

Overview of NIOSH Surveillance May 31, 2016

Background

The [Occupational Safety and Health Act of 1970](#) established the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) with the mandate to assure “every man and woman in the Nation safe and healthful working conditions and to preserve our human resources.” NIOSH later became part of the U.S. Centers for Disease Control and Prevention, in the U.S. Department of Health and Human Services. NIOSH has operations in Anchorage, AK, Atlanta, GA, Cincinnati, OH, Denver, CO, Morgantown, WV, Pittsburgh, PA, Spokane, WA and Washington, DC. It has more than 1,300 employees from diverse fields including epidemiology, medicine, nursing, industrial hygiene, safety, psychology, chemistry, statistics, economics, and many branches of engineering. The Coal Mine Health and Safety Act of 1969, amended in 1977, mandates a medical monitoring program for coal miners which NIOSH oversees. NIOSH works closely with OSHA and the Mine Safety and Health Administration (MSHA) in the U.S. Department of Labor to protect American workers.

The NIOSH strategic goals for 2016-2020 include one goal which specifically addresses the need for occupational safety and health surveillance: *‘Track work-related hazards, exposures, illnesses and injuries for prevention.’* For more about the NIOSH Vision, Mission and Strategic Goals please see <http://www.cdc.gov/niosh/about/default.html>

Overview of Occupational Health and Safety Surveillance Conducted by NIOSH

According to Thacker (2000), ‘public health surveillance is the ongoing, systematic collection, analysis, and interpretation of health-related data essential to the planning, implementation and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know. The final link in the surveillance chain is the application of these data to prevention and control.’ Occupational health and safety surveillance would include, in addition to health, illness and injury data, the collection, analysis and dissemination of exposure and hazard and prevention and control data related to the work environment. A robust surveillance program should: identify emerging issues in illness, injury or exposure; monitor trends over time; guide priority setting; and, in the long-term, help evaluate the impact of research and interventions. The NIOSH Surveillance Program embodies these qualities as described below.

Occupational health and safety surveillance encompasses a host of illnesses and injuries either caused by exposures in the work environment or exacerbated by them. There is no single data system in the US available to monitor and track legacy and newly arising occupational diseases, injuries, or exposures. Thus, to conduct surveillance, NIOSH continues to build relationships and partnerships with other federal agencies, the states, private industry, and the public health community to access relevant sources of surveillance data.

Existing data sources and national surveys (e.g. state death certificates, hospital emergency department data, state cancer registries, Bureau of Labor Statistics (BLS) data, National Notifiable Disease Surveillance System and various National Center for Health Statistics [NCHS] surveys) are used to calculate rates, monitor trends over time and measure progress toward the goals of reducing occupational injury and disease. These existing sources are often supplemented by data from other

sources such as poison control centers; clinical laboratory reporting; supplemental questions added to national surveys; and targeted data collections in populations that are at risk and/or difficult to monitor such as workers employed in the maritime industry.

The variety of systems used to capture data concerning occupational injuries are incomplete for a number of reasons and undercount the extent of the problem. However, because occupational injuries are connected in place and time with work, they are more readily captured than many occupational diseases, which have multiple risk factors, in addition to work, and often occur after employment ends. The type and nature of data sources for occupational injury and illness surveillance are consequently very different. Surveillance on the magnitude and distribution of occupational exposures can complement occupational illness and injury surveillance by identifying targets for intervention before the health outcome or injury occurs. Examples of useful exposure data systems are the inspection databases maintained by OSHA and MSHA, although these are administrative systems designed for storing enforcement data rather than systems designed for exposure surveillance or research.

To complement population-based surveillance data, focused case-based surveillance is used. In this approach, when possible, cases are identified and followed back to develop targeted interventions that can be communicated to similar workplaces. This case-based surveillance approach is particularly effective for adverse health conditions and exposures that are amenable to interventions, for example, traumatic injuries, fatalities, and asthma. NIOSH uses this approach by funding 26 state departments of health and labor and universities through the extramural program.

NIOSH Surveillance Program

Surveillance is conducted in NIOSH divisions located in Anchorage, Cincinnati, Denver, Morgantown, Pittsburgh, and Spokane. The NIOSH Surveillance Program coordinates surveillance activities across the NIOSH divisions, emphasizing collaboration and communication while avoiding overlap between surveillance activities at the multiple locations. More information about the NIOSH Surveillance Program may also be found at <http://www.cdc.gov/niosh/topics/surveillance/default.html>.

Surveillance of occupational injuries is conducted by researchers in the:

- Division of Safety Research: <http://www.cdc.gov/niosh/contact/im-dsr.html>
 - Center for Motor Vehicle Safety,
<http://www.cdc.gov/niosh/motorvehicle/ncmvs/default.html>
- Division of Surveillance, Hazard Evaluations and Field Studies:
 - Center for Workers' Compensation Studies,
<http://www.cdc.gov/niosh/topics/workercomp/cwcs/default.html>
- Western States Division
 - Fatalities in the Oil and Gas Extraction Industry
<http://www.cdc.gov/niosh/topics/fog/default.html>
 - Center for Maritime Safety and Health Studies:
<http://www.cdc.gov/niosh/maritime/default.html>
- Office of Mine Safety and Health Research:
<http://www.cdc.gov/niosh/mining/statistics/default.html>

Surveillance of occupational diseases and related exposures are conducted by researchers in the:

- Division of Surveillance, Hazard Evaluations and Field Studies:
<http://www.cdc.gov/niosh/contact/im-dshe.html>
- Respiratory Health Division <http://www.cdc.gov/niosh/contact/im-drds.html>

Integration of Surveillance into the Strategy for the NIOSH Research Agenda

The NIOSH Surveillance Program is committed to providing useful data for all NIOSH Sector and Health and Safety Cross-Sector Programs. The National Occupational Research Agenda (NORA) is a partnership program to stimulate innovative research and improved workplace practices. Unveiled in 1996, NORA is a research framework for NIOSH and the nation. NIOSH research priorities are based on the tenets of Burden, Need and Impact (BNI). The principles underlying the BNI construct are that NIOSH must: (1) focus on the highest priority work to protect the workforce, given the burden, need and impact and; (2) guide the investment of scarce resources in a clear and transparent manner.

Burden is the evidence of health and safety and economic burden (or potential burden) of workplace risks and hazards. **Need** considers the type of research that is most necessary to fill the knowledge gap (i.e. etiologic, intervention, translational) and the unique resources NIOSH might have to address those gaps. **Impact** refers to the likelihood that the work will lead to improvements in health and safety (i.e. promote a practical intervention, adoption of new technology, develop evidence-based guidance, change in standards).

The NIOSH Surveillance Program plays key roles in this strategy by identifying burden of diseases, injuries and exposures, and thus, helping to define priorities. The program also measures the long-term impact of research, intervention, and surveillance activities conducted by NIOSH or its partners.

NIOSH Surveillance Strategy

NIOSH is currently working to meet the objective of providing needed surveillance data to the Sector and Health and Safety Cross-Sector Programs and to the occupational health community. The approach includes efforts to reach the long term goal to incorporate industry and occupation (I&O) into health surveys, case reporting and, ultimately into electronic health records (EHRs). The approach also includes a key objective to communicate findings to facilitate future research and interventions.

EHRs, coupled with other health information systems, hold potential for more comprehensive occupational injury and illness surveillance in the future. However, many of the major health information systems, including EHRs, include either minimal or no standard occupational data elements that would allow the identification of work-related cases and associations with occupational exposures. As noted below, a long-term NIOSH goal is to integrate work into EHRs as key information elements.

The NIOSH Surveillance Program plans to continue to address surveillance needs by: 1) leveraging existing surveys and data systems managed by other agencies; 2) incorporating I&O into existing surveys, case reports, data systems and EHRs; 3) improving the capacity and accuracy of I&O autocoders; 4) building state occupational health surveillance capacity; and, 5) accelerating communication for prevention.

1. Leveraging Existing Surveys and Data Systems

Although the U.S. lacks a survey focusing on the health of its workers, NIOSH utilizes existing surveys and data systems created by other federal agencies, the states, and private industry to evaluate and track occupational disease, injury, and exposure trends. Many of these data systems were not created for the purpose of assessing worker health or injuries and must be manipulated by adding relevant work-related questions, or by coding data, such as I&O.

Over the past 30 years NIOSH has analyzed many different extant data sets for use in surveillance. Below are brief descriptions of some of the surveillance data currently used by NIOSH.

A. National Surveys and Systems

National Health Interview Survey (NHIS) – The NHIS, conducted by NCHS, is an annual health survey of a statistical sample of U.S. households which collects basic employment information for each respondent (~30,000) in the core sample adult survey. Approximately 20,000 respondents are employed and report current I&O. <http://www.cdc.gov/nchs/nhis/index.htm>

Occupational health supplement: In 1988, NIOSH funded an occupational health supplement to the NHIS which collected data on various physical and chemical occupational exposures, back pain, hand discomfort (including diagnosed carpal tunnel syndrome), occupational respiratory symptoms, dermatitis, and several other work-related conditions. In 2010, NIOSH conducted a second occupational health supplement with questions about dermatitis, carpal tunnel syndrome and occupational asthma– conditions that are not well documented by the BLS Survey of Occupational Injuries and Illnesses (SOII). Other topics explored in the 2010 supplement include long work hours, irregular shifts, work organization factors, and workplace psychosocial exposures (e.g., harassment). In 2015, another supplement similar to the 2010 version was administered; data will be available to NIOSH in July, 2016. <http://www.cdc.gov/niosh/topics/nhis/output.html>

Sector report: NIOSH periodically analyzes data from the general health section of the NHIS. To provide each NORA Sector Program with baseline health status information on the sector workforce, in 2012 NIOSH released an analysis by NORA Sector Program. <http://www.cdc.gov/niosh/topics/nhis/profile.html> Other targeted analyses from NHIS data, such as hearing loss and asthma have also been conducted. Future reports will include analyses of data from the general health section of the NHIS collected in the 2004-2013 surveys using more detailed I&O data available through the CDC Research Data Center. Publications addressing work-related conditions developed by NIOSH and others using the NHIS Occupational Health Supplement can be found here: <http://www.cdc.gov/niosh/topics/nhis/output.html>

National Health and Nutrition Examination Survey (NHANES) – The NHANES is an interview and examination survey conducted annually by NCHS. The interview collects I&O information, but NCHS does not code the data. Because the sample size (only 5,000 people) is much smaller than NHIS, multiple years of data are needed to obtain a sufficient sample size to examine health by I&O. NIOSH provided technical support to NCHS to ensure collection of spirometry data from participants over a six year period to study obstructive lung disease in the U.S. population and to collect data on workplace exposures. NIOSH coded I&O using NIOSH Industry and Occupation Computerized Coding System (NIOCCS) (see Section 3) to analyze NHANES data for occupational surveillance purposes. In addition NIOSH provided questions relating to lifetime history of exposure

to mineral and organic dusts, gases, fumes, and vapors in the workplace and provided quality control and input for the survey results. NIOSH is currently analyzing data from spirometry, interviews, and occupational exposures by I&O. <http://www.cdc.gov/niosh/topics/spirometry/nhanes.html>

Death Certificates – The 2003 Standard US Death Certificate contains the usual I&O of the decedent in narrative text fields. These vital records are collected by all states and most collect I&O electronically. Since 1980, NIOSH has partnered with selected states and NCHS to obtain and code the I&O narratives. Recently, NIOSH has coded most of the I&O data from these states using the NIOCCS (see Section 3). Death certificate records are one of the few available data sources that can be used for surveillance of chronic disease by I&O. The death certificate data (underlying and contributory causes, demographic information, and I&O) feed into the National Occupational Mortality Surveillance (NOMS) System and National Occupational Respiratory Mortality System (NORMS). These two systems are used to evaluate trends in mortality by I&O group. Over 100 papers have been published using these data. Currently NOMS contains over 13 million death records. NOMS: <http://www.cdc.gov/niosh/topics/noms/>
NORMS: <http://webappa.cdc.gov/ords/norms.html>

NIOSH is proposing to conduct a pilot effort with NCHS in 2018 to code all I&O data collected in real time from 17 states currently participating in the NOMS. If successful, this partnership will provide the opportunity to analyze mortality patterns by I&O for all 50 states.

The National Birth Defects Prevention Study (NBDPS) - The NBDPS is the largest population-based case-control study in the U.S. looking at the causes of birth defects. Birth defects are common, costly, and critical conditions that affect 1 in every 33 babies born in the United States. The causes of most birth defects are not known. The CDC conducted the NBDPS in ten states, interviewing more than 35,000 women from 1997-2011. These women are mothers who have had babies or pregnancies affected by birth defects as well as mothers of healthy babies. NIOSH is partnering with the NBDPS to examine the role of work on birth defects and other pregnancy outcomes. From this study, associations have been found between several parental jobs and workplace exposures and specific birth defects. The collaborators are continuing to study occupation and birth defects in more detail. <http://www.nbdps.org/> and <http://www.bdsteps.org>

National Ambulatory Medical Care Survey (NAMCS) – Since 1989 NCHS, via the NAMCS, has provided annual data on visits to office-based physicians who are primarily engaged in direct patient care. Beginning in 2006, the survey also includes an annual sample of visits to community health centers. NIOSH participated in the design and implementation of a supplement to the 2012-13 survey about physicians' opinions and use of the National Asthma Education and Prevention Program (NAEPP) Guidelines for the Diagnosis and Management of Asthma. The 2012 NAMCS sample was expanded over past years from ~3,500 to ~10,000 physician offices or more, and also included an increased sample of pertinent specialists (allergist/immunologists and pulmonologists). NCHS had to develop a new approach to weighting the community health center sample, and is resolving issues associated with data collection. The 2012-2013 Asthma Supplement to NAMCS provides an opportunity for NIOSH to learn more about work-related asthma management strategies. In collaboration with other agencies NIOSH will develop tools to measure 1) major barriers to implementation of work-related asthma (WRA) management strategies, and 2) overall knowledge and acceptance of the Guidelines by health care practitioners with regard to WRA. <http://www.cdc.gov/nchs/ahcd/index.htm>

Survey of Occupational Injuries and Illnesses (SOII) –The BLS SOII provides estimates for nonfatal cases of work-related injuries and illnesses from 46 states and territories that are recorded by employers under the OSHA recordkeeping guidelines. The annual SOII surveys a sample of employers and is the primary source of occupational injury and acute illness surveillance. SOII data are being used to track two Healthy People 2020 objectives. <http://www.bls.gov/iif/oshstate.htm>.

Census of Fatal Occupational Injuries (CFOI) –The BLS CFOI program collects data on occupational fatalities using multiple data sources. <http://www.bls.gov/iif/oshcfoi1.htm> BLS routinely reports numbers and rates by selected industry sectors, and has released a number of industry specific analyses that include CFOI data with the recognition that this would meet the needs of NIOSH and partners. Through NIOSH, publicly available CFOI tables and charts are accessible through the WISARDS website. Several NIOSH programs have Memoranda of Understanding with BLS that allow access to micro-level data files, facilitating in-depth research analyses not possible using published and query-accessible data on the BLS website. CFOI data are used to track progress on two Healthy People 2020 objectives. <http://wwwn.cdc.gov/wisards/workrisqs/>

Occupational Safety and Health Administration Information System (OIS), previously the Integrated Management Information System (IMIS) – OIS/IMIS is an OSHA administrative system to record information from compliance inspections and consultation surveys conducted since May 1979. The data are reported by federal and state OSHA compliance safety and health officers and only exposure data for OSHA-regulated substances are collected. Mining, maritime, railroad, armed forces, and other federal government agencies are excluded because they are not regulated by OSHA. This database contains more than 1.8 million exposure records and NIOSH has published analyses of the exposure levels and trends for some of the more common workplace exposures such as silica, lead, noise, and solvents. Data are also used in the Work-Related Lung Disease Surveillance System (eWoRLD). <http://wwwn.cdc.gov/eworld/>

Emergency Departments (NEISS-Work) – This is a Consumer Product Safety Commission (CPSC) database that collects nationally representative data of emergency room-treated occupational injuries and illnesses from approximately 67 hospitals across the country. NIOSH provides funding to CPSC to obtain work-related injury and illness data, piggy-backing onto the CPSC surveillance system designed to capture consumer product-related injuries. This system captures data on injured workers, regardless of the size of the employer or nature of employment, and includes workers who are excluded from the BLS SOII. This system also provides a mechanism to conduct follow-back telephone interviews with injured workers. Follow-back surveys were recently conducted to assess if workers treated in emergency rooms for work-related injuries reported their injuries to their employers. NEISS-Work is a data source in three Healthy People 2020 objectives to track nonfatal injuries and illnesses and nonfatal workplace assaults. <http://wwwn.cdc.gov/wisards/workrisqs/>

National Crime Victimization Survey (NCVS) -This annual survey, administered for the U.S. Bureau of Justice Statistics (BJS) by the U.S. Census Bureau, collects detailed information on the frequency and nature of the crimes of rape, sexual assault, robbery, aggravated and simple assault from a nationally representative sample of U.S. households. The survey measures both crimes reported to police and crimes not reported to the police, and data are collected on crimes that occur while the victim was working. About 80,000 persons age 12 and older are interviewed every 6 months. Households remain in the sample for 3 years and are interviewed seven times at 6-month intervals. NIOSH has worked with the BJS over the last several years to improve data on work-

related violence collected through the NCVS, and BJS, NIOSH, and BLS are currently collaborating on a statistical document that will include work-related violence data from all three agencies. <http://www.bjs.gov/index.cfm?ty=dcdetail&iid=245>

Fatality Analysis Reporting System (FARS) -FARS, operated by the National Highway Traffic Safety Administration (NHTSA), is a national census of fatal motor vehicle traffic crashes in the United States. Detailed data on the driver, vehicle, roadway and circumstances contributing to the crash are collected from police crash reports. Cases involving large trucks and buses are presumed to be work-related and FARS data support analyses specific to these drivers. Because FARS ascertains work relationship solely on information from death certificates, it is less successful in identifying fatal occupational crashes involving lighter vehicles. NIOSH, NHTSA and BLS are currently collaborating to link data from CFOI and FARS and provide more comprehensive data on fatal occupational crashes across multiple industries and vehicle types. <http://www.nhtsa.gov/FARS>

Audiometric Service Providers – The 2006 National Academies report on the NIOSH Hearing Loss Prevention Program noted the lack of surveillance data on hearing loss with recommendations to improve surveillance. Little is known about the prevalence of work-related hearing loss and whether OSH programs are effective. Since 2011 NIOSH has partnered with audiometric service providers, occupational health clinics, hospitals and others who conduct worker audiometric testing to collect audiometry data on noise-exposed workers. The partners also include private companies conducting in-house worker audiometric testing. NIOSH also collaborates with the US Air Force which is sharing both audiometric and job specific noise and chemical exposure information for civilian and military jobs. To date, approximately 10.3 million private sector audiograms and 5.5 million Air Force audiograms have been collected and several analyses of hearing loss by industry have been published. <http://www.cdc.gov/niosh/topics/ohl/default.html>

OSHA Electronic Injury and Illness Reporting- Beginning January 1, 2017, OSHA will require some employers to electronically submit injury and illness data currently required to be recorded on onsite OSHA Injury and Illness forms. Analysis of these data will enable OSHA to use its enforcement and compliance assistance resources more efficiently. Availability of electronic injury and illness data, while limited to specific employers also presents an opportunity to use this enforcement data for surveillance purposes. NIOSH is interested in partnering with OSHA and BLS on their plans for using these data for prevention.

B. Targeted Data Collections – The following projects are examples of the NIOSH Surveillance Program’s effort to target surveillance of at-risk populations identified through analysis of large population-based surveys and/or case reporting systems. There are also some populations at risk that cannot be effectively tracked using the large national surveys and data systems. Below are some current surveys and systems that are used to obtain information on these at-risk populations.

Fire Fighter Fatality Investigation and Prevention Program – NIOSH conducts case-based surveillance of fire fighter fatalities, including those associated with traumatic events and health outcomes such as heart attacks, with congressionally appropriated funds to support a fire fighter safety and health initiative, <http://www.cdc.gov/niosh/fire/>. In addition to case-based fatality investigation reports, NIOSH supports an interactive fire fighter fatality map utilizing surveillance data collected by the U.S. Fire Administration, http://www.cdc.gov/niosh/fire/usfa_ff_map.html

Law Enforcement Officer Motor Vehicle Crash and Struck-by Fatality Investigations - A Pilot Program - With funding from the National Institute of Justice, NIOSH is piloting a program to conduct case-based investigations for motor vehicle-related occupational fatalities of law enforcement officers in the United States. These investigations are identifying risk factors for fatal motor vehicle-related events that will be used to construct prevention recommendations. These recommendations will be shared with law enforcement agencies across the U.S. with the goal of reducing law enforcement officer motor vehicle-related deaths.

<http://www.cdc.gov/niosh/topics/leo/default.html>

Mine Safety and Health Administration (MSHA) - Data files on mining accidents, injuries, fatalities, employment, and production, are collected by MSHA. Reporting requirements for injuries and illnesses are stipulated by law. The MSHA data are a rich source of information and NIOSH routinely uses these data to track injuries and exposures.

<http://www.cdc.gov/niosh/mining/data/default.html>

Mine Safety and Health Administration (MSHA) Metal/Nonmetal Mine Data - The metal/nonmetal mine data (MNMD) are records of industrial hygiene samples collected by MSHA inspectors in non-coal surface and underground mines and mills since 1974. NIOSH receives the data yearly from MSHA's TeraData Query System. Data are summarized in the eWoRLD system.

<http://www2a.cdc.gov/drds/worldreportdata/html/SourcesOfData.asp>

Coal Workers Health Surveillance Program - This program, mandated by MSHA, provides medical examinations for early detection and prevention of respiratory disease in coal miners. The program has four components (1) Coal Workers' X-ray Surveillance Program; (2) the Coal Workers' Spirometry Surveillance Program, (3) the Enhanced Coal Workers' Health Surveillance Program, and (4) NIOSH B-Reader Certification Program. NIOSH manages this program, certifying health facilities to provide chest radiographs and spirometry testing for miners, certifying physicians to classify chest radiographs for dust-related lung disease, and providing direct services to miners with a mobile van. <http://www.cdc.gov/niosh/topics/surveillance/ords/cwhsp.html>

Emergency Medical Services Workers Surveillance - Surveillance of injuries and illnesses of emergency medical services workers is difficult for a number of reasons, including the variety of industries that employ these workers, and the considerable proportion of this work conducted by volunteer workers. The NHTSA shares an interest with NIOSH in the numbers and patterns of injuries and illnesses to these workers, and has provided NIOSH funds to conduct surveillance, including follow-back surveys, of these workers using the NEISS-Work. NHTSA funding ends in FY2016, though NIOSH plans to continue analyzing and reporting EMS worker injuries using NEISS-Work. <http://www.cdc.gov/niosh/topics/ems/default.html> <http://wwwn.cdc.gov/wisards/>

Occupational Health Safety Network (OHSN) - The OHSN is a voluntary, web-based system developed by NIOSH that provides health care facilities and NIOSH the ability to identify problem areas and work practices, evaluate the effectiveness of prevention efforts, and ultimately minimize or eliminate occupational injury among healthcare personnel. OHSN integrates OSHA recordable data collected under regulatory requirements for surveillance and prevention at the healthcare facility level. OHSN provides participating healthcare facilities with the patterns of injuries that occur within hospitals by department, injury type, employee type and other characteristics. OHSN monitors common, high risk, and preventable injury events. Patient handling; slips, trips, and falls; and workplace violence are part of OHSN currently. Sharps injuries and blood body fluid exposure will

be added to OHSN in July 2016. In 2016, 118 hospitals participate in OHSN.
<http://www.cdc.gov/niosh/topics/ohsn/>

Planning for the Future of Agricultural Injury Surveillance at NIOSH – Beginning in Fiscal Year 2015, NIOSH began a rigorous examination of future options for agricultural injury surveillance. <http://www.cdc.gov/niosh/agforfish/aginjurysurv.html> This was prompted by several challenges including increased costs and an uncertain funding landscape. NIOSH sought stakeholder input in a variety of forums, including a public docket and meeting. <http://www.cdc.gov/niosh/docket/archive/docket281.html> NIOSH also commissioned RAND to conduct an assessment of the costs and feasibility for numerous previous recommendations for agricultural injury surveillance that were made in a program review by an expert panel in 2012. NIOSH plans to propose future directions by the end of Calendar Year 2016.

Fatalities in Oil and Gas Extraction (FOG) – The NIOSH Fatalities in Oil and Gas Extraction (FOG) is a national database that collects detailed information about fatal events (land-based and offshore) in the U.S. oil and gas extraction industry. Fatal events are identified through: 1) preliminary descriptions, citations, and closed investigations from the Occupational Safety and Health Administration’s (OSHA) Occupational Safety and Health Information System (OIS) or the Integrated Management Information System (IMIS); 2) media reports; 3) formal investigations from federal, state, and local agencies; 4) motor vehicle crash reports; 5) emergency responder and police reports; 6) coroner and medical examiner reports; and 7) death certificates. FOG data are used to monitor trends, identify emerging issues, and produce timely reports summarizing fatal events in the industry. FOG data are used to inform NIOSH, industry, and other stakeholder groups, and guide interventions that will prevent future loss of life in this industry. FOG reports can be found on the Fatalities in Oil and Gas Topic Page. <http://www.cdc.gov/niosh/topics/fog/default.html>

Fatalities in Commercial Fishing - NIOSH developed the Commercial Fishing Incident Database (CFID) to collect and analyze data on fatalities in the entire US commercial fishing industry. The system was initiated in 2000 and continues to be maintained with current up-to-date information. The purpose of this surveillance system is to identify high risk fisheries in the US and to identify the risk factors that contribute to fatal incidents. Data for CFID are collected from multiple sources, including the US Coast Guard, law enforcement agencies, death certificates, news media, and state-based occupational fatality surveillance programs. CFID includes information specific to each incident including vessel characteristics, environmental factors, and victim demographic data. CFID contains over 100 variables for each fatality in the US fishing industry and currently holds 16 years of data (2000-2015). In addition to occupational deaths in the fishing industry, CFID also collects data on survivors of fishing vessel disasters. This enables epidemiologists to study survival factors by comparing survivors to decedents of such incidents. <http://www.cdc.gov/niosh/topics/fishing/>

2. Incorporate Industry & Occupation into Existing Surveys and Data Systems

Many national surveillance surveys or systems have a wealth of population-based health data but are missing information about work or work-related risk factors. NIOSH has worked or is working with the managers of several of these systems to incorporate work-related information and to evaluate the value of inclusion. Below are several current efforts.

Behavioral Risk Factor Surveillance System (BRFSS) - The BRFSS is a national health survey administered cooperatively by CDC and states since 1984 through telephone interviews to collect data about US adult health-related risk behaviors, chronic health conditions, and access to/use of preventive services. Data are collected annually by 50 states and three US territories, from over 400,000 respondents each year. The survey includes a standardized core questionnaire asked by all states and territories, optional modules with a set of questions that address specific topics and state added questions to address topics important for state programs. The BRFSS is the primary source of population health data for states, and smaller geographic areas (e.g. counties). However, no information about work, other than employment status, was routinely collected, prior to 2013.

BRFSS Asthma Call-Back Survey (ACBS) - The ACBS, an optional BRFSS module, has been implemented through BRFSS every year since 2006. It includes questions regarding work-relatedness of asthma. The number of states or territories participating in the ACBS has increased each year. Since the 2011 survey, the weighting methodology for the BRFSS was changed significantly and cell phone samples were added to the traditional landline phone samples. The new weighting methodology, iterative proportional fitting, replaced the post-stratification weighting method that had been used with previous BRFSS datasets. Similar methodology changes were made to ACBS data. In addition, the ACBS questions were reordered and revised in 2012. Due to these methodological changes, ACBS data from years 2011 and earlier are not comparable to data from year 2012 and later. NIOSH in collaboration with NCEH have accessed ACBS data to evaluate epidemiology of work-related asthma among working adults. To date NIOSH published 14 peer-reviewed manuscripts and two MMWR articles using the data.

<http://www.cdc.gov/brfss/acbs/> and <http://www.cdc.gov/asthma/acbs.htm>; ACBS Data Analysis User Manual: available upon request (asthmacallbackinfo@cdc.gov).

BRFSS, Incorporation of I&O - In partnership with states, NIOSH sponsored a pilot effort to include two standard I&O questions as an optional module in the annual survey from 2013-2017. The I&O questions were very closely worded to those in the NHIS. This pilot is designed to demonstrate to participating states, CDC and the public health community of the value of adding I&O into the core BRFSS because they are key demographic variables related to health and health behaviors. Approximately 25 states have opted to add the I&O module and NIOSH codes these data. Approximately 100,000 currently employed adults are included in the I&O module data for each year of data collection. Data for years 2013 and 2014 are available for analysis; individual states and NIOSH have already published surveillance research using these data. Other CDC centers have also requested the I&O data for analyses. In 2011 and 2015 NIOSH proposed that I&O be added to the core of BRFSS but the required supermajority (70%) of states did not affirm, primarily due to concerns that the survey core is too long. For general information about BRFSS go to <http://www.cdc.gov/brfss/>

Pregnancy Risk Assessment Monitoring System (PRAMS) -The CDC PRAMS survey, in partnership with state health departments, collects information on women's experiences and behaviors before, during, and shortly after pregnancy. Approximately 77,000 women who have recently given birth participate in this survey, providing an opportunity to surveil more common adverse pregnancy outcomes such as preterm birth. Whether or not a woman works during pregnancy can be a significant predictor of pregnancy outcomes. However, no information on the I&O of the mother is obtained. NIOSH has provided some funding to the survey to include collection of I&O as a pilot test in 5 states during 2016-2018. <http://www.cdcancec.gov/prams/>

Cancer Registries - Cancer registries are administered by state health departments, and funded, in part by the CDC, National Program of Cancer Registries. Registries collect information on cancer diagnosis, incidence, demographics and treatment. These data are used to generate national and state cancer statistics. The Cancer Registries Amendment Act of 1992 states that cancer registries will collect “information on the industrial or occupational history of the individuals with cancer, to the extent such information is available from the [medical] record.” Cancer registries collect I&O information from medical records/hospital abstracts, death certificates, or both. In a survey of cancer registries conducted in 2008 by the CDC National Program of Cancer Registries, of 41 registries 36 cancer registries were collecting I&O from death certificates, physician, and hospital records. However, there are considerable deficiencies in collection rates and quality of the data. NIOSH has collaborated with the California Cancer Registry since 2007; NIOSH coded the available I&O and published four papers using the data to identify high risk populations for specific cancers. NIOSH just began collaboration with 5 additional statewide cancer registries to further explore cancer trends in worker populations and to encourage other statewide cancer registries to do the same.

National Notifiable Disease Surveillance System (NNDSS) – NNDSS is a nationwide collaboration that enables all levels of public health—local, state, territorial, federal, and international—to share notifiable disease-related health information. Public health agencies at the federal, state and local level use this information to monitor, control, and prevent the occurrence and spread of state-reportable and nationally notifiable diseases and conditions, primarily infectious diseases. Of the 90 conditions included in the NNDSS, approximately 36 collect some information on work but the data are not harmonized across the conditions nor is the information coded using a standard coding system. CDC is undergoing an effort to harmonize the variables collected in its surveillance systems. This work provides an opportunity for NIOSH to influence collection and harmonization of I&O for conditions within NNDSS. This is important due to the increasing awareness of infectious and vector-borne diseases relevant to a variety of occupational groups. Harmonization of data elements within NNDSS and inclusion and standardized coding of I&O would permit greater ability to recognize risks among exposed workers both within and across conditions reported in NNDSS. <https://www.ndc.cdc.gov/nndss/>

Electronic Health Records -- Electronic health records (EHRs) provide the potential for conducting substantially more comprehensive surveillance of work-related injuries and illnesses to define the health status of the US working population. In 2011, The IOM issued a Letter Report stating that, “occupational information could contribute to fully realizing the meaningful use of EHRs in improving individual and population health care” and outlining recommendation for moving forward. <http://www.nationalacademies.org/hmd/Reports/2011/Incorporating-Occupational-Information-in-Electronic-Health-Records-Letter-Report.aspx> This promise can be realized only if, at minimum: 1) EHRs are capable of readily collecting and managing structured patient “occupational data for health” (ODH), including current and usual I&O; 2) the ODH and clinical data are made available from the EHRs to public health for surveillance; 3) public health is able to collect and use the data.

NIOSH’s EHR workgroup has moved the topic of adding I&O into EHRs to the agenda of national and state programs. Demonstration projects have illustrated the ability of intake personnel to capture usable I&O in clinic settings. Other work has concentrated on building the informatics structure needed to create the underpinnings to support the capture of ODH in EHRs, such as the creation of an information model to inform vendors of what information is to be collected, when and how; development of an occupation glossary for HL7; creating functional profiles for ODH; and other activities. In addition, NIOSH is developing a tool to work with EHRs to collect and code I&O in a

standardized way. This tool will most likely share components with NIOCCS (see below), but is not the same. The EHR capture and coding tool will work differently because it is aimed at collecting and coding I&O in real-time from the patient, so checks for accuracy are different, and the data need to be recorded in terms that are most useful to the care provider while still facilitating public health surveillance.

Widespread inclusion of occupational data in the record will depend on the care provider obtaining significant benefit from having the data available, i.e., understanding the significance of the relationship between work and health or disease and injuries and being empowered by tools to use the data to improve patient care. NIOSH and its partners have engaged in research to explore linking occupational data to information sources, and to offer additional clinical decision support to inform and educate users about potential symptoms and conditions related to work. The initial efforts addressed diabetes, asthma, and return to work after an injury. NIOSH is working toward pilot-testing one of these concepts as clinical decision support delivered through the EHR at the point-of-care.

There are efforts underway elsewhere to effectively establish and/or improve existing information technology and informatics components that support a chain of interoperability for infectious disease NNDSS data from EHRs to state or local jurisdictions for case reporting and from state or local jurisdictions to CDC. Cancer registries are increasingly receiving data through interoperability with EHRs. NIOSH and partners are examining how best to join these efforts to support public health reporting of conditions primarily associated with occupational exposures and integrate occupational data in the data collections of other programs. Interoperable health information systems also provide the opportunity for occupational public health programs to execute distributed queries of data recorded in EHRs, once the remaining components are in place.

3. Improve Autocoding Technology

The ability to autocode free text fields related to work variables is an important element in leveraging the use of health and injury data collected by others. NIOSH has focused on autocoding I&O as well as text in workers compensation medical records.

NIOSH Industry and Occupation Computerized Coding System (NIOCCS) - A key obstacle to including I&O in public health surveillance systems has been the investment in labor and time needed to manually code I&O. Autocoding of I&O is mitigating these concerns.

Text based I&O data can be found in many records including surveys, birth and death records, case reports and, hopefully, in the future, in EHRs. There are a number of federally generated classification systems that categorize I&O to standard numeric codes, such as the Bureau of Census Industry and Occupation Classification Systems <https://www.census.gov/people/io/methodology/indexes.html> and the Standard Occupation Classification System <http://www.bls.gov/soc/> and the North American Industrial Classification System. <http://www.census.gov/eos/www/naics/> Manual coding of I&O was the standard method for many years. But human coding is labor intensive, subject to random and systematic errors, and can be expensive. Over the past 20 years, organizations have developed computer applications, using the standard classification systems, to automatically code text based I&O to reduce the time and expense of manual coding.

In 2012, NIOSH launched NIOCCS. NIOCCS is a web-based software tool designed to translate I&O text from a variety of data sources to standardized I&O codes. It is used by occupational researchers,

federal government agencies, state health departments and other organizations that collect and/or evaluate information using I&O. Its purpose is to provide a tool that reduces the high cost of manually coding I&O information while simultaneously improving uniformity of the codes. NIOCCS is available free of charge and requires only internet access and a web browser for use. Users are required to [register for a NIOCCS account](#) if they wish to upload files of records for coding. More than 200 individuals or organization are registered users. More than 13 million records from surveys, vital records, cancer registries and other sources have been successfully coded. When NIOCCS cannot code an entry, a computer assist program is enlisted using human coders. Program updates are based on encounters with new types of data, partner needs, technologic advancements and updates to the standard coding system. <http://www.cdc.gov/niosh/topics/coding/overview.html>

Automated coding of Text-based “Cause of Injury” in Workers Compensation records- Manually reading free-text narratives in large databases to identify the cause of an injury can be very time consuming and recently, there has been much work in automating this process. NIOSH and BLS have developed a few methods (including variations of naïve Bayes models and a logistic model) to autocode the cause of injury in workers compensation records. Further modest improvements were made by using sequences of keywords as opposed to only single keywords. NIOSH shares the programs and weights with researchers who would like to automatically assign event codes to large data-sets of text narratives. The utility of sharing these programs was tested with BLS and state partners which used the programs on their sets of injury narratives with promising results. Thus far 1.4 million workers compensation records in Ohio have been coded using this system.

4. Build State Occupational Health Surveillance Capacity

States are uniquely positioned to use state-specific data sources to identify emerging health issues, conduct case-based follow-back interventions, and fill gaps in national data by generating state-specific data on working populations not gathered by other sources. Variation in the geography, climate, industry mix, and population size contributes to differences in the risk profile of jobs within states.

The NIOSH State Occupational Health and Safety Surveillance Program: 1) builds capacity of state health departments to conduct occupational public health including tracking of occupational health indicators; 2) conducts case-based occupational surveillance of high priority conditions, exposures or populations, with the objective of fostering interventions; and 3) builds partnerships for prevention of occupational disease and injury. <http://www.cdc.gov/niosh/oep/statereports.html>

NIOSH has created a searchable clearinghouse of state-based publications to enable sharing of information between the states. There are currently over 4,500 documents in the State-based Occupational Health Surveillance Clearinghouse <http://wwwn.cdc.gov/niosh-survapps/statedocs/>

Occupational Health Indicators – All 26 states funded through the NIOSH State Occupational Health and Safety Surveillance Program report annually on at least 15 of 24 occupational health indicators. The indicators are based on a combination of federal and state data sources, including SOII, CFOI, emergency department visits, and workers’ compensation data. The Council of State and Territorial Epidemiologists (CSTE) produces a combined annual report for all 26 funded States. Links to these reports and other NIOSH-funded state generated products can be found at: <http://www.cste.org/?page=EHOHI>

Expanded State-based Occupational Health and Safety Surveillance Programs – The mission of the expanded state-based programs is to build occupational illness and injury surveillance capacity within state health departments. Under this program, NIOSH provides [cooperative agreement funding](#) and technical support to state health departments to conduct surveillance on one or more occupational illnesses or injuries. Publications and information produced by state partners may be found at: <http://wwwn.cdc.gov/niosh-survapps/statedocs/default.aspx>

Occupational Respiratory Disease Surveillance – State-based surveillance for occupational respiratory disease forms a critical part to the overall NIOSH program of occupational respiratory disease surveillance. State health departments are in a unique position to identify work environments that place workers at high risk for occupational respiratory disease and to identify potential risk factors. Their in-depth surveillance and follow-up investigations help identify emerging issues, disseminate data and information and formulate prevention strategies and interventions for occupational respiratory disease. Five states collaborate and work with NIOSH staff in the exchange of information and collectively publish occupational respiratory disease surveillance products. <http://www.cdc.gov/niosh/topics/surveillance/ords/statebasedsurveillance.html>

SENSOR Pesticides – Surveillance for occupational pesticide-related illness and injury is designed to protect workers by determining the magnitude and root causes of over-exposure to pesticides in the workplace. Surveillance also serves as an early warning system of any harmful effects not detected by manufacturer testing of pesticides. NIOSH, with some funding from the Environmental Protection Agency, conducts surveillance for occupational pesticide-related illness and injury. In collaboration with participating states, NIOSH provides technical support to 12 state health departments, and funds four of these states to, conduct this surveillance and to standardize reporting and case submission to the National Aggregated Database. This program gives NIOSH and the states the opportunity to exchange information and collectively publish pesticide poisoning findings. <http://www.cdc.gov/niosh/topics/pesticides/overview.html>

Fatality Assessment and Control Evaluation (FACE) - NIOSH staff work with 7 states to conduct field-based investigations of selected types of deaths. NIOSH and states publish case reports that include recommendations for preventing future similar deaths. NIOSH and state partners also publish fact sheets, videos, and digital stories highlighting data and investigation findings. <http://www.cdc.gov/niosh/face/>

The Teens at Work: Injury Surveillance and Prevention Project (Teens): This is an expanded surveillance project conducted by the Massachusetts Department of Public Health. The project seeks to prevent work related injuries to young workers by: identifying cases using multiple state data sources, conducting case follow-up with some cases, analyzing data and disseminating findings to stakeholders, developing and conducting intervention and prevention activities, and collaborating with government and community partners to use surveillance data for prevention purposes. <http://www.mass.gov/eohhs/gov/departments/dph/programs/admin/dmoa/ohsp/injuries-workers-under-18/>

Trucking Injury Reduction Emphasis through Surveillance (TIRES) Program: This is an expanded surveillance project conducted by the Washington State Department of Labor and Industries. The TIRES program uses multiple sources of surveillance data and stakeholder input to develop prevention materials. Surveillance data includes worker and employer surveys and workers compensation claims. <http://keeptruckingsafe.org/>

The Adult Blood Lead Epidemiology Surveillance (ABLES) - is a long-standing state-based surveillance program of laboratory-reported adult blood lead levels (BLLs). From 1987 to 2013, NIOSH provided funding that resulted in the expansion of the ABLES program from 4 to 41 states. However, federal funding for State ABLES programs was discontinued in September 2013. In August 2015, funding to support adult BLL surveillance was resumed but at a reduced amount and to fewer states compared to the pre-2013 funding level. As of December 2015, 28 states collaborate with NIOSH to conduct adult BLL surveillance. Blood lead level data are available from the ABLES Data website. <http://www.cdc.gov/niosh/topics/ables/description.html>

Occupational Health Alert Network – The 26 states funded through the NIOSH State Occupational Health and Safety Surveillance Program are planning to initiate a new system to coordinate case identification and response to unique or emerging occupational illnesses, injuries, and fatalities identified by state health departments or state departments of labor. The states plan to include NIOSH, OSHA, and BLS as technical assistants to the states. Occupational health alert notifications will be done through the existing CDC Epi-X system or a comparable system. Examples of recent sentinel events identified by states that would have benefited from this type of system are diacetyl exposures to coffee roasters, and methylene chloride exposures to bathtub refinishers.

Workers' Compensation (WC) Data – In 2013, NIOSH created a Center for Workers' Compensation Studies (CWCS) whose purpose is to use WC data for prevention purposes. Use of the data for surveillance is an important step in setting research priorities. While WC data primarily address injury and musculoskeletal disorders, the data contain very detailed information on the cause and cost of the injury that is not available from other data sources. In 2015, NIOSH created a cooperative agreement program modeled on methods used by the State of Washington. The cooperative agreements, awarded to state health and state WC agencies seeks to build capacity for state-based WC surveillance and intervention activities within the states. NIOSH funded states will 1) collect, analyze, interpret, and disseminate findings on the incidence of occupational injuries, illnesses, deaths and exposures to hazards; 2) identify trends, emerging issues, high-risk occupations, industries, and worker populations; and 3) develop recommendations for workplace interventions. NIOSH currently funds four states for three years per state and intends to fund two new states in 2017. NIOSH is also providing technical assistance to four other states. <http://www.cdc.gov/niosh/topics/workercomp/cwcs/default.html>

5. Accelerate Communication for prevention

Timely dissemination of surveillance findings is necessary to inform partners, stakeholders and the community of today's changing work environment. It is important that surveillance information generated by the US government reaches the public as quickly as possible. The internet, social media, data mapping and other methods expand the ability to reach and communicate to large numbers of people and many types of audiences, such as teens, immigrants and others missed by traditional communication methods.

Effective communication of surveillance information provides NIOSH and its partners with knowledge to assess the burden of legacy and emerging occupational health issues. Surveillance data also provide the basis for etiologic research as well as the measure of impact once interventions and prevention efforts by NIOSH and others have occurred.

The following is a list of selected current and planned communication tools and dissemination

products.

Examples of current communication activities:

- National Electronic Injury Surveillance System (NEISS-Work) query system which allows users to generate data of specific interest, including numbers and rates by year, demographic characteristics of injured worker, and characteristics of the injury <http://wwwn.cdc.gov/wisards/>
- The National Occupational Mortality System (NOMS) is a national database query system which allows users to generate all disease mortality reports by several variables of interest. Outputs are proportionate mortality ratios (PMRs) that illustrate increased risk of dying from a specific cause compared to all other causes among a specific group of workers. <http://www.cdc.gov/niosh/topics/noms/query.html>
- The National Occupational Respiratory Mortality System (NORMS) is a national database query system which allows users to generate respiratory disease mortality reports by several variables of interest. Outputs are counts, rates, and years of potential life lost. <http://webappa.cdc.gov/ords/norms-national.html>
- The Firefighter Fatality Investigation and Prevention Program interactive Firefighter Fatality Map will provide a variety of geographic displays of firefighter fatalities. The interactive system allows users to review information about each case, including whether the case has or will be investigated by NIOSH. <http://wwwn.cdc.gov/wisards/ffmap/>
- The Work-Related Lung Disease Surveillance System (eWoRLD) provides charts and tables on selected work-related respiratory diseases. <http://wwwn.cdc.gov/eworld>
- State-based Occupational Health Clearinghouse was developed to promote public access to occupational health outputs produced by the states. The application provides a centralized point of access to state-based occupational health surveillance and related outputs where the original state publications can be searched and viewed. <http://wwwn.cdc.gov/niosh-survapps/statedocs/>

Communications activities under development and future needs

Visual and interactive representation of surveillance data provide many opportunities to reach a larger audience than the conventional representation of tables, charts and graphs. The NIOSH Surveillance Program recognizes that there are many avenues with which to disseminate NIOSH surveillance information. Easy- to- use and inexpensive tools are available that will allow stakeholders to interact with the data and form ideas for research or action. Among the many stakeholders who would benefit from improvements in this area are the NIOSH Sector and the Health and Safety Cross-Sector Programs. NIOSH currently has a number of query systems designed to produce tables, and some charts for specific systems and data. NIOSH is developing prototype visualization tools and software to replace existing query systems and is evaluating some off-the-shelf tools. Data to be illustrated using these tools may include information from the BLS SOII and CFOI, the ABLES, pesticide poisoning and workers compensation data, as well as data from BRFSS and the NHIS.