates*.

Aim 5: Continue collaboration with government and community stakeholders in Massachusetts and other states to promote use of surveillance findings for prevention.

TAW has continued this period to lead the Massachusetts Youth Employment and Safety (YES) Team regularly bringing together multiple state and federal agencies to coordinate efforts to protect young workers. The YES Team met regularly throughout the project period to coordinate educational as well as regulatory activities. Educational materials for teens, parents, employers and health care providers, previously developed by the *Teens at Work Project*, were updated in 2010 to reflect changes in the Federal Child Labor Laws and several were translated into other languages; tens of thousands of copies of these materials have been disseminated by TAW, other team members and community partners.

TAW interview data revealed that while the number of teens reporting not having a work permit at the time of injury had declined over time, 25% still were not obtaining work permits as required by state child labor laws. This finding as well as questions from schools about the work permit process led the YES Team to develop a flow chart of the process to obtain a work permit. The Office of the Attorney General mailed the flowchart to all high schools and superintendents, and it is posted on the state's youth employment website.

TAW has an ongoing relationship with the Massachusetts Coalition for Occupational Safety and Health's (MassCOSH) Teens Lead @ Work (TL@W) Peer Leader Program. Collaboration with TL@W has included providing input and feedback for their workplace violence curriculum, as well as multiple survey instruments. TAW also regularly presented at

TL@W's 3-day annual youth leadership academy, sponsored, in part, by MDPH's violence program.

Poster Contest. Each year this period, TAW collaborated with the YES Team and MassCOSH to coordinate a *Safe Jobs for Youth Poster Contest*, which has grown into one of our most successful collaboration activities. The annual contest asked teens ages 14-19 to design and submit posters about workplace health and safety, and culminated with public awards ceremonies that included finalists and their families, state agency and community partners, legislators, and keynote speakers. Each subsequent year the contest had greater community engagement, in large part due to teachers using it as a teaching tool and assigning the contest as homework to students, TAW's outreach to teens across the state to serve as judges for the contest, and MassCOSH's awards ceremony invitations to legislators, which has helped to enhance the public perception of the event's importance. The past four winning posters likely helped to raise general public awareness with summer month ad placement (space donated by local transit authorities) on subways and buses throughout Boston and select local communities. The contest has also provided an opportunity to learn more about how teens perceive of health and safety issues in the workplace, as well as what kinds of visuals and messages resonate best with them from a marketing perspective.

Talking Safety. This period, TAW developed new state-level modules for and contributed to national-level developments of the *Youth@Work: Talking Safety* educational curriculum. At the state level, TAW developed a new sexual harassment lesson in response to Massachusetts teens' concerns about harassment in the workplace, and developed a series of scenarios, based on interview data, to mirror the types of jobs in which Massachusetts teens are placed through state-funded summer jobs programs, which now mandate health and safety training for participating youth. Both the lesson and scenarios have received hundreds of monthly downloads from our website since release. At the invitation of the NIOSH Education and Information Division (EID), TAW staff also served as reviewers for the 2015 national *Talking Safety* curriculum, participated in the NIOSH-EID *Talking Safety* curriculum dissemination project meeting in Cincinnati, and served as invited subject matter experts for development of a NIOSH *Talking Safety* assessment tool.

Evaluation. Given the five year term of this cooperative agreement, TAW's evaluation has focused primarily on shorter term intermediate outcomes, described below. TAW included feedback questions on forms to request additional materials that were mailed with the 2011-2014 *TAW Surveillance Updates* from this period. Nearly 100% (n=174) of respondents indicated that the *Update* was good or excellent. TAW received requests for an average of over 8,000 materials with each of these mailings. The 2015 *Update* did not include a request/feedback form as TAW relocated its materials to the MDPH one-stop-shopping Health Promotion Clearinghouse, which does not allow for individual material assessment. While this is a limitation of using the Clearinghouse, this transfer saves TAW substantial resources previously spent responding to materials requests. Five annual employer mailings included fax request forms for materials; the annual average number of materials requested for these mailings was 590. TAW continued tracking hits to its webpages: During this period, there were over 75,000 hits to pages and materials, averaging nearly 1,260 hits per month. Web hits increased in the months following outreach activities by TAW. TAW also routinely tracks the teen occupational injury rate (our end outcome)

over time. The overall rate declined from 1993-2008, faster than that for adults. The rate rose slightly this period to pre-recession levels, underscoring the need for continued efforts to protecting working teens.

A CSTE fellow working with OHSP performed an evaluation of the TAW surveillance system. Macro sensitivity of the TAW surveillance system was evaluated using the BLS SOII estimate of 16-17-year-old workers as a crude comparison. Results showed that TAW identified nearly double the amount of cases between 2005 and 2008. TAW's data sources were also evaluated for sensitivity and positive predictive value (PPV). Comparison of its workers' compensation (WC) and statewide emergency department (ED) databases showed only a 4 percent overlap and reiterated the importance of having a multi-source surveillance system. An efficient SAS algorithm was developed to identify these overlaps based on routinely available information. Using manual records review, the PPV of the case ascertainment criteria of WC as expected payer in the ED database was high (93%). Records misclassified as work-related were often those involving a sports-related injury.

Representativeness of the data sources was also evaluated. Industry and occupation (I/O) distributions in the WC data were found to be representative of the statewide ED data, and suggested that manual coding of I/O in the statewide ED database may not be needed. Additionally, demographic, employment, and injury information from the sample of nine EDs were found representative of the statewide EDs.

Lastly, an evaluation of the geographic representativeness of the TAW surveillance system showed that TAW captured cases from all Public Use Microdata Areas (PUMAs) in Massachusetts. Additionally, geographic areas with high rates of work-related injuries among teens were identified. This information was provided to the Office of the Attorney General per request. One limitation of this analysis was that rates of injury could only be calculated by the teen's residence not employer's location due to the lack of employer information in the ED database.

d. Surveillance and Prevention of Sharps Injuries and Musculoskeletal Disorders among Massachusetts Hospital Workers

Introduction

More workers in Massachusetts are employed in health care than any other industry; approximately 44% - over 163,000 individuals - work in 119 hospitals throughout the state. The size of the hospital workforce has been projected to increase by 23% between 2010 and 2020 (Massachusetts Executive Office of Labor and Workforce Development, 2013). Massachusetts hospital workers, like those nationwide, are at high risk of being injured on the job, with sharps injuries (SIs) and musculoskeletal disorders (MSDs) associated with patient handling (PH-MSDs) being two of the most common injuries (BLS, 2009). These are preventable injuries that impose substantial human and economic costs.

In 2001, the Massachusetts Department of Public Health (MDPH) passed regulations requiring acute and chronic care hospitals to develop SI prevention programs and to report SIs annually to MDPH. Subsequently, with support from NIOSH, MDPH worked with hospitals and hospital workers to develop and implement the Massachusetts Sharps Injury Surveillance System (MSISS). SI data are collected from all MDPH licensed hospitals each year, providing detailed information about the devices and procedures associated with SIs as well as occupations at risk. Summary data are provided back to hospital every year and used to promote both hospital specific as well as broad-based prevention activities. Project staff provide technical assistance to individual hospitals regarding SI surveillance and prevention and work with stakeholders within MDPH and the healthcare industry to foster prevention activities. The rate of SIs among Massachusetts hospital workers has declined significantly since the inception of the system.

During the prior project period, in response to concerns about ergonomic hazards and MSDs raised by employee health staff in Massachusetts hospitals, the Occupational Health Surveillance Program (OHSP) Hospital Worker project analyzed data from the Bureau of Labor Statistics (BLS) Survey of Occupational Injuries and Illnesses (SOII) for 2004-2007. Findings showed that the rates of injuries involving days away from work for hospital workers were consistently higher in Massachusetts as compared to the nation, and in 2007 injury rates for injuries involving days away from work due to MSDs among hospital workers was twice the national rate. (BLS, 2009)

This Cooperative Agreement has enabled OHSP to continue and expand the MSISS during July 2010-2015 and also to build on the successful partnerships to explore approaches to surveillance and prevention of MSDs among hospital workers. Major accomplishments of the Hospital Worker project during this project period are described below. Key lessons learned and changes are discussed. This information is organized according to the aims proposed in the initial Hospital Worker project application.

Aim 1. Continue to collect case level anonymous data on sharps injuries among hospital workers from all hospitals on an annual basis to generate statewide and hospital specific information.

The Hospital Worker project continued to collect case level data on SIs from all 99 MDPH licensed hospitals annually maintaining reporting by 100% of hospitals for nine consecutive years. More than 3,000 SIs were reported each year. MSISS followed standard protocols in notifying hospitals about reporting deadlines and contacting those who were late. On average, 89% of hospitals reported their data by the February 1 deadline over the past five years. All data continued to be reported electronically via secure email system using the *Annual Summary of Sharps Injuries*, a simple MSExcel tool developed by MSISS.

For the first time in 2010, information regarding the mechanism of the sharps injury prevention feature was collected in the *Annual Summary*. This critical information allows us to better describe the devices involved in sharps injuries and informs the development of improved sharps injury prevention technologies. We recognize, however, that the information is most valuable when paired with additional data elements such as device type and should not be reported in isolation.

Follow-up with hospitals to clarify discrepant information continued to be conducted within two weeks of receipt of the data each year, with the exception of 2014. In general, this practice resulted in better data quality and allowed for data cleaning and coding to be completed more quickly. Electronic tools for cleaning and coding the records continued to be updated, which has also led to improved efficiency in coding and timeliness of annual reports. (Further discussed under Aim 2.) The 2014 data was collected during the same time frame as our office relocation, which impacted our ability to follow up within the two-week time period.

The Manual documenting the surveillance system and coding protocols has been updated as necessary to document changes in the surveillance system and protocols for processing the data. The Manual is available to others upon request.

Data from the state's Human Resource Division (HRD) were also reviewed this period to characterize SIs among workers in psychiatric hospitals. Given the small numbers of SIs reported, we decided not to enlist their participation in the surveillance system but to include them in prevention outreach.

Aim 2. Analyze data on sharps injuries and disseminate findings to all hospitals and other stakeholders to increase understanding of sharps injuries and promote prevention efforts.

Each year, data were coded according to established protocols, stratified by hospital size and teaching status and analyzed. A semi-automated coding algorithm using SAS software continued to be used to 1) transform the narratives for optimal use of the algorithm; 2) use the presence or absence of keywords, pairs of keywords, and strings of text in the narrative description; and 3) assign the category that is most useful for prevention intervention. The algorithm was updated each year to capture new terms and additional narrative descriptions. This algorithm is able to clean and code the SI data with high sensitivity and specificity. Moreover, the SAS algorithm is able to automatically code at least 90% of the fields for most variables. This SAS code is available upon request.

NIOSH's National Industry and Occupation Computerized Coding System (NIOCCS) was applied to the 2012 SI data. NIOCCS was able to auto-code 71% (2146/3021) of the records to the Census 2000 I/O classification scheme. Records were coded at high (at least 90%) confidence in terms of accuracy of auto-coding.

Annual reports of surveillance findings were completed for 2009-2012 and distributed to all hospitals, as well as other stakeholders and researchers; the 2013 report is currently under internal review. A summary fact sheet of aggregate results since the beginning of the surveillance system was updated most recently in June 2015 with data through 2012.

As a new initiative, in line with MDPH-wide efforts, a shorter annual report with tables of key findings and less narrative was developed. As part of this effort, we conducted a brief survey of hospital staff regarding their use of the annual SI data and their preference for detailed versus broad categories within each data element. Annual reports from 2011 forward have been published in this new format.

Based on input from the legislatively mandated Sharps Injury Advisory Committee, a template for hospital specific reports has been developed and hospital specific findings for each MPDH licensed acute care hospital will be published as a single report during next project period.

An updated version of the special topic report on SIs among medical trainees was published in 2011. Main findings in this analysis were that medical trainees accounted for more than half of all SIs to physicians (60%, 4,972). There was a declining trend over the academic year in the frequency of injuries to trainees, while injuries among attending physicians remained steady. The sharps injury rate was higher among medical trainees (84 injuries per 1,000 trainees FTEs) than that of attending physicians (65 injuries per 1,000 attending FTEs).

In June 2011, we published findings in *Infection Control and Hospital Epidemiology* based on an analysis completed the previous project period. This journal article summarized trends over time from 2002 through 2007 and reported an increase use of devices with sharps injury prevention features and a corresponding significant decline in injury rates over time.

A significant highlight this period was the completion of an analysis examining trends in SI rates among employees of acute care hospitals for an 11 year period - 2002-2013. An important methodological advance in this analysis was the use of Joinpoint statistical software to identify changes in rate trends over time. Findings revealed an overall significant decrease in SI rates over time - an overall decline of 1.8% for all hospitals. When restricting to acute care hospitals, the decline was 2.3%. With the joinpoint regression method, we were further able to identify a change in the direction of the rate in 2009. Between 2002 and 2009, rates continued to decline each year. However, starting in 2009, rates remained relatively steady and appear to have plateaued through 2013, the most recent year analyzed. Injury rates among nurses specifically have followed a similar pattern. A journal article summarizing these findings is in process.

While the observed decline in SI rates is an important public health success, the more recent plateauing in the rates underscore the need for renewed attention to prevention. The surveillance findings underscore a number of specific issues to be addressed in Massachusetts:

- The need to implement safe work practices and alternative methods for wound closure to reduce the high number of injuries in the operating rooms.
- After excluding SIs involving sutures, 39% of the SIs involved devices lacking sharps injury protections in 2012. This points to the continued need to convert to devices with sharps injury prevention features where alternatives are available.
- It is notable that in 2012 less than 2% of injuries involving winged steel needles occurred with devices lacking sharps injury prevention features. This likely reflects the wide uptake of devices with sharps injury prevention features.
- Since surveillance began, there have been proportionally increasing numbers of SIs among physicians compared to nurses. The percentage of SIs among physicians have increased from 31.9% (1,088) in 2002 to 37.5% (1,131) in 2012, while the percentage of SIs among nurses has decreased from 40.6% (1,387) in 2002 to 37.3% (1,130) in 2012.

While the declining rate with the apparent increase use of sharps with engineered sharps injury prevention features (SESIPs) lends weight to the efficacy of these more protective devices, the finding that a substantial proportion of injuries involve SESIPS raises questions about the effectiveness of technology currently available to prevent SIs and the need for continuous improvements in device design. It also highlights that engineering controls are not the sole solution, but rather are one part of a comprehensive prevention program. Efforts to ensure that hospitals are purchasing devices with sharps injury prevention features are still needed. However, training on these new devices is important in order to be certain that the sharps injury prevention features are used correctly and practitioners feel comfortable using them.

In addition to printed materials and postings on the MDPH website, findings from MSISS have been presented at numerous local and national conferences including, for example, the annual meetings of the Council of State and Territorial Epidemiologists, the American Public Health Association, the International Commission on Occupational Health, the Massachusetts Nurses Association, and the Association of Professionals in Infection Control New England Chapter. Presentations to the Boston Biosafety Users Group and the Yale Occupational Medicine Department were also given. Findings were also presented by invitation at the World Health Organization (WHO) Safe Injection Global Network meetings in February 2015, and at a landmark national conference convened by the American Nurses Association that included a nationally broadcast webinar as well as a conference hosted by University of Virginia in 2010, both marking the 10 year anniversary of the federal Needlestick Safety and Prevention Act. MSISS reports have also been posted on NIOSH and OSHA web sites and have been circulated by WHO. Sharps data were also used in teaching several classes at Boston College Connell School of Nursing, Harvard School of Public Health and Tufts University School of Medicine Public Health program.

The data collected by MSISS are some of the most representative data available on SIs among hospital workers. A challenge has been finding the time to complete more in-depth

analyses, thereby taking full advantage of the richness of the data. While student projects have been helpful, the final products produced by students frequently fall short of publication standards, requiring additional staff time to finalize. Our initially proposed report on devices lacking sharps injury prevention features focusing on manufacturers was postponed given competing project priorities and challenges of presenting manufacturer data in the absence of market share information. OHSP welcomes academic and NIOSH collaborators in interpreting and publishing the Massachusetts data.

Aim 3. Provide guidance to and promote information sharing among hospitals, healthcare workers, and other stakeholders regarding successful approaches to sharps injury surveillance and prevention.

The Hospital Worker project is engaged in a number of ongoing activities to prevent SIs in hospitals. The Hospital Worker project maintains a dedicated email address for hospitals to submit inquiries regarding SI surveillance and prevention as well as their *Annual Summaries*. Staff responds to inquiries by phone and email and conducts on-site consultation visits and presentations to staff upon request. The Hospital Worker project has a strong working relationship with OSHA and serves as an intermediary sharing information with the hospitals about OSHA requirements.

The regulations requiring hospitals to submit the *Annual Summary* fall under the MDPH hospital licensure regulations, enforced by the MDPH DHCQ. DHCQ surveyors conduct worksite investigations and provide a written list of formal citations to be addressed by hospitals at the end of these site visits. Hospital Worker project staff participated in a number joint site visits with the DHCQ to formally assess compliance with MDPH regulations regarding SI prevention and surveillance. Some of these visits were routine licensure visits conducted by DHCQ, and some were conducted under an initiative by DHCQ to assess infection control programs as part of a statewide effort to reduce healthcare associate infections. Hospital specific data regarding sharps injuries over time was also provided to DHCQ surveyors prior to their visits to assist in the investigation and focus attention on particular areas of interest.

A new protocol for hospital specific follow-up regarding continued use of devices lacking sharps in injury prevention features was piloted this period. Letters were sent in March 2013 to hospitals reporting injuries with such devices, requesting more information, namely copies of the required form "Exemption from use of devices with sharps injury prevention technology" for any hypodermic needles/syringes. This protocol enabled us to reach more hospitals than site visits alone. Review of the waivers indicated that hospitals need additional guidance on establishing procedures for approving the use of devices without sharps injury prevention features.

Feedback to reporters is an essential component of any active reporting system. Since MSISS was established, the Hospital Worker project has held periodic meetings with staff from hospitals across the state to share information about SI surveillance and prevention. The Hospital Worker project successfully piloted replacing the single statewide annual meeting with hospitals with regional meetings to increase participation. Three regional meetings to share sharps injury data and prevention strategies were held in October 2010. Participation

in these three sessions was triple that in previous years; four regional meetings were held in both 2011 and 2012 in response to requests from hospital contacts. Due to low participation in the western most location, three meetings were held in 2014. These meetings serve as an important forum for hospital representatives to meet and share successes and challenges in addressing worker health and safety. Information shared during these meetings is also critical to OHSP, informing our interpretation of surveillance findings, and allowing us to make modifications to the surveillance system to best meet the needs of the hospitals. Meeting evaluations indicate that attendees find the sessions helpful and they would like even more opportunities for exchange.

In line with our interest in influencing device suppliers as well as users, Hospital Worker project staff and members of the MDPH Sharps Injury Prevention Advisory committee met with a major device manufacturer in April, 2011 to share relevant sharps injury data and discuss strategies to reduce sale and use of devices without sharps injury prevention features.

Given ongoing policy discussions regarding flu vaccination for healthcare workers, in September, 2013 the Hospital Worker project conducted a survey of all MDPH licensed hospitals regarding policies and practices for prevention of influenza. We achieved an 80% response rate. For most hospitals, the influenza vaccine is recommended and a signed declination is required, with no consequences for declining the vaccine. More than 90% of respondents indicated that they offer the influenza vaccine to non-employee practitioners. Many hospitals have programs in place covering multiple prevention strategies. Findings were presented at the 2013 APHA annual meeting and also at the 2014 regional meetings with hospitals, prompting hospitals to share creative approaches to increasing their vaccination rates.

Aim 4. Use available administrative data sets and input from hospitals to characterize MSDs and safe patient handling programs in hospitals.

As a new initiative this project period, the Hospital Worker project completed analyses of patient handling injuries using data from multiple sources (Bureau of Labor Statistics, Massachusetts Department of Industrial Accidents and Massachusetts Human Resources Division Workers' Comp eServices). We collaborated with the Region I Bureau of Labor Statistics (BLS) office to analyze data from the Survey of Occupational Injuries and Illnesses (SOII) on all MSDs and MSDs specifically associated with patient handling (PH-MSDs) among hospital workers in Massachusetts. Information about PH-MSDs is not routinely published in BLS reports. Rates of lost time injuries for PH-MSDs decreased between 2004 and 2011, both in Massachusetts and nationwide. However, the MSD rate overall and the PH-MSD rate for workers in Massachusetts hospitals was at least 70% higher than the comparable rates for workers in hospitals nationwide every year since 2004 for which data were available. As part of this analysis, we explored alternative approaches to using SOII data to generate an estimate of the total number of workdays lost as a result of PH-MSDs in MA hospitals. Using the most conservative approach, we estimated that in 2010, Massachusetts hospital workers lost over 21,485 days of work as a result of PH-MSDs.

Analysis of the Massachusetts Department of Industrial Accidents (DIA) workers' compensation claim data for injuries resulting in five or more lost workdays found that more than 2,000 lost-time claims were filed between 2008 and 2010 for PH-MSDs among hospital workers. Injury rates increased with hospital size, with workers in large hospitals (>300 beds) experiencing injuries at a rate more than double that for workers at hospitals with less than 100 beds. PH-MSDs accounted for 25% of all workers' compensation lost-time claims filed by hospital workers. Coding protocols refined in this work was used to update our prior analysis of the HRD Workers' Comp eServices data on MSDs among employees of state-run hospitals.

Analysis of the HRD Workers' Comp eServices data revealed that patient handling injuries accounted for 8% of all injuries reported by workers in public sector hospitals. About 70% of the workers with PH-MSDs were nursing aides and 17% were nurses. This differed from findings from the DIA where 49% of PH-MSDs occurred among nurses and 27% occurred among aides. The average cost per PH-MSD claim paid was $14,710 which was higher than the average cost for other MSD claims and more than double the average cost for non-MSD claims.

Findings from these analyses were included in the report of the Massachusetts Hospital Ergonomics Task Force (see below) and presented at a number of local and national meetings, including CSTE and APHA annual conferences.

Based on extensive review of the literature, a survey instrument was developed to collect information about safe patient handling (SPH) programs/activities in acute care and rehabilitation hospitals. (Available on request). The survey was administered by mail to all MDPH licensed hospitals in March, 2012 and achieved a 90% response rate. Project staff mentored a student from Tufts University, who worked on this project as her applied learning experience, a requirement for the MPH degree. Findings indicate that 66% of respondents have a patient handling program that is written or in development and 65% had a committee dealing with patient handlings, although only 34% had both a committee and a written program. A SPH index, which is a measure of the extent to which hospitals have multiple program components in place, was also developed. Survey results were disseminated to all MA acute and chronic care hospitals, included in the Hospital Ergonomics Task Force Report and presented at a number of local and national meetings.

Aim 5. Continue collaboration with representatives of management and labor in the hospital industry and internal MDPH stakeholders to promote the use of data to prevent sharps injuries and extend this collaboration to address MSDs.

OHSP continues to coordinate the legislatively mandated MDPH Sharps Injury Prevention Advisory Committee, which includes representatives of the hospitals, employee unions and various professional organizations as well as a technical advisor and a consumer. This Advisory Committee met at least twice each year, and members provided MDPH with valuable input regarding interpretation of surveillance findings, enhancements to the surveillance system, and priorities for prevention.

OHSP worked this period on several other related projects within MDPH. Hospital Worker project staff collaborated with other MDPH programs to develop a guidance document regarding source patients when there has been an occupational exposure. The guidance document covers circumstances when a source patient is unable to consent for HIV testing and the release of results to the injured employee's treating physician. Hospital Worker project staff participated in site visits to evaluate the preparedness of hospitals with regard to receiving possible or confirmed Ebola patients. The site visits, conducted in conjunction with the Harvard School of Public Health, were done at eight hospitals that were subsequently designated as either treatment or assessment facilities. Hospital Worker project staff were also involved in coordinating involvement by OSHA in the site visits.

With enthusiastic support from the MDPH Commissioner, the proposed Hospital Ergonomics Task Force was established in 2012 and met over the next 18 months. This 26 member task force included representatives of hospitals, the hospital association, unions, academic researchers, insurers, ergonomic experts and other government agencies. The Task Force was charged with reviewing available evidence and developing recommendations for reducing the high rate of MSDs and disability among Massachusetts hospital workers. Three subcommittees carried out this work: Data & Surveillance, Interventions & Programs Assessment, and Policy Needs & Options.

Substantial time and effort was spent on preparing the report of the Hospital Ergonomics Task Force, "Moving into the Future: Promoting safe patient handling for worker and patient safety in Massachusetts hospitals". The Task Force reviewed new findings provided by MDPH on PH-MSDs among MA hospital workers and their associated costs (described above), the results of the survey of hospital SPH practices (described above), the research on effectiveness of interventions to reduce PH injuries and current practice guidelines. It also examined policy initiatives to promote SPH in other states. Informed by this review as well as their own experience, Task Force members worked to define essential elements of effective and sustainable SPH programs. Based on these inputs, the Task Force developed a set of 14 recommendations to reduce PH-MSDs among MA hospital workers, directed not only to MDPH but to hospitals and other stakeholders with roles to play in improving worker and patient safety. The report was published in December 2014 and disseminated to hospitals, researchers and other stakeholders the following month and has served as a blue print for moving forward to reduce PH-MSDs among Massachusetts hospital workers in the next project period.

At the October 2013 National Academies of Science Safe Patient Handling and Mobility Planning meeting, the Principal Investigator presented information compiled as part of Task Force activity on the legislative landscape across the country regarding SPH regulations.

Within MDPH, project staff collaborated with several other programs. In preparation for the 2012 regulations prohibiting community disposal of sharps in the solid waste stream, project staff worked with the MDPH Bureau of Environmental Health on a fact sheet regarding community disposal of sharps and injury prevention. Project staff also collaborated with the Bureau of Infectious Disease to update the list of occupations included in the MDPH infectious disease electronic surveillance system. The new list was fully implemented in May 2015. Project staff also worked with the Office of Preparedness and

Emergency Management to conduct site visits at several hospitals to assess preparedness for dealing with suspected or confirmed Ebola patients. Some of these site visits were conducted with CDC Rapid Ebola Preparedness members taking the lead.

Project staff worked with several students during the project period. A public health student from Tufts University assisted with the development and dissemination of the Survey of Safe Patient Handling Activities mentioned above. A student from Boston University School of Public Health developed and disseminated a survey of hospitals about influenza prevention activities in 2013 (See Aim 3). A UMass Lowell graduate student received a grant from the Harvard School of Public Health Educational Resource Center to carry out a student project using MSISS data to examine the mechanisms of sharps injury prevention features on devices associated with injuries. Data on devices purchased was collected from a small sample of hospitals, demonstrating feasibility of gathering this type of denominator data and setting the foundation for future studies on the mechanisms of sharps injury prevention features.

Project staff are also worked with the Organization for Safety, Asepsis and Prevention (OSAP) on a NIOSH funded survey of dental offices regarding exposure control plans and bloodborne pathogens which was disseminated in 2014, with NIOSH on the development of a module in OHSN (the web based Occupational Health Safety Network) for the surveillance of exposures to bloodborne pathogens, and with WHO to develop policies regarding safe injection practices and the use of devices with sharps injury prevention features as well as reuse prevention features.

***Other collaborations*.** Project staff continued to collaborate with UMass Lowell researchers on a related NIOSH funded project addressing sharps and other injuries in home health care, specifically policies influencing presence of sharp devices in the home environment. Dr. Quinn, from UMass Lowell, Principal Investigator of the home care grant, presented findings from this study to MDPH staff and invited guests from other agencies in October 2013. This collaborative work continues through a recently funded grant examining the risks in home healthcare regarding cleaning and disinfection.

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e. Surveillance and Prevention of Work-related Asthma

Background

More than 18 million adults in the US have asthma—a serious, respiratory disease—recognized as a critical clinical and public health problem in the US and Massachusetts (Moorman et al, 2012). Asthma prevalence has been increasing in recent years and has remained consistently higher in Massachusetts than in the US (MDPH Burden of Asthma in Massachusetts, unpublished). From 2000 through 2010, current asthma prevalence increased 22.4% among Massachusetts adults. In 2012, an estimated 10.8% of adults had current asthma, and, for close to 74% of these adults, their asthma was classified as not well or very poorly controlled (MDPH Burden of Asthma). The effects of asthma are felt disproportionately by minorities, nationally and in Massachusetts (Coogan et al., 2014). In Massachusetts, from 2002-2011, Black and Hispanic adults had age-adjusted rates of hospitalization due to asthma that were three times higher than the rates for whites (MDPH Burden of Asthma).

Occupational exposures play an important role in asthma etiology and severity (Tarlo and Lemiere, 2014). An estimated 16.9% of adult-onset asthma is caused by work exposures and over 20% of those with asthma have work exacerbated asthma (Toren and Blanc, 2009, Henneberger et al, 2011). Work-Related Asthma—including both new onset and work-aggravated asthma—is the most prevalent occupational respiratory disease in developed countries. In Massachusetts, 41% of adults with asthma report in the BRFSS that their asthma was caused or exacerbated by work, but only 9.8% had discussed this concern with their healthcare provider. There is increasing evidence that Work-Related Asthma (WRA) results in more severe asthma, with increased health care utilization and poorer quality of health—both physical and mental—and adverse economic consequences (Breton et al 2006, Le Moual et al 2014, Knoeller et al 2013). Cleaning and disinfecting products remain significant contributors to WRA affecting millions of workers, with implications for asthma prevalence among children (Dumas et al., 2014). Yet WRA remains poorly diagnosed, resulting in missed opportunities for disease management and prevention.

The Occupational Health Surveillance Program (OHSP) in the Massachusetts Department of Public Health (MDPH) has received NIOSH funding since 1987 to conduct surveillance of work-related asthma (WRA), implementing the SENSOR model, which includes translation of findings for prevention. MDPH-OHSP received funding through the Cooperative Agreement to continue and enhance surveillance and prevention of WRA in Massachusetts, covering the project period July 1, 2010 to June 30, 2015. Methods, results, lessons learned and challenges during the project period are presented below, organized according to the aims proposed in the WRA project application.

Aim 1. Case Ascertainment: Continue and enhance case ascertainment for WRA, using multiple data sources to identify sentinel cases.

Sentinel health events are warning signals that prevention efforts have failed (Rutstein, 1983). In Massachusetts, sentinel surveillance of WRA had previously relied on healthcare provider (HCP) reports with added inpatient hospitalization (HD) data to identify persons

with WRA. This project period, emergency department (ED) data and workers' compensation (WC) indemnity claims data became important supplementary case ascertainment sources. A total of 1010 possible cases of WRA were identified from all four data sources—HCP reports (n=52, 5.1%), statewide ED (n=360, 35.6%) and HD data (n=39, 3.9%) and workers' compensation claims data (n=559, 55.3%). See Aim 2 for information about confirming cases according to the surveillance case definition.

WC became an increasingly important data source, accounting for 35% of all probable cases this period. Utilizing WC indemnity claim data has provided an interesting challenge. Possible WRA cases are ascertained by respiratory ANSI codes 570, 571, and 572 that are not specific for asthma, requiring review of multiple cases to identify WRA. The case report lacks a medical diagnosis of asthma, which is needed for case confirmation. Interviewed cases are therefore asked to provide their HCP names and addresses. Staff, or rotating occupational/environmental residents from Harvard School of Public Health, contact the identified HCPs and request information about the diagnosis, which often requires another step, a fax to verify that MDPH is requesting the information and is qualified to obtain protected health information.

This period, we successfully negotiated more timely access to WC and hospital data. In August 2014, we began receiving WC files weekly, rather than quarterly, substantially reducing time between reported "date of injury" and initiation of case follow-up. Interim hospital data files from the MA Center for Health Information and Analysis (CHIA) for the first four years of the grant period were received five months ahead of release of the final files. This reduced the time between date of visit and initiation of case follow-up. However, due to reorganization and changes in leadership at both MDPH and CHIA, we did not receive the interim files in 2015, which severely impacted our case ascertainment and follow-up activities in the final months of the project period. We are in the process of renegotiating access to the interim data and are highly optimistic that efforts will reestablish regular receipt of these files for next year and beyond.

With the Fundamental project, we gained access to a new data source. In July 2013, OHSP began receiving biweekly reports of work-related poisoning calls to the MA-RI Regional Center for Poison Control and Prevention (PCC), which are reviewed for probable WRA. PCC is now collecting and including new information on employment in these reports. To date no WRA cases have been identified; however, this remains a potential source for identification of additional work-related lung diseases.

OHSP continued to participate in meetings and receive updates related to accessing and utilizing data from the new All-Payers Claims Dataset (APCD). OHSP confirmed that workers' compensation carriers are not required to report into the APCD; it is unclear if there will be a potential indicator of work that OHSP will be able to use to identify work-related cases. When the data becomes widely available to MDPH programs, OHSP will consider exploring this data source and make final decisions about is utility for work-related lung disease surveillance.

Aim 2. Case Follow-up: Conduct timely follow-up of cases of WRA in order to confirm and fully characterize these cases and target workplace interventions.

OHSP attempts to conduct follow-up telephone interviews with all probable cases to confirm and classify WRA, obtain additional information and triage cases for worksite investigation. OHSP uses a standard interview instrument developed in collaboration with other NIOSH-funded WRA states. These interviews provide information about industry, occupation and exposures not available elsewhere and serve as informative case stories to complement the statistics. Specifically, information is collected about demographics, symptoms, work history, exposures, previous history of asthma, smoking, other workers at risk, employment status, and workers' concerns about intervention. Confirmed cases are classified as new onset or work-aggravated asthma according to the NIOSH surveillance case classification criteria for WRA (Jajosky et al., 1999).

This period 221 WRA cases were confirmed, 180 ascertained during this project period. The majority were confirmed by telephone interview (196) and an additional 25 by medical record review. The cases were classified as follows according to the NIOSH WRA case classification criteria: 42% work-aggravated asthma, 50% new onset asthma (including Reactive Airways Dysfunction Syndrome—RADS) and 8% confirmed, but unclassifiable (Jajosky et al., 1999).

In light of both departmental and OHSP priorities to address health inequity, this period, we increased efforts to reach minority workers. We translated the WRA survey instrument into Spanish and hired an experienced bilingual interviewer. She conducted 13 interviews in Spanish, 12 of which were confirmed WRA.

In an attempt to reduce the number of cases lost to follow-up, we explored confirmation of WRA cases by review of medical records when a telephone interview was not successful. This proved challenging. Protocols for abstracting details about onset of asthma and work-relatedness of symptoms were reviewed and expert advice from occupational medicine physicians obtained. In order to better understand other states' approaches, we led a coding exercise at the NIOSH/States WRA annual meeting (4/2012). To date, we have implemented this method of confirmation for select cases obtained from HCP reports or WC whom we were unable to interview. However, this has not become standard practice for cases ascertained from ED data due to low positive predictive value (PPV) of these cases. Notably, the PPV of possible cases identified in the ED data is only 17%. And while the PPV is higher after screening medical records for the ED cases to identify "probable" cases (over 50%), it is not sufficient to simply accept these cases as WRA. Case follow-up remains essential to produce credible data on WRA cases identified in the ED.

Summary WRA data (see *Occupational Lung Disease Bulletins* August 2010; Spring2015) allow review of patterns of confirmed WRA cases over time. The number of cases diagnosed and reported by HCPs has decreased. Concomitant with this trend is the decreasing proportion of new-onset asthma cases, including RADS. The predominance of cases from the ED in this project period partially explains the increasing proportion of work-aggravated asthma, as a full workup of WRA is not conducted in the ED. This shift may also reflect the decreasing number of expert healthcare providers (occupational medicine,

pulmonology, allergy) who ask their patients with asthma about work exposures and temporality of symptoms. The stability over time in several categories (% female, age, predominance of healthcare workers and three leading agents) point out continued, uncorrected hazards in healthcare and indications of increasing prevalence of cleaning product issues. Other observations of changes over time include: declining cases in manufacturing, as this industry contracted in Massachusetts and the US; continued low number of cases among construction workers; and the rising proportion of Latino workers. The proportion of cases who are white declined (83% to 73%), possibly reflecting better capture of patients of color who are treated in EDs. The increasing proportion of WRA among workers of color may reflect the shift in case ascertainment, but is also consistent with prior research suggesting that minority workers are at elevated risk. The stable median age of 46 suggests that this is a mid-career disease, that may take time to develop, or be tolerated at younger ages, and then may lead to midcareer-changing decisions. Prolonged time to diagnosis cannot be ruled out as an explanation. These findings raise the continued importance of physician education about WRA and the need to explore innovative approaches, such as clinical decision support for HCPs and consideration of a return of focus on sentinel reporters to lead the way and provide expert consultation to other providers. Our efforts to explore electronic reporting by HCPs this period were not successful as there is currently no practical, low cost means for secure data transmission of individual case level data to MDPH. Overcoming this barrier to electronic reporting will continue to be important in the new project period in which we will extend surveillance to other Work-Related Lung Diseases.

The most recent review of 2003 through 2013 data revealed that most new-onset WRA cases (56.6%) were ascertained from HCP reports, which highlights the important role that providers play in recognizing and reporting WRA. Notably, less than half of all cases (41.2%) reported that they had applied for workers' compensation.

Aim 3. Intervention and Prevention: Plan, conduct and foster intervention and prevention activities to reduce the risk of WRA in targeted workplaces and industries.

OHSP has continued to conduct prevention activities linked to surveillance findings, as conceived as part of the SENSOR model. Intervention and prevention activities this project period included worksite investigations prompted by case reports and broad-based activities in industries and regarding hazards identified through surveillance.

Broad-based prevention. Cleaning and disinfecting products have remained the leading exposure associated with sentinel WRA cases in Massachusetts and a focus of prevention activities. Most recently, OHSP worked with partners within MDPH (Division for Perinatal, Early Childhood & Special Health Needs) and with the Massachusetts Department of Early Education and Care to change policy regarding cleaning, sanitizing and disinfecting surfaces in childcare. As part of this effort, we conducted an analysis of 2011-2013 Massachusetts BRFSS data on childcare workers and found a high rate of asthma compared to that for workers in other industries (see Aim 4 below). This finding was presented in an *Occupational Lung Disease Bulletin* submitted for review this project period that also included a case example of work-related asthma in a childcare worker, news of the policy

change and a discussion of how this change should discourage overuse of bleach and other disinfectants and promote safer cleaning practices.

WRA project staff participated in a one and a half year process led by the NIOSH NORA healthcare and social assistance sector that led to publication of a gap analysis about cleaning and disinfecting environmental surfaces in healthcare. The Cleaning and Disinfecting workgroup, with participation of two other WRA surveillance states as well as OHSP, summarized the extensive literature on WRA associated with disinfecting products and identified research gaps to be addressed. The peer-reviewed journal article was authored by 40 international partners, and published May 2015. The article and process represented an innovative collaboration between infection control practitioners and occupational health and safety experts, which will be crucial in developing solutions that control both infectious disease and WRA (see publications). OHSP also played a leadership role in developing a CSTE position statement (11-OH-01) calling on CDC Infectious Disease to work with NIOSH to include occupational health concerns in developing guidance on cleaning and disinfection. This helped to lay the basis for OHSP and other state WRA surveillance programs' participation in this process.

OHSP continued to work on cleaning and disinfecting purchasing policies with the Operational Services Division (OSD), the state's procurement agency, and other state partners. OSD issued a new 3-7 year state contract for "Environmentally Preferable Cleaning Products, Programs, Equipment and Supplies Statewide Contract" that relies on third party certified cleaning products without asthmagens for cleaning and provides guidance on sanitizers and disinfectants, relying on EPA's Safer Choice. The contracts represent millions of dollars in purchases by state and city agencies, and promotes a regional approach with vendors required to market to more than one New England state. OHSP participated with other agencies in developing guidance and training about cleaning bathrooms in parks and protecting state workers who implement the practices.

Efforts early in the project period to decrease use of asthmagens in hair and nail salons, with Boston Safe Nail Salons Partners and the statewide Healthy Cosmetology Committee met with many delays. National publicity led to changes in hair straighteners, such as Brazilian Blowout, to decrease exposures of stylists and clients to formaldehyde, but Massachusetts continues to have regulations requiring the use of Steri-dry in hair salons, which is formaldehyde. Efforts to change the regulations have just been renewed this summer. OHSP will continue to monitor these efforts, offering support as indicated.

Worksite intervention. OHSP's industrial hygienist continued to review all reported cases of WRA to triage for worksite follow-up. Since July 2010**,** intervention activities were initiated in 25 workplaces including referrals for investigation: three to OSHA, and nine to other agencies (three to the MDPH Bureau of Environmental Health, two to the Massachusetts Department of Labor Standards, and one to MDPH Health Care Quality). OHSP collaborated in two NIOSH Health Hazard Evaluations, accompanying NIOSH representatives to a printing plant on a Legionnaires investigation and reporting back to a syntactic foam manufacturer about the results of an HHE, with additional walk-around observations. OHSP conducted visits to 11 worksites, with occupational medicine residents from Harvard School of Public Health accompanying on five. Several of these investigations

and referrals generated compelling case studies that have been used in journal articles, and educational presentations. The physicians learn about investigating workplaces for respiratory hazards as a component of their rotation at OHSP, which is a component of their Master of Public Health program.

- Isocyanates were exposures noted in a number of investigations in a variety of industries, including pressure sensitive film, specialty materials for aerospace and telecommunications, shoe soles and printing on cloth. We provided background information about WRA and toluene diisocyanate for the Office of Technical Assistance in the Massachusetts Executive Office of Energy and Environmental Affairs, as they considered state action to designate this isocyanate as a Higher Hazard Substance, subject to a lower reporting threshold. One of the referrals to OSHA led to an inspection of a spray foam installer and citations for failure to provide personal protective equipment and training on the health hazards of isocyanates.
- In two cases, previous WRA site investigations led to requests for additional technical assistance for employees. In one case, incense worn by library patrons triggered symptoms in employees with work-related asthma. In another case, a young man who worked as a temp in the syntactic foam plant died from influenza, which led to a review of the medical and autopsy records to seek any work factor contribution.
- An inspection of an aluminum extrusion company did not find compelling evidence of exposures consistent with WRA, but provided the basis for a grand rounds presentation by a resident to faculty and staff at Harvard School of Public Health about WRA, aluminum manufacturing, pot room asthma and the role of the health department in surveillance (9/11/13).
- Four WRA cases over 18 years triggered an inspection of an animal facility that breeds mice, rats and other laboratory animals for researchers. The site visit resulted in recommendations regarding animal allergen exposure, disinfectant handling procedures and mechanisms for training Spanish speaking staff.

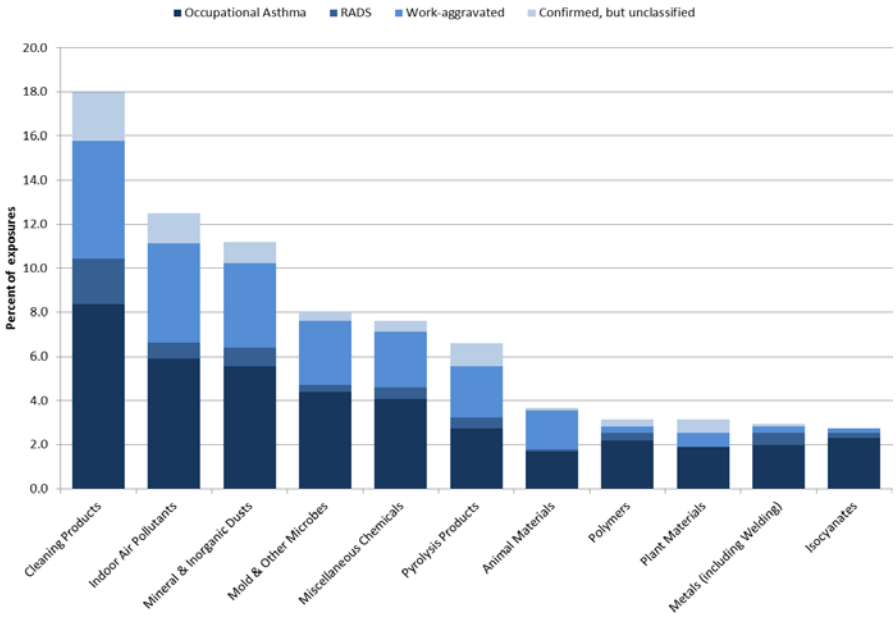
Educational materials are now available on the Massachusetts Health Promotion Clearinghouse, a one-stop shopping website that houses and distributes educational materials for all of MDPH, free of charge to the public. Having our materials in the clearinghouse will increase the visibility of "workplace health & safety" as a public health issue alongside other traditional topics. Materials about WRA and the *Resource Guide: Occupational Health Information and Services in Massachusetts* were mailed to all workers who completed interviews. While we have developed some educational materials on select hazards, we still do not have access to user-friendly materials on a wide range of WRA hazards and we have found that it can be awkward to disseminate materials developed by other states without substantial effort to redo the documents. We have recently asked for assistance from NIOSH and other states in developing materials that might be issued by NIOSH or the Association of Occupational and Environmental Clinics (AOEC), to avoid duplication of efforts by states.

In collaboration with the Fundamental project, OHSP conducted training for the Poison Control Center staff and residents in a program labeled "Tox Tuesday (10/14/2014)," highlighting isocyanates, bleach and quats and their role in inducing work-related asthma.

Aim 4. Data Analysis and Dissemination: Analyze sentinel and population-based surveillance data and disseminate findings to increase awareness and understanding of WRA.

Sentinel surveillance data on WRA provide valuable information on industries and occupations where workers are at risk, and hazardous exposures that need to be addressed. However, case-based surveillance alone cannot describe the overall burden of WRA. Complementary approaches are needed to generate population-based estimates of the magnitude and distribution of WRA, to track trends over time and generate targets for prevention and workplace intervention. This period, OHSP conducted new analyses of sentinel case data and also placed increased emphasis on the use of the Behavioral Risk Factor Surveillance System (BRFSS) to provide population-based data on asthma and WRA in the state.

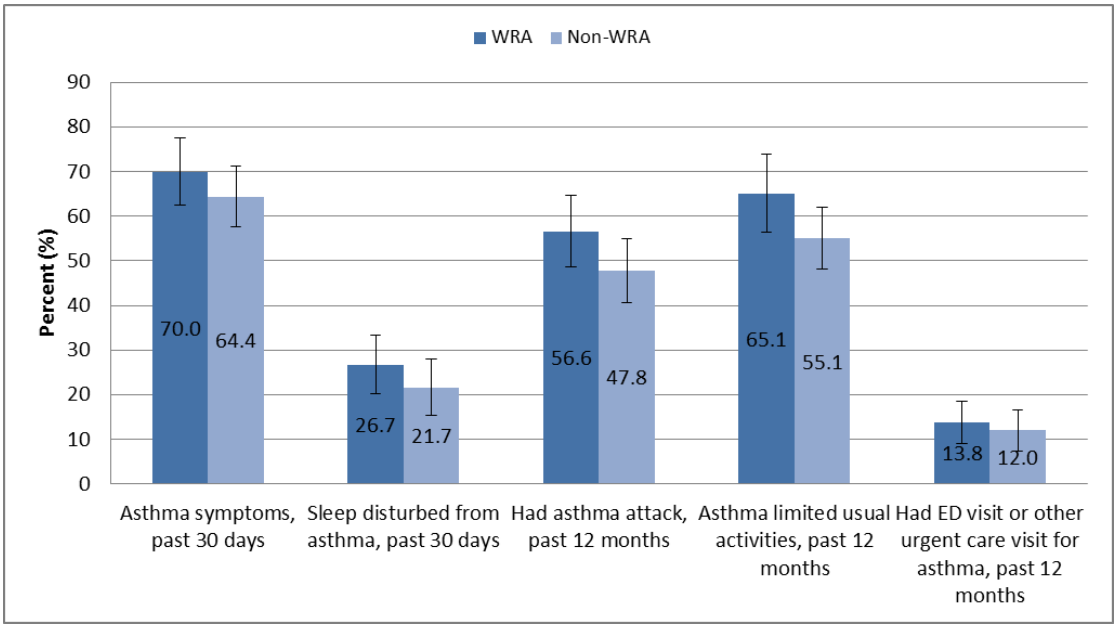
- We analyzed sentinel WRA data and presented findings in issues of the *Occupational Lung Disease Bulletin* (August 2010, Spring 2015), the *Burden of Asthma in Massachusetts* draft report (See below), and to the OHSP Advisory Board (Spring 2014). De-identified data were sent to NIOSH and combined with data from other states in NIOSH eWoRLD and two peer-reviewed publications. Leading industries among Massachusetts WRA cases from 2003-2013 presented in the Spring 2015 *Occupational Lung Disease Bulletin*, were Health Care and Social Assistance (30%), Manufacturing (18%), and Public Administration (11%). The most frequently reported exposures were Cleaning Products (18%), Indoor Air Pollutants (13%), Mineral and Inorganic Dusts (11%), and Mold and Microbes (8%) (See figure below)



- OHSP collaborated with other WRA states and NIOSH on an analysis of diisocyanate-associated WRA. OHSP contributed WRA cases and also had the primary responsibility for analyzing OSHA air sampling data for inclusion as a hazard surveillance tool to identify industries with exposures. OHSP worked closely with the other states and NIOSH

on a peer-review article that was published in AJIM (September 2015). Also, NJ colleagues presented a poster with findings at the "Isocyanates and Health: Past, Present and Future" conference (4/13).

- OHSP worked closely with the MDPH Asthma Prevention and Control Program on analyses and writing of an update to the statewide the *Burden of Asthma in Massachusetts* draft report. OHSP took the lead on the WRA section highlighting findings from our analysis of WRA sentinel surveillance data along with BRFSS I/O and Asthma Call-back Survey (ACBS) data, and played a large role in review of this document. A key finding from the 2006-2010 ACBS data (figure below) indicated that Massachusetts adults with work-related asthma are worse-off compared to those with asthma that is not work-related. Among ever-employed adults with current asthma, those with work-related asthma were consistently more likely to report indicators of poor asthma control or more severe disease compared to those with asthma that was not work-related; however differences were not statistically significant.



Despite this example of strong, successful intra-departmental collaboration and integration, to date this document is still under review and has not been released by MDPH.

- OHSP used industry and occupation (I/O) data in the BRFSS for innovative analyses, underscoring the value of collecting I/O in health surveys to both generate hypotheses about the impact of work on health and inform worksite wellness and occupational health activities.
  - A 2012 analysis revealed higher asthma prevalence among Massachusetts service workers (15.6%), particularly those in personal care and service occupations (22.9%), compared to all workers (8.8%). Findings provided an important impetus for considering work as it contributes to asthma and have implications for worksite-based wellness efforts. Results were presented at 2012 CSTE Annual Conference (6/12), and at internal MDPH meetings. Findings were published in the *Bulletin*

(October 2012), which was broadly disseminated and posted on the MDPH website. The findings informed projects by colleagues in NH health department and academia (Yale, University of Maine), were highlighted on the American Lung Association of the Northeast's website, and distributed by Collaborative for Health and the Environment. This analysis prompted the MDPH Health Survey Program (HSP) to choose current asthma by occupation for a leading section in the 2012 MA BRFSS report (Spring 2014). OHSP shared SAS code and methods with other states via the CSTE BRFSS I/O Work Group.

- A 2013 analysis of exposure to environmental tobacco smoke (ETS) at work highlighted the overall success of the statewide Smoke-free Workplace Law, but also groups of blue collar workers that continue to be exposed. We presented findings in the *Occupational Lung Disease Bulletin* and at the 2013 APHA Annual Meeting, and collaborated on multiple dissemination efforts, including a *Boston Globe* article that was redistributed by news outlets nationally, NIOSH Science Blog, NIOSH eNews, and BRFSS Facts & News. This work was instrumental in prompting other state BRFSS programs to include I/O questions in their surveys. The national COPD Foundation used the findings in employer trainings on COPD. Lastly, this analysis prompted OHSP to add ETS at work as a state-based Occupational Health Indicator that will be generated annually.
- A 2014-2015 analysis of current asthma prevalence among childcare workers found that 1 in 4 workers in the childcare industry had current asthma compared to 1 in 10 of workers in all other industries. Findings were shared with relevant programs within MDPH and the Massachusetts Department of Early Education and Care (EEC), as well as with colleagues from other states in an oral presentation at the 2015 CSTE Annual Conference (6/15/15). This analysis was prompted by the OHSP's collaborative work with colleagues in MDPH early childhood, infectious disease, and asthma programs and the EEC on a new policy statement on cleaning, sanitizing and disinfecting in childcare settings (see Aim 3 above.). In terms of methods, this was the first analysis in which we were able to use multiple years of BRFSS industry data to look at a detailed industry group (single CIC code).

- Through participation in CDC's BRFSS Asthma Call-back Survey (ACBS) Workgroup and ACBS WRA Section Workgroup, OHSP played a key role in the design and analysis of the WRA section of the Adult ACBS, as well as a successful effort to develop the national WRA indicator using this data.
  - This period, proposed revisions to the WRA section for the 2012 ACBS were finalized and the revised section was submitted for approval by CDC and states participating in the ACBS. A user's guide for the WRA section that provides background information, suggests WRA indicators, data considerations and SAS code for analysis was also developed.
  - The national WRA indicator and how-to guide were approved at the 2013 CSTE meeting. This will be included in the national Occupational Health Indicator (OHI) reports, and in Massachusetts OHI reports going forward. In 2012, 50% of ever-employed Massachusetts adults with current asthma reported that their asthma was caused or made worse by exposures at work.

Aim 5. Collaboration: Continue and enhance collaboration with government and community stakeholders at the state and regional levels to promote use of surveillance findings for prevention.

Collaboration between OHSP and other MDPH programs and external organizations is necessary to assure that WRA is included in the broader asthma agenda and to promote the use of surveillance findings for prevention.

Within MDPH, OHSP has participated in the **Internal Asthma Working Group**, led by the CDC funded **Asthma Prevention and Control Program**. We have worked closely with them on preparing an updated *Burden of Asthma in Massachusetts* report, which is currently in review and the *Strategic Plan for Asthma in Massachusetts 2015-2020* (May 2015). Effective 9/22/15, a newly redesigned MDPH webpage has been posted which lists WRA, alongside the Asthma Prevention and Control Program and Bureau of Environmental Health, providing improved visibility and access to WRA materials and furthers the integration of work issues into departmental plans for asthma.

Close collaboration with the MDPH **Division for Perinatal, Early Childhood & Special Needs** led to policy change in the Massachusetts Department of Education regarding guidance for childcare provider on cleaning, sanitizing and disinfecting in early education settings. Work is expected to continue on cleaning guidance in schools, which will be informed by California's new Healthy Cleaning and Asthma Safer Schools How-To Guide. We have worked over the years with partners, such as MassCOSH, the Massachusetts Asthma Action Partnership, and MDPH **School Health**, and **Bureau of Environmental Health**, and with schools, especially around cleaning and sanitizing issues. Work slowed around the issue of promoting alternative cleaning and sanitizing products without asthmagens in food protection, but is expected to be addressed going forward.

One of the biggest successes of this project period was collaboration with local and national partners in planning and hosting a two-day "Primary Prevention of Asthma: A Symposium on Current Evidence, Research Needs and Opportunities for Action," conference at MA Medical Society (April 23-24, 2013). The symposium brought together scientists and advocates from academia, government and the community, with potential to shift the dialogue beyond disease management to incorporate primary prevention. The conference findings provided the basis for inclusion of a 25-page Roadmap for the "Primary Prevention of Asthma in Massachusetts," in the *Strategic Plan for Asthma in Massachusetts 2015-2020* (May 2015). As a member of the planning committee and active participant, OHSP ensured that occupational asthma, school, early education and healthcare as *work* settings, and disparities by race and ethnicity were included in the plans. The roadmap facilitated organizing a new committee within the Massachusetts Asthma Action Partnership (MAAP), and OHSP serves as co-chair of this committee. MAAP dissolved the "adult and work-related asthma committee" with transfer of attention to the lessons from occupational asthma that are relevant for all primary prevention efforts. Exploring the links between WRA and primary prevention was the basis of presentations at CSTE (6/24/14, Nashville and APHA (11/18/14, New Orleans) and informed the APHA roundtable entitled "Little data: Sentinel surveillance of occupational injuries and illnesses are crucial for action (11/17/14)."

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Non-Fatal Work-Related Injuries to Massachusetts Teens, 2005-2010: Overview [2013]

Non-Fatal Work-Related Injuries to Massachusetts Teens, 2005-2010: Food Service [2013]

Non-Fatal Work-Related Injuries to Massachusetts Teens, 2005-2010: Grocery Stores [2013]

Non-Fatal Work-Related Injuries to Massachusetts Teens, 2005-2010: Health Care Service [2013]

Non-Fatal Work-Related Injuries to Massachusetts Teens, 2005-2010: Retail Trade [2013]

Non-Fatal Work-Related Injuries to Massachusetts Teens, 2005-2010: Construction [2013]

Emergency department visits for work-related injuries among 18-24-year-olds, 2005-2009 [2013]

Hospitalizations for work-related injuries among 18-24-year-olds, 2005-2009 [2013]

Emergency department visits for work-related injuries among 18-24-year-olds, 2007-2011 [2014]

Hospitalizations for work-related injuries among 18-24-year-olds, 2007-2011 [2014]

Educational Materials
Youth at Work: Talking Safety Sexual Harassment Supplementary Lesson (curriculum)

Youth at Work: Talking Safety Summer Jobs Supplementary Scenarios (curriculum)

Safe Jobs for Youth: Safety and Health Resources for Massachusetts Cooperative Education Placement Coordinators [2011]

Child Labor Laws in Massachusetts (Poster) [updated 2010] (available in English, Spanish, Portuguese, Chinese, Haitian Creole, Khmer, Vietnamese, Cape Verdean, Russian, Ukrainian)

Do You Work? Protect Your Health, Know Your Rights: A Guide for Working Teens [updated 2015]

Protecting Your Working Teen: A Guide for Parents [updated 2015] (available in English, Spanish, Portuguese)

Employer Tips: Keeping Young Workers Safe on the Job

Employer Resources for Keeping Teens Safe at Work

Restaurant Employer Resources for Keeping Teens Safe at Work

OHIP brochures: Health and Safety Tips for Young Adult Workers in 1) Child Care Settings; 2) Day Camp Settings; 3) Grounds Maintenance

Winning Posters from the Annual Safe Jobs for Youth Poster Contest

Other

Graduate Capstone Project: Workplace Safety Awareness in Young Hispanic Workers – A Massachusetts Department of Public Health Project to Reduce Nonfatal Workplace Injuries in Hispanic Workers ages 18- to 24-years old

Department Homepage Feature Stories

Safe Jobs for Youth Poster Contest. Teens across Massachusetts: use your creativity to speak out about the importance of job safety and your rights as young workers. January 7, 2011.

Keeping Teens Safe at Work. Hundreds of Massachusetts teens are injured every year on the job. If there are working teens in your life, learn more about how to help keep them safe. July 1, 2013.

Speak Up for Teen Safety at Work. Teen workers are everywhere – learn more on efforts to keep them safe while they're on the job. March 14, 2014.

Teens Are Working: Let's Keep Them Safe. Learn more about injuries to teen workers and how we can all help prevent them. June 24, 2015.

Department Blog Posts

Teens Speak Up about Safe Jobs for Youth. May 22, 2012.

The "Art" of Creating Dialogue: Teen Worker Safety and Health. March 13, 2013.

From Vision to Action: Making Teen Workplace Safety a Reality. March 18, 2014.

Don't Forget About Summer Job Safety. May 19, 2014.

Tapping Into Social Media to Help Teens Recognize Workplace Safety. April 8, 2015.

Can Teens Drive for Work? June 23, 2015.

Surveillance and Prevention of Sharps Injuries and MSDs among Massachusetts Hospital Workers

Peer reviewed publications

Laramie AK, Pun VC, Fang SC, Kriebel D, & Davis L. Sharps Injuries among Employees of Acute Care Hospitals in Massachusetts, 2002-2007. Infect Control Hosp Epidemiol. 2011 Jun; 32(6):538-44

Laramie AK, & Galligan CJ. (2011). A call to action. Nursing management, 42(8), 8-8.

Galligan C, Chalupka S, Laramie A, & Davis L. (2011). Prepackaged procedure trays and sharps safety standards. Nursing management, 42(3), 50-52.

Galligan, C and Laramie A. Letter to the Editor regarding article "Prepackaged procedure trays and sharps safety standards" in Nursing Management (2011)

MacCannell T, Laramie AK, Gomaa A, & Perz JF (2010). Occupational exposure of health care personnel to hepatitis B and hepatitis C: prevention and surveillance strategies. Clin Liver Dis, 14(1), 23-36.

Galligan C, Chalupka S, Laramie A, & Davis L. (2010). Do your procedure trays meet sharps safety standards?. OR Nurse 2013, 4(6), 11-14.

Data Reports

Fact Sheet: Sharps Injuries among Hospital Workers in Massachusetts 2002-2012 (2015)
http://www.mass.gov/eohhs/docs/dph/occupational-health/sharps-injuries-hospital-workers.pdf

Moving into the future: Promoting safe patient handling for worker and patient safety in Massachusetts Hospitals. (2015)
http://www.mass.gov/eohhs/docs/dph/occupational-health/ergo-sph-hospitals-2014.pdf

Sharps Injuries among Hospital Workers in Massachusetts Hospitals, 2012 (2014)
http://www.mass.gov/eohhs/docs/dph/occupational-health/injuries/injuries-hospital-2012.pdf

Sharps Injuries among Hospital Workers in Massachusetts Hospitals, 2011 (2014) http://www.mass.gov/eohhs/docs/dph/occupational-health/injuries/injuries-hospital-2011.pdf

Survey of Safe Patient Handling Activities in Massachusetts Hospitals (2013) http://www.mass.gov/eohhs/docs/dph/occupational-health/safepatienthandling.pdf

Sharps Injuries among Hospital Workers in Massachusetts Hospitals, 2010 (2012) http://www.mass.gov/eohhs/docs/dph/occupational-health/injuries/injuries-hospital-2010.pdf

Sharps Injuries among Hospital Workers in Massachusetts Hospitals, 2009 (2011) http://www.mass.gov/eohhs/docs/dph/occupational-health/injuries/injuries-hospital-2009.pdf

Sharps Injuries Among Medical Trainees, 2002-2009 (2011) http://www.mass.gov/eohhs/docs/dph/occupational-health/injuries/injuries-medical-trainees-02-09.pdf

Sharps Injuries among Hospital Workers in Massachusetts Hospitals, 2008 (2010) http://www.mass.gov/eohhs/docs/dph/occupational-health/injuries/injuries-hospital-2008.pdf

Project-generated Resources

Massachusetts Sharps Injury Surveillance System Program Manual

Data collection instrument: Survey of Influenza Vaccination and Prevention Programs for Workers in MA Hospitals

Survey instrument for the "Survey of Hospital Based Patient Handling Activities"

Presentations

Laramie AK, Hawkins D, Davis L. (2015) Sharps Injuries among Massachusetts Hospital Workers: Focus on Injection Related Injuries. WHO Safe Injection Global Network Annual Meeting. Geneva, Switzerland.

Hawkins D, Laramie AK, Davis L. (2015) Getting the Most from Your Surveillance Data: Methods Used By the Massachusetts Sharps Injury Surveillance System. Council of State and Territorial Epidemiologists Annual Conference. Boston, MA.

Davis L, Miner C, Laramie AK. (2014) Patient handling injuries and safe patient handling practices in Massachusetts Hospitals. Health Care Services Board of the Massachusetts Department of Industrial Accidents

Davis LK, Laramie AK, Miner CE. (2014) Using multiple data sources to characterize patient handling related musculoskeletal disorders among Massachusetts Hospitals. CSTE Annual Conference. Nashville, TN

Miner CE, Laramie AK, Tran D, Davis L, Tak S, Wegman D. (2013) Safe patient handling activities in Massachusetts hospitals. 141st APHA Annual Meeting and Exposition. Boston, MA.

Sours K, Laramie AK, Miner CE, Davis L. (2013) Influenza vaccination of healthcare personnel in Massachusetts hospitals. 141st APHA Annual Meeting and Exposition. Boston, MA. Sours K,

Davis L, Sparer E, Laramie AK. (2013) Analysis of existing legislative approaches to Safe Patient Handling. National Academies of Science Safe Patient Handling and Mobility Planning meeting

Laramie AK, Miner CE, Galligan C, Davis L. (2012) Sharps Injuries and Devices from Pre-Packaged Kits. 140th APHA Annual Meeting and Exposition. San Francisco, CA.

Laramie AK, Bednarsh HS. (2012) Occupational Exposures to Bloodborne Pathogens among Dental Workers. 140th APHA Annual Meeting and Exposition. San Francisco, CA.

Laramie A, Pun V, Davis L. (2011) Sharps Injuries among Nurses in Massachusetts Hospitals, 2002-2009. CSTE Annual Conference.

Laramie AK, Pun V, Davis L. (2010) Sharps Injuries among Massachusetts Hospital Workers: 2002-2007. 8th International Conference on Occupational Health for Healthcare Workers, Casablanca, Morocco.

Laramie AK, Pun V, Davis L. (2010) Sharps injuries among attending physicians and medical trainees in Massachusetts. 138th APHA Annual Meeting and Exposition. Denver, CO.

Publications and Presentations to which OHSP contributed content

Kriebel, D., Brouillette, N., Markkanen, P., Galligan, C., Sama, S., Gore, R., Laramie, A., Okyere D., Sun, C., Davis L., & Quinn, M. (2014). Preventing needlesticks and other sharps injuries to home care aides: results of a survey to identify hazards during home visits. Occupl Environ Med, 71(Suppl 1), A36-A37.

Quinn, M., Markkanen, P., Galligan, C., Sama, S., Kriebel, D., Gore, R., Laramie, A., Brouillette, N., Okeyere, D., & Sun, C. (2014). Quantifying Hazardous Occupational Exposures and Injuries in Home Care: Results from the Safe Home Care Survey. Occup Environ Med, 71(Suppl 1), A39-A39.

Quinn, M. M., Markkanen, P. K., Galligan, C. J., Kriebel, D., Chalupka, S. M., Kim, H., Gore, R., Sama, S.R., Laramie, A.K., & Davis, L. (2009). Sharps injuries and other blood and body fluid exposures among home health care nurses and aides. Am J Public Health, 99 (Suppl 3), S710.

Quinn MM, Markkenen PK, Galligan CJ, Sama SR, Kriebel D, Gore RJ, Brouillette NM, Okyere D, Sun C, Punnett L, Laramie AK, Davis L. (2015) Occupational health of home care aides: results of the safe home care survey. Occup Environ Med.

Markkanen P, Galligan C, Laramie A, Fisher J, Sama S, Quinn M. (2015) Understanding sharps injuries in home healthcare: The Safe Home Care qualitative methods study to identify pathways for injury prevention. BMC Public Health. 15:359

Markkanen P, Quinn MM, Laramie A, Fisher J, Galligan C, Sama S, Brouillette N, Okyere O, Davis L. (2013) Why are needlesticks and other sharps injuries occurring in home healthcare? 141st APHA Annual Meeting and Exposition. Boston, MA.

Markkanen P, Quinn MM, Galligan C, Sama S, Brouillette N, Okyere D, Bello A, Laramie A, Davis L. (2012) Occupational safety and health hazards among homecare aides. 140th APHA Annual Meeting and Exposition. San Francisco, CA.

Surveillance and Prevention of Work-related Asthma

Peer reviewed publications

Casey M, Stanton ML, Cummings KJ, **Pechter E**, **Fitzsimmons K**, LeBouf RF, Schuler CR, Kreiss K. Work-related asthma cluster at a syntactic foam manufacturing facility - Massachusetts 2008-2013. MMWR Morb Mortal Wkly Rep. 2015 Apr 24;64(15):411-4. PMID: 25905894

Quinn M, Henneberger PK, and NIOSH NORA Cleaning and Disinfecting in Healthcare Working Group: Braun B, Delclos GL, Fagan K, Huang V, Knaack JLS, Kusek L, Lee S-J, Le Moual N, Maher KAE, McCrone SH, Mitchell AH, **Pechter E**, Rosenman K, Sehulster L, Stephens AC, Wilburn S, Zock J-P. Cleaning and disinfecting environmental surfaces in health care: toward an integrated framework for infection and occupational illness prevention. Am J Infec Control 43(2015):424-434. PMID: 25792102

White GE, Seaman C, Filios MS, Mazurek JM, Flattery J, Harrison RJ, Reilly MJ, Rosenman KD, Lumia ME, Stephens AC, **Pechter E, Fitzsimmons K, Davis LK**. Gender differences in work-related asthma: surveillance data from California, Massachusetts, Michigan, and New Jersey, 1993-2008. J Asthma. 2014;epublication ahead of print:1-12. PMID:24673105

Lefkowitz D, **Pechter E, Fitzsimmons K**, Lumia M, Stephens A, **Davis L**, Flattery J, Weinberg J, Harrison RJ, Reilly MJ, Filios MS, White GE, Rosenman KD. Isocyanates and Work-related Asthma: Findings from California, Massachusetts, Michigan, and New Jersey, 1993–2008. AJIM. Published Online 9/9/15. PMID: 26351141

Data reports and other materials

Occupational Lung Disease Bulletins and Factsheets

Fall 2015: Asthma in Child Care Workers. (Submitted for review, June 2015. Anticipated release, September 2015.)

Spring 2015: Work-Related Asthma Surveillance, Massachusetts, 2003 – 2013. http://www.mass.gov/eohhs/docs/dph/occupational-health/sensor-lung-disease-bulletins/spring2015.pdf

Fall 2013: On-the-job exposure to environmental tobacco smoke (ETS) in Massachusetts. http://www.mass.gov/eohhs/docs/dph/occupational-health/sensor-lung-disease-bulletins/fall2013.pdf

Summer 2013: Disinfecting Surfaces and Asthma. http://www.mass.gov/eohhs/docs/dph/occupational-health/sensor-lung-disease-bulletins/summer2013.pdf

October 2012: Burden of Asthma Among Massachusetts Service Workers, 2010. http://www.mass.gov/eohhs/docs/dph/occupational-health/sensor-lung-disease-bulletins/oct2012.pdf

Winter 2011-2012: Hair Straightening with Health Risks. http://www.mass.gov/eohhs/docs/dph/occupational-health/sensor-lung-disease-bulletins/winter2011-2012.pdf

July 2011: Evaluating a Patient Exposed to Mold. http://www.mass.gov/eohhs/docs/dph/occupational-health/sensor-lung-disease-bulletins/july2011.pdf

January 2011: Work-Related Asthma among Laboratory Animal Workers. http://www.mass.gov/eohhs/docs/dph/occupational-health/sensor-lung-disease-bulletins/jan2011.pdf

August 2010: Work-Related Asthma Surveillance Massachusetts 1995 – 2008. http://www.mass.gov/eohhs/docs/dph/occupational-health/sensor-lung-disease-bulletins/august2010.pdf

May 2011: "Is My Asthma Work-Related?" brochure in collaboration with the American Lung Association, New England. http://www.mass.gov/eohhs/docs/dph/occupational-health/asthma-work-related.pdf

Published materials to which OHSP contributed content

"Cleaning Can Be Bad for Your Health". Massachusetts Public Health Blog. 06/16/15. http://blogs.cdc.gov/niosh-science-blog/2013/11/

Massachusetts Department of Public Health, Asthma Prevention and Control Program. Strategic Plan for Asthma in Massachusetts, 2015-2020. May 2015. http://massclearinghouse.ehs.state.ma.us/ASTHMA/AS931.html

"Exposure to secondhand smoke at work on the decline, but gaps remain". Press Release. APHA. 11/4/13.

"Gaps seen in exposure to smoke on the job". News Article. *The Boston Globe*. 11/4/13. http://www.bostonglobe.com/lifestyle/health-wellness/2013/11/04/despite-workplace-ban-many-blue-collar-workers-still-exposed-secondhand-smoke/0CerkVLSsW6D2d5WVGQYEL/story.html

"Reducing Worker Exposure to ETS". NIOSH Science Blog. 11/21/2013. http://blogs.cdc.gov/niosh-science-blog/2013/11/

"On-the-job Exposure to Environmental Tobacco Smoke". NIOSH eNews. 12/2013. http://www.cdc.gov/niosh/enews/enewsV11N8.html

"State Spotlight: Massachusetts". BRFSS Facts & News. Spring 2014. http://www.cdc.gov/brfss/pdf/BRFSS_Newsletter_spring14.pdf

Massachusetts Department of Public Health, Health Survey Program. April 2014. A Profile of Health among Massachusetts Residents, 2012. http://www.mass.gov/eohhs/docs/dph/behavioral-risk/report-2012.pdf

Environmentally Preferable Products Purchasing Program: Cleaning the Bathroom Operational Services Division. October 2013. http://www.mass.gov/anf/docs/osd/epp/fact-sheets/cleaningthebathroomflyer.pdf

"A Report on Barriers to Reducing the Use of Asthma-Related Chemicals." Massachusetts Office of Technical Assistance and Technology. May 2013. http://www.mass.gov/eea/docs/eea/ota/tur-prog/asthma-barriers-report-may-2013-final.pdf

NIOSH Work-Related Lung Disease Surveillance System (eWoRLD). December 2012. http://www2a.cdc.gov/drds/worldreportdata/SectionDetails.asp?ArchiveID=1&SectionTitleID=9

"Cleaning for Healthier Schools—An Infection Control Handbook." UMASS Lowell Toxics Use Reduction Institute. 2010. http://www.turi.org/Our_Work/Home_Community/Apply_for_a_Community_Grant/Library_of_Past_Projects/Schools/National_Cleaning_for_Healthier_Schools_and_Infection_Control_Workgroup/Project-Materials/Infection-Control-Handbook

Massachusetts Department of Public Health, Asthma Prevention and Control Program. Fall 2014, submitted for review. Burden of Asthma in Massachusetts.

Data Sets

DPH's interagency data use agreements with the Department of Industrial Accidents and the Human Resources Division prohibit OHSP from releasing any file level data obtained from those sources. Statewide hospitalization and emergency department data are available to the public through the Massachusetts Center for Health Information and Analysis. Poison control data are available to the public through the Massachusetts/Rhode Island Regional Center for Poison Control and Prevention or the American Association of Poison Control Centers' National Poison Data System.

Researchers could apply for access to coded industry and occupation data from the Behavioral Risk Factor Surveillance System (BRFSS) with the MDPH Health Survey Program. De-identified data collected from the TAW sample of emergency departments and collected through interviews with injured teens and confirmed cases of work-related asthma are available to other researchers. In order to access these data a researcher must complete a research application with the Department of Public Health. Aggregated fatality data may be requested; requests will be forwarded to Massachusetts CFOI and data releases will be reviewed to be in compliance with privacy regulations for both MDPH and BLS. Sharps injury data collected under 105 CMR 130.1000 et seq. is protected by statute and cannot be released. Any researchers wishing to conduct analysis of the data will be required to be on-site at MDPH, and will be required to complete any applicable confidentiality agreements.

Other materials available for other investigators

The following materials are available upon request from the Principal Investigator, or are available on line as indicated.

SAS code/algorithms for 1) identifying local government workers & classifying them into major occupation categories, 2) grouping industry and occupation codes into standard coding schemes (Census, NAICS, SOC), 3) coding event/cause of injury using key word search of narrative text, 4) generating descriptive analyses and calculating FTE estimates using the American Community Survey Public Use Microdata Sample (modified from other researchers' work)

Guidance for data collection and transfer of work-related data from the MA/RI Regional Center for Poison Control and Prevention to MDPH

Cut out Cuts at Work: A Survey for Teens (mail survey for cut injuries)

Stop the Pain from Sprains at Work: A Survey for Teens (mail survey for sprain and strain injuries)

Turn up the Heat on Burns at Work: A Survey for Teens (mail survey for burn injuries)

Massachusetts Sensor Teens at Work: Injury Surveillance and Prevention Project Questionnaire (telephone survey for any injury)

Burns at Work: A Survey of Injured Workers (mail survey for burn injuries for young adults)

Amputations at Work: A Survey of Injured Workers (mail survey for amputation injuries for young adults)

Lessons learned/advice on promotional design and messaging for teens, based on poster contest judging sessions with Massachusetts youth

Massachusetts Sharps Injury Surveillance System Program Manual

Data collection instrument: Survey of Influenza Vaccination and Prevention Programs for Workers in MA Hospitals

Survey instrument for the "Survey of Hospital Based Patient Handling Activities"

Updated Annual Summary of Sharps Injuries
http://www.mass.gov/Eeohhs2/docs/dph/occupational_health/annual_summary_sharp_injuries.xls

Updated Bloodborne Pathogen Exposure Incident Recording form
http://www.mass.gov/Eeohhs2/docs/dph/occupational_health/bbpexpincirepform.pdf

MDPH Form: Request for exemption from inclusion of sharps injury prevention technology

Template for hospitals to use in creating an inventory of devices lacking sharps injury prevention technology

SAS programs for automated coding of sharps injury characteristics based on narrative text

Massachusetts Work-related Asthma Project Questionnaire (telephone survey for workers with probable work-related asthma; available in English and Spanish)

Inclusion of gender and minority study subjects

No individuals were excluded from surveillance and intervention activities based on race, ethnicity, religion or gender. OHSP includes all cases of conditions under surveillance regardless of gender, age, race or ethnicity. Thus inclusion of these groups in our various surveillance reports should reflect their distribution in the affected populations. Notably, there is evidence that injuries/illnesses among minority workers are undercounted in traditional occupational health surveillance systems. Documenting and addressing occupational needs of minority and immigrant workers are an OHSP program priority, and patterns of work-related injuries and illness were examined by race and ethnicity when these variables were available in the datasets used for surveillance**.** The FACE project specifically targeted immigrant and minority worker deaths for investigations and outreach. To ensure inclusion of Spanish-speaking workers, the Work-related Asthma Project has a bilingual interviewer and an interview instrument translated into Spanish.

Information regarding gender, race and ethnicity is not captured by the Massachusetts Sharps Injury Surveillance System. Women and individuals of all races and ethnic groups

will be included in the surveillance findings to the extent that they are included in the populations under surveillance.

Inclusion of children

Individuals captured in the surveillance data will reflect the working population; therefore, it is possible that individuals under the age of 21 were included in the data. Case reports of individuals under the age of 21 were actively solicited in the Teens at Work Surveillance and Prevention Project. The FACE surveillance system included a full census of children. Deaths of working children less than 21 years of age were targeted for in-depth field investigations.

Information regarding age is not available in the Massachusetts Sharps Injury Surveillance System.