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NJ Fundamental Occupational Health Surveillance
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LIST OF TERMS AND ABBREVIATIONS

BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CDRSS	Communicable Disease Reporting and Surveillance System
CPWR	Center for Construction Research and Training
CSTE	Council of State and Territorial Epidemiologists
DC	Death Certificate
ED	Emergency Department
EPHT	Environmental Public Health Tracking
EpiCenter	NJ Syndromic Surveillance System
HD	Hospital Discharge Data
ICD	International Classification of Diseases
NAICS	North American Industry Classification System
NIOSH	National Institute for Occupational Safety & Health
NJBRFS	New Jersey Behavioral Risk Factor Survey
NJDEP	NJ Department of Environmental Protection
NJDOH	New Jersey Department of Health
NJDLWD	New Jersey Department of Labor & Workforce Development
NJPIES	New Jersey Poison Information and Education System
NJSHAD	New Jersey State Health Assessment Data System
OEI	Occupational Eye Injuries
OHI	Occupational Health Indicators
OHS	Occupational Health Surveillance
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment
PEOSH	Public Employees Occupational Safety & Health
SAS	Statistical Analysis Software
SIC	Standard Industrial Classification
UB	Uniform Billing
WCD	Workers' Compensation Data

New Jersey Occupational Health and Safety Surveillance

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ABSTRACT

The Occupational Health Surveillance Unit in the New Jersey Department of Health has been conducting surveillance of work-related injuries and illnesses in New Jersey since 1981. This project works to enhance surveillance and prevention activities fundamental to an established program. The aims of this project are to: conduct population-based surveillance using existing state data sources; continue case-based surveillance of serious work-related conditions that require immediate public health response; foster integration of occupational health into ongoing public health activities; and promote collaboration with various stakeholders to improve state occupational health surveillance capacity. Presented below are the goals for each area of study.

- Occupational Health Indicators provide a snapshot of the health of workers in New Jersey. These indicators can be used by public health officials to track work-related adverse health effects and their causes, and guide priorities for prevention and intervention efforts. Population-based surveillance of specified OHIs will be conducted in order to estimate their magnitude and trends particularly in vulnerable populations. Using the state's hospital discharge data, project staff will also compose a picture of the frequency of occupational related burns among vulnerable populations.
- A new Occupational Health Indicator will also be developed for occupational eye injuries and submitted to the Council of State and Territorial Epidemiologists (CSTE) for adoption and implementation in applicable states to expand surveillance of occupational injuries.
- Surveillance, case follow-up, and interventions of elevated heavy metals exposure, including lead, among adults will also be conducted. Based on this knowledge, intervention strategies can be devised to reach at-risk working populations.

Improvements have been seen in worker health and safety over the years and the implementation of new data collection methods have improved surveillance of work-related illnesses and injuries in New Jersey. Elevated blood lead values ≥ 25μg/dL in workers employed in certain industries are still seen, but there has been a trend that indicates decreasing blood lead levels in adults over time which may be due to the closing of a large lead acid battery manufacturing facility and the implementation of an electronic reporting system which more efficiently collects reported heavy metals cases. However, challenges still remain. For example, compared with other US workers, New Jersey workers still experience higher rates of pneumoconiosis. Annual, age-standardized mortality rates for asbestosis between 2000 and 2019 were 4.4-13.8 deaths per million residents in New Jersey compared to U.S. rates which were 3.8-6.9 deaths per million residents. Also, the annual, age-standardized rate of hospitalization due to asbestosis between 2000 and 2019 in New Jersey was 66.0-277.0 hospitalizations/million residents. The occupational health indicators continue to provide baseline data for the New Jersey Fundamental Surveillance Program and serves as a useful means to identify specific populations at risk, provide benchmarks for intervention and opportunities for education.

SECTION 1
Fundamental Occupational Health Surveillance

Under the NIOSH-funded Fundamental Surveillance grant, the Occupational Health Surveillance (OHS) Unit of the New Jersey Department of Health (NJDOH) accomplished the following: 1) Identified and obtained vital occupational disease surveillance data from new data sources necessary to identify potential occupational diseases and fatal occupational injuries for which intervention actions can be efficiently implemented; 2) Collaborated with department, state, federal, labor, academia, and private entities to achieve the goal of eliminating work-related health hazards and exposures; and 3) Assessed the effectiveness of the NJDOH fundamental occupational health surveillance system.

PART A: Maintain and analyze Occupational Health Indicator (OHI) data.

Significant or Key Findings

- *Occupational Health Indicators (OHIs)*: From 2000-2019, there were over 3,000 work-related hospitalizations per year and 1,987 workers died from fatal injuries. Asbestosis hospitalizations (66-277 hospitalizations per million residents) and deaths (4-14 deaths per million residents) still remain high in NJ.
- *Heavy Metals Registry*: There has been a trend towards decreasing blood lead levels in adults over time. However, this should be interpreted cautiously for a few reasons including an overall decrease in manufacturing in NJ, the closing of a large lead acid battery manufacturing facility in the state, and the implementation of an electronic reporting system which more efficiently collects, and de-duplicates reported lead cases.

Translation of Findings

- *OHIs*: Surveillance indicators allow a state to compare its health or risk status with that of other states and evaluate trends over time within the state, and guide priorities for prevention and intervention efforts. These data sources are also used to identify cases of work-related respiratory illnesses such as pneumoconiosis, which are reportable, for public health follow-up.
- *Heavy Metals Registry*: OHS Staff worked with the NJ Office of Information Technology to consolidate all heavy metals reports into one registry in compliance with the CDC's Public Health Information Network (PHIN) and National Electronic Disease Surveillance System (NEDSS) requirements using standardized Health Level 7 (HL7) language. The web based NJDOH Communicable Disease Reporting and Surveillance System (CDRSS) was the logical choice since many clinical labs already use this platform to report mandated conditions. This has led to more efficient data collection and analysis, and case follow-up to help prevent exposures and potential illness.

Research Outcomes/Impact

- *Intermediate Outcome*: Key finding are posted on the OHI webpage featuring narratives and completed trend analyses for OHIs from 2000-2019, including employment demographics. This information is updated annually and provides stakeholders and the public with quick access to comprehensive NJ occupational health and safety statistics. Links to related topics are also featured on the page. Also, eight OHIs are included in the State Health Assessment Data (SHAD), which is a NJDOH web portal featuring numerous indicators of the health of NJ residents.
- *Intermediate Outcome*: Since all adult blood lead and other heavy metal records have been transferred to the CDRSS platform which facilitates the timely reporting and immediate sharing of pertinent data. This allows for the appropriate public health responses and collaborations with OSHA and NJ Public Employee Occupational Safety and Health (PEOSH). Also, case-finding activities are no longer labor-intensive.

PART B: Further analyze specified OHIs to characterize occupational health injuries and illnesses among vulnerable populations.

Significant (Key) Findings

- *Work-Related Burns*: Burns are among the most expensive work-related injuries to treat and can often result in significant disability. So, staff expanded the analysis of the "Hospitalizations for Work-Related Burns" indictor to include emergency department visits and found that 40% of young workers, ages 12-17 years, who had a work-related burn reported working in the food-service industry and 47% of the burns were to the hand.

- *Work-Related Eye Injuries:* Even though occupational safety measures are in place to wear personal protective equipment, such as eye protection, many workers still suffer from severe eye injuries. Since data is limited on work-related eye injuries, staff developed a work-related eye injury occupational health indicator. While developing this indicator, staff also conducted medical record review for 170 cases with work-related eye injuries. It was shown that 34 (20%) of the cases had a primary diagnosis of ocular laceration with prolapse or exposure of intraocular tissue. Examples of injuries resulting in this diagnosis includes struck in eye with razor blade, injury with nail gun, and electrical wire hit eye.

Translation of Findings

- *Work-Related Burns*: More in-depth analysis of both the HD and ED data were done to help characterize target populations, types of burns, and occupation and industry for work-related burns in NJ. Further characterizing these OHI can help to formulate strategies for interventions and educational outreach, particularly for youths and Hispanics.
- *Work-Related Eye Injuries:* As previously mentioned, there is limited information on work-related eye injuries. A new Occupational Health Indicator for severe eye injuries resulting in hospitalizations was developed by staff based on the current OHI data collection methodology and pilot testing. This new OHI was submitted to CSTE for adoption and implementation in the CSTE OHI How-to Guide for national collection to expand surveillance of occupational eye injuries.

Outcomes/Impact

- *Intermediate Outcome:* An infographic targeting youth work-related burns in the food-service industry has been created and is currently under review. This will be posted on an interactive web-based application being developed which allows minors to request occupational health information. Information will also be shared with partners and stakeholders to help promote and disseminate material to targe populations.
- *Intermediate Outcome*: The newly developed OHI#25, "Hospitalizations for and with Occupational Eye Injuries", was developed and published in the CSTE OHI How-to Guide for all states to collect.
- Most outreach activities were delayed due to staff being reassigned to COVID-19 emergency response.

PART C: Assess the Effectiveness of the Fundamental Occupational Health Surveillance System

Significant (Key) Findings

- The OHS Unit has identified two near real-time data sources to enhance classification and situational awareness of work-related injuries and illnesses, thus leading to a better understanding of the burden of non-fatal work-related injuries and illnesses and allowing for quicker response. For this purpose, data from the NJ Syndromic Surveillance System (EpiCenter) and the NJ Poison Information and Education System (NJPIES) were used as new data sources for occupational injuries and illnesses. Poison data is now uploaded in the state syndromic surveillance system on a daily basis.

Translation of Findings

- The use of multiple data sources can help identify populations, occupations, and industries at high risk of a workplace injury and illness and help to monitor trends of work-related injuries and illnesses over time. Also, underreporting of work-related injuries and illnesses is a major concern, identifying gaps can lead to improved, standardized methods, including better case definitions, reporting procedures, and data collection tools. The results will provide the project team the ability to put research into practice by making unique, relevant recommendations on data collection and interventions to mitigate worker health effects and will allow for quicker response to work-related health events. Surveillance tools developed by the OHS Unit will be transferable to other states and agencies that conduct occupational health surveillance.

Research Outcomes/Impact

- *Potential Outcomes*: Occupational surveillance currently involves collecting data on potential cases on a quarterly or yearly basis, often long after the diagnosis was made. However, using these real-time data sources allows staff to identify illnesses and injuries early so a timelier response can be initiated, reducing further risk of occupational injuries and illness.
- *Intermediate Outcomes*: Staff created a syndromic working group through CSTE and also a guidance document to help other states implement syndromic surveillance for occupational health surveillance.

SECTION 2

SCIENTIFIC REPORT
Fundamental Occupational Health Surveillance

A. Background

The OHS Unit has been conducting surveillance of work-related injuries and illnesses in New Jersey since 1981. This project builds on this experience to enhance surveillance and prevention activities fundamental to an established program. Aims of the project are the following: to conduct population-based surveillance using existing state data sources; to continue case-based surveillance of serious work-related conditions that require immediate public health response; to foster integration of occupational health into ongoing public health activities; and to promote collaboration with various stakeholders to improve state occupational health surveillance capacity. The injuries and illnesses that were proposed for surveillance include the Occupational Health Indicators (OHIs) identified by NIOSH and the Council of State and Territorial Epidemiologists (CSTE). Indicators are a construct of public health surveillance that defines a specific measure of health or risk status (i.e., the occurrence of a health event or of factors associated with that event) among a specified population.[1] Surveillance indicators allow a state to compare its health or risk status with that of other states, evaluate trends over time within the state, and guide priorities for prevention and intervention efforts. OHIs can provide information about a population's health status with respect to workplace injuries and illnesses or to factors that can influence health. Population-based surveillance of specified OHIs was conducted in order to estimate their magnitude and trends.

Table 1: List of Occupational Health Indicators

- Employment Demographic Profile
- 1-Non-Fatal Injuries and Illnesses
- 2-Work-Related Hospitalizations
- 3-Fatal Work-Related Injuries
- 4-Amputations Reported by Employers
- 5-Amputations Identified in State Workers' Compensation
- 6-Hospitalizations for Work-Related Burns
- 7-Musculoskeletal Disorders Reported by Employers
- 8-Carpal Tunnel Syndrome Cases Identified in State Workers' Compensation
- 9-Pneumoconiosis Hospitalizations
- 10-Pneumoconiosis Mortality
- 11-Acute Work-Related Pesticide Poisonings Reported to Poison Control Centers
- 12-Incidence of Malignant Mesothelioma
- 13-Elevated Blood Lead Levels Among Adults
- 14-Workers Employed in Industries with High Risk for Occupational Morbidity
- 15-Workers Employed in Occupations with High Risk for Occupational Morbidity
- 16-Workers in Occupations and Industries with High Risk for Occupational Mortality
- 17-Occupational Health and Safety Professionals
- 18-OSHA Enforcement Activities
- 19-Workers' Compensation Awards
- 20-Work-Related Low Back Disorder Hospitalizations
- 21-Asthma Among Adults Caused or Made Worse by Work
- 22-Work-Related Severe Traumatic Injury Hospitalizations
- 23-Influenza Vaccination Coverage Among Healthcare Professionals
- 24-Occupational Heat-Related Emergency Department Visits
- 25-Hospitalizatons for or with Occupational Eye Injuries

B. Progress Achieved Under Specific Aims

The overall goal of the work conducted by the OHS Unit under the Fundamental Occupational Health Surveillance grant had the following two broad objectives to enhance existing surveillance activities in NJ:

a) Conduct population-based surveillance of established occupational health indicators in order to estimate their magnitude and trends; and

b) Evaluate surveillance systems in order to enhance data collection, prevention and intervention activities in the State.

These objectives were achieved through the following Specific Aims:

Specific Aim 1:
Maintain and expand data collection of 23 specified occupational health indicators. Analyze data and disseminate findings to stakeholders.

As previously stated, OHIs (**Table 1**) are generated to describe the occupational health status of NJ's working population. OHS staff follows the CSTE OHI "how-to" guide, which is a step-by-step manual that describes the methods for acquiring the OHI

data and how to calculate numbers and rates that need to be submitted to CSTE annually. Since 2008, NJ no longer generates Amputations Filed with State Workers' Compensation System (OHI #5) and Annual Number of Carpal Tunnel Syndrome Cases Filed with State Workers' Compensation System (OHI #8) due to changes in the requirements for the transmission of claims information from claims administrators (insurers, self-insured employers, and third-party administrators) to the NJ Department of Labor and Workforce Development. Data for most of the indicators can be obtained from the NJ hospital discharge and emergency discharge data, online from the US Bureau of Labor Statistics, US Census Bureau, and the National Academy of Social Insurance. The NJDOH State Cancer Registry and Division of Healthcare System Analysis provide the mesothelioma and work-related hospitalizations data, respectively. Data for elevated blood lead levels among adult's indicator are obtained from the NJDOH Heavy Metals Registry. Some OHI, such as OSHA Enforcement Activities (OHI #18), are compiled by NIOSH for participating states. Examples of NJ OHIs are provided in **Tables 2** and **3** below.

Table 2. New Jersey Employment Demographics, 2018-2019

Demographics	2018	2019
Percentage of civilian workforce unemployed	4.2	3.5
Percentage of civilian employment self-employed	4.0	4.0
Percentage of civilian employment in part-time jobs	16.2	16.1
Percentage of civilian employment by number of hours worked		
<40 hours	28.7	28.0
40 hours	51.1	51.9
>40 hours	20.1	19.9
Percentage of civilian employment by sex		
Males	52.7	52.0
Females	47.3	48.0
Percentage of civilian employment by age group		
16 to 17	1.0	1.0
18 to 64	92.3	91.4
65+	6.8	7.6
Percentage of civilian employment by race/ethnicity		
White	73.9	73.8
Black	14.2	14.6
Hispanic origin	11.9	11.6
Other	17.5	19.0

Source: US Bureau of Labor Statistics (BLS)

Table 3. Selected 2018 and 2019 New Jersey Occupational Health Indicators

Occupational Health Indicator	2018	2019
Annual average # of adults (civilian non-institutionalized) working in NJ[1]	4,232,000	4,359,000
Estimated annual total number of work-related injuries and illnesses[2]	74,400	69,000
Annual number of work-related traumatic fatalities[1]	83	74
Annual number of work-related hospitalizations	3,220	4,199

Sources: [1]US Bureau of Labor Statistics' (BLS)

OHIs are analyzed and disseminated annually to stakeholders and the general public in various formats such as, annual reports published by the NJDOH, Grant Performance Reports published by NIOSH on their OEP Web page, the CSTE OHI webpage, and the NJDOH Occupational Health Statistics webpage at https://www.nj.gov/health/workplacehealthandsafety/occupational-health-surveillance/statistics/nj_ohi.shtml

The OHS Unit staff collaborated with NJDOH Environmental Public Health Tracking (EPHT) researchers to continue to incorporate occupational health indicators into the NJDOH online indicator-based information system, NJ State Health Assessment Data (SHAD), available at https://www-doh.state.nj.us/doh-shad/topic/Occupational.html. NJ SHAD is hosted by the NJDOH Center for Health Statistics and features numerous other leading NJ health indicators. Occupational indicators currently posted on SHAD include Fatal Work-Related Injuries (OHI #3); Elevated Blood Lead Levels among Adults (OHI #13); Non-Fatal Work-Related Injuries and Illnesses Reported by Employers (OHI #1); Work-Related Hospitalizations (OHI #2); Hospitalizations for Work-Related Burns (OHI #6); Hospitalizations from or with Pneumoconiosis (OHI #9); and Mortality from or with Pneumoconiosis (OHI #10).

Three OHIs, Fatal Work-Related Injuries (OHI #3), Mortality from or with Pneumoconiosis (OHI #10), and Elevated Blood Lead Levels among Adults (OHI #13) were incorporated into Healthy NJ 2020 as Occupational Health and Safety objectives and referenced accordingly in the SHAD indicator system. [https://www.nj.gov/health/chs/hnj2020/]

The following is a summary of education and outreach projects and publications that were completed in this grant period:

• August 2016, a New Jersey clam fisherman inadvertently dredged up old munitions from the seafloor off the coast of New Jersey. Per reports, a munition appeared on the conveyor belt during clam processing shipboard and was recognized as a "bomb" by a crew member who then threw it back into the water. This clammer later developed painful blistering on the right lower and upper arms the same morning of this bomb exposure. An infographic entitled, "What's Your Catch? - Dangers in dredging old bombs from the New Jersey ocean floor" was developed in collaboration with the NJDOH Food and Drug Safety Program, The Seafood and Shellfish Project and distributed, along with a survey, to NJ Shellfish Dealers and Harvesters. (https://www.nj.gov/health/ceohs/documents/njdoh_fishing_munitions.pdf)

• An infographic entitled, "Workplace Fatalities Involving Multiple Victims" was published that characterizes the 68 workplace incidents involving multiple victims that occurred in New Jersey between 1991 and 2015. It describes three case studies, the number of fatal and nonfatal injuries involving both workers and bystanders. In addition, it provides the demographics for the 170 workers who died during these 68 incidents including the incident types and the industry sectors with 10 or more worker fatalities. (https://www.nj.gov/health/workplacehealthandsafety/documents/occupational-health-surveillance/nj_multiple_wrfatalities.pdf)

• Two published NJDOH workplace fatality investigation reports were chosen by the National Safety Council to be featured in the October and December 2016 issues of their monthly magazine (Safety + Health). The first report details how a 34-year-old Hispanic day laborer was killed on his first day on the job when a backhoe loader operator, not realizing the victim was working nearby, rotated the boom, hitting the victim with the bucket (https://www.safetyandhealthmagazine.com/articles/14776-facevalue-worker-struck-and-killed-by-backhoe-bucket). The second report describes how a 62-year-old male mechanic was killed while removing salvageable equipment from a 993.5-pound electrical cabinet when the cabinet tipped over and crushed him between the floor and the cabinet (https://www.safetyandhealthmagazine.com/articles/15020-facevalue-mechanic-crushed-to-death-under-electrical-cabinet). This effort was the subject of a March 2017 NIOSH eNews (https://www.cdc.gov/niosh/enews/enewsv14n11.html) and highlighted in the November-December 2016 NJDOH Health Matters (https://www.state.nj.us/health/newsletter/documents/2016/Nov-Dec%202016.pdf).

• An infographic entitled, "Hazard! Unprotected Trench" was published after 4 deaths occurred within 9 months of each other involving workers in trenches. The infographic included information on lessons learned, training resources, and also described four case studies. (https://www.nj.gov/health/workplacehealthandsafety/documents/occupational-health-surveillance/nj_trenching_alert.pdf)

• In 2019 some states had started to see an increase in silicosis cases among younger workers involved in stone countertop fabrication, which initiated a larger campaign for education and outreach in this industry. Therefore, an infographic entitled, "Health Alert! Stone Countertop Fabrication Workers at Risk for an Incurable Lung Disease" was published. This work was also presented to the NJ Public Employee Occupational Safety and Health (PEOSH).
(https://www.nj.gov/health/workplacehealthandsafety/documents/occupational-health-surveillance/njdoh%20stone%20countertops%20alert_2020.pdf)

• During this last grant cycle staff began using social media as another way of messaging to reach a larger audience in the state. Numerous tweets on topics such as heat-related illness, cold stress, noise, tree-related injuries during severe weather events, Worker Memorial Day, etc., can be found here: https://twitter.com/NJDeptofHealth?ref_src=twsrc%5Egoogle%7Ctwcamp%5Eserp%7Ctwgr%5Eauthor

Specific Aim 2:
Analyze specified OHIs to characterize occupational health injuries and illnesses among vulnerable populations, e.g., youths, Hispanics and other worker populations to formulate strategies for interventions.

Trend Analysis: Using the state's hospital discharge data, the OHS Unit was able to compose a picture of the frequency of common types of work-related injuries and illnesses among certain populations (specifically race/ethnicity, age, and industry/occupation group) for the period of 2000-2019. An in-depth analysis was also conducted to characterize industry and occupation for work-related burns. Project staff focused only on OHIs for which there is: current access to the data source, historical data, and for which demographic data are available:

1. *Pneumoconiosis Hospitalizations*
   a. There have been over 27,000 cases of pneumoconiosis in NJ between 2000 and 2019. Of the reported cases of pneumoconiosis hospitalizations, 92% (25,604) were due to asbestosis. The NJ annual, age-standardized rate of asbestosis between 2000 and 2019 was 66-277 hospitalizations/million residents. Rates of asbestosis in NJ may be higher because the production of asbestos products and use of asbestos, especially in NJ's many shipyards. Several NJ studies have documented excess mesothelioma among NJ workers in industries with asbestos exposure, including NJ's most well-known asbestos products manufacturer, the Manville Corporation in Somerset County. The NJDOH has estimated that as many as 500,000 NJ workers may have been exposed to asbestos since 1940.
2. *Pneumoconiosis Mortality*
   a. The rate of mortality from or with pneumoconiosis in NJ has remained slightly higher than US rates.
   b. In NJ, asbestosis resulted in the greatest number of deaths from pneumoconiosis, over 1,200 between 2000 and 2019. In NJ, asbestosis annual, age-standardized mortality rates between 2000 and 2019 (4-14 deaths per million residents) have been slightly higher than the US (4-7 deaths per million residents). Rates of asbestosis in NJ may be higher due to the reasons listed above.
   c. Silicosis and coal workers' pneumoconiosis each resulted in less than 5 deaths per year between 2000 and 2019; therefore, rates could not be accurately calculated.
3. *Non-Fatal Work-Related Injuries and Illnesses*
   a. In NJ, there have been over 1.8 million non-fatal work-related injuries and illnesses reported by employers between 2000 and 2019. NJ annual incidence rates decreased from 4,900 in 2000 to 2,500 injuries per 100,000 FTEs in 2019. NJ annual rates were lower than the US rates which ranged from 2,800-6,100 cases per 100,000 FTEs.
   b. Between 2000 and 2019, in NJ, there were over 300,000 estimated cases involving more than 10 days away from work. The incidence rate for cases involving full days away from work beyond the day of the incident was 1,000 cases per 100,000 FTEs in 2019.
4. *Work-Related Hospitalizations*
   a. In NJ there have been over 86,000 work-related hospitalizations between 2000 and 2019. In 2019 there were 4,199 work-related hospitalizations. Of these, 2,681 (64%) individuals were

male, and the average age was 49 years. Over 2,000 (52%) of the hospitalized individuals were White; 796 (19%) were Black; and over 1,000 (27%) were of Hispanic origin. NJ annual rates have decreased from 143 per 100,000 in 2000 to 96 per 100,000 in 2019.

5. *Adult Lead Exposure*
   a. In NJ, there has been a trend towards decreasing blood lead levels in adults over time. However, this must be interpreted cautiously for a variety of reasons including the closing of a large lead acid battery manufacturing facility and an overall decrease in manufacturing in NJ. Despite these overall trends, OHS still routinely finds elevated blood lead values above 25 µg/dL in workers employed in certain industries.
6. *Hospitalizations for Work-Related Burns*
   a. In NJ there have been over 1,000 work-related burns between 2000 and 2019 and NJ annual rates ranged from 0.7-2.9 hospitalizations/100,000 workers. In 2019, there were 32 work-related burn hospitalizations in NJ. Of these 29 (91%) were male and the average age was 39 years. Nine (28%) of the hospitalized individuals were White; 5 (16%) were Black; and 17 (53%) were of Hispanic origin. Of the 32 reported cases of work-related burns in 2019, 28% of the burns were to face, head, and trunk; followed by head, face, and neck (22%); and shoulder and upper limb, except wrist and hand (19%).
   b. Medical record review, and interviews, was completed for 59 hospitalized adult work-related burn cases for 2017 and 2018. Thirteen (22%) of the cases involved burns to the head, face, and neck; 7 (12%) were to the forearm; and 6 (11%) were burns to the lower limb. Of the 59 cases, 32 (54%) of the cases had 3rd degree burns; 16 (27%) worked in the food service industry; and 17 (29%) were due to hot water or cooking oil. Educational material targeting working adults on work-related burns is currently being developed. Staff reassignment to COVID-19 emergency response delayed education and outreach efforts.

Collaboration: Burns can be the most expensive work-related injuries to treat, result in large amounts of lost work time, and can be extremely painful. Staff worked with a Drexel University public health student to characterize industry and occupation for work-related burns in youth workers. Between 2015 and 2019, 111 young workers, ages 12-17, were treated at NJ emergency departments for work-related burns. Of these cases, 71 (64%) were female; 75 (68%) were White; and 15 (14%) were of Hispanic Origin. Of those who reported occupation, 29 (40%) were food-service jobs and 52 (47%) had burns to the hand. An infographic targeting youth work-related burns in the food-service industry has been created and is currently under review.

⊗ **Publication**:

- Analysis of these data is posted to the NJDOH OHI Web page [http://nj.gov/health/surv/nj_ohi.shtml]
- NJ State Health Assessment Data webpage [https://www26.state.nj.us/doh-shad/home/Welcome.html]

Specific Aim 3:
Using the occupational health indicators framework, characterize occupational eye injuries in New Jersey's hospital discharge and emergency department data sets and submit a proposal for consideration as a new OHI.

This project utilized the occupational health indicators framework to characterize occupational eye injuries using hospital discharge data. Eye injuries are among the most traumatic injuries sustained in the workplace. Yet, protective eyewear can prevent more than 90 percent of serious eye injuries. To determine the appropriate ICD-10-CM codes for work-related eye injuries, a preliminary analysis of the hospitalization data for the period 2010-2014 was completed. Medical records were pulled based on whether the ocular injury-related ICD code was the primary diagnosis or secondary diagnosis in patients aged 16 years and older with workers' compensation as a primary payer (proxy for work-relatedness). A total of 170 records met the study criteria. Cases ranged in age from 18-77 years; 152 (89%) of the cases were male; 79 (47%) were White; and 49 (29%) were of Hispanic Origin. 34 (20%) of the cases had a primary diagnosis of 871.1, ocular laceration with prolapse or exposure of intraocular tissue. Examples of injuries resulting in this diagnosis includes struck in eye with razor blade, injury with nail gun; and

electrical wire hit eye. Once the appropriate ICD-10-CM codes were identified, nine states (CA, CO, GA, IA, IL, MD, MI, MT, WA) volunteered to pilot test the "How-To-Guide" and ICD-10-CM codes for occupational eye injuries. Eye injury cases were typically a sequela of another injury and were typically a secondary diagnosis (65-80%) with an injury other than eye as the primary diagnosis. The results were presented at the December 2017 Winter Partners meeting and was approved as a new Occupational Health Indicator (OHI#25, Hospitalizations for and with Occupational Eye Injuries) and included in the 2019 How-To-Guide for states to begin collecting 2016 data.

A ten-year trend analysis of hospitalizations due to work-related eye injuries was also conducted. From 2010 through 2019 there were 281 hospitalizations. Of these cases 252 (90%) were male; mean age was 42 years; 125 (44%) were White; and 95 (34%) were of Hispanic origin. Of the 127 cases that reported their job, 17 (13%) worked in construction and 9 (7%) were drivers. The average total charges for claims averaged $113,050.

Collaboration: Staff have been working with a Rutgers University public health student to further characterize work-related eye-injuries focusing on hospitalization data from 2010 through 2019 since cases who have been hospitalized are more likely to be the more severe cases. The student will further look at the data to help identify specific target populations such as youth and Hispanics and also characterize industry and occupation. Education and outreach material will be developed based on findings from the data analysis. Due to staff, and local university public health students, being reassigned to COVID-19 emergency response, some data analysis and outreach activities were delayed.

⊗ Publication:

- The newly developed OHI#25, Hospitalizations for and with Occupational Eye Injuries, was published in the CSTE OHI How-to Guide [https://cdn.ymaws.com/www.cste.org/resource/resmgr/occupationalhealth/OHI_GuidanceManual_2018_FINA.pdf]

Aim 4
Maintain data collection of adult blood lead and other heavy metals such as mercury, arsenic and cadmium. Analyze data to identify individuals at risk of exposure for further investigation and formulate strategies for intervention.

NJ state regulations require reporting of heavy metal test values from clinical laboratories, physicians, and hospitals.[1] Heavy metal lab reports are submitted electronically to the NJ Communicable Disease Reporting Surveillance System (CDRSS) which automatically process potential cases of occupational heavy metal exposure by means of laboratory test (i.e., blood lead level ≥5µg/dL), age of the case (≥16 years), and if it is a new or existing case. When a potential work-related case is identified a telephone interview using a standardized questionnaire is conducted, or a survey (with educational material) is mailed if unable to reach by phone. As per an agreement with Occupational Safety and Health Administration (OSHA), staff refers all confirmed work-related cases of BLL ≥ 40 µg/dL. Staff updated all lead educational materials, alerts and brochures targeted at workers, employers, and parents. In addition, the mailed survey was translated into Spanish.

During the grant period, the Adult Blood Lead project collected over 350 potential work-related lead exposure cases (age 16+) with blood lead levels (BLL) between 5 µg/dL and 9 µg/dL (NJ did not start collecting this BLL range in CDRSS until 2018); 2,257 cases between 10 µg/dL and 24 µg/dL; 342 cases between 25 µg/dL and 39 µg/dL; and 101 cases ≥ 40 µg/dL. Of these cases 86% were male; 36% were white; and 12% were of Hispanic origin. Over 140 cases were interviewed by phone and over 2,000 surveys with educational material were sent to cases who could not be reached for a phone interview or had a BLL below 20 µg/dL. Of the cases that provided work-related information most worked at a firing range or shooting was a hobby. Staff also found that lead exposure often occurred through cultural use of

[1] N.J.A.C. 8:44-2.11, N.J.A.C. 8:58-1.5, 1.6, 1.7, and N.J.A.C. 8:58-1.4, 1.6, 1.7

certain imported products such as turmeric. For the other heavy metals, 167 arsenics; seven cadmium; and 189 mercury cases were reported during the grant period.

Staff worked with a fellow from the Council of State and Territorial Epidemiologists (CSTE) to further evaluate elevated levels of arsenic and their potential sources of exposure. In an effort to conduct surveillance to determine potential sources of arsenic exposure in NJ, individuals who had elevated levels of total arsenic reported to CDRSS in 2017 to obtain information regarding occupational, dietary, environmental, and other exposures. Of the 36 reported cases, urinary arsenic tests measure chronic arsenic exposure while blood tests are reflective of an acute exposure. Among those who had an elevated total arsenic in 24-hour urine test, the mean value was 176.1 µg/L (range: 104.0-291.0 µg/L). There was one report for arsenic in blood, with a value of 0.095 µg/mL. The mean age of respondents was 56 years (range: 39-76 years). There were 6 (40%) females and 9 (60%) males. The majority of respondents (n=10, 67%) identified their race as white, 4 (27%) as other/unknown and 1 (7%) as Asian. There were 10 (67%) respondents who identified their ethnicity as non-Hispanic, 1 (7%) as Hispanic and 4 (27%) as other/unknown. It was found that exposures were largely due to a diet high in seafood and rice. The following potential risk factors were reported by some respondents: wood working, having a private well as the source of drinking water, smoking, and working in the vicinity of a manufacturing plant that smelts copper.

⊗ Publication:

- NJ lead data is submitted annually to the NIOSH State Adult Blood Lead Epidemiology and Surveillance (ABLES) Program. Data was published in the updated MMWR "Elevated Blood Lead Levels Among Employed Adults — United States, 1994–2013". [https://www.cdc.gov/mmwr/volumes/63/wr/mm6355a5.htm]
- Educational material for the Adult Blood Lead project "Don't Take Lead Dust Home from Work!" and "Occupational Lead Exposure" are sent to cases with blood lead levels >5 ug/dL. Information on lead, and other heavy metal exposure can also be found on the OHS Web page at http://www.nj.gov/health/workplacehealthandsafety/occupational-health-surveillance/heavy-metals/

C. Other Fundamental Occupational Health Surveillance Activities

(1) *Work-Related Youth Injuries*: The OHS collaborated with Rutgers University, School of Public Health, on hospitalization and injury fatality rates among NJ adolescent youths. Injury at work, in various outdoor and indoor microenvironments, is an increasing public health concern, particularly among adolescent workers ages 14-21. Hospitalization and fatality rates were higher among young adult workers ages 19-21; non-Hispanic Whites (NHW); and males. The percent fatality for the 19-21 age group is over three times the combined percent fatality for ages 14-17 and 18. Understanding the causes and mechanisms of injuries that create the largest share of this burden and understanding disparities among affected groups can inform public health prevention efforts. A manuscript based on this collaborative work, "Reported Injury, Hospitalization, and Injury Fatality Rates among New Jersey Adolescent Workers", was accepted for publication to Injury Epidemiology. [https://link.springer.com/article/10.1186/s40621-019-0216-9]

(2) *Syndromic Surveillance (EpiCenter)*: The OHS Unit collaborated with the NJDOH Communicable Disease Service, Infectious, and Zoonotic Disease Program staff to incorporate occupational injury syndrome definitions into the state-based syndromic surveillance system, EpiCenter. Staff was asked by CSTE to chair a Syndromic Surveillance for Occupational Health Surveillance Workgroup and staff has created a guidance document for other states to use so they can also implement syndromic surveillance in their own state for occupational health surveillance. This guidance document has been posted on the CSTE website[https://cdn.ymaws.com/www.cste.org/resource/resmgr/occupationalhealth/publications/OccSyS_WhitePaper_03_08_21.pdf] and includes information on how states have used syndromic surveillance; how their jurisdictions developed their occupational health syndrome definitions; and

descriptions (types of systems, variables collected, etc.) of their states syndromic surveillance systems. OHS staff also continue to receive automatic electronic notifications whenever three or more cases of chemical exposures present in NJ emergency departments, which provides an opportunity for the OHS Unit to partner with the NJDOH Public Employees Occupational Safety and Health (PEOSH) Program, the regional OSHA area offices, and the NJDOH Office of Emergency Management to provide them with real-time data on work-related injuries occurring among NJ employees.

(3) *NJ Poison Information and Education System (NJPIES)*: The OHS Unit collaborated with NJPIES as an additional data source for occupational health surveillance. Occupational exposures are reportable under NJ state law. Thus, one of the areas NJPIES codes for is occupational exposure. NJPIES immediately notifies the OHS Unit of occupational poisonings, which has allowed us to further enhance the classification and capture of work-related non-fatal injuries with improved efforts in prevention. Also, in collaboration with the NJDOH Communicable Disease Service, Infectious, and Zoonotic Disease Program, OHS staff have been working with NJPIES to create a Poison Control Data Module in the NJ Syndromic Surveillance System, EpiCenter, to stream work-related poison data in near real-time. This data has been used to supplement the chemical exposure data in the syndromic surveillance system and helped identify work-related poisonings related to increased chemical use as a result of COVID.

(4) *Council of State and Territorial Epidemiologists (CSTE) Occupational Health Subcommittee*: The PI and coordinator of the NJ Occupational Health Indicators has been serving as the state-representative co-chair for the CSTE/NIOSH Occupational Health Indicators Work Group for the past 6 years. The PI was also recently appointed as a committee member of the Occupational Health Subcommittee Leadership Group.

(5) *NIOSH State-Based Occupational Health Surveillance Clearinghouse*: The OHS Unit is currently cooperating with NIOSH to compile materials to be included in the Clearinghouse. All occupational health publications will be included in the clearinghouse: grey literature, peer-reviewed publications, NIOSH-sponsored research articles, and materials that were not funded by NIOSH.

(6) *Collaborations with Other Stakeholders:* OHS seeks out opportunities to collaborate with NJ State agencies and other stakeholders to address occupational health issues in NJ. OHS Unit staff attends meetings, participates in workgroups, and Listservs to explore possibilities for collaboration, and then selects and designs a collaboration including:
- NIOSH annual meetings and workshops with states;
- CSTE annual workgroups meetings;
- Northeast Regional Occupational Health annual meeting (CT, MA, ME, NH, NJ, NY, RI) in Connecticut.

D. Conclusions

The occupational health indicators continue to provide baseline data for the New Jersey Fundamental Surveillance Program. Understanding specific populations at risk and obtaining rates of fatal and non-fatal injuries provides an estimate of the risk in sub-groups which may be more informative than traditional counts of injuries. The Indicator process has been instrumental in establishing relationships with various data owners including the NJ Bureau of Workers' Compensation and the NJ Cancer Registry. The information gained by the OHS Unit's analyses of HD data has been useful in focusing interventions on a target group (Hispanic workers). Characterizing the populations most at risk for work-related illnesses and injuries assists the NJDOH in prioritizing occupational health needs at the national and state level, and in effectively directing resources. The Fundamental Surveillance Program has also allowed the NJDOH to expand its group of partners and develop strategic alliances in the effort to include occupational health into mainstream public health. Fundamental surveillance has transitioned into a core surveillance system with activities in chemical poisoning surveillance, data sharing through an environmental public health tracking initiative, workplace violence, environmental consumer product decision-making, and other scenarios having implications on workers' health.

LITERATURE CITED

1. Council of State and Territorial Epidemiologists: [2005] Putting data to work: occupational health indicators from thirteen pilot states for 2000. Atlanta, GA.

2. Statistical Analysis Software: [2005] Version 9.1. The SAS Institute. Cary, NC.

Publications

1. Kelly-Reif K, et al.: [2021] Notes from the Field: Publicly reported COVID-19–related mortality among employees and volunteers of first responder agencies — March–April 2020, United States. Public Health Reports 136(3) 315-319. DOI: 10.1177/0033354921999171.

2. Borjan M, Braun C, Dreher D, Lavender A, Marcum J, Patel K, Reilly A, Weston C: [2021] Syndromic Surveillance for Occupational Health Surveillance: Guidance Document and Examples. Council of State and Territorial Epidemiologists (CSTE) Occupational Syndromic Surveillance Workgroup. Available at: https://cdn.ymaws.com/www.cste.org/resource/resmgr/occupationalhealth/publications/OccSyS_WhitePaper_03_08_21.pdf

3. Rosenman KD, Reilly MJ, Pechter E, Fitzsimmons K, Flannery J, Weinberg J, Cummings K, Borjan M, Harrison R, Dodd K, Schleiff P: [2020] Cleaning Products and Work-Related Asthma, 10 Year Update. Journal of Occupational and Environmental Medicine 62(2): 130-37. DOI: 10.1097/JOM.0000000000001771.

4. Uhiara D, Shendell DG, Borjan M, Graber J, Koshy K, Lumia M: [2019] Reported Injury, Hospitalization, and Injury Fatality Rates among New Jersey Adolescent Workers. Injury Epidemiology 6:37. DOI: 10.1186/s40621-019-0216-9.

5. Marshall EG, Lu S, Williams AO, Lefkowitz D, Borjan M: [2018] Tree-Related Injuries Associated with Response and Recovery from Hurricane Sandy, New Jersey, 2011-2014. Public Health Reports 133(3): 266-273. DOI: 10.1177/0033354918766871.

6. Borjan M, Lumia M: [2017] Evaluation of a State Based Syndromic Surveillance System for the Classification and Capture of Non-Fatal Occupational Injuries and Illnesses in New Jersey. American Journal of Industrial Medicine 60(7): 621-626. DOI: 10.1002/ajim.22734.

7. Morano L, Jagger M, Barrett E, Berisha V, Borjan M, Heitzinger K, Kumar R, Lane K, Lumia M, Menager H, Thie L: [2017] Syndromic Surveillance Climate and Health Guidance Document: How Jurisdictions Can Use Surveillance to Quantify and Track Climate-Related Health Impacts. Council of State and Territorial Epidemiologists (CSTE) Climate and Health Syndromic Workgroup. Available at: https://cdn.ymaws.com/www.cste.org/resource/resmgr/pdfs/pdfs2/Syndromic_surveillance_clima.pdf

8. Marshall EG, Lu S, Shi Z, Swerdel J, Borjan M, Lumia M: [2016] Work-Related Unintentional Injuries Associated with Hurricane Sandy in New Jersey. Disaster Medicine and Public Health Preparedness 10(3): 394-404. DOI: 10.1017/dmp.2016.47.

9. Borjan M, Patel T, Lefkowitz D, Campbell C, Lumia M: [2016] Assessing Barriers to the Use of Fall Protection in Small Residential Construction Companies in New Jersey. New Solutions: A Journal of Environmental and Occupational Health Policy 26(I): 40-54. DOI: 10.1177/1048291115609706.2015.

CUMMULATIVE ENROLLMENT REPORTS

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

Study Title: Fundamental

Comments: Not applicable. Human subject were not enrolled. All data presented was obtained through public health surveillance activities conducted under mandated state regulations. The occupational injuries and illnesses discussed in the progress report are reportable under state regulations.

Racial Categories	Ethnic Categories									Total
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native										
Asian										
Native Hawaiian or Other Pacific Islander										
Black or African American										
White										
More Than One Race										
Unknown or Not Reported										
Total										

Inclusion of Gender and Minority Subjects

Women and minorities were included based on their proportions of identified individuals. Inclusion criteria did not target or intentionally exclude any vulnerable populations, minorities or sub-groups. Inclusion is based purely on existence of data and occupational injuries and illnesses that are reportable under state regulations.

Inclusion of Children

Children ages 16-17, who are employed, were included based on their proportions of identified individuals. Inclusion criteria did not target or intentionally exclude any vulnerable populations, minorities or sub-groups. Inclusion was based purely on occupational injuries and illnesses that are reportable under state regulations.