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Occupational and Environmental Health Surveillance

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How many workers are fatally injured at work each year? In which industries and occupations are workers at highest risk of fatal injury?

How are environmental hazards changing temporally and spatially? Are these changes associated with changes in disease occurrence?

Which industries and workplaces should the Occupational Safety and Health Administration (OSHA) focus on to prevent amputations, noise-induced hearing loss, or musculoskeletal disorders?

Which communities should the state health department prioritize for prevention of childhood lead poisoning?

Public health surveillance provides data to help answer these and many other questions to protect the health of workers and communities. Surveillance is recognized as the cornerstone of public health practice that provides the foundation upon which to build successful prevention programs and to evaluate their impact. *Surveillance*, sometimes also called *tracking*, is defined as the "ongoing, systematic collection, analysis, interpretation of health data essential to the planning, implementation and evaluation of public health practice closely integrated with the timely dissemination of data to those who need to know for purposes of prevention."[1] (Figure 6-1.) Its key elements are:

- *Surveillance is ongoing*: Collection, analysis, interpretation, and dissemination of data are often continuous but can also be periodic, such as biannual surveys conducted to monitor trends. (However, cross-sectional studies and one-time surveys are not considered surveillance.)
- *Surveillance is systematic:* It involves using consistent methods over time.
- *Surveillance involves interpretation of findings*: It is not sufficient to simply generate data tables; surveillance programs must interpret data so that findings and their significance can be understood.
- *Dissemination of surveillance findings for the purpose of prevention*: Surveillance carries with it the responsibility for public health action. The final link in the surveillance chain is the actual application of the data to prevention. Findings and their interpretation must be promptly and appropriately disseminated to those who can use the information to take preventive action.

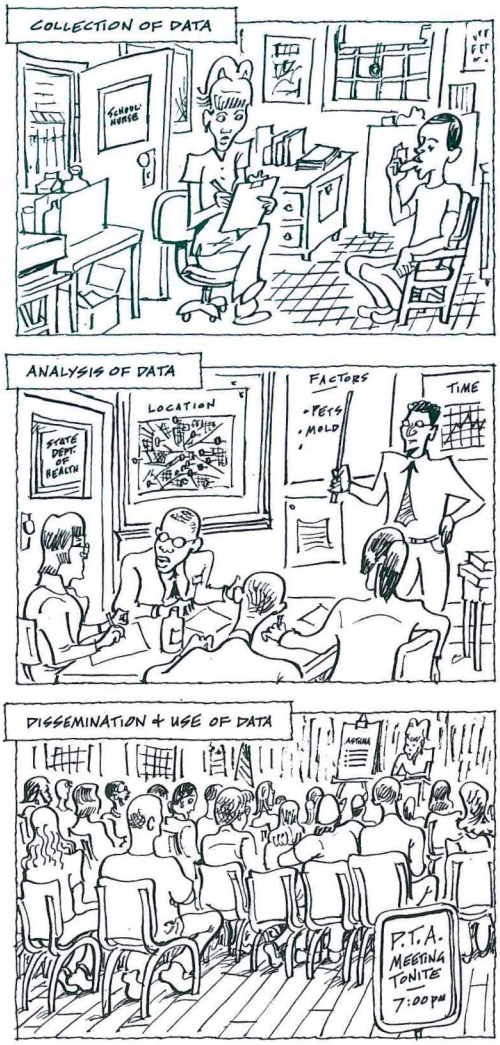

Figure 6-1. The three phases of surveillance. (Drawing by Nick Thorkelson.)

SURVEILLANCE IN OCCUPATIONAL AND ENVIRONMENTAL HEALTH

The overarching aim of occupational and environmental health (OEH) surveillance is to protect the health of workers and communities by providing information needed to target, design, and evaluate actions to control hazards and prevent occupational and environmental injuries and illnesses. It provides data used to inform public policy, regulatory and educational activities, development of safer technologies, and future research priorities. Specific objectives of surveillance are to:

- Document the nature, extent, and time trends of occupational and environmental injuries and illnesses
- Characterize the nature and distribution of OEH hazards and exposures—information that allows for interventions before injuries or illnesses occur
- Identify geographic locations, industries, specific workplaces, and occupations in which interventions are needed
- Identify emerging OEH problems that require investigation
- Generate hypotheses for etiologic research
- Evaluate the effectiveness of interventions.

Public health, in general, places special emphasis on addressing health needs of vulnerable populations. Therefore, another objective of OEH surveillance is to assess health risks by population characteristics, including race, ethnicity, age, and gender, in order to guide preventive measures to reduce health inequities. Surveillance findings can also be used to educate and mobilize the political and financial support of policymakers and the general public for necessary preventive actions.

OEH surveillance involves tracking many different types of hazards and health outcomes. A wide range of approaches and data sources are used, each with strengths and limitations. There is no single national surveillance system in occupational or environmental health but rather sets of different systems to meet different surveillance objectives.

Surveillance can be divided into two broad categories: *surveillance of health outcomes*, such as work-related injuries or childhood asthma, and *surveillance of hazards*, such as the presence of toxic substances in the workplace or drinking water. A subcategory of hazard surveillance is *exposure surveillance*, which provides more detailed information about intensity and duration of exposure to hazards. This may involve, for example, monitoring of individuals to assess exposure to a toxic agent, such as elevated levels of lead in the blood, or preclinical health effects. Surveillance of

diseases caused by environmental or occupational hazards is especially challenging because (a) most of the diseases have many potential causes, and (b) there can be a substantial lag time between onset of exposure and onset of disease. In the United States, most occupational health surveillance systems focus on injuries and illnesses—not hazards. In environmental health surveillance, there is increasing focus on hazards in the environment.

Occupational and environmental health surveillance is conducted at national and state levels. National data are used to help determine national priorities and plan federal programs. However, relying solely on national data can obscure risks that are relevant to specific states or communities. In the United States, state government agencies—mainly in public health, labor, and environmental protection—often with financial and technical support from the federal government, play a central role in occupational and environmental surveillance. Many national surveillance systems rely on data sent to them by states. State health agencies have the legal authority to require disease and injury reporting, such as from physicians and laboratories, and to access a wide variety of health-related data. State agencies can also respond to local concerns by collaborating with city and county health departments, other agencies, and nongovernmental community organizations to translate surveillance findings into preventive action.

While public health surveillance is often thought of as a function of government, workplace-based tracking of injuries, illnesses, and hazards is also critical to protect worker and community health. Surveillance is recognized as an essential component of effective workplace injury and illness programs and environmental management programs.[2] Many large companies have extensive programs, some of which are mandated by law, for monitoring emissions to air and water and for tracking workplace hazards and exposures. OSHA requires many companies to maintain records of work-related injuries and illnesses. Some companies voluntarily go beyond required surveillance by tracking other indicators, including leading indicators such as "near misses," which enables them to identify and control risks before illnesses and injuries occur.[3]

CASE-BASED AND POPULATION-BASED SURVEILLANCE IN OCCUPATIONAL HEALTH

Occupational health surveillance systems may be (a) case-based, providing detailed information—although often not complete and not representative—on individual cases of work-related injury or illness, and/or (b) population-based, generating representative data on the occurrence and distribution of work-related injuries and illnesses. Case-based surveillance is based on the concept of a *sentinel health event*—a case is a warning sign that prevention has failed and intervention may be warranted.[4] It involves the ongoing timely collection of data on cases, including personal identifying information, such as name and contact information, which allows for case follow-up. Case-based surveillance is usually implemented under the state's authority to require illness and injury reporting by physicians and other healthcare providers. Follow-up may be done to assure that the affected individual has received medical treatment, that hazards are controlled to protect other workers, and that opportunities are taken to improve scientific understanding of the hazard and the associated illness or injury.

Several states implement case-based surveillance of selected occupational disorders using the Sentinel Event Notification System for Occupational Risks (SENSOR), a model developed by the National Institute for Occupational Safety and Health (NIOSH).[5] Following this model, state programs identify sentinel cases of illness or injury from various data sources, such as mandatory case reports from healthcare providers, hospital records, and workers' compensation claims. Identified cases are assessed to see if they meet stringent case definitions. Results of summary data analyses, while not necessarily representative, are informative and useful for planning preventive measures. Data from several states are often aggregated to gain a broader perspective on a problem, such as work-related asthma. (See Box 6-1.)

Box 6-1. Data for Action: Work-related Asthma Data Influence Green Cleaning Standards

Data from California, Massachusetts, Michigan, and New Jersey, which conduct surveillance of work-related asthma, demonstrated that 12% of reported cases of work-related asthma between 1993 and 1997 were associated with cleaning products. About 20% of these workers were employed in jobs where cleaning was their primary task; the other 80% worked in non-cleaning jobs near areas being cleaned.[1] In response to these findings, these states recommended that chemicals known to cause asthma, such as formaldehyde and quaternary ammonium compounds, be prohibited from products certified by third-party environmental certification standards. They successfully worked with environmental certification organizations to include this prohibition in the revision of several environmental standards for institutional, industrial, and household cleaning products. These state-based surveillance programs are collaborating with schools and hospitals to adopt safer cleaning practices and products.

Reference

1. Rosenman KD, Reilly MJ, Schill DP, et al. Cleaning products and work-related asthma. Journal of Occupational and Environmental Medicine 2003; 45: 556–563.

(Adapted from Council of State and Territorial Epidemiologists. Putting data to work for worker safety and health: Success in the states. Available at: http://www.cste2.org/webpdfs/ohsuccessstories.pdf. Accessed November 21, 2016.)

In contrast, *population-based* (or *rate-based*) *surveillance* collects data that can be used to assess the nature and magnitude of a problem and to monitor trends in a population over time. It may involve collecting data on a *census*—all cases of an illness or injury—or a representative sample of cases. Population-based surveillance collects data on demographic characteristics, such as age and gender, and, ideally, type of industry or occupation—but does not necessarily collect personally identifying information on workers or employers. Population-based surveillance requires denominator information—such as the number of workers at risk for a specific injury or illness. The annual Survey of Occupational Injuries and Illnesses conducted by the Bureau of Labor Statistics is an example of a widely used population-based surveillance system.

Case-based and population-based approaches to surveillance are not mutually exclusive. Some of the most effective surveillance systems at the state level have attributes of both, identifying both sentinel health events (cases) for follow-up and representative summary data to understand the magnitude and distribution of the problem and to plan preventive measures. A combination of compelling case reports (stories) and summary data (statistics) is often most successful in raising awareness of the public and policymakers about a problem. The state-based surveillance system for elevated blood lead levels (BLLs) in adults, which has contributed to a substantial reduction of occupational exposure to lead over time, is an example of a system that generates both case reports and summary data.

NATIONAL SURVEILLANCE SYSTEMS FOR OCCUPATIONAL INJURIES AND ILLNESSES

The major U.S. national surveillance systems for occupational illnesses and injuries are the Census of Fatal Occupational Injuries (CFOI) and the Survey of Occupational Injuries and Illnesses (SOII). Both are population-based surveillance systems that are administered by the Bureau of Labor Statistics (BLS) in the U.S. Department of Labor, in collaboration with state labor departments or other state government agencies. CFOI, which has been implemented in all U.S. states since 1992, produces a complete count of all fatal occupational injuries in a timely manner. For a death to be counted, the person who died must have been self-employed, working for pay, or volunteering at the time of the event, engaged in a legal work activity, and present at the site of the incident as a job requirement. Homicides and suicides as well as unintentional injuries at work are included. To provide counts that are as complete as possible, CFOI uses multiple data sources, including death certificates, police reports, and news media reports, to identify, verify, and describe

fatal occupational injuries. For each death, information is collected about the worker, the workplace, and the circumstances of the event. BLS provides training and resources to the states for data collection. States transmit the data to BLS, which compiles a national data set. National and state-level findings are reported annually.

The most comprehensive source of statistics on nonfatal work-related injuries and acute illnesses, SOII provides estimates of the numbers and rates of work-related injuries and illnesses, overall and by industry, nationally and for most states. For serious cases that involve one or more days away from work, SOII also provides more detailed data on the nature and circumstances of the injury or illness as well as characteristics of affected workers. Unlike other major public health surveillance systems, SOII collects data from workplaces, rather than from healthcare providers or facilities or from individuals at risk. BLS uses a scientific sampling approach to select employers that represent all industries and employers of all sizes. Selected employers are required to provide information on all work-related injuries and illnesses for which OSHA requires recordkeeping—those resulting in loss of consciousness, one or more days away from work, restricted work activities, transfer to another job, or medical treatment beyond first aid. As with CFOI, BLS provides training and resources to state agencies to collect SOII data. Data are transmitted to BLS. National and state-level surveillance reports, which are issued annually, are an important source of information used widely by government agencies, industries, labor unions, and others. However, SOII has several limitations:

- Excluded are self-employed, household workers and workers on farms with fewer than 11 employees, which together comprise about 14% of the total U.S. workforce.
- Injuries and illnesses that are not recorded by employers on OSHA logs or not reported by workers to their employers are not captured by SOII.
- SOII fails to capture most chronic occupational illnesses—physicians' failure to recognize occupational illnesses, the long latency periods for many occupational diseases, and the multifactorial nature of many of these diseases make tracking difficult by a workplace-based reporting system.
- Injuries are also underreported, probably by 20% to 50%, in SOII, and there is some evidence that reporting varies by worker and employer and by injury characteristics.[6-9] For example, immigrant workers, many of whom perform very hazardous tasks, may be reluctant to report their injuries because of fear of reprisal or job loss. (See Box 6-2.)
- Since SOII, like CFOI, is a population-based surveillance system, it does not allow for case-based follow-up to intervene in specific workplaces in order to protect others at risk or to learn more about factors contributing to injuries and illnesses.

A range of additional approaches are undertaken by federal and state agencies to address these surveillance gaps, as described next.

Box 6-2. Underreporting of Injuries in the Workplace

Multiple factors contribute to underreporting of work-related injuries. Some employers, especially in smaller workplaces, are unaware of or confused about OSHA recordkeeping requirements. Others do not have effective systems for documenting and recording injuries. Yet other employers intentionally avoid recording injuries because they want to avoid OSHA penalties, increases in workers' compensation premiums, or rejection as subcontractors due to poor safety records. In addition, workers often fail to report their injuries to their employers or file workers' compensation claims, especially if the injury is not serious, sometimes fearing retaliation by their employers if they report injuries. Workplace programs that punish workers for injuries or reward workers or their managers for good safety records can deter workers from reporting their injuries. In 2016, OSHA issued new recordkeeping regulations that specify that employer policies for reporting workplace injuries and illnesses must be reasonable and prohibit retaliation against employees who report a workplace injury or illness. Workplace safety programs should encourage workers to report injuries.

Box 6-3. State Health Data Sources Used for Occupational Health Surveillance

Case Reports

- Healthcare providers
- Clinical laboratories
- Poison control centers

Administrative Data

- Hospital discharges
- Emergency department visits
- Hospital outpatient visits
- Emergency medical services
- Workers' compensation

State Registries

- Birth and death registries (vital records)
- Cancer registries
- Birth defect registries
- Trauma registries
- Burn registries

Surveys

- State SOII data
- Behavioral Risk Factor Surveillance System
- Youth Risk Behavior System
- Other state health surveys

Other Sources

- News media searches
- OSHA and Coast Guard records
- Autopsy reports
- National Violent Death Reporting System

Potential New Sources

- All payer claims data
- Electronic health records
- Social media

STATE-BASED OCCUPATIONAL HEALTH SURVEILLANCE

State agencies have access to a wide variety of state data sources that can be used to identify local health and safety problems and help fill gaps in surveillance at the national level. (See Box 6-3.) State health and labor departments, many with funding from NIOSH, use these data sources to perform a variety of both case- and population-based surveillance activities. State government agencies can, in turn, collaborate with local intervention partners, such as trade associations, unions, worker centers, healthcare organizations, and OSHA and other government agencies, to address identified health and safety problems. In addition, occupational health programs within state health departments can partner with other public health programs to develop more comprehensive approaches to hazards, such as indoor air in schools, distracted driving, and infectious diseases, which can affect workers and the general public alike.

States rely on both data collected specifically for occupational surveillance, such as case reports of occupational health illnesses and injuries from physicians and existing administrative data sources, such as statewide emergency department data systems. States can also incorporate information about occupation and industry into other public health surveillance systems, such as state health surveys. Doing so not only leverages use of these other surveillance resources for occupational health but can also enhance practice in other areas of public health by providing information about patterns of health outcomes and determinants of health, such as smoking behaviors or access to preventive health services, in relation to work.

With financial support from NIOSH, 26 states, in 2016, were using data from state data systems to generate information for a standardized set of occupational health indicators to track trends in occupational health.[10,11] Some states conduct more intensive surveillance focused on specific industries, populations, or health outcomes, such as fatal injuries, pesticide poisoning, carbon monoxide poisoning, occupational lung disease, and injuries to young workers, hospital workers, and truckers. Many of these systems combine data from several data sources. All of them include intervention and prevention activities to protect worker health.

PHYSICIAN AND LABORATORY REPORTING

Public health reporting laws enable state agencies to gather surveillance data, mainly on communicable diseases, with information about the affected individuals that allows for case follow-up. In 1874, physician reporting of disease to public health agencies began when Massachusetts

established a voluntary reporting program in which physicians mailed a postcard every week to the state health department listing "prevalent" diseases. In 1893, Michigan became the first state to require physician reporting of specific diseases. By 1901, reporting of smallpox, tuberculosis, and cholera was legally required in all states. While communicable diseases still dominate the list of reportable conditions, 30 states also require healthcare providers to report to the state health department selected occupational disorders, such as work-related asthma, silicosis, and injuries to teen workers. These laws may also allow the health departments to follow up to obtain confidential medical information from healthcare providers and facilities when they identify possible cases using other data sources. Healthcare providers should become familiar with which, if any, occupational and environmental disorders are required to be reported in the states where they practice. Reporting these cases to the designated government agency is not a violation of the Health Insurance Portability and Accountability Act (HIPAA), which has specific exemptions of its privacy provisions related to public health reporting laws.[12]

While not all cases are reported, as required, these laws have been valuable in facilitating identification of new occupational risks. Recent examples include lung disease due to diacetyl exposure in food-flavoring industry workers and deaths from methylene chloride exposure in bathtub refinishers.

Mandatory reporting by clinical laboratories provides the foundation for yet other surveillance systems, such as those for identifying people with high BLLs. Most states require clinical laboratories to report to a state health agency results of BLL tests in both adults and children. Results at or above the reference level of 5 μg/dL indicate what is deemed to be excessive exposure, although any presence of lead in blood may be harmful. Since 1987, the NIOSH Adult Blood Lead Epidemiology and Surveillance (ABLES) program has provided financial support to states for adult blood lead surveillance. Participating states conduct follow-up of individual cases, based on BLLs, to assure adequate medical treatment and removal from exposure and to control exposures in order to protect others at risk. Some state health departments collaborate with OSHA to conduct follow-up in workplaces where workers with elevated BLLs were exposed to lead. Summary data are used to monitor trends and to identify for outreach industries and communities with high levels. The ABLES program demonstrated a 50% decline in occupational lead exposure in the United States from 1994 through 2010.[13]

USE OF ADMINISTRATIVE DATA FOR OCCUPATIONAL HEALTH SURVEILLANCE

Data collected for administrative purposes, such as on hospital discharges, emergency department visits, and workers' compensation claims, contain useful information on occupational injuries and illnesses that can augment information from employer-based reporting. Data from hospitals include demographic, diagnostic, and cause-of-injury information but generally not information on work-relatedness of the disorder or industry or occupation of the affected worker. Diagnostic information for those conditions that, by definition, are likely caused by workplace exposures—such as silicosis—can be used to identify occupational cases. Payment information indicating that hospital charges were paid by a workers' compensation insurer can be used to identify other work-related cases in these data sets. Workers' compensation records provide more detailed information about the workplaces in which workers are injured or made ill.

Workers' compensation data have been used extensively for surveillance research and prevention in some states. The Safety and Health Assessment for Research and Prevention program in the state of Washington regularly reports on injury and illness data from the state's workers' compensation system. Ohio routinely uses workers' compensation data to identify state health and safety priorities. The Massachusetts Young Workers Project uses records of workers' compensation claims to identify injuries affecting workers under age 25. Information obtained in all these programs is used to plan worksite interventions. Findings, which are disseminated to employers, labor unions, schools, and state legislatures, have been used to promote policy

Box 6-4. Data to Action: Protecting Teens at Work in Massachusetts

Since the early 1990s, the Young Workers Project of the Massachusetts Department of Public Health has used multiple data sources, including emergency department records, workers' compensation claims, and burn registry reports, to track injuries to working teens—a population at high risk of being injured on the job. The project collaborates with multiple agency and community partners to address identified risks. Findings have been used to promote updates to the state child labor laws, require youth job training programs to provide health and safety training, and offer statewide outreach to teens, parents, teachers, and employers about protecting youth at work.

When the surveillance data revealed many burns in a large franchised restaurant chain, the project conducted worksite investigations and found that injured teens had changed coffee filters without realizing that coffee was still brewing in filters full of near-boiling water. When they pulled out the brew baskets, hot coffee slurry splashed on their hands and wrists causing second- and third-degree burns. The project presented data to corporate officials and recommended that the company work with its equipment suppliers to develop a safer coffee machine design. Subsequently, the company introduced a new coffee brewer with a funnel lock, which prevents the brew basket from being pulled out before the machine has completed brewing. This engineering solution—an example of prevention through design—could protect all workers, not just teens, in the company's 13,000 restaurants across the United States.

and practice changes and educational initiatives for worker safety and health. (See Box 6-4.)

Because workers' compensation laws and eligibility requirements vary among states, surveillance findings based on based on workers' compensation records cannot be readily compared among states. In addition, workers' compensation records are not representative of all workers with occupational injuries and illnesses because some workers are not covered by workers' compensation and some never submit claims or receive payments.[14] The NIOSH Center for Workers' Compensation Studies promotes the use of workers' compensation data to improve workplace safety and health. The Center develops new methods for coding, analyzing, and disseminating workers' compensation data; fosters research collaborations; and shares best surveillance and research practices among state agencies, research programs, and insurance companies who use these data.

SELECTED OTHER OCCUPATIONAL HEALTH SURVEILLANCE SYSTEMS

The NIOSH Fatality Assessment Control and Evaluation (FACE) program aims to prevent fatal occupational injuries by identifying underlying risk factors and developing and disseminating prevention recommendations. FACE is a collaborative program between NIOSH and seven states that NIOSH funds to conduct surveillance and investigations of select fatal occupational injuries. Each investigation results in a report, describing the event and recommendations to prevent similar incidents, which is disseminated, with related alerts, to businesses, labor unions, equipment manufacturers, and others. Overall, FACE provides in-depth information about the circumstances leading to deaths and compelling case studies that augment the CFOI statistics.

The National Electronic Injury Surveillance System, operated by the Consumer Product Safety Commission, collects data from a national sample of hospitals on emergency department visits for nonfatal injuries associated with consumer products and with work.

The Behavioral Risk Factor Surveillance System is a national health survey, conducted by telephone, of a representative sample of adults. Administered by state health departments in collaboration with the Centers for Disease Control and Prevention (CDC), it provides state- and national-level surveillance data. In 2016, about half of the states, with support from NIOSH, started collecting current occupation and industry of survey respondents, enabling assessment of health-related behaviors, health outcomes, and use of health services in relation to employment characteristics.

The National Health Interview Survey, conducted by the National Center for Health Statistics, is an annual health survey of representative sample of U.S. households. It collects basic employment information that is used to analyze the occurrence of chronic diseases by occupation and industry. Periodically, it collects

national-level data on some occupational health outcomes and exposures.[15]

The National Occupational Respiratory Mortality System, maintained by NIOSH, is an interactive data system based on death certificate data for deaths caused by pneumoconiosis, malignant mesothelioma, hypersensitivity pneumonitis, and other respiratory disorders. It is used to evaluate trends in death rates for these diseases by occupation and industry.

Occupational health indicators are a group of well-defined surveillance measures of occupational health or risk status that are used by state health departments to track health problems over time (or among states) and guide preventive measures.[16] Developed by the Council of State and Territorial Epidemiologists, the list of recommended occupational health indicators is evolving, with new indicators being added over time as new issues emerge and as new data sources become available.[16]

OSHA requires employers to report, within hours, workplace fatalities and hospitalizations of three or more employees. In 2014, OSHA expanded reporting requirements to include all amputations, in-patient hospitalizations, and losses of an eye. OSHA receives about 30 reports of these severe injuries daily from about half of the states. OSHA uses this system to prioritize its enforcement and compliance-assistance activities. Summary data provide useful information on trends in severe injuries by industry and other variables.[17]

OSHA also requires employers in certain industries to maintain on-site logs of workplace injuries and illnesses. While the SOII collects information from these logs from a sample of employers every year, employers have not had to routinely submit their detailed log data to OSHA. In 2016, OSHA issued new regulations requiring employers to submit their OSHA log data to it electronically. The amount of data to be submitted varies, depending on size of the company and type of industry.

HEALTHY PEOPLE

Some of the *Healthy People* objectives for the United States, developed for each decade by government officials, researchers, and others, relate to occupational health and safety as well as environmental health.[18]

Disaster Surveillance

Recognizing the dangers confronted by response workers, the CDC-NIOSH Emergency Preparedness and Response Office has developed the Emergency Responder Health Monitoring and Surveillance system for monitoring these workers, before, during, and after deployment. (See Chapter 31.)

Hazard Surveillance

Hazard surveillance involves tracking health and safety hazards in the workplace, such as the presence and levels of toxic substances, noise, and ionizing radiation as well as, in farming communities, the prevalence of tractors lacking rollover protection.[19] Its aim is to identify opportunities to intervene and control hazards before illnesses or injuries occur.[20] Especially valuable is surveillance of health hazards, such as asbestos, that are associated with diseases with long latency periods. Hazard surveillance also provides information that can be used to generate hypotheses about potential associations between hazards and diseases that warrant further research.

There is no U.S. national system for surveillance of occupational hazards or exposures. In the past, NIOSH has conducted surveys to collect data on occupational exposures to chemical, physical, and biologic hazards from a sample of over 4,000 workplaces nationwide. Using survey data, it estimated the number of workers potentially exposed to each of thousands of hazardous substances, by industry and occupation.

OSHA maintains data, in the OSHA Information System database, on hazards and exposures collected during its investigations of workplaces. However, the information is limited to hazards regulated by OSHA at these workplaces. Some OSHA regulations require employers to conduct assessments of exposures to chemical and physical hazards, such as silica dust and noise. Data from these assessments, which may be used for internal hazard surveillance by these companies, are available to OSHA during its investigations but not to others. Data

on hazards in the mining industry are collected and made publically available by the Mine Safety and Health Administration.

The Occupational Information Network (O*NET) program of the U.S. Department of Labor provides information useful for surveillance of some workplace hazards. The O*NET interactive online database contains information on hundreds of standardized and occupation-specific descriptors for over 900 occupations, including training requirements and types of tasks, tools, and technology used.

Additional data sources on environmental health hazards can help in monitoring potential occupational risks, including the Toxic Release Inventory, a publicly available Environmental Protection Agency database that contains information on toxic chemical releases and pollution prevention activities reported by industrial or federal facilities. Data from poison control centers have also been used to track exposures to both occupational and environmental hazards.

ENVIRONMENTAL HEALTH SURVEILLANCE

Environmental health surveillance provides information to plan and take action to prevent environmental illnesses and injuries. It involves monitoring of environmental hazards, ranging from toxic substances to extreme weather events, and associated illnesses and injuries.[21] State departments of public health and environmental protection, often with federal support, conduct environmental health surveillance with multiple data sources and various approaches. Data are used to guide state and local prevention activities and are sent to federal agencies, which use the data to set national environmental health priorities.

State departments of environmental protection and agriculture generally take the lead in collecting data, for regulatory and ecologic purposes, on environmental hazards, such as air pollutants and spills of hazardous substances. State health departments more frequently take the lead in tracking the impact of environmental hazards on human health. For example, state and some city health departments, with the support of the CDC Center for Environmental Health, conduct surveillance of BLLs of children, relying on physician and laboratory reports of children with elevated BLLs. State and city health departments perform follow-up to ensure that affected infants and children receive appropriate medical treatment and that environmental measures are taken to reduce their lead exposure and prevent additional cases. As of 2016, there were 46 states reporting data to CDC as part of the Childhood Blood Lead Surveillance System. CDC also supports state-based surveillance of asthma through the Behavioral Risk Factor Surveillance System.

Some states also participate in the CDC National Biomonitoring Program to assess human exposures to toxic substances though air, water, food, soil, dust, and consumer products. This program measures environmental chemicals in human tissues and body fluids. In addition, the CDC collects representative national data on human exposures through the National Health and Nutrition Examination Survey.

State health departments collaborate with state environmental agencies to combine health and environmental data on illnesses that may have environmental causes, such as certain cancers, heart disease, and birth defects.[22] Methods and mapping tools based on geographic information systems are used extensively in this work.

The National Environmental Public Health Tracking Network, an interactive, multitiered, web-based system of integrated health, exposure, and hazard information from a wide variety of national, state, and city sources, aims to help identify associations between environmental factors and adverse health outcomes as well as elevated risks among vulnerable populations, such as children and older people. The CDC provides funds to many state and local health departments to implement local tracking networks to obtain data on environmental health indicators. These data improve the understanding of associations between environmental factors and diseases and assess unusual trends and events to help plan interventions to reduce risks.

Although occupational health and environmental health surveillance systems are almost always separate, there can be value in combining occupational and environmental health surveillance and including it within a holistic approach to public health surveillance.[23] Many of the hazardous substances to which workers are exposed

are released into the environment through waste disposal, stack emissions, on workclothes, or in other ways, leading to family and community exposures. Other hazards, such as environmental (secondhand) tobacco smoke, cleaning products containing chemicals that cause asthma, lead exposures during home renovation, and extreme weather events, pose risks to both workers and the general public. In addition, some populations, such as low-income and minority individuals, are often exposed to hazards in both the ambient environment and at work. Some state OEH surveillance programs are collaborating by including data on occupational health indicators in the Environmental Public Health Tracking Network and collecting occupation and industry data in other public health surveillance systems, such as the Behavioral Risk Factor Surveillance System.

CONCLUSION

Changes in healthcare delivery, information technology, the workplace, and the environment provide new surveillance opportunities and challenges.[24] New initiatives include:

- Promoting the integration of occupation and industry data in electronic health records to improve both clinical care and population health
- Developing and using new methods and tools to conduct surveillance of workers and community members after natural disasters or terrorist events
- Using surveillance to understand the health effects of climate change (Chapter 29)
- Using information technology to enhance completeness, efficiency, and timeliness of data collection and reporting
- Developing and implementing new approaches for the early detection of disease outbreaks (syndromic surveillance) to mobilize rapid response
- Exploring approaches to documenting work-related health effects, given the changing nature of work relationships, such as the increase in short-term independent contractors and temporary workers as well as the increase in multi-employer worksites.

To address new challenges effectively, OEH surveillance programs will continue to rely on professionals from a wide range of disciplines—including epidemiology, medicine, nursing, industrial hygiene, safety, informatics, and health communication—and to provide rewarding opportunities to bridge the gap between science and practice to advance public health.

AUTHORS' NOTE

The findings and conclusions in this chapter are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health, the Centers for Disease Control and Prevention, or the Massachusetts Department of Public Health.

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Occupational and Environmental Health

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Seventh Edition

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Oxford University Press is a department of the University of Oxford. It furthers the University's objective of excellence in research, scholarship, and education by publishing worldwide. Oxford is a registered trade mark of Oxford University Press in the UK and certain other countries.

Published in the United States of America by Oxford University Press
198 Madison Avenue, New York, NY 10016, United States of America.

Fourth edition published by 2000
Fifth edition published by 2006
Sixth edition published by 2011
Seventh edition published by 2018

Library of Congress Cataloging-in-Publication Data
Names: Levy, Barry S., editor. | Wegman, David H., editor. | Baron, Sherry, L. editor. |
Sokas, Rosemary K., editor.
Title: Occupational and environmental health : recognizing and preventing disease and injury /
edited by Barry S. Levy, David H. Wegman, Sherry L. Baron, Rosemary K. Sokas, with the assistance of Heather L. McStowe.
Other titles: Occupational health (Levy) Description: Seventh edition. | Oxford ; New York : Oxford University Press, [2018] |
Includes bibliographical references and index.
Identifiers: LCCN 2017012926 (print) | LCCN 2017014701 (ebook) |
ISBN 9780190662684 (updf) | ISBN 9780190662691 (epub) | ISBN 9780190662677 (pbk. : alk. paper)
Subjects: | MESH: Occupational Diseases—prevention & control | Occupational Exposure—prevention & control |
Environmental Exposure—prevention & control | Occupational Health | Environmental Health
Classification: LCC RC963 (ebook) | LCC RC963 (print) | NLM WA 440 |
DDC 616.9/803—dc23
LC record available at https://lccn.loc.gov/2017012926

9 8 7 6 5 4 3 2 1

Printed by Sheridan Books, Inc., United States of America