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### Indicators for Occupational Health Surveillance

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# Indicators for Occupational Health Surveillance

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## Summary

Each year, millions of the estimated 140 million U.S. workers are injured on the job or become ill from exposure to hazards at work. These work-related injuries and illnesses result in substantial human and economic costs for workers, employers, and society; estimated direct and indirect costs of work-related injuries and illnesses are approximately \$170 billion annually. In 1998, the Council of State and Territorial Epidemiologists (CSTE) and CDC's National Institute for Occupational Safety and Health (NIOSH) convened a work group that identified priority occupational health conditions to be placed under surveillance, addressed cross-cutting surveillance concerns, and made recommendations regarding the role of states in a comprehensive nationwide surveillance system for work-related disease, injuries, and hazards. CSTE recommendations led to the generation of 19 occupational health indicators (OHIs) and one Employment Demographic Profile, which were developed during 2001–2003. The OHIs complement other guidelines for state-based occupational health surveillance to address overall state and national goals to improve public health. These OHIs are intended to help states build occupational health capacity by providing them with tools to collect and generate important, basic information concerning the occupational health status of the state population and to identify areas in which to focus prevention efforts. In 2005, CSTE released a report compiling OHI data from 13 states. NIOSH provides funding for the OHIs because they are now a required component of state-based cooperative agreements for occupational health surveillance. This report introduces the OHIs and describes CSTE's approach to developing this new occupational health surveillance tool.

## Introduction

Approximately 140 million persons are employed in the United States (1). Every year, millions of these workers are injured on the job or become ill as a result of exposure to safety and health hazards at work. These injuries and illnesses result in substantial human and economic costs not only for workers and employers but also for society. In 2003, workers' compensation (WC) insurance claims cost approximately \$55 billion (2). Estimated direct and indirect costs of work-related injuries and illnesses are approximately \$170 billion annually (3).

Public health surveillance is vital to preventing occupational diseases, injuries, and fatalities (4). Surveillance data are needed to determine the magnitude of the problem of work-related injuries and illnesses, identify workers at greatest risk, and establish prevention priorities. Data are also necessary to measure the effectiveness of prevention activities and to identify workplace health and safety problems that need further investigation. Although surveillance of occupational diseases and injuries in the United States has improved substantially during the last decade, it remains inadequate. The only current nationwide surveillance system is for fatal occupational injuries, and surveillance of occupational illnesses and nonfatal occupational injuries is limited and fragmented.

State health agencies play a central role in public health surveillance. However, national statistics on occupational injuries and illnesses have been collected primarily outside of the public health infrastructure and rely nearly entirely on data reported by employers. State health agencies that have access to various public health data systems are uniquely positioned to 1) provide critical data on occupational diseases, 2) generate information necessary to evaluate the conventional occu-

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pational injury data sources, 3) link surveillance findings with intervention efforts, and 4) integrate occupational health into mainstream public health (5).

## Occupational Health Indicators

In 1998, the Council of State and Territorial Epidemiologists (CSTE), in association with CDC's National Institute for Occupational Safety and Health (NIOSH), convened the Occupational Health Surveillance Work Group (Work Group) to recommend state-based surveillance activities through 2010. The Work Group identified priority occupational health conditions to be placed under surveillance, addressed surveillance concerns that are common to more than one specific condition, and offered recommendations regarding the role of states in a nationwide comprehensive surveillance system for work-related diseases, injuries, and hazards (5). During 2001–2003, the Work Group developed 19 occupational health indicators and one employment demographic profile recommended for use by the states (Table). These OHIs are intended to complement other guidelines for state-based surveillance of occupational injuries and illnesses (5–7) as part of overall state and national goals to improve public health (8).

In selecting the indicators, the Work Group considered the following criteria:

- **Availability of easily obtainable statewide data.** The ability to use existing data available in the majority of states was considered critical for developing indicators. Although certain states might have access to other sources of data for occupational health surveillance, these OHIs represent a core or minimum set of indicators.
- **Public health importance of the occupational health effect or exposure to be measured.** Factors considered in determining public health importance included the extent of the effect or exposure, severity of the health effect, economic impact, emergent status of the condition, and level of public concern.
- **Potential for intervention activities.** Indicators should be used to affect program and policy development at the state level to protect worker safety and health.

The OHIs were piloted among 13 states by using data from 2000, during which the OHI definitions were refined and a technical guidance document for states implementing the OHIs was developed (6). The results of the pilot tests are detailed in CSTE's 2005 report, *Putting Data to Work: Occupational Health Indicators from Thirteen Pilot States for 2000* (9).

The Work Group has acknowledged limitations in the design of these OHIs. The underlying data sources were developed for purposes other than public health surveillance. In addition, substantial variability in source data frequently occurs among the states. Because of these limitations, caution is advised when interpreting the OHIs. Factors affecting quality and comparability of state OHI data include

- underreporting of occupational injuries and illnesses;
- variability in recognition by health-care providers of the occupational etiology of injuries and illnesses;
- difficulties in attributing diseases with long latency (e.g., silicosis) or from multifactorial causes (e.g., lung cancer) to occupational exposure(s);
- exclusion of special populations from certain data sources (e.g., persons self-employed or in the military);
- injury, illness, and death coding errors;
- state-specific differences in structure of administrative databases used for surveillance (e.g., WC and hospital discharge data).

## Data Sources

Data for the OHIs are derived from multiple sources.

- **Death certificates.** All states send death certificate data to the National Vital Statistics System in CDC's National Center for Health Statistics. The cause-of-death section on the certificate contains the contributing and underlying causes of death. For injury-related deaths, all state death certificates include a query concerning whether the incident occurred at work.
- **Cancer registries.** Data on cancer incidence are centralized in registries in all except five states that collect data from multiple sources, including hospitals and laboratories. The North American Association of Central Cancer Registries has standards for the operation of registries; however, not all cancer registries meet these standards. Reporting typically includes in situ or malignant neoplasms, but slight variations exist among states.
- **State hospital discharge data.** Nearly all acute-care hospitals participate in mandatory or voluntary systems for compiling discharge data at the state level. The majority of hospital medical records are maintained electronically and contain standard demographics, diagnoses, and billing information. Although these data sets do not include explicit information concerning work-relatedness of the health conditions for which a patient is hospitalized, the designation of WC as the expected primary payer is a suitable proxy. For several conditions, the diagnoses might indicate work-relatedness (10).

**TABLE. Occupational health indicators, profile, and corresponding measures of frequency used in surveillance for occupational safety and health**

Indicator	Measures of frequency
No. 1: Nonfatal work-related injuries and illnesses reported by private sector employers	<ol style="list-style-type: none"> <li>1. Estimated annual number and rate of work-related injuries and illnesses among private sector workers.</li> <li>2. Estimated annual number and rate of work-related injuries and illnesses involving days away from work.</li> <li>3. Estimated annual number of injuries and illnesses involving &gt;10 days away from work.</li> </ol>
No. 2: Work-related hospitalizations	<ol style="list-style-type: none"> <li>1. Annual number and rate of hospitalizations for persons aged <math>\geq 16</math> years with workers' compensation (WC) reported as the primary payer.</li> </ol>
No. 3: Fatal work-related injuries	<ol style="list-style-type: none"> <li>1. Annual number of fatal work-related injuries.</li> <li>2. Annual rate of fatal work-related injuries among persons aged <math>\geq 16</math> years.</li> </ol>
No. 4: Work-related amputations involving days away from work reported by private sector employers	<ol style="list-style-type: none"> <li>1. Estimated annual number and rate of work-related amputations involving days away from work among private sector workers.</li> </ol>
No. 5: Amputations identified in state WC systems	<ol style="list-style-type: none"> <li>1. Annual number and rate of amputations identified in state WC systems.</li> </ol>
No. 6: Hospitalizations for work-related burns	<ol style="list-style-type: none"> <li>1. Annual number and rate of hospitalizations for persons aged <math>\geq 16</math> years with a principal diagnosis of burn and a primary payer coded as WC.</li> </ol>
No. 7: Work-related musculoskeletal disorders involving days away from work reported by private sector employers	<ol style="list-style-type: none"> <li>1. Estimated annual number and rate of musculoskeletal disorders (MSDs) involving days away from work among private sector workers.</li> <li>2. Estimated annual number rate of MSDs of the back involving days away from work among private sector workers.</li> <li>3. Estimated annual number and rate of MSDs of the upper extremities, neck, and shoulder involving days away from work among private sector workers.</li> <li>4. Estimated annual number and rate of carpal tunnel syndrome cases involving days away from work among private sector workers.</li> </ol>
No. 8: Carpal tunnel syndrome cases identified in state WC systems	<ol style="list-style-type: none"> <li>1. Annual number and rate of carpal tunnel syndrome cases identified in state workers' compensation systems.</li> </ol>
No. 9: Hospitalizations from or with pneumoconiosis	<ol style="list-style-type: none"> <li>1. Annual number and rate of hospitalizations for persons aged <math>\geq 15</math> years with pneumoconiosis as a principal or secondary discharge diagnosis.</li> </ol>
No. 10: Mortality from or with pneumoconiosis	<ol style="list-style-type: none"> <li>1. Annual number and rate of deaths of persons aged <math>\geq 15</math> years with pneumoconiosis as the underlying or contributing cause of death.</li> </ol>
No. 11: Acute work-related pesticide-associated illness and injury reported to poison-control centers	<ol style="list-style-type: none"> <li>1. Annual number and rate of work-related pesticide poisonings reported to state poison-control centers.</li> </ol>
No. 12: Incidence of malignant mesothelioma	<ol style="list-style-type: none"> <li>1. Annual number and rate of persons aged <math>\geq 15</math> years newly diagnosed with malignant mesothelioma.</li> </ol>
No. 13: Elevated blood lead levels among adults	<ol style="list-style-type: none"> <li>1. Annual number and rates (prevalence and incidence) of persons aged <math>\geq 16</math> years with blood lead levels <math>\geq 25</math> micrograms per deciliter (<math>\mu\text{g}/\text{dL}</math>) and <math>\geq 40</math> <math>\mu\text{g}/\text{dL}</math>.</li> </ol>
No. 14: Workers employed in industries with high risk for occupational morbidity	<ol style="list-style-type: none"> <li>1. Number and percentage of workers employed in industries with high risk for occupational morbidity.</li> </ol>
No. 15: Workers employed in occupations with high risk for occupational morbidity	<ol style="list-style-type: none"> <li>1. Number and percentage of workers employed in occupations with high risk for occupational morbidity.</li> </ol>
No. 16: Workers employed in industries and occupations with high risk for occupational mortality	<ol style="list-style-type: none"> <li>1. Number and percentage of workers employed in industries and occupations with high risk for occupational mortality as a result of injuries.</li> </ol>
No. 17: Occupational safety and health professionals	<ol style="list-style-type: none"> <li>1. Estimated number and rate of occupational safety and health professionals.</li> </ol>
No. 18: Occupational Safety and Health Administration (OSHA) enforcement activities	<ol style="list-style-type: none"> <li>1. Total number of establishments under federal/state OSHA jurisdiction.</li> <li>2. Annual number of establishments inspected by federal/state OSHA.</li> <li>3. Percentage of establishments under federal/state OSHA jurisdiction inspected by federal/state OSHA.</li> <li>4. Annual number of employees whose work areas were inspected by federal/state OSHA.</li> <li>5. Percentage of employees in establishments under federal/state OSHA jurisdiction whose work areas were inspected.</li> </ol>
No. 19: WC awards	Annual workers' compensation benefits paid and average amount paid per covered worker.
Profile	Measures of frequency
Employment demographics	<ol style="list-style-type: none"> <li>1. Percentage of civilian workforce unemployed.</li> <li>2. Percentage of civilian employment, self-employed.</li> <li>3. Percentage of civilian employment, employed part-time.</li> <li>4. Percentage of civilian employment, by number of hours worked (&lt;40, 40, and <math>\geq 41</math> hours).</li> <li>5. Percentage of civilian employment, by sex.</li> <li>6. Percentage of civilian employment, by age group (ages 16–17, 18–64, and <math>\geq 65</math>).</li> <li>7. Percentage of civilian employment, by race (white, black, and other).</li> <li>8. Percentage of civilian employment, by Hispanic origin.</li> <li>9. Percentage of civilian employment, by industry.</li> <li>10. Percentage of civilian employment, by occupation.</li> </ol>

- **State WC systems.** WC is a no-fault insurance system designed to limit the legal liability of employers while compensating workers who sustain work-related injuries or illnesses. All states have WC systems, and employers in all states, except in Texas, are required to provide insurance for employees. Separate federal systems exist for certain groups (e.g., federal workers, and longshore and harbor workers). States' WC claim coding systems, eligibility, reimbursement, and other regulations differ substantially. Therefore, OHIs in which WC data are used can be used to monitor trends within states over time but should not be used to compare states.
  - **Occupational safety and health professionals.** Membership in occupational safety and health professional associations reflects the availability of resources to prevent occupational injuries and illnesses. However, membership has multiple limitations, including 1) member addresses might not represent work locations, 2) membership rolls might include retired occupational health professionals, and 3) certain occupational health professionals might not be members of these organizations.
  - **Survey of occupational injuries and illnesses.** The Bureau of Labor Statistics (BLS) Annual Survey of Occupational Injuries and Illnesses provides national and state level estimates of the numbers and rates of work-related injuries and illnesses. In a nationwide sample, employers are asked questions concerning work-related injuries and illnesses. Although survey data are detailed, occupational diseases are not well documented, and evidence suggests that injuries are underreported (11–13). The national estimates exclude public sector workers, self-employed persons, household workers, and workers on small farms.
  - **Census of fatal occupational injuries.** The BLS Census of Fatal Occupational Injuries (CFOI) includes work-related fatalities resulting from unintentional and intentional injuries. CFOI uses multiple data sources to identify, document, and verify work-related injury deaths. Therefore, CFOI is considered a nearly complete ascertainment of work-related injury deaths (14).
  - **Poison-control centers.** Nearly all U.S. poison-control centers (PCCs) submit real-time data to the American Association of Poison Control Centers for inclusion in its Toxic Exposure Surveillance System (15). PCCs receive telephone calls concerning actual or potential exposures to substances. Although PCCs record whether a call is work-related, the call might be miscoded or not completed. In addition, health-care workers with experience in managing work-related poisoning might be less likely than other health-care workers to use PCCs. Therefore, underreporting might vary by state, according to the experience and expertise of health-care workers and by the level of underused PCC services.
  - **Adult blood lead epidemiology and surveillance.** The Adult Blood Lead Epidemiology and Surveillance (ABLES) system is a state-based program funded by NIOSH. Surveillance of elevated blood lead levels identifies industries and occupations in which workers are exposed to lead. The U.S. Department of Labor Occupational Safety and Health Administration (OSHA) mandates blood lead level testing of persons working when airborne lead exceeds a certain level. However, ABLES does not capture persons who have been exposed to lead and whose employers do not comply with OSHA's biologic monitoring requirements nor does it capture persons who have been tested by laboratories that do not comply with the reporting requirement. In addition, the threshold reported varies from state-to-state, and not all states receive ABLES funding; therefore, national data do not represent all states.
  - **OSHA integrated management information system.** OSHA and state agencies conduct worksite inspections to determine compliance with health and safety standards. Inspection data are maintained in the Integrated Management Information System (IMIS), including the type of inspection, reason for inspection, inspection date, state, and worksite type and number of employees. The number of unique establishments inspected (and therefore unique workers affected) is difficult to quantify because IMIS entries are listed by inspections rather than by establishment. Because IMIS is an administrative database, the data are updated with each subsequent inspection.
- The following data sources are used to quantify the appropriate population at risk (i.e., denominators) for the calculation of rates:
- **U.S. Census.** The Census Bureau takes the census of the entire United States during years that end in zero. In the 2000 census, the long form sent to approximately one in six households was used to obtain information concerning labor force status, place of employment, occupation, industry, work status, and income. After a debate concerning undercounting the population, the Census Bureau performed a coverage measurement survey and decided not to adjust the 2000 census.
  - **County business patterns.** The Census Bureau annually produces County Business Patterns (CBP) to provide economic data by industry. CBP counts the number of employees in the primary industry of an establishment.

CBP data include the number of establishments, employment, and payroll for each county. Data do not include self-employed persons; persons working in private households, on farms, and on railroads. In addition, the data do not include the majority of federal, state, and local government employees. Each year, CBP quantifies the number of full- and part-time employees on company payrolls for the week that includes March 12th.

- **Current population survey.** The Census Bureau conducts the Current Population Survey (CPS) for BLS. The CPS is a monthly survey of approximately 60,000 households that represent the civilian, noninstitutionalized U.S. population and collects information concerning demographics, employment status, hours worked, and the industry and occupation of each household member aged  $\geq 15$  years. In addition, the CPS data provide statistics that represent where persons live (not where they work) and undercount persons who have no permanent address or are migratory.
- **National Academy of Social Insurance (NASI).** NASI is a nonprofit, nonpartisan organization dedicated to the study of social insurance programs (e.g., WC). NASI estimates benefits, coverage, costs, and the number of covered workers, by using state unemployment insurance data. WC frequently awards payments that are disbursed over time; therefore, awards do not reflect the full cost of injuries and illnesses accurately within a given year. State WC coverage and systems vary from state-to-state, so comparisons are problematic.
- **Quarterly census of employment and wages.** The BLS Quarterly Census of Employment and Wages (QCEW) provides a comprehensive tabulation of employment and wage information. Employment is calculated for the number of workers covered by state unemployment insurance laws during the month. QCEW excludes persons in the military, self-employed persons, private household workers, and railroad workers. QCEW reports industry for the state, county, and metropolitan levels as long as confidentiality can be maintained.

## Conclusion

The OHIs are intended to help states build capacity for occupational health surveillance by providing them with tools to generate vital basic information concerning the occupational health status of the state population. Because multiple states do not yet have adequate occupational health surveillance programs, these OHIs provide an essential mechanism

by which states can learn to use and apply available occupational health data. OHI data will be most useful when multiple years of data are available to highlight trends within each state. States and the nation can use these OHIs to measure the burden of occupational injury and illness, prioritize state occupational health needs, target resources, and measure progress in preventing work-related diseases and injuries. Additional states are encouraged to join this initiative. NIOSH provides funding for the OHIs because they are now required as a component of state-based cooperative agreements for occupational health surveillance (16). CSTE will also continue to work with NIOSH and states to implement the OHIs by periodically publishing state and national OHI data. Based on evaluation of the OHIs and changes in data sources and public health priorities, CSTE might add, modify, or delete OHIs in the future.

The OHIs are a critical part of a larger CSTE initiative to develop public health surveillance indicators across program areas for states to use in generating a comprehensive picture of the populations' public health status. Recommended indicators also have been developed for injury (17) and chronic disease (18) surveillance, and the OHIs are serving as a model for environmental public health indicators (19) currently under development. Detailed information concerning the OHIs are available at <http://www.cste.org>.

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### **Occupational Health Indicators Working Group, May 2006**

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